Detlef Mader

Moon-Related Population Dynamics and Ecology of the Stag Beetle *Lucanus cervus*, Other Beetles, Butterflies, Dragonflies and Other Insects

Mondbezogene Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus*, anderer Käfer, Schmetterlinge, Libellen und anderer Insekten

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Preface

After the timely publication of my book on population dynamics, ecology and conservation of the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) in the region around Heidelberg and Mannheim in the southwestern part of Germany (MADER 2009) still before the beginning of the flight season of the most spectacular and best known beetle in the entomofauna of Middle Europe in spring 2009, a suite of additional data has been obtained by own observations, reports from friends of nature and review of the literature which have allowed the further elaboration and the enhanced assessment of various aspects of the biology of the Stag Beetle *Lucanus cervus*. The incorporation of the new results on ethology, ecology and phaenology of the Stag Beetle *Lucanus cervus* into revised and enlarged outlines of three chapters of my monograph has stimulated the edition of this volume as supplement and extension of my book. The new material has been integrated into extended and actualized evaluations of three sections of my compilation of the life history of the Stag Beetle *Lucanus cervus* which are presented in three articles in this volume. The three papers in this volume comprise summaries of long-term population dynamics, short-term population dynamics and swarming behaviour, and conservation measures of the Stag Beetle *Lucanus cervus*. This volume is published after the end of the flight season 2009 of the most spectacular and best known beetle in the entomofauna of Middle Europe, and is therefore available before the beginning of the flight season in spring 2010. The second article on the selenocyclical population dynamics of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects represents a considerable broadening of the spectrum of investigated species beyond the aspects which have been discussed in my book, and this significant widening of the suite of more than 500 evaluated species has resulted in the establishment of this issue as an additional volume to my book on the Stag Beetle *Lucanus cervus*.

The first article on the long-term population dynamics of the Stag Beetle *Lucanus cervus* over up to 50 – 75 years contains the evaluation of the reports of the observations of the Stag Beetle *Lucanus cervus* by more than 600 people at more than 225 localities in the region around Heidelberg and Mannheim in the southwestern part of Germany. The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east. Abt. 150 contributors have continuously observed the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years at their places of residence where they have been able to monitor its yearly occurrence in more or less constant quantity every year or in changing frequency with often a trend of diminution of the numbers of the individuals during the course of the years at abt. 75 localities, with the longest documentation reaching back to 1935. These long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to three quarters of a century are unique data in the entomological literature. The long-term population dynamics of the Stag Beetle *Lucanus cervus* for periods of several decades or even more than half a century reflects the almost permanent stability of numerous established populations in the framework of various climatical and environmental changes. The analysis of the long-term population dynamics of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years has revealed that two different scenarios are developed. The first scenario comprises a more or less constant or randomly fluctuating quantity of observed individuals of the Stag Beetle *Lucanus cervus* per year where no trend of diminution of the number of registered individuals with time can be delineated. The second scenario includes the establishment of a pronounced trend of diminution of the quantity of observed individuals of the Stag Beetle *Lucanus cervus* with time. Although the numbers of individuals of the Stag Beetle *Lucanus cervus* appearing in the successive years are subjected to changes depending on various climatical and environmental influences, the fact that the populations continue to show up annually irrespectively of variations in frequency of individuals underlines the resistivity of the populations against external stress and the successful survival of the populations independently of the changing

conditions of the surrounding framework. The long-term records of the regular yearly appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years in the region around Heidelberg and Mannheim in the southwestern part of Germany by abt. 150 observers at abt. 75 localities in an areal extension of more than 100 km both from north to south and from west to east document the stability of the populations for several decades or even more than half a century and confirm the annual success of reproduction over the whole time span, thereby suggesting that under favourable conditions, the populations of the Stag Beetle *Lucanus cervus* have the chance to exist nearly permanently and to continue almost for ever like a perpetuum mobile.

The second article on the correlation of swarm phases of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the new moon and full moon phases of the lunar cycle includes the analysis of the short-term population dynamics of the Stag Beetle *Lucanus cervus* by the evaluation of the distribution of its peak activity during the period of appearance in the current year. The phaenological study has revealed that the culmination of the occurrence of the Stag Beetle *Lucanus cervus* takes place mainly on abt. 1 – 7 days when a pronounced swarming is established in the crepuscular period in the evening when predominantly abt. 10 – 20 or even abt. 20 – 30 individuals and subordinately abt. 5 – 10 individuals per day are flying and walking around, whereas before and after these swarm evenings, predominantly only abt. 1 – 2 or abt. 3 – 5 individuals and subordinately only abt. 5 – 10 individuals per day are walking and flying around during the period of appearance in the current year. The peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, thus suggesting that the breakout of the culmination of its activity and the development of extraordinary swarm evenings are frequently triggered by the turning points of the lunar cycle. The correlation of the peak activity of the Stag Beetle *Lucanus cervus* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has been documented at numerous localities based on own observations, personal communications and literature evaluation. Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects is frequently related with the new moon or the full moon which is presented in a suite of examples of a broad spectrum of in total more than 500 species based on own observations and literature evaluation. The selenocyclical assessment of the short-term population dynamics of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects includes also the interpretation of the mechanisms triggering the correlation of swarm phases, mass flights and peak abundances with the new moon or the full moon. The turning points of the lunar cycle are often also significant breaks in weather character with frequently rapid changes from dry and warm periods to wet and cool periods or vice versa, and therefore particularly the changes from wet and cool periods to dry and warm periods around the new moon or the full moon could be the reasons for the triggering of the culmination of the activity with establishment of the peak numbers of individuals and development of pronounced swarm events or mass flights of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects. The significance of the correlation of swarm events or mass flights of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the new moon and full moon phases of the lunar cycle is also documented in the title of this volume on moon-related population dynamics and ecology of various insects. The selenocyclical assessment of the distribution of the frequency of occurrence of the Stag Beetle *Lucanus cervus*, other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects and their connection with the new moon or the full moon has turned out to represent a fundamental advance in the understanding of the triggering of swarm phases, mass flights and peak abundances of insects, and it has been confirmed by several

examples that the selenocyclical interpretation enhances also the understanding of mass growth of mushrooms and mass wandering of toads. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature includes abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

The third article on conservation measures for the Stag Beetle *Lucanus cervus* in garden, orchard, forest, forest margin, house and street for all friends of nature focusses on various simple possibilities of support and assistance in the successful performance of its life cycle. The Stag Beetle *Lucanus cervus* is since long time in Germany and in other countries of Europe under rigorous nature protection which has been further restricted in the European Union in the last years. During the course of my study of population dynamics and ecology of the Stag Beetle *Lucanus cervus* in the region around Heidelberg and Mannheim in the southwestern part of Germany, I have developed a suite of simple conservation measures which could be executed by every friend of nature without problems in garden, orchard, forest, forest margin, house and street. These simple conservation measures could lead to a significant improvement of the conditions of life and reproduction of the Stag Beetle *Lucanus cervus*, and therefore as many friends of nature as possible should participate consequently in their application. The proposed conservation measures for the Stag Beetle *Lucanus cervus* include the transit service at streets and roads at the forest margin, the temporary closure of streets and roads at the forest margin for the traffic, the turnaround of males and females which are found lying on their back, the accumulation of compost heaps and dead wood piles with sufficient deposit time in gardens and orchards; the maintenance of natural tree stumps and the installation of artificial tree stumps in gardens, orchards and forests; the construction of stag beetle pyramids, piles and cradles; the installation of stag beetle pavements, the delineation of forest regions with restricted or prohibited cultivation, the supply of sap runs on trees in gardens and orchards, the planting and cultivation of cherry trees in gardens and orchards, the cover and control of water containers in gardens, the inspection of lawns before mowing, the multiplication by sensitization of other friends of nature, the regular reporting of observations for central evaluation, and the engagement against actions of chemical destruction of populations of the Cockchafer *Melolontha*. The significance of the consequent execution of the proposed conservation measures for the Stag Beetle *Lucanus cervus* is particularly underlined by the fact that every single female which can be protected from premature non-natural mortality and which can find suitable substrates for the deposition of its eggs without problems is able for itself alone to found and to secure the persistence of the corresponding population in the next generation. Every single friend of nature who participates in the application of the suggested conservation measures for the Stag Beetle *Lucanus cervus* contributes with his help to achieve the aims of the fauna-flora-habitat-directive of the European Union in an extent as wide as possible and to secure the pronounced position of the Stag Beetle *Lucanus cervus* in the entomofauna of Middle Europe permanently.

Because I plan to continue my research on population dynamics, ecology and conservation of the Stag Beetle *Lucanus cervus* during the next years, I would very much appreciate if the readers of my papers in this volume would supply me observations particularly on swarming behaviour and long-term population dynamics of the Stag Beetle *Lucanus cervus* at any place and from any time of record. I would also be grateful if the readers of my articles in this supplement would send me significant photographs of males and females of the Stag Beetle *Lucanus cervus* in its natural environment, would inform me on notes of the occurrence of the Stag Beetle *Lucanus cervus* in newspapers and remote journals, and would report me the names and affiliations of other people working currently on the Stag Beetle *Lucanus cervus* which are not quoted with their publications in the reference lists in my papers in this volume and in my book. I would also very much appreciate if the readers of my articles in this supplement would supply me with the corresponding material also on the Rhinoceros Beetle *Oryctes nasicornis* which I intend to evaluate for comparative interpretation.

I would also welcome if many readers of my articles in this volume would support my work on the life history and conservation of the Stag Beetle *Lucanus cervus* by ordering a copy of my book (price 49 €) with me. All the returns from the sale of my book will be exclusively utilized for the funding of my research of the life history of the Stag Beetle *Lucanus cervus* and the application of the results in the promotion of conservation measures for the Stag Beetle *Lucanus cervus*. The easiest and quickest possibility to send me observations, informations, photographs and orders of my book of the Stag Beetle *Lucanus cervus* is by e-mail: dr.detlef.mader@web.de.

The edition of the manuscript has been finished and the material has been passed to press for publication on 10.05.2010.

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Moon-Related Population Dynamics and Ecology of the Stag Beetle *Lucanus cervus,*
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Long-Term Population Dynamics of the Stag Beetle *Lucanus cervus* (Coleoptera: Lucanidae) over up to 50 – 75 Years in the Region around Heidelberg and Mannheim (Germany)

Langfristige Populationsdynamik des Hirschkäfers *Lucanus cervus* (Coleoptera: Lucanidae) über bis zu 50 – 75 Jahre im Raum um Heidelberg und Mannheim (Deutschland)

Detlef Mader

Abstract

The evaluation of the reports of the observations of the Stag Beetle *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae) by more than 600 people at more than 225 localities in the region around Heidelberg and Mannheim in the southwestern part of Germany with an extension of the study area of more than 100 km both from north to south and from west to east has revealed predominantly individual sightings of males and females that can be classified as accidental meetings which could not be reproduced in the following days, weeks, months or years by the recording people. Abt. 150 contributors, however, have continuously observed the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years at their places of residence where they have been able to monitor its yearly occurrence in more or less constant quantity every year or in changing frequency with often a trend of diminution of the numbers of the individuals during the course of the years at abt. 75 localities. These long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to three quarters of a century are unique data in the entomological literature. The long-term population dynamics of the Stag Beetle *Lucanus cervus* for periods of several decades or even more than half a century reflects the almost permanent stability of numerous established populations in the framework of various climatical and environmental changes. The analysis of the long-term population dynamics of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years has revealed that two different scenarios are developed. The first scenario comprises a more or less constant or randomly fluctuating quantity of observed individuals of the Stag Beetle *Lucanus cervus* per year where no trend of diminution of the number of registered individuals with time can be delineated. The second scenario includes the establishment of a pronounced trend of diminution of the quantity of observed individuals of the Stag Beetle *Lucanus cervus* with time. In the first scenario of a more or less constant or randomly fluctuating quantity of observed individuals of the Stag Beetle *Lucanus cervus* per year where no trend of diminution of the number of registered individuals with time can be delineated, the long-term population dynamics can be summarized as follows: from abt. 1945 – 1950 to 2008, predominantly abt. 1 – 2 or abt. 2 – 3 individuals and subordinately abt. 3 – 5 or abt. 5 – 10 individuals have been recorded per year by most of the observers, with only in some years or at some localities also abt. 10 – 15 individuals

having been noted per year by some observers. In the second scenario of the establishment of a pronounced trend of diminution of the quantity of observed individuals of the Stag Beetle *Lucanus cervus* with time, the long-term population dynamics can be summarized as follows: from abt. 1945 – 1950 to abt. 1980 – 1990, predominantly abt. 5 – 10 or abt. 10 – 15 individuals and subordinately abt. 15 – 20 or abt. 3 – 5 individuals have been registered per year by most of the observers, whereas from abt. 1980 – 1990 to abt. 2000, predominantly abt. 3 – 5 or abt. 5 – 10 individuals and subordinately abt. 10 – 15 or abt. 2 – 3 individuals have been seen per year by most of the observers, and from abt. 2000 to 2008, predominantly abt. 1 – 2 or abt. 2 – 3 individuals and subordinately abt. 3 – 5 or abt. 5 – 10 individuals have been encountered per year by most of the observers. Much more long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* are required for the completion of the model of its population dynamics for periods of up to three quarters of a century, and therefore all the readers of my paper are invited to try to collect comparable long-term observations for periods of 5 years and more in their study areas and, if possible, to pass these data to me for comparison and averaged evaluation. I would sincerely welcome any contribution that would help to further approach the generalization of the interpretation and the conclusion of the understanding of the long-term population dynamics of the Stag Beetle *Lucanus cervus*. A suite of simple conservation measures can be carried out by every friend of nature in garden, orchard, forest, forest margin, house and street and can provide considerable support in the effectivity of reproduction of the Stag Beetle *Lucanus cervus* which helps to guarantee its survival and renewed appearance in the next generations. The long-term records of the regular yearly appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years in the region around Heidelberg and Mannheim in the southwestern part of Germany by abt. 150 observers at abt. 75 localities in an areal extension of more than 100 km both from north to south and from west to east document the stability of the populations for several decades or even more than half a century and confirm the annual success of reproduction over the whole time span, thereby suggesting that under favourable conditions, the populations of the Stag Beetle *Lucanus cervus* have the chance to exist nearly permanently and to continue almost for ever like a perpetuum mobile.

Zusammenfassung

Die Auswertung der Berichte der Beobachtungen des Hirschkäfers *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) von über 600 Naturfreunden an über 225 Lokalitäten im Raum um Heidelberg und Mannheim im südwestlichen Teil von Deutschland mit einer Ausdehnung des Untersuchungsgebietes von über 100 km sowohl von Norden nach Süden als auch von Westen nach Osten hat hauptsächlich individuelle Sichtungen von Männchen und Weibchen ergeben, die als zufällige Einzelfunde klassifiziert werden können, welche in den folgenden Tagen, Wochen, Monaten oder Jahren durch die erfassenden Personen nicht reproduziert werden konnten. Etwa 150 Naturfreunde haben jedoch das regelmäßige jährliche Erscheinen des Hirschkäfers *Lucanus cervus* über Zeiträume von bis zu 50 – 75 Jahren an ihren Wohnorten kontinuierlich beobachtet, und konnten dort das jährliche Auftreten in mehr oder weniger konstanter Anzahl in jedem Jahr oder in wechselnder Häufigkeit mit oftmals einem Trend der Abnahme der Anzahl der Individuen im Laufe der Jahre an etwa 75 Lokalitäten registrieren. Diese langfristigen Erfassungen des regelmäßigen jährlichen Erscheinens des Hirschkäfers *Lucanus cervus* über Zeiträume bis zu drei Vierteln eines Jahrhunderts sind unikale Daten in der entomologischen Literatur. Die langfristige Populationsdynamik des Hirschkäfers *Lucanus cervus* über Zeiträume von mehreren Jahrzehnten oder sogar mehr als einem halben Jahrhundert spiegelt die fast permanente Stabilität von zahlreichen bestehenden Populationen im Rahmen von verschiedenen klimatischen und umweltlichen Veränderungen wider. Die Analyse der langfristigen Populationsdynamik des Hirschkäfers *Lucanus cervus* über Zeiträume von bis zu 50 – 75 Jahren hat ergeben, daß zwei verschiedene Szenarien entwickelt sind. Das erste Szenario beinhaltet eine mehr oder weniger konstante oder unregelmäßig schwankende Anzahl der

beobachteten Individuen des Hirschkäfers *Lucanus cervus* pro Jahr, ohne daß ein Trend der Abnahme der Anzahl der registrierten Exemplare im Laufe der Zeit festgestellt werden kann. Das zweite Szenario umfaßt die Ausbildung eines ausgeprägten Trends der Abnahme der Anzahl der beobachteten Individuen des Hirschkäfers *Lucanus cervus* im Laufe der Zeit. Im ersten Szenario einer mehr oder weniger konstanten oder unregelmäßig schwankenden Anzahl der beobachteten Exemplare des Hirschkäfers *Lucanus cervus* pro Jahr, ohne daß ein Trend der Abnahme der Anzahl der registrierten Individuen im Laufe der Zeit festgestellt werden kann, läßt sich die langfristige Populationsdynamik wie folgt zusammenfassen: von etwa 1945 – 1950 bis 2008 wurden überwiegend etwa 1 – 2 oder etwa 2 – 3 Exemplare und untergeordnet etwa 3 – 5 oder etwa 5 – 10 Individuen pro Jahr von den meisten Beobachtern registriert, wobei nur in einigen Jahren oder an einigen Lokalitäten auch etwa 10 – 15 Exemplare pro Jahr von einigen Beobachtern notiert wurden. Im zweiten Szenario der Ausbildung eines ausgeprägten Trends der Abnahme der Anzahl der beobachteten Individuen des Hirschkäfers *Lucanus cervus* im Laufe der Zeit läßt sich die langfristige Populationsdynamik wie folgt zusammenfassen: von etwa 1945 – 1950 bis etwa 1980 – 1990 wurden überwiegend etwa 5 – 10 oder etwa 10 – 15 Exemplare und untergeordnet etwa 15 – 20 oder etwa 3 – 5 Individuen pro Jahr von den meisten Beobachtern registriert, wohingegen von etwa 1980 – 1990 bis etwa 2000 überwiegend etwa 3 – 5 oder etwa 5 – 10 Exemplare und untergeordnet etwa 10 – 15 oder etwa 2 – 3 Individuen pro Jahr von den meisten Beobachtern gesehen wurden, und von etwa 2000 – 2008 wurden überwiegend etwa 1 – 2 oder etwa 2 – 3 Exemplare und untergeordnet etwa 3 – 5 oder etwa 5 – 10 Individuen pro Jahr von den meisten Beobachtern angetroffen. Es werden wesentlich mehr langfristige Erfassungen des regelmäßigen jährlichen Erscheinens des Hirschkäfers *Lucanus cervus* für die Vervollständigung des Modells der Populationsdynamik über Zeiträume bis zu drei Vierteln eines Jahrhunderts benötigt, und deshalb sind alle Leser meiner Arbeit eingeladen zu versuchen, vergleichbare langfristige Beobachtungen über Zeiträume von 5 Jahren und mehr in ihren Untersuchungsgebieten zu sammeln und, wenn möglich, diese Daten an mich zum Vergleich und zur verallgemeinerten Auswertung weiterzuleiten. Ich würde jegliche Beiträge, welche in der weiteren Annäherung an die Generalisierung der Interpretation und die Schlußfolgerung des Verständnisses der langfristigen Populationsdynamik des Hirschkäfers *Lucanus cervus* behilflich sind, sehr begrüßen. Eine Reihe von einfachen Schutzmaßnahmen, welche von jedem Naturfreund in Garten, Streuobstwiese, Wald, Waldrand, Haus und Straße durchgeführt werden können, kann eine beträchtliche Unterstützung in der Effektivität der Fortpflanzung des Hirschkäfers *Lucanus cervus* bewirken und dadurch helfen, das Überleben und das erneute Erscheinen in den nächsten Generationen sicherzustellen. Die langfristigen Erfassungen des regelmäßigen jährlichen Erscheinens des Hirschkäfers *Lucanus cervus* über Zeiträume von bis zu 50 – 75 Jahren im Gebiet um Heidelberg und Mannheim im südwestlichen Teil von Deutschland durch etwa 150 Beobachter an etwa 75 Lokalitäten in einer arealen Erstreckung von über 100 km sowohl von Norden nach Süden als auch von Westen nach Osten dokumentieren die Stabilität der Populationen über mehrere Jahrzehnte oder sogar mehr als ein halbes Jahrhundert und bestätigen den jährlichen Erfolg der Fortpflanzung über die ganze Zeitspanne, und verdeutlichen damit, daß die Populationen des Hirschkäfers *Lucanus cervus* unter günstigen Bedingungen die Chance haben, fast permanent zu existieren und nahezu für immer wie ein Perpetuum Mobile fortzubestehen.

Résumé

L´évaluation des reports des observations du Cerf Volant *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) par plus que 600 gens à plus que 225 localités dans la région autour de Heidelberg et Mannheim dans le sud-ouest de l´Allemagne avec une extension de la région étudiée de plus que 100 km en les directions du nord au sud ainsi que de l´ouest à l´est a résultée principalement en observations individuelles de mâles et femelles qui peuvent être classifiquées comme des rencontres accidentelles qui ne pouvaient pas être reproducées dans les jours, semaines, mois ou années sui-

vantes par les observateurs. Cependant, plus ou moins 150 observateurs ont registrés l´apparition annuelle régulière du Cerf Volant *Lucanus cervus* par des temps de jusqu´à 50 – 75 ans à leurs domiciles où ils pouvaient observer sa présence en chaque année en quantité plus ou moins constante ou en quantité variable avec souvent une tendance de diminution des nombres d´individus pendant la course d´années à plus ou moins 75 localités. Les registrements à long terme de l´apparition annuelle régulière du Cerf Volant *Lucanus cervus* par des temps jusqu´à trois quarts d´une siècle sont des données uniques dans la littérature entomologique. La dynamique à long terme des populations du Cerf Volant *Lucanus cervus* par plusieurs décades ou même plus qu´une demi-siècle montre la stabilité presque permanente de beaucoup de populations établies dans le cadre des changements divers du climat et du milieu. L´analyse de la dynamique à long terme des populations du Cerf Volant *Lucanus cervus* par des temps de jusqu´à 50 – 75 ans a montrée que deux scénarios différents sont développés. Le scénario premier contient une quantité d´individus observés du Cerf Volant *Lucanus cervus* plus ou moins constante ou avec une variabilité irrégulière qu´il n´est pas possible de constater une tendance de diminution du nombre d´individus registrés avec le temps. Le scenario deuxième comprend la formation d´une tendance prononcée de diminution du nombre d´individus registrés du Cerf Volant *Lucanus cervus* avec le temps. Le scénario premier d´une quantité d´individus observés du Cerf Volant *Lucanus cervus* plus ou moins constante ou avec une variabilité irrégulière qu´il n´est pas possible de constater une tendance de diminution du nombre d´individus registrés avec le temps permet de résumer la dynamique à long terme des populations comme suivant: d´environ 1945 – 1950 à 2008, prépondérant à peu près 1 – 2 ou à peu près 2 – 3 individus et subordonné à peu près 3 – 5 ou à peu près 5 – 10 individus ont été registrés par année par la plupart des observateurs, et seulement en quelques années ou à quelques localités, quelques observateurs ont aussi vérifiés à peu près 10 – 15 individus par année. Le scenario deuxième de la formation d´une tendance prononcée de diminution du nombre d´individus registrés du Cerf Volant *Lucanus cervus* avec le temps permet de résumer la dynamique à long terme des populations comme suivant: d´environ 1945 – 1950 à environ 1980 – 1990, prépondérant à peu près 5 – 10 ou à peu près 10 – 15 individus et subordonné à peu près 15 – 20 ou à peu près 3 – 5 individus ont été registrés par année par la plupart des observateurs, tandis que d´environ 1980 – 1990 à environ 2000, prépondérant à peu près 3 – 5 ou à peu près 5 – 10 individus et subordonné à peu près 10 – 15 ou à peu près 2 – 3 individus ont été apercevus par année par la plupart des observateurs, et d´environ 2000 à 2008, prépondérant à peu près 1 – 2 ou à peu près 2 – 3 individus et subordonné à peu près 3 – 5 ou à peu près 5 – 10 individus ont été rencontrés par année par la plupart des observateurs. Il a besoin de beaucoup plus de registrements à long terme de l´apparition annuelle régulière du Cerf Volant *Lucanus cervus* pour la complétion du modèle de la dynamique des populations par des temps jusqu´à trois quarts d´une siècle, et de cette facon, tous les lecteurs de mon travail sont invités à essayer de collecter des observations à long terme comparables par des temps de 5 ans et plus dans leurs régions de recherche et, si possible, de passer ces données à moi pour la comparaison et l´évaluation généralisée. Je souhaite la bienvenue à tous les contributions qui peuvent aider en l´approche successive de la généralisation de l´interprétation et la conclusion de la compréhension de la dynamique à long terme des populations du Cerf Volant *Lucanus cervus*. Une collection de mesures simples de protection peut être appliquée par chaque ami de la nature dans le jardin, le verger, la forêt, la lisière de la forêt, la maison et la rue, et peut donner de soutien considérable en l´effectivité de reproduction du Cerf Volant *Lucanus cervus* qui aide à garantir la survie et l´apparition renouvelée dans les générations prochaines. Les registrements à long terme de l´apparition annuelle régulière du Cerf Volant *Lucanus cervus* par des temps de jusqu´à 50 – 75 ans dans la région autour de Heidelberg et Mannheim dans le sud-ouest de l´Allemagne par à peu près 150 observateurs à plus ou moins 75 localités avec une extension spatiale de plus que 100 km en les directions du nord au sud ainsi que de l´ouest à l´est documentent la stabilité des populations par plusieurs décades ou même plus qu´une demi-siècle et confirment le succès annuel de la reproduction par toute la durée du temps, et montrent qu´en cas de conditions favorables, les populations du Cerf Volant *Lucanus cervus* ont la chance d´exister presque permanent et de continuer presque pour toujours comme un

perpetuum mobile.

Key words

Lucanus cervus, Stag Beetle, population dynamics, regular annual appearance, long-term records (up to 50 – 75 years), population stability, wood types, predators, parasites, conservation, protection, saproxylic, xylobiontic, crepuscular, phaenology, Upper Rhine valley, Heidelberg, Mannheim, Germany, Palaearctic region.

1 Introduction

After the accidental and lucky discovery of a rich population of the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) at Tairnbach in the surroundings of Heidelberg in the southwestern part of Germany on 01.06.2008, I have started a daily regular survey of the site until 15.08.2008 (except of some days with rainfalls or thunderstorms) and have monitored the appearance of flying and walking males and females during the crepuscular period in the evening from abt. 20.30 hrs to abt. 22.00 hrs Middle European summer time, with the activity of the Stag Beetle *Lucanus cervus* having culminated in a spectacular and impressive swarm evening on 05.06.2008 which has happened two days after the new moon (MADER 2009a). The introductory comments focus on long-term observations of numerous friends of nature in large-scale regional and temporal distribution, significance of the interpretation of the long-term population dynamics, and status of the Stag Beetle *Lucanus cervus* in the entomofauna of Middle Europe.

1.1 Long-term observations of numerous friends of nature in large-scale regional and temporal distribution

In addition to my own observations of the population of the Stag Beetle *Lucanus cervus* at Tairnbach by a daily regular survey of the site from 01.06.2008 to 15.08.2008 (except of some days with rainfalls or thunderstorms) with monitoring of the appearance of flying and walking males and females, I have collected long-term observations of numerous friends of nature in large-scale regional and temporal distribution. For the purpose of receiving sufficient information on the regional distribution of the Stag Beetle *Lucanus cervus* at various localities and at different times in the area around Heidelberg and Mannheim, I have placed some calls for observations in several regional newspapers (RHEIN-NECKAR-ZEITUNG 2008a, 2008b, 2008c, 2008d; SCHWETZINGER ZEITUNG 2008, BRUCHSALER RUNDSCHAU 2008), and in response to these notes, more than 600 people have reported finds of the Stag Beetle *Lucanus cervus* at more than 225 localities with an extension of the study area of more than 100 km both from north to south and from west to east by telephone call, e-mail or letter to me. I have then interviewed all these people by telephone conversation in order to receive more details on the dates, times, numbers, localities and conditions of their observations of the Stag Beetle *Lucanus cervus* in 2008 and earlier years. The daily regular survey of the population of the Stag Beetle *Lucanus cervus* at Tairnbach with monitoring of the appearance of flying and walking males and females has been continued from 01.05.2009 to 10.07.2009 (except of some days with rainfalls or thunderstorms; MADER 2010a), and for the reason of getting further information on its regional distribution in the area around Heidelberg and Mannheim, I have placed again some calls for observations in several regional newspapers (MANNHEIMER MORGEN 2009a, 2009b; RHEIN-NECKAR-ZEITUNG 2009a, 2009b, 2009c; WEINHEIMER NACHRICHTEN 2009), and I have also been invited to an interview in broadcasting (KURPFALZ RADIO 2009).

Most of the reported observations of the Stag Beetle *Lucanus cervus* have been individual sightings of males or females that can be classified as accidental meetings which could not be reproduced in the following days, weeks, months or years by the recording people. Abt. 150 contributors, however, have supplied me extraordinary long-term data according to their continuous observations of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years at their places of residence where they have been able to monitor its yearly occurrence in more or less constant quantity every year or in changing frequency with often a trend of diminution of the numbers of individuals during the course of the years at abt. 75 localities. These long-term observations of the Stag Beetle *Lucanus cervus* for periods of several decades or even more than half a century are unique data in the entomological literature and could only be collected, because the Stag Beetle *Lucanus cervus* is such a spectacular and well-known insect that it is familiar to most people and is therefore easily recognized without the need of special determination, and because the meetings with the largest beetle in the entomofauna of Middle Europe have been such impressive events for most people that they still remember the details of the sightings of the outstanding insect even after very long time. The oldest observations of the Stag Beetle *Lucanus cervus* which have been reported to me during the above outlined data collection reach back to 1935.

1.2 Significance of the interpretation of the long-term population dynamics

Particularly outstanding examples of the long-term appearance of the Stag Beetle *Lucanus cervus* in every year have been contributed by various people from the district Branich northeast of Schriesheim north of Heidelberg, and from the district Neuenheim in the northern part of the city of Heidelberg north of the river Neckar. The observations of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years by different people in Schriesheim and Neuenheim as well as at other in total abt. 75 localities permit the comparison of the individual reports of different observers at the same locality not knowing of each other or sharing with each other, and enable the mutual confirmation and complementation of the individual records of different observers at the same locality acting either independently of each other covering more or less the same time span or in overlapping succession covering different time spans, thereby allowing to exclude personal bias and to draw general conclusions that rely not only on the report of one individual observer, but are based on the observations of a whole group of people which live close to each other but have not been in touch with each other. Most of the residents have supplied only qualitative records of the regular annual appearance of the Stag Beetle *Lucanus cervus* during the course of the years, but some observers have also been able to provide quantitative information and to tell the average number of individuals which they have noted in every year, with in these cases the population dynamics having been summarized by the averaged evaluation of the individual reports of several independent observers at the same locality or at a few separate localities in close neighbourhood to each other. The qualitative and quantitative long-term observations of the regular annual appearance of the Stag Beetle *Lucanus cervus* provide the base for the interpretation of its long-term population dynamics for periods of up to 50 – 75 years in the region around Heidelberg and Mannheim which constitutes a significant contribution to the entomological literature as a consequence of the collection of unique data of the long-term yearly occurrence of the Stag Beetle *Lucanus cervus* for periods of several decades or even more than half a century in an area with an extension of more than 100 km both from north to south and from west to east.

This paper is only a short outline of the most important long-term observations of the regular annual appearance of the Stag Beetle *Lucanus cervus* by abt. 150 people at abt. 75 localities in the region around Heidelberg and Mannheim for periods of up to 50 – 75 years, whereas all the details of the observations that have been submitted to me until my editorial deadline on 15.03.2009 are contained in my book (MADER 2009a). The most significant aspects of the short-term population dynamics

of the Stag Beetle *Lucanus cervus* with particular emphasis on the impact of the phases of the new moon and the full moon of the lunar cycle on the development of swarm events and peak activity are summarized in another article in this volume (MADER 2010a), and the third contribution in this issue contains an outline of conservation measures for the Stag Beetle *Lucanus cervus* in garden, orchard, forest, forest margin, house and street for all friends of nature (MADER 2010b).

1.3 Status of the Stag Beetle *Lucanus cervus* in the entomofauna of Middle Europe

The Stag Beetle *Lucanus cervus* is the most spectacular and easiest recognizable member of the group of saproxylic or xylobiontic beetles with predominantly crepuscular appearance, and another extraordinary and well known representative of this suite is the Rhinoceros Beetle *Oryctes nasicornis* (LINNAEUS 1758) (Coleoptera: Scarabaeidae) which has also been reported to occur at various localities in the region around Heidelberg and Mannheim. The Stag Beetle *Lucanus cervus* is the largest, most attractive and best known beetle in Middle Europe. On global scale, the Stag Beetles (family Lucanidae) belong also to the most beautiful, greatest and outstanding insects especially because of the considerable size of most of the species. The male of the Stag Beetle *Lucanus cervus* reaches a length of up to more than 90 mm and is thus not only the biggest beetle in Middle Europe, but belongs also to the greatest beetles in the world, whereas the female reaches a length of up to 50 mm. As the unusual Stag Beetle *Lucanus cervus* is particularly famous among the insects in Middle Europe, it has been described and depicted in literature and art since more than 2,000 years (TARONI 1998, SPRECHER & TARONI 2004, SPRECHER-UEBERSAX 2008, MADER 2009a) and has been the topic of more than 1,000 publications (TARONI 1998, TOCHTERMANN in HAMBERGER 2006, MADER 2009a), and its extraordinary morphology and overwhelming size have been the reasons why the male of the Stag Beetle *Lucanus cervus* has frequently been selected as illustration not only in books, journals and papers, but also on stamps and sometimes even on coins which has significantly broadened its knowledge in the public. The excellent reputation and almost perfect knowledge of the Stag Beetle *Lucanus cervus* have considerably facilitated the collection of the data for the present study by compilation, evaluation and interpretation of the reports from numerous friends of nature who have replied to my calls for observations and have submitted their short-term and long-term records of this exceptionally fascinating member of the order of the beetles in Middle Europe.

2 Research history

The research history of the Stag Beetle *Lucanus cervus* is briefly summarized in overviews of biology and distribution, wood types as substrates for the development of the larvae, birds as predators of imagines, mammals as predators of imagines or larvae, and insects as predators or parasites of larvae of the Stag Beetle *Lucanus cervus* as follows. More detailed accounts of the research history of the Stag Beetle *Lucanus cervus* with comprehensive compilations of references are contained in my book (MADER 2009a).

2.1 Biology and biogeography

Aspects of the biology of the Stag Beetle *Lucanus cervus* in parts of Germany and adjacent areas have recently been investigated particularly by TOCHTERMANN (1987, 1992, in HAMBERGER 2006), SPRECHER-UEBERSAX & DURRER (1998a, 1998b, 2001a, 2001b), MÜLLER (2001), SPRECHER-UEBERSAX (2001), WENZEL (2001a, 2001b); KRENN, PERNSTICH, MESSNER, HANNAPPEL & PAULUS (2002); HILPÜSCH (2004), RINK & SINSCH (2006, 2007a, 2007b, 2008a, 2008b, 2009), RINK (2007, 2009) and MADER

(2009a, 2010a). Comments on the biogeography of the Stag Beetle *Lucanus cervus* in parts of Germany have recently been given among others also by OCHSE (1993), KARNER (1994), SCHAFFRATH (1994, 1997), SCHERF (1995), FELDMANN (1996), HAUSMANN (2001), HORN (2003), BEINLICH & KÖBLE (2004), MALTEN (2005); HACHTEL, SCHMID & CHMELA (2006); GESKE (2007); HACHTEL, SCHMID, CHMELA & BÖHME (2007); SCHREMPP (2007), EBERT & MÜLLER-PFANNENSTIEL (2008), HOFMANN (2008) and MATT (2008).

The biology of the Stag Beetle *Lucanus cervus* in Germany and surrounding regions has recently been summarized by KLAUSNITZER (1995), BRECHTEL & KOSTENBADER (2002), KLAUSNITZER & WURST (2003), KLAUSNITZER & SPRECHER-UEBERSAX (2008) and MADER (2009a). The history of description and illustration of the Stag Beetle *Lucanus cervus* in literature and art since more than 2,000 years has been reviewed by TARONI (1998), SPRECHER & TARONI (2004) and SPRECHER-UEBERSAX (2008). Overviews of the international literature on biology and biogeography of the Stag Beetle *Lucanus cervus* beyond Germany and adjacent areas as well as more extensive compilations of references on biology and distribution of the Stag Beetle *Lucanus cervus* within Germany are contained in my book (MADER 2009a).

2.2 Wood types as substrates for the development of the larvae

The following wood types have been confirmed as substrates for the development of the larvae of the Stag Beetle *Lucanus cervus* in the literature (in alphabetical order): the Maple *Acer* (Aceraceae), the Horse-Chestnut *Aesculus* (Hippocastanaceae), the Alder *Alnus* (Betulaceae), the Birch *Betula* (Betulaceae), the Butterfly-Bush or Summer-Lilac *Buddleja davidii* (Loganiaceae), the European Hornbeam *Carpinus betulus* (Betulaceae), the Sweet Chestnut *Castanea sativa* (Fagaceae), the Catalpa or Bean-Tree *Catalpa* (Bignoniaceae), the Cherry *Cerasus* (Rosaceae), the Common Hazelnut *Corylus avellana* (Betulaceae), the Hawthorn *Crataegus* (Rosaceae), the Monterey Cypress *Cupressus macrocarpa* (Cupressaceae), the Beech *Fagus* (Fagaceae), the Forsythia *Forsythia* (Oleaceae), the Ash *Fraxinus* (Oleaceae), the Clustered Ivy *Hedera helix* (Araliaceae), the Common Holly *Ilex aquifolium* (Aquifoliaceae), the Common Walnut *Juglans regia* (Juglandaceae), the Golden Rain *Laburnum* (Fabaceae), the Oregon-Grape *Mahonia* (Berberidaceae), the Apple *Malus domestica* (Rosaceae), the Mulberry *Morus* (Moraceae), the Common Spruce *Picea abies* (Pinaceae), the Pine *Pinus* (Pinaceae), the Poplar *Populus* (Salicaceae), the Plum *Prunus* (Rosaceae), the Common Pear *Pyrus communis* (Rosaceae), the Oak *Quercus* (Fagaceae), the Rosebay *Rhododendron* (Ericaceae), the False Acacia *Robinia pseudoacacia* (Fabaceae), the Willow *Salix* (Salicaceae), the Mountain Ash *Sorbus aucuparia* (Rosaceae), the Snowberry *Symphoricarpos* (Caprifoliaceae), the Common Lilac *Syringa vulgaris* (Oleaceae), the Arbor-Vitae *Thuja* (Cupressaceae), the Lime *Tilia* (Tiliaceae), the Elm *Ulmus* (Ulmaceae) and the Virburnum *Viburnum* (Caprifoliaceae) (compilation of references in MADER 2009a).

2.3 Birds as predators of imagines

The following birds have been reported as predators of imagines of the Stag Beetle *Lucanus cervus* in the literature (in alphabetical order): *Accipiter nisus* (Accipitridae), *Aegolius funereus* (Strigidae), *Asio otus* (Strigidae), *Athene noctua* (Strigidae), *Bubo bubo* (Strigidae), *Buteo buteo* (Accipitridae), *Caprimulgus europaeus* (Caprimulgidae), *Coccothraustes coccothraustes* (Fringillidae), *Coracias garrulus* (Coraciidae), *Corvus corone* (Corvidae), *Corvus frugilegus* (Corvidae), *Corvus monedula* (Corvidae), *Dendrocopos major* (Picidae), *Dryocopus martius* (Picidae), *Falco subbuteo* (Falconidae), *Falco tinnunculus* (Falconidae), *Gallus* (Phasianidae), *Garrulus glandarius* (Corvidae),

Lanius excubitor (Laniidae), *Larus* (Laridae), *Otus scops* (Strigidae), *Passer domesticus* (Ploceidae), *Phoenicurus phoenicurus* (Muscicapidae), *Pica pica* (Corvidae), *Strix aluco* (Strigidae), *Sturnus vulgaris* (Sturnidae) and *Turdus* (Muscicapidae) (compilation of references in MADER 2009a).

2.4 Mammals as predators of imagines or larvae

The following mammals have been mentioned as predators of imagines or larvae of the Stag Beetle *Lucanus cervus* in the literature (in alphabetical order): *Canis familiaris* (Canidae), Chiroptera, *Erinaceus europaeus* (Erinaceidae), *Felis domesticus* (Felidae), *Meles meles* (Mustelidae), *Mustela* (Mustelidae), *Sciurus vulgaris* (Sciuridae), *Talpa europaea* (Talpidae), *Sorex araneus* (Soricidae), *Sus scrofa* (Suidae) and *Vulpes vulpes* (Canidae) (compilation of references in MADER 2009a). To some degree, also man (*Homo sapiens*) plays a certain role as predator of the Stag Beetle *Lucanus cervus* by accidentally or deliberately killing various individuals by overrolling and crushing by vehicle and pedestrian traffic, trapping in water containers and holes, damage and destruction by fear and lacking knowledge, collecting and trading, felling and removal of defective and dead trees, and other reasons (overview of human impact in MADER 2009a).

2.5 Insects as predators or parasites of larvae

The following insects or their larvae have been identified as predators or parasites of the larvae of the Stag Beetle *Lucanus cervus* in the literature (in alphabetical order): *Ampedus* (Coleoptera: Elateridae), *Calliphora* (Diptera: Calliphoridae), *Dorcus parallelepipedus* (Coleoptera: Lucanidae), *Lacon punctatus* (Coleoptera: Elateridae), *Lasius niger* (Hymenoptera: Formicidae), *Megascolia maculata flavifrons* (Hymenoptera: Scoliidae), *Myiocera ferina* (Diptera: Tachinidae), *Omalus auratus* (Coleoptera: Chrysididae) and *Prionus coriarius* (Coleoptera: Cerambycidae) (compilation of references in MADER 2009a). Mites (Acari) have also been found occasionally as parasites of adults or larvae of the Stag Beetle *Lucanus cervus* and the Rhinoceros Beetle *Oryctes nasicornis*.

3 Geography and geology of the study area

The study area of the distribution of the populations of the Stag Beetle *Lucanus cervus* in the surroundings of Heidelberg and Mannheim is located in the middle part of the Upper Rhine valley as well as in the westwards and eastwards adjacent highlands of the Palatinate Forest, the Odenwald and the Kraichgau in the southwestern part of Germany. The outline of geography and geology of the study area focusses on Quaternary fluvial sand plain with vegetated aeolian dunes of the Upper Rhine valley; Mesozoic sediments in the highlands of Palatinate Forest, Vosges, Odenwald, Kraichgau and Black Forest; Variscan basement in the central parts of Odenwald, Black Forest and Vosges; Quaternary aeolian loess cover in Upper Rhine valley and adjacent highlands, Tertiary mafic volcanoes in Upper Rhine valley and adjacent highlands, and elevation above sea level.

3.1 Quaternary fluvial sand plain with vegetated aeolian dunes of the Upper Rhine valley

The band-like plain of the Upper Rhine valley extends as an elongated north-south-trending depression zone from Mainz westsouthwest of Frankfurt am Main in the north via Darmstadt, Worms, Mannheim/Ludwigshafen, Heidelberg, Karlsruhe, Rastatt, Strasbourg, Offenburg, Lahr, Freiburg

and Neuenburg to Basel in the south. The Upper Rhine valley is geologically a graben and geomorphologically a plain of abt. 35 – 40 km width which is surrounded by the highlands of the Palatinate Forest and the Vosges in the west as well as the Odenwald, the Kraichgau and the Black Forest in the east. The marginal faults of the Upper Rhine graben are nowadays still active in some extension which is also reflected by the occasional occurrence of isolated and restricted little earthquakes from time to time in different parts of the area that are too weak to cause visible damage to buildings except of sometimes a few thin cracks of limited length in the walls of some houses. Some of these little natural earthquakes in the surroundings of the marginal faults of the Upper Rhine graben have happened in Heidelberg and vicinity at the eastern margin of the Upper Rhine graben on 26.02.1969 (HEIDELBERGER TAGEBLATT 1969), 03.09.1978 (RHEIN-NECKAR-ZEITUNG 1978) and 26.03.2005 (RHEIN-NECKAR-ZEITUNG 2005), whereas another little earthquake that has occurred in Landau southwest of Heidelberg at the western margin of the Upper Rhine graben on 15.08.2009 has probably been stimulated artificially (RHEIN-NECKAR-ZEITUNG 2009d). I have experienced the little earthquake on 03.09.1978 during my time as a student at the university of Heidelberg when I have felt a weak shaking of the ground with a slight wobbling of cupboards and lamps in my rooms in Walldorf in the early morning of that day.

The plain of the Upper Rhine valley is covered mainly by Quaternary fluvial sand sheets and strings of the river Rhine and its tributaries (among others the Neckar around Heidelberg and Mannheim), with in some regions groups of vegetated Quaternary aeolian sand dunes sitting as small patches on the fluvial sand flat (MADER 1995a) and reaching a height of abt. 10 – 20 m (such as for example around and between Sandhausen and Walldorf south of Heidelberg as well as around Schwetzingen and Oftersheim westsouthwest of Heidelberg).

3.2 Mesozoic sediments in the highlands of Palatinate Forest, Vosges, Odenwald, Kraichgau and Black Forest

The highlands of the Palatinate Forest, the Vosges, the Odenwald and the Black Forest are mainly built up of continuous sheets of red fluvial and aeolian sandstones of the Buntsandstein (Lower Triassic; MADER 1985a, 1985b, 1992a, 1992b, 1999) which cover either limited fans, lenses and wedges of red fluvial sandstones, lacustrine mudstones and acid or mafic volcanites of the Rotliegendes (Lower Permian; MADER 1992a, 1999) or rest with erosional and/or angular unconformity immediately on the granite and gneiss of the eroded Variscan basement that has formed the pre-Permian or pre-Triassic surface of the landscape with a pronounced relief including elevations and depressions. The highland of the Kraichgau is predominantly composed of continuous sheets of grey marine limestones of the Muschelkalk (Middle Triassic) and yellow, green, grey and red fluvial sandstones and lacustrine mudstones with intercalations of grey lacustrine limestones of the Keuper (Upper Triassic; MADER 1990, 1992a, 1995b, 1997). The fluvial sandstones and lacustrine mudstones of the Upper Buntsandstein and the Middle Keuper contain numerous typical blue-violet and red-violet horizons which represent calcrete palaeosols that include frequently fossil root levels, and include also various breccia layers which constitute deposits of reworked fragments of calcareous concretions and root tubes from blue-violet and red-violet calcrete palaeosols (MADER 1990, 1992a, 1997). The geological boundary between Odenwald and Kraichgau as well as between Black Forest and Kraichgau is represented by the boundary between the red continental Buntsandstein and the grey marine Muschelkalk at the current surface of the landscape.

In some regions of the plain of the Upper Rhine valley and its margins, also black marine mudstones of the Liassic (Lower Jurassic) or yellow, green and grey marine sandstones and limestones of Eocene, Oligocene and Miocene (Tertiary) participate in limited troughs and synclines in the construction of the landscape.

The red, yellow, green and grey terrestrial sandstones of Buntsandstein and Keuper have formerly been used as building stones for castles, fortifications, churches, cathedrals, monasteries, palaces, town halls, city walls, city gates, towers, bridges, monuments and numerous houses in extensive areal distribution. In the highland of the Palatinate Forest, the alternation of harder fluvial sandstones and weaker aeolian sandstones in the stratigraphical record of the Buntsandstein and the tectonical framework of a slight inclination of the geological formations has allowed the development of spectacular rock monuments on the tops and flanks of many hills in both the open and forested terraced or stepped landscape, with the shapes of the denudation remnants of the Buntsandstein piles that have been created by the continuous erosion by water and wind encompassing among others tables, mushrooms, umbrellas, boots, pillars, towers, stairs, bridges, gates and arches (MADER 1995a, 1992a). Pronounced terraces and steps in the landscape of Palatinate Forest, Odenwald and Black Forest which are created by strongly-cemented layers of the Buntsandstein that are resistant against weathering are repeatedly the places of fascinating and attractive waterfalls.

3.3 Variscan basement in the central parts of Odenwald, Black Forest and Vosges

In the central parts of Odenwald, Black Forest and Vosges, the granite and gneiss of the eroded Variscan basement is also immediately exposed at the present surface of the landscape without a cover of Mesozoic sediments or Palaeozoic deposits or volcanites. In most parts of the highlands, however, the granite and gneiss of the eroded Variscan basement that has formed the pre-Permian or pre-Triassic surface of the landscape with a pronounced relief including elevations and depressions is covered by Mesozoic sediments of the Buntsandstein (Lower Triassic) or Palaeozoic deposits or volcanites of the Rotliegendes (Lower Permian) with erosional and/or angular unconformity (MADER 1985a, 1985b, 1992a, 1992b, 1999).

3.4 Quaternary aeolian loess cover in Upper Rhine valley and adjacent highlands

Both the plain of the Upper Rhine valley and the adjacent highlands are in parts covered by blankets and wedges of Quaternary aeolian loess (MADER 1999, 2000) which reaches up to several m thickness and is at many places in the landscape exposed in the typical hollow ways, ravines or gorges with quite stable walls consisting of loess and being stabilized by trees, bushes and grasses growing on the loess and rooting in the loess, by calcareous concretions that are dispersed or concentrated to layers within the loess, by loamy recent and fossil soils having developed on the loess or being buried within the loess, and by assemblages of calcareous tubes in ancient root horizons within the palaeosols in the pile of the loess. The loess is one of the best substrates for the widespread viticulture of red, blue, green and white grapes from which excellent and world-famous red and white wines and champagnes are produced, and is also one of the preferred substrates for nesting of various bees and wasps that favour insolated slopes of hollow ways and other exposed profiles of the loess for nidification.

3.5 Tertiary mafic volcanoes in Upper Rhine valley and adjacent highlands

The highlands surrounding the plain of the Upper Rhine valley are in places perforated by the eroded remnants of Tertiary mafic volcanoes (MADER 1985a, 1999), with the geomorphologically most accentuated and the geologically most outstanding member of the assemblage of the denudated ruins of Tertiary mafic volcanoes being the Katzenbuckel east of Eberbach eastnortheast of Heidelberg which reaches 626 m above sea level at its top and is the highest elevation in the Odenwald (MADER 2009a), and thus represents a significant landmark that can be seen from long distances.

The Katzenbuckel is geologically highlighted by its unique assemblage of alcaline basaltic volcanic and subvolcanic rocks as well as by inclusions of xenoliths of fossiliferous marine mudstones of the Dogger (Middle Jurassic) in the breccia filling parts of the volcanic pipe that document the removal of cover strata of abt. 600 m thickness by erosion since the eruption of the Tertiary Katzenbuckel volcano (FRENZEL 1975). Another famous downgraded relict of Tertiary mafic volcanoes in the highlands adjacent to the plain of the Upper Rhine valley is the Steinsberg south of Sinsheim southeast of Heidelberg that reaches 333 m above sea level at its top and is known as the compass of the Kraichgau, and at the northern margin of the Odenwald, the most pronounced eroded remnant of Tertiary mafic volcanoes is the Otzberg southsouthwest of Groß-Umstadt eastsoutheast of Darmstadt which reaches 368 m above sea level at its top and permits the orientation over large areas in the broad plain of the Main valley between Frankfurt am Main and Aschaffenburg.

Within the southern part of the Upper Rhine valley, the outstanding Tertiary volcanic complex of the Kaiserstuhl northwest of Freiburg resides like a crown of mountains on the fluvial sand plain and is similarly as the Katzenbuckel in the Odenwald world-famous for its exceptional petrographical assemblage of extraordinary volcanic and subvolcanic rocks, with several types of special volcanic and subvolcanic rocks of Kaiserstuhl and Katzenbuckel being unique in the world and occurring nowhere else in such a composition as at Kaiserstuhl and Katzenbuckel.

3.6 Elevation above sea level

The elevation above sea level within the study area is abt. 100 m in the plain of the Upper Rhine valley and extends up to abt. 600 m in the highlands of Odenwald, Palatinate Forest and Kraichgau surrounding the middle part of the Upper Rhine valley, whereas outside of the study area, the highest mountains in Black Forest and Vosges adjacent to the southern part of the Upper Rhine valley reach up to abt. 1,500 m.

4 Forestry of the study area

The comments on forestry of the study area of the distribution of the populations of the Stag Beetle *Lucanus cervus* in the surroundings of Heidelberg and Mannheim include wood types and distribution of the forest; and wood types in gardens, parks and graveyards.

4.1 Wood types and distribution of the forest

Both the plain of the Upper Rhine valley and the surrounding highlands of the Palatinate Forest and the Vosges in the west as well as the Odenwald, the Kraichgau and the Black Forest in the east contain numerous larger forest areas which are either coniferous forests that are dominated by pines, firs or larches, or are mixed deciduous forests including mainly oaks, beeches and ashes and subordinately also asps, birches, chestnut trees, elms, limes, maples, planes, poplars, redwood trees and robinias. The forests in the plain of the Upper Rhine valley and in the gentle landscape of the Kraichgau are usually easily accessible and are therefore regularly cultivated, whereas the forests in the adjacent highlands of Palatinate Forest, Vosges, Odenwald and Black Forest cover also steep slopes of hills and mountains where many parts are only hardly accessible and thus only limited cultivation is carried out in various intervals with pronounced morphology. Many towns and villages border immediately forest areas or extend with their outskirts into the adjacent or surrounding forest regions, and parts of the forest had formerly been removed during the expansion of the settle-

ments and the establishment of new districts around the old cores.

4.2 Wood types in gardens, parks and graveyards

In the marginal districts of many towns and villages close to the boundary to the neighbouring forest, particularly larger gardens, parks and graveyards with several to numerous older trees comprising mainly pines, firs, oaks, beeches, robinias, chestnut, cherry and walnut trees provide a forest-like environment which is accepted by the stag beetle *Lucanus cervus* as secondary urban habitat in addition to and in short distance from its original forest habitat. The forest-like environment in the marginal districts of many towns and villages has stimulated the extension of the habitat of the stag beetle *Lucanus cervus* from the forest into the gardens, parks and graveyards as a consequence of the primary reason of the successive advance of the settlements to the boundary of the surrounding forest or even into the adjacent forest, and the continuous approach of the marginal districts of many towns and villages towards or even into the neighbouring forest has triggered the secondary effect of establishment of a synanthropic tendency of the stag beetle *Lucanus cervus* to follow its suitable habitats from the original forest outside of the urban regions to the successive forest-like zones within the urban regions.

Larger gardens, parks and graveyards contain often subordinately to accessorily also (in alphabetical order) asp, birch, cedar, elm, ginkgo, larch, lime, maple, mulberry, plane, poplar, redwood, willow and yew trees, and many orchards consist predominantly of apple, pear, plum, cherry, quince and walnut trees. The suite of plum trees in the orchards includes different types which are mainly plum, greengage, mirabelle and peach trees, and another member of the assemblage of plum trees is the blackthorn which grows at the margins of forests and meadows in hedges. Various avenues are seamed by rows of oaks, chestnut trees, robinias or plane trees at one or both sides, and squares and public places are often highlighted by one or several oaks, chestnut trees, robinias, plane trees or walnut trees.

5 Climate and weather of the study area

The comments on climate and weather of the study area of the distribution of the populations of the Stag Beetle *Lucanus cervus* in the surroundings of Heidelberg and Mannheim include Mediterranean-like climate, immigration of meridional insects, average temperatures, maximum temperatures, wind and humidity.

5.1 Mediterranean-like climate

The middle and southern parts of the elongated plain of the Upper Rhine valley in the southwestern part of Germany are characterized by a Mediterranean-like climate with warm summers and mild winters which allows the growth and cultivation of peach, fig, kiwi and lemon trees and in some regions and/or in some extension even olive, orange and palm trees, and that supports also the widespread viticulture of red, blue, green and white grapes from which excellent and world-famous red and white wines and champagnes are produced. The peach trees that are cultivated in various gardens and orchards around Nußloch and Walldorf south of Heidelberg comprise different types with red, orange yellow, light yellow, yellowish green and greenish grey fruits and have been full of sweet and mature fruits in late summer 2009. Fig and kiwi trees are present in various gardens in the surroundings of Heidelberg where they produce fruits almost every year.

5.2 Immigration of meridional insects

The Mediterranean-like climate in the middle and southern parts of the Upper Rhine valley is also highlighted by the autochthonous occurrence of some typical thermophilous and heliophilous meridional insects such as the Praying Mantis *Mantis religiosa* LINNAEUS 1758 (Mantodea: Mantidae) which is particularly a characteristical member of the caloriphilous and solarophilous assemblage of the entomofauna of the Kaiserstuhl northwest of Freiburg (STROHM 1924, DETZEL 1992; BRECHTEL, EHRMANN & DETZEL 1996; DETZEL & EHRMANN 1998; EHRMANN 2002, 2003; STÄRZ 2006) which represents the eroded remnants of an outstanding Tertiary volcanic complex having perforated and sitting on the fluvial sand plain, and that contains also other Mediterranean elements.

The Delta Mud wasp *Delta unguiculatum* (VILLERS 1789) (Hymenoptera: Eumenidae) which is also originally of meridional provenance has immigrated into the southern parts of Germany already more than 100 years ago and is established as a permanent resident with stable indigenous populations in an extensive area in the Upper Rhine valley and in the side valleys in the adjacent highlands since long time (MADER 2000), and the Mud-Dauber *Sceliphron destillatorium* (ILLIGER 1807) (Hymenoptera: Sphecidae) has also already immigrated into some regions of the southern parts of Germany (MADER 2001).

Another spectacular meridional element of the entomofauna is the largest saturnid nocturnal butterfly in Middle Europe, the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* SCHIFFERMÜLLER (DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Saturniidae), which does not occur in indigenous populations in Germany, but is present in autochthonous populations in parts of Switzerland, Austria, France and Czechia, and sometimes even a few individuals immigrate temporarily as visitors into the southern parts of Germany where they are occasionally discovered as single specimens (EBERT & RENNWALD 1994), with among others one individual having been detected in Stuttgart in 1880 (WARNECKE 1927), several individuals having been captured in Heidelberg in 1907 and earlier years (SCHEPP 1908, KNÖRZER 1909), a few individuals having been noticed in Groitzsch southsouthwest of Leipzig in 1930 (IRMSCHER 1930), several individuals having been found in Singen westnorthwest of Konstanz at Lake Constance in 1931 (FUNK 1931), several individuals having been encountered within and around Saarbrücken in the period of abt. 1950 – 1960 (WAGNER-ROLLINGER 1950, SCHMIDT-KOEHL 1973) as well as one individual having been captured near Saarbrücken on 26.06.1963 (DUTREUX in PELLES 1963, ALPHONSE PELLES in HARBICH & WITTSTADT 1964), one individual having been observed in Sankt Ingbert northeast of Saarbrücken on 13.07.1975 (P. HUBERTUS in SCHMIDT-KOEHL 1977), several individuals having occurred within and around Sarreguemines (formerly Saargemünd) at the boundary between Germany and France since 1902 (MÜLLENBERGER 1906a, WARNECKE 1927, H. MÄRKER & P. SEILER in SCHMIDT-KOEHL 1977), and several individuals having been observed around Basel at the boundary between Germany and Switzerland in 1955 and earlier years (BOURGOGNE 1957). An experiment of artificial introduction of the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* has been carried out in Bad Windsheim southeast of Würzburg in 1872 (JÄCKEL 1873).

Another outstanding meridional and african element of the entomofauna is the largest sphingid nocturnal butterfly in Middle Europe, the Death´s-Head Hawk-Moth *Acherontia atropos* LINNAEUS 1758 (Lepidoptera: Sphingidae), which immigrates regularly from the Mediterranean region and from Africa into Middle Europe and occurs also in indigenous populations in the southern parts of Germany at least during the aestival generation (HARZ 1965, EBERT & RENNWALD 1994), with a particular abundant immigration having happened in 1956 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958), but is not a permanent resident. Other thermophilous and heliophilous meridional and pontian insects which immigrate into the southern parts of Germany are discussed among others by HUBER (1916) and WARNECKE (1927).

5.3 Average temperatures

The temperatures in the study area in the surroundings of Heidelberg and Mannheim during the flight period of the Stag Beetle *Lucanus cervus* in May, June and July are mainly in the range between abt. 18 °C and abt. 32 °C during the day and between abt. 15 °C and abt. 28 °C during the crepuscular period in the evening between 20 hrs and 22 hrs Middle European summer time when usually only a weak wind is blowing or it is even calm. The temperature range depends on the severity of the interruptions of longer periods of summerly sunny weather with occasional rainshowers and thunderstorms by shorter phases of cooler and wetter weather with lower temperatures, more rainfall and also more windy conditions. The temperature range depends also on the elevation of the localities above sea level and on the strength of the wind. The cumulative duration of sunshine in the middle and southern parts of the Upper Rhine valley exceeds 1,500 hrs per year and reaches sometimes even 2,000 hrs per year (ARMBORST 2008, RHEIN-NECKAR-ZEITUNG 2010).

5.4 Maximum temperatures

The maximum temperature at peak days of heat phases can reach in most cases up to 35 °C and in extreme cases even up to 38 °C particularly in the plain of the Upper Rhine valley, with usually only a few of such peak days occurring in May and June but in some years more peak days being developed in July and August. In most of the years, the maximum temperature reaches or exceeds 35 °C only at up to abt. 3 – 5 days, and in many years, the maximum temperature is above 30 °C only at up to abt. 10 – 20 days, whereas in especially hot summers, the maximum temperature could reach or exceed 35 °C at up to abt. 20 – 30 days and is above 30 °C at up to abt. 40 – 50 days. Particularly hot summers with extended heat phases in July and August have happened in 1994 and 2003. In some average or normal years, the maximum temperature does even not reach or exceed 35 °C at all, and the maximum temperature is above 30 °C only at up to abt. 5 – 15 days. A detailed record of the temperature as well as comments on rainfall and wind during the flight period of the Stag Beetle *Lucanus cervus* at the location of Tairnbach during my almost daily observations from 01.06.2008 to 15.08.2008 are contained in my book (MADER 2009a).

5.5 Wind

The wind in the study area in the surroundings of Heidelberg and Mannheim during the flight period of the Stag Beetle *Lucanus cervus* in May, June and July is mainly blowing from west to east and only subordinately to accessorily also from east to west. At many days, particularly in the morning and in the evening it is almost calm, whereas during the day, either a weak to moderate wind is blowing or it is also nearly calm. Stronger winds are predominantly or exclusively restricted to significant changes of weather with arrival and passage of rain and storm fronts in phases of unstable weather and low pressure, whereas they are absent or occur only exceptionally in periods of stable weather and high pressure.

5.6 Humidity

The humidity of the air is often high in the plain of the Upper Rhine valley, whereas it is usually low in the surrounding highlands, but occasionally also low humidity is established in the plain and high humidity is developed in the highlands. Particularly the days before the ends of longer periods of warm, dry and sunny weather which are terminated and separated by shorter phases of cool,

cloudy and rainy weather are quite sultry in the plain of the Upper Rhine valley, whereas the air is usually slightly to considerably drier in the adjacent highlands. Quite sultry conditions develop also in the front of advancing thunderstorms which frequently start to build up during the afternoon and burst out in the evening.

6 Investigated localities and research strategy

In addition to a list of the investigated localities in the study area of the distribution of the populations of the Stag Beetle *Lucanus cervus* in the surroundings of Heidelberg and Mannheim, some comments are offered on the research strategy for the achievement of data on the long-term population dynamics of the Stag Beetle *Lucanus cervus*.

6.1 Research strategy

In response to my calls for observations of the Stag Beetle *Lucanus cervus* in several regional newspapers (Rhein-Neckar-Zeitung 2008a, 2008b, 2008c, 2008d; Schwetzinger Zeitung 2008, Bruchsaler Rundschau 2008), more than 600 people have reported me their records at more than 225 localities in the area around Heidelberg and Mannheim in the southwestern part of Germany. Out of these more than 600 people, abt. 150 persons have registered the regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* at their places of residence for periods of up to 50 – 75 years at abt. 75 localities. These long-term data of the regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been grouped into individual localities or clusters of a few neighbouring localities. All the long-term data have been evaluated qualitatively, and if the observers could also report the average number of individuals of the Stag Beetle *Lucanus cervus* that they could note during their yearly observations, these long-term data have also been analyzed quantitatively. In various cases, several people at the same locality have covered more or less the same time span independently of each other, thus allowing an averaged quantitative evaluation and generalization of the population dynamics of the Stag Beetle *Lucanus cervus*. In other cases, several people have covered different time spans at the same locality in overlapping succession which permits a combination of the individual records to a longer chain, whereas in most cases, only individual reports of single observers are available which cannot be compared and averaged with the records of other observers of the Stag Beetle *Lucanus cervus*.

After the publication of my book (Mader 2009a), some more long-term data of the regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* in the area around Heidelberg and Mannheim have been received in response to further calls for observations in several regional newspapers in the current year (Mannheimer Morgen 2009a, 2009b; Rhein-Neckar-Zeitung 2009a, 2009b, 2009c; Weinheimer Nachrichten 2009) and also to an interview in broadcasting (Kurpfalz Radio 2009). The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east.

Periods of several decades or even more than half a century are usually beyond the extension of the career of most scientists. Even if a scientist would start to collect comparable long-term data on the regular annual appearance of the Stag Beetle *Lucanus cervus* at his place of residence and possibly also at a few other localities in close vicinity of his home site at young age at the beginning of his career, he would finally have only one single data set from one locality or a few data sets from a couple of neighbouring localities after a long time of continuous recording near the end of his career in advanced age, and this would be also only possible if the scientist could collect his data at

one or a few places during longer periods of time which would require his staying at one working affiliation without major changes over greater distances. The integrated evaluation of numerous data sets of the long-term regular annual appearance of the Stag Beetle *Lucanus cervus* has therefore only been possible by collection of the information of various amateur observers which live at their residences since longer periods of time. Luckily abt. 150 people in the area around Heidelberg and Mannheim have submitted long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years from abt. 75 localities for my integrated evaluation, and quite a few of them have even been able to quantify their observations for periods of up to three quarters of a century. It is clear that the records of these amateur observers which in part extend beyond my age cannot be evaluated with modern statistical techniques and do not meet the standard of modern statistical analyses of the distribution of individuals at the investigated localities, but in light of the above explanations there is no other way of interpretation and generalization of the long-term population dynamics of the Stag Beetle *Lucanus cervus*.

6.2 Investigated localities

Long-term population dynamics of the Stag Beetle *Lucanus cervus* have been recorded at the following localities which are listed in alphabetical order (the distances from Heidelberg have been measured from the Theodor-Heuss-bridge across the river Neckar between Heidelberg-Altstadt and Heidelberg-Neuenheim): Adelsheim (abt. 51 km east of Heidelberg), Adelsheim-Sennfeld (abt. 51 km east of Heidelberg), Angelbachtal-Eichtersheim (abt. 20 km southsoutheast of Heidelberg), Bellheim (abt. 38 km westsouthwest of Heidelberg), Bensheim (abt. 29 km north of Heidelberg), Bruchsal (abt. 31 km southsouthwest of Heidelberg), Bruchsal-Büchenau (abt. 36 km southsouthwest of Heidelberg), Brühl (abt. 11 km west of Heidelberg), Buchen (abt. 47 km eastnortheast of Heidelberg), Bürstadt (abt. 30 km northnorthwest of Heidelberg), Daisbach (abt. 19 km southeast of Heidelberg), Dielheim (abt. 15 km southsoutheast of Heidelberg), Dielheim-Horrenberg (abt. 16 km southsoutheast of Heidelberg), Dielheim-Unterhof (abt. 15 km southsoutheast of Heidelberg), Dossenheim (abt. 4 km north of Heidelberg), Dudenhofen (abt. 24 km westsouthwest of Heidelberg), Eberbach (abt. 22 km eastnortheast of Heidelberg), Eberbach-Gaimühle (abt. 27 km eastnortheast of Heidelberg), Eggenstein-Leopoldshafen (abt. 42 km southsouthwest of Heidelberg), Eppingen-Mühlbach (abt. 38 km southeast of Heidelberg), Eschelbronn (abt. 16 km southeast of Heidelberg), Fahrenbach (abt. 33 km eastnortheast of Heidelberg), Forst (abt. 29 km southsouthwest of Heidelberg), Graben-Neudorf (abt. 30 km southsouthwest of Heidelberg), Hambrücken (abt. 27 km southsouthwest of Heidelberg), Hirschberg-Großsachsen (abt. 11 km north of Heidelberg), Hirschberg-Leutershausen (abt. 9 km north of Heidelberg), Immelhäuser Hof south of Sinsheim (abt. 24 km southeast of Heidelberg), Karlsruhe-Rüppurr (abt. 52 km southsouthwest of Heidelberg), Ketsch (abt. 12 km westsouthwest of Heidelberg), Kraichtal-Oberöwisheim (abt. 29 km south of Heidelberg), Kronau (abt. 21 km south of Heidelberg), Lampertheim-Hüttenfeld (abt. 22 km northnorthwest of Heidelberg), Langenbrücken (abt. 23 km south of Heidelberg), Leimen (abt. 7 km south of Heidelberg), Limbach-Wagenschwend (abt. 33 km eastnortheast of Heidelberg), Malsch (abt. 19 km south of Heidelberg), Mingolsheim (abt. 21 km south of Heidelberg), Mörlenbach (abt. 20 km northnortheast of Heidelberg), Mosbach (abt. 32 km eastsoutheast of Heidelberg), Mühlhausen (abt. 18 km southsoutheast of Heidelberg), Neckarbischofsheim (abt. 23 km eastsoutheast of Heidelberg), Neckarelz (abt. 31 km eastsoutheast of Heidelberg), Neckarzimmern (abt. 33 km eastsoutheast of Heidelberg), Nußloch (abt. 9 km south of Heidelberg), Obergrombach (abt. 37 km southsouthwest of Heidelberg), Oftersheim (abt. 9 km westsouthwest of Heidelberg), Östringen (abt. 22 km south of Heidelberg), Philippsburg-Huttenheim (abt. 29 km southsouthwest of Heidelberg), Rauenberg (abt. 16 km south of Heidelberg), Reilingen (abt. 16 km southsouthwest of Heidelberg), Rettigheim (abt. 19 km south of Heidelberg), Robern (abt. 34 km eastnortheast of Heidelberg),

Römerberg-Mechtersheim (abt. 27 km westsouthwest of Heidelberg), Rot (abt. 16 km south of Heidelberg), Rot-Malsch train station (abt. 19 km south of Heidelberg), Sandhausen (abt. 8 km south of Heidelberg), Schönau (abt. 9 km eastnortheast of Heidelberg), Schriesheim (abt. 7 km north of Heidelberg), Schwetzingen (abt. 9 km westsouthwest of Heidelberg), Sensbachtal-Hebstahl (abt. 25 km eastnortheast of Heidelberg), Sinsheim (abt. 22 km southeast of Heidelberg), Sinsheim-Dühren (abt. 21 km southeast of Heidelberg), Sinsheim-Reihen (abt. 27 km southeast of Heidelberg), Sinsheim-Steinsfurt (abt. 25 km southeast of Heidelberg), Sinsheim-Weiler (abt. 26 km southeast of Heidelberg), Speyer (abt. 22 km westsouthwest of Heidelberg), Sankt Leon (abt. 17 km southsouthwest of Heidelberg), Stutensee-Friedrichstal (abt. 38 km southsouthwest of Heidelberg), Untergrombach (abt. 37 km southsouthwest of Heidelberg), Viernheim (abt. 17 km northnorthwest of Heidelberg), Vorderweidenthal (abt. 75 km southsouthwest of Heidelberg), Waghäusel-Kirrlach (abt. 21 km southsouthwest of Heidelberg), Waghäusel-Wiesental (abt. 24 km southsouthwest of Heidelberg), Walldorf (abt. 12 km south of Heidelberg), Weinheim (abt. 16 km north of Heidelberg), Wiesenbach (abt. 10 km eastsoutheast of Heidelberg), Wiesloch (abt. 13 km south of Heidelberg), Zeiskam (abt. 37 km westsouthwest of Heidelberg), and Zeutern (abt. 25 km south of Heidelberg). Short-term population dynamics of the stag beetle *Lucanus cervus* have also been investigated in Tairnbach which is situated abt. 17 km southsoutheast of Heidelberg. The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east.

7 Qualitative and quantitative long-term records of regular annual appearance of individuals

The results of the long-term population dynamics of the Stag Beetle *Lucanus cervus* in the area around Heidelberg and Mannheim in the southwestern part of Germany are grouped into four sections comprising qualitative long-term records, quantitative long-term records with averaged evaluation of several observers, quantitative long-term records of individual observers without averaged evaluation with changing frequency, and quantitative long-term records of individual observers without averaged evaluation with constant frequency which are presented as follows.

7.1 Qualitative long-term records over 50 – 75 years

From the more than 600 people which have delivered me data on observations of the Stag Beetle *Lucanus cervus* at more than 225 localities in the region around Heidelberg and Mannheim in the southwestern part of Germany, abt. 150 contributors have supplied me long-term observations of the regular annual appearance of the Stag Beetle *Lucanus cervus* at their places of residence for periods of up to 50 – 75 years at abt. 75 localities. The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east.

More than 70 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by HANSJÖRG RUFER (person. commun. 2008) in Schriesheim north of Heidelberg since 1935, with this outstanding documentation being the longest record of the continuous occurrence of the Stag Beetle *Lucanus cervus* in almost every year that has been obtained during my collection of data of the long-term distribution of the most prominent beetle in the entomofauna of Middle Europe.

More than 65 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by KARL SCHÄFER (person. commun. 2008) in Untergrombach southsouthwest of Heidelberg since abt. 1940, with this again remarkable documentation

being the second longest record of the continuous occurrence of the Stag Beetle *Lucanus cervus* in nearly every year which has been received during my compilation of data of the long-term distribution of the most spectacular beetle in the entomofauna of Middle Europe.

More than 60 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by GEBHARD MILDENBERGER (person. commun. 2008) in Hirschberg-Leutershausen north of Heidelberg since abt. 1945, by WERNER DIETRICH (person. commun. 2008) in Philippsburg-Huttenheim southwest of Heidelberg since abt. 1945, by WILHELM FLACH (person. commun. 2008) at the Immelhäuser Hof south of Sinsheim southeast of Heidelberg since 1945, and by ERICH BETTAG (person. commun. 2009) in Speyer and Dudenhofen westsouthwest of Heidelberg since 1949.

More than 55 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by HEINRICH REINHARD (person. commun. 2008) in the district Kanzelbachtal east of Schriesheim north of Heidelberg since 1950, by BIRGIT RAPP (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since abt. 1950, by THEO HEMBERGER (person. commun. 2008) in Rot and in Malsch south of Heidelberg since 1950, by EGON GÖBEL (person. commun. 2008) in Rettigheim south of Heidelberg since abt. 1950, by HEINRICH and CECILIA BIERLEIN (person. commun. 2008) in Philippsburg-Huttenheim southsouthwest of Heidelberg since abt. 1950, by WERNER EISELER (person. commun. 2008) in Forst southsouthwest of Heidelberg since abt. 1950, by KLAUS MÜLLER (person. commun. 2008) in Obergrombach southsouthwest of Heidelberg since abt. 1950, by HANS GASSMANN (person. commun. 2008) in Wiesloch south of Heidelberg since 1951, by HANS GUSE (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1952, and by HANS KOHLMANN (person. commun. 2008) in Neckarzimmern eastsoutheast of Heidelberg since 1952.

More than 50 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by MICHAEL PABST-NEUFANG (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1955, by HARTMUT BAUER (person. commun. 2008) in Schriesheim north of Heidelberg from abt. 1950 to 2005, by CHRISTA and ROBERT ERBRECHT (person. commun. 2008) in Hambrücken southsouthwest of Heidelberg from abt. 1945 to abt. 1998, by HANSJÖRG GÖTZ (person. commun. 2008) in Adelsheim east of Heidelberg since abt. 1955, and by ROLF SENK (person. commun. 2008) in Mosbach and Neckarelz eastsoutheast of Heidelberg from 1956 to 2006.

7.2 Qualitative long-term records over 30 – 50 years

More than 45 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by HANNA PFEFFERLE (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since 1958, by WALTER BRANDMEIER (person. commun. 2008) in Sankt Leon southsouthwest of Heidelberg from abt. 1945 to abt. 1995, by HERBERT MONTAG (person. commun. 2008) in Brühl west of Heidelberg from abt. 1948 to abt. 1998, by HEINRICH SCHMIDT (person. commun. 2008) in Nußloch south of Heidelberg since abt. 1960, by WILHELM MICHENFELDER (person. commun. 2008) in Zeutern south of Heidelberg since abt. 1960, by GERHARD KRÄMER (person. commun. 2008) in Adelsheim-Sennfeld east of Heidelberg since abt. 1960, by CHRISTA and ALFRED TREIBER (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1962, by GERDA REUSCHER (person. commun. 2008) in Schriesheim north of Heidelberg since 1962, by JOACHIM SCHÄFFNER (person. commun. 2008) in Bruchsal-Büchenau southsouthwest of Heidelberg since 1962, by LINDE GÖTZE (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since 1963, by FRIED-

RICH SCHWARTZ (person. commun. 2008) in Hirschberg-Leutershausen north of Heidelberg since 1963, and by HARTMUT BRÜCKER (person. commun. 2009) in Weinheim north of Heidelberg from 1955 to 2000.

More than 40 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by ELISABETH LÖFFLER (person. commun. 2008) in Schriesheim north of Heidelberg since 1965, by PETRA and NORBERT LOCHBÜHLER (person. commun. 2008) between Dossenheim and Schriesheim north of Heidelberg since abt. 1965, by MANFRED SCHMITT (person. commun. 2008) in Sinsheim southeast of Heidelberg since abt. 1965, by JÜRGEN WERNER (person. commun. 2008) in Bruchsal-Büchenau southsouthwest of Heidelberg since abt. 1965, by DIETER NOTHEIS (person. commun. 2008) in Hambrücken and Neudorf southsouthwest of Heidelberg since abt. 1965, by PETER RICHTER (person. commun. 2009) in Sinsheim-Weiler southeast of Heidelberg since 1967; and by JÜRGEN ALBERTI (person. commun. 2008) in the forests around Östringen, Rettigheim, Mühlhausen, Mingolsheim, Langenbrücken, Kronau, Sankt Leon, Rot, Walldorf, Wiesloch, Sandhausen, Nußloch and Leimen south of Heidelberg since 1967.

More than 35 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by ELFRIEDE FLACH (person. commun. 2008) at the Immelhäuser Hof south of Sinsheim southeast of Heidelberg since 1969, by GUDRUN KLUGE (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1970, by GABRIELE and WOLFGANG GIERSDORF (person. commun. 2008) in Ketsch westsouthwest of Heidelberg since 1970, by ULRICH SOHNS (person. commun. 2008) in Nußloch south of Heidelberg since abt. 1970, by PETER KNOPP (person. commun. 2008) in Eppingen-Mühlbach southeast of Heidelberg since abt. 1970, by GERHARD WERSTEIN (person. commun. 2008) in Untergrombach southsouthwest of Heidelberg since 1970, by ULRIKE SCHOFER (person. commun. 2008) in Leimen south of Heidelberg from abt. 1957 to abt. 1997, by JOHN GÖTTLING (person. commun. 2008) in Zeutern south of Heidelberg since 1972, by HORST WELKER (person. commun. 2008) in Nußloch south of Heidelberg since 1973, by ERIKA and KARL SCHRAMM (person. commun. 2008) in Sensbachtal-Hebstahl eastnortheast of Heidelberg since 1973, and by ROLF SCHOLTYSEK (person. commun. 2008) in Vorderweidenthal southsouthwest of Heidelberg since 1973.

More than 30 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by ANDREAS WEISS (person. commun. 2008) in Graben-Neudorf and Philippsburg-Huttenheim southsouthwest of Heidelberg since abt. 1975, by MARION VESPER (person. commun. 2008) in Eberbach eastnortheast of Heidelberg since abt. 1975, by HANNELORE REINHARD (person. commun. 2008) in the district Kanzelbachtal east of Schriesheim north of Heidelberg since 1976, by ERIKA ROTHERMEL (person. commun. 2008) at the train station Rot-Malsch south of Heidelberg since 1976, by ANNEMARIE BENDER (person. commun. 2008) in Rettigheim south of Heidelberg since 1977, by GERHARD BECKER (person. commun. 2008) in the district Kanzelbachtal east of Schriesheim north of Heidelberg since 1978, by GABI and WOLFGANG SCHEUER (person. commun. 2008) in Reilingen southsouthwest of Heidelberg since 1978, by SIGRID and FRITZ OTT (person. commun. 2008) in Mosbach eastsoutheast of Heidelberg since 1978, by WALTER WISWESSER (person. commun. 2008) in Adelsheim east of Heidelberg since 1978, and by WALDEMAR ZIMMERMANN (person. commun. 2008) in the forests around Bruchsal and Untergrombach southsouthwest of Heidelberg since abt. 1978.

7.3 Qualitative long-term records over 20 – 30 years

More than 25 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by SIGRID KEIL (person. commun. 2008) in Mosbach

eastsoutheast of Heidelberg since 1979, by RUTH WELKER (person. commun. 2008) in Nußloch south of Heidelberg since abt. 1980, by KLAUS HARTENSUER (person. commun. 2009) in Ketsch westsouthwest of Heidelberg since 1980, by HELGA MATTERN (person. commun. 2008) in Mosbach eastsoutheast of Heidelberg since 1980, by MARIA KOTTER (person. commun. 2008) in Untergrombach southsouthwest of Heidelberg since 1980, by HERMANN SCHWARZ (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since abt. 1980, by ERICH LEHN (person. commun. 2008) in the district Ziegelhausen at the eastern margin of the city of Heidelberg from abt. 1942 to abt. 1970, by ROSEMARIE BRAUCH (person. commun. 2008) in Mosbach eastsoutheast of Heidelberg since 1981, by ERWIN SEFRIN (person. commun. 2009) in Römerberg-Mechtersheim southwest of Heidelberg since 1982, by JOSEF SCHÄFER (person. commun. 2008) in Walldorf south of Heidelberg from 1967 to 1993 and from abt. 1945 to 1958, by PETER RICHTER (person. commun. 2009) in Dielheim southsoutheast of Heidelberg since 1983, by WILHELM GOES (person. commun. 2008) in Eberbach-Gaimühle eastnortheast of Heidelberg since 1983, and by JOACHIM ZÜRKER (person. commun. 2009) in Zeiskam and Bellheim westsouthwest of Heidelberg since abt. 1983. The period of 25 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* has also been covered by repetitive observations during yearly visits by PETER SANDMAIER (person. commun. 2008) in Jochenstein north of Engelhartszell eastsoutheast of Passau in the Danube valley from 1982 to 2007, and by continuous observations by ANDREAS MALTEN (person. commun. 2009) in Dreieich-Buchschlag south of Frankfurt am Main in the Main valley since 1984.

More than 20 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by DIETER RÖSCH (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1984, by RENATE and FRITZ SCHASER (person. commun. 2008) in Graben-Neudorf southsouthwest of Heidelberg since 1984, by GODULA HÄNLEIN (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since 1985, by KLAUS-PETER FRANK (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since abt. 1985, by KARL-FRIEDRICH RAQUÉ (person. commun. 2008) in the district Handschuhsheim at the northern margin of the city of Heidelberg since abt. 1985; by FRANZISKA STAU (person. commun. 2008) in Eggenstein-Leopoldshafen, Graben-Neudorf and Waghäusel-Wiesental southsouthwest of Heidelberg since abt. 1985; by GERHARD REUSCHER (person. commun. 2008) in Bürstadt northnorthwest of Heidelberg from abt. 1960 to 1983, by INGOLF NOBEST (person. commun. 2009) in Sinsheim-Steinsfurt southeast of Heidelberg from abt. 1960 to abt. 1985, by STEFAN LICHTBLAU (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg from abt. 1980 to abt. 2002, by DAGMAR ZIMMERMANN (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1987, and by FRIEDRICH SCHWARTZ (person. commun. 2008) in Hirschberg-Großsachsen north of Heidelberg since 1987.

7.4 Qualitative long-term records over 10 – 20 years

More than 15 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by GERLINDE GODER (person. commun. 2008) in Schriesheim north of Heidelberg since 1989, by GERTRUD and MAX ZENKNER (person. commun. 2008) in Rettigheim south of Heidelberg since 1989, by BERTRAM-ERNST BERNHARDT (person. commun. 2008) in Adelsheim east of Heidelberg since 1989, by HELGA BEYAERT (person. commun. 2008) in Schriesheim north of Heidelberg from 1977 to 1997, by LUDWIG FUHRMANN (person. commun. 2008) in Limbach-Wagenschwend eastnortheast of Heidelberg from 1960 to 1980, by HELGA GÖCK (person. commun. 2008) in Ketsch westsouthwest of Heidelberg from abt. 1950 to abt. 1970, by HERMANN GREULICH (person. commun. 2008) in Rauenberg south of Heidelberg from abt. 1950 to abt. 1970, by CHRISTEL SEITZ (person. commun. 2008) in the district Branich northeast of Schriesheim north of Heidelberg since 1990, by FRANZ AUER (person. commun. 2009) in the district Hand-

schuhsheim at the northern margin of the city of Heidelberg since abt. 1990, by BETTINA PFISTER (person. commun. 2008) in Ketsch westsouthwest of Heidelberg since 1990, by KARL-FRIEDRICH RAQUÉ (person. commun. 2008) in Adelsheim east of Heidelberg since abt. 1990, by UDO HANKE (person. commun. 2008) in Ketsch westsouthwest of Heidelberg from 1975 to 1993, by FRANK SÜRMANN (person. commun. 2008) in Mörlenbach northnortheast of Heidelberg since 1992, by GABRIELE FALK (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since 1993, by KARL-HEINZ HOLL (person. commun. 2008) in the district Handschuhsheim at the northern margin of the city of Heidelberg since abt. 1993, by LEONORE HEILIG (person. commun. 2008) in Leimen south of Heidelberg since 1993, by GUNTER GLASBRENNER (person. commun. 2008) in Daisbach southeast of Heidelberg from 1965 to 1980 and in Walldorf south of Heidelberg since 1993, by ALPH LEHMANN (person. commun. 2008) in Dielheim-Horrenberg southsoutheast of Heidelberg since abt. 1993, by MANFRED SCHMITT (person. commun. 2008) in Daisbach southeast of Heidelberg from 1950 to 1965, and by EDUARD REISS (person. commun. 2008) in Rettigheim south of Heidelberg from abt. 1950 to abt. 1965.

More than 10 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by HANS-MICHAEL KÜHL (person. commun. 2008) in Hirschberg-Großsachsen north of Heidelberg since 1995, by KORNELIA KAPINUS (person. commun. 2008) in Sinsheim-Dühren southeast of Heidelberg since abt. 1995, by WERNER KRÖLL (person. commun. 2008) in Kronau south of Heidelberg since abt. 1995, by GERHARD ZAHN (person. commun. 2008) in Dielheim-Unterhof southsoutheast of Heidelberg since 1996, by SUSANNE HOFER VON LOBENSTEIN (person. commun. 2008) in Schwetzingen westsouthwest of Heidelberg from 1993 to 2007, by ERICH SCHWEIKERT (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg from abt. 1995 to 2007, by INGEBORG FISCHER (person. commun. 2008) in Eschelbronn southeast of Heidelberg from 1994 to 2006, by KONRAD PAULER (person. commun. 2008) in Rinschheim eastnortheast of Buchen eastnortheast of Heidelberg from abt. 1945 to 1959, by ELFENTRAUD WABRO (person. commun. 2008) in Mingolsheim south of Heidelberg from abt. 1950 to abt. 1960 or 1965, by WOLFGANG SCHMITT (person. commun. 2008) in Schriesheim north of Heidelberg from 1955 to 1966, by WALTRAUD MOOS (person. commun. 2008) in Schönau eastnortheast of Heidelberg from 1968 to 1980, and by HEIDRUN MAIER (person. commun. 2008) in Sinsheim-Reihen southeast of Heidelberg from abt. 1960 to 1975.

7.5 Qualitative long-term records over up to 10 years

More than 5 years of regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* have been covered by continuous observations by MICHAEL GUSSMANN (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg since 1998, by NICOLA LUTZMANN (person. commun. 2008) in the district Neuenheim in the northern part of the city of Heidelberg from 1997 to 2007, by BRIGITTA and WERNER KNEISEL (person. commun. 2008) in Nußloch south of Heidelberg since abt. 1998, by MANFRED HÄUSELMANN (person. commun. 2008) in Angelbachtal-Eichtersheim southsoutheast of Heidelberg since abt. 1998 and from abt. 1948 to 1955, by GÜNTER NASTANSKY-WARNECKE (person. commun. 2008) in Lampertheim-Hüttenfeld northnorthwest of Heidelberg from 1973 to 1982, by MICHAEL WAITZMANN (person. commun. 2008) in Stutensee-Friedrichstal and around Karlsruhe-Rüppurr southsouthwest of Heidelberg since 2000, by SUSANNE HEISS (person. commun. 2008) and ANKE GUNTHER-THEIL (person. commun. 2008) in Dossenheim north of Heidelberg from 2000 to 2007, by GABRIELE and WOLFGANG SCHMITT (person. commun. 2008) in Schriesheim north of Heidelberg since 2000 and from 1978 to abt. 1982, by GUIDO ABELN (person. commun. 2008) in Schriesheim north of Heidelberg from 1980 to 1990, by MATHIAS BEYER (person. commun. 2009) in Schriesheim north of Heidelberg since abt. 2002, by PETER BAUMANN (person. commun. 2008) and MATTHIAS RUFER (person. commun. 2008) in Schriesheim north of Heidelberg

since 2003, by Ruth Schilling (person. commun. 2008) in Schriesheim north of Heidelberg from 1994 to 2003, by Hans Welter (person. commun. 2008) in Schriesheim north of Heidelberg from abt. 1991 to abt. 1998, by Petra Berger (person. commun. 2008) in Schönau eastnortheast of Heidelberg from abt. 1998 to 2007, by Manfred Robens (person. commun. 2008) in Schwetzingen westsouthwest of Heidelberg since 2002 and in Ketsch westsouthwest of Heidelberg from 1997 to 2007, by Rolf Scholtysek (person. commun. 2008) in Ketsch westsouthwest of Heidelberg since 2000, by Willi Gruhn (person. commun. 2008) in Reilingen southsouthwest of Heidelberg since 2000, by Bernd Behring (person. commun. 2008) in Walldorf south of Heidelberg since abt. 2000, by Astrid Bombosch (person. commun. 2008) in Leimen south of Heidelberg since 2001, by Monika Lucha (person. commun. 2008) in Oftersheim westsouthwest of Heidelberg since abt. 2002, by Karin and Karl-Heinz Treu (person. commun. 2008) in Mühlhausen southsoutheast of Heidelberg since abt. 2002, by Armin Horst (person. commun. 2008) in Buchen eastnortheast of Heidelberg from abt. 1970 to 1981, by Dieter Weick (person. commun. 2008) in Philippsburg-Huttenheim southsouthwest of Heidelberg from abt. 1969 to 1975, by Gabriela Delvo-Frey (person. commun. 2008) in Wiesenbach eastsoutheast of Heidelberg from 1957 to 1967, by Lukas Kieslinger (person. commun. 2008) in Nußloch south of Heidelberg from abt. 1975 to 1985, by Angelika Zimmermann (person. commun. 2008) in Rettigheim south of Heidelberg from abt. 1970 to abt.1980, by Manfred Emmerich (person. commun. 2008) in Malsch south of Heidelberg from abt. 1960 to abt. 1970, by Gisela Heiler (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg from 1940 to 1950, by Karl Quell (person. commun. 2009) in Waghäusel-Kirrlach southsouthwest of Heidelberg from 1939 to 1949, by Franz Debatin (person. commun. 2008) in Hambrücken southsouthwest of Heidelberg since abt. 2002, by Jürgen Ludreschl (person. commun. 2008) in Neckarbischofsheim eastsoutheast of Heidelberg from abt. 1970 to 1980, by Fritz Eidenmüller (person. commun. 2008) in Weinheim north of Heidelberg from 1965 to 1972, by Andreas Sauer (person. commun. 2009) in Viernheim northnorthwest of Heidelberg from 1989 to 1999, by Klaus Blume (person. commun. 2008) in Bensheim north of Heidelberg from 1955 to 1965, by Peter Braun (person. commun. 2008) in Mosbach eastsoutheast of Heidelberg from 1968 to 1975, by Barbara Berger (person. commun. 2008) in Mosbach eastsoutheast of Heidelberg from 1998 to 2007, by Ingrid Diehm (person. commun. 2008) in Fahrenbach eastnortheast of Heidelberg from 1950 to 1958, by Hans Huber (person. commun. 2008) in Robern eastnortheast of Heidelberg from 1950 to 1960, by Maritta Belz (person. commun. 2008) in Adelsheim east of Heidelberg from abt. 1970 to 1980, by Kristin Tröndle-Stork and Martin Stork (person. commun. 2008) in Bruchsal southsouthwest of Heidelberg since 2003, and by Roland Zimmermann (person. commun. 2009) in Kraichtal-Oberöwisheim south of Heidelberg since abt. 2000.

7.6 Quantitative long-term records with averaged evaluation of several observers

In addition to the qualitative long-term records of the regular annual occurrence of the Stag Beetle *Lucanus cervus* by abt. 150 observers for periods of up to 50 – 75 years at abt. 75 localities in the region around Heidelberg and Mannheim in the southwestern part of Germany, various of these observers have also been able to supply quantitative long-term records by providing also information on the average number of individuals of the Stag Beetle *Lucanus cervus* that they have noticed in the consecutive years. The localities where the long-term regular annual occurrence of the Stag Beetle *Lucanus cervus* has been registered by several observers independently of each other covering more or less the same time span or in overlapping succession covering different time spans, thereby allowing generalization of the population dynamics by averaged evaluation of the individual reports, include the district Branich northeast of Schriesheim and the district Kanzelbachtal east of Schriesheim north of Heidelberg, Schriesheim and Weinheim north of Heidelberg, the dis-

trict Neuenheim in the northern part of the city of Heidelberg; Nußloch, Leimen, Rettigheim and Zeutern south of Heidelberg; Ketsch westsouthwest of Heidelberg; Philippsburg-Huttenheim, Hambrücken, Graben-Neudorf, Bruchsal and Untergrombach southsouthwest of Heidelberg; Eberbach eastnortheast of Heidelberg, Adelsheim east of Heidelberg, and Mosbach and Neckarelz eastsoutheast of Heidelberg.

In the district Branich northeast of Schriesheim north of Heidelberg, the averaged evaluation of the long-term records of several observers that have registered the regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other summarizes the population dynamics as follows: from abt. 1950 to abt. 1990, predominantly abt. 10 – 20 individuals and subordinately abt. 5 – 10 individuals have been seen annually by every observer, whereas from abt. 1990 to abt. 2000, predominantly abt. 5 – 10 individuals and subordinately abt. 10 – 20 individuals have been recorded annually by every observer, and from abt. 2000 to 2008, predominantly abt. 3 – 5 individuals and subordinately abt. 5 – 10 individuals have been recognized annually by every observer, thus reflecting a decline of the number of individuals of the Stag Beetle *Lucanus cervus* with time. In the district Neuenheim in the northern part of the city of Heidelberg north of the river Neckar as well as in Schriesheim (except of the districts Branich and Kanzelbachtal) north of Heidelberg, the averaged evaluation of the long-term records of several observers that have noticed the regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other summarizes the population dynamics as follows: from abt. 1950 to 2008, predominantly abt. 2 – 3 individuals or abt. 3 – 5 individuals and subordinately abt. 5 – 10 individuals or even abt. 10 – 15 individuals have been registered annually by every observer, thus not permitting to outline a trend of diminution of the number of individuals of the Stag Beetle *Lucanus cervus* with time, but rather reflecting random fluctuations of the yearly quantity of individuals depending on various climatical and environmental influences.

In the district Kanzelbachtal east of Schriesheim north of Heidelberg, several observers have registered the regular annual occurrence of the Stag Beetle *Lucanus cervus* from 1950 to 2008 and have encountered either abt. 5 – 10 individuals or abt. 10 – 20 individuals per year, thus also not allowing to conclude a trend of diminution of the number of individuals with time, but rather indicating irregular changes of the annual quantity of individuals similarly as in Neuenheim and Schriesheim. The same relationships concerning the long-term population dynamics of the Stag Beetle *Lucanus cervus* as being valid for Neuenheim and Schriesheim (except of the district Branich but including the district Kanzelbachtal) apply also for other localities which are outlined as follows. In Nußloch and Leimen south of Heidelberg, the averaged evaluation of the long-term records of several observers that have noticed the regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other indicates that from abt. 1960 to 2008, predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals have been registered annually by every observer, with only in some places also abt. 20 – 30 individuals per year having been seen from 1998 to 2008 by a few observers in Nußloch. A similar trend as in Nußloch and Leimen has been established in Rettigheim south of Heidelberg and in Philippsburg-Huttenheim southsouthwest of Heidelberg where from abt. 1945 to 2008, predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals of the Stag Beetle *Lucanus cervus* have been encountered annually by every observer, with only in some years also abt. 10 – 15 individuals per year having been met by a few observers in Rettigheim and only in some places also abt. 20 – 30 individuals per year having been seen from 1996 to 2008 by a few observers in Philippsburg-Huttenheim.

In Weinheim north of Heidelberg, in Adelsheim east of Heidelberg and in Zeutern south of Heidelberg, the averaged evaluation of the long-term records of several observers that have noticed the regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other reveals that from abt. 1955 to 2008, predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals have been registered annually by every observer. The same distribution has been found in

Mosbach eastsoutheast of Heidelberg where from abt. 1978 to 2008, predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals of the Stag Beetle *Lucanus cervus* have been encountered annually by every observer. A similar trend has also been established in Eberbach eastnortheast of Heidelberg where from abt. 1945 to 2008, predominantly abt. 1 – 2 individuals and subordinately abt. 3 – 5 individuals have been met annually by every observer, and in Hambrücken and Bruchsal southsouthwest of Heidelberg where from abt. 1962 to 2008, predominantly abt. 1 – 2 individuals and subordinately abt. 3 – 5 individuals have been seen annually by every observer, with only in some years also abt. 5 – 10 individuals per year having been identified by a few observers in Hambrücken. In Ketsch westsouthwest of Heidelberg, the averaged evaluation of the long-term records of several observers that have noticed the regular annual appearance of the Stag Beetle *Lucanus cervus* in overlapping succession covering different time spans testifies to the occurrence of predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals per year from abt. 1950 to 2008 according to the registration by the individual observers in consecutive sequence.

In Untergrombach southsouthwest of Heidelberg, the averaged evaluation of the long-term records of several observers that have noticed the regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other delineates that from abt. 1940 to abt. 1960, abt. 10 – 15 individuals have been registered annually, whereas from abt. 1960 to 2008, predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals have been encountered annually by every observer, with only in some years also abt. 5 – 10 individuals having been noted by a few observers. In Graben-Neudorf southsouthwest of Heidelberg, from 1975 to 2008 several observers have recorded annually abt. 1 – 2 individuals or abt. 3 – 5 individuals of the Stag Beetle *Lucanus cervus*, whereas in some years, also up to 5 – 10 individuals have been noted per year. In Neckarelz eastsoutheast of Heidelberg, from abt. 1956 to 2006 predominantly abt. 5 – 10 individuals and subordinately abt. 10 – 15 individuals of the Stag Beetle *Lucanus cervus* have been encountered annually by one observer, whereas another observer has reported the yearly occurrence of abt. 2 – 3 individuals from abt. 1945 to 2008.

7.7 Quantitative long-term records of individual observers without averaged evaluation with changing frequency

Apart from the aforementioned outstanding cases where several observers have registered the long-term regular annual appearance of the Stag Beetle *Lucanus cervus* independently of each other covering more or less the same time span or in overlapping succession covering different time spans at the same locality or at a few separate localities in close neighbourhood to each other, thus allowing generalization of the population dynamics by averaged evaluation of the individual reports, various individual observers have also contributed quantitative long-term records which cannot be compared with the results of other observers at the same locality or at an adjacent locality. The localities where the long-term regular annual occurrence of the Stag Beetle *Lucanus cervus* has been documented only by individual observers thus not permitting averaged evaluation include Hirschberg-Leutershausen and Hirschberg-Großsachsen north of Heidelberg, the district Handschuhsheim at the northern margin of the city of Heidelberg, the district Ziegelhausen at the eastern margin of the city of Heidelberg, Brühl west of Heidelberg, Bürstadt and Lampertheim-Hüttenfeld northnorthwest of Heidelberg; Sankt Leon, Rot, Reilingen, Waghäusel-Wiesental, Eggenstein-Leopoldshafen, Forst, Obergrombach and Stutensee-Friedrichstal southsouthwest of Heidelberg; Walldorf, Wiesloch, Malsch, the train station Rot-Malsch, Kronau and Mingolsheim south of Heidelberg; Dielheim-Horrenberg southsoutheast of Heidelberg; Sinsheim, Daisbach and Eppingen-Mühlbach southeast of Heidelberg; Neckarzimmern eastsoutheast of Heidelberg; Eberbach, Sensbachtal-Hebstahl and Buchen eastnortheast of Heidelberg; Mörlenbach northnortheast of Heidelberg; and

Speyer, Dudenhofen, Römerberg-Mechtersheim, Zeiskam, Bellheim and Vorderweidenthal west-southwest of Heidelberg. The examples of quantitative long-term records of the Stag Beetle *Lucanus cervus* of individual observers without averaged evaluation with changing frequency are compiled in this section, whereas the examples of quantitative long-term records of individual observers without averaged evaluation with constant frequency are grouped in the following section.

Friedrich Schwartz (person. commun. 2008) has noticed annually abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* from 1963 to 1987 and abt. 1 – 3 individuals from 1987 to 2008 in Hirschberg-Leutershausen north of Heidelberg as well as abt. 3 – 5 individuals from 1987 to 2007 in Hirschberg-Großsachsen north of Heidelberg, and Klaus Hartensuer (person. commun. 2009) has recorded abt. 5 – 10 individuals per year in Hirschberg-Leutershausen and Hirschberg-Großsachsen from 1967 to 1980. In Brühl west of Heidelberg, Herbert Montag (person. commun. 2008) has seen annually abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* from abt. 1948 to abt. 1983, abt. 1 – 2 individuals from abt. 1983 to abt. 1998, and no more individuals from abt. 1998 to 2008. In Sankt Leon southsouthwest of Heidelberg, Walter Brandmeier (person. commun. 2008) has registered annually abt. 20 – 25 individuals of the Stag Beetle *Lucanus cervus* from abt. 1945 to abt. 1955, whereas from abt. 1955 to abt. 1995, the quantity of individuals has successively diminished via abt. 10 – 15 individuals and abt. 5 – 10 individuals to abt. 2 – 5 individuals, and from 1995 to 2007, no more individuals have been observed. At the train station Rot-Malsch south of Heidelberg, Erika Rothermel (person. commun. 2008) has recognized annually abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* from 1976 to 2000, whereas the number of individuals has decreased to abt. 3 – 5 individuals from 2000 to 2005 and to abt. 1 – 3 individuals from 2005 to 2008. In Obergrombach southsouthwest of Heidelberg, Klaus Müller (person. commun. 2008) has seen annually abt. 10 – 15 individuals of the Stag Beetle *Lucanus cervus* from abt. 1950 to abt. 1985, whereas the quantity of individuals has diminished to abt. 5 – 10 individuals from abt. 1985 to abt. 1995 and to abt. 3 – 5 individuals from abt. 1995 to 2008.

In Sinsheim southeast of Heidelberg, Manfred Schmitt (person. commun. 2008) has realized annually abt. 15 – 20 individuals of the Stag Beetle *Lucanus cervus* from abt. 1965 to abt. 1996, whereas the amount of individuals has declined to abt. 3 – 5 individuals from abt. 1996 to 2003 and to abt. 1 – 2 individuals from 2003 to 2008. In Sinsheim-Reihen southeast of Heidelberg, Heidrun Maier (person. commun. 2008) has recorded annually abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* from abt. 1960 to 1970, whereas from 1970 to 1975, only still abt. 1 – 2 individuals have been observed, and after 1975, no more individuals have been encountered. In Forst southsouthwest of Heidelberg, Werner Eiseler (person. commun. 2008) has seen annually abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* from abt. 1950 to 1960, whereas he has only still observed abt. 2 – 3 individuals in most of the years from 1960 to 2008. In Eppingen-Mühlbach southeast of Heidelberg, Peter Knopp (person. commun. 2008) has noticed annually abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* from abt. 1970 to abt. 1995, whereas the quantity of individuals has diminished to abt. 1 – 3 individuals from abt. 1995 to 2008. In Mingolsheim south of Heidelberg, Elfentraud Wabro (person. commun. 2008) has registered annually up to abt. 10 individuals of the Stag Beetle *Lucanus cervus* from abt. 1950 to 1955, whereas the quantity of individuals has decreased to abt. 3 – 5 individuals from 1955 to abt. 1960 or 1965, and after abt. 1960 or 1965, no more individuals have been met.

7.8 Quantitative long-term records of individual observers without averaged evaluation with constant frequency

The examples of quantitative long-term records of the Stag Beetle *Lucanus cervus* of individual ob-

servers without averaged evaluation with constant frequency are compiled in this section, whereas the examples of quantitative long-term records of individual observers without averaged evaluation with changing frequency are grouped in the preceding section.

Abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* have been encountered annually from 1973 to 2008 by ROLF SCHOLTYSEK (person. commun. 2008) in Vorderweidenthal southsouthwest of Heidelberg as well as from 1939 to 1949 by KARL QUELL (person. commun. 2009) in Waghäusel-Kirrlach southsouthwest of Heidelberg, and abt. 15 – 30 individuals have been recorded per year from 1980 to 2009 by KLAUS HARTENSUER (person. commun. 2009) in Ketsch westsouthwest of Heidelberg. Abt. 15 – 20 individuals of the Stag Beetle *Lucanus cervus* per evening have been observed annually for 2 – 4 successive days each during repetitive visits on weekends from 1982 to 2007 by PETER SANDMAIER (person. commun. 2008) in Jochenstein north of Engelhartszell eastsoutheast of Passau in the Danube valley. Abt. 15 – 20 individuals of the Stag Beetle *Lucanus cervus* or even more have been registered annually from 1984 to 2009 by ANDREAS MALTEN (person. commun. 2009) in Dreieich-Buchschlag south of Frankfurt am Main in the Main valley.

Abt. 10 – 15 individuals of the Stag Beetle *Lucanus cervus* have been noticed annually from 1983 to 2008 by WILHELM GOES (person. commun. 2008) in Eberbach-Gaimühle eastnortheast of Heidelberg, from 1965 to 1980 by GUNTER GLASBRENNER (person. commun. 2008) in Daisbach southeast of Heidelberg, from 2000 to 2008 by MICHAEL WAITZMANN (person. commun. 2008) in Stutensee-Friedrichstal southsouthwest of Heidelberg, and from 1940 to 1950 by GISELA HEILER (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg.

Up to abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* have been observed annually from 1949 to 2008 by ERICH BETTAG (person. commun. 2009) in Speyer and Dudenhofen westsouthwest of Heidelberg; from 1967 to 2008 by JÜRGEN ALBERTI (person. commun. 2008) in the forests around Östringen, Rettigheim, Mühlhausen, Mingolsheim, Langenbrücken, Kronau, Sankt Leon, Rot, Walldorf, Wiesloch, Sandhausen, Nußloch and Leimen south of Heidelberg; from 1982 to 2008 by ERWIN SEFRIN (person. commun. 2009) in Römerberg-Mechtersheim westsouthwest of Heidelberg, from abt. 1983 to 2008 by JOACHIM ZÜRKER (person. commun. 2009) in Zeiskam and Bellheim westsouthwest of Heidelberg, from 1990 to 2007 by FRANZ AUER (person. commun. 2009) in the district Handschuhsheim at the northern margin of the city of Heidelberg, from 1992 to 2008 by FRANK SÜRMANN (person. commun. 2008) in Mörlenbach northnortheast of Heidelberg, from 1993 to 2008 by GUNTER GLASBRENNER (person. commun. 2008) in Walldorf south of Heidelberg, from abt. 1945 to 1959 by KONRAD PAULER (person. commun. 2008) in Rinschheim eastnortheast of Buchen eastnortheast of Heidelberg, from 1950 to 1958 by INGRID DIEHM (person. commun. 2008) in Fahrenbach eastnortheast of Heidelberg, from 1973 to 1982 by GÜNTER NASTANSKY-WARNECKE (person. commun. 2008) in Lampertheim-Hüttenfeld northnorthwest of Heidelberg, from 1989 to 1999 by ANDREAS SAUER (person. commun. 2009) in Viernheim northnorthwest of Heidelberg, and from 2000 to 2008 by ROLAND ZIMMERMANN (person. commun. 2009) in Kraichtal-Oberöwisheim south of Heidelberg.

Abt. 3 – 5 individuals of the Stag Beetle *Lucanus cervus* have been registered annually from abt. 1985 to 2008 by KARL-FRIEDRICH RAQUÉ (person. commun. 2008) in the district Handschuhsheim at the northern margin of the city of Heidelberg, from 1967 to 1993 and from abt. 1945 to 1958 by JOSEF SCHÄFER (person. commun. 2008) in Walldorf south of Heidelberg, from abt. 1942 to abt. 1970 by ERICH LEHN (person. commun. 2008) in the district Ziegelhausen at the eastern margin of the city of Heidelberg, from 1950 to 1965 by MANFRED SCHMITT (person. commun. 2008) in Daisbach southeast of Heidelberg, from 1965 to 1972 by FRITZ EIDENMÜLLER (person. commun. 2008) in Weinheim north of Heidelberg, and from 2003 to 2008 by KRISTIN TRÖNDLE-STORK and MARTIN STORK (person. commun. 2008) in Bruchsal southsouthwest of Heidelberg. Predominantly abt. 2 – 3 individuals and subordinately abt. 3 – 5 individuals of the Stag Beetle *Lucanus cervus* have been met annually from

1973 to 2008 by Erika and Karl Schramm (person. commun. 2008) in Sensbachtal-Hebstahl east-northeast of Heidelberg.

Abt. 2 – 3 individuals of the Stag Beetle *Lucanus cervus* have been seen annually from 1945 to 2008 by Wilhelm Flach (person. commun. 2008) at the Immelhäuser Hof south of Sinsheim south-east of Heidelberg, from abt. 1945 to 2008 by Gebhard Mildenberger (person. commun. 2008) in Hirschberg-Leutershausen north of Heidelberg, from abt. 1993 to 2008 by Alph Lehmann (person. commun. 2008) in Dielheim-Horrenberg southsoutheast of Heidelberg, from abt. 1995 to 2008 by Kornelia Kapinus (person. commun. 2008) in Sinsheim-Dühren southeast of Heidelberg, from abt. 1998 to 2008 and from abt. 1948 to 1955 by Manfred Häuselmann (person. commun. 2008) in Angelbachtal-Eichtersheim southsoutheast of Heidelberg, from 2000 to 2008 by Michael Waitzmann (person. commun. 2008) around Karlsruhe-Rüppurr southsouthwest of Heidelberg, from 2000 to 2007 by Anke Gunther-Theil (person. commun. 2008) and Susanne Heiss (person. commun. 2008) in Dossenheim north of Heidelberg, from 2002 to 2008 by Monika Lucha (person. commun. 2008) in Oftersheim westsouthwest of Heidelberg, from 1950 to 1960 by Hans Huber (person. commun. 2008) in Robern eastnortheast of Heidelberg, from 1955 to 1965 by Klaus Blume (person. commun. 2008) in Bensheim north of Heidelberg, and from abt. 1970 to 1980 by Jürgen Ludreschl (person. commun. 2008) in Neckarbischofsheim eastsoutheast of Heidelberg.

Abt. 1 – 2 individuals of the Stag Beetle *Lucanus cervus* have been registered annually from 1951 to 2008 by Hans Gassmann (person. commun. 2008) in Wiesloch south of Heidelberg, from 1952 to 2008 by Hans Kohlmann in Neckarzimmern eastsoutheast of Heidelberg, from 1950 to 2008 by Theo Hemberger (person. commun. 2008) in Rot and in Malsch south of Heidelberg, from 1978 to 2008 by Gabi and Wolfgang Scheuer (person. commun. 2008) in Reilingen southsouthwest of Heidelberg, from abt. 1980 to abt. 2002 by Stefan Lichtblau (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg; from abt. 1985 to 2008 by Franziska Stau (person. commun. 2008) in Eggenstein-Leopoldshafen, Waghäusel-Wiesental and Graben-Neudorf southsouthwest of Heidelberg; from 1993 to 2007 by Susanne Hofer von Lobenstein (person. commun. 2008) in Schwetzingen westsouthwest of Heidelberg, from 1994 to 2006 by Ingeborg Fischer (person. commun. 2008) in Eschelbronn southeast of Heidelberg, from abt. 1995 to 2008 by Werner Kröll (person. commun. 2008) in Kronau south of Heidelberg, from abt. 1995 to 2007 by Erich Schweikert (person. commun. 2008) in Waghäusel-Wiesental southsouthwest of Heidelberg, from 1996 to 2008 by Gerhard Zahn (person. commun. 2008) in Dielheim-Unterhof southsoutheast of Heidelberg, from abt. 1998 to 2007 by Petra Berger (person. commun. 2008) in Schönau eastnortheast of Heidelberg, from 2000 to 2008 by Willi Gruhn (person. commun. 2008) in Reilingen southsouthwest of Heidelberg, and from abt. 1960 to 1983 by Gerhard Reuscher (person. commun. 2008) in Bürstadt northnorthwest of Heidelberg.

8 Conservation measures in garden, orchard, forest, forest margin, house and street

Every friend of nature can support the effectivity of the reproduction of the Stag Beetle *Lucanus cervus* and thus help to guarantee its survival and renewed appearance in the next generations by participating in the application of a suite of simple conservation measures in garden, orchard, forest, forest margin, house and street which are briefly outlined as follows, whereas a detailed discussion and an extensive literature review are contained in my book (Mader 2009a) and in another article in this volume (Mader 2010b). The short comments below include limitation of losses of imagines by traffic and predators, improvement of the availability of substrates for the development of the larvae, improvement of the availability of food for the supply of the imagines, limitation of losses of

imagines by gardening, and participation in information and mobilization of the public for contributions to protection.

8.1 Limitation of losses of imagines by traffic and predators

On streets near the margins of forests, a transit service should be offered to crossing individuals of the Stag Beetle *Lucanus cervus* in order to help to reduce the losses by traffic (HAWES 2008), with the walking females and males being picked up from the street and being placed down at the margin of the forest, meadow or garden beside the street during the flight season. In the application of the transit service by removal of crossing individuals of the Stag Beetle *Lucanus cervus* from the street, the females and males should be replaced to that margin of the road towards which they have been oriented in their movement.

Further reduction of the danger of road kills of walking individuals of the Stag Beetle *Lucanus cervus* can be achieved by temporary closure of street intervals with high frequency of crossing females and males during the crepuscular period in the evening.

Males and females of the Stag Beetle *Lucanus cervus* which are found lying on their back at any place should be turned around and be put on their feet again, because in the helpless dorsal position, they would be easy preys of birds and mammals.

8.2 Improvement of the availability of substrates for the development of the larvae

Compost, mulch and bark heaps as well as log piles of rotten and decayed wood should be accumulated and maintained in gardens and orchards, and should be left untouched for at least five years in order to allow the larvae of the Stag Beetle *Lucanus cervus* therein to develop into imagines. Old, defective and dead trees in gardens, orchards and forests should only be felled if it is really unavoidable, and should be cut in at least 1 m height above the ground or even better in abt. 2 – 3 m height above the ground. The wood of felled old, defective and dead trees in gardens, orchards and forests should be accumulated to log piles and should be left untouched for longer periods of time, and the residual tree stumps should not be excavated, but should remain within the ground. The twigs and branches of the felled trees should be cut into pieces and should be piled up to brushwood heaps which again should be left untouched for longer periods of time, or should be chaffed or chopped and should then also be deposited as organic debris heaps.

In addition to the maintenance of natural residual tree stumps, artificial tree stumps should be erected by bundling of pieces of rotten and decayed stems and twigs that are collected in the forest and by partial burial of the bundles in the ground, and also log pyramids and log pavements should be installed by partial burial of blocks and pieces of rotten and decayed wood within the ground according to the classical model of TOCHTERMANN (1987, 1992, in HAMBERGER 2006) which is applied as a standard conservation measure for the Stag Beetle *Lucanus cervus* in Germany and surrounding countries.

The mentioned conservation measures apply for all wood types and are also suitable to support the development of other saproxylic or xylobiontic beetles such as the Rhinoceros Beetle *Oryctes nasicornis* which has also been reported to occur at various localities in the region around Heidelberg and Mannheim. The availability of substrates for the development of the larvae of the Stag Beetle *Lucanus cervus* can also be improved by the delineation of forest regions with restricted or prohibited cultivation.

8.3 Improvement of the availability of food for the supply of the imagines

Sap runs as food and energy sources for the Stag Beetle *Lucanus cervus* should be created artificially by incisions into the surface of the stems of several trees of different wood types which should be repeated to keep the sap springs flowing, if there are not already natural sap outflows present on some trees in gardens, orchards and forests. Because the Stag Beetle *Lucanus cervus* has been repeatedly confirmed to feed also on the juice of cherries (KRENN, PERNSTICH, MESSNER, HANNAPPEL & PAULUS 2002), existing cherry trees in gardens and orchards should be cultivated and, if necessary, new cherry trees should be planted.

In addition to the natural and artificial sap runs on the stems of trees, also articifial mixtures of juices and fruits should be prepared and supplied as food and energy sources for the Stag Beetle *Lucanus cervus* in gardens and orchards.

8.4 Limitation of losses of imagines by gardening

Water containers of all kinds in gardens and orchards have frequently turned out to become traps for individuals of the Stag Beetle *Lucanus cervus* which cannot get out of the water again once they have fallen therein, and therefore all the water containers should be covered during the flight season and should also be controlled daily for trapped individuals drifting helpless in the water which should be taken out of the water and should be put on a dry ground even if they seem to be already dead, because they can survive up to several days in the water and recover within a few hours after their removal from the water. The same applies for holes of drain and waste pipes at the bottom of the outer staircases at the basement exits of many houses into the adjacent gardens where also abundantly individuals of the Stag Beetle *Lucanus cervus* become caught. Lawns should be carefully inspected before mowing in order to avoid casualties of individuals of the Stag Beetle *Lucanus cervus* which are hidden in the grass by the cutting machines (LANGTON 1967, NAPIER 1999, JONES 2001, SMITH 2003).

8.5 Participation in information and mobilization of the public for contributions to protection

Every friend of nature should also try to convince as much people as possible in his personal environment to participate in the application of the suite of simple conservation measures in garden, orchard, forest, street and house, and also to report observations of individuals of the Stag Beetle *Lucanus cervus* in response to calls for sightings in regional newspapers for the purpose of central evaluation and general interpretation of the population dynamics. Calls for reporting of observations and finds of males and females of the Stag Beetle *Lucanus cervus* should be timely printed after receipt in the editorial offices of regional newspapers, and scientists should always bear in mind that only timely publication of the results of research and registration of the Stag Beetle *Lucanus cervus* would really support the improvement of the understanding of its life history and permit the enhancement of conservation measures. Every friend of nature could also help in collection of notices of occurrences of the Stag Beetle *Lucanus cervus* in regional newspapers and remote journals. Protest should be exercised against plans of actions of chemical mass destruction of populations of the Cockchafer *Melolontha*, because it has turned out that also numerous individuals of the Stag Beetle *Lucanus cervus* are killed by the spraying of the poisonous substances from helicopters and trucks (WANNER 1954).

Contact and exchange addresses and connections for the reporting of finds and observations of indi-

viduals of the Stag Beetle *Lucanus cervus* as well as overviews of current projects of data collection and research are compiled together with information on literature, conferences and meetings in the internet in the websites http://agnu-haan.de/hirschkaefer and http://maria.fremlin.de/stagbeetles. Observations of individuals of the Stag Beetle *Lucanus cervus* in the region around Heidelberg and Mannheim in the southwestern part of Germany should be reported to me preferably by e-mail: dr.detlef.mader@web.de.

Every friend of nature who is interested in more details of current research and conservation of the Stag Beetle *Lucanus cervus* and who wants to participate actively in the work on protection and monitoring of the Stag Beetle *Lucanus cervus* should also consider joining the European Stag Beetle Group which is an international working group of scientists and amateurs that are involved in the study of the Stag Beetle *Lucanus cervus* and related species (contact by e-mail to: european-stag-beetle-group@googlegroups.com).

9 Ecological interpretation of long-term population dynamics

The ecological interpretation of the long-term population dynamics of the Stag Beetle *Lucanus cervus* in the area around Heidelberg and Mannheim in the southwestern part of Germany is grouped into three sections comprising two scenarios of long-term population dynamics, long-term stability of the populations, and outlook and call for cooperation which are discussed as follows.

9.1 Two scenarios of long-term population dynamics

The analysis of the long-term population dynamics of the Stag Beetle *Lucanus cervus* in the area around Heidelberg and Mannheim for periods of up to 50 – 75 years has revealed that two different scenarios are developed. The first scenario comprises a more or less constant or randomly fluctuating quantity of observed individuals of the Stag Beetle *Lucanus cervus* per year where no trend of diminution of the number of registered individuals with time can be delineated. The second scenario includes the establishment of a pronounced trend of diminution of the quantity of observed individuals of the Stag Beetle *Lucanus cervus* with time.

In the first scenario of a more or less constant or randomly fluctuating quantity of observed individuals of the Stag Beetle *Lucanus cervus* per year where no trend of diminution of the number of registered individuals with time can be delineated, the long-term population dynamics can be summarized as follows: from abt. 1945 – 1950 to 2008, predominantly abt. 1 – 2 or abt. 2 – 3 individuals and subordinately abt. 3 – 5 or abt. 5 – 10 individuals have been recorded per year by most of the observers, with only in some years or at some localities also abt. 10 – 15 individuals having been noted per year by some observers.

In the second scenario of the establishment of a pronounced trend of diminution of the quantity of observed individuals of the Stag Beetle *Lucanus cervus* with time, the long-term population dynamics can be summarized as follows: from abt. 1945 – 1950 to abt. 1980 – 1990, predominantly abt. 5 – 10 or abt. 10 – 15 individuals and subordinately abt. 15 – 20 or abt. 3 – 5 individuals have been registered per year by most of the observers, whereas from abt. 1980 – 1990 to abt. 2000, predominantly abt. 3 – 5 or abt. 5 – 10 individuals and subordinately abt. 10 – 15 or abt. 2 – 3 individuals have been seen per year by most of the observers, and from abt. 2000 to 2008, predominantly abt. 1 – 2 or abt. 2 – 3 individuals and subordinately abt. 3 – 5 or abt. 5 – 10 individuals have been encountered per year by most of the observers.

9.2 Long-term stability of the populations

The long-term records of the yearly appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years in the region around Heidelberg and Mannheim in the southwestern part of Germany by abt. 150 observers at abt. 75 localities document the stability of the populations for several decades or even more than half a century and confirm the annual success of reproduction over the whole time span, thereby suggesting that under favourable conditions, the populations of the Stag Beetle *Lucanus cervus* have the chance to exist nearly permanently and to continue almost for ever like a perpetuum mobile. Although the numbers of individuals of the Stag Beetle *Lucanus cervus* appearing in the successive years are subjected to changes depending on various climatical and environmental influences, the fact that the populations continue to show up annually irrespectively of variations in frequency of individuals underlines the resistivity of the populations against external stress and the successful survival of the populations independently of the changing conditions of the surrounding framework.

The long-term observations of its regular annual appearance by abt. 150 people at abt. 75 localities both in the plain and in the highlands in the region around Heidelberg and Mannheim in the southwestern part of Germany underline that the stability of the populations of the Stag Beetle *Lucanus cervus* for periods of up to three quarters of a century is independent of the locality and its elevation and can be established at any place within the extensive area where suitable conditions are developed continuously during the course of the years.

The long-term stability of the populations of the Stag Beetle *Lucanus cervus* for periods of up to three quarters of a century which has been confirmed by the records of abt. 150 observers at abt. 75 localities in an area that extends for more than 100 km both from north to south and from west to east highlights particularly the continuous availability of sufficient amounts of suitable substrates for the development of the larvae of the Stag Beetle *Lucanus cervus* during the extraordinarily long metamorphosis of abt. 5 years, and testifies also to the presence of sufficient amounts of both males and females in every generation which succeed in termination of the processes of mating and deposition of eggs within suitable substrates prior to their natural death and irrespective of the varying rate of premature losses by predation and accidents.

9.3 Outlook and call for cooperation

Much more long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* are required in order to understand its population dynamics for several decades or even more than half a century and to enable generalization of trends of constant or diminishing occurrence of individuals with time. I sincerely hope to get significantly more reports of the long-term presence of the Stag Beetle *Lucanus cervus* in various populations in the area around Heidelberg and Mannheim during the coming flight periods in this year and in the next years when I will again place some calls for observations in several regional newspapers. I would also like to encourage all colleagues reading this paper to try to collect comparable long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of 5 years and more in their study areas and, if possible, to pass these data to me for comparison and averaged evaluation.

This paper can only be a first step in the process of elaboration of a model of the long-term population dynamics of the Stag Beetle *Lucanus cervus* and the stability of its populations for periods of several decades or even more than half a century in the framework of various climatical and environmental changes. Any contribution of further long-term records of the regular annual appearance

of the Stag Beetle *Lucanus cervus* would be sincerely acknowledged, and I would very much appreciate any response to my call for cooperation and supply of data for comparison and general evaluation. Everybody has to understand that first of all it is the Stag Beetle *Lucanus cervus* which will profit from a better understanding of its long-term population dynamics in the framework of various climatical and environmental changes that would significantly contribute to establish the conditions for a guarantee and security of the long-term survival of the most famous and best known beetle of Middle Europe in stable populations for the next centuries. Everybody has to understand that the Stag Beetle *Lucanus cervus* should receive any support which could be offered to guarantee and secure that the largest beetle in the entomofauna of Middle Europe would continue to show up annually in unthreatened populations still at the time when the present volume of the journal will remain on the bookshelves in the libraries as one of the few testimonials of all those who have contributed with their papers to its completion and publication.

Contact and exchange addresses and connections for the reporting of finds and observations of individuals of the Stag Beetle *Lucanus cervus* as well as overviews of current projects of data collection and research are compiled together with information on literature, conferences and meetings in the internet in the websites http://agnu-haan.de/hirschkaefer and http://maria.fremlin.de/stagbeetles. Observations of individuals of the Stag Beetle *Lucanus cervus* in the region around Heidelberg and Mannheim in the southwestern part of Germany should be reported to me preferably by e-mail: dr.detlef.mader@web.de.

Every friend of nature who is interested in more details of current research and conservation of the Stag Beetle *Lucanus cervus* and who wants to participate actively in the work on protection and monitoring of the Stag Beetle *Lucanus cervus* should also consider joining the European Stag Beetle Group which is an international working group of scientists and amateurs that are involved in the study of the Stag Beetle *Lucanus cervus* and related species (contact by e-mail to: european-stag-beetle-group@googlegroups.com).

10 Acknowledgements

I sincerely thank all the people that are mentioned in this paper who have supplied me long-term records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years for their generosity to submit this extraordinarily valuable information to me and to permit the publication of their observations. All the people who have given me data on the long-term population dynamics of the Stag Beetle *Lucanus cervus* have contributed to establish an outstanding collection of records of its regular annual appearance for several decades or even more than half a century which are unique results in the entomological literature. All the people who have supplied me their observations which they have collected during the course of numerous years have thus provided extremely important contributions to the understanding of the long-term population dynamics of the Stag Beetle *Lucanus cervus* and have significantly helped in the process of general evaluation and conclusion of a model of its appearance for periods of up to three quarters of a century which is unmatched in the entomological literature.

I am particularly grateful to the single male of the Stag Beetle *Lucanus cervus* which has landed right next to my feet in the evening of 01.06.2008 when I have been walking along the margin of the forest at Tairnbach, and which has stimulated my interest in this population and has triggered my research enthusiasm that has exploded already a few days later when I have had the extraordinary luck to observe an outstanding swarming of numerous males and females of the Stag Beetle *Lucanus cervus* around the trees in the crepuscular period before the beginning of the night of

05.06.2008 which has been two days after the new moon on 03.06.2008. I have already started to observe butterflies, beetles, dragonflies, damselflies and other insects in 1964 when a male of the Brimstone *Gonepteryx rhamni* has flown in bright sunshine in our garden and has fascinated me at once, but it has taken almost 45 years until the landing of the single male of the Stag Beetle *Lucanus cervus* right next to my feet on 01.06.2008 and the swarming of the crowd of individuals of the Stag Beetle *Lucanus cervus* around the trees on 05.06.2008 that has happened shortly after the new moon on 03.06.2008 has suddenly provided me with the extremely interesting research topic of the selenocyclical population dynamics which has permitted me to summarize all my experience and records of monitoring of insects over the whole period of time. Since my first observations of butterflies, beetles, dragonflies, damselflies and other insects in 1964, I have always searched for a demanding research topic which permits to elaborate the results of my field studies to a comprehensive interpretation of the population dynamics that concludes in the presentation of new aspects of the triggering and control of the life cycle of the insects, and I have had to wait for almost half a century until the landing of the single male of the Stag Beetle *Lucanus cervus* right next to my feet on 01.06.2008 and the swarming of the crowd of individuals of the Stag Beetle *Lucanus cervus* around the trees on 05.06.2008 that has happened shortly after the new moon on 03.06.2008 has been the decisive lightning which has struck my head and has immediately convinced me that finally this is the outstanding direction of the integrated and synoptical evaluation of the results of my field studies with the ultimate contribution of new mechanisms of the fundamental regulation of the population dynamics of the insects to the progress of the science of entomology.

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12 Status

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Moon-Related Population Dynamics and Ecology of the Stag Beetle *Lucanus cervus,*
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Correlation of Swarm Phases of the Stag Beetle *Lucanus cervus,* Other Beetles, Butterflies, Dragonflies and Other Insects with the New Moon and Full Moon Phases of the Lunar Cycle

Korrelation von Schwärmphasen des Hirschkäfers *Lucanus cervus,* anderer Käfer, Schmetterlinge, Libellen und anderer Insekten mit den Neumond- und Vollmond-Phasen des lunaren Zyklus

Detlef Mader

Abstract

The analysis of the short-term population dynamics of the Stag Beetle *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae) by the evaluation of the distribution of its peak activity during the period of appearance in the current year has revealed that the culmination of its occurrence takes place mainly on abt. 1 – 7 days when a pronounced swarming is established in the crepuscular period in the evening when predominantly abt. 10 – 20 or even abt. 20 – 30 individuals and subordinately abt. 5 – 10 individuals per day are flying and walking around, whereas before and after these swarm evenings, predominantly only abt. 1 – 2 or abt. 3 – 5 individuals and subordinately only abt. 5 – 10 individuals per day are walking and flying around during the period of appearance in the current year. The peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, thus suggesting that the break-out of the culmination of its activity and the development of extraordinary swarm evenings are frequently triggered by the turning points of the lunar cycle. The correlation of the peak activity of the Stag Beetle *Lucanus cervus* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has been documented at numerous localities based on own observations, personal communications and literature evaluation. Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects is frequently related with the new moon or the full moon which is presented in a suite of examples of a broad spectrum of in total more than 500 species based on own observations and literature evaluation. Among other beetles (Coleoptera), the correlation of the appearance of the peak numbers of individuals with the new moon has been observed for the Summer Chafer *Amphimallon solstitiale* (Linnaeus 1758) (Scarabaeidae), the Dune Chafer *Anomala dubia* (Scopoli 1763) (Scarabaeidae), the Golden Rose Chafer *Cetonia aurata* Linnaeus 1761 (Scarabaeidae), the Seven-Spot Ladybird *Coccinella septempunctata* Linnaeus 1758 (Coccinellidae), the Forest Dung Beetle *Geotrupes stercorosus* (Scriba 1791) (Scarabaeidae), the Forest Cockchafer *Melolontha hippocastani* Fabricius 1801 (Scarabaeidae), and the Field Cockcha-

fer *Melolontha melolontha* Linnaeus 1758 (Scarabaeidae), and the correlation of the appearance of the peak numbers of individuals with the full moon has been observed for the Summer Chafer *Amphimallon solstitiale,* the Golden Rose Chafer *Cetonia aurata,* the Seven-Spot Ladybird *Coccinella septempunctata,* the Field Cockchafer *Melolontha melolontha,* the Tanner Sawyer Beetle *Prionus coriarius* (Linnaeus 1758) (Cerambycidae), and the Golden Ground Beetle *Carabus auratus* Linnaeus 1761 (Carabidae). Among the butterflies (Lepidoptera), the correlation of the appearance of the peak numbers of individuals with the new moon has been observed for the male of the Orange Tip *Anthocharis cardamines* Linnaeus 1758 (Pieridae), the Black-Veined White *Aporia crataegi* Linnaeus 1758 (Pieridae), the Map Butterfly *Araschnia levana* Linnaeus 1758 (Nymphalidae), the Silver-Washed Fritillary *Argynnis paphia* Linnaeus 1758 (Nymphalidae), the Clouded Yellow *Colias croceus* Fourcroy 1785 (Pieridae), the Jersey Tiger *Euplagia quadripunctaria* (Poda 1761) (Arctiidae), the Brimstone *Gonepteryx rhamni* Linnaeus 1758 (Pieridae), the Wall Brown *Lasiommata megera* Linnaeus 1767 (Satyridae), the Wood White *Leptidea sinapis* Linnaeus 1758 (Pieridae), the Marbled White *Melanargia galathea* Linnaeus 1758 (Satyridae), the Swallowtail *Papilio machaon* Linnaeus 1758 (Papilionidae), the Comma Butterfly *Polygonia c-album* Linnaeus 1758 (Nymphalidae), the Common Blue *Polyommatus icarus* Rottemburg 1775 (Lycaenidae), the Red Admiral *Vanessa atalanta* Linnaeus 1758 (Nymphalidae), and the Six-Spot Burnet *Zygaena filipendulae* Linnaeus 1758 (Zygaenidae), as well as among other insects for the Beautiful Demoiselle *Calopteryx virgo* Linnaeus 1758 (Odonata: Calopterygidae) and the Burrowing Mayflies *Ephoron virgo* (Olivier 1791) (Ephemeroptera: Polymitarcyidae) and *Oligoneuriella rhenana* (Imhoff 1852) (Ephemeroptera: Oligoneuriidae). Among the butterflies (Lepidoptera), the correlation of the appearance of the peak numbers of individuals with the full moon has been observed for the male of the Orange Tip *Anthocharis cardamines,* the Ringlet *Aphantopus hyperantus* Linnaeus 1758 (Satyridae), the Clouded Yellow *Colias croceus*, the Jersey Tiger *Euplagia quadripunctaria*, the Wood White *Leptidea sinapis*, the Marbled White *Melanargia galathea*, the Swallowtail *Papilio machaon,* the Comma Butterfly *Polygonia c-album,* the Red Admiral *Vanessa atalanta,* the Painted Lady *Vanessa cardui* Linnaeus 1758 (Nymphalidae), and the Six-Spot Burnet *Zygaena filipendulae,* as well as among other insects for the Banded Demoiselle *Calopteryx splendens* (Harris 1782) (Odonata: Calopterygidae) and the Burrowing Mayflies *Ephoron virgo* and *Oligoneuriella rhenana*. The correlation of the appearance of the peak numbers of individuals with the decreasing half moon in the fourth quarter of the lunar cycle has been observed for the Tau Emperor *Aglia tau* (Linnaeus 1761) (Saturniidae), the Purple Emperor *Apatura iris* Linnaeus 1758 (Nymphalidae), the Black-Veined White *Aporia crataegi*, the Peacock Butterfly *Inachis io* Linnaeus 1758 (Nymphalidae), the Queen of Spain Fritillary *Issoria lathonia* Linnaeus 1758 (Nymphalidae), and the Black Hairstreak *Strymonidia pruni* Linnaeus 1758 (Lycaenidae), as well as among other insects for the Beautiful Demoiselle *Calopteryx virgo* and the Burrowing Mayfly *Ephoron virgo*. The correlation of the appearance of the peak numbers of individuals with the increasing half moon in the first quarter of the lunar cycle has been observed for the Silver-Washed Fritillary *Argynnis paphia,* the Peacock Butterfly *Inachis io,* and the Wood White *Leptidea sinapis,* as well as among other insects for the Burrowing Mayfly *Ephoron virgo*. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies. The selenocyclical assessment of the short-term population dynamics of the Stag Beetle *Lucanus cervus*, other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects includes also the interpretation of the mechanisms triggering the correlation of swarm phases, mass flights and peak abundances with the new moon or the full moon. The turning points of the lunar cycle are often also significant breaks in weather character with frequently rapid changes from dry and warm periods to wet and cool periods or vice versa, and therefore particularly the changes from wet and cool periods to dry and warm periods around the new moon or the full moon could be the reasons for the triggering of the culmination of the activity with establishment of the peak numbers of individuals and develop-

ment of pronounced swarm events or mass flights of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects. The distribution of warm weather periods and cold weather phases in relation to the turning points of the lunar cycle in spring and summer 2008 is illustrated as a base for the selenocyclical evaluation of the short-term population dynamics of the observed beetles and butterflies. Much more examples of the correlation of the peak activity of the Stag Beetle *Lucanus cervus,* other beetles, butterflies, dragonflies, damselflies and other diurnal and crepuscular insects with the new moon or the full moon are required for the further generalization of the interpretation of the triggering of outstanding swarm days or evenings by the turning points of the lunar cycle, and therefore all the readers of my paper are invited to pay attention to the possible correlation of swarm days or evenings of the Stag Beetle *Lucanus cervus,* other beetles, butterflies, dragonflies, damselflies and other diurnal and crepuscular insects with the new moon or the full moon, and to report examples to me for averaged selenocyclical evaluation of the short-term population dynamics. The selenocyclical assessment of the distribution of the frequency of occurrence of the Stag Beetle *Lucanus cervus*, other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects and their connection with the new moon or the full moon has turned out to represent a fundamental advance in the understanding of the triggering of swarm phases, mass flights and peak abundances of insects, and it has been confirmed by several examples that the selenocyclical interpretation enhances also the understanding of mass growth of mushrooms and mass wandering of toads.

Zusammenfassung

Die Analyse der kurzfristigen Populationsdynamik des Hirschkäfers *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) durch die Auswertung der Verteilung der Höhepunkte seiner Aktivität während der Erscheinungsperiode im laufenden Jahr hat ergeben, daß die Kulmination seines Auftretens über etwa 1 – 7 Tage stattfindet, an denen ein ausgeprägtes Schwärmen in der Dämmerung am Abend ausgebildet ist, wenn überwiegend etwa 10 – 20 oder sogar etwa 20 – 30 Exemplare und untergeordnet etwa 5 – 10 Individuen pro Tag herumfliegen und herumlaufen, wohingegen vor und nach den Schwärmabenden überwiegend nur etwa 1 – 2 oder etwa 3 – 5 Exemplare und untergeordnet nur etwa 5 – 10 Individuen pro Tag während der Erscheinungsperiode im laufenden Jahr herumlaufen und herumfliegen. Der Höhepunkt der Aktivität des Hirschkäfers *Lucanus cervus* mit spektakulären Schwärmabenden an etwa 1 – 7 Tagen erfolgt häufig um den Neumond oder den Vollmond, was darauf hinweist, daß der Ausbruch der Kulmination seiner Aktivität und die Entwicklung von außergewöhnlichen Schwärmabenden oftmals durch die Wendepunkte des Mondzyklus ausgelöst werden. Die Korrelation des Höhepunktes der Aktivität des Hirschkäfers *Lucanus cervus* mit dem Neumond am Ende des vorhergehenden Mondzyklus oder am Anfang des folgenden Mondzyklus sowie mit dem Vollmond am mittleren oder zentralen Punkt des Mondzyklus wurde an zahlreichen Lokalitäten aufgrund von eigenen Beobachtungen, persönlichen Mitteilungen und Auswertung der Literatur dokumentiert. Ähnlich wie der Höhepunkt der Aktivität des Hirschkäfers *Lucanus cervus* mit spektakulären Schwärmabenden häufig um den Neumond oder den Vollmond stattfindet, erfolgt auch die Kulmination des Erscheinens von anderen Käfern, Tagfaltern, Nachtfaltern und anderen Insekten oftmals um den Neumond oder den Vollmond, welches in einer Fülle von Beispielen mit einem breiten Spektrum von insgesamt mehr als 500 Arten aufgrund eigener Beobachtungen und Auswertung der Literatur präsentiert wird. Von anderen Käfern (Coleoptera) wurde die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem Neumond bei dem Junikäfer *Amphimallon solstitiale* (LINNAEUS 1758) (Scarabaeidae), dem Kleinen Julikäfer *Anomala dubia* (SCOPOLI 1763) (Scarabaeidae), dem Gold-Rosenkäfer *Cetonia aurata* LINNAEUS 1761 (Scarabaeidae), dem Siebenpunkt-Marienkäfer *Coccinella septempunctata* LINNAEUS 1758 (Coccinellidae), dem Waldmistkäfer *Geotrupes stercorosus* (SCRIBA 1791) (Scarabaeidae), dem Waldmaikäfer *Melolontha hippocastani* FABRICIUS 1801 (Scarabaeidae), und dem Feldmaikäfer *Melolontha melolontha*

LINNAEUS 1758 (Scarabaeidae) beobachtet, und wurde die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem Vollmond bei dem Junikäfer *Amphimallon solstitiale*, dem Gold-Rosenkäfer *Cetonia aurata,* dem Siebenpunkt-Marienkäfer *Coccinella septempunctata*, dem Feldmaikäfer *Melolontha melolontha,* dem Sägebock *Prionus coriarius* (LINNAEUS 1758) (Cerambycidae), und dem Goldlaufkäfer *Carabus auratus* LINNAEUS 1761 (Carabidae) beobachtet. Von den Schmetterlingen (Lepidoptera) wurde die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem Neumond bei dem Männchen des Aurorafalters *Anthocharis cardamines* LINNAEUS 1758 (Pieridae), dem Baumweißling *Aporia crataegi* LINNAEUS 1758 (Pieridae), dem Landkärtchen *Araschnia levana* LINNAEUS 1758 (Nymphalidae), dem Kaisermantel *Argynnis paphia* LINNAEUS 1758 (Nymphalidae), dem Postillon-Heufalter *Colias croceus* FOURCROY 1785 (Pieridae), dem Russischen Bären *Euplagia quadripunctaria* (PODA 1761) (Arctiidae), dem Zitronenfalter *Gonepteryx rhamni* LINNAEUS 1758 (Pieridae), dem Mauerfuchs *Lasiommata megera* LINNAEUS 1767 (Satyridae), dem Senfweißling *Leptidea sinapis* LINNAEUS 1758 (Pieridae), dem Schachbrett *Melanargia galathea* LINNAEUS 1758 (Satyridae), dem Schwalbenschwanz *Papilio machaon* LINNAEUS 1758 (Papilionidae), dem C-Falter *Polygonia c-album* LINNAEUS 1758 (Nymphalidae), dem Hauhechelbläuling *Polyommatus icarus* ROTTEMBURG 1775 (Lycaenidae), dem Admiral *Vanessa atalanta* LINNAEUS 1758 (Nymphalidae), und dem Sechsfleck-Widderchen *Zygaena filipendulae* LINNAEUS 1758 (Zygaenidae) beobachtet, und wurde von anderen Insekten ebenso auch bei der Blauflügel-Prachtlibelle *Calopteryx virgo* LINNAEUS 1758 (Odonata: Calopterygidae), dem Uferaas *Ephoron virgo* (OLIVIER 1791) (Ephemeroptera: Polymitarcyidae) und der Rheinmücke *Oligoneuriella rhenana* (IMHOFF 1852) (Ephemeroptera: Oligoneuriidae) festgestellt. Von den Schmetterlingen (Lepidoptera) wurde die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem Vollmond bei dem Männchen des Aurorafalters *Anthocharis cardamines,* dem Braunen Waldvogel *Aphantopus hyperantus* LINNAEUS 1758 (Satyridae), dem Postillon-Heufalter *Colias croceus*, dem Russischen Bären *Euplagia quadripunctaria*, dem Senfweißling *Leptidea sinapis*, dem Schachbrett *Melanargia galathea*, dem Schwalbenschwanz *Papilio machaon,* dem C-Falter *Polygonia c-album,* dem Admiral *Vanessa atalanta,* dem Distelfalter *Vanessa cardui* LINNAEUS 1758 (Nymphalidae), und dem Sechsfleck-Widderchen *Zygaena filipendulae* beobachtet, und wurde von anderen Insekten ebenso auch bei der Gebänderten Prachtlibelle *Calopteryx splendens* (HARRIS 1782) (Odonata: Calopterygidae), dem Uferaas *Ephoron virgo* und der Rheinmücke *Oligoneuriella rhenana* festgestellt. Die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem abnehmenden Halbmond im letzten Viertel des Mondzyklus wurde bei dem Nagelfleck *Aglia tau* (LINNAEUS 1761) (Saturniidae), dem Großen Schillerfalter *Apatura iris* LINNAEUS 1758 (Nymphalidae), dem Baumweißling *Aporia crataegi,* dem Tagpfauenauge *Inachis io* LINNAEUS 1758 (Nymphalidae), dem Kleinen Perlmutterfalter *Issoria lathonia* LINNAEUS 1758 (Nymphalidae), und dem Pflaumenzipfelfalter *Strymonidia pruni* LINNAEUS 1758 (Lycaenidae) beobachtet, und wurde von anderen Insekten ebenso auch bei der Blauflügel-Prachtlibelle *Calopteryx virgo* und dem Uferaas *Ephoron virgo* festgestellt. Die Korrelation des Erscheinens der Höhepunkte der Individuenzahlen mit dem zunehmenden Halbmond im ersten Viertel des Mondzyklus wurde bei dem Kaisermantel *Argynnis paphia,* dem Tagpfauenauge *Inachis io,* und dem Senfweißling *Leptidea sinapis* beobachtet, und wurde von anderen Insekten ebenso auch bei dem Uferaas *Ephoron virgo* festgestellt. Die selenozyklische Auswertung der Daten der Beobachtungen von signifkanten Mengen von Insekten auf der Basis der Literaturübersicht umfaßt etwa 15 Käferarten, mehr als 100 Tagfalterarten, mehr als 300 Nachtfalterarten, etwa 30 Großlibellenarten und etwa 20 Kleinlibellenarten. Die selenozyklische Beurteilung der kurzfristigen Populationsdynamik des Hirschkäfers *Lucanus cervus,* anderer Käfer, Tagfalter, Nachtfalter, Großlibellen, Kleinlibellen und anderer Insekten beinhaltet auch die Interpretation der Mechanismen, welche die Korrelation von Schwärmphasen, Massenflügen und Spitzenhäufigkeiten mit dem Neumond oder dem Vollmond auslösen. Die Wendepunkte des Mondzyklus sind häufig auch signifikante Umbrüche im Wettercharakter mit oftmals raschen Wechseln von trockenen und warmen Perioden zu nassen und kühlen Perioden oder umgekehrt, und deshalb könnten besonders die Wechsel von nassen und kühlen Perioden zu trockenen und warmen

Perioden um den Neumond oder den Vollmond die Gründe für das Auslösen der Kulmination der Aktivität mit der Entwicklung der Spitzenzahlen der Individuen und der Ausbildung von markanten Schwärmereignissen oder Massenflügen des Hirschkäfers *Lucanus cervus,* anderer Käfer, Tagfalter, Nachtfalter, Großlibellen, Kleinlibellen und anderer Insekten sein. Die Verteilung der Warmwetterperioden und Kaltwetterphasen in Relation zu den Wendepunkten des Mondzyklus in Frühling und Sommer 2008 wird als Basis für die selenozyklische Auswertung der kurzfristigen Populationsdynamik der beobachteten Käfer und Schmetterlinge illustriert. Es werden wesentlich mehr Beispiele der Korrelation der Spitzenaktivität des Hirschkäfers *Lucanus cervus,* anderer Käfer, Schmetterlinge, Libellen und anderer diurnaler und krepuskulärer Insekten mit dem Neumond oder dem Vollmond für die weitere Verallgemeinerung der Interpretation der Steuerung von herausragenden Schwärmtagen oder -abenden durch die Wendepunkte des Mondzyklus benötigt, und deshalb sind alle Leser meiner Arbeit eingeladen, auf die mögliche Korrelation von Schwärmtagen oder -abenden des Hirschkäfers *Lucanus cervus,* anderer Käfer, Schmetterlinge, Libellen und anderer diurnaler und krepuskulärer Insekten mit dem Neumond oder dem Vollmond zu achten, und Beispiele an mich zur zusammenfassenden selenozyklischen Auswertung der kurzfristigen Populationsdynamik zu melden. Die selenozyklische Beurteilung der Verteilung der Häufigkeit des Auftretens des Hirschkäfers *Lucanus cervus,* anderer Käfer, Tagfalter, Nachtfalter, Großlibellen, Kleinlibellen und anderer Insekten und ihrer Verbindung mit dem Neumond oder dem Vollmond hat sich als ein fundamentaler Fortschritt im Verständnis der Auslösung von Schwärmphasen, Massenflügen und Spitzenhäufigkeiten von Insekten herausgestellt, und es wurde durch mehrere Beispiele bestätigt, daß die selenozyklische Interpretation auch das Verständnis von Massenwachstum von Pilzen und Massenwanderung von Kröten verbessert.

Résumé

L´analyse de la dynamique à courte terme des populations du Cerf Volant *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae) par l´évaluation de la distribution de son activité au point culminant pendant la période d´apparition en l´année courante a montrée que la culmination de son apparition a lieu pendant environ 1 – 7 jours quand un essaim accentué est établi dans la période crépusculaire en soir quand prépondérant à peu près 10 – 20 ou même à peu près 20 – 30 individus et subordonné à peu près 5 – 10 individus volent ou courent par jour, tandis que avant et après ces soirs d´essaim, prépondérant seulement à peu près 1 – 2 ou à peu près 3 – 5 individus et subordonné seulement à peu près 5 – 10 individus courent et volent par jour pendant la période d´apparition en l´année courante. L´activité au point culminant du Cerf Volant *Lucanus cervus* avec des soirs d´essaim spectaculaires pendant environ 1 – 7 jours se passe souvent vers la nouvelle lune ou la pleine lune, et à cause de cela, il semble que le déclenchement de la culmination de son activité et le développement des soirs d´essaim extraordinaires sont souvent provoqués par les tournants du cycle lunaire. La corrélation de l´activité au point culminant du Cerf Volant *Lucanus cervus* avec la nouvelle lune au fin du cycle lunaire précédent ou au début du cycle lunaire prochain ainsi qu´avec la pleine lune au point moyen ou central du cycle lunaire a été documentée à des localités nombreuses à la base des observations propres, des communications personelles et de l´évaluation de la littérature. Semblablement comme l´activité au point culminant du Cerf Volant *Lucanus cervus* avec des soirs d´essaim spectaculaires se passe souvent vers la nouvelle lune ou la pleine lune, aussi la culmination de l´apparition des individus d´autres scarabées, de papillons diurnes, de papillons nocturnes, de libellules, de demoiselles et d´autres insectes est souvent corrélée avec la nouvelle lune ou la pleine lune qui est presentée en une suite d´exemples avec un spectre large de totalement plus de 500 espèces à la base des observations propres et de l´évaluation de la littérature. Parmi les autres scarabées (Coleoptera), la corrélation de l´apparition des nombres culminantes des individus avec la nouvelle lune a été observée pour le Hanneton de Juin *Amphimallon solstitiale* (Linnaeus 1758) (Scarabaeidae), le Hanneton Bronzé *Anomala dubia* (Scopoli 1763) (Scarabaeidae), le Cétoine Dorée *Cetonia*

aurata Linnaeus 1761 (Scarabaeidae), la Coccinelle à Sept Points *Coccinella septempunctata* Linnaeus 1758 (Coccinellidae), le Fouille-Merdes de la Forêt *Geotrupes stercorosus* (Scriba 1791) (Scarabaeidae), le Hanneton de la Fôret *Melolontha hippocastani* Fabricius 1801 (Scarabaeidae), et le Hanneton du Champ *Melolontha melolontha* Linnaeus 1758 (Scarabaeidae), et la corrélation de l ´apparition des nombres culminantes des individus avec la pleine lune a été observée pour le Hanneton de Juin *Amphimallon solstitiale*, le Cétoine Dorée *Cetonia aurata,* la Coccinelle à Sept Points *Coccinella septempunctata*, le Hanneton du Champ *Melolontha melolontha,* le Prione Tanneur *Prionus coriarius* (Linnaeus 1758) (Cerambycidae), et le Carabe Dorée *Carabus auratus* Linnaeus 1761 (Carabidae). Parmi les papillons (Lepidoptera), la corrélation de l´apparition des nombres culminantes des individus avec la nouvelle lune a été observée pour le mâle de l´Aurore *Anthocharis cardamines* Linnaeus 1758 (Pieridae), le Gazé *Aporia crataegi* Linnaeus 1758 (Pieridae), la Carte Géographique *Araschnia levana* Linnaeus 1758 (Nymphalidae), le Tabac d´Espagne *Argynnis paphia* Linnaeus 1758 (Nymphalidae), le Souci *Colias croceus* Fourcroy 1785 (Pieridae), l´Ecaille Chinée *Euplagia quadripunctaria* (Poda 1761) (Arctiidae), le Citron *Gonepteryx rhamni* Linnaeus 1758 (Pieridae), le Satyre *Lasiommata megera* Linnaeus 1767 (Satyridae), le Piéride de la Moutarde *Leptidea sinapis* Linnaeus 1758 (Pieridae), le Demi-Deuil *Melanargia galathea* Linnaeus 1758 (Satyridae), le Grand Porte-Queue *Papilio machaon* Linnaeus 1758 (Papilionidae), le Robert le Diable *Polygonia c-album* Linnaeus 1758 (Nymphalidae), l´Argus Azuré *Polyommatus icarus* Rottemburg 1775 (Lycaenidae), le Vulcain *Vanessa atalanta* Linnaeus 1758 (Nymphalidae), et la Zygène de la Filipendule *Zygaena filipendulae* Linnaeus 1758 (Zygaenidae), ainsi que parmi d´autres insectes pour le Caloptéryx Vierge *Calopteryx virgo* Linnaeus 1758 (Odonata: Calopterygidae) et les Mannes *Ephoron virgo* (Olivier 1791) (Ephemeroptera: Polymitarcyidae) et *Oligoneuriella rhenana* (Imhoff 1852) (Ephemeroptera: Oligoneuriidae). Parmi les papillons (Lepidoptera), la corrélation de l´apparition des nombres culminantes des individus avec la pleine lune a été observée pour le mâle de l´Aurore *Anthocharis cardamines,* le Tristan *Aphantopus hyperantus* Linnaeus 1758 (Satyridae), le Souci *Colias croceus*, l´Ecaille Chinée *Euplagia quadripunctaria*, le Piéride de la Moutarde *Leptidea sinapis*, le Demi-Deuil *Melanargia galathea*, le Grand Porte-Queue *Papilio machaon,* le Robert le Diable *Polygonia c-album,* le Vulcain *Vanessa atalanta,* la Belle Dame *Vanessa cardui* Linnaeus 1758 (Nymphalidae), et la Zygène de la Filipendule *Zygaena filipendulae,* ainsi que parmi d´autres insectes pour le Caloptéryx Bandé *Calopteryx splendens* (Harris 1782) (Odonata: Calopterygidae) et les Mannes *Ephoron virgo* et *Oligoneuriella rhenana*. La corrélation de l´apparition des nombres culminantes des individus avec le dernier quartier du cycle lunaire a été observée pour le Hachette *Aglia tau* (Linnaeus 1761) (Saturniidae), le Grand Mars *Apatura iris* Linnaeus 1758 (Nymphalidae), le Gazé *Aporia crataegi*, le Paon de Jour *Inachis io* Linnaeus 1758 (Nymphalidae), le Petit Nacré *Issoria lathonia* Linnaeus 1758 (Nymphalidae), et l´Endrine *Strymonidia pruni* Linnaeus 1758 (Lycaenidae), ainsi que parmi d´autres insectes pour le Caloptéryx Vierge *Calopteryx virgo* et la Manne *Ephoron virgo*. La corrélation de l´apparition des nombres culminantes des individus avec le premier quartier du cycle lunaire a été observée pour le Tabac d´Espagne *Argynnis paphia,* le Paon de Jour *Inachis io,* et le Piéride de la Moutarde *Leptidea sinapis,* ainsi que parmi d´autres insectes pour la Manne *Ephoron virgo*. L´interprétation sélénocyclique des dates d´observations de quantités significantes d´insectes renferme à peu près 15 espèces de scarabées, plus de 100 espèces de papillons diurnes, plus de 300 espèces de papillons nocturnes, à peu près 30 espèces de libellules et à peu près 20 espèces de demoiselles. L´évaluation sélénocyclique de la dynamique à courte terme des populations du Cerf Volant *Lucanus cervus*, d´autres scarabées, de papillons diurnes, de papillons nocturnes, de libellules, de demoiselles et d´autres insectes comprend aussi l´interprétation des mécanismes qui déclenchent la corrélation des phases d´essaim, des vols massifs et d´apparitions des nombres culminantes avec la nouvelle lune ou la pleine lune. Les tournants du cycle lunaire sont fréquemment aussi des cassures significatives en caractère du temps avec souvent des changes rapides de périodes sèches et chaudes à périodes humides et fraîches ou inverse, et à cause de cela, particulièrement les changes de périodes humides et fraîches à periodes sèches et chaudes vers la nouvelle lune ou la pleine lune peuvent être les raisons pour le déclenche-

ment de la culmination de l´activité avec l´apparition des nombres culminantes des individues et le développement des événements d´essaim accentués ou des vols massifs du Cerf Volant *Lucanus cervus,* d´autres scarabées, de papillons, de libellules, de demoiselles et d´autres insectes. La distribution des périodes de temps chaud et des phases de temps froid en relation avec les tournants du cycle lunaire en printemps et été 2008 est illustrée comme une base pour l´évaluation sélénocyclique de la dynamique à courte terme des populations des scarabées et des papillons observés. Il a besoin de beaucoup plus d´exemples de la corrélation de l´activité au point culminant du Cerf Volant *Lucanus cervus,* d´autres scarabées, de papillons, de libellules, de demoiselles et d´autres insectes diurnales et crépusculaires avec la nouvelle lune ou la pleine lune pour la suite de la généralisation de l´interprétation du déclenchement des jours ou soirs d´essaim extraordinaires par les tournants du cycle lunaire, et de cette facon, tous les lecteurs de mon travail sont invités de faire attention à la corrélation possible des jours ou soirs d´essaim du Cerf Volant *Lucanus cervus,* d´autres scarabées, de papillons, de libellules, de demoiselles et d´autres insectes diurnales et crépusculaires avec la nouvelle lune ou la pleine lune, et de notifier des exemples à moi pour l´évaluation sélénocyclique généralisée de la dynamique à courte terme des populations. L´évaluation sélénocyclique de la distribution de la fréquence d´apparition du Cerf Volant *Lucanus cervus*, d´autres scarabées, des papillons diurnes, des papillons nocturnes et d´autres insectes et leur connection avec la nouvelle lune ou la pleine lune à mis en évidence un progrès fondamental en la compréhension du déclenchement des phases d´essaim, des vols massifs et d´apparitions des nombres culminantes d´insectes, et il a été confirmée par plusieurs exemples que l´interprétation sélénocyclique améliore aussi la compréhension de la croissance massive des champignons et de la migration massive des crapauds.

Key words

Lucanus cervus, Stag Beetle, Rhinoceros Beetle, Rose Chafer, Cockchafer, Summer Chafer, butterflies, dragonflies, damselflies, mayflies, swarming, peak activity, mass appearance, mass flight, lunar cycle, new moon, full moon, half moon, selenocyclical population dynamics, weather periods, saproxylic, xylobiontic, diurnal, crepuscular, nocturnal, phaenology, Upper Rhine valley, Heidelberg, Mannheim, Germany, Palaearctic region, more than 500 species of insects.

1 Introduction

The discovery of a rich population of the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) at the margin of the forest in Tairnbach southsoutheast of Heidelberg in the southwestern part of Germany on 01.06.2008 has been the start for an extensive investigation of this site on almost every evening (except of some days with rainfalls or thunderstorms) until 15.08.2008 (MADER 2009a, 2010a). The introductory comments focus on discovery of the relationship of swarm phases of the Stag Beetle *Lucanus cervus* with the new moon and full moon phases of the lunar cycle, short-term observations of numerous friends of nature in large-scale regional distribution, and role of the Stag Beetle *Lucanus cervus* in the origin of my study of selenocyclical population dynamics of insects.

1.1 Discovery of the relationship of swarm phases of the Stag Beetle *Lucanus cervus* with the new moon and full moon phases of the lunar cycle

During my regular almost daily monitoring of the population at the margin of the forest in Tairnbach, I have observed only abt. 1 – 5 individuals of the Stag Beetle *Lucanus cervus* per evening on

most of the days of its activity, whereas in the crepuscular period in the evening of 05.06.2008, a spectacular swarming of abt. 25 – 30 males and females has happened which have flown along and around the trees in up to abt. 20 m height at the margin of the forest, with this outstanding swarming having occurred only two days after the new moon on 03.06.2008. I have at once suspected that this remarkable connection is probably not simply accidental, but that there could be a fundamental relationship between the swarming of the Stag Beetle *Lucanus cervus* as well as other insects and the turning points of the lunar cycle, and therefore I have paid attention to the phases of the new moon and the full moon when recording the appearance of various diurnal and crepuscular insects during my regular entomological observations in 2008, and I have particularly looked for pronounced cases of selenocyclical correlation of swarm events and breakouts of peak numbers of individuals of beetles and butterflies. During the course of my field survey of the distribution of different beetles and butterflies at several localities in the region around Heidelberg and Mannheim in 2008, I have indeed discovered a suite of striking examples of the more or less sudden breakout of numerous individuals of several beetles, various butterflies, dragonflies, damselflies and some other insects around the new moon or the full moon. In the further analysis of the phenomenon of the swarming of various diurnal and crepuscular insects around the turning points of the lunar cycle, I have also checked my notes of my regular entomological observations in 2007 and earlier years, and I have therein also found some significant examples of the selenocyclical correlation of the appearance of the peak numbers of diurnal and crepuscular insects. Further accentuated examples of the selenocyclical triggering of the culmination of the frequency of individuals of diurnal and crepuscular insects have been collected during the continuation of my regular entomological observations in 2009.

1.2 Short-term observations of numerous friends of nature in large-scale regional distribution

In addition to my regular almost daily monitoring of the activity of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach, I have placed some calls for observations of the Stag Beetle *Lucanus cervus* in several regional newspapers (Rhein-Neckar-Zeitung 2008a, 2008b, 2008c, 2008d; Schwetzinger Zeitung 2008, Bruchsaler Rundschau 2008), and in response to these calls, more than 600 people have contacted me by telephone, e-mail or letter and have reported me observations and finds in 2008 and earlier years from more than 225 localities in the region around Heidelberg and Mannheim (Mader 2009a). From these over 600 people who have replied to my calls in the regional newspapers, abt. 500 people have supplied predominantly individual sightings of the Stag Beetle *Lucanus cervus* which could not be reproduced during the following days, weeks, months or years by the observers, whereas abt. 150 people have delivered records of its regular annual appearance during periods of up to 50 – 75 years at abt. 75 localities, with the oldest reported observations reaching back to 1935 (Mader 2010a). Quite some people have also observed the swarming of numerous individuals of the Stag Beetle *Lucanus cervus* on one or several evenings. These observations have also been evaluated in the context of the present paper on the short-term population dynamics of the Stag Beetle *Lucanus cervus* which summarizes the most important aspects of the selenocyclical correlation of the swarm phases of various insects in a short outline, whereas all the details of the results up to 2008 are contained in my book (Mader 2009a). Further information has been gathered from the response to several calls for observations of the Stag Beetle *Lucanus cervus* in several regional newspapers in the last year (Mannheimer Morgen 2009a, 2009b; Rhein-Neckar-Zeitung 2009a, 2009b, 2009c; Weinheimer Nachrichten 2009) and also to an interview in broadcasting (Kurpfalz Radio 2009) after the publication of my book. The most significant aspects of the long-term population dynamics of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years are summarized in another article in this volume (Mader 2010a), and the third con-

tribution in this issue contains an outline of conservation measures for the Stag Beetle *Lucanus cervus* in garden, orchard, forest, forest margin, house and street for all friends of nature (MADER 2010b). The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east.

1.3 Role of the Stag Beetle *Lucanus cervus* in the origin of my study of selenocyclical population dynamics of insects

The Stag Beetle *Lucanus cervus* is the largest, most spectacular and best known beetle in Middle Europe. The male of the Stag Beetle *Lucanus cervus* reaches a length of up to more than 90 mm and is thus not only the biggest beetle in Middle Europe, but belongs also to the greatest beetles in the world, whereas the female reaches a length of up to 50 mm. The Stag Beetle *Lucanus cervus* has been described and depicted in literature and art since more than 2,000 years (TARONI 1998, SPRECHER & TARONI 2004, SPRECHER-UEBERSAX 2008, MADER 2009a) and has been the topic of more than 1,000 publications (TARONI 1998, TOCHTERMANN in HAMBERGER 2006, MADER 2009a). Although almost everybody knows the Stag Beetle *Lucanus cervus* from books, papers, stamps, lectures, expositions, television and education, there are still many people who have up to now not yet had the chance to discover and to observe an individual of this impressive and outstanding beetle in the nature.

I have not seen any single individual of the Stag Beetle *Lucanus cervus* in the nature for almost 35 years since neighbours have shown me two big males in Walldorf south of Heidelberg in 1974, and I have therefore been extremely fascinated when a male has landed right next to my feet in Tairnbach southsoutheast of Heidelberg on 01.06.2008, and I have thus been immediately excited when I have had the luck to observe the swarming of abt. 25 – 30 individuals at the same place on 05.06.2008 which has convinced me at once to take the chance and to begin an evaluation of population dynamics and ecology of the Stag Beetle *Lucanus cervus* that has culminated in the publication of my book (MADER 2009a). My sudden understanding of the relationship of the swarm evening of the Stag Beetle *Lucanus cervus* on 05.06.2008 with the new moon phase of the lunar cycle has also been the start of my study of the selenocyclical population dynamics of beetles, butterflies and other insects which has been summarized in the present volume. The Stag Beetle *Lucanus cervus* is the most spectacular and easiest recognizable member of the group of saproxylic or xylobiontic beetles with predominantly crepuscular appearance, and another extraordinary and well known representative of this suite is the Rhinoceros Beetle *Oryctes nasicornis* (LINNAEUS 1758) (Coleoptera: Scarabaeidae) which has also been reported to occur at various localities in the region around Heidelberg and Mannheim, with again also observations of swarm evenings being available.

2 Investigated insects, investigated localities and research strategy

The short-term population dynamics of the Stag Beetle *Lucanus cervus* (MADER 2009a) as well as other beetles, a suite of diurnal and nocturnal butterflies, dragonflies, damselflies and some other insects have been observed at several localities in the region around Heidelberg and Mannheim in the southwestern part of Germany. The in total more than 500 species of investigated insects including beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects, as well as the studied mushrooms and localities are listed as follows. Further information on the short-term population dynamics of the Stag Beetle *Lucanus cervus* has been taken from several phaenological publications (SPRECHER-UEBERSAX & DURRER 1998, SPRECHER-UEBERSAX 2001, HILPÜSCH 2004, FREMLIN 2009, FREMLIN & FREMLIN 2010) and various faunistical notes in the literature. Comments on

data collection and evaluation are contained in the introduction and are also offered below. Overviews of the research history of the Stag Beetle *Lucanus cervus* as well as outlines of geography and geology, forestry, and climate and weather in the study area around Heidelberg and Mannheim are included in MADER (2010a) and are not repeated here. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

2.1 Investigated beetles

The beetles (Coleoptera) which have been investigated by own observations at one or several localities in the surroundings of Heidelberg comprise predominantly the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Lucanidae; MADER 2009a), and subordinately also the Golden Rose Chafer *Cetonia aurata* LINNAEUS 1761 (Scarabaeidae), the Field Cockchafer *Melolontha melolontha* LINNAEUS 1758 (Scarabaeidae), the Forest Cockchafer *Melolontha hippocastani* FABRICIUS 1801 (Scarabaeidae), the Summer Chafer *Amphimallon solstitiale* (LINNAEUS 1758) (Scarabaeidae), the Forest Dung Beetle *Geotrupes stercorosus* (SCRIBA 1791) (Scarabaeidae), the Tanner Sawyer Beetle *Prionus coriarius* (LINNAEUS 1758) (Cerambycidae), and the Golden Ground Beetle *Carabus auratus* LINNAEUS 1761 (Carabidae).

In addition to the afore reported beetles from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, comments are also given on the Rhinoceros Beetle *Oryctes nasicornis* (LINNAEUS 1758) (Scarabaeidae) based on a report of its swarming by HANSJÖRG GÖTZ (person. commun. 2008), on the Dune Chafer *Anomala dubia* (SCOPOLI 1763) based on a report of its swarming by ARNO THOMAES (person. commun. 2009); and on the Seven-Spot Ladybird *Coccinella septempunctata* LINNAEUS 1758 (Coccinellidae), the Rove Beetle *Philonthus cognatus* STEPHENS 1832 (Staphylinidae), and the Flea Beetle *Psylliodes affinis* (PAYKULL 1799) (Chrysomelidae) based on literature evaluation. The English and French names of the investigated beetles have been taken from http://en.wikipedia.org and http://fr.wikipedia.org where descriptions and photographs of every species are available. A broad literature review has only been carried out for the Stag Beetle *Lucanus cervus*, whereas only some selected references have been quoted for the other beetles for which a more detailed literature search has been postponed to a future project.

2.2 Investigated diurnal butterflies

The diurnal butterflies (Lepidoptera) which have been investigated by own observations at one or several localities in the surroundings of Heidelberg include (in alphabetical order of Latin names) the male of the Orange Tip *Anthocharis cardamines* LINNAEUS 1758 (Pieridae), the Purple Emperor *Apatura iris* LINNAEUS 1758 (Nymphalidae), the Ringlet *Aphantopus hyperantus* LINNAEUS 1758 (Satyridae), the Black-Veined White *Aporia crataegi* LINNAEUS 1758 (Pieridae), the Map Butterfly *Araschnia levana* LINNAEUS 1758 (Nymphalidae), the Silver-Washed Fritillary *Argynnis paphia* LINNAEUS 1758 (Nymphalidae), the Clouded Yellow *Colias croceus* FOURCROY 1785 (Pieridae), the Brimstone *Gonepteryx rhamni* LINNAEUS 1758 (Pieridae), the Peacock Butterfly *Inachis io* LINNAEUS 1758 (Nymphalidae), the Queen of Spain Fritillary *Issoria lathonia* LINNAEUS 1758 (Nymphalidae), the Wall Brown *Lasiommata megera* LINNAEUS 1767 (Satyridae), the Wood White *Leptidea sinapis* LINNAEUS 1758 (Pieridae), the Marbled White *Melanargia galathea* LINNAEUS 1758 (Satyridae), the Swallowtail *Papilio machaon* LINNAEUS 1758 (Papilionidae), the Speckled Wood *Pararge aegeria*

LINNAEUS 1758 (Satyridae), the Comma Butterfly *Polygonia c-album* LINNAEUS 1758 (Nymphalidae), the Common Blue *Polyommatus icarus* ROTTEMBURG 1775 (Lycaenidae), the Black Hairstreak *Strymonidia pruni* LINNAEUS 1758 (Lycaenidae), the Red Admiral *Vanessa atalanta* LINNAEUS 1758 (Nymphalidae), and the Painted Lady *Vanessa cardui* LINNAEUS 1758 (Nymphalidae). Some aspects of the Small Tortoiseshell *Aglais urticae* LINNAEUS 1758 (Nymphalidae) are also outlined.

In addition to the afore reported diurnal butterflies from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, various examples of mass occurrences of diurnal butterflies have been taken from the literature. Apart from the above mentioned diurnal butterflies where the comments are based on own observations, examples of mass occurrences that are based on literature evaluation are also presented for (in alphabetical order of Latin names) the Lesser Purple Emperor *Apatura ilia* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Nymphalidae), the Brown Argus *Aricia agestis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lycaenidae), the Dark Green Fritillary *Argynnis aglaja* LINNAEUS 1758 (Nymphalidae), the Niobe Fritillary *Argynnis niobe* LINNAEUS 1758 (Nymphalidae), the Cranberry Fritillary *Boloria aquilonaris* STICHEL 1908 (Nymphalidae), the Violet Fritillary *Boloria dia* LINNAEUS 1767 (Nymphalidae), the Bog Fritillary *Boloria eunomia* ESPER 1799 (Nymphalidae), the Pearl-Bordered Fritillary *Boloria euphrosyne* LINNAEUS 1758 (Nymphalidae), the Small Pearl-Bordered Fritillary *Boloria selene* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Nymphalidae), the Lesser Marbled Fritillary *Brenthis ino* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Nymphalidae), the Great Banded Grayling *Brintesia circe* FABRICIUS 1775 (Satyridae), the Geranium Bronze *Cacyreus marshalli* BUTLER 1898 (Lycaenidae), the Green Hairstreak *Callophrys rubi* LINNAEUS 1758 (Lycaenidae), the Mallow Skipper *Carcharodus alceae* ESPER 1780 (Hesperiidae), the Marbled Skipper *Carcharodus lavaterae* (ESPER 1783) (Hesperiidae), the Chequered Skipper *Carterocephalus palaemon* PALLAS 1771 (Hesperiidae), the Holly Blue *Celastrina argiolus* LINNAEUS 1758 (Lycaenidae), the Hermit *Chazara briseis* LINNAEUS 1764 (Satyridae), the Pearly Heath *Coenonympha arcania* LINNAEUS 1761 (Satyridae), the Chestnut Heath *Coenonympha glycerion* BORKHAUSEN 1788 (Satyridae), the Small Heath *Coenonympha pamphilus* LINNAEUS 1758 (Satyridae), the Large Heath *Coenonympha tullia* (MÜLLER 1764) (Satyridae), the Pale Clouded Yellow *Colias hyale* LINNAEUS 1758 (Pieridae), the Moorland Clouded Yellow *Colias palaeno* LINNAEUS 1761 (Pieridae), the Little Blue *Cupido minimus* FUESSLY 1775 (Lycaenidae), the Scotch Argus *Erebia aethiops* ESPER 1777 (Satyridae), the Arran Brown *Erebia ligea* LINNAEUS 1758 (Satyridae), the Woodland Ringlet *Erebia medusa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Satyridae), the Dingy Skipper *Erynnis tages* LINNAEUS 1758 (Hesperiidae), the Marsh Fritillary *Euphydryas aurinia* ROTTEMBURG 1775 (Nymphalidae), the Short-Tailed Blue *Everes argiades* PALLAS 1771 (Lycaenidae), the Green-Underside Blue *Glaucopsyche alexis* PODA 1761 (Lycaenidae), the Duke of Burgundy Fritillary *Hamearis lucina* LINNAEUS 1758 (Nemeobiidae), the Silver-Spotted Skipper *Hesperia comma* LINNAEUS 1758 (Hesperiidae), the Large Chequered Skipper *Heteropterus morpheus* PALLAS 1771 (Hesperiidae), the Rock Grayling *Hipparchia alcyone* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Satyridae), the Woodland Grayling *Hipparchia fagi* (SCOPOLI 1763) (Satyridae), the Grayling *Hipparchia semele* LINNAEUS 1758 (Satyridae), the Scarce Swallowtail *Iphiclides podalirius* SCOPOLI 1763 (Papilionidae), the Long-Tailed Blue *Lampides boeticus* LINNAEUS 1767 (Lycaenidae), the Large Wall Brown *Lasiommata maera* LINNAEUS 1758 (Satyridae), the White Admiral *Limenitis camilla* LINNAEUS 1763 (Nymphalidae), the Poplar Admiral *Limenitis populi* LINNAEUS 1758 (Nymphalidae), the Woodland Brown *Lopinga achine* (SCOPOLI 1763) (Satyridae), the Purple-Shot Copper *Lycaena alciphron* ROTTEMBURG 1775 (Lycaenidae), the Large Copper *Lycaena dispar* HAWORTH 1803 (Lycaenidae), the Violet Copper *Lycaena helle* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lycaenidae), the Purple-Edged Copper *Lycaena hippothoe* LINNAEUS 1761 (Lycaenidae), the Small Copper *Lycaena phlaeas* LINNAEUS 1761 (Lycaenidae), the Sooty Copper *Lycaena tityrus* (PODA 1761) (Lycaenidae), the Scarce Copper *Lycaena virgaureae* (LINNAEUS) 1758 (Lycaenidae), the Large Blue *Maculinea arion* LINNAEUS 1758 (Lycaenidae), the Alcon Blue *Maculinea alcon* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜL-

LER 1775) (Lycaenidae), the Dusky Large Blue *Maculinea nausithous* BERGSTRÄSSER 1779 (Lycaenidae), the Rebel´s Blue *Maculinea rebeli* HIRSCHKE 1904 (Lycaenidae), the Scarce Large Blue *Maculinea teleius* BERGSTRÄSSER 1779 (Lycaenidae), the Meadow Brown *Maniola jurtina* LINNAEUS 1758 (Satyridae), the Heath Fritillary *Melitaea athalia* ROTTEMBURG 1775 (Nymphalidae), the Nickerl´s Fritillary *Melitaea aurelia* NICKERL 1850 (Nymphalidae), the Glanville Fritillary *Melitaea cinxia* LINNAEUS 1758 (Nymphalidae), the False Heath Fritillary *Melitaea diamina* LANG 1789 (Nymphalidae), the Spotted Fritillary *Melitaea didyma* ESPER 1779 (Nymphalidae), the Sloe Hairstreak *Nordmannia acaciae* FABRICIUS 1787 (Lycaenidae), the Ilex Hairstreak *Nordmannia ilicis* ESPER 1779 (Lycaenidae), the Camberwell Beauty *Nymphalis antiopa* LINNAEUS 1758 (Nymphalidae), the Large Tortoiseshell *Nymphalis polychloros* LINNAEUS 1758 (Nymphalidae), the Large Skipper *Ochlodes venatus* BREMER & GREY 1852 (Hesperiidae), the Apollo *Parnassius apollo* LINNAEUS 1758 (Papilionidae), the Clouded Apollo *Parnassius mnemosyne* LINNAEUS 1758 (Papilionidae), the Large White *Pieris brassicae* LINNAEUS 1758 (Pieridae), the Green-Veined White *Pieris napi* LINNAEUS 1758 (Pieridae), the Small White *Pieris rapae* LINNAEUS 1758 (Pieridae), the Silver-Studded Blue *Plebejus argus* LINNAEUS 1758 (Lycaenidae), the Reverdin´s Blue *Plebejus argyrognomon* BERGSTRÄSSER 1779 (Lycaenidae), the Amanda´s Blue *Plebicula amanda* SCHNEIDER 1792 (Lycaenidae), the Turquoise Blue *Plebicula dorylas* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lycaenidae), the Adonis Blue *Polyommatus bellargus* ROTTEMBURG 1775 (Lycaenidae), the Chalkhill Blue *Polyommatus coridon* (PODA 1761) (Lycaenidae), the Mazarine Blue *Polyommatus semiargus* ROTTEMBURG 1775 (Lycaenidae), the Bath White *Pontia daplidice* LINNAEUS 1758 (Pieridae), the Eastern Bath White *Pontia edusa* (FABRICIUS 1776) (Pieridae), the Baton Blue *Pseudophilotes baton* BERGSTRÄSSER 1779 (Lycaenidae), the Large Grizzled Skipper *Pyrgus alveus* HÜBNER 1803 (Hesperiidae), the Safflower Skipper *Pyrgus fritillarius* PODA 1761 (Hesperiidae), the Grizzled Skipper *Pyrgus malvae* (LINNAEUS 1758) (Hesperiidae), the Gatekeeper *Pyronia tithonus* LINNAEUS 1771 (Satyridae), the Purple Hairstreak *Quercusia quercus* LINNAEUS 1758 (Lycaenidae), the Chequered Blue *Scolitantides orion* PALLAS 1771 (Lycaenidae), the Red Underwing Skipper *Spialia sertorius* HOFFMANNSEGG 1804 (Hesperiidae), the Blue-Spot Hairstreak *Strymonidia spini* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lycaenidae), the White-Letter Hairstreak *Strymonidia w-album* (KNOCH 1782) (Lycaenidae), the Lang´s Short-Tailed Blue *Syntarucus pirithous* LINNAEUS 1767 (Lycaenidae), the Brown Hairstreak *Thecla betulae* LINNAEUS 1758 (Lycaenidae), the Lulworth Skipper *Thymelicus acteon* ROTTEMBURG 1775 (Hesperiidae), the Essex Skipper *Thymelicus lineola* OCHSENHEIMER 1808 (Hesperiidae), and the Small Skipper *Thymelicus sylvestris* PODA 1761 (Hesperiidae).

In the context of the evaluation of the relationships of swarm phases, mass flights and peak occurrences of diurnal butterflies with the new moon and full moon phases of the lunar cycle, comments are also given on the following species: the Canarian Large White *Pieris cheiranthi* (HÜBNER 1808) (Pieridae), the Indian Red Admiral *Vanessa indica* (HERBST 1794) (Nymphalidae) and the Plain Tiger *Danaus chrysippus* LINNAEUS 1758 (Danaidae).

The various examples of mass occurrences of diurnal and nocturnal butterflies which have been taken from the literature have mainly been retrieved and interpreted from the annual and topical reports in the journals Atalanta (Zeitschrift der Deutschen Forschungszentrale für Schmetterlingswanderungen) and Melanargia (Nachrichten der Arbeitsgemeinschaft Rheinisch-Westfälischer Lepidopterologen) as well as from a selection of papers in other journals. The interpretation and discussion of mass occurrences of diurnal and nocturnal butterflies according to the review of the literature has predominantly been restricted to examples from localities in Germany and contains only subordinately also some cases from countries adjacent to Germany. A more comprehensive literature survey of examples of mass occurrences of beetles, butterflies, dragonflies, damselflies and other insects has been beyond the limit of this volume and has therefore been postponed to a future compilation and evaluation of observations and reports of swarm phases and mass flights of various insects. Numerous examples of mass flights of diurnal and nocturnal butterflies from the older litera-

ture are compiled in Williams (1930), Fraenkel (1932) and Williams, Cockbill, Gibbs & Downes (1942). The English and French names of the aforementioned diurnal butterflies have been taken from Higgins & Riley (1971) and Wrobel (2000) as well as from http://en.wikipedia.org, http://fr.wikipedia.org, http://www.leps.it, http://www.ukbutterflies.co.uk and http://www.uksafari.com where descriptions and photographs of every species are available.

In addition to the aforementioned Palaearctic diurnal butterflies, I have also had the opportunity to observe some examples of Nearctic diurnal butterflies. I have seen numerous individuals of the Eastern Tiger Swallowtail *Papilio glaucus* Linnaeus 1758 (Papilionidae) during a geological excursion to the Grand Canyon in Arizona in the western part of the United States of America in summer 1982, and abundant individuals of small brown satyrid butterflies during a visit of Nuevo Laredo and Monterrey in the northeastern part of Mexico in autumn 1989.

2.3 Investigated nocturnal butterflies

The nocturnal butterflies (Lepidoptera) which have been investigated by own observations at one or several localities in the surroundings of Heidelberg include (in alphabetical order of Latin names) the Tau Emperor *Aglia tau* (Linnaeus 1761) (Saturniidae), the Jersey Tiger *Euplagia quadripunctaria* (Poda 1761) (Arctiidae), and the Six-Spot Burnet *Zygaena filipendulae* Linnaeus 1758 (Zygaenidae).

In addition to the afore reported nocturnal butterflies from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, various examples of mass occurrences of nocturnal butterflies have been taken from the literature. Apart from the above mentioned nocturnal butterflies where the comments are based on own observations, examples of mass occurrences that are based on literature evaluation are also presented for (in alphabetical order of Latin names) the Dark Spectacle *Abrostola triplasia* Linnaeus 1758 (Noctuidae), the Yellow Horned *Achlya flavicornis* (Linnaeus 1758) (Thyatiridae), the Pale Shoulder *Acontia lucida* (Hufnagel 1766) (Noctuidae), the Sycamore *Acronicta aceris* Linnaeus 1758 (Noctuidae), the Scarce Dagger *Acronicta auricoma* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Miller *Acronicta leporina* Linnaeus 1758 (Noctuidae), the Poplar Grey *Acronicta megacephala* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Light Knot Grass *Acronicta menyanthidis* (Esper 1879) (Noctuidae), the Knot Grass *Acronicta rumicis* Linnaeus 1758 (Noctuidae), the Marsh Dagger *Acronicta strigosa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Pale-Shouldered Cloud *Actinotia hyperici* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Cistus Forester *Adscita geryon* (Hübner 1813) (Zygaenidae), the Forester *Adscita statices* (Linnaeus 1758) (Zygaenidae), the Almond-Tree Leaf Sleletonizer Moth *Aglaope infausta* Linnaeus 1767 (Zygaenidae), the Convolvulus Hawk-Moth *Agrius convolvuli* Linnaeus 1758 (Sphingidae), the Brick *Agrochola circellaris* (Hufnagel 1766) (Noctuidae), the Flounced Chestnut *Agrochola helvola* Linnaeus 1758 (Noctuidae), the Brown-Spot Pinion *Agrochola litura* Linnaeus 1761 (Noctuidae), the Red-Line Quaker *Agrochola lota* (Clerck 1759) (Noctuidae), the Yellow-Line Quaker *Agrochola macilenta* (Hübner 1809) (Noctuidae), the Heart and Club *Agrotis clavis* (Hufnagel 1766) (Noctuidae), the Heart and Dart *Agrotis exclamationis* (Linnaeus 1758) (Noctuidae), the Dark Sword-Grass *Agrotis ipsilon* (Hufnagel 1766) (Noctuidae), the Shuttle-Shaped Dart *Agrotis puta* (Hübner 1803) (Noctuidae), the Turnip Moth *Agrotis segetum* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Archer´s Dart *Agrotis vestigialis* (Hufnagel 1766) (Noctuidae), the Green-Brindled Descent *Allophyes oxyacanthae* Linnaeus 1758 (Noctuidae), the Svensson´s Copper Underwing *Amphipyra berbera* Rungs 1949 (Noctuidae), the Copper Underwing *Amphipyra pyramidea* Linnaeus 1758 (Noctuidae), the Beautiful Yellow Underwing *Anarta myrtilli* (Linnaeus 1761) (Noctuidae), the Clouded-Bordered Brindle *Apamea crenata* (Hufnagel 1766)

(Noctuidae), the Clouded Brindle *Apamea epomidion* (Haworth 1809) (Noctuidae), the Confused *Apamea furva* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Light Arches *Apamea lithoxylea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Dark Arches *Apamea monoglypha* (Hufnagel 1766) (Noctuidae), the Dusky Brocade *Apamea remissa* Hübner 1809 (Noctuidae), the Slender Brindle *Apamea scolopacina* (Esper 1788) (Noctuidae), the Rustic Shoulder-Knot *Apamea sordens* (Hufnagel 1766) (Noctuidae), the Reddish Light Arches *Apamea sublustris* (Esper 1788) (Noctuidae), the Small Clouded Brindle *Apamea unanimis* (Hübner 1813) (Noctuidae), the Festoon *Apoda limacodes* (Hufnagel 1766) (Limacodidae), the Deep-Brown Dart *Aporophyla lutulenta* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Black Rustic *Aporophyla nigra* (Haworth 1809) (Noctuidae), the Brown-Veined Wainscot *Archanara dissoluta* (Treitschke 1825) (Noctuidae), the Twin-Spotted Wainscot *Archanara geminipuncta* (Haworth 1809) (Noctuidae), the Garden Tiger *Arctia caja* Linnaeus 1758 (Arctiidae), the Cream-Spot Tiger *Arctia villica* (Linnaeus 1758) (Arctiidae), the Black V Moth *Arctornis l-nigrum* (Müller 1764) (Lymantriidae), the Fen Wainscot *Arenostola phragmitidis* (Hübner 1803) (Noctuidae), the Sprawler *Asteroscopus sphinx* (Hufnagel 1766) (Noctuidae), the Centre-Barred Sallow *Atethmia centrago* (Haworth 1809) (Noctuidae), the Marsh Moth *Athetis gluteosa* (Treitschke 1835) (Noctuidae), the Gold Spangle *Autographa bractea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Silver Y *Autographa gamma* Linnaeus 1758 (Noctuidae), the Beautiful Golden Y *Autographa pulchrina* (Haworth 1809) (Noctuidae), the Flame *Axylia putris* Linnaeus 1761 (Noctuidae), the Six-Belted Clearwing *Bembecia ichneumoniformis* Schiffermüller (in Denis & Schiffermüller 1775) (Sesiidae), the Dark Brocade *Blepharita adusta* (Esper 1790) (Noctuidae), the Beautiful Arches *Blepharita satura* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Minor Shoulder-Knot *Brachylomia viminalis* (Fabricius 1777) (Noctuidae), the Burren Green *Calamia tridens* (Hufnagel 1766) (Noctuidae), the Scarlet Tiger *Callimorpha dominula* Linnaeus 1758 (Arctiidae), the Mother Shipton *Callistege mi* (Clerck 1759) (Noctuidae), the Pale Tussock *Calliteara pudibunda* Linnaeus 1758 (Lymantriidae), the Mottled Rustic *Caradrina morpheus* (Hufnagel 1766) (Noctuidae), the Yellow Underwing *Catocala conversa* Esper 1787 (Noctuidae), the Rosy Underwing *Catocala electa* (Vieweg 1790) (Noctuidae), the Blue Underwing *Catocala fraxini* Linnaeus 1758 (Noctuidae), the Red Underwing *Catocala nupta* (Linnaeus 1767) (Noctuidae), the Yellow Underwing *Catocala nymphaea* Esper 1787 (Noctuidae), the Light Crimson Underwing *Catocala promissa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Dark Crimson Underwing *Catocala sponsa* (Linnaeus 1767) (Noctuidae), the Haworth´s Minor *Celaena haworthii* (Curtis 1829) (Noctuidae), the Antler Moth *Cerapteryx graminis* Linnaeus 1758 (Noctuidae), the White-Marked *Cerastis leucographa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Cypress Spurge *Chamaephecia empiformis* Esper 1783 (Sesiidae), the Treble Lines *Charanyca trigrammica* (Hufnagel 1766) (Noctuidae), the Concolourous *Chortodes extrema* (Hübner 1809) (Noctuidae), the Mere Wainscot *Chortodes fluxa* (Hübner 1809) (Noctuidae), the Small Wainscot *Chortodes pygmina* (Haworth 1809) (Noctuidae), the Chinese Character *Cilix glaucata* (Scopoli 1763) (Drepanidae), the Scarce Chocolate-Tip *Clostera anachoreta* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Small Rufous *Coenobia rufa* (Haworth 1809) (Noctuidae), the Nut-Tree Tussock *Colocasia coryli* Linnaeus 1758 (Noctuidae), the Red-Headed Chestnut *Conistra erythrocephala* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Black-Spot Chestnut *Conistra rubiginosa* (Scopoli 1763) (Noctuidae), the Chestnut *Conistra vaccinii* Linnaeus 1761 (Noctuidae), the Lesser-Spotted Pinion *Cosmia affinis* Linnaeus 1767 (Noctuidae), the Lunar-Spotted Pinion *Cosmia pyralina* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Dun-Bar *Cosmia trapezina* Linnaeus 1758 (Noctuidae), the Tree-Lichen Beauty *Cryphia algae* (Fabricius 1775) (Noctuidae), the Marbled Beauty *Cryphia domestica* (Hufnagel 1766) (Noctuidae), the Marbled Gray *Cryphia raptricula* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Mullein Moth *Cucullia dracunculi* (Hübner 1813) (Noctuidae), the Oak Lutestring *Cymatophorima diluta* Schiffermüller (in Denis & Schiffermüller 1775) (Drepanidae), the Elephant Hawk-Moth *Deilephila elpenor* Linnaeus 1758 (Sphingidae), the Small Elephant Hawk-Moth *Deile-*

phila porcellus Linnaeus 1758 (Sphingidae), the Silver Barred *Deltote bankiana* (Fabricius 1775) (Noctuidae), the Pretty Marbled *Deltote deceptoria* (Scopoli 1763) (Noctuidae), the Burnished Brass *Diachrysia chrysitis* Linnaeus 1758 (Noctuidae), the Clouded Buff *Diachrysia sannio* Linnaeus 1758 (Arctiidae), the Purple Clay *Diarsia brunnea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Fen Square-Spot *Diarsia florida* (F. Schmidt 1859) (Noctuidae), the Ingrailed Clay *Diarsia mendica* Fabricius 1775 (Noctuidae), the Small Square-Spot *Diarsia rubi* (Vieweg 1790) (Noctuidae), the Merveille du Jour *Dichonia aprilina* Linnaeus 1758 (Noctuidae), the Figure of Eight *Diloba caeruleocephala* Linnaeus 1758 (Noctuidae), the Oak Hook-Tip *Drepana binaria* (Hufnagel 1767) (Drepanidae), the Dusky Hook-Tip *Drepana curvatula* (Borkhausen 1790) (Drepanidae), the Pebble Hook-Tip *Drepana falcataria* Linnaeus 1758 (Drepanidae), the Scarce Hook-Tip *Drepana harpagula* Esper 1786 (Drepanidae), the Marbled Brown *Drymonia dodonaea* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Oak Marbled Brown *Drymonia querna* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Lunar Marbled Brown *Drymonia ruficornis* (Hufnagel 1766) (Notodontidae), the Undotted Marbled Brown *Drymonia trimacula* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Brindled Green *Dryobotodes eremita* (Fabricius 1775) (Noctuidae), the Handmaid *Dysauxes ancilla* (Linnaeus 1767) (Arctiidae), the Silver Cloud *Egira conspicillaris* (Linnaeus 1758) (Noctuidae), the Hoary Footman *Eilema caniola* (Hübner 1808) (Arctiidae), the Scarce Footman *Eilema complana* Linnaeus 1758 (Arctiidae), the Buff Footman *Eilema depressa* (Esper 1787) (Arctiidae), the Dingy Footman *Eilema griseola* (Hübner 1803) (Arctiidae), the Common Footman *Eilema lurideola* (Zincken 1817) (Arctiidae), the Ivory Footman *Eilema palliatella* (Scopoli 1763) (Arctiidae), the Pigmy Footman *Eilema pygmaeola* (Doubleday 1847) (Arctiidae), the Orange Footman *Eilema sororcula* (Hufnagel 1766) (Arctiidae), the Rosy Marbled *Elaphria venustula* (Hübner 1790) (Noctuidae), the Spotted Sulphur *Emmelia trabealis* (Scopoli 1763) (Noctuidae), the Angle-Striped Sallow *Enargia paleacea* (Esper 1788) (Noctuidae), the Willowherb Yellow Underwing *Epilecta linogrisea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Dusky Sallow *Eremobia ochroleuca* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Burnet Companion *Euclidia glyphica* (Linnaeus 1758) (Noctuidae), the Autumnal Rustic *Eugnorisma glareosa* (Esper 1788) (Noctuidae), the Rosy Marsh Moth *Eugraphe subrosea* (Stephens 1829) (Noctuidae), the Small Angle Shades *Euplexia lonigera* Linnaeus 1758 (Noctuidae), the Yellow-Tail *Euproctis similis* Fuessly 1775 (Lymantriidae), the Satellite *Eupsilia transversa* (Hufnagel 1766) (Noctuidae), the Great Brocade *Eurois occulta* Linnaeus 1758 (Noctuidae), the Drinker *Euthrix potatoria* Linnaeus 1758 (Lasiocampidae), the Garden Dart *Euxoa aquilina* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Square-Spot Dart *Euxoa obelisca* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Alder Kitten *Furcula bicuspis* (Borkhausen 1790) (Notodontidae), the Lappet *Gastropacha quercifolia* Linnaeus 1758 (Lasiocampidae), the Dusky Marbled Brown *Gluphisia crenata* (Bray 1929) (Notodontidae), the Fisher´s Estuarine Moth *Gortyna borelii* (Pierret 1837) (Noctuidae), the Frosted Orange *Gortyna flavago* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Double Dart *Graphiphora augur* (Fabricius 1775) (Noctuidae), the Buff Arches *Habrosyne pyritoides* (Hufnagel 1766) (Thyatiridae), the Shears *Hada plebeja* Linnaeus 1761 (Noctuidae), the Varied Coronet *Hadena compta* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Marbled Coronet *Hadena confusa* (Hufnagel 1766) (Noctuidae), the Tawny Shears *Hadena perplexa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Barrett´s Marbled Coronet *Hadena luteago* (Doubleday 1864) (Noctuidae), the Scarce Bordered Straw *Helicoverpa armigera* (Hübner 1808) (Noctuidae), the Bordered Gothic *Heliophobus reticulata* (Goeze 1781) (Noctuidae), the Shoulder-Striped Clover *Heliothis maritima* Graslin 1855 (Noctuidae), the Bordered Straw *Heliothis peltigera* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Marbled Clover *Heliothis viriplaca* Hufnagel 1766 (Noctuidae), the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* Linnaeus 1758 (Sphingidae), the Common Swift *Hepialus lupulinus* Linnaeus 1758 (Hepialidae), the Small Fan-Foot *Herminia nemoralis* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Shaded Fan-Foot *Herminia tarsicrinalis* (Knoch 1782) (Noctuidae), the Uncertain

Hoplodrina alsines Brahm 1791 (Noctuidae), the Vine´s Rustic *Hoplodrina ambigua* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Rustic *Hoplodrina blanda* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Powdered Rustic *Hoplodrina superstes* (Ochsenheimer 1816) (Noctuidae), the Butterbur *Hydraecia petasitis* (Doubleday 1847) (Noctuidae), the Spurge Hawk-Moth *Hyles euphorbiae* (Linnaeus 1758) (Sphingidae), the Bedstraw Hawk-Moth *Hyles gallii* (Rottemburg 1775) (Sphingidae), the Striped Hawk-Moth *Hyles livornica* (Esper 1779) (Sphingidae), the Pine Hawk-Moth *Hyloicus pinastri* Linnaeus 1758 (Sphingidae), the Snout *Hypena proboscidalis* Linnaeus 1758 (Noctuidae), the Marsh Oblique-Barred *Hypenodes humidalis* (Doubleday 1850) (Noctuidae), the Brown Tiger *Hyporaia aulica* (Linnaeus 1758) (Arctiidae), the Saxon *Hyppa rectilinea* (Esper 1788) (Noctuidae), the Olive *Ipimorpha subtusa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Bright-Line Brown-Eye *Lacanobia oleracea* (Linnaeus 1758) (Noctuidae), the Dog´s Tooth *Lacanobia suasa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Light Brocade *Lacanobia w-latinum* (Hufnagel 1766) (Noctuidae), the Poplar Hawk-Moth *Laothoe populi* (Linnaeus 1758) (Sphingidae), the Oak Eggar *Lasiocampa quercus* Linnaeus 1758 (Lasiocampidae), the Beautiful Hook-Tip *Laspeyria flexula* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the White Prominent *Leucodonta bicoloria* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the White Satin Moth *Leucoma salicis* Linnaeus 1758 (Lymantriidae), the Blackneck *Lygephila pastinum* (Treitschke 1826) (Noctuidae), the Silver Hook *Lithacodia uncula* (Clerck 1759) (Noctuidae), the Pale Pinion *Lithophane hepatica* (Clerck 1759) (Noctuidae), the Nonconformist *Lithophane lamda* (Fabricius 1787) (Noctuidae), the Grey Shoulder-Knot *Lithophane ornitopus* (Hufnagel 1766) (Noctuidae), the Tawny Pinion *Lithophane semibrunnea* (Haworth 1809) (Noctuidae), the Sandhill Rustic *Luperina nickerlii* (Freyer 1845) (Noctuidae), the Flounced Rustic *Luperina testacea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the True Lover´s Knot *Lycophotia porphyrea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Gipsy Moth *Lymantria dispar* Linnaeus 1758 (Lymantriidae), the Black Arches *Lymantria monacha* Linnaeus 1758 (Lymantriidae), the Dewick´s Plusia *Macdunnoughia confusa* Stephens 1850 (Noctuidae), the Hummingbird Hawk-Moth *Macroglossum stellatarum* (Linnaeus 1758) (Sphingidae), the Ground Lackey *Malacosoma castrensis* Linnaeus 1758 (Lasiocampidae), the Lackey *Malacosoma neustria* Linnaeus 1758 (Lasiocampidae), the Cabbage Moth *Mamestra brassicae* Linnaeus 1758 (Noctuidae), the Kent Black Arches *Meganola albula* Schiffermüller (in Denis & Schiffermüller 1775) (Nolidae), the Dot Moth *Melanchra persicariae* (Linnaeus 1761) (Noctuidae), the Common Rustic *Mesapamea secalella* Remm 1983 (Noctuidae), the Common Rustic *Mesapamea secalis* Linnaeus 1758 (Noctuidae), the Rosy Minor *Mesoligia literosa* (Haworth 1809) (Noctuidae), the Rosy Footman *Miltochrista miniata* Forster 1771 (Arctiidae), the Lunar Double-Stripe *Minucia lunaris* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Old Lady *Mormo maura* (Linnaeus 1758) (Noctuidae), the White-Point *Mythimna albipuncta* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Brown-Line Bright-Eye *Mythimna conigera* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Clay *Mythimna ferrago* Fabricius 1787 (Noctuidae), the Smoky Wainscot *Mythimna impura* Hübner 1808 (Noctuidae), the L-Album Wainscot *Mythimna l-album* (Linnaeus 1767) (Noctuidae), the Cosmopolitan *Mythimna loreyi* (Duponchel 1827) (Noctuidae), the Striped Wainscot *Mythimna pudorina* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Fen Wainscot *Mythimna turca* Linnaeus 1761 (Noctuidae), the White-Speck *Mythimna unipuncta* (Haworth 1809) (Noctuidae), the Delicate *Mythimna vitellina* (Hübner 1808) (Noctuidae), the Lesser Yellow Underwing *Noctua comes* (Hübner 1813) (Noctuidae), the Broad-Bordered Yellow Underwing *Noctua fimbriata* Schreber 1759 (Noctuidae), the Lesser Broad-Bordered Yellow Underwing *Noctua janthina* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Large Yellow Underwing *Noctua pronuba* Linnaeus 1758 (Noctuidae), the Scarce Black Arches *Nola aerugula* (Hübner 1793) (Nolidae), the Iron Prominent *Notodonta dromedarius* Linnaeus 1767 (Notodontidae), the Large Dark Prominent *Notodonta torva* (Hübner 1803) (Notodontidae), the Three-Humped Prominent *Notodonta tritophus* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Pebble Prominent *Notodonta*

ziczac Linnaeus 1758 (Notodontidae), the Oak Nycteoline *Nycteola revayana* (Scopoli 1772) (Noctuidae), the Common Lutestring *Ochropacha duplaris* (Linnaeus 1761) (Thyatiridae), the Flame Shoulder *Ochropleura plecta* Linnaeus 1761 (Noctuidae), the Scarce Prominent *Odontosia carmelita* (Esper 1798) (Notodontidae), the Middle-Barred Minor *Oligia fasciuncula* Haworth 1809 (Noctuidae), the Tawny Marbled Minor *Oligia latruncula* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Marbled Minor *Oligia strigilis* Linnaeus 1758 (Noctuidae), the Rufous Minor *Oligia versicolor* (Borkhausen 1792) (Noctuidae), the Lunar Underwing *Omphaloscelis lunosa* (Haworth 1809) (Noctuidae), the Polygone Moth *Opigena polygona* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Vapourer *Orgyia antiqua* Linnaeus 1758 (Lymantriidae), the Scarce Vapourer *Orgyia recens* (Hübner 1819) (Lymantriidae), the Small Quaker *Orthosia cruda* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Hebrew Character *Orthosia gothica* Linnaeus 1758 (Noctuidae), the Clouded Drab *Orthosia incerta* (Hufnagel 1766) (Noctuidae), the Blossom Underwing *Orthosia miniosa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Twin-Spotted Quaker *Orthosia munda* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Common Quaker *Orthosia stabilis* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Feathered Ear *Pachetra sagittigera* (Hufnagel 1766) (Noctuidae), the Glaucous Muslin *Paidia rica* Freyer 1858 (Arctiidae), the Pine Beauty *Panolis flammea* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Nun or Monk Moth *Panthea coenobita* (Esper 1785) (Noctuidae), the Glaucous Shears *Papestra biren* (Goeze 1781) (Noctuidae), the Pale-Mottled Willow *Paradrina clavipalpis* (Scopoli 1763) (Noctuidae), the Wood Tiger *Parasemia plantaginis* Linnaeus 1758 (Arctiidae), the Suspected *Parastichtis suspecta* (Hübner 1817) (Noctuidae), the Common Fan-Foot *Pechipogo strigilata* (Clerck 1759) (Noctuidae), the Dotted Footman *Pelosia muscerda* Hufnagel 1766 (Arctiidae), the Raspberry Clearwing *Pennisetia hylaeiformis* (Laspeyres 1801) (Sesiidae), the Great Prominent *Peridea anceps* (Goeze 1781) (Notodontidae), the Pearly Underwing *Peridroma saucia* (Hübner 1808) (Noctuidae), the Buff-Tip *Phalera bucephala* Linnaeus 1758 (Notodontidae), the Map-Winged Swift *Pharmacis fusconebulosa* de Geer 1778 (Hepialidae), the Lesser Sallow Prominent *Pheosia gnoma* (Fabricius 1777) (Notodontidae), the Angle Shades *Phlogophora meticulosa* Linnaeus 1758 (Noctuidae), the Reed Leopard *Phragmataecia castaneae* (Hübner 1790) (Cossidae), the Ruby Tiger *Phragmatobia fuliginosa* Linnaeus 1758 (Arctiidae), the Gold Spot *Plusia festucae* Linnaeus 1758 (Noctuidae), the Lempke´s Gold Spot *Plusia putnami* (Grote 1873) (Noctuidae), the December Moth *Poecilocampa populi* Linnaeus 1758 (Lasiocampidae), the Large Ranunculus *Polymixis flavicincta* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Cameo *Polymixis gemmea* (Treitschke 1825) (Noctuidae), the Black-Banded *Polymixis xanthomista* (Hübner 1819) (Noctuidae), the Guernsey Underwing *Polyphaenis sericata* Esper 1787 (Noctuidae), the Frosted Green *Polyploca ridens* (Fabricius 1787) (Thyatiridae), the Marbled White Spot *Protodeltote pygarga* (Hufnagel 1766) (Noctuidae), the Shining Marbled *Pseudeustrotia candidula* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae), the Green Silver-Lines *Pseudoips prasinana* (Warren 1913) (Noctuidae), the Pale Prominent *Pterostoma palpina* (Clerck 1759) (Notodontidae), the Coxcomb Prominent *Ptilodon capucina* Linnaeus 1758 (Notodontidae), the Plumed Prominent *Ptilophora plumigera* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae), the Bordered Sallow *Pyrrhia umbra* (Hufnagel 1766) (Noctuidae), the Dark Forester *Rhagades pruni* Schiffermüller (in Denis & Schiffermüller 1775) (Zygaenidae), the Large Wainscot *Rhizedra lutosa* (Hübner 1803) (Noctuidae), the Straw Dot *Rivula sericealis* (Scopoli 1763) (Noctuidae), the Emperor Moth *Saturnia pavonia* Linnaeus 1758 (Saturniidae), the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* Schiffermüller (Denis & Schiffermüller 1775) (Saturniidae), the Spotted Clover Moth *Schinia nuchalis* (Grote 1878) (Noctuidae), the Pinion-Streaked Snout *Schrankia costaestrigalis* Stephens 1834 (Noctuidae), the Blair´s Wainscot *Sedina buettneri* (E. Hering 1858) (Noctuidae), the Flame Wainscot *Senta flammea* (Curtis 1828) (Noctuidae), the Dew Moth *Setina roscida* Schiffermüller (in Denis & Schiffermüller 1775) (Arctiidae), the White Colon *Sideridis albicolon* (Hübner 1813) (Noctuidae), the Reed Dagger *Simyra albovenosa* (Goeze 1781) (Noctuidae), the Stout Dart *Spaelotis ravida* Schiffermül-

LER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Argentine *Spatalia argentina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Notodontidae), the Privet Hawk-Moth *Sphinx ligustri* LINNAEUS 1758 (Sphingidae), the Buff Ermine *Spilarctia luteum* (HUFNAGEL 1766) (Arctiidae), the White Ermine *Spilosoma lubricipeda* LINNAEUS 1758 (Arctiidae), the White Tiger *Spilosoma menthastri* (ESPER 1786) (Arctiidae), the Water Ermine *Spilosoma urticae* (ESPER 1789) (Arctiidae), the Feathered Footman *Spiris striata* (LINNAEUS 1758) (Arctiidae), the Small Mottled Willow *Spodoptera exigua* (HÜBNER 1808) (Noctuidae), the Lobster Moth *Stauropus fagi* LINNAEUS 1758 (Notodontidae), the Orange-Tailed Clearwing *Synanthedon andrenaeformis* (LASPEYRES 1801) (Sesiidae), the Red-Belted Clearwing *Synanthedon myopaeformis* (BORKHAUSEN 1789) (Sesiidae), the Yellow-Legged Clearwing *Synanthedon vespiformis* (LINNAEUS 1761) (Sesiidae), the Scarce Silver Y *Syngrapha interrogationis* LINNAEUS 1758 (Noctuidae), the Nine-Spotted Moth *Syntomis phegea* LINNAEUS 1758 (Arctiidae), the Figure of Eighty *Tethea ocularis* LINNAEUS 1767 (Thyatiridae), the Poplar Lutestring *Tethea or* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Thyatiridae), the Satin Lutestring *Tetheella fluctuosa* (HÜBNER 1813) (Thyatiridae), the Straw Underwing *Thalpophila matura* (HUFNAGEL 1766) (Noctuidae), the Oak Processionary *Thaumetopoea processionea* LINNAEUS 1758 (Thaumetopoeidae), the Hedge Rustic *Tholera cespitis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Feathered Gothic *Tholera decimalis* (PODA 1761) (Noctuidae), the Round-Winged Muslin *Thumatha senex* (HÜBNER 1808) (Arctiidae), the Peach Blossom *Thyatira batis* LINNAEUS 1758 (Thyatiridae), the Pale Eggar *Trichiura crataegi* LINNAEUS 1758 (Lasiocampidae), the Four-Spotted Moth *Tyta luctuosa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Green-Brindled Dot *Valeria oleagina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Barred Hook-Tip *Watsonalla cultraria* (FABRICIUS 1775) (Drepanidae), the Orange Sallow *Xanthia citrago* LINNAEUS 1758 (Noctuidae), the Pale-Lemon Sallow *Xanthia ocellaris* (BORKHAUSEN 1792) (Noctuidae), the Heath Rustic *Xestia agathina* (DUPONCHEL 1827) (Noctuidae), the Neglected Rustic *Xestia castanea* (ESPER 1798) (Noctuidae), the Setaceous Hebrew Character *Xestia c-nigrum* (LINNAEUS 1758) (Noctuidae), the Triple-Spotted Clay *Xestia ditrapezium* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Square-Spotted Clay *Xestia rhomboidea* (ESPER 1790) (Noctuidae), the Double Square-Spot *Xestia triangulum* (HUFNAGEL 1766) (Noctuidae), the Square-Spot Rustic *Xestia xanthographa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Noctuidae), the Blood Droplet Moth *Zygaena carniolica* SCOPOLI 1763 (Zygaenidae), the Variable Burnet *Zygaena ephialtes* LINNAEUS 1767 (Zygaenidae), the Narrow-Bordered Five-Spot Burnet *Zygaena lonicerae* (SCHEVEN 1777) (Zygaenidae), the Slender Scotch Burnet *Zygaena loti* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Zygaenidae), the Transparent Burnet *Zygaena purpuralis* (BRÜNNICH 1763) (Zygaenidae), the Transalpine Burnet *Zygaena transalpina* (ESPER 1781) (Zygaenidae), the Five-Spot Burnet *Zygaena trifolii* ESPER 1783 (Zygaenidae), and the New Forest Burnet *Zygaena viciae* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Zygaenidae).

The various examples of mass occurrences of diurnal and nocturnal butterflies which have been taken from the literature have mainly been retrieved and interpreted from the annual and topical reports in the journals Atalanta (Zeitschrift der Deutschen Forschungszentrale für Schmetterlingswanderungen) and Melanargia (Nachrichten der Arbeitsgemeinschaft Rheinisch-Westfälischer Lepidopterologen) as well as from a selection of papers in other journals. The interpretation and discussion of mass occurrences of diurnal and nocturnal butterflies according to the review of the literature has predominantly been restricted to examples from localities in Germany and contains only subordinately also some cases from countries adjacent to Germany. A more comprehensive literature survey of examples of mass occurrences of beetles, butterflies, dragonflies, damselflies and other insects has been beyond the limit of this volume and has therefore been postponed to a future compilation and evaluation of observations and reports of swarm phases and mass flights of various insects. Numerous examples of mass flights of diurnal and nocturnal butterflies from the older literature are compiled in WILLIAMS (1930), FRAENKEL (1932) and WILLIAMS, COCKBILL, GIBBS & DOWNES (1942).

The English and French names of the aforementioned butterflies have been taken from WROBEL (2000) and from http://en.wikipedia.org, http://fr.wikipedia.org, http://www.leps.it, http://uk-moths.org.uk, http://www.ukbutterflies.co.uk and http://www.uksafari.com where descriptions and photographs of every species are available. For the purpose of limitation of the width of the spectrum of selected species, the Geometridae and the Microlepidoptera (with the exception of a few clearwings of the Sesiidae) have not been considered here.

2.4 Investigated dragonflies

For the purpose of comparison with the investigated butterflies and beetles, comments are also given on various dragonflies, damselflies and other insects. The dragonflies (Odonata: Anisoptera) which have been investigated by own observations at one or several localities in the surroundings of Heidelberg include (in alphabetical order of Latin names) the Green Hawker *Aeshna viridis* EVERSMANN 1836 (Aeshnidae).

In addition to the afore reported dragonflies from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, various examples of mass occurrences of dragonflies have been taken from the literature. Apart from the above mentioned dragonflies (Odonata: Anisoptera) where the comments are based on own observations, examples of mass occurrences that are based on literature evaluation are also presented for (in alphabetical order of Latin names) the Southern Migrant Hawker *Aeshna affinis* LINDEN 1820 (Aeshnidae), the Southern Hawker *Aeshna cyanea* RAMBUR 1842 (Aeshnidae), the Brown Hawker *Aeshna grandis* LINNAEUS 1758 (Aeshnidae), the Norfolk Hawker *Aeshna isosceles* O.F. MÜLLER 1767 (Aeshnidae), the Migrant Hawker *Aeshna mixta* LATREILLE 1805 (Aeshnidae), the Emperor Dragonfly *Anax imperator* LEACH 1815 (Aeshnidae), the Lesser Emperor Dragonfly *Anax parthenope* SÉLYS 1839 (Aeshnidae), the Hairy Dragonfly *Brachytron pratense* O.F. MÜLLER 1764 (Aeshnidae), the Golden-Ringed Dragonfly *Cordulegaster boltonii* (DONOVAN 1807) (Cordulegasteridae), the Downy Emerald *Cordulia aenea* LINNAEUS 1758 (Corduliidae), the Scarlet Dragonfly *Crocothemis erythraea* BRULLÉ 1832 (Libellulidae), the Western Clubtail *Gomphus pulchellus* SÉLYS 1840 (Gomphidae), the Common Clubtail *Gomphus vulgatissimus* LINNAEUS 1758 (Gomphidae), the Lilypad Whiteface *Leucorrhinia caudalis* (CHARPENTIER 1840) (Libellulidae), the Broad-Bodied Chaser *Libellula depressa* LINNAEUS 1758 (Libellulidae), the Scarce Chaser *Libellula fulva* O.F. MÜLLER 1764 (Libellulidae), the Four-Spotted Chaser *Libellula quadrimaculata* LINNAEUS 1758 (Libellulidae), the Small Pincertail *Onychogomphus forcipatus* LINNAEUS 1758 (Gomphidae), the Green Snaketail *Ophiogomphus cecilia* (FOURCROY 1785) (Gomphidae), the Southern Skimmer *Orthetrum brunneum* FONSCOLOMBE 1837 (Libellulidae), the Keeled Skimmer *Orthetrum coerulescens* (FABRICIUS 1798) (Libellulidae), the Black-Tailed Skimmer *Orthetrum cancellatum* LINNAEUS 1758 (Libellulidae), the Brilliant Emerald *Somatochlora metallica* (LINDEN 1825) (Corduliidae), the Black Darter *Sympetrum danae* (SULZER 1776) (Libellulidae), the Yellow-Winged Darter *Sympetrum flaveolum* LINNAEUS 1758 (Libellulidae), the Red-Veined Darter *Sympetrum fonscolombii* (SÉLYS 1840) (Libellulidae), the Ruddy Darter *Sympetrum sanguineum* (O.F. MÜLLER 1764) (Libellulidae), the Common Darter *Sympetrum striolatum* CHARPENTIER 1840 (Libellulidae), and the Vagrant Darter *Sympetrum vulgatum* LINNAEUS 1758 (Libellulidae).

The various examples of mass occurrences of dragonflies and damselflies which have been taken from the literature have mainly been retrieved and interpreted from the annual and topical reports in the journal Pflanzen und Tiere in Rheinland-Pfalz as well as from a selection of papers in other journals. The interpretation and discussion of mass occurrences of dragonflies and damselflies as well as other insects according to the review of the literature has predominantly been restricted to

examples from localities in Germany and contains only subordinately also some cases from countries adjacent to Germany. A more comprehensive literature survey of examples of mass occurrences of beetles, butterflies, dragonflies, damselflies and other insects has been beyond the limit of this volume and has therefore been postponed to a future compilation and evaluation of observations and reports of swarm phases and mass flights of various insects. Numerous examples of mass flights of various insects from the older literature are compiled in FRAENKEL (1932). The English and French names of the aforementioned dragonflies have been taken from http://en.wikipedia.org, http://fr.wikipedia.org and http://www.dragonflypix.com where descriptions and photographs of every species are available.

2.5 Investigated damselflies

For the purpose of comparison with the investigated butterflies and beetles, comments are also given on various dragonflies, damselflies and other insects. The damselflies (Odonata: Zygoptera) which have been investigated by own observations at one or several localities in the surroundings of Heidelberg include (in alphabetical order of Latin names) the Banded Demoiselle *Calopteryx splendens* (HARRIS 1782) (Odonata: Calopterygidae), and the Beautiful Demoiselle *Calopteryx virgo* LINNAEUS 1758 (Odonata: Calopterygidae).

In addition to the afore reported damselflies from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, various examples of mass occurrences of damselflies have been taken from the literature. Apart from the above mentioned damselflies (Odonata: Zygoptera) where the comments are based on own observations, examples of mass occurrences that are based on literature evaluation are also presented for (in alphabetical order of Latin names) the Willow Emerald Damselfly *Chalcolestes viridis* (LINDEN 1828) (Lestidae), the Southern Damselfly *Coenagrion mercuriale* CHARPENTIER 1825 (Coenagrionidae), the Azure Damselfly *Coenagrion puella* LINNAEUS 1758 (Coenagrionidae), the Variable Damselfly *Coenagrion pulchellum* LINDEN 1825 (Coenagrionidae), the Common Blue Damselfly *Enallagma cyathigerum* CHARPENTIER 1840 (Coenagrionidae), the Goblet-Marked Damselfly *Erythromma lindenii* (SÉLYS 1840) (Coenagrionidae), the Red-Eyed Damselfly *Erythromma najas* HANSEMANN 1823 (Coenagrionidae), the Small Red-Eyed Damselfly *Erythromma viridulum* CHARPENTIER 1840 (Coenagrionidae), the Blue-Tailed Damselfly *Ischnura elegans* LINDEN 1820 (Coenagrionidae), the Scarce Blue-Tailed Damselfly *Ischnura pumilio* CHARPENTIER 1840 (Coenagrionidae), the Southern Emerald Damselfly *Lestes barbarus* (FABRICIUS 1798) (Lestidae), the Emerald Spreadwing Damselfly *Lestes dryas* (W.F. KIRBY 1890) (Lestidae), the Emerald Damselfly *Lestes sponsa* (HANSEMANN 1823) (Lestidae), the Small Emerald Damselfly *Lestes virens* (CHARPENTIER 1828) (Lestidae), the White-Legged Damselfly *Platycnemis pennipes* (PALLAS 1771) (Platycnemididae), the Large Red Damselfly *Pyrrhosoma nymphula* (SULZER 1776) (Coenagrionidae), and the Common Winter Damselfly *Sympecma fusca* (LINDEN 1820) (Lestidae).

The various examples of mass occurrences of dragonflies and damselflies which have been taken from the literature have mainly been retrieved and interpreted from the annual and topical reports in the journal Pflanzen und Tiere in Rheinland-Pfalz as well as from a selection of papers in other journals. The interpretation and discussion of mass occurrences of dragonflies and damselflies as well as other insects according to the review of the literature has predominantly been restricted to examples from localities in Germany and contains only subordinately also some cases from countries adjacent to Germany. A more comprehensive literature survey of examples of mass occurrences of beetles, butterflies, dragonflies, damselflies and other insects has been beyond the limit of this volume and has therefore been postponed to a future compilation and evaluation of observations and reports of swarm phases and mass flights of various insects. Numerous examples of mass

flights of various insects from the older literature are compiled in FRAENKEL (1932). The English and French names of the aforementioned damselflies have been taken from http://en.wikipedia.org, http://fr.wikipedia.org and http://www.dragonflypix.com where descriptions and photographs of every species are available.

2.6 Investigated other insects

For the purpose of comparison with the investigated butterflies and beetles, comments are also given on various dragonflies, damselflies and other insects. The other insects which have been investigated by own observations at one or several localities in the surroundings of Heidelberg include (in alphabetical order of Latin names) the Burrowing Mayfly *Ephoron virgo* (OLIVIER 1791) (Ephemeroptera: Polymitarcyidae), the Mason Bee *Megachile parietina* (GEOFFROY in FOURCROY 1785) (Hymenoptera: Megachilidae), and the Carpenter Bee *Xylocopa violacea* LINNAEUS 1758 (Hymenoptera: Anthophoridae).

In addition to the afore reported other insects from which I have documented the results of my own observations at one or several localities in the surroundings of Heidelberg, various examples of mass occurrences of other insects have been taken from the literature. Apart from the above mentioned other insects where the comments are based on own observations, examples of mass occurrences that are based on literature evaluation are also presented for (in alphabetical order of Latin names) the Black Bean Aphid *Aphis fabae* SCOPOLI 1763 (Hemiptera: Aphididae), the Bean Aphid *Aphis rumicis* LINNAEUS 1758 (Hemiptera: Aphididae), the Hawthorn Fly *Bibio marci* LINNAEUS 1758 (Diptera: Bibionidae), the Burrowing Mayfly *Ephoron virgo* (OLIVIER 1791) (Ephemeroptera: Polymitarcyidae), the Cosmopolitan Grain Psocid *Lachesilla pedicularia* LINNAEUS 1758 (Psocoptera: Lachesillidae), the Common Elbowed Red Ant *Myrmica scabrinodis* NYLANDER 1846 (Hymenoptera: Formicidae), the Peach-Potato Aphid *Myzus persicae* (SULZER 1776) (Hemiptera: Aphididae), the Burrowing Mayfly *Oligoneuriella rhenana* (IMHOFF 1852) (Ephemeroptera: Oligoneuriidae), the Lettuce-Root Aphid *Pemphigus bursarius* (LINNAEUS 1758) (Hemiptera: Aphididae), and the Springtail *Sminthurus ater* LATREILLE (Collembola: Sminthuridae).

In the context of the evaluation of the relationships of swarm phases, mass flights and peak occurrences of various insects with the new moon and full moon phases of the lunar cycle, comments are also given on the following species: the Honey Bee *Apis mellifera* LINNAEUS 1758 (Hymenoptera: Apidae), the Delta Mud Wasp *Delta unguiculatum* (VILLERS 1789) (Hymenoptera: Eumenidae), the Mason Bee *Osmia anthocopoides* SCHENCK 1853 (Hymenoptera: Megachilidae) and the Mud Dauber *Sceliphron destillatorium* (ILLIGER 1807) (Hymenoptera: Sphecidae).

The mentioned examples of mass occurrences of other insects which have been taken from the literature have been retrieved and interpreted from a suite of papers in various volumes of selected journals. A more comprehensive literature survey of examples of mass occurrences of beetles, butterflies, dragonflies, damselflies and other insects has been beyond the limit of this volume and has therefore been postponed to a future compilation and evaluation of observations and reports of swarm phases and mass flights of various insects. Numerous examples of mass flights of various insects from the older literature are compiled in FRAENKEL (1932). The English and French names of the aforementioned other insects have been taken from http://en.wikipedia.org, and http://fr.wikipedia.org where descriptions and photographs of every species are available.

For the broadening of the systematical scope of the selenocyclical evaluation of the population dynamics of the aforementioned beetles, butterflies and other insects, some comments are also given on the Common Toad *Bufo bufo* LAURENTI 1768 (Amphibia: Bufonidae) based on own observations.

2.7 Investigated mushrooms

For the purpose of comparison with the investigated insects, results are also presented for various mushrooms which I have observed in fields, meadows and forests within and around Walldorf in 2009. The investigated mushrooms include (in alphabetical order of Latin names) the Field Mushroom *Agaricus campestris* LINNAEUS 1753 (Agaricales: Agaricaceae), the Honey Fungus *Armillaria mellea* (VAHL 1792) (Agaricales: Marasmiaceae), the Edible Bolete *Boletus edulis* BULLIARD 1782 (Boletales: Boletaceae), the Ink Cap *Coprinus comatus* (O.F. MÜLLER 1797) (Agaricales: Coprinaceae), the Saffron Milk Cap *Lactarius deliciosus* LINNAEUS 1753 (Russulales: Russulaceae), and the Parasol Mushroom *Macrolepiota procera* (SCOPOLI 1772) (Agaricales: Lepiotaceae).

In the context of the discussion of the selenocyclical relationships of the aforementioned mushrooms, comments are also given on (in alphabetical order of Latin names) the Fly Agaric *Amanita muscaria* LINNAEUS 1753 (Agaricales: Amanitaceae), the Inkstain Bolete *Boletus pulverulentus* OPATOWSKI 1836 (Boletales: Boletaceae), the Chanterelle *Cantharellus cibarius* LINNAEUS 1753 (Cantharellales: Cantharellaceae), the Octopus Stinkhorn *Clathrus archeri* (BERKELEY 1860) (Phallales: Phallaceae), the Sulphur Tuft *Hypholoma fasciculare* (HUDSON 1778) (Agaricales: Strophariaceae), the Milk Cap *Lactarius fluens* BOUDIER 1899 (Russulales: Russulaceae), the Woolly Milk Cap *Lactarius torminosus* (SCHÄFFER 1774) (Russulales: Russulaceae), the Clouded Agaric *Lepista nebularis* (BATSCH 1789) (Agaricales: Tricholomataceae), the Gem-Studded Puffball *Lycoperdon perlatum* PERSOON 1801 (Agaricales: Agaricaceae), the Umber-Brown Puffball *Lycoperdon umbrinum* PERSOON 1801 (Agaricales: Agaricaceae), the Cauliflower Mushroom *Sparassis crispa* (WULFEN in JACQUIN 1781) (Polyporales: Sparassidaceae), the Larch Bolete *Suillus grevillei* (KLOTZSCH 1832) (Boletales: Boletaceae), the Slippery Jack *Suillus luteus* (LINNAEUS 1753) (Boletales: Boletaceae), the Bay Bolete *Xerocomus badius* (FRIES 1818) (Boletales: Boletaceae), and the Red Cracking Bolete *Xerocomus chrysenteron* (BULLIARD 1791) (Boletales: Boletaceae). The nomenclature of the aforementioned mushrooms is based on KRIEGLSTEINER (2000a, 2000b, 2001, 2003). The English and French names of the aforementioned mushrooms have been taken from http://en.wikipedia.org and http://fr.wikipedia.org where descriptions and photographs of every species are available.

2.8 Investigated localities

The various beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects have predominantly been observed at the following localities which are listed in alphabetical order (the distances from Heidelberg have been measured from the Theodor-Heuss-bridge across the river Neckar between Heidelberg-Altstadt and Heidelberg-Neuenheim): Nußloch (abt. 9 km south of Heidelberg), Rot (abt. 16 km south of Heidelberg), Schriesheim (abt. 7 km north of Heidelberg), Sankt Leon (abt. 17 km southsouthwest of Heidelberg), Tairnbach (abt. 17 km southsoutheast of Heidelberg), and Walldorf (abt. 12 km south of Heidelberg). Some comparative examples of the occurrence of the Stag Beetle *Lucanus cervus* have also been contributed from Mosbach-Diedesheim (abt. 32 km eastsoutheast of Heidelberg), Viernheim (abt. 17 km northnorthwest of Heidelberg, and Zeutern (abt. 25 km south of Heidelberg. An example of the swarming of the Rhinoceros Beetle *Oryctes nasicornis* has been reported from Adelsheim (abt. 51 km east of Heidelberg).

The various diurnal and nocturnal butterflies have subordinately also been observed at the following localities (in alphabetical order): Banfe, Hannover-Linden, Höhr-Grenzhausen, Mülheim-Kärlich, Müsch, Neuwied, Rodgau-Jügesheim and Wildbad. The locality Banfe is situated abt. 5 km westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen. The locality Hannover-Linden is situated at the western margin of the city of Hannover in the Leine valley in the southern part of the Northern German plain north of the highlands of Weserbergland, Solling and Harz

as well as their northern foothills and outposts. The locality Höhr-Grenzhausen is situated abt. 11 km northnortheast of Koblenz at the eastern margin of the Westerwald. The locality Mülheim-Kärlich is situated abt. 7 km northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between the highlands of the Eifel in the west and the Westerwald in the east. The locality Müsch is situated abt. 7 km westnorthwest of Adenau in the Ahr valley in the eastern part of the Eifel. The locality Neuwied is situated abt. 12 km northnorthwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between the highlands of the Eifel in the west and the Westerwald in the east. The locality Rodgau-Jügesheim is situated abt. 18 km southeast of the city centre of Frankfurt am Main in the Frankfurt Basin of the Main valley between the highlands of the Taunus in the north and the Odenwald in the south. The locality Wildbad is situated abt. 20 km southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest.

2.9 Research strategy

The accidental and lucky discovery of a rich population of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach southsoutheast of Heidelberg in the southwestern part of Germany on 01.06.2008 has been the start for an extensive investigation of this site on almost every evening (except of some days with rainfalls or thunderstorms) until 15.08.2008 (Mader 2009a, 2010a) and similarly from 01.05.2009 to 10.07.2009. During my systematical survey of the population of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach, I have registered the appearance of flying and walking males and females during the crepuscular period in the evening from abt. 20.30 hrs to abt. 22.00 hrs Middle European summer time. Regular daily monitoring of the activity of the Stag Beetle *Lucanus cervus* in a similar manner as my systematical observations at the margin of the forest in Tairnbach southsoutheast of Heidelberg in Germany from 01.06.2008 to 15.08.2008 and from 01.05.2009 to 10.07.2009 has also been carried out in Münchenstein south of Basel in the northwestern part of Switzerland from 1991 to 2000 (Sprecher-Uebersax & Durrer 1998, Sprecher-Uebersax 2001), in Heiligenhaus-Isenbügel northeast of Düsseldorf in the northwestern part of Germany in 2004 (Hilpüsch 2004), and in Colchester in Essex eastnortheast of London in the southeastern part of England from 2005 to 2007 (Fremlin 2009, Fremlin & Fremlin 2010) as well as in 2008 and 2009 (Maria Fremlin, person. commun. 2009), with these papers having been evaluated in comparison with my results in Tairnbach and with reports of observations by various people in Schriesheim north of Heidelberg and a few persons in other localities in the context of the selenocyclical analysis of swarm phases and peak occurrences of the Stag Beetle *Lucanus cervus*. Further examples of the appearance of abundant individuals of the Stag Beetle *Lucanus cervus* on or around the full moon or the new moon are mentioned among others in Chop (1863), Cornelius (1867, 1868), Frings (1897), Schmitt (1928), Rammner (1933), Donisthorpe (1935), Wilmink (1950), Tippmann (1954), Wanner (1954), Singer (1955), Kamp (1958), Frankfurter Allgemeine Zeitung (1959), Smith (1959), Kless (1961), Gauss (1963), Langton (1967), Hall (1969), Allenspach (1970), Dutreix (1974), Kühnel & Neumann (1981), Zucchi & Zucchi (1982), Schwerdtfeger (1983), Bevierre (1984), Bizely (1984), Carrière (1989), Verdcourt (1990), Mamonov (1991), Ochse (1993), Wüest (1993), Karner (1994), Guye (1996), Bowdrey (1997), Nückel (1999), Hawes (2000), Brechtel & Kostenbader (2002), Franzke (2003), Rippegather (2004), Schader (2004), Fremlin (2005) and Weitzel (2005), with the results being contained in these notes also having been integrated into the selenocyclical interpretation of the population dynamics of the Stag Beetle *Lucanus cervus*.

The other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects have predominantly been registered during my regular entomological observations at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf southsouthwest, south and southsoutheast of

Heidelberg in the southwestern part of Germany from early spring to late autumn in 2007, 2008 and 2009. The various diurnal and nocturnal butterflies have subordinately also been recorded during my occasional entomological observations at the localities Mülheim-Kärlich and Neuwied between 1964 and 1972, at the locality Wildbad between 1968 and 1972, at the locality Höhr-Grenzhausen between 1970 and 1972, at the locality Walldorf between 1972 and 1979 as well as between 1989 and 2006, at the locality Banfe between 1973 and 1982, at various localities in the Eifel between Mechernich in the north and Trier in the south between 1975 and 1985, at the locality Hannover-Linden between 1979 and 1986, at the locality Müsch between 1980 and 1983, and at the locality Rodgau-Jügesheim between 1986 and 1989. The new moon and full moon phases of the lunar cycle from earlier years beyond my calendar record have been calculated with the tools on the website http://www.mondkalender-online.de/Mondkalender-Rechner.

3 Meteorological and astronomical framework

Some aspects of the meteorological and astronomical framework of the study area around Heidelberg and Mannheim in the southwestern part of Germany are briefly outlined as follows, whereas a more extensive account is contained in my book (MADER 2009a). The distribution of warm weather periods and cold weather phases in relation to the turning points of the lunar cycle in spring and summer 2008 is illustrated as a base for the selenocyclical evaluation of the short-term population dynamics of the observed beetles, butterflies, dragonflies, damselflies and other insects, and the length of the day from sunrise to sunset at the astronomical boundaries of the seasons is contributed as fundamental information for the assessment of the distribution of the crepuscular period at the transition from day to night in the evening. The new moon and full moon phases of the lunar cycle from earlier years beyond my calendar record have been calculated with the tools on the website http://www.mondkalender-online.de/Mondkalender-Rechner.

3.1 Distribution of warm weather periods and cold weather phases in spring and summer 2008

The distribution of warm weather periods and cold weather phases in relation to the turning points of the lunar cycle in spring and summer 2008 is illustrated as a base for the selenocyclical evaluation of the short-term population dynamics of the observed beetles and butterflies. In the region around Heidelberg and Mannheim in the southwestern part of Germany, five longer periods of summerly warm and sunny weather with maximum day temperatures of abt. 25 – 28 °C or more in spring and summer 2008 have been interrupted and separated by shorter intervals of cooler and changeable weather with reduced temperatures, increased clouding, increased precipitation, and in phases also stronger wind. A detailed account of the distribution of warm weather periods and cold weather phases in spring and summer 2008 is contained in my book (MADER 2009a).

The first longer period of summerly warm and sunny weather has begun with the finishing of the transition phase from winter to spring before the new moon on 05.05.2008 and has ended with the set in of the May cold (Ice Saints) with cooler and changeable weather before the full moon on 20.05.2008. This first period of summerly warm and sunny weather from 02.05.2008 to 14.05.2008 between the transition phase from winter to spring until 01.05.2008 and the May cold (Ice Saints) from 15.05.2008 to 18.05.2008 has not been interrupted by thunderstorms and rainfalls.

The second longer period of summerly warm and sunny weather has begun with the termination of the May cold (Ice Saints) before the full moon on 20.05.2008 and has ended with the breakout of

the June cold (sheep cold) with cooler and changeable weather before the full moon on 18.06.2008. This second period of summerly warm and sunny weather from 19.05.2008 to 12.06.2008 between the May cold (Ice Saints) from 15.05.2008 to 18.05.2008 and the June cold (sheep cold) from 13.06.2008 to 17.06.2008 has been repeatedly interrupted by thunderstorms and rainfalls, and within this second period of summerly warm and sunny weather, the maximum day temperature of 30 °C has been reached for the first time in the current year on 27.05.2008.

The third longer period of summerly warm and sunny weather has begun with the finishing of the June cold (sheep cold) before the full moon on 18.06.2008 and has ended with the intercalation of the July cold with cooler and changeable weather after the new moon on 03.07.2008. This third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 between the June cold (sheep cold) from 13.06.2008 to 17.06.2008 and the July cold from 06.07.2008 to 22.07.2008 has only occasionally been interrupted by thunderstorms and rainfalls.

The fourth longer period of summerly warm and sunny weather has included the canicular days, and has begun with the fadeout of the July cold before the decreasing half moon on 25.07.2008 and has ended with the intercalation of the August cold with cooler and changeable weather on the increasing half moon on 08.08.2008. This fourth period of summerly warm and sunny weather from 23.07.2008 to 07.08.2008 between the July cold from 06.07.2008 to 22.07.2008 and the August cold from 08.08.2008 to 23.08.2008 has been repeatedly interrupted by thunderstorms and rainfalls, and within this fourth period of summerly warm and sunny weather, the maximum day temperature of 30 °C has been reached for the last time in the current year on 07.08.2008.

The fifth and last longer period of summerly warm and sunny weather has comprised the late summer, and has begun with the termination of the August cold after the decreasing half moon on 24.08.2008 and has ended with the set in of a transition phase to the autumn with cooler and changeable weather between the new moon on 30.08.2008 and the increasing half moon on 07.09.2008. This fifth period of summerly warm and sunny weather from 24.08.2008 to 02.09.2008 between the August cold from 08.08.2008 to 23.08.2008 and the transition phase to the autumn from 03.09.2008 to 12.09.2008 has only once been interrupted by a thunderstorm on 01.09.2008 which has been the forerunner of the following change to the transition phase to the autumn.

3.2 Length of the day from sunrise to sunset

The length of the day in Heidelberg in the southwestern part of Germany is illustrated by the compilation of the times of sunrise and sunset at the astronomical boundaries of the seasons. At the vernal equinox which represents the boundary between winter and spring on 21.03.2008, sunrise has been at 6.27 hrs Middle European time and sunset has been at 18.41 hrs, and the length of the day has thus been 12 hrs 14 min. At the aestival solstice that constitutes the passage from spring to summer on 21.06.2008, sunrise has been at 5.21 Middle European summer time and sunset has been at 21.37 hrs, and the length of the day has thus been 16 hrs 16 min. At the automnal equinox which is defined as the transition from summer to autumn on 21.09.2008, sunrise has been at 7.12 hrs Middle European summer time and sunset has been at 19.27 hrs, and the length of the day has thus been 12 hrs 15 min. At the hibernal solstice that marks the replacement of autumn by winter on 21.12.2008, sunrise has been at 8.19 hrs Middle European time and sunset has been at 16.30 hrs, and the length of the day has thus been 8 hrs 11 min. The times of sunrise and sunset at the astronomical boundaries of the seasons in 2009 have been exactly the same as in 2008.

The exactly identical length of day and night around the vernal equinox on 21.03.2008 has been

reached in Heidelberg already four days earlier on 17.03.2008, because on that day, sunrise has been at 6.35 hrs Middle European time and sunset has been at 18.35 hrs, and the length of the day has thus been exactly 12 hrs. The exactly identical length of day and night around the automnnal equinox on 21.09.2008 has been reached in Heidelberg still four days later on 25.09.2008, because on that day, sunrise has been at 7.18 hrs Middle European summer time and sunset has been at 19.18 hrs, and the length of the day has thus been exactly 12 hrs. The times of sunrise and sunset at the dates of the exactly identical length of day and night around the equinox in spring and autumn in 2009 have been exactly the same as in 2008.

4 Relationships of swarm phases, mass flights and peak occurrences of beetles with the new moon and full moon phases of the lunar cycle

The relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* with the new moon and full moon phases as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the turning points of the lunar cycle are outlined as follows. The observations and analysis of the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species with the new moon and full moon phases of the lunar cycle are the base for the selenocyclical evaluation of the short-term population dynamics of the treated diurnal and crepuscular insects. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

4.1 The Stag Beetle *Lucanus cervus* based on own observations

The short-term population dynamics of the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) are particularly highlighted by the analysis of swarm evenings in Tairnbach southsoutheast of Heidelberg and in Schriesheim north of Heidelberg in the southwestern part of Germany. During my investigations of the population at the margin of the forest in Tairnbach southsoutheast of Heidelberg from 01.06.2008 to 15.08.2008, I have observed only abt. 1 – 5 individuals of the Stag Beetle *Lucanus cervus* per evening on most of the days of its activity, whereas in the crepuscular period in the evening of 05.06.2008, a spectacular swarming of abt. 25 – 30 males and females has happened which have flown along and around the trees in up to abt. 20 m height at the margin of the forest, with this outstanding swarming having occurred only two days after the new moon on 03.06.2008. The extraordinary swarming of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach on 05.06.2008 that has taken place two days after the new moon on 03.06.2008 has happened within the second period of summerly warm and sunny weather from 19.05.2008 to 12.06.2008 which has started before the full moon on 20.05.2008 and has ended before the full moon on 18.06.2008. Apart from the outstanding swarm evening on 05.06.2008 with the exceptional flight of abt. 25 – 30 males and females of the Stag Beetle *Lucanus cervus* at the locality Tairnbach, 1 – 3 flying males each have only still been observed on 01.06.2008, 07.06.2008, 08.06.2008, 09.06.2008 and 10.06.2008 which has been around and between the new moon on 03.06.2008 and the increasing half moon on 10.06.2008, and after the increasing half moon on 10.06.2008, no more flying males have been discovered. Flying females of the Stag Beetle *Lucanus cervus* have been noticed at the locality Tairnbach on 07.06.2008, 08.06.2008, 18.06.2008, 19.06.2008, 20.06.2008

and 22.06.2008 which has been around and between the increasing half moon on 10.06.2008 and the full moon on 18.06.2008, with on most of these days only 1 flying female each having been detected and only on 07.06.2008 even 2 flying females having been recorded. Walking females of the Stag Beetle *Lucanus cervus* have been registered at the locality Tairnbach on 07.06.2008, 08.06.2008, 09.06.2008, 10.06.2008, 14.06.2008, 18.06.2008, 19.06.2008, 21.06.2008, 22.06.2008, 24.06.2008, 28.06.2008, 02.07.2008, 07.07.2008, 10.07.2008, 11.07.2008, 25.07.2008 and 26.07.2008 which has been in the period from the new moon on 03.06.2008 to the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, with on most of these days only 1 walking female each having been encountered and only on 10.06.2008, 22.06.2008 and 25.07.2008 even 2 walking females each having been met. The almost regular appearance of at least 1 walking female of the Stag Beetle *Lucanus cervus* per day since 07.06.2008 which has been several days after the new moon on 03.06.2008 has been terminated around the new moon on 03.07.2008, and the last walking female at the locality Tairnbach has been confirmed on the day after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008. The period of activity of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach in 2008 has thus extended more or less from the new moon on 03.06.2008 to the new moon on 01.08.2008. The details of my regular almost daily monitoring of the population of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach from 01.06.2008 to 15.08.2008 are contained in my book (MADER 2009a).

In 2009, the Stag Beetle *Lucanus cervus* has appeared at the locality Tairnbach and at various other localities in the region around Heidelberg and Mannheim around the full moon on 09.05.2009 when numerous males have been found as predation victims without abdomina on the ground within and at the margins of forests, and around the new moon on 24.05.2009, the occurrence of females has been observed as road kills and predation victims at the localities Tairnbach and Walldorf and has been reported to me from several other localities. The swarming of males of the Stag Beetle *Lucanus cervus* at the locality Tairnbach has started on the new moon on 24.05.2009 when for the first time in this year abt. 5 – 10 males have flown at the margin of the forest on the background of the sunset glow during the crepuscular period between the sunset and the beginning of the night at the end of a warm and dry day with bright sky from the morning to the evening, whereas no flying males have been recognized before. One day after the new moon on 24.05.2009, I have observed only 3 flying males of the Stag Beetle *Lucanus cervus* at the locality Tairnbach, whereas on the following days, I have not detected flying individuals until 31.05.2009 when I have again seen only 3 flying males. The flight of individuals of the Stag Beetle *Lucanus cervus* on and around the new moon on 24.05.2009 has also been reported to me from other localities in the region around Heidelberg and Mannheim.

The swarming of males of the Stag Beetle *Lucanus cervus* at the locality Tairnbach has continued on 01.06.2009 after the increasing half moon on 31.05.2009 when again abt. 5 – 10 males have flown at the margin of the forest during the crepuscular period, and has extended until 03.06.2009 which has been four days before the full moon on 07.06.2009, with abt. 5 – 10 males or even up to abt. 10 – 15 males having flown per evening. Flying males of the Stag Beetle *Lucanus cervus* at the locality Tairnbach have then been observed on 05.06.2009 when abt. 5 – 7 individuals have been active two days before the full moon on 07.06.2009, and on 10.06.2009, 11.06.2009, 12.06.2009 and 13.06.2009 when only 1 individual each has been active between the full moon on 07.06.2009 and the decreasing half moon on 15.06.2009, whereas on 04.06.2009, 06.06.2009, 07.06.2009, 08.06.2009, 09.06.2009, 14.06.2009 and 15.06.2009, I have not encountered flying males. After the decreasing half moon on 15.06.2009 between the full moon on 07.06.2009 and the new moon on 22.06.2009, no more flying males of the Stag Beetle *Lucanus cervus* have been noted at the locality Tairnbach, and one walking male each has been encountered on 02.06.2009, 09.06.2009 and 13.06.2009. Walking females of the Stag Beetle *Lucanus cervus* at the locality Tairnbach have been

observed for the first time on 02.06.2009 which has been a few days after the increasing half moon on 31.05.2009, and have then been noted on 09.06.2009, 13.06.2009, 14.06.2009, 17.06.2009, 19.06.2009 and 20.06.2009 which has been between the full moon on 07.06.2009 and the new moon on 22.06.2009, with on most of these days only 1 individual each having shown up and 2 – 3 individuals having appeared only on 13.06.2009 and 20.06.2009, whereas a flying female has only been recognized on 16.06.2009. After the new moon on 22.06.2009, I have seen one walking female each of the Stag Beetle *Lucanus cervus* at the locality Tairnbach only still on 23.06.2009, 28.06.2009 and 29.06.2009, whereas after the increasing half moon on 29.06.2009 during my observations from 30.06.2009 to 10.07.2009, I have not discovered any more walking female. The period of activity of the Stag Beetle *Lucanus cervus* at the margin of the forest in Tairnbach in 2009 has thus extended more or less from the full moon on 09.05.2009 to the full moon on 07.07.2009.

The comparative evaluation of the short-term population dynamics of the Stag Beetle *Lucanus cervus* at the locality Tairnbach indicates that in contrast to the high number of individuals which has been observed in 2008, significantly less individuals have been recorded in 2009 in relation to 2008, although the absolute and independent assessment permits to qualify the population as also consisting of numerous individuals in 2009. The considerable difference in abundance in 2009 in relation to 2008 is reflected by the frequency of both flying males and walking females of the Stag Beetle *Lucanus cervus* that have been seen during the regular daily monitoring of the site in Tairnbach from 01.06.2008 to 15.08.2008 and from 01.05.2009 to 10.07.2009. The striking difference in abundance is also documented in the amount of road kills of females of the Stag Beetle *Lucanus cervus* at the locality Tairnbach, with abt. 10 females having been collected as victims of traffic in 2008 in contrast to only one female that has been overrolled by vehicles in 2009. Another important indication of the significant difference in frequency is the fact that such a pronounced swarm evening as on 05.06.2008 when abt. 25 – 30 males and females of the Stag Beetle *Lucanus cervus* have flown along and around the trees in up to abt. 20 m height at the margin of the forest in Tairnbach has not been developed in 2009 when only up to abt. 10 – 15 males each have flown at in total 5 swarm evenings. The quantitative assessment of the observed individuals of the Stag Beetle *Lucanus cervus* at the locality Tairnbach permits to estimate that the populations have consisted of at least abt. 100 – 150 individuals or even up to abt. 125 – 175 individuals in 2008 in contrast to only at least abt. 50 – 100 individuals or at the highest up to abt. 75 – 125 individuals in 2009.

During the culmination of the swarming of the Stag Beetle *Lucanus cervus* at the locality Tairnbach from 01.06.2009 to 05.06.2009, I have had several times the rare chance to observe flying males from closest distance under almost ideal conditions when several males have flown in the height of my head repeatedly to and fro a limited interval along the way at the forest margin in very low speed which has enabled me to follow them easily by walking. Some of the males of the Stag Beetle *Lucanus cervus* have flown so nicely in low height directly in front of my head that I have been almost able to touch them with my nose during my detailed inspection of their flight pattern. I have been so extremely fascinated during my careful observation of the amazing flight show of several males of the Stag Beetle *Lucanus cervus* in almost slow motion immediately before my eyes that I have just looked with admiration at this outstanding presentation and have even not thought on the possibility to document this extraordinary scene in photographs. The exceptional experience of the very detailed observation of the flight of several males of the Stag Beetle *Lucanus cervus* in front of my head in nearly slow motion due to the very low velocity of the flying beetles has been one of the most striking events during my entomological research.

4.2 The Stag Beetle *Lucanus cervus* based on personal communications

Similar swarm evenings of the Stag Beetle *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae)

as having been recorded by myself in Tairnbach southsoutheast of Heidelberg in the southwestern part of Germany have been observed by ELISABETH LÖFFLER (person. commun. 2008) in Schriesheim north of Heidelberg where abt. 30 individuals have flown on three successive days in the crepuscular period in the evening near the margin of the vineyards below the castle at the margin of the forest in the period from the end of June to the beginning of July 2008, with these three successive swarm evenings also having occurred around the new moon on 03.07.2008. Before and after these three successive swarm evenings in 2008 as well as in earlier years, ELISABETH LÖFFLER (person. commun. 2008) has noted only abt. 1 – 3 individuals per day during the periods of activity of the Stag Beetle *Lucanus cervus* from 1965 to 2008. In the same period around the new moon on 03.07.2008, also MARIANNE KRIEG and MANFRED GLASER (person. commun. 2008) have observed in Schriesheim the appearance of abt. 5 males and abt. 5 females of the Stag Beetle *Lucanus cervus* which have flown around in the garden of their house on a warm summer evening, whereas on the evenings before and after this swarm event, only some single individuals have shown up. The swarm evenings of the Stag Beetle *Lucanus cervus* which ELISABETH LÖFFLER (person. commun. 2008) as well as MARIANNE KRIEG and MANFRED GLASER (person. commun. 2008) have observed in Schriesheim around the new moon on 03.07.2008 have happened within the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 which has started on the full moon on 18.06.2008 and has ended after the new moon on 03.07.2008.

Several people have registered an extension of the swarm phases of the Stag Beetle *Lucanus cervus* in Schriesheim for abt. one week. NORBERT MORAST (person. commun. 2008) has noted abt. 20 individuals of the Stag Beetle *Lucanus cervus* per day during abt. one week in June or July 2000 which have flown around a jasmine tree in the garden of his house in Schriesheim and have sit on the wall of the house, whereas before and after this swarm phase of abt. one week duration in 2000 as well as from 2001 to 2004, only abt. 2 – 3 individuals per day have appeared during the periods of activity of the Stag Beetle *Lucanus cervus*. PETER FINDEISEN (person. commun. 2008) has observed abt. 20 individuals of the Stag Beetle *Lucanus cervus* per day on the two weekends of 14.06.2008 – 15.06.2008 and 21.06.2008 – 22.06.2008 which have flown in the garden of his house in Schriesheim and have walked in the garden and in the yard of the house, whereas before these two swarm weekends, only single individuals have shown up and have flown along the street before the house, and after these two swarm weekends, no more individuals have appeared. The swarm weekends of 14.06.2008 – 15.06.2008 und 21.06.2008 – 22.06.2008 when PETER FINDEISEN (person. commun. 2008) has observed the peak activity of the Stag Beetle *Lucanus cervus* in Schriesheim have occurred several days before and after the full moon on 18.06.2008, respectively. RUTH SCHILLING (person. commun. 2008) has encountered abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* per day during abt. one week in June 1994 in a garden below the graveyard in Schriesheim which have emerged from the root of a cut stump of an old cherry tree that has been in parts covered by ivy and have flown in the garden, and on one day of this swarm phase, even abt. 30 individuals have appeared during the crepuscular period in the evening, whereas before and after this swarm phase of abt. one week duration in 1994, only abt. 3 – 5 individuals have shown up per day during the period of activity of the Stag Beetle *Lucanus cervus.* The swarm evenings of the Stag Beetle *Lucanus cervus* which RUTH SCHILLING (person. commun. 2008) has registered in June 1994 in Schriesheim have probably happened around and between the new moon on 09.06.1994 and the full moon on 23.06.1994. DAGMAR ZIMMERMANN (person. commun. 2008) has noted abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* per day during abt. one week in some years between 1987 and 2000 which have flown in the garden behind her house in Schriesheim and in the street before the house during the crepuscular period in the evening, whereas before and after these swarm phases of abt. one week duration, only abt. 3 – 5 individuals have appeared per day during the periods of activity of the Stag Beetle *Lucanus cervus* from 1987 to 2008.

The most spectacular swarming of the Stag Beetle *Lucanus cervus* has been reported by GERDA and

GERD REUSCHER (person. commun. 2008) in Schriesheim where they have registered the daily appearance of abt. 15 – 20 individuals in the crepuscular period in the evening which have flown around the house and into the yard of the house, have walked in the yard and in the street before the house, and have sit in the yard and on the walls of the house on every evening for abt. 3 – 4 weeks in June 2007, whereas before and after this swarm phase in 2007 as well as in earlier years, only abt. 3 – 5 individuals per day have shown up during the periods of activity of the Stag Beetle *Lucanus cervus* from 1962 to 1977 according to observations by GERDA REUSCHER (person. commun. 2008) as well as from 1983 to 2006 and in 2008 according to observations by GERDA and GERHARD REUSCHER (person. commun. 2008). The swarm evenings of the Stag Beetle *Lucanus cervus* which GERDA and GERD REUSCHER (person. commun. 2008) have registered in June 2007 in Schriesheim have happened around and between the full moon on 01.06.2007, the new moon on 15.06.2007 and the full moon on 30.06.2007. An exceptional record of the swarming of the Stag Beetle *Lucanus cervus* has been compiled by PETER SANDMAIER (person. commun. 2008) in Jochenstein north of Engelhartszell eastsoutheast of Passau in the Danube valley in the southeastern part of Germany where he has observed the annual swarming of abt. 15 – 20 individuals per evening around a big lime tree in a beer garden adjacent to the Danube during yearly visits of the locality for 2 – 4 days on weekends from 1982 to 2007, and has thus been able to document the regular annual swarming of numerous individuals of the stag beetle *Lucanus cervus* for several successive days at the same place in Jochenstein for a period of 25 years. An outstanding swarm evening of the Stag Beetle *Lucanus cervus* has also been experienced by GERD PASCHER (person. commun. 2008) in Mosbach-Diedesheim eastsoutheast of Heidelberg on one day in the period between the end of May and the end of June 2007 when in the evening between 21.30 hrs and 22 hrs Middle European summer time, successively more than 20 individuals have flown to a big box tree in the garden of his house adjacent to the margin of the forest, have landed within a limited interval of the box tree, have then walked on the ground and on the terrace, and have finally disappeared in the darkness of the night, whereas no individuals have appeared on the next day. The swarm evening of the Stag Beetle *Lucanus cervus* which GERD PASCHER (person. commun. 2008) has registered on one day in the period between the end of May and the end of June 2007 in Mosbach-Diedesheim has happened around and between the full moon on 01.06.2007, the new moon on 15.06.2007 and the full moon on 30.06.2007.

Other remarkable swarm evenings of the Stag Beetle *Lucanus cervus* have been reported by ULRIKE SCHUBACH (person. commun. 2008) who has observed the flight of abt. 30 individuals along the margin of the forest between Ubstadt and Zeutern south of Heidelberg on one evening in 2003 or 2004, with the numerous individuals having repeatedly flown to and fro the way at the margin of the forest, and by HORST MARTHALER (person. commun. 2009) who has seen the flight of abt. 10 – 20 individuals along a way in the forest between Mannheim-Käfertal and Viernheim northnorthwest of Heidelberg on one evening in abt. 1990. Swarm evenings of the Stag Beetle *Lucanus cervus* with the appearance of at least abt. 30 males and females per day on several successive days have been experienced by HORST GRUHLKE (person. commun. 2008) near Stresa at the western shore of the Lago Maggiore in the northwestern part of Italy in the period from abt. late June to abt. early July 1998 when numerous individuals have flown over the water at the shore of the lake during abt. 2 hrs each in the darkness of the evening, with these swarm evenings having probably happened around and between the new moon on 24.06.1998 and the full moon on 09.07.1998. The details of the reports of swarm evenings of the Stag Beetle *Lucanus cervus* at other localities in Germany as well as at various places in Eastern Europe, Southern Europe and Western Europe by numerous friends of nature beyond the above mentioned examples are compiled in my book (MADER 2009a).

ARNO THOMAES (person. commun. 2009) has observed the occurrence of abt. 30 individuals of the Stag Beetle *Lucanus cervus* each in Watermaal-Bosvoorde in the southeastern part of Bruxelles in the central part of Belgium on 13.06.2003 and 20.06.2003, and cannot remember to have seen again such a large number of individuals during one night at any place or at any time. The mass appearan-

ces of the Stag Beetle *Lucanus cervus* which ARNO THOMAES (person. commun. 2009) has registered on 13.06.2003 and 20.06.2003 have happened one day before the full moon on 14.06.2003 as well as one day before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively.

4.3 The Stag Beetle *Lucanus cervus* based on literature evaluation

The evaluation of the graphical and/or tabular presentations of the observed numbers of individuals of the Stag Beetle *Lucanus cervus* LINNAEUS 1758 (Coleoptera: Lucanidae) per day in SPRECHER-UEBERSAX & DURRER (1998), SPRECHER-UEBERSAX (2001), HILPÜSCH (2004), FREMLIN (2009) and FREMLIN & FREMLIN (2010) has revealed that in most of the investigated years, one or two pronounced peaks of activity have been developed when predominantly abt. 10 – 20 or even abt. 20 – 30 individuals and subordinately abt. 5 – 10 individuals have been recorded per day, whereas before and after these culminations of activity, predominantly only abt. 1 – 2 or abt. 3 – 5 individuals and subordinately only abt. 5 – 10 individuals have been noted per day, and in most of the investigated years, also a correlation between the peaks of activity of the Stag Beetle *Lucanus cervus* and the new moon or the full moon has been established. Further examples of the appearance of abundant individuals of the Stag Beetle *Lucanus cervus* on or around the full moon or the new moon are mentioned among others in CHOP (1863), CORNELIUS (1867, 1868), FRINGS (1897), SCHMITT (1928), RAMMNER (1933), DONISTHORPE (1935), WILMINK (1950), TIPPMANN (1954), WANNER (1954), SINGER (1955), KAMP (1958), FRANKFURTER ALLGEMEINE ZEITUNG (1959), SMITH (1959), KLESS (1961), GAUSS (1963), LANGTON (1967), HALL (1969), ALLENSPACH (1970), DUTREIX (1974), KÜHNEL & NEUMANN (1981), ZUCCHI & ZUCCHI (1982), SCHWERDTFEGER (1983), BEVIERRE (1984), BIZELY (1984), CARRIÈRE (1989), VERDCOURT (1990), MAMONOV (1991), OCHSE (1993), WÜEST (1993), KARNER (1994), GUYE (1996), BOWDREY (1997), NÜCKEL (1999), HAWES (2000), BRECHTEL & KOSTENBADER (2002), FRANZKE (2003), RIPPEGATHER (2004), SCHADER (2004), FREMLIN (2005) and WEITZEL (2005), with the results being contained in these notes also having been integrated into the selenocyclical interpretation of the population dynamics of the Stag Beetle *Lucanus cervus*.

In Colchester in Essex eastnortheast of London in the southeastern part of England, FREMLIN (2009) and FREMLIN & FREMLIN (2010) have investigated the distribution of individuals of the Stag Beetle *Lucanus cervus* per day during its periods of activity in 2005, 2006 and 2007. The evaluation of the graphical and tabular presentations of the observed numbers of individuals of the Stag Beetle *Lucanus cervus* per day in FREMLIN & FREMLIN (2010) has revealed that in 2005, peaks of activity with the appearance of abt. 10 – 25 individuals per day have been developed on 26.05.2005 – 27.05.2005, 09.06.2005, 13.06.2005 – 14.06.2005 and 17.06.2005, with these culminations of activity having occurred three to four days after the full moon on 23.05.2005, three days after the new moon on 06.06.2005, one and two days before and two days after the increasing half moon on 15.06.2005, and five days before the full moon on 22.06.2005, respectively. An extraordinary mass flight of abundant individuals of the Stag Beetle *Lucanus cervus* has happened on 17.06.2005 (MARIA FREMLIN, person. commun. 2009) which has been two days after the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005. In 2006, peaks of activity with the appearance of abt. 10 – 15 individuals of the Stag Beetle *Lucanus cervus* per day have been established on 10.06.2006 – 11.06.2006 and 17.06.2006, with these culminations of activity having taken place one day before and on the full moon on 11.06.2006 as well as one day before the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, respectively. In 2007 (FREMLIN 2009, FREMLIN & FREMLIN 2010), peaks of activity with the appearance of abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* per day have been manifested on 23.05.2007, 01.06.2007 – 02.06.2007, 07.06.2007 – 10.06.2007 and 17.06.2007, with

these culminations of activity having happened on the increasing half moon on 23.05.2007, on and one day after the full moon on 01.06.2007, several days before and after the decreasing half moon on 08.06.2007, and five days before and two days after the new moon on 15.06.2007, respectively. In 2008 (MARIA FREMLIN, person. commun. 2009), a peak of activity with the appearance of abt. 9 – 11 individuals of the Stag Beetle *Lucanus cervus* per day has been established on 08.06.2008 – 09.06.2008, with this culmination of activity having been manifested one and two days before the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.06.2008. In 2009 (MARIA FREMLIN, person. commun. 2009), peaks of activity with the appearance of abt. 8 – 10 individuals of the Stag Beetle *Lucanus cervus* per day have been developed on 31.05.2009, 02.06.2009 and 13.06.2009 – 14.06.2009, with these culminations of activity having occurred on and two days after the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009 as well as one and two days before the decreasing half moon on 15.06.2009 between the full moon on 07.06.2009 and the new moon on 22.06.2009, respectively. In addition to the regular continuous monitoring of the distribution of individuals of the Stag Beetle *Lucanus cervus* per day during its periods of activity in 2005, 2006 and 2007 (FREMLIN 2009, FREMLIN & FREMLIN 2010) as well as in 2008 and 2009 (MARIA FREMLIN, person. commun. 2009), single occasional records of peaks of activity are available from Colchester for 1996 (BOWDREY 1997) and 2003 (FREMLIN 2005). In 2003 (FREMLIN 2005), a peak of activity with the appearance of abundant individuals of the Stag Beetle *Lucanus cervus* per day in Colchester has been established on 07.06.2003 (MARIA FREMLIN, person. commun. 2009), with this culmination of activity having happened on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003. In 1996 (BOWDREY 1997), a peak of activity with the appearance of up to 40 – 50 individuals of the Stag Beetle *Lucanus cervus* per day in Colchester has been manifested on 17.06.1996, with this culmination of activity having taken place one day after the new moon on 16.06.1996.

In Heiligenhaus-Isenbügel northeast of Düsseldorf in the northwestern part of Germany, HILPÜSCH (2004) has investigated the distribution of individuals of the Stag Beetle *Lucanus cervus* per day during its period of activity in 2004. The evaluation of the tabular presentation of the observed numbers of individuals of the Stag Beetle *Lucanus cervus* per day in HILPÜSCH (2004) has revealed that in 2004, peaks of activity with the appearance of abt. 10 – 15 individuals per day have been developed on 26.06.2004 – 27.06.2004, 08.07.2004, 16.07.2004 and 23.07.2004, with these culminations of activity having occurred one and two days after the increasing half moon on 25.06.2004 between the new moon on 17.06.2004 and the full moon on 02.07.2004, one day before the decreasing half moon on 09.07.2004 between the full moon on 02.07.2004 and the new moon on 17.07.2004, one day before the new moon on 17.07.2004, and two days before the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004, respectively.

In Münchenstein south of Basel in the northwestern part of Switzerland, SPRECHER-UEBERSAX & DURRER (1998) and SPRECHER-UEBERSAX (2001) have investigated the distribution of individuals of the Stag Beetle *Lucanus cervus* per day during its periods of activity from 1991 to 2000. The evaluation of the graphical and tabular presentations of the observed numbers of individuals of the Stag Beetle *Lucanus cervus* per day in SPRECHER-UEBERSAX & DURRER (1998) and SPRECHER-UEBERSAX (2001) has revealed that in 1991, the peak of activity with the appearance of abt. 10 – 15 individuals per day has been developed on 30.06.1991, with this culmination of activity having occurred three days after the full moon on 27.06.1991. In 1992, the peak of activity with the appearance of abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* per day has been established on 15.06.1992 – 17.06.1992, with this culmination of activity having taken place on and a few days after the full moon on 15.06.1992. In 1993, the peak of activity with the appearance of abt. 15 – 20 individuals of the Stag Beetle *Lucanus cervus* per day has been manifested on 16.06.1993, with this culmina-

tion of activity having happened four days before the new moon on 20.06.1993. In 1994, the peak of activity with the appearance of abt. 10 – 25 individuals of the Stag Beetle *Lucanus cervus* per day has been developed on 15.06.1994 – 16.06.1994, with this culmination of activity having occurred one day before and on the increasing half moon on 16.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994. In 1995, the peak of activity with the appearance of abt. 5 – 10 individuals of the Stag Beetle *Lucanus cervus* per day has been established on 20.06.1995 – 21.06.1995, with this culmination of activity having taken place on and one day after the decreasing half moon on 20.06.1995 between the full moon on 13.06.1995 and the new moon on 28.06.1995. In 1996, the peak of activity with the appearance of abt. 8 – 10 individuals of the Stag Beetle *Lucanus cervus* per day has been manifested on 10.06.1996 – 11.06.1996, with this culmination of activity having happened one and two days after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996 as well as several days before the new moon on 16.06.1996, respectively. In 1997, peaks of activity with the appearance of abt. 8 – 10 individuals of the Stag Beetle *Lucanus cervus* per day have been developed on 05.06.1997 and 12.06.1997, with these culminations of activity having occurred on the new moon on 05.06.1997 as well as one day before the increasing half moon on 13.06.1997 between the new moon on 05.06.1997 and the full moon on 20.06.1997, respectively. In 1998, peaks of activity with the appearance of abt. 5 – 8 individuals of the Stag Beetle *Lucanus cervus* per day have been established on 08.06.1998 – 09.06.1998 and 19.06.1998 – 21.06.1998, with these culminations of activity having taken place one and two days before the full moon on 10.06.1998 as well as three to five days before the new moon on 24.06.1998, respectively. In 1999, the peak of activity with the appearance of abt. 10 – 20 individuals of the Stag Beetle *Lucanus cervus* per day has been manifested on 16.06.1999 – 17.06.1999, with this culmination of activity having happened three to four days after the new moon on 13.06.1999. In 2000, peaks of activity with the appearance of abt. 5 – 8 individuals of the Stag Beetle *Lucanus cervus* per day have been developed on 13.06.2000 and 17.06.2000, with these culminations of activity having occurred four days before and on the full moon on 17.06.2000, respectively.

Other cases of the occurrence of abundant individuals of the Stag Beetle *Lucanus cervus* on or around the full moon or the new moon are mentioned in various publications, with some examples being outlined as follows. Swarm evenings of the Stag Beetle *Lucanus cervus* with the appearance of at least abt. 5 – 10 individuals per day have been recorded by VOLKER KLOCK (in NÜCKEL 1999, in BRECHTEL & KOSTENBADER 2002) in the period from the beginning to mid of May 1999 in the district Rüppurr at the southern margin of the city of Karlsruhe (abt. 52 km southsouthwest of Heidelberg) in the southwestern part of Germany over an interval of several weeks when he has collected almost daily abt. 5 – 10 caput-thorax-fragments of males which reflect a pronounced swarming of numerous individuals that has happened five years after the exceptionally hot summer in 1994, with the registered swarm evenings having taken place around and between the full moon on 30.04.1999 and the new moon on 15.05.1999. Swarm evenings of the Stag Beetle *Lucanus cervus* with the occurrence of at least abt. 15 – 30 individuals per day have been experienced by FRINGS (1897) in a forest south of Bonn in the Middle Rhine valley in the northwestern part of Germany where in total 28 individuals (23 males and 5 females) on 14.06.1891, in total 16 individuals on 28.06.1892, and in total abt. 15 – 20 individuals per day on every calm and sultry evening in June 1893 and in June 1894 have flown around predominantly in abt. 2 m height, with the swarming on 14.06.1891 having happened on the increasing half moon on 14.06.1891 between the new moon on 06.06.1891 and the full moon on 22.06.1891 as well as the swarming on 28.06.1892 having been established four days after the new moon on 24.06.1892. The swarming of the Stag Beetle *Lucanus cervus* around Bonn (FRINGS 1897) in June 1893 has been manifested around and between the full moon on 30.05.1893, the new moon on 14.06.1893 and the full moon on 29.06.1893, whereas the swarming in June 1894 has been developed around and between the new moon on 03.06.1894, the full moon on 18.06.1894 and the new moon on 03.07.1894. Swarm evenings of the Stag Beetle *Lucanus cervus* with the oc-

currence of abundant individuals per day have been mentioned by SINGER (1955) from Rückersbach northwest of Aschaffenburg in the Main valley in the central part of Germany on 25.05.1922 and 08.06.1926, with these swarm evenings having been established one day before the new moon on 26.05.1922 and two days before the new moon on 10.06.1926, respectively. Swarm evenings of the Stag Beetle *Lucanus cervus* with the occurrence of numerous individuals per day have been reported by INGO RICHTER (in FRANZKE 2003) from Holbeck southsoutheast of Berlin in the northeastern part of Germany on 04.06.2003 and the days before that date, with these swarm evenings having happened several days after the new moon on 31.05.2003.

The most spectacular mass occurrence of the Stag Beetle *Lucanus cervus* that is documented in the literature has been reported by CORNELIUS (1867) from the Haardtbusch near Wuppertal-Elberfeld in the Wupper valley east of Düsseldorf in the northwestern part of Germany where on various days in the period from 20.06.1867 to 06.07.1867, between 25 and 150 individuals per day have walked on the floor in the vicinity of rotten stumps and roots of oaks in the forest, whereas in other years, considerably less individuals have appeared there, with the mentioned extraordinary abundance of individuals having happened around and between the full moon on 17.06.1867 and the new moon on 01.07.1867. Other spectacular swarm evenings of the Stag Beetle *Lucanus cervus* have been experienced by MAMONOV (1991) in Kiev in the northwestern part of the Ukraina where during the flight periods from mid of June to mid of July in 1974 and 1976, in total several hundreds of individuals each have flown in the evening after sunset along and around the numerous cherry trees in the gardens and streets in the district Goncharovka where the Pokrov cathedral is located. The swarm evenings of the Stag Beetle *Lucanus cervus* which MAMONOV (1991) has observed in Kiev in the northwestern part of the Ukraina from mid of June to mid of July 1974 have probably been established around and between the new moon on 20.06.1974 and the full moon on 04.07.1974, and the swarm evenings from mid of June to mid of July 1976 have probably been developed around and between the full moon on 12.06.1976 and the new moon on 27.06.1976. HAABER (in CORNELIUS 1868) has carried out an interesting experiment on the full moon on 11.07.1862 when he has fixed a female of the Stag Beetle *Lucanus cervus* with a black silk thread on the stem of an oak near Prague in the northwestern part of Czechia, and during the course of abt. 1.5 hrs, he has registered abt. 75 males which have flown to and around the tree with the fixed female, thereby confirming the stimulation of the swarming of the males of the Stag Beetle *Lucanus cervus* by odorous substances which are secreted by the females in addition to and independent of the effect of the full moon. CHOP (1863) has observed at least 35 males and females of the Stag Beetle *Lucanus cervus* sucking sap on a damaged spot of the stem of a big old oak in a garden in Sondershausen in the Gera valley northnorthwest of Erfurt in the northeastern part of Germany from the early afternoon until the evening of a hot day at the end of June 1863, with the reported mass assemblage having been established before the full moon on 01.07.1863. RAMMNER (1933) has watched abundant individuals of the Stag Beetle *Lucanus cervus* flying around the trees in a forest in the late afternoon of a hot and sultry day at the end of June 1932 or 1933 when a thunderstorm has been approaching, with this swarming having taken place probably around the new moon on 03.07.1932 or around the new moon on 23.06.1933.

Outstanding swarm evenings of the Stag Beetle *Lucanus cervus* have also been observed by BEVIERRE (1984) in Bougival at the southern margin of Paris in the northwestern part of France in early July 1983 when on each evening, abt. 50 individuals have flown around within a street that crosses a forest consisting of oaks and chestnut trees, with these swarm evenings having happened around and between the full moon on 25.06.1983 and the new moon on 10.07.1983. DUTREIX (1974) has recorded the swarming of more than 20 individuals of the Stag Beetle *Lucanus cervus* in the vicinity of the horse-racing course in Vincennes at the southeastern margin of Paris in the northwestern part of France on 16.06.1973 and 17.06.1973 which have flown and walked around the stem of a chestnut tree, with this swarming having been developed one and two days after the full moon on 15.06.1973. CARRIÈRE (1989) has noticed abt. 100 males of the Stag Beetle *Lucanus cervus* in the

vicinity of Minerve northnorthwest of Narbonne in the Languedoc in the southeastern part of France in the afternoon between 15 hrs and 18 hrs Middle European summer time on 15.06.1988 which have flown in abt. 2 – 4 m height from east to west, with this swarming having been established one day after the new moon on 14.06.1988, whereas he has registered also numerous individuals on 12.06.1988 and only a few individuals on 19.06.1988 which has been two days before and five days after the new moon on 14.06.1988, respectively. GUYE (1996) has observed the swarming of males of the Stag Beetle *Lucanus cervus* in a garden in Cabanac-et-Villagrains southsouthwest of Talence in the southwestern part of France on 25.06.1995, with this swarming having happened two days before the new moon on 27.06.1995. DONISTHORPE (1935) has collected hundreds of road kills of predominantly females of the Stag Beetle *Lucanus cervus* as remnants of the swarming on a street outside of Windsor Forest south of Slough west of London in the southeastern part of England on 03.07.1935 which have been distributed within an interval of abt. 1 mile on the road, with this swarming having taken place three days after the new moon on 30.06.1935. SMITH (1959) has seen in total 23 flying and walking individuals of the Stag Beetle *Lucanus cervus* within a short interval of a street in the vicinity of the tennis courts in Slough west of London in the southeastern part of England on 09.06.1959 which have been 11 males and 12 females, with this swarming having happened three days after the new moon on 06.06.1959. LANGTON (1967) has reported the swarming of abundant individuals of the Stag Beetle *Lucanus cervus* in a garden in Worthing south of London in the southeastern part of England on an evening mid of June 1962, with this swarming having occurred around the full moon on 18.06.1962, and has also registered the find of the remnants of abt. 100 individuals in a lawn after mowing in July 1961, with the corresponding mass appearance having taken place around and between the full moon on 28.06.1961, the new moon on 12.07.1961 and the full moon on 27.07.1961. HAWES (2000) has watched the flight of 30 individuals (27 males and 3 females) of the Stag Beetle *Lucanus cervus* in a street in Holbrook northeast of Birmingham in the southeastern part of England in the evening on the full moon on 17.06.2000 between 21.15 hrs and 22.00 hrs.

BIZELY (1984) has mentioned the swarming of hundreds of individuals of the Stag Beetle *Lucanus cervus* in Leatherhead south of London in the southeastern part of England in mid of June 1984 which have flown over gardens and have been watched by numerous people, with this swarming that has also been reported in a local newspaper having taken place around the full moon on 13.06.1984, and has also registered abt. 55 dead or dying individuals of the Stag Beetle *Lucanus cervus* in the garden of his house at the end of June to the beginning of July 1980 which have been victims of predators according to the lack of their abdomina, with this mass emergence prior to the predation having probably been established around the full moon on 28.06.1980. Similar mass emergences of more than 20 individuals of the Stag Beetle *Lucanus cervus* from the ground around tree stumps that have then immediately become the prey of birds have been observed by VERDCOURT (1990) in Maidenhead west of Slough west of London in the southeastern part of England on 16.06.1989 which has been developed three days before the full moon on 19.06.1989, and by FRITZ PURDEL (in SCHMITT 1928) in Berlin in the northeastern part of Germany on 03.06.1926 which has been manifested one day before the decreasing half moon on 04.06.1926 between the full moon on 27.05.1926 and the new moon on 10.06.1926. A mass occurrence of abt. 100 individuals of the Stag Beetle *Lucanus cervus* according to the distribution of fragments on an interval of abt. 50 m on a way in the forest around the airport southwest of Frankfurt am Main in the central part of Germany on 24.05.1993 (KARNER 1994) has been established three days after the new moon on 21.05.1993, and at the same locality, a mass occurrence of abundant individuals due to the presence of numerous remnants which has been reported on 02.06.2004 (RIPPEGATHER 2004) has happened one day before the full moon on 03.06.2004. A mass appearance of abt. 100 individuals as being reflected by the accumulation of fragments around an old oak in the Fasanerie at the northern margin of the city of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 17.06.1956 (GAUSS 1963) has taken place one day after the increasing half moon on 16.06.1956 bet-

ween the new moon on 08.06.1956 and the full moon on 23.06.1956, and similar mass appearances in the period of 15.06.1956 – 22.06.1956 have also been located around the increasing half moon on 16.06.1956 and before the full moon on 23.06.1956. A mass occurrence of abt. 200 – 300 individuals of the Stag Beetle *Lucanus cervus* as being confirmed by the assemblage of remnants around an old oak near Reuden north of Roßlau in the Elbe valley southwest of Berlin in the northeastern part of Germany in July 1964 (HOHMUTH & REICHHOFF 1980: according to a reference in KÜHNEL & NEUMANN 1981) has been manifested around and between the full moon on 25.06.1964, the new moon on 09.07.1964 and the full moon on 24.07.1964. A mass appearance of abt. 60 individuals of the Stag Beetle *Lucanus cervus* as being documented by the distribution of their dead bodies on an interval of abt. 150 m on a way in the forest Paradies around Heilbronn in the Neckar valley in the southwestern part of Germany on 10.06.1953 following a control action against cockchafer populations with dispersal of insecticides (WANNER 1954) has been discovered one day before the new moon on 11.06.1953.

The swarming of abt. 50 individuals of the Stag Beetle *Lucanus cervus* around a pear tree near Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany in June 1954 (KLESS 1961) has taken place around and between the new moon on 01.06.1954, the full moon on 16.06.1954 and the new moon on 30.06.1954. The swarming of abt. 20 individuals of the Stag Beetle *Lucanus cervus* around an old half-timbered barn in Oberweimar south of Marburg in the Lahn valley in the central part of Germany on several successive evenings in June 1982 (ZUCCHI & ZUCCHI 1982) has probably been developed around and between the full moon on 06.06.1982 and the new moon on 21.06.1982. The swarming of abt. 20 individuals of the Stag Beetle *Lucanus cervus* in a forest in the Losse valley immediately east of Kassel in the Fulda valley in the northwestern part of Germany on 13.06.1992 (OCHSE 1993) has been manifested two days before the full moon on 15.06.1992. The swarming of abundant individuals of the Stag Beetle *Lucanus cervus* at the airport southwest of Frankfurt am Main in the central part of Germany which has been reported on 29.05.1959 (FRANKFURTER ALLGEMEINE ZEITUNG 1959) has happened a few days before the decreasing half moon on 30.05.1959 between the full moon on 22.05.1959 and the new moon on 06.06.1959. The swarming of numerous individuals of the Stag Beetle *Lucanus cervus* in the Mattheiser Wald in Trier in the Moselle valley in the western part of Germany on several days in June 2003 (WEITZEL 2005) has been established around and between the new moon on 31.05.2003, the full moon on 14.06.2003 and the new moon on 29.06.2003. The swarming of abundant individuals of the Stag Beetle *Lucanus cervus* in the forest around Vienna in the eastern part of Austria in the crepuscular period of an evening in June 1937 (TIPPMANN 1954) has probably been manifested around and between the new moon on 08.06.1937 and the full moon on 23.06.1937. The swarming of numerous individuals of the Stag Beetle *Lucanus cervus* which have emerged from an old oak near Meinier northeast of Geneva in the southwestern part of Switzerland on 30.05.1992 or 30.05.1993 (WÜEST 1993) has happened two days before the new moon on 01.06.1992 or five days before the full moon on 04.07.1993, respectively. The swarming of abundant individuals of the Stag Beetle *Lucanus cervus* around an old chestnut tree near Ponto Valentino/Val Blenio north of Bellinzona in the southeastern part of Switzerland in the afternoon on 06.07.1958 (ALLENSPACH 1970) has been developed five days after the full moon on 01.07.1958. The swarming of numerous individuals of the Stag Beetle *Lucanus cervus* in Geul east of Maastricht in the southeastern part of the Netherlands on the evening of 29.06.1949 (WILMINK 1950) has been established three days after the new moon on 26.06.1949.

A mass occurrence of at least 25 individuals of the Stag Beetle *Lucanus cervus* on a short interval of a road in Bromsberrow southwest of Birmingham in the southwestern part of England in early August 1968 (H. BRITTEN in HALL 1969) has probably been developed around and between the new moon on 25.07.1968 and the full moon on 08.08.1968. A mass emergence of abt. 20 males of the Stag Beetle *Lucanus cervus* around an old cherry tree in a garden in Bürstadt-Riedrode (abt. 30 km

northnorthwest of Heidelberg) in the middle part of the Upper Rhine valley in the southwestern part of Germany which has been reported on 15.07.2004 (SCHADER 2004) has happened several days before the new moon on 17.07.2004. A mass occurrence of abt. 20 individuals of the Stag Beetle *Lucanus cervus* on a limited interval in a forest near Metzingen in the Erms valley southsoutheast of Stuttgart in the Neckar valley in the southwestern part of Germany on 06.08.1952 (KAMP 1958) has been observed one day after the full moon on 05.08.1952. The discovery of 16 males of the Stag Beetle *Lucanus cervus* in earth holes where they have been waiting ready for their emergence in a garden in the district Rüppurr at the southern margin of the city of Karlsruhe (abt. 52 km south-southwest of Heidelberg) in the southwestern part of Germany has been reported on 29.06.1983 (SCHWERDTFEGER 1983, BRECHTEL & KOSTENBADER 2002) which has been four days after the full moon on 25.06.1983. The find of numerous dead individuals of the Stag Beetle *Lucanus cervus* in the lawn in a park in the southern part of London in the southeastern part of England shortly after its cutting by tractor-drawn grass-mowing machinery on 17.06.1999 (JONES 2001) has been made four days after the new moon on 13.06.1999.

4.4 The Cockchafer *Melolontha* and the Golden Rose Chafer *Cetonia aurata* based on own observations

In addition to the record of the spectacular swarm evening of the Stag Beetle *Lucanus cervus* in Tairnbach on 05.06.2008 which has been manifested only two days after the new moon on 03.06.2008, I have also observed the occurrence of swarm days of the Cockchafer *Melolontha* and the Golden Rose Chafer *Cetonia aurata* LINNAEUS 1761 (Coleoptera: Scarabaeidae) in the period of a few days before and after the new moon. The swarming of the Golden Rose Chafer *Cetonia aurata* in Nußloch and the Forest Cockchafer *Melolontha hippocastani* FABRICIUS 1801 (Coleoptera: Scarabaeidae) in Sankt Leon has happened around the new moon on 05.05.2008, and the swarming of the Field Cockchafer *Melolontha melolontha* LINNAEUS 1758 (Coleoptera: Scarabaeidae) in Tairnbach has taken place around the full moon on 02.05.2007. The swarm days of the Golden Rose Chafer *Cetonia aurata* in Nußloch and the Forest Cockchafer *Melolontha hippocastani* in Sankt Leon around the new moon on 05.05.2008 have occurred at the beginning of the first period of summerly warm and sunny weather from 02.05.2008 to 14.05.2008 which has started before the new moon on 05.05.2008 and has ended before the full moon on 20.05.2008.

In 2009, the swarming of the Golden Rose Chafer *Cetonia aurata* in Nußloch and the Field Cockchafer *Melolontha melolontha* in Tairnbach has been established around the new moon on 25.04.2009 and has been developed in the second period of dry and warm weather with temperatures of up to 20 – 25 °C from 19.04.2009 to 26.04.2009 which has started after the decreasing half moon on 17.04.2009 between the full moon on 09.04.2009 and the new moon on 25.04.2009, and has ended after the new moon on 25.04.2009. The individuals of the Golden Rose Chafer *Cetonia aurata* in Nußloch have often flown several circular, elliptical or spiral orbits around specific trees in the meadows close to the forest, whereas the individuals of the Field Cockchafer *Melolontha melolontha* in Tairnbach have mainly flown along and around the trees at the margin of the forest without single or multiple revolutions around particular trees. The flight pattern of the Golden Rose Chafer *Cetonia aurata* resembles thus the flight pattern of the Summer Chafer *Amphimallon solstitiale,* whereas the flight pattern of the Field Cockchafer *Melolontha melolontha* is similar to that of the Stag Beetle *Lucanus cervus* and the Tanner Sawyer Beetle *Prionus coriarius.* The green metallic colour of both dorsal and ventral sides as well as the anatomical particularity of the exertion of the flying wings without opening of the cover wings are the reasons for the spectacular appearance of the individuals of the Golden Rose Chafer *Cetonia aurata* as flying emeralds which glitter and gleam when swarming in bright sunlight.

In 2010, the first individuals of the Field Cockchafer *Melolontha melolontha* have appeared in Tairnbach and Nußloch as well as at other localities in the surroundings of Heidelberg and Mannheim (Zielbauer 2010, Rhein-Neckar-Zeitung 2010a) around the new moon on 14.04.2010. The swarming of the Field Cockchafer *Melolontha melolontha* with the flight of masses of individuals in the crepuscular period after the sunset in the evening in Tairnbach has started a few days before the full moon on 28.04.2010. The abundant individuals of the Field Cockchafer *Melolontha melolontha* have emerged from the meadows in front of the margin of the forest and have flown unidirectionally in either straight or curved pattern towards the trees at the margin of the forest where they have landed on the twigs or have flown along and around the branches. The peak of activity of the Field Cockchafer *Melolontha melolontha* at the margin of the forest in Tairnbach around the full moon on 28.04.2010 has taken place between 21 hrs and 21.15 hrs Middle European summer time when a continuous buzzing could be heard when I was standing and walking below the branches of the trees, and when smaller and larger groups of individuals have kept on flying from the meadows to the forest margin either in an almost continuous stream or with only short interruptions between the arrival of the successive groups. Some bats have flown along the margin of the forest and have obviously hunted on flying individuals of the Field Cockchafer *Melolontha melolontha.* The appearance of the peak numbers of the Field Cockchafer *Melolontha melolontha* in Tairnbach around the full moon on 28.04.2010 has taken place within the first longer period of warm and sunny weather with temperatures of up to 20 – 25 °C from 17.04.2010 to 29.04.2010 which has started three days after the new moon on 14.04.2010 and has ended one day after the full moon on 28.04.2010. The swarming of the Field Cockchafer *Melolontha melolontha* has also started at other localities in the surroundings of Heidelberg and Mannheim (Rhein-Neckar-Zeitung 2010b, 2010c) around the full moon on 28.04.2010. The first longer period of warm and sunny weather with temperatures of up to 20 – 25 °C from 17.04.2010 to 29.04.2010 has been replaced by a period of cooler and changeable weather with repeated rainfalls (Rhein-Neckar-Zeitung 2010e, 2010f) which has started on 30.04.2010 and has been the beginning of an extended phase of the May cold (Ice Saints).

In 2010, the first individuals of the Golden Rose Chafer *Cetonia aurata* have appeared in Tairnbach, Nußloch and Walldorf around the new moon on 14.04.2010. The swarming of the Golden Rose Chafer *Cetonia aurata* with the flight of numerous individuals in bright sunlight during the day in Walldorf has started a few days before the full moon on 28.04.2010. I have excellent conditions of observation from my balcony which is directed towards the garden in the east of the building where several large violet-flowering lilac trees are in full sunshine from the early morning onwards. On 25.04.2010 which has been three days before the full moon on 28.04.2010, I have heard the characteristic buzzing of the flying individuals of the Golden Rose Chafer *Cetonia aurata* that have orbited the lilac trees for the first time in the current year, whereas on the other days since the beginning of the first longer period of warm and sunny weather with temperatures of up to 20 °C on 17.04.2010 which has started three days after the new moon on 14.04.2010, I have not detected the typical noise of the flying individuals, although I have sit on the balcony for several hours in every morning. The flight of various individuals of the Golden Rose Chafer *Cetonia aurata* around the lilac trees has continued until 29.04.2010 when the first longer period of warm and sunny weather with temperatures of up to 20 – 25 °C which has begun on 17.04.2010 has ended and has been succeeded by a period of cooler and changeable weather with repeated rainfalls (Rhein-Neckar-Zeitung 2010e) marking the onset of an extended phase of the May cold (Ice Saints), and has thus happened mainly in the period between a few days before and a few days after the full moon on 28.04.2010.

Arno Thomaes (person. commun. 2009) has observed the swarming of abundant individuals of the Field Cockchafer *Melolontha melolontha* in Kruibeke southwest of Antwerpen in the northwestern part of Belgium in the evening on 04.05.2009 which has happened a few days after the increasing half moon on 01.05.2009 between the new moon on 25.04.2009 and the full moon on 09.05.2009, or has happened five days before the full moon on 09.05.2009.

4.5 The Cockchafer *Melolontha* based on literature evaluation

Examples of excessive swarm phases of the Field Cockchafer *Melolontha melolontha* LINNAEUS 1758 (Coleoptera: Scarabaeidae) with mass flights of hundreds of thousands or even millions of individuals have been reported among others from Winkl, Pestenacker, Wabern, Walleshausen, Prittriching, Scheuring und Beuerbach north of Landsberg am Lech in the southeastern part of Germany on 04.05.1936 – 06.05.1936 (EITSCHBERGER 1970c) which has been on and a few days before the full moon on 06.05.1936; from Mundraching, Stadel, Issing and Thaining south of Landsberg am Lech on 28.05.1938 (EITSCHBERGER 1970c) which has been one day before the new moon on 29.05.1938; from Prittriching and Winkl north of Landsberg am Lech on 22.04.1960 (EITSCHBERGER 1970c) which has been four days before the new moon on 26.04.1960, from Plattling southsouthwest of Deggendorf in the Danube valley in the southeastern part of Germany on 19.05.1937 (MEISSNER 1938) which has been one day after the increasing half moon on 18.05.1937 between the new moon on 10.05.1937 and the full moon on 25.05.1937, from Burghausen in the Salzach valley in the southeastern part of Germany on 30.04.1932 (R. KRATZER in MEISSNER 1938) which has been five days before the new moon on 05.05.1932, from Heilbronn in the Neckar valley in the southwestern part of Germany in the days before 12.05.1884 (LEYDIG 1902) which has been around the full moon on 10.05.1884, from Frankfurt am Main in the central part of Germany at the beginning of May 1937 (A. HEPP in MEISSNER 1938) which has been around the new moon on 10.05.1937, from Bad Nauheim north of Frankfurt am Main in the central part of Germany on 31.05.1937 (A. HEPP in MEISSNER 1938) which has been three days before the decreasing half moon on 03.06.1937 between the full moon on 25.05.1937 and the new moon on 08.06.1937, from Bergheim west of Cologne in the northwestern part of Germany at the beginning of May 1845 (STOLLWERCK 1846) which has been around the new moon on 06.05.1845, from Halle in the Saale valley in the northeastern part of Germany at the beginning of May 1933 (MEISSNER 1938) and on 12.05.1937 (FRANZ BANDERMANN in MEISSNER 1938) which has been around the full moon on 09.05.1933 and two days after the new moon on 10.05.1937, respectively; from Talmontiers at the road between Gournay-en-Bray and Gisors northnorthwest of Paris in the northwestern part of France on 18.05.1832 (LEFEBVRE 1832, LEFEBVRE in HAGEN 1861, KEFERSTEIN 1863) which has been four days after the full moon on 14.05.1832, and from Le Havre northwest of Paris in the northwestern part of France on 08.07.1862 (POORTMANN 1862, KEFERSTEIN 1863) which has been three days before the full moon on 11.07.1862.

Examples of excessive swarm phases of the Forest Cockchafer *Melolontha hippocastani* FABRICIUS 1801 (Coleoptera: Scarabaeidae) with mass flights of hundreds of thousands or even millions of individuals have been reported among others from Kaufering and Lagerlechfeld north of Landsberg am Lech at the beginning of May 1968 (EITSCHBERGER 1970c) which has been around and between the new moon on 27.04.1968 and the full moon on 12.05.1968, and from Burghausen in the Salzach valley in the southeastern part of Germany on 30.04.1932 (R. KRATZER in MEISSNER 1938) which has been five days before the new moon on 05.05.1932.

Examples of extraordinary swarm years of the Field Cockchafer *Melolontha melolontha* and the Forest Cockchafer *Melolontha hippocastani* with mass flights of hundreds of thousands or even millions of individuals have been compiled among others by FREUNTHALLER (1882), SCHUSTER (1906) and SCHMIDT (1925).

4.6 The Tanner Sawyer Beetle *Prionus coriarius*

During course of my monitoring of the appearance of the Stag Beetle *Lucanus cervus* at the locality Tairnbach in 2008, I have observed the first single individuals of the Tanner Sawyer Beetle *Prionus coriarius* (LINNAEUS 1758) (Coleoptera: Cerambycidae) two days after the increasing half moon on

10.07.2008 between the new moon on 03.07.2008 and the full moon on 18.07.2008, and the peak numbers of up to 4 individuals per day have been reached in the period from one day before the full moon on 18.07.2008 to two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, whereas later until two days after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, again only single individuals have shown up. A pronounced swarming of the Tanner Sawyer Beetle *Prionus coriarius* has not been established at the locality Tairnbach in 2008. The individuals of the Tanner Sawyer Beetle *Prionus coriarius* have flown along and around the trees at the margin of the forest and have walked along and across the way at the margin of the forest. The flight pattern of the Tanner Sawyer Beetle *Prionus coriarius* resembles thus the flight pattern of the Stag beetle *Lucanus cervus* and the Field Cockchafer *Melolontha melolontha,* and is different from that of the Golden Rose Chafer *Cetonia aurata* and the Summer Chafer *Amphimallon solstitiale* which fly often several circular, elliptical or spiral orbits around specific trees.

The swarming of the Tanner Sawyer Beetle *Prionus coriarius* has been observed by MICHAEL JOSEPHY (person. commun. 2008) at the Dachsbuckel at the southern margin of the district Emmertsgrund at the southern margin of the city of Heidelberg in 2006 when on several successive evenings, numerous individuals have flown along and around the trees at the margin of the forest, whereas before and after the few consecutive swarm evenings, only a few single individuals have appeared.

4.7 The Summer Chafer *Amphimallon solstitiale*

During course of my monitoring of the appearance of the Stag Beetle *Lucanus cervus* at the locality Tairnbach in 2009, I have recorded a pronounced swarming of the Summer Chafer *Amphimallon solstitiale* (LINNAEUS 1758) (Coleoptera: Scarabaeidae) during the crepuscular period in the evening from abt. 21.15 hrs to abt. 21.45 hrs Middle European summer time around the full moon on 07.07.2009 when numerous individuals have flown around and along some trees at the margin of the forest. The individuals of the Summer Chafer *Amphimallon solstitiale* have predominantly swarmed around one particular single tree at the beginning of the margin of the forest at the southern boundary of Tairnbach which stands near the creek crossing the meadows still outside of the interval where the individuals of the Stag Beetle *Lucanus cervus* have flown at the margin of the forest. Only on and after but not before the full moon on 07.07.2009, the individuals of the Summer Chafer *Amphimallon solstitiale* have also swarmed along the same interval at the margin of the forest where the Stag Beetle *Lucanus cervus* has flown, whereas in contrast the Stag Beetle *Lucanus cervus* has not swarmed around the particular single tree close to the creek which has been orbited by the individuals of the Summer Chafer *Amphimallon solstitiale.*

The individuals of the Summer Chafer *Amphimallon solstitiale* have often flown several circular, elliptical or spiral orbits around the isolated tree at the creek, whereas the individuals of the Stag Beetle *Lucanus cervus* have mainly flown along and around the trees at the margin of the forest without single or multiple revolutions around specific trees. The flight pattern of the Summer Chafer *Amphimallon solstitiale* resembles thus the flight pattern of the Golden Rose Chafer *Cetonia aurata,* and is different from that of the Stag beetle *Lucanus cervus,* the Tanner Sawyer Beetle *Prionus coriarius* and the Field Cockchafer *Melolontha melolontha.*

ARNO THOMAES (person. commun. 2009) has observed the swarming of thousands of individuals of the Summer Chafer *Amphimallon solstitiale* in Vivoin north of Le Mans westsouthwest of Paris in the northwestern part of France in the evening on 27.06.2006 or 29.06.2006, and in the evening on the next day, he has noticed that the frequency of individuals has been significantly less, but still

hundreds of individuals have flown around. ARNO THOMAES (person. commun. 2009) has also seen more than hundred individuals of the dune chafer *Anomala dubia* in Fontainebleau south of Paris in the northwestern part of France during the day on 26.06.2006 which have flown around in the sun, with the individuals having repeatedly taken off from the ground when the sun has been shining between isolated clouds and having landed again on the ground when a cloud has moved before the sun and has hidden it. The swarming of thousands of individuals of the Summer Chafer *Amphimallon solstitiale* in the evening on 27.06.2006 or 29.06.2006 in Vivoin (ARNO THOMAES, person. commun. 2009) and the swarming of more than hundred individuals of the dune chafer *Anomala dubia* in Fontainebleau during the day on 26.06.2006 (ARNO THOMAES, person. commun. 2009) have happened one and a few days after the new moon on 25.06.2006, respectively.

4.8 The Forest Dung Beetle *Geotrupes stercorosus*

Some single individuals of the vernal generation of the Forest Dung Beetle *Geotrupes stercorosus* (SCRIBA 1791) (Coleoptera: Scarabaeidae) have occasionally crawled on the ways in the forests around Walldorf since abt. mid of May 2009, whereas two days after the new moon on 24.05.2009, suddenly numerous individuals have occurred and only a few days later, the number of individuals has already again significantly declined, although still quite some individuals have been observed on the ways in the forests around Walldorf and also on the way at the margin of the forest in Tairnbach.

Some single individuals of the aestival generation of the Forest Dung Beetle *Geotrupes stercorosus* have occasionally crawled on the way at the margin of the forest in Tairnbach since the beginning to mid of August 2009, whereas on the increasing half moon on 27.08.2009, suddenly numerous individuals have occurred and only a few days later, the number of individuals has already again significantly declined, although still quite some individuals have been observed on the way at the margin of the forest in Tairnbach and also on the ways in the forests around Walldorf.

4.9 The Rhinoceros Beetle *Oryctes nasicornis*

The swarming of the Rhinoceros Beetle *Oryctes nasicornis* (LINNAEUS 1758) (Coleoptera: Scarabaeidae) has been observed by HANSJÖRG GÖTZ (person. commun. 2008) in Adelsheim (abt. 51 km east of Heidelberg) in the period from the end of May to the beginning of June 2007 when on several successive evenings, abt. 10 – 20 individuals per day have flown around the house and particularly around its roof, whereas before and after the abt. three consecutive swarm evenings, only a few single individuals have appeared. The breakout of the swarming of the abundant individuals of the Rhinoceros Beetle *Oryctes nasicornis* which has been restricted to several successive evenings has probably been related to the full moon on 01.06.2007.

During my entomological observations in the surroundings of Heidelberg, I have found a dead male of the Rhinoceros Beetle *Oryctes nasicornis* with a short horn at the margin of a street in Walldorf on 22.05.2009, and before that, I have only found a dead male with a long horn in Walldorf in 1972.

4.10 The Seven-Spot Ladybird *Coccinella septempunctata*

A spectacular mass occurrence of the Seven-Spot Ladybird *Coccinella septempunctata* LINNAEUS 1758 (Coleoptera: Coccinellidae) has been reported from the beach of Warnemünde north of

Rostock at the coast of the Baltic Sea in the northeastern part of Germany by articles and photographs in a regional newspaper which have appeared one day after the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009 (RATHKE 2009). Because the process of reporting and publishing in the newspaper has probably taken one or only a few days, it is possible that the breakout of the abundance of the Seven-Spot Ladybird *Coccinella septempunctata* has been related either to the new moon on 22.07.2009 or to the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009. Mass occurrences of the Seven-Spot Ladybird *Coccinella septempunctata* are common phenomena in the summer of many years at the coasts of the Baltic Sea in the northeastern part of Germany and the North Sea in the northwestern part of Germany where the beetles are often concentrated in spill seams on the beaches (among others FRAENKEL 1932, EICHLER 1971, DUNK 1989; KLAUSNITZER 1989, 1992; compilation of further literature references in MADER 1995 and KLAUSNITZER & KLAUSNITZER 1997).

Mass occurrences of the Seven-Spot Ladybird *Coccinella septempunctata* at the coast of the North Sea have also been observed at the beach near Sankt Peter-Ording southwest of Husum in the northwestern part of Germany on 07.08.1967 (HARZ 1967b) which has been one day after the new moon on 06.08.1967; on the island Föhr northwest of Husum in the northwestern part of Germany in the period of 25.07.1971 – 20.08.1971 (M. PETERSEN-HEILANDT in HARZ 1972) which has been around and between the new moon on 22.07.1971, the full moon on 06.08.1971 and the new moon on 21.08.1971; at the beach of the island Pagensand in the Elbe river westnorthwest of Hamburg close to its mouth into the North Sea in the northwestern part of Germany on 08.08.1997 (ALLMER 2000) which has been five days after the new moon on 03.08.1997; in Kiel at the coast of the Baltic Sea in the northwestern part of Germany on 21.07.1989, in Kalundborg west of Copenhagen in the eastern part of Denmark on 22.07.1989 – 23.07.1989, and near the island Borkum northnorthwest of Emden in the northwestern part of Germany on 25.07.1989 (PAUKSTADT 1989) which has been several days after the full moon on 18.07.1989 as well as a few days before the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, respectively; at the beach at the western margin of the island Sylt westnorthwest of Flensburg in the northwestern part of Germany on 09.08.1975 (MEINEKE 1976) which has been two days after the new moon on 07.08.1975; near Dover southeast of London in the southeastern part of England on 12.08.1847 – 13.08.1847 (WESTWOOD 1847) which has been two and three days after the new moon on 10.08.1847, or on 12.08.1839 – 13.08.1839 (HAGEN 1861) which has been three and four days after the new moon on 09.08.1839, respectively; near Saint Mary´s Bay westsouthwest of Folkestone southeast of London in the southeastern part of England where hundreds of individuals have flown on 25.09.1949 (BURTON 1950) which has been three days after the new moon on 22.09.1949; and at the beach of Colwyn Bay west of Liverpool at the coast of the Irish Sea in the northern part of Wales on 19.07.1976 (K. KÜRSCHNER in EITSCHBERGER & STEINIGER 1977b) which has been on the decreasing half moon on 19.07.1976 between the full moon on 11.07.1976 and the new moon on 27.07.1976.

Mass occurrences of the Seven-Spot Ladybird *Coccinella septempunctata* at the coast of the Baltic Sea have also been noticed at the beach at the western margin of the Darß between Ahrenshoop and Darßer Ort north of Ribnitz-Damgarten in the northeastern part of Germany on 28.07.1961 (SPITTLER 1963) and more or less at the same time also in the city of Schwerin (KLAUS GRASER in SPITTLER 1963) which has been one day after the full moon on 27.07.1961; at the beach at the western margin of the Darß between Drei Eichen and the lighthouse north of Ribnitz-Damgarten in the northeastern part of Germany on 09.07.1989 – 10.07.1989 and 22.07.1989 – 26.07.1989 (KLAUSNITZER 1989, KLAUSNITZER & KLAUSNITZER 1997) as well as on 13.07.1992 (KLAUSNITZER 1992, KLAUSNITZER & KLAUSNITZER 1997) which has been several days before the increasing half moon on 12.07.1989 between the new moon on 03.07.1989 and the full moon on 18.07.1989, a few days before and on the

decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, and one day before the full moon on 14.07.1992, respectively; at the beach at the western margin of the Fischland between Wustrow and Dierhagen northwest of Ribnitz-Damgarten in the northeastern part of Germany on 26.07.1989 (G. MORITZ in KLAUSNITZER 1989) which has been on the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, in Rerik west of Rostock in the northeastern part of Germany on 22.07.1989 – 26.07.1989 (HÜSING 1990) which has been around and between the full moon on 18.07.1989 and the new moon on 01.08.1989, and at the beach near and within Lubmin eastnortheast of Greifswald as well as within and around Greifswald in the northeastern part of Germany on 01.08.2005 – 02.08.2005 (EITSCHBERGER 2005) which has been three and four days before the new moon on 05.08.2005,

Mass occurrences of the Seven-Spot Ladybird *Coccinella septempunctata* have also been registered in the Randecker Maar south of Weilheim an der Teck southeast of Stuttgart in the southwestern part of Germany on 06.08.1972 (GATTER & GATTER 1973) which has been three days before the new moon on 09.08.1972, and at the Museum of Natural History in the city of Vienna in the eastern part of Austria on 04.07.1968 (HARZ 1968b) which has been on the increasing half moon on 04.07.1968 between the new moon on 26.06.1968 and the full moon on 10.07.1968.

4.11 The Golden Ground Beetle *Carabus auratus*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have repeatedly seen individuals of the Golden Ground Beetle *Carabus auratus* LINNAEUS 1761 (Coleoptera: Carabidae) in different quantities at various places, and I have also recognized peak occurrences in the vicinity of Walldorf in 2007 and 2008 when numerous individuals have been running along and across the ways in the fields and in the forests. I have, however, not recorded the sudden breakout of large quantities of individuals of the Golden Ground Beetle *Carabus auratus* in 2007 and 2008 which would permit the selenocyclical interpretation of the appearance of the abundance of the beetles.

In 2010, single individuals of the Golden Ground Beetle *Carabus auratus* have appeared on the ways in the fields and in the forests at the localities Walldorf, Nußloch and Tairnbach already after the new moon on 14.04.2010, whereas a few days after the full moon on 28.04.2010, I have suddenly recorded the occurrence of quite some individuals on the ways in the fields around Walldorf.

A mass occurrence of large quantities of individuals of the Golden Ground Beetle *Carabus auratus* has also been observed along the road between Falkenrehde and Grube northnorthwest of Potsdam in the northeastern part of Germany where abt. 100 individuals have been encountered during an excursion at the end of May 1930 (AUEL 1930) which has been around the new moon on 28.05.1930.

4.12 The Rove Beetle *Philonthus cognatus*

A mass occurrence of large quantities of individuals of the Rove Beetle *Philonthus cognatus* STEPHENS 1832 (Coleoptera: Staphylinidae) has been reported from the St. Bride´s Bay north of Martin´s Haven northnorthwest of Pembroke westnorthwest of Swansea in the southwestern part of England where masses of individuals have flown on 11.09.1959 (SAGE 1960) which has been one day after the increasing half moon on 10.09.1959 between the new moon on 03.09.1959 and the full moon on 17.09.1959.

4.13 The Flea Beetle *Psylliodes affinis*

A mass occurrence of large quantities of individuals of the Flea Beetle *Psylliodes affinis* (PAYKULL 1799) (Coleoptera: Chrysomelidae) has been mentioned from the Fuchsenholz near Goggendorf northwest of Hollabrunn northwest of Vienna in the eastern part of Austria where masses of individuals have occupied the trees in August 1898 (BLÜMML 1899) which has been around and between the full moon on 02.08.1898, the new moon on 17.08.1898 and the full moon on 31.08.1898.

5 Relationships of swarm phases, mass flights and peak occurrences of diurnal butterflies with the new moon and full moon phases of the lunar cycle

In addition to the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* and other beetles with the new moon and full moon phases, also the correlations of mass flights and peak occurrences of diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the turning points of the lunar cycle are outlined as follows. The observations and analysis of the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species with the new moon and full moon phases of the lunar cycle are the base for the selenocyclical evaluation of the short-term population dynamics of the treated diurnal and crepuscular insects. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

5.1 The Orange Tip *Anthocharis cardamines* based on own observations

The Orange Tip *Anthocharis cardamines* LINNAEUS 1758 (Lepidoptera: Pieridae) is one of the first butterflies which appear in early spring with a newly developed vernal generation of individuals that have freshly emerged from the pupae in the first period of dry and warm weather with temperatures of up to 20 – 25 °C in the current year, whereas many other butterflies showing up in early spring represent in fact the automnal generation of the preceding year, with the adults having hibernated after having already emerged from the pupae in the autumn of the previous year. The appearance of the Orange Tip *Anthocharis cardamines* represents therefore an excellent indicator of the entomological beginning of spring with emergence of new generations of imaginal stages of insects from the pupae in the current year. During my occasional entomological observations between 1964 and 2006 as well as during my regular entomological observations in 2007, 2008 and 2009, I have always been particularly attracted by the appearance of the Orange Tip *Anthocharis cardamines* in early spring. The flight of the male of the Orange Tip *Anthocharis cardamines* is especially fascinating due to the pronounced orange shining of its fore wings in bright sunlight which makes it easily recognizable among various white butterflies flying across meadows or along forest margins even over larger distances. During my regular observations of the butterflies at the localities Nußloch and Tairnbach in 2007 and 2008, I have noted that numerous males of the Orange Tip *Anthocharis cardamines* have appeared in the periods of a few days before and after the new moon on 17.04.2007 and 05.05.2008, respectively, when the first periods of dry and warm weather with temperatures of up to 20 – 25 °C have been established in the corresponding years, whereas only some single males have shown up earlier and the number of males has started to decline again abt. one week to ten days later. The appearance of the peak numbers of the Orange Tip *Anthocharis cardamines* in Nuß-

loch and Tairnbach around the new moon on 05.05.2008 has taken place at the beginning of the first period of summerly warm and sunny weather from 02.05.2008 to 14.05.2008 which has started before the new moon on 05.05.2008 and has ended before the full moon on 20.05.2008.

In 2009, the first period of dry and warm weather with temperatures of up to 20 – 25 °C has started already on 02.04.2009 and has ended on 15.04.2009, with this period of dry and warm weather having finished and succeeded the winter. One day after the full moon on 09.04.2009, I have observed only 1 male of the Orange Tip *Anthocharis cardamines* in Nußloch and none in Tairnbach, whereas two days after the full moon, I have registered 5 males in Nußloch and 1 male in Tairnbach; three days after the full moon, I have encountered 4 males in Nußloch and 5 males in Tairnbach; four days after the full moon, I have noted 7 males in Nußloch and 4 males in Tairnbach; five days after the full moon, I have seen 5 males in Nußloch and 2 males in Tairnbach; and six days after the full moon, I have met 5 males in Nußloch and 3 males in Tairnbach; with this succession highlighting the breakout of an increasing number of males of the Orange Tip *Anthocharis cardamines* shortly after the full moon that reaches already more or less stagnation within a few days. On the seventh day after the full moon on 09.04.2009, the period of dry and warm weather has been terminated and replaced by a phase of wet and cool weather with a rapid drop in temperature to 10 – 12 °C which has lasted for several days. The appearance of the peak numbers of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the full moon on 09.04.2009 has thus taken place within the first period of summerly warm and sunny weather from 02.04.2009 to 15.04.2009 which has started on the increasing half moon on 02.04.2009 between the new moon on 26.03.2009 and the full moon on 09.04.2009, and has ended before the decreasing half moon on 17.04.2009 between the full moon on 09.04.2009 and the new moon on 25.04.2009.

The second culmination of the occurrence of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach in 2009 has happened around the new moon on 25.04.2009 with the sudden appearance of 8 males each in Nußloch and Tairnbach one day after the new moon in contrast to the presence of only 2 – 5 males per day at each locality in the days before. The second appearance of the peak numbers of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the new moon on 25.04.2009 has been developed in the second period of dry and warm weather with temperatures of up to 20 – 25 °C from 19.04.2009 to 26.04.2009 that has started after the decreasing half moon on 17.04.2009 and has ended after the new moon on 25.04.2009. The activity of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach has then persisted for another complete lunar cycle with the occurrence of 2 – 5 males per day at each locality, and has faded out around the new moon on 24.05.2009, with the last males having been observed a few days after the latter turning point of the lunar cycle and no more males having been discovered around the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009. Since the peak of abundance on 26.04.2009, more than 5 males of the Orange Tip *Anthocharis cardamines* per day and locality have only been still registered on 01.05.2009 when 8 males have flown in Nußloch, and on 03.05.2009 when 6 males have appeared in Nußloch. The period of activity of the Orange Tip *Anthocharis cardamines* at the margin of the forest in Nußloch and Tairnbach in 2009 has thus extended more or less from the full moon on 09.04.2009 to the new moon on 24.05.2009.

In 2010, no males of the Orange Tip *Anthocharis cardamines* have flown in Nußloch several days before the new moon on 14.04.2010, whereas a few days after the new moon on 14.04.2010, suddenly 7 males have flown in Nußloch and 3 males have flown in Tairnbach on 17.04.2010, 6 males have flown in Nußloch and 6 males have flown in Tairnbach on 18.04.2010, 6 males have flown in Nußloch and 4 males have flown in Tairnbach on 19.04.2010, and 6 males have flown in Nußloch and 2 males have flown in Tairnbach on 20.04.2010, thereby confirming the breakout of the new generation around the new moon on 14.04.2010. On the following days, 5 males have flown in

Nußloch on 22.04.2010, 8 males have flown in Nußloch and 3 males have flown in Tairnbach on 23.04.2010, 6 males have flown in Nußloch and 6 males have flown in Tairnbach on 24.04.2010, 7 males have flown in Nußloch and 6 males have flown in Tairnbach on 25.04.2010, 3 males have flown in Nußloch on 26.04.2010, 4 males have flown in Nußloch on 27.04.2010, 7 males have flown in Nußloch and 5 males have flown in Tairnbach on 28.04.2010, and 5 males have flown in Nußloch on 29.04.2010. The appearance of the peak numbers of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the new moon on 14.04.2010 has taken place within the first longer period of warm and sunny weather with temperatures of up to 20 – 25 °C from 17.04.2010 to 29.04.2010 which has started three days after the new moon on 14.04.2010 and has ended one day after the full moon on 28.04.2010, whereas during the earlier shorter phase of warm and sunny weather with temperatures of up to 20 °C from 06.04.2010 to 10.04.2010 that has included the first days of fine spring after the winter and has been terminated four days before the new moon on 14.04.2010, no males have shown up in Nußloch. The first longer period of warm and sunny weather with temperatures of up to 20 – 25 °C from 17.04.2010 to 29.04.2010 has been replaced by a period of cooler and changeable weather with repeated rainfalls (Rhein-Neckar-Zeitung 2010e, 2010f) which has started on 30.04.2010 and has been the beginning of an extended phase of the May cold (Ice Saints) including snowfall in the mountains of the Black Forest.

5.2 The Orange Tip *Anthocharis cardamines* based on literature evaluation

Mass occurrences of large quantities of individuals of the Orange Tip *Anthocharis cardamines* Linnaeus 1758 (Lepidoptera: Pieridae) have been registered in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abundant individuals have flown on 11.05.2008 (Hanisch 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 25 individuals have flown on 19.05.1990 (Kinkler & Hürter 1992) which has been five days before the new moon on 24.05.1990, near Remagen in the Middle Rhine valley southsoutheast of Bonn in the western part of Germany where abt. 5 individuals have flown on 06.05.2008 (Heinz Stetzuhn in Bosselmann 2009) which has been one day after the new moon on 05.05.2008, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 15 individuals have flown on 11.04.1991 (Hans Kwiatkowski in Hasselbach 1992) which has been three days before the new moon on 14.04.1991, around Loreley and Bornich southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 10 individuals each have flown on 14.06.1980 – 15.06.1980 (Nippel 1980) which has been two and three days after the new moon on 12.06.1980; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 15 individuals and 30 individuals have flown on 12.05.1992 and 30.04.1994, respectively (Broszkus 1995), which has been four days before the full moon on 16.05.1992 and five days after the full moon on 25.04.1994, respectively; near Nahbollenbach in the Nahe valley eastnortheast of Idar-Oberstein in the southwestern part of Germany where 10 individuals have flown on 05.05.1993 (Broszkus 1995) which has been one day before the full moon on 06.05.1993; and near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 30 individuals and 50 individuals have flown on 09.04.1993, 09.05.1993 and 24.04.1994, respectively (S. Jouaux in Broszkus 1995), which has been three days after the full moon on 06.04.1993, three days after the full moon on 06.05.1993, and one day before the full moon on 25.04.1994, respectively; and near Penzance west of Plymouth in the southwestern part of England where numerous individuals have flown in the period of 16.05.1933 – 26.05.1933 (Adkin 1933) which has been around and between the decreasing half moon on 17.05.1933 between the full moon on 10.05.1933 and the new moon on

24.05.1933 as well as the new moon on 24.05.1933.

5.3 The Black-Veined White *Aporia crataegi,* the Queen of Spain Fritillary *Issoria lathonia* and the Black Hairstreak *Strymonidia pruni* based on own observations

In 2008, numerous individuals of the Black-Veined White *Aporia crataegi* LINNAEUS 1758 (Lepidoptera: Pieridae), the Queen of Spain Fritillary *Issoria lathonia* LINNAEUS 1758 (Lepidoptera: Nymphalidae) and the Black Hairstreak *Strymonidia pruni* LINNAEUS 1758 (Lepidoptera: Lycaenidae) have appeared almost suddenly at the locality Rot in the period of a few days before and after the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008, whereas only some single individuals have shown up earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Black-Veined White *Aporia crataegi,* the Queen of Spain Fritillary *Issoria lathonia* and the Black Hairstreak *Strymonidia pruni* in Rot around the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008 has taken place within the second period of summerly warm and sunny weather from 19.05.2008 to 12.06.2008 which has started before the full moon on 20.05.2008 and has ended before the full moon on 18.06.2008.

In 2009, the Black-Veined White *Aporia crataegi* has suddenly appeared on the new moon on 24.05.2009 when several individuals have shown up at the localities Tairnbach and Walldorf, whereas no individuals have been noted earlier at these places, and abt. one week to ten days later, the number of individuals has again started to decline.

5.4 The Black Hairstreak *Strymonidia pruni* based on literature evaluation

Mass occurrences of large quantities of individuals of the Black Hairstreak *Strymonidia pruni* LINNAEUS 1758 (Lepidoptera: Lycaenidae) have been reported from the Diemel valley near Liebenau eastsoutheast of Warburg southsoutheast of Paderborn in the northwestern part of Germany where abt. 40 individuals have flown on 14.06.1971 (RETZLAFF 1973, ROBRECHT in RETZLAFF 1973) which has been three days before the decreasing half moon on 17.06.1971 between the full moon on 08.06.1971 and the new moon on 23.06.1971; from Stommelerbusch near Pulheim northwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 15 individuals and abt. 5 individuals each have flown on 11.06.2006 (KARL-HEINZ JELINEK in SCHUMACHER 2007a) as well as on 01.06.2000, 05.06.2001 and 31.05.2003 (JELINEK 2006), respectively, which has been on the full moon on 11.06.2006, one day before the new moon on 02.06.2000, one day before the full moon on 06.06.2001 and on the new moon on 31.05.2003, respectively; from Hennef-Stadt Blankenberg eastnortheast of Bonn in the northwestern part of Germany where 25 individuals have flown on 18.06.1978 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992) which has been one day before the full moon on 19.06.1989; from Bröleck west of Ruppichteroth and Millerscheid westnorthwest of Ruppichteroth eastnortheast of Siegburg in the northwestern part of Germany where abt. 5 individuals and 15 individuals have flown on 18.06.1989 and 25.06.1989, respectively (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992), which has been one day before the full moon on 19.06.1989, and two days before the decreasing half moon on 27.06.1989 between the full moon on 19.06.1989 and the new moon on 03.07.1989, respectively; from Alchen west of Siegen in the northwestern part of Germany where abt. 10 – 15 individuals have flown on 17.06.1989 (CHRISTIAN ANTON in FIEBER 1991a) which has been two days before the full moon on 19.06.1989; from the Naafbach valley near Neunkirchen south of Siegen in the northwestern part of Germany where abt. 15 individuals have flown on 05.06.2008 and 08.06.2008 (RALPH SCHÖPWINKEL in SCHUMACHER 2009) which has been two and five days after the new moon on 03.06.2008, respectively; from Loreley and Bornich southeast of

Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 30 individuals each have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980, from Kaub northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where 30 individuals have flown on 25.06.1995 (HANS-ARNOLD HÜRTER in KINKLER 1996) which has been two days before the new moon on 27.06.1995; from unspecified localities in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 10 individuals each have flown on 29.05.1993 and 31.05.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been on and two days after the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively; and from the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 20 individuals have flown on 28.06.1995 (HASSELBACH 1996) which has been one day after the new moon on 27.06.1995.

5.5 The Blue-Spot Hairstreak *Strymonidia spini* and the White-Letter Hairstreak *Strymonidia w-album*

Significant quantities of individuals of the Blue-Spot Hairstreak *Strymonidia spini* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Lycaenidae) have been mentioned from the Diemel valley near Liebenau eastsoutheast of Warburg southsoutheast of Paderborn in the northwestern part of Germany where abt. 10 individuals have flown on 10.07.1971 (RETZLAFF 1973) which has been three days after the full moon on 08.07.1971, from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals have flown on 28.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been two days after the full moon on 26.07.1991, from Dörscheid and Kaub in the Middle Rhine valley northnorthwest of Bingen in the western part of Germany where 15 individuals have flown on 10.07.1991 (HÜCKER in KINKLER 1992) which has been one day before the new moon on 11.07.1991, and from Klotten in the Moselle valley northeast of Cochem in the western part of Germany where 5 individuals have flown on 10.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been one day before the full moon on 11.07.2006.

Significant quantities of individuals of the White-Letter Hairstreak *Strymonidia w-album* (KNOCH 1782) (Lepidoptera: Lycaenidae) have been encountered near Herten north of Gelsenkirchen in the northwestern part of Germany where 5 individuals have flown on 04.07.2008 (M. DERRA in SCHUMACHER 2009) which has been one day after the new moon on 03.07.2008, near Eller at the southeastern margin of the city of Düsseldorf in the northwestern part of Germany where 5 individuals have flown on 08.07.1953 (KARL OERTEL & KLAUS SCHILINGER in KINKLER, SCHMITZ & NIPPEL 1971) which has been one day after the full moon on 07.07.1953, and near the Cloef southeast of Orscholz westnorthwest of Mettlach in the Saar valley in the northern part of the Saar area in the western part of Germany where abt. 30 individuals have flown on 25.07.1972 (D. MEYER in SCHMIDT-KOEHL 1977) which has been one day before the full moon on 26.07.1972.

5.6 The Queen of Spain Fritillary *Issoria lathonia* based on literature evaluation

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* LINNAEUS 1758 (Lepidoptera: Nymphalidae) in the northwestern part of Germany have been reported from the island Borkum northnorthwest of Emden at the coast of the North Sea where abt. 20 individuals and more than 50 individuals have been monitored on 05.05.1994 (HENSLE 2001d) and in May 1995 (HENSLE 2001e), respectively, which has been five days before the full moon on 10.05.1994 as well as around and between the new moon on 29.04.1995, the full moon on

14.05.1995 and the new moon on 29.05.1995, respectively; from the island Baltrum northeast of Norden at the coast of the North Sea where abt. 15 individuals have been observed on 19.08.2006 (HENSLE 2007a) which has been four days before the new moon on 23.08.2006, from Lüchow north of Salzwedel south of the Elbe valley where abt. 90 individuals have been registered in the period of 22.07.1982 – 15.08.1982 (STEINIGER & EITSCHBERGER 1985) which has been around and between the new moon on 20.07.1982, the full moon on 04.08.1982 and the new moon on 19.08.1982; from Küsten west of Lüchow north of Salzwedel south of the Elbe valley where more than 10 individuals have flown on 25.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been five days before the full moon on 30.08.1985, from Liebenau eastnortheast of Warburg and Trendelburg south of Bad Karlshafen where 25 individuals have flown on 22.08.1992 (HINZ in KINKLER 1993) which has been on the decreasing half moon on 22.08.1992 between the full moon on 13.08.1992 and the new moon on 28.08.1992; from Oberelsbach northnorthwest of Bad Neustadt an der Saale where 20 individuals and 30 individuals have flown on 11.07.2005 (HENSLE 2006a) and 03.07.2006 (HENSLE 2007a), respectively, which has been five days after the new moon on 06.07.2005 as well as on the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, respectively; from Breinigerberg northeast of Breinig southeast of Aachen where 15 individuals have flown on 18.09.2005 (HENSLE 2006a) which has been on the full moon on 18.09.2005, and from Insenborn westsouthwest of Esch-sur-Sûre northwest of Ettelbrück in the northern part of Luxembourg where abt. 15 individuals have flown on 13.07.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been two days before the increasing half moon on 15.07.1967 between the new moon on 07.07.1967 and the full moon on 21.07.1967.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in the western part of Germany have been mentioned from Simmerath northnortheast of Monschau in the northwestern part of the Eifel where 40 individuals have flown in the period of 16.06.1972 – 05.07.1972 (STEINIGER 1973a) which has been around and between the increasing half moon on 19.06.1972 between the new moon on 11.06.1972 and the full moon on 26.06.1972 as well as the decreasing half moon on 05.07.1972 between the full moon on 26.06.1972 and the new moon on 10.07.1972, from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 10 individuals have flown on 13.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007b) which has been two days after the full moon on 11.07.2006, from Rengen north of Daun in the northwestern part of the Eifel where 10 individuals have flown on 06.09.2004 – 07.09.2004 (U. FLESCH in SCHUMACHER 2005b) which has been on and one day after the decreasing half moon on 06.09.2004 between the full moon on 30.08.2004 and the new moon on 14.09.2004; from Überherrn west of Saarbrücken where 5 individuals and 10 individuals have flown on 28.04.2007 (HENSLE 2008a) and 11.05.2008 (HENSLE 2009a), respectively, which has been four days before the full moon on 02.04.2007 as well as one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008, respectively; from Sankt Wendel north of Saarbrücken where 20 individuals have flown on 15.10.2007 (A. CASPARI in HENSLE 2008a) which has been four days after the new moon on 11.10.2007, from Hahn west of Kirchberg in the northeastern part of the Hunsrück where abt. 10 individuals have flown on 19.08.2003 (J. BEGER in SCHUMACHER 2004b) which has been one day before the decreasing half moon on 20.08.2003 between the full moon on 12.08.2003 and the new moon on 27.08.2003, from Montabaur in the southwestern part of the Westerwald northeast of Koblenz where more than 150 individuals and abt. 50 individuals have flown on 25.09.2005 and 10.10.2005, respectively (R. WENDT in HENSLE 2006a), which has been on the decreasing half moon on 25.09.2005 between the full moon on 18.09.2005 and the new moon on 03.10.2005 as well as on the increasing half moon on 10.10.2005 between the new moon on 03.10.2005 and the full moon on 17.10.2005, respectively; from Kaub in the Middle Rhine valley northnorthwest of Bingen where abt. 40 individuals in total have flown on 17.06.2002 and 16.08.2002 (HENSLE 2003) which has been one day before the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, and one day after the in-

creasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, respectively; and from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 5 individuals, more than 10 individuals, abt. 30 individuals and abt. 10 individuals have flown on 17.08.1991 (HANS KWIATKOWSKI in HASSELBACH 1992), 06.08.1992, 19.08.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993) and 29.05.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994), respectively, which has been one day before the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991, on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, three days before the decreasing half moon on 22.08.1992 between the full moon on 13.08.1992 and the new moon on 28.08.1992, and on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in the southwestern part of Germany have been notified from the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 10 individuals each have flown on 21.10.1990 (HASSELBACH 1991) and 24.09.1994 (HASSELBACH 1995a) which has been three days after the new moon on 18.10.1990 and five days after the full moon on 19.09.1994, respectively; from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach where abt. 5 individuals have flown on 16.07.1992 (BROSZKUS 1995) which has been two days after the full moon on 14.07.1992, from Daubach west of Bad Kreuznach where 60 individuals have flown on 03.08.2006 (R. WENDT in HENSLE 2007a) which has been one day after the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 15 individuals have flown on 07.09.1989 (HANS-ARNOLD HÜRTER in KINKLER 1989c) which has been two days before the increasing half moon on 09.09.1989 between the new moon on 31.08.1989 and the full moon on 15.09.1989, from Altenbach eastnortheast of Schriesheim in the western part of the Odenwald northnortheast of Heidelberg where numerous individuals have flown on 20.08.1972 – 25.08.1972 (STEINIGER 1973a) which has been around the full moon on 24.08.1972, from Waghäusel-Kirrlach northnortheast of Karlsruhe in the middle part of the Upper Rhine valley where 25 individuals have flown on 18.08.2008 (HENSLE 2009a) which has been two days after the full moon on 16.08.2008, from Flehingen eastsoutheast of Bruchsal where 130 individuals in total have flown on 12.09.1999 – 16.09.1999 (HENSLE 2001k) which has been around and between the new moon on 10.09.1999 as well as the increasing half moon on 18.09.1999 between the new moon on 10.09.1999 and the full moon on 25.09.1999, from Steinenbronn south of Stuttgart where 10 individuals have flown on 08.09.2008 (HENSLE 2009a) which has been one day after the increasing half moon on 07.09.2008 between the new moon on 30.08.2008 and the full moon on 15.09.2008, from Tuningen southeast of Villingen-Schwenningen where abt. 25 individuals have flown on 09.09.1973 (EITSCHBERGER & STEINIGER 1974b) which has been three days before the full moon on 12.09.1973, from Langenenslingen northeast of Sigmaringen in the Danube valley where abt. 15 individuals have flown on 28.09.2001 (HENSLE 2002a) which has been three days after the increasing half moon on 25.09.2001 between the new moon on 17.09.2001 and the full moon on 02.10.2001; and from an unspecified locality where 25 individuals and 60 individuals have flown on 30.06.1992 and 08.08.1992, respectively (HASSELBACH 1993), which has been on the new moon on 30.06.1992 and five days before the full moon on 13.08.1992, respectively.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in the southeastern part of Germany have been documented from Marktleuthen north of Wunsiedel in the Fichtelgebirge south of Hof where more than 40 individuals have flown on 25.08.2001 – 03.09.2001 (HENSLE 2002a) which has been around and between the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001 as well as the

full moon on 03.09.2001, from Goldkronach southsoutheast of Bad Berneck im Fichtelgebirge southeast of Kulmbach where 6 individuals have flown on 06.09.1969 (EITSCHBERGER 1970d) which has been two days after the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and the new moon on 11.09.1969; from Hartenstein westnorthwest of Sulzbach-Rosenberg where abt. 25 individuals in total have been counted on 16.08.1983 and 24.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been on the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983 as well as one day after the full moon on 23.08.1983, respectively: from Freising in the Isar valley northnortheast of München where 7 individuals have flown on 14.09.1969 (EITSCHBERGER 1970d) which has been three days after the new moon on 11.09.1969, and from Grafendorf southsoutheast of Mainburg westnorthwest of Landsberg where abt. 10 individuals have flown on 15.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been one day after the increasing half moon on 14.08.1986 between the new moon on 05.08.1986 and the full moon on 19.08.1986.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in the northeastern part of Germany have been signaled from Zehdenick northnorthwest of Berlin where dozens of individuals have been observed on 27.08.1972 (STEINIGER 1973a) which has been three days after the full moon on 24.08.1972; from Schönefeld southsoutheast of Berlin and Woltersdorf southsouthwest of Rüdersdorf east of Berlin where abt. 10 individuals each have flown on 09.08.1983 as well as on 12.08.1983 and 15.08.1983, respectively (STEINIGER & EITSCHBERGER 1985), which has been one and four days after the new moon on 08.08.1983 as well as one day before the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983, respectively; from Templin southwest of Prenzlau where more than 600 individuals have been recorded on 14.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been two days before the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1982, from the Schollener See west of Schollene northwest of Rathenow where 30 individuals have been counted on 29.06.2005 (HENSLE 2006a) which has been one day after the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005; from Kamern southsoutheast of Havelberg in the Elbe valley southeast of Wittenberge where more than 1.000 individuals and 40 individuals have been registered on 05.08.2004 and 30.08.2005, respectively (HENSLE 2006a), which has been two days before the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004 as well as four days before the new moon on 03.09.2005, respectively; from Rühstädt southsoutheast of Wittenberge in the Elbe valley where 50 individuals in total have flown on 27.06.1995 and 29.06.1995 (HENSLE 2001e) which has been on and two days after the new moon on 27.06.1995, respectively; from Schullwitz east of Dresden in the Elbe valley where up to 30 individuals have flown in the period of 28.07.1986 – 14.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been around and between the full moon on 21.07.1986, the new moon on 05.08.1986 and the full moon on 19.08.1986; from Graupa northnorthwest of Pirna in the Elbe valley eastsoutheast of Dresden where abt. 10 individuals have flown on 22.06.1999 (HENSLE 2001k) which has been one day after the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 28.06.1999, from Altenburg southsoutheast of Leipzig where abt. 20 individuals have flown on 15.09.2003 (HENSLE 2004a) which has been five days after the full moon on 10.09.2003, from Frohburg-Roda northeast of Altenburg southsoutheast of Leipzig where abundant individuals have flown on 18.05.2007 (HENSLE 2008a) which has been two days after the new moon on 16.05.2007, from Radebeul northwest of Dresden in the Elbe valley where more than 10 individuals have flown on 20.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been three days before the full moon on 23.08.1983; from Langenwetzendorf northnorthwest of Plauen where abt. 20 individuals have flown on 25.07.1983 and 01.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been one day after the full moon on 24.07.1983 as well as two days before the decreasing half moon on 03.08.1983 between the full moon on 24.07.1983 and the new moon on 08.08.1983, respectively; from Zwickau where

abt. 40 individuals have flown in the period of 08.08.1983 – 29.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been around and between the new moon on 08.08.1983 and the full moon on 23.08.1983; from Lichtenstein northeast of Zwickau where 20 individuals each have flown on 15.07.1982 and 28.08.1982 (STEINIGER & EITSCHBERGER 1985) which has been on the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982 as well as one day after the increasing half moon on 27.08.1982 between the new moon on 19.08.1982 and the full moon on 03.09.1982, respectively; from Wildenfels eastsoutheast of Zwickau where 23 individuals and 10 individuals have flown on 07.08.1986 – 09.08.1986 and 17.08.1986, respectively (STEINIGER & EITSCHBERGER 1988), which has been two to four days after the new moon on 05.08.1986 and two days before the full moon on 19.08.1986, respectively; from Hartenstein eastsoutheast of Zwickau where more than 25 individuals have flown on 16.08.1983 and 24.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been on the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983 as well as one day after the full moon on 23.08.1983, respectively; from Niedercrinitz south of Zwickau where abt. 15 individuals have flown on 08.07.1983 (STEINIGER & EITSCHBERGER 1985) which has been two days before the new moon on 10.07.1983, from Knappenrode eastsoutheast of Hoyerswerda where abt. 10 individuals have flown on 18.05.1983 (STEINIGER & EITSCHBERGER 1985) which has been two days before the increasing half moon on 20.05.1983 between the new moon on 12.05.1983 and the full moon on 26.05.1983, and from Lakoma northnortheast of Cottbus where abt. 200 individuals have flown on 19.08.2005 (G. HERMANN in HENSLE 2006a) which has been on the full moon on 19.08.2005.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in Austria have been reported from Dürnstein-Unterloiben in the Danube valley westsouthwest of Krems westnorthwest of Vienna in the eastern part of Austria where 40 individuals, abt. 60 individuals and 15 individuals have flown on 27.03.2007 and 12.04.2007 (CHRISTOPHER RABL in HENSLE 2008a) as well as on 30.03.2008 (CHRISTOPHER RABL in HENSLE 2009a), respectively, which has been two days after the increasing half moon on 25.03.2007 between the new moon on 19.03.2007 and the full moon on 02.04.2007, two days after the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007, and one day after the decreasing half moon on 29.03.2008 between the full moon on 21.03.2008 and the new moon on 07.04.2008, respectively; from Vent southsouthwest of Sölden in the eastern part of Austria where 10 individuals have flown on 19.08.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been three days after the full moon on 16.08.2008, from Freistadt in the western part of Austria where 7 individuals have flown on 08.09.1969 (EITSCHBERGER 1970d) which has been three days before the new moon on 11.09.1969, from Kaunerberg east of Kauns southeast of Landeck in the western part of Austria where 15 individuals have flown on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977, and from Leibnitz in the Mur valley in the southern part of Austria where 10 individuals have flown on 11.05.1998 (HENSLE 2001i) which has been on the full moon on 11.05.1998.

Mass occurrences of large quantities of individuals of the Queen of Spain Fritillary *Issoria lathonia* in France, Luxembourg, Switzerland and Italy have been mentioned from Les Baux south of Avignon, Tarascon southsouthwest of Avignon and Cavaillon southeast of Avignon northnorthwest of Marseille in the southeastern part of France where abt. 25 individuals in total have flown on 19.05.1990 (STEINIGER & EITSCHBERGER 1992) which has been one day after the decreasing half moon on 18.05.1990 between the full moon on 09.05.1990 and the new moon on 24.05.1990; from Le Bousquet-d´Orb north of Bédarieux westnorthwest of Montpellier in the southeastern part of France where 10 individuals have flown in the period of 19.06.1993 – 30.06.1993 (HENSLE 2001c) which has been around and between the new moon on 20.06.1993 as well as the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993, from Grünewald east of Walferdange north of Luxembourg in the central part of Luxembourg where 17

individuals have flown on 20.06.1970 (EITSCHBERGER 1971b) which has been one day after the full moon on 19.06.1970; from Mörel and Betten in the Rhône valley northeast of Brig in the southeastern part of Switzerland where more than 10 individuals in total have flown on 17.07.1997 and 21.07.1997 (HENSLE 2001h) which has been three days before and one day after the full moon on 20.07.1997, respectively; from the Monte Tamaro southeast of Locarno in the southeastern part of Switzerland where 10 individuals per hour have flown on 06.08.1995 (HENSLE 2001e) which has been one day after the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, from Latsch in the Etsch valley west of Merano in Southern Tyrol in the northeastern part of Italy where 15 individuals have flown on 23.07.1977 (BURMANN & TARMANN 1979) which has been one day before the increasing half moon on 24.07.1977 between the new moon on 16.07.1977 and the full moon on 30.07.1977, from the Sonnenberg near Latsch in the Etsch valley west of Merano in Southern Tyrol in the northeastern part of Italy where more than 30 individuals have flown on 30.09.1994 – 02.10.1994 (HENSLE 2001d) which has been three to five days before the new moon on 05.10.1994, and from the Sonnenberg near Tannas westnorthwest of Laas in the Etsch valley west of Merano in Southern Tyrol in the northeastern part of Italy where abt. 50 individuals have flown on 07.10.1977 (BURMANN & TARMANN 1979) which has been one day after the decreasing half moon on 06.10.1977 between the full moon on 27.09.1977 and the new moon on 12.10.1977.

5.7 The Black-Veined White *Aporia crataegi* based on literature evaluation

Mass flights of large quantities of individuals of the Black-Veined White *Aporia crataegi* LINNAEUS 1758 (Lepidoptera: Pieridae) have been documented from various localities in the surroundings of Heidelberg in the literature. Mass occurrences of several hundreds or thousands of individuals of the Black-Veined White *Aporia crataegi* have been established in the vicinity of Mannheim-Seckenheim (abt. 12 km northwest of Heidelberg) around the Mannheim intersection of the motorway A 6 (running north-south) and the motorway A 656 (trending northwest-southeast) in the middle part of the Upper Rhine valley in the southwestern part of Germany in the years 1977 – 1986 (TREFFINGER & TREFFINGER 1981, 1983a, 1983b, 1985; TREFFINGER 1986, 1987, 1988, 1989, 1991; EBERT & RENNWALD 1991). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Mannheim-Seckenheim have been particularly observed and documented on 03.06.1977 (TREFFINGER 1991), 03.06.1979 – 04.06.1979 (TREFFINGER & TREFFINGER 1981, 1983a; EITSCHBERGER & STEINIGER 1981a, ROER 1984), 05.06.1980 – 08.06.1980 (TREFFINGER & TREFFINGER 1981), 22.05.1981 – 07.06.1981 (EITSCHBERGER & STEINIGER 1983), 23.05.1982 – 08.06.1982 and beyond until early July 1982 (EITSCHBERGER & STEINIGER 1984), 04.06.1983 – 05.06.1983 (TREFFINGER & TREFFINGER 1985, EBERT & RENNWALD 1991), 10.06.1984 – 17.06.1984 (TREFFINGER 1986, EITSCHBERGER & STEINIGER 1986) and 04.06.1985 (TREFFINGER 1987). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Mannheim-Seckenheim on 03.06.1977 (TREFFINGER 1991) has been developed two days after the full moon on 01.06.1977, the swarming on 03.06.1979 – 04.06.1979 (TREFFINGER & TREFFINGER 1981, 1983a; EITSCHBERGER & STEINIGER 1981a, ROER 1984) has happened on and after the increasing half moon on 03.06.1979 between the new moon on 26.05.1979 and the full moon on 10.06.1979, the swarming on 05.06.1980 – 08.06.1980 (TREFFINGER & TREFFINGER 1981) has been established around the decreasing half moon on 07.06.1980 between the new moon on 30.05.1980 and the full moon on 12.06.1980, the swarming on 22.05.1981 – 07.06.1981 (EITSCHBERGER & STEINIGER 1983) has taken place around and between the full moon on 18.05.1981 and the new moon on 02.06.1981, the swarming on 23.05.1982 – 08.06.1982 and beyond (EITSCHBERGER & STEINIGER 1984) has occurred around and between the new moon on 23.05.1982 and the full moon on 06.06.1982, the swarming on 04.06.1983 – 05.06.1983 (TREFFINGER & TREFFINGER 1985, EBERT & RENNWALD 1991) has been manifested one and two days after the decreasing half moon on 03.06.1983, the swarming on 10.06.1984 – 17.06.1984 (TREFFINGER 1986, EITSCHBERGER & STEINIGER 1986) has been developed

before and after the full moon on 13.06.1984, and the swarming on 04.06.1985 (TREFFINGER 1987) has happened one day after the full moon on 03.06.1985. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Mannheim-Seckenheim have also been confirmed on 23.05.1993 and 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the new moon on 21.05.1993 as well as on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been recognized in the vicinity of Mannheim-Wallstadt along the motorway A 6 (trending north-south) on 28.05.1993 – 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been one and two days before the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993.

Mass occurrences of several hundreds or thousands of individuals of the Black-Veined White *Aporia crataegi* have also been registered in the vicinity of Heidelberg-Kirchheim (particularly near Patrick-Henry-Village) along the motorway A 5 (running north-south) near the exit Heidelberg/ Schwetzingen in the middle part of the Upper Rhine valley in the southwestern part of Germany in the years 1984 – 1988 (EITSCHBERGER & STEINIGER 1986, 1987; TREFFINGER 1987, 1988, 1989, 1990). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Heidelberg-Kirchheim have been particularly observed and documented on 17.06.1984 (EITSCHBERGER & STEINIGER 1986), 28.05.1985 (EITSCHBERGER & STEINIGER 1987) and 04.06.1985 (TREFFINGER 1987), 30.05.1986 – 01.06.1986 (TREFFINGER 1988), 06.06.1987 – 15.06.1987 (TREFFINGER 1989) and 23.05.1988 (TREFFINGER 1990). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Heidelberg-Kirchheim on 17.06.1984 (EITSCHBERGER & STEINIGER 1986) has been established four days after the full moon on 13.06.1984; the swarming on 28.05.1985 (EITSCHBERGER & STEINIGER 1987) and 04.06.1985 (TREFFINGER 1987) has happened on the increasing half moon on 28.05.1985 between the new moon on 20.05.1985 and the full moon on 03.06.1985 as well as one day after the full moon on 03.06.1985, respectively; the swarming on 30.05.1986 – 01.06.1986 (TREFFINGER 1988) has been developed before and after the decreasing half moon on 31.05.1986 between the full moon on 23.05.1986 and the new moon on 07.06.1986, the swarming on 06.06.1987 – 15.06.1987 (TREFFINGER 1989) has been manifested before and after the full moon on 11.06.1987, and the swarming on 23.05.1988 (TREFFINGER 1990) has taken place one day before the increasing half moon on 24.05.1988 between the new moon on 16.05.1988 and the full moon on 31.05.1988. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Heidelberg-Kirchheim have also been confirmed on 23.05.1993 and 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the new moon on 21.05.1993 as well as on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been established in the vicinity of Eppelheim (abt. 4 km westsouthwest of Heidelberg) around the Heidelberg intersection of the motorway A 5 (running north-south) and the motorway A 656 (trending northwest-southeast) on 22.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been four days after the new moon on 18.06.1985, as well as in a garden within Eppelheim on 31.05.1985 and 06.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been three days before and three days after the full moon on 03.06.1985, respectively; and around the Viernheim motorway triangle of the motorway A 6 (running first west-east and then north-south) and the motorway A 67 (trending first north-south and then ending at the triangle) northwest of Viernheim northnorthwest of Heidelberg on 07.07.1985 (EITSCHBERGER & STEINIGER 1987) which has been five days after the full moon on 02.07.1985. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* have also been found along the motorway A 5 (stretching north-south) near the exit Dossenheim west of Dossenheim (abt. 4 km north of Heidelberg) on 08.06.1979, 12.06.1979 and 21.06.1979 (EITSCHBERGER & STEINIGER 1981a) and 06.06.1980 – 13.06.1980 (EITSCHBERGER & STEINIGER 1981b) which has been two days each before and after the full moon on 10.06.1979, three days before the new moon on 24.06.1979, and around and between the decreasing half moon on 07.06.1980 between the full

moon on 30.05.1980 and the new moon on 12.06.1980 as well as the new moon on 12.06.1980, respectively; and around the Walldorf intersection of the motorway A 6 (running westnorthwest-eastsoutheast) and the motorway A 5 (trending north-south) southsouthwest of Walldorf (abt. 12 km south of Heidelberg) on 14.06.1987 (MARTIN WIEMERS in EITSCHBERGER & STEINIGER 1989) which has been three days after the full moon on 11.06.1987.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been discovered along the motorway A 6 (trending north-south) near the exit Mannheim/ Schwetzingen northwest of Schwetzingen (abt. 9 km westsouthwest of Heidelberg) in the years 1992 – 1994 (TREFFINGER 1994; EITSCHBERGER & STEINIGER 1995a, 1996a). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Schwetzingen have been particularly observed and documented on 23.05.1993 and 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) and 19.05.1994 (EITSCHBERGER & STEINIGER 1996a). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Schwetzingen on 23.05.1993 and 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) has been developed two days after the new moon on 21.05.1993 as well as on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively; and the swarming on 19.05.1994 (EITSCHBERGER & STEINIGER 1996a) has been established on the increasing half moon on 19.05.1994 between the new moon on 10.05.1994 and the full moon on 25.05.1994. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Schwetzingen have also been confirmed on 28.05.1995 (EITSCHBERGER & STEINIGER 1996b) which has been one day before the new moon on 29.05.1995.

Mass occurrences of several hundreds or thousands of individuals of the Black-Veined White *Aporia crataegi* have also been noticed along the highway B 36 (running north-south) south of Graben-Neudorf (abt. 30 km southsouthwest of Heidelberg) in the middle part of the Upper Rhine valley in the southwestern part of Germany in the years 1987 – 1993, 1997 – 2002 and 2005 – 2007 (SCHIEBER 1994; EITSCHBERGER & STEINIGER 1995a, 1999A, 2000a, 2000b, 2001, 2002, 2003a; U. RAUSCH in HENSLE 2006a; HENSLE 2007a, 2008a). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Graben-Neudorf have been particularly observed and documented on 28.05.1992 and 06.06.1992 (SCHIEBER 1994), 29.05.1993 (EITSCHBERGER & STEINIGER 1995a), 05.06.1997 (EITSCHBERGER & STEINIGER 1999a), 28.05.1998 (EITSCHBERGER & STEINIGER 2000a), 23.05.1999 – 13.06.1999 (EITSCHBERGER & STEINIGER 2000b), 26.05.2000 (EITSCHBERGER & STEINIGER 2001), 11.06.2001 (EITSCHBERGER & STEINIGER 2002a), 02.06.2002 (EITSCHBERGER & STEINIGER 2003a), 28.05.2005 – 17.06.2005 (U. RAUSCH in HENSLE 2006a), 04.06.2006 – 15.06.2006 (HENSLE 2007a) and 19.05.2007 – 31.05.2007 (HENSLE 2008a). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Graben-Neudorf on 28.05.1992 and 06.06.1992 (SCHIEBER 1994) has been established four days before and five days after the new moon on 01.06.1992, respectively; the swarming on 29.05.1993 (EITSCHBERGER & STEINIGER 1995a) has been manifested on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, the swarming on 05.06.1997 (EITSCHBERGER & STEINIGER 1999a) has taken place on the new moon on 05.06.1997, the swarming on 28.05.1998 (EITSCHBERGER & STEINIGER 2000a) has been developed three days after the new moon on 25.05.1998; the swarming on 23.05.1999 – 13.06.1999 (EITSCHBERGER & STEINIGER 2000b) has happened around and between the increasing half moon on 23.05.1999 between the new moon on 15.05.1999 and the full moon on 30.05.1999 as well as around and between the decreasing half moon on 08.06.1999 between the full moon on 30.05.1999 and the new moon on 13.06.1999, respectively; the swarming on 26.05.2000 (EITSCHBERGER & STEINIGER 2001) has been established one day before the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, the swarming on 11.06.2001 (EITSCHBERGER & STEINIGER 2002a) has been developed five days after the full moon on 06.06.2001, the swarming on 02.06.2002 (EITSCHBERGER & STEINIGER 2003a) has been expressed one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon

on 11.06.2002, the swarming on 28.05.2005 – 17.06.2005 (U. RAUSCH in HENSLE 2006a) has been established around and between the decreasing half moon on 30.05.2005 between the full moon on 23.05.2005 and the new moon on 06.06.2005 as well as around and between the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005, the swarming on 04.06.2006 – 15.06.2006 (HENSLE 2007a) has been developed around and between the increasing half moon on 04.06.2006 between the new moon on 27.05.2006 and the full moon on 11.06.2006 as well as around the full moon on 11.06.2006, and the swarming on 19.05.2007 – 31.05.2007 (HENSLE 2008a) has happened around and between the new moon on 16.05.2007 and the full moon on 01.06.2007. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Graben-Neudorf have also been confirmed on 19.05.1994 (EITSCHBERGER & STEINIGER 1996a) which has been on the increasing half moon on 19.05.1994 between the new moon on 10.05.1994 and the full moon on 25.05.1994, and on 07.06.2008 – 08.06.2008 (KARL TREFFINGER in HENSLE 2009a) which has been four and five days after the new moon on 03.06.2008. The swarming of the Black-Veined White *Aporia crataegi* on 29.05.1993 has happened not only in the vicinity of Graben-Neudorf, but also around Karlsdorf-Neuthard (abt. 32 km southsouthwest of Heidelberg) southeast of Graben-Neudorf (EITSCHBERGER & STEINIGER 1995a), whereas on 19.05.1994, the swarming has only been established near Karlsdorf-Neuthard in contrast to the occurrence of only significant numbers of individuals in the surroundings of Graben-Neudorf (EITSCHBERGER & STEINIGER 1996a), and on the other hand, the swarming around Graben-Neudorf on 23.05.1999 – 13.06.1999 has not reached the vicinity of Karlsdorf-Neuthard (EITSCHBERGER & STEINIGER 2000b). Mass occurrences of the Black-Veined White *Aporia crataegi* in the vicinity of Karlsdorf-Neuthard have also been developed on 31.05.1986 (TREFFINGER 1988) which has been on the decreasing half moon on 31.05.1986 between the full moon on 23.05.1986 and the new moon on 07.06.1986, and on 28.05.1995 and 11.06.1995 (EITSCHBERGER & STEINIGER 1996b) which has been one day before the new moon on 29.05.1995 and two days before the full moon on 13.06.1995, respectively. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* have also been registered in the vicinity of Ettlingen south of Karlsruhe in the period from end of May 1953 to mid of June 1953 (PEKARSKY 1955a) which has been around and between the full moon on 28.05.1953 and the new moon on 11.06.1953, near Waghäusel-Kirrlach northnortheast of Graben-Neudorf on 26.05.2008 (HENSLE 2009a) which has been two days before the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008, near Muggensturm east of Rastatt southsouthwest of Karlsruhe on 06.06.1975 – 13.06.1975 (EITSCHBERGER & STEINIGER 1976) which has been around the new moon on 09.06.1975, and near Rastatt on 03.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been two days after the new moon on 01.06.1973.

Mass occurrences of several hundreds or thousands of individuals of the Black-Veined White *Aporia crataegi* have also been detected along the highway B 44 (running north-south) between Groß-Gerau-Dornheim and Riedstadt-Erfelden west of Darmstadt in the northern part of the Upper Rhine valley in the southwestern part of Germany in 1993 – 1994 (EITSCHBERGER & STEINIGER 1995a, 1996a). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Groß-Gerau-Dornheim and Riedstadt-Erfelden have been particularly observed and documented on 19.05.1993 – 20.05.1993 (EITSCHBERGER & STEINIGER 1995a) and 29.05.1994 (EITSCHBERGER & STEINIGER 1996a). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Groß-Gerau-Dornheim and Riedstadt-Erfelden on 19.05.1993 – 20.05.1993 (EITSCHBERGER & STEINIGER 1995a) has been developed one and two days before the new moon on 21.05.1993, and the swarming on 29.05.1994 (EITSCHBERGER & STEINIGER 1996a) has been manifested four days after the full moon on 25.05.1994. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been confirmed around Büttelborn southeast of Groß-Gerau on 04.07.1984 – 10.07.1984 (EITSCHBERGER & STEINIGER 1986) which has been around and between the new moon on 29.06.1984, the increasing half moon on 04.07.1984 and the full moon on 13.07.1984; on 29.05.1994 and the following days (EITSCHBERGER

& STEINIGER 1996a) which has been after the full moon on 25.05.1994 and before the new moon on 09.06.1994, on 10.06.2006 (HENSLE 2007a) which has been one day before the full moon on 11.06.2006, and on 13.05.2007 (HENSLE 2008a) which has been three days before the new moon on 16.05.2007. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been noticed around Weiterstadt eastsoutheast of Groß-Gerau on 06.06.1985 – 08.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been three to five days after the full moon on 03.06.1985, and near Gimbsheim southsouthwest of Groß-Gerau on 28.06.1955 – 29.06.1955 (BLUNCK & WILBERT 1962) which has been on and one day after the increasing half moon on 28.06.1955 between the new moon on 20.06.1955 and the full moon on 05.07.1955.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been recorded in the vicinity of Bad Krozingen southwest of Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany along the motorway A 5 (running north-south) in the years 1986 – 1988 (TREFFINGER 1988, 1990). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Bad Krozingen have been particularly observed and documented on 16.06.1986 (TREFFINGER 1988) and 30.05.1988 (TREFFINGER 1990). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Bad Krozingen on 16.06.1986 (TREFFINGER 1988) has been developed on the increasing half moon on 16.06.1986 between the new moon on 07.06.1986 and the full moon on 22.06.1986, and the swarming on 30.05.1988 (TREFFINGER 1990) has been manifested one day before the full moon on 31.05.1988. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Bad Krozingen have also been confirmed on 03.06.1994 (EITSCHBERGER & STEINIGER 1996a) which has been six days before the new moon on 09.06.1994. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been noticed in the vicinity of Müllheim southsouthwest of Bad Krozingen on 30.05.1988 (TREFFINGER 1990) which has been one day before the full moon on 31.05.1988, near Hartheim westnorthwest of Bad Krozingen on 28.05.1994 (EITSCHBERGER & STEINIGER 1996a) which has been three days after the full moon on 25.05.1994; and in the vicinity of Grißheim southwest of Bad Krozingen in the period of 28.05.1994 – 12.06.1994 (EITSCHBERGER & STEINIGER 1996a), on 21.05.1995 (EITSCHBERGER & STEINIGER 1996b), in the period of 08.06.1996 – 29.06.1996 (EITSCHBERGER & STEINIGER 1998), on 13.06.1998 and 20.06.1998 (EITSCHBERGER & STEINIGER 2000a), on 29.05.2005 and 12.06.2005 (HENSLE 2006a) and in the period of 07.06.2006 – 11.07.2006 (C. WIDDER in HENSLE 2007a) which has been around and between the full moon on 25.05.1994 and the new moon on 09.06.1994, one day before the decreasing half moon on 22.05.1995 between the full moon on 14.05.1995 and the new moon on 29.05.1995, around and between the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996 as well as the full moon on 01.07.1996, three days after the full moon on 10.06.1998 and four days before the new moon on 24.06.1998, one day before the decreasing half moon on 30.05.2005 between the full moon on 23.05.2005 and the new moon on 06.06.2005 as well as three days before the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005, and around and between the full moon on 11.06.2006, the new moon on 25.06.2006 and the full moon on 11.07.2006, respectively. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Grißheim have also been registered in the period of 05.06.2001 – 24.06.2001 (EITSCHBERGER & STEINIGER 2002a) which has been around and between the full moon on 06.06.2001 and the new moon on 21.06.2001, on 15.06.2002 – 16.06.2002 (EITSCHBERGER & STEINIGER 2003a) which has been two and three days before the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, and in the period of 14.05.2008 – 05.07.2008 (C. WIDDER, M. REUSCH & J. BASTIAN in HENSLE 2009a). Mass occurrences of the Black-Veined White *Aporia crataegi* have also been verified in the vicinity of Hirtzfelden northnortheast of Mulhouse in the southern part of the Upper Rhine valley in the northeastern part of France in the period of 20.05.1993 – 07.06.1993 (HENSLE 1995) and on 03.06.1995 (EITSCHBERGER & STEINIGER 1996b) which has been around and between the new moon on 21.05.1993 and the full moon on 04.06.1993 as well

as five days after the new moon on 29.05.1995, respectively; near Soultzeren in the southern part of the Vosges westsouthwest of Colmar in the northeastern part of France on 26.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days after the new moon on 24.06.1979, at the Rainkopf and near Cornimont in the southern part of the Vosges westsouthwest to southwest of Colmar in the northeastern part of France on 07.06.1995 and 29.06.1995, respectively (EITSCHBERGER & STEINIGER 1996b), which has been three days before the full moon on 10.06.1995 and two days after the new moon on 27.06.1995, respectively; and around Colmar in the southern part of the Upper Rhine valley as well as near Wildenstein and at the Col de Bramont north of Wildenstein westnorthwest of Guebwiller westsouthwest of Colmar, at the Col de Belmont westsouthwest of Strasbourg, and at the Hartmannswillerkopf west of Soultz-Haut-Rhin southeast of Guebwiller southsouthwest of Colmar in the southern part of the Vosges in the northeastern part of France on 18.06.1990 and 19.06.1991 (TREFFINGER 1992) which has been four days before the new moon on 22.06.1990 as well as one day before the increasing half moon on 20.06.1991 between the new moon on 12.06.1991 and the full moon on 27.06.1991, respectively.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been discovered in the vicinity of Breisach and in the Kaiserstuhl westnorthwest of Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany around the river Rhine (running north-south) in the years 1980 and 1987 – 1991 (EITSCHBERGER & STEINIGER 1981b; HENSLE 1989; TREFFINGER 1989, 1990, 1992). Mass flights of the Black-Veined White *Aporia crataegi* in the vicinity of Breisach have been particularly observed and documented on 12.06.1980 (EITSCHBERGER & STEINIGER 1981b), 17.06.1987 and 27.06.1987 (HENSLE 1989, TREFFINGER 1989), 30.05.1988 (TREFFINGER 1990), 02.06.1989 (EITSCHBERGER & STEINIGER 1990a), 03.06.1990 (TREFFINGER 1992) and 05.06.1991 (TREFFINGER 1992). The swarming of the Black-Veined White *Aporia crataegi* in the vicinity of Breisach on 12.06.1980 (EITSCHBERGER & STEINIGER 1981b) has been established on the new moon on 12.06.1980; the swarming on 17.06.1987 and 27.06.1987 (HENSLE 1989, TREFFINGER 1989) has been expressed two days before the decreasing half moon on 19.06.1987 between the full moon on 11.06.1987 and the new moon on 26.06.1987 as well as one day after the new moon on 26.06.1987, respectively; the swarming on 30.05.1988 (TREFFINGER 1990) has been developed one day before the full moon on 31.05.1988, the swarming on 02.06.1989 (EITSCHBERGER & STEINIGER 1990a) has taken place one day before the new moon on 03.06.1989, the swarming on 03.06.1990 (TREFFINGER 1992) has been manifested five days before the full moon on 08.06.1990, and the swarming on 05.06.1991 (TREFFINGER 1992) has happened one day before the decreasing half moon on 06.06.1991 between the full moon on 28.05.1991 and the new moon on 12.06.1991. Significant numbers of individuals of the Black-Veined White *Aporia crataegi* in the vicinity of Breisach have also been registered on 14.06.1985 and 30.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been four days before the new moon on 18.06.1985 and two days before the full moon on 02.07.1985, respectively.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been noticed within and around Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany in the years 1989 – 1991 (EITSCHBERGER & STEINIGER 1990a, TREFFINGER 1992). Mass flights of the Black-Veined White *Aporia crataegi* within and around Freiburg have been particularly observed and documented on 19.06.1989 (EITSCHBERGER & STEINIGER 1990a), 18.06.1990 (TREFFINGER 1992) and 19.06.1991 (TREFFINGER 1992). The swarming of the Black-Veined White *Aporia crataegi* within and around Freiburg on 19.06.1989 (EITSCHBERGER & STEINIGER 1990a) has been developed on the full moon on 19.06.1989, the swarming on 18.06.1990 (TREFFINGER 1992) has been manifested four days before the new moon on 22.06.1990, and the swarming on 19.06.1991 (TREFFINGER 1992) has happened one day before the increasing half moon on 20.06.1991 between the new moon on 12.06.1991 and the full moon on 27.06.1991.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been registered in Fahl northeast of Todtnau southeast of Freiburg in the southern part of the Black Forest in the southwestern part of Germany in the years 1989 – 1991 (EITSCHBERGER & STEINIGER 1990a, TREFFINGER 1992). Mass flights of the Black-Veined White *Aporia crataegi* in Fahl have been particularly observed and documented on 20.06.1989 (EITSCHBERGER & STEINIGER 1990a), 18.06.1990 (TREFFINGER 1992) and 19.06.1991 (TREFFINGER 1992). The swarming of the Black-Veined White *Aporia crataegi* in Fahl on 20.06.1989 (EITSCHBERGER & STEINIGER 1990a) has been developed one day after the full moon on 19.06.1989, the swarming on 18.06.1990 (TREFFINGER 1992) has been manifested four days before the new moon on 22.06.1990, and the swarming on 19.06.1991 (TREFFINGER 1992) has happened one day before the increasing half moon on 20.06.1991 between the new moon on 12.06.1991 and the full moon on 27.06.1991. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been noticed between Lenzkirch and Raitenbuch south of Titisee-Neustadt eastsoutheast of Freiburg on 25.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been five days after the new moon on 20.06.1993, at the Dossen near Wildböllen southwest of Todtnau eastsoutheast of Bad Krozingen on 10.06.2007 (HENSLE 2008a) which has been two days after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and around Bonndorf northnortheast of Waldshut-Tiengen in the southern part of the Black Forest in the southwestern part of Germany on 10.07.1978 – 13.07.1978 (EITSCHBERGER & STEINIGER 1979) which has been a few days before the increasing half moon on 14.07.1978 between the new moon on 05.07.1978 and the full moon on 20.07.1978.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* have also been recorded at the motorway exit towards Beuron east of Donaueschingen in the Danube valley eastsoutheast of Freiburg in the southwestern part of Germany in the years 1989 – 1991 (EITSCHBERGER & STEINIGER 1990a, TREFFINGER 1992). Mass flights of the Black-Veined White *Aporia crataegi* near Donaueschingen have been particularly observed and documented on 12.06.1989 (EITSCHBERGER & STEINIGER 1990a), 15.06.1990 (TREFFINGER 1992) and 16.06.1991 (TREFFINGER 1992). The swarming of the Black-Veined White *Aporia crataegi* near Donaueschingen on 12.06.1989 (EITSCHBERGER & STEINIGER 1990a) has been developed on the increasing half moon on 12.06.1989 between the new moon on 03.06.1989 and the full moon on 19.06.1989, the swarming on 15.06.1990 (TREFFINGER 1992) has been manifested one day before the decreasing half moon on 16.06.1990 between the full moon on 08.06.1990 and the new moon on 22.06.1990, and the swarming on 16.06.1991 (TREFFINGER 1992) has happened four days after the new moon on 12.06.1991. Mass occurrences of the Black-Veined White *Aporia crataegi* have also been noticed near Tuningen eastsoutheast of Villingen-Schwenningen on 07.06.1993 – 08.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been three and four days after the full moon on 04.06.1993, near Talheim eastsoutheast of Villingen-Schwenningen on 09.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been five days after the full moon on 04.06.1993, near Fridingen in the Danube valley eastnortheast of Tuttlingen on 08.07.1972 – 11.07.1972 (EITSCHBERGER 1973a) which has been around the new moon on 10.07.1972, near Fridingen and Hausen im Tal northeast of Fridingen in the Danube valley eastnortheast of Tuttlingen on 06.07.1971 – 15.07.1971 (EITSCHBERGER 1972) which has been around and between the full moon on 08.07.1971 as well as the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971, near Geisingen in the Danube valley southwest of Tuttlingen in the period of 15.06.1973 – 01.07.1973 (EITSCHBERGER & STEINIGER 1974b) which has been around and between the full moon on 15.06.1973 and the new moon on 30.06.1973, and near Mühlheim in the Danube valley northeast of Tuttlingen on 25.05.2007 (HENSLE 2008a) which has been two days after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the northwestern and northeastern parts of the Eifel in the western part of Germany have been con-

firmed near Kesseling southwest of Bad Neuenahr-Ahrweiler in the Ahr valley in the northeastern part of the Eifel on 17.06.1982 (EITSCHBERGER & STEINIGER 1984), on 06.07.1985 and 13.07.1985 (EITSCHBERGER & STEINIGER 1987), from 15.06.1986 onwards (EITSCHBERGER & STEINIGER 1988) and in the period of 28.06.1987 – 12.07.1987 (EITSCHBERGER & STEINIGER 1989) which has been four days before the new moon on 21.06.1982, four days after the full moon on 02.07.1985 as well as two days after the decreasing half moon on 11.07.1985 between the full moon on 02.07.1985 and the new moon on 17.07.1985, before and after the increasing half moon on 16.06.1986 between the new moon on 07.06.1986 and the full moon on 22.06.1986, and around and between the new moon on 25.07.1987 and the full moon on 11.07.1987, respectively; near Altenahr in the Ahr valley west-southwest of Bad Neuenahr-Ahrweiler in the northeastern part of the Eifel in the period of 01.06.1981 – 15.06.1981 (EITSCHBERGER & STEINIGER 1983) which has been around and between the new moon on 02.06.1981 and the full moon on 17.06.1981, near Insenborn westsouthwest of Esch-sur-Sûre northwest of Ettelbrück in the northern part of Luxembourg on 03.07.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been four days before the new moon on 07.07.1967; near Daleiden southwest of Prüm in the northwestern part of the Eifel on 10.07.1987 (EITSCHBERGER & STEINIGER 1989), 18.06.1988 (EITSCHBERGER & STEINIGER 1990b) and 14.07.1996 (EITSCHBERGER & STEINIGER 1998) which has been one day before the full moon on 11.07.1987, four days after the new moon on 14.06.1988 and one day before the new moon on 15.07.1996, respectively; near Irrhausen south-west of Prüm in the northwestern part of the Eifel in the period of 19.06.1985 – 13.07.1985 (EITSCHBERGER & STEINIGER 1989) as well as on 03.07.1987 – 05.07.1987 (EITSCHBERGER & STEINIGER 1989) and 18.06.1988 (EITSCHBERGER & STEINIGER 1990b) which has been around and between the new moon on 18.06.1985, the full moon on 02.07.1985 and the new moon on 18.07.1985, on and several days before the increasing half moon on 05.07.1987 between the new moon on 25.07.1987 and the full moon on 11.07.1987, and four days after the new moon on 14.06.1988, respectively; between Abenden and Berg in the Rur valley south of Nideggen in the northwestern part of the Eifel on 06.06.1957 (GARLING 1963a) which has been on the increasing half moon on 06.06.1957 between the new moon on 29.05.1957 and the full moon on 12.06.1957; in the Helingsbach valley near Dreiborn westnorthwest of Schleiden westsouthwest of Mechernich in the northwestern part of the Eifel in the period of 25.05.2007 – 19.06.2007 (JOHN in SCHUMACHER 2008a) which has been around and between the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and the increasing half moon on 22.06.2007 between the new moon on 15.06.2007 and the full moon on 30.06.2007; near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel on 23.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been one day before the new moon on 24.06.1979, near Ahrdorf in the Ahr valley north-northwest of Daun in the northwestern part of the Eifel on 11.06.1992 (EITSCHBERGER & STEINIGER 1994a) which has been four days before the full moon on 15.06.1992; near Ahrhütte in the Ahr valley northnorthwest of Daun in the northwestern part of the Eifel on 27.06.1992 (EITSCHBERGER & STEINIGER 1994a) and 26.06.1999 (EITSCHBERGER & STEINIGER 2000b) which has been three days before the new moon on 30.06.1992 and two days before the full moon on 28.06.1999, respectively; near Blankenheim northnorthwest of Daun in the northwestern part of the Eifel on 12.06.1976 – 13.06.1976 (EITSCHBERGER & STEINIGER 1977a), 05.06.1993 (EITSCHBERGER & STEINIGER 1995a) and 08.06.2008 – 21.06.2008 (HENSLE 2009a) which has been on and one day after the full moon on 12.06.1976, one day after the full moon on 04.06.1993, and around and between the new moon on 03.06.2008 and the full moon on 18.06.2008, respectively; near Ahrhütte, Blankenheim and Antweiler northnorthwest of Daun in the northwestern part of the Eifel on 23.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been three days after the new moon on 20.06.1974; near Dollendorf southsoutheast of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel on 12.06.2006 (HENSLE 2007a) which has been one day after the full moon on 11.06.2006, near Büdesheim west of Gerolstein westnorthwest of Daun in the northwestern part of the Eifel on 13.06.1971 (EITSCHBERGER 1972) which has been five days after the full moon on 08.06.1971, and near Rockes-

kyll northeast of Gerolstein in the Kyll valley in the northwestern part of the Eifel on 09.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been four days after the full moon on 05.06.1974.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the southwestern and southeastern parts of the Eifel in the western part of Germany have been registered near Mürlenbach in the Kyll valley westsouthwest of Daun in the southwestern part of the Eifel on 14.06.1994 (EITSCHBERGER & STEINIGER 1996a) which has been three days before the increasing half moon on 17.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, near Alf in the Moselle valley south of Cochem in the southeastern part of the Eifel on 11.06.1976 – 12.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been one day before and on the full moon on 12.06.1976, near Pommern in the Moselle valley eastnortheast of Cochem in the southeastern part of the Eifel on 20.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been on the decreasing half moon on 20.06.1976 between the full moon on 12.06.1976 and the new moon on 27.06.1976, near Cochem in the Mosel valley in the southeastern part of the Eifel and near Nonnweiler-Braunshausen southeast of Trier in the western part of the Hunsrück on 06.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the full moon on 04.06.1993, near Cochem in the Mosel valley in the southeastern part of the Eifel on 20.06.1994 – 29.06.1994 (EITSCHBERGER & STEINIGER 1996a) which has been around and between the full moon on 23.06.1994 and the decreasing half moon on 01.07.1994 before the new moon on 09.07.1994, near Trier in the Moselle valley in the southwestern part of the Eifel on 17.06.1972 (EITSCHBERGER 1973a), 10.06.1976 and 17.06.1976 (EITSCHBERGER & STEINIGER 1977a), and 12.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been two days before the increasing half moon on 19.06.1972 between the new moon on 11.06.1972 and the full moon on 26.06.1972, two days before and five days after the full moon on 12.06.1976, and one day after the decreasing half moon on 11.06.1985 between the full moon on 03.06.1985 and the new moon on 18.06.1985, respectively; around Welling and Trimbs east of Mayen in the southeastern part of the Eifel on 02.06.2005 and 08.06.2005 (H. STERN in HENSLE 2006a) which has been four days before and two days after the new moon on 06.06.2005, respectively; at an unspecified locality in the vicinity of Mayen in the southeastern part of the Eifel on 13.06.1992 (JÜRGEN BOSSELMANN & CHRISTIAN DIETZEN in HASSELBACH 1993) which has been two days before the full moon on 15.06.1992, near Freudenburg southsouthwest of Trier in the northern part of the Saar area on 28.06.1996 (EITSCHBERGER & STEINIGER 1998) which has been three days before the full moon on 01.07.1996, near Haustadt north of Saarlouis in the Saar valley in the southern part of the Saar area on 07.06.1996 (EITSCHBERGER & STEINIGER 1998) which has been two days before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, and near Reinheim southeast of Saarbrücken in the southern part of the Saar area on 26.05.2005 (HENSLE 2006a) which has been three days after the full moon on 23.05.2005.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the western part of the Hunsrück in the western part of Germany have been recorded near Sommerau southeast of Trier on 09.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been one day after the increasing half moon on 08.06.1973 between the new moon on 01.06.1973 and the full moon on 15.06.1973, near Sommerau southeast of Trier and Reitscheid east of Nonnweiler southeast of Trier on 30.05.1971 (EITSCHBERGER 1972) which has been three days before the increasing half moon on 02.06.1971 between the new moon on 24.05.1971 and the full moon on 08.06.1971, near Hinzenburg westnorthwest of Hermeskeil southeast of Trier on 12.07.1990 (EITSCHBERGER & STEINIGER 1992a) which has been four days after the full moon on 08.07.1990; near Grimburg southwest of Hermeskeil southeast of Trier on 25.06.1995 (EITSCHBERGER & STEINIGER 1996b) and 18.06.1996 (EITSCHBERGER & STEINIGER 1998) which has been two days before the new moon on 27.06.1995 and two days after the new moon on 16.06.1996, respectively; near Nonnweiler-Braunshausen southeast of Trier in the period of 15.06.1969 – 01.07.1969 (EITSCHBERGER 1970a) as well as on 30.05.1971 and 13.06.1971 (EITSCHBERGER 1972), respectively, which has been around and between the new

moon on 15.06.1969 and the full moon on 29.06.1969, three days before the increasing half moon on 02.06.1971 between the new moon on 24.05.1971 and the full moon on 08.06.1971, and five days after the full moon on 08.06.1971, respectively; near Türkismühle east of Nonnweiler on 10.06.1971 (EITSCHBERGER 1972) which has been two days after the full moon on 08.06.1971; and near Oberlöstern southwest of Nonnweiler on 17.06.1994 and 02.07.1994 (EITSCHBERGER & STEINIGER 1996a) as well as on 17.06.1996 (EITSCHBERGER & STEINIGER 1998) which has been on the increasing half moon on 17.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and one day after the new moon on 16.06.1996, respectively.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the eastern part of the Hunsrück in the western part of Germany have been recognized near Niederkumbd north of Simmern on 05.08.1998 – 07.08.1998 (EITSCHBERGER & STEINIGER 2000a) which has been one to three days before the full moon on 08.08.1998, at the forested parking of the motorway A 61 east of Rheinböllen westsouthwest of Wiesbaden at the end of June 1988 (EITSCHBERGER & STEINIGER 1990a) which has been around the full moon on 29.06.1988; around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz near the eastern boundary of the Hunsrück on 14.06.1980 – 15.06.1980 (NIPPEL 1980, EITSCHBERGER & STEINIGER 1981b) which has been two and three days after the new moon on 12.06.1980; near Kaub northnorthwest of Bingen in the Middle Rhine valley near the eastern boundary of the Hunsrück on 10.06.1997 (EITSCHBERGER & STEINIGER 1999a) which has been five days after the new moon on 05.06.1997; near Niederalben north of Kusel in the Glan valley on 10.06.1973 and 17.06.1973 (EITSCHBERGER & STEINIGER 1974b) which has been two days after the increasing half moon on 08.06.1973 between the new moon on 01.06.1973 and the full moon on 15.06.1973 as well as two days after the full moon on 15.06.1973, respectively; near Idar-Oberstein in the Nahe valley in the period of 20.05.1976 – 15.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the new moon on 29.05.1976 and the full moon on 12.06.1976; near Bergen westsouthwest of Kirn in the Nahe valley in the period of 30.05.1976 – 27.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the new moon on 29.05.1976, the full moon on 12.06.1976 and the new moon on 27.06.1976; and at unspecified localities in the vicinity of Koblenz in the Middle Rhine valley on 24.05.1993 and 29.05.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been three days after the new moon on 21.05.1993 as well as on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993; respectively.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the southwestern and central parts of Germany have also been noticed around Gau-Algesheim and Ingelheim in the Middle Rhine valley westsouthwest of Mainz in the southwestern part of Germany on 08.06.1954 (BLUNCK & MARTINI 1954) which has been one day before the increasing half moon on 09.06.1954 between the new moon on 01.06.1954 and the full moon on 16.06.1954; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany on 30.05.1992 and 05.06.1993 (BROSZKUS 1995) which has been two days before the new moon on 01.06.1992 and one day after the full moon on 04.06.1993, respectively; near Linkenheim-Hochstetten north of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 11.06.1983 (EITSCHBERGER & STEINIGER 1985) which has been on the new moon on 11.06.1983, near Dannstadt-Schauernheim southwest of Ludwigshafen in the middle part of the Upper Rhine valley in the southwestern part of Germany on 14.05.2000 (EITSCHBERGER & STEINIGER 2001) which has been four days before the full moon on 18.05.2000; near Engen west of Stockach in the southwestern part of Germany on 16.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been four days before the new moon on 20.06.1974, near Reichenau northwest of Konstanz at Lake Constance in the southwestern part of Germany at the beginning of August 1937 (HANS REITHINGER

in WENZEL 1937a) which has been around the new moon on 06.08.1937; near Sambachshof south-southwest of Bad Königshofen im Grabfeld northeast of Schweinfurt in the central part of Germany on 26.06.1972 – 07.07.1972 (EITSCHBERGER 1973a) which has been around and between the full moon on 26.06.1972 and the new moon on 10.07.1972, near Bad Königshofen im Grabfeld north-east of Schweinfurt in the central part of Germany on 10.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been on the full moon on 10.06.1979, near Volkach eastnortheast of Würzburg in the Main valley in the central part of Germany in the period of 05.06.1972 – 25.06.1972 (EITSCHBERGER 1973a) which has been around and between the decreasing half moon on 05.06.1972 between the full moon on 28.05.1972 and the new moon on 11.06.1972 as well as the increasing half moon on 19.06.1972 between the new moon on 11.06.1972 and the full moon on 26.06.1972; near Volkach and Sommerach eastnortheast of Würzburg in the Main valley in the central part of Germany in the periods of 03.06.1973 – 17.06.1973 and 12.06.1973 – 21.06.1973, respectively (EITSCHBERGER & STEINIGER 1974a), which has been around and between the new moon on 01.06.1973 and the full moon on 15.06.1973, and around and between the full moon on 15.06.1973 as well as the decreasing half moon on 24.06.1973 between the full moon on 15.06.1973 and the new moon on 30.06.1973, respectively; near Volkach and Sommerach eastnortheast of Würzburg in the Main valley in the central part of Germany at the beginning of June 1975 (EITSCHBERGER & STEINIGER 1976) which has been around the decreasing half moon on 03.06.1975 between the full moon on 25.05.1975 and the new moon on 09.06.1975, and near Sommerach eastnortheast of Würzburg in the Main valley in the central part of Germany in the period of 01.06.1976 – 15.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the new moon on 29.05.1976 and the full moon on 12.06.1976.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the northwestern part of Germany have been confirmed near Wilnsdorf-Rudersdorf southeast of Siegen in the Rothaargebirge on 13.06.1976 (EITSCHBERGER & STEINIGER 1977a), 18.06.1978 (EITSCHBERGER & STEINIGER 1979) and 03.07.1979 – 05.07.1979 (EITSCHBERGER & STEINIGER 1981a) which has been one day after the full moon on 13.06.1976, two days before the full moon on 20.06.1978, and around the increasing half moon on 03.07.1979 between the new moon on 24.06.1979 and the full moon on 09.07.1979, respectively; near Irmgarteichen east of Siegen in the Rothaargebirge on 13.06.1976 (EITSCHBERGER & STEINIGER 1977a) and 20.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been one day after the full moon on 13.06.1976 and four days before the new moon on 24.06.1979, respectively; in Hannover-Kananohe in the Leine valley on 10.05.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days before the full moon on 12.05.1979, in the Drömlinger Moor northeast of Wolfsburg on 12.06.1971 – 16.06.1971 (TILSNER in EITSCHBERGER 1972) which has been around and between the full moon on 08.06.1971 as well as the decreasing half moon on 17.06.1971 between the full moon on 08.06.1971 and the new moon on 23.06.1971, near Venne east of Senden southsouthwest of Münster on 17.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been five days after the full moon on 12.06.1976; near Davert south of Münster on 23.06.1973 – 26.06.1973 and 09.07.1973 – 13.07.1973 (EITSCHBERGER & STEINIGER 1975a) as well as on 16.06.1974 and 23.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been around the decreasing half moon on 24.06.1973 between the full moon on 15.06.1973 and the new moon on 30.06.1973, around and between the increasing half moon on 08.07.1973 between the new moon on 30.06.1973 and the full moon on 14.08.1973 as well as the full moon on 14.08.1973, two days after the decreasing half moon on 14.06.1974 between the full moon on 05.06.1974 and the new moon on 20.06.1974, and three days after the new moon on 20.06.1974, respectively; near Schloß Holte southsoutheast of Bielefeld on 16.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been one day after the full moon on 15.06.1973, near Bad Bentheim southsoutheast of Nordhorn on 21.06.1970 (EITSCHBERGER 1971a) which has been two days after the full moon on 19.06.1970, near Börger in the Hümmling north of Sögel northnortheast of Meppen on 04.07.1987 (M. WILLIAMS in EITSCHBERGER & STEINIGER 1989) which has been one day before the increasing half moon on

05.07.1987 between the new moon on 25.07.1987 and the full moon on 11.07.1987, near Niederhaverbeck northwest of Bispingen westsouthwest of Lüneburg on 13.06.1999 (EITSCHBERGER & STEINIGER 2000b) which has been on the new moon on 13.06.1999; near Radbruch northwest of Lüneburg in the period of 11.06.1986 – 26.06.1986 (EITSCHBERGER & STEINIGER 1988) as well as on 03.06.2000 and 11.06.2000 (EITSCHBERGER & STEINIGER 2001) which has been around and between the new moon on 07.06.1986 and the full moon on 22.06.1986, one day after the new moon on 02.06.2000, and one day after the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 17.06.2000, respectively; near Lüchow north of Salzwedel on 15.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been one day after the decreasing half moon on 14.06.1974 between the full moon on 05.06.1974 and the new moon on 20.06.1974, in the Königsmoor near Stotel south of Bremerhaven on 15.06.1974 – 22.06.1974 (EITSCHBERGER & STEINIGER 1975a) which has been several days before and after the new moon on 20.06.1974, near Upjever south of Jever west of Wilhelmshaven on 16.06.1973 – 25.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been around and between the full moon on 15.06.1973 and the new moon on 30.06.1973, near Zetel southsouthwest of Wilhelmshaven on 17.07.1983 (EITSCHBERGER & STEINIGER 1985) which has been one day before the increasing half moon on 18.07.1983 between the new moon on 10.07.1983 and the full moon on 24.07.1983, and near Esens eastnortheast of Norden on 04.07.1983 – 05.07.1983 (EITSCHBERGER & STEINIGER 1985) which has been on and one day after the decreasing half moon on 04.07.1983 between the full moon on 25.06.1983 and the new moon on 10.07.1983.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the northeastern part of Germany have been verified in Berlin on 19.06.1965 (HARBICH 1967) and 16.06.1967 (CLEVE in EITSCHBERGER in HARZ 1968a) which has been five days after the full moon on 14.05.1965 as well as on the increasing half moon on 16.06.1967 between the new moon on 08.06.1967 and the full moon on 22.06.1967, respectively; in the Jungfernheide near Berlin on 09.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been one day before the full moon on 10.06.1968; near Eberswalde northnortheast of Berlin in June 1889 (ECKSTEIN 1892) which has been around and between the new moon on 29.05.1889, the full moon on 13.06.1889 and the new moon on 28.06.1889; near Waren at the Müritzsee on 03.06.1959 (EICHBAUM in KOCH 1960) and 26.06.1961 (ALBERTI in KOCH, ALBERTI & HANNEMANN 1962) which has been three days before the new moon on 06.06.1959 and two days before the full moon on 28.06.1961, respectively; near Rathenow northnorthwest of Brandenburg an der Havel in the period of 27.05.1981 – 16.06.1981 (EITSCHBERGER & STEINIGER 1983) which has been around and between the decreasing half moon on 27.05.1981 between the full moon on 18.05.1981 and the new moon on 02.06.1981 as well as the new moon on 02.06.1981 and the full moon on 17.06.1981; near Stendal westnorthwest of Brandenburg an der Havel from the beginning of June 1961 to the beginning of July 1961 (ZICKERMANN in KOCH, ALBERTI & HANNEMANN 1962) which has been around and between the full moon on 30.05.1961, the new moon on 13.06.1961, the full moon on 28.06.1961 and the new moon on 12.07.1961; near Oranienbaum southwest of Lutherstadt Wittenberg in the Elbe valley on 07.06.1995 – 08.06.1995 (EITSCHBERGER & STEINIGER 1996b) which has been on and one day after the increasing half moon on 07.06.1995 between the new moon on 29.05.1995 and the full moon on 13.06.1995, near Aken in the Elbe valley west of Dessau on 16.06.2005 (ERNST GÖRGNER in HENSLE 2006a) which has been one day after the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005; near Raben north of Lutherstadt Wittenberg in the Elbe valley in the period of 13.06.2006 – 07.07.2006 (HENSLE 2007a) which has been around and between the full moon on 11.06.2006, the new moon on 25.06.2006 and the full moon on 11.07.2006; near Perleberg northnortheast of Wittenberge in the Elbe valley on 04.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been on the full moon on 04.06.1993, near Seehausen south of Wittenberge in the Elbe valley from the end of May 1959 to the beginning of June 1959 (ENGELHARD in KOCH 1960) which has been around and between the full moon on 22.05.1959 and the new moon

on 06.06.1959, near Weinböhla northwest of Dresden in the Elbe valley on 21.06.1982 – 24.06.1982 (EITSCHBERGER & STEINIGER 1984) which has been on and several days after the new moon on 21.06.1982, near Weinböhla and Auer in the Elbe valley northwest to northnorthwest of Dresden on 10.06.1983 – 15.06.1983 (EITSCHBERGER & STEINIGER 1985) which has been before and after the new moon on 11.06.1983, near Radebeul northwest of Dresden on 26.06.1999 (EITSCHBERGER & STEINIGER 2000b) which has been two days before the full moon on 28.06.1999; near Jena in the Saale valley eastsoutheast of Weimar on 24.06.1976 – 30.06.1976 (EITSCHBERGER & STEINIGER 1977a), 23.06.1982 and 07.07.1982 (EITSCHBERGER & STEINIGER 1984), 10.07.1985 (EITSCHBERGER & STEINIGER 1987) and 16.06.1986 (EITSCHBERGER & STEINIGER 1988) which has been around and between the decreasing half moon on 20.06.1976 between the full moon on 12.06.1976 and the new moon on 27.06.1976 as well as the new moon on 27.06.1976, two days after the new moon on 21.06.1982, one day after the full moon on 06.07.1982, one day before the decreasing half moon on 11.07.1985 between the full moon on 02.07.1985 and the new moon on 17.07.1985, and on the increasing half moon between the new moon on 07.06.1986 and the full moon on 22.06.1986, respectively; near Thalbürgel eastnortheast of Jena east of the Saale valley on 05.06.1993 – 06.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been one and two days after the full moon on 04.06.1993, near Piesau east of Neuhaus am Rennweg southwest of Saalfeld in the Saale valley on 21.06.2008 – 22.06.2008 (GERD LINTZMEYER in HENSLE 2009a) which has been three and four days after the full moon on 18.06.2008; near Zeitz in the Weiße Elster valley northnortheast of Gera on 03.06.2005 and 23.06.2005 (GERD LINTZMEYER in HENSLE 2006a) and 19.06.2006 (GERD LINTZMEYER in HENSLE 2007a) which has been three days before the new moon on 06.06.2005 and one day after the full moon on 22.06.2005 as well as one day after the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, respectively; near Heinersgrün northnortheast of Hof in the Saale valley on 14.06.2001 (EITSCHBERGER & STEINIGER 2002a) which has been one day before the decreasing half moon on 15.06.2001 between the full moon on 06.06.2001 and the new moon on 21.06.2001, near Altenburg south of Leipzig on 17.06.1967 (EGON JUNGMANN in EITSCHBERGER in HARZ 1968a) which has been one day after the increasing half moon on 16.06.1967 between the new moon on 08.06.1967 and the full moon on 22.06.1967; in the Kammer forest near Altenburg south of Leipzig on 07.06.1993 (EITSCHBERGER & STEINIGER 1995a) as well as on 06.06.1994 and 19.06.1994 (EITSCHBERGER & STEINIGER 1996a) which has been three days after the full moon on 04.06.1993, three days before the new moon on 09.06.1994 and four days before the full moon on 23.06.1994, respectively; near Köckern northnorthwest of Leipzig on 03.06.2002 (EITSCHBERGER & STEINIGER 2003a) which has been on the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, in the Lucka forest near Meuselwitz southsouthwest of Leipzig on 07.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been three days after the full moon on 04.06.1993, near Wermsdorf eastsoutheast of Leipzig on 07.06.1981 (EITSCHBERGER & STEINIGER 1983) which has been five days after the new moon on 02.06.1981, near Waldenburg northnortheast of Zwickau on 04.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been one day after the increasing half moon on 03.06.1979 between the new moon on 25.05.1979 and the full moon on 10.06.1979, near Weißbach south of Zwickau in the period of 02.06.1993 – 18.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been around and between the full moon on 04.06.1993 and the new moon on 20.06.1993, near Langenbach southsoutheast of Zwickau in the period of 07.06.1993 – 16.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been around and between the full moon on 04.06.1993 and the new moon on 20.06.1993, near Bärenwalde southwest of Aue on 22.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days before the new moon on 24.06.1979, near Crinitzberg-Obercrinitz eastnortheast of Plauen on 18.06.1989 (EITSCHBERGER & STEINIGER 1990a) which has been one day before the full moon on 19.06.1989, near Sachsgrün southsouthwest of Plauen on 18.06.1994 (NOWAK 1996) which has been five days before the full moon on 23.06.1994; near Hartenstein eastsoutheast of Zwickau on 21.05.1985 (EITSCHBERGER & STEINIGER 1987) and 22.07.1987 (EITSCHBERGER & STEINIGER 1989) which has been two days after the new moon on 19.05.1985 and three days before the new moon on

25.07.1987, respectively; near Streufdorf, Völkershausen, Käßlitz and Ummerstadt southsouthwest to southsoutheast of Hildburghausen on 08.06.1994 (EITSCHBERGER & STEINIGER 1996a) which has been one day before the new moon on 09.06.1994; and near Nochten south of Weißwasser on 02.06.2006 (D. KOOP in HENSLE 2007a) which has been two days before the increasing half moon on 04.06.2006 between the new moon on 27.05.2006 and the full moon on 11.06.2006.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the southeastern part of Germany have been documented near Mährenhausen westnorthwest of Coburg on 26.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been one day before the new moon on 27.06.1976, at the Ruhberg near Marktredwitz eastnortheast of Bayreuth on 29.05.2002 (SCHMAUS in EITSCHBERGER & STEINIGER 2003a) which has been three days after the full moon on 26.05.2002; near Pechbrunn-Seibersbach southeast of Marktredwitz eastnortheast of Bayreuth in mid of June 2000 and in mid of June 2002 (HEINZ SIMECEK in EITSCHBERGER & STEINIGER 2003a) which has been around the full moon on 17.06.2000 as well as around and between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; around Wunsiedel in the Fichtelgebirge south of Hof on 20.06.1963 – 22.06.1963 (HARBICH & WITTSTADT 1964) which has been around the new moon on 21.06.1963, at Holzmühl near Marktleuthen in the Fichtelgebirge south of Hof on 30.06.2002 (EITSCHBERGER & STEINIGER 2003a) which has been two days before the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002; near Franken southeast of Weißenstadt and Marktleuthen in the Fichtelgebirge south of Hof on 18.06.2005 – 27.06.2005 (HENSLE 2006a) and 21.06.2006 – 08.07.2006 (HENSLE 2007a) which has been several days before and after the full moon on 22.06.2005 as well as around and between the new moon on 25.06.2006 and the full moon on 11.07.2006, respectively; in the Kempten forest near Durach southsoutheast of Kempten in the period of 14.07.1984 – 04.08.1984 (EITSCHBERGER & STEINIGER 1986) which has been around and between the full moon on 13.07.1984, the new moon on 28.07.1984 and the full moon on 11.08.1984; near Sachsenried eastsoutheast of Kaufbeuren on 24.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been three days before the new moon on 27.06.1976; near Jachenau east of the Walchensee northeast of Garmisch-Partenkirchen on 03.07.1971 (EITSCHBERGER 1972) and 24.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days after the increasing half moon on 01.07.1971 between the new moon on 23.06.1971 and the full moon on 08.07.1971, and on the new moon on 24.06.1979, respectively; near Sylvenstein-Vorderriß southeast of the Walchensee northeast of Garmisch-Partenkirchen on 20.06.2008 (HENSLE 2009a) which has been two days after the full moon on 18.06.2008, near Murnau am Staffelsee northnortheast of Garmisch-Partenkirchen on 16.06.2006 (I. DANIELS in HENSLE 2007a) which has been two days before the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, near Eschenlohe in the Loisach valley northnortheast of Garmisch-Partenkirchen on 20.06.2008 (HENSLE 2009a) which has been two days after the full moon on 18.06.2008; near Lenggries in the Isar valley south of Bad Tölz on 04.06.1971 (EITSCHBERGER 1972) and 24.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been four days before the full moon on 08.06.1971 and on the new moon on 24.06.1979, respectively; near Königsdorf northnorthwest of Bad Tölz on 04.06.2007 (MARKUS SCHWIBINGER in HENSLE 2008a) which has been three days after the full moon on 01.06.2007, near Weihenlinden east of Bruckmühl westnorthwest of Rosenheim in the southeastern part of Germany on 09.06.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been two days before the full moon on 11.06.2006, and between Schneizlreuth and Melleck southwest of Bad Reichenhall on 26.06.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days after the new moon on 24.06.1979.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in Austria and Switzerland have been recognized near Großgmain southsouthwest of Salzburg in the Salzach valley in the western part of Austria on 02.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days before the full moon on 04.06.1993; near Golling southsoutheast of Salzburg in

the Salzach valley in the western part of Austria on 20.06.1967 – 24.06.1967 (ULF EITSCHBERGER in HARZ 1968a) and 24.06.2006 (ERICH SCHNÖLL in HENSLE 2007a) which has been around the full moon on 22.06.1967 and one day before the new moon on 25.06.2006, respectively; near Haldenstein north of Chur in the Alpine Rhine valley in the northeastern part of Switzerland on 15.05.2005 (HENSLE 2006a), 26.06.2006 (HENSLE 2007a), 30.05.2007 (HENSLE 2008a) and 02.07.2008 (HENSLE 2009a) which has been one day before the increasing half moon on 16.05.2005 between the new moon on 08.05.2005 and the full moon on 23.05.2005, one day after the new moon on 25.06.2006, two days before the full moon on 01.06.2007 and one day before the new moon on 03.07.2008, respectively; near Flims westsouthwest of Chur in the Alpine Rhine valley in the northeastern part of Switzerland on 23.07.1970 – 02.08.1970 (EITSCHBERGER 1971a) and 15.07.1971 – 23.07.1971 (EITSCHBERGER 1972) which has been around and between the full moon on 18.07.1970 and the new moon on 02.08.1970, and around and between the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971 as well as the new moon on 22.07.1971, respectively; at the Col du Sanetsch north of Sion in the Rhône valley in the southeastern part of Switzerland on 19.07.1992 (EITSCHBERGER & STEINIGER 1994a) which has been five days after the full moon on 14.07.1992, near Simplon south of the Rhône valley southsoutheast of Brig in the southeastern part of Switzerland on 04.07.2008 (HENSLE 2009a) which has been one day after the new moon on 03.07.2008, in the Val Bavona northwest of Cavergno northwest of Locarno in the southeastern part of Switzerland on 26.06.1972 (EITSCHBERGER 1973a) which has been on the full moon on 26.06.1972, near Roveredo northeast of Bellinzona eastnortheast of Locarno in the southeastern part of Switzerland on 15.05.2002 (EITSCHBERGER & STEINIGER 2003a) which has been three days after the new moon on 12.05.2002, near Mergoscia northeast of Ascona at the Lago Maggiore in the southeastern part of Switzerland on 05.06.2007 (G. PAULUS in HENSLE 2008a) which has been four days after the full moon on 01.06.2007, near Val Bedretto southwest of Airolo in the southeastern part of Switzerland on 10.06.2007 (HENSLE 2008a) which has been two days after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and near Vicosoprano southwest of Sankt Moritz in the southeastern part of Switzerland on 16.06.2007 (HENSLE 2008a) which has been one day after the new moon on 15.06.2007.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the northeastern and southwestern parts of France have been registered near Oermingen southeast of Sarreguemines in the Sarre valley in the northeastern part of France on 09.06.1973 – 10.06.1973 (EITSCHBERGER & STEINIGER 1974b) which has been one and two days after the increasing half moon on 08.06.1973 between the new moon on 01.06.1973 and the full moon on 15.06.1973, near Verdun westnorthwest of Metz in the northeastern part of France on 18.06.2000 (EITSCHBERGER & STEINIGER 2001) which has been one day after the full moon on 17.06.2000, near Aurillac east of Bordeaux in the southwestern part of France on 09.07.1975 (EITSCHBERGER & STEINIGER 1976) which has been on the new moon on 09.07.1975; near and around Montignac, Saint-Génies, Coly and Condat-sur-Vézère westsouthwest of Brive-la-Gaillarde east of Bordeaux in the southwestern part of France on 02.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days before the full moon on 04.06.1993; and near Luz-Saint-Sauveur south of Lourdes westsouthwest of Toulouse in the southwestern part of France on 26.06.1993 – 27.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been on and one day before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 03.07.1993.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in the southeastern part of France have been noted near Clermont-Ferrand and Vichy north of Clermont-Ferrand westnorthwest and north of Lyon on 06.07.1975 – 07.07.1975 (EITSCHBERGER & STEINIGER 1976) which has been two to three days before the new moon on 09.07.1975, in the Ain valley and its surroundings westnorthwest of Bourg-en-Bresse northnortheast of Lyon on 16.06.1996 – 19.06.1996 (EITSCHBERGER & STEINIGER 1998) which has been on and a few days after the new moon

on 16.06.1996, near Saint-Maurice-Navacelles northeast of Lodève northwest of Marseille on 16.05.1997 (EITSCHBERGER & STEINIGER 1999a) which has been six days before the full moon on 22.05.1997, near Barjac northnortheast of Millau northwest of Marseille on 26.07.1972 (EITSCHBERGER 1973a) which has been on the full moon on 26.07.1972, near Vallon northwest of Millau northwest of Marseille on 20.06.1983 – 26.06.1983 (EITSCHBERGER & STEINIGER 1985) which has been around the full moon on 25.06.1983; near Apt north of Aix-en-Provence northnortheast of Marseille in the period of 10.06.1981 – 24.06.1981 (EITSCHBERGER & STEINIGER 1983) and on 14.05.2002 (EITSCHBERGER & STEINIGER 2003a) which has been around and between the increasing half moon on 10.06.1981 between the new moon on 02.06.1981 and the full moon on 17.06.1981 as well as the decreasing half moon on 26.06.1981 between the full moon on 17.06.1981 and the new moon on 01.07.1981, and two days after the new moon on 12.05.2002, respectively; near Rians northnortheast of Aix-en-Provence northnortheast of Marseille and at the Col de Babaou eastnortheast of Hyères eastnortheast of Toulon on 12.05.2002 – 14.05.2002 (EITSCHBERGER & STEINIGER 2003a) which has been on and several days after the new moon on 12.05.2002, near Digne-les-Bains northwest of Cannes on 14.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been one day before the full moon on 15.06.1973, near Les Mées westsouthwest of Digne-les-Bains northwest of Cannes on 29.05.1972 – 09.06.1972 (EITSCHBERGER 1973a) which has been around and between the full moon on 28.05.1972 and the new moon on 11.06.1972, near Saint-André-les-Alpes southeast of Digne-les-Bains northwest of Cannes on 19.07.1978 – 29.07.1978 (EITSCHBERGER & STEINIGER 1979) which has been around and between the full moon on 20.07.1978 as well as the decreasing half moon on 27.07.1978 between the full moon on 20.07.1978 and the new moon on 03.08.1978, at the Col du Pillon westnorthwest of Grasse northwest of Cannes on 20.07.1978 (EITSCHBERGER & STEINIGER 1979) which has been on the full moon on 20.07.1978, near Saint-Auban northwest of Grasse northwest of Cannes on 10.07.1978 (EITSCHBERGER & STEINIGER 1979) which has been five days after the new moon on 05.07.1978, at the Massif de l´Esterel eastsoutheast of Les Adrets-de-l´Esterel westnorthwest of Cannes on 29.05.1972 (EITSCHBERGER 1973a) which has been one day after the full moon on 28.05.1972, and near the Col de Vence northnorthwest of Vence northwest of Nice on 27.05.1985 – 03.06.1985 (EITSCHBERGER & STEINIGER 1987) which has been around and between the increasing half moon on 28.05.1985 between the new moon on 19.05.1985 and the full moon on 03.06.1985 as well as the full moon on 03.06.1985.

Mass occurrences of large quantities of individuals of the Black-Veined White *Aporia crataegi* in Italy, Poland, Hungary and Croatia have been recorded near Schluderns in the Etsch valley west of Merano in Southern Tyrol in the northeastern part of Italy in the period of 15.06.1967 – 02.07.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been around and between the increasing half moon on 16.06.1967 between the new moon on 08.06.1967 and the full moon on 22.06.1967 as well as the decreasing half moon on 30.06.1967 between the full moon on 22.06.1967 and the new moon on 07.07.1967, near Taufers im Münstertal west of Merano in Southern Tyrol in the northeastern part of Italy on 05.07.1970 (EITSCHBERGER 1971a) which has been two days after the new moon on 03.07.1970, in the Val d´Ampola near the road to the Passo di Tremalzo west of the Lago di Garda eastnortheast of Milano in the northeastern part of Italy on 04.07.1972 (EITSCHBERGER 1973a) which has been one day before the decreasing half moon on 05.07.1972 between the full moon on 26.06.1972 and the new moon on 10.07.1972, near the former forester´s district Tryszyn (formerly Trischin) north of Bydgoszcz (formerly Bromberg) in the northwestern part of Poland on 23.06.1916 – 25.06.1916 (BURKHARDT 1916) which has been on and after the decreasing half moon on 23.06.1916 between the full moon on 16.06.1916 and the new moon on 30.06.1916, in the vicinity of Eger in the surroundings of the Mátra Mountains northeast of Budapest in the northeastern part of Hungary at the end of May 1906 (AIGNER-ABAFI 1907) which has been around and between the new moon on 23.05.1906 and the full moon on 06.06.1906, in Vukovar in the Danube valley southsoutheast of Osijek east of Zagreb in the northern part of Croatia on 03.06.1913 (SCHWEPPENBURG 1917) which has been one day before the new moon on 04.06.1913; and between Varazdin and

Osijek north and east, respectively, of Zagreb in the northern part of Croatia on 30.05.1972 (O. BAUER in EITSCHBERGER 1973a) which has been two days after the full moon on 28.05.1972. The peak emergence of the Black-Veined White *Aporia crataegi* has been documented by STELLWAAG (1924) in a cultivation in Haßloch westnorthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where he has noted the peak appearance of individuals on 25.05.1921 – 26.05.1921 which has been four and five days after the new moon on 21.05.1921.

Various examples of mass flights of the Black-Veined White *Aporia crataegi* from the older literature are compiled and quoted in BLUNCK & WILBERT (1962).

5.8 Normal and black individuals of the Marbled White *Melanargia galathea* based on own observations

In 2008, some single individuals of the Marbled White *Melanargia galathea* LINNAEUS 1758 (Lepidoptera: Satyridae) have occasionally flown at the localities Walldorf, Nußloch and Tairnbach since early June 2008, whereas around the full moon on 18.06.2008, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Marbled White *Melanargia galathea* in Walldorf, Nußloch and Tairnbach around the full moon on 18.06.2008 has taken place at the beginning of the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 which has started on the full moon on 18.06.2008 and has ended after the new moon on 03.07.2008.

In 2009, some single individuals of the Marbled White *Melanargia galathea* have occasionally flown at the localities Walldorf, Nußloch and Tairnbach since mid of June 2009, whereas a few days before the new moon on 22.06.2009, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline, with only a few single individuals having still been present several days after the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009, and no more individuals having been discovered some days before the full moon on 06.08.2009.

Among hundreds of individuals of the Marbled White *Melanargia galathea,* I have seen only once each in 2008 and 2009 a single anomalous individual of a black variation where both the white and black fields of the chessboard structure have been underlain by a black background in such a manner that the whole individuals have appeared in black colour during their flight among the white and yellowish white normal individuals with black and white patches. The black variation of the Marbled White *Melanargia galathea* could be confused with the Ringlet *Aphantopus hyperantus* at the first glimpse of the flying individual, but a second look permits to clearly notice the typical chessboard structure of light and dark fields even in the negro forms of the Marbled White *Melanargia galathea,* and also the flight pattern of the Ringlet *Aphantopus hyperantus* is different from that of the Marbled White *Melanargia galathea.*

5.9 Normal and black individuals of the Marbled White *Melanargia galathea* based on literature evaluation

Mass occurrences of large quantities of individuals of the Marbled White *Melanargia galathea* LINNAEUS 1758 (Lepidoptera: Satyridae) in the southwestern part of Germany have been reported from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 50 individuals have flown on 22.06.1992 (BROSZKUS 1995) and 200 individuals have flown on 04.07.1993 (S. JOUAUX in

Broszkus 1995) which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992 as well as on the full moon on 04.07.1993, respectively; from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach where 50 individuals, 100 individuals and 1.000 individuals have flown on 22.06.1992, 16.07.1992 and 02.07.1993 (Broszkus 1995) which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, two days after the full moon on 14.07.1992 and two days before the full moon on 04.07.1993, respectively; from Obertalheim northnorthwest of Horb am Neckar in the southern part of the Neckar valley where abt. 200 individuals have flown on 10.06.1966 (Schulmeister 1966) which has been two days before the decreasing half moon on 12.06.1966 between the full moon on 03.06.1966 and the new moon on 18.06.1966, from the vicinity of Markdorf northwest of Friedrichshafen at Lake Constance where abundant individuals have flown on 07.06.1921 (Gremminger 1925) which has been one day after the new moon on 06.06.1921, and from the vicinity of Konstanz at Lake Constance where masses of individuals have flown in the period of 01.07.1937 – 16.07.1937 (Hans Reithinger in Wenzel 1937a) which has been around and between the decreasing half moon on 02.07.1937 between the full moon on 24.06.1937 and the new moon on 08.07.1937 as well as the increasing half moon on 16.07.1937 between the new moon on 08.07.1937 and the full moon on 23.07.1937.

Mass occurrences of large quantities of individuals of the Marbled White *Melanargia galathea* in the northwestern part of Germany have been documented in the Zahrenser Bruch near Schneverdingen southsouthwest of Hamburg where masses of individuals have flown on 12.07.1947 – 14.07.1947 (Warnecke 1955) which has been on and a few days after the decreasing half moon on 12.07.1947 between the full moon on 03.07.1947 and the new moon on 18.07.1947, in the Judenbektal near Ratzeburg southsoutheast of Lübeck where very abundant individuals have flown on 18.07.1943 (Warnecke 1955) which has been one day after the new moon on 17.07.1943, at the Süselberg near Niederndorf south of Freudenberg west of Siegen where abt. 45 – 50 individuals have flown on 17.07.1991 (Fieber 1992) which has been two days before the increasing half moon on 19.07.1991 between the new moon on 11.07.1991 and the full moon on 26.07.1991; in the Dornbruch near Olpe northnorthwest of Siegen in the northwestern part of Germany where abundant individuals have flown on 07.08.1958 (Martin Jung in Harkort 1976) which has been one day before the decreasing half moon on 08.08.1958 between the full moon on 30.07.1958 and the new moon on 15.08.1958, near Littfeld eastsoutheast of Olpe northnorthwest of Siegen in the northwestern part of Germany where abundant individuals have flown on 07.07.1957 (Martin Jung in Harkort 1976) which has been five days before the full moon on 12.07.1957, near Flammersbach southwest of Haiger southeast of Siegen and near Freusburg north of Kirchen southwest of Siegen where abt. 30 individuals each have flown on 21.07.1991 and 22.07.1991, respectively (Fieber 1992), which has been two and three days after the increasing half moon on 19.07.1991 between the new moon on 11.07.1991 and the full moon on 26.07.1991, respectively; near the districts Rath and Heumar at the southeastern margin of the city of Cologne in the Middle Rhine valley where at least 20 individuals have flown on 15.07.2008 (Hanisch 2009) which has been three days before the full moon on 18.07.2008; in the districts Sürth and Godorf at the southern margin of the city of Cologne in the Middle Rhine valley where abt. 130 individuals, abt. 340 individals and abt. 110 individuals have flown on 07.07.1992, 23.06.1993 and 06.07.1995, respectively (W. Halfenberg in Hanisch 2009), which has been one day before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, three days after the new moon on 20.06.1993, and on the increasing half moon on 06.07.1995 between the new moon on 29.04.1995 and the full moon on 12.07.1995, respectively; in the district Hahnwald at the southern margin of the city of Cologne in the Middle Rhine valley where abt. 100 individuals have flown on 23.06.1993 (W. Halfenberg in Hanisch 2009) which has been three days after the new moon on 20.06.1993; in the districts Porz and Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley where abt. 100 individuals have been counted within half an hour on

29.06.2009 (HANISCH 2009) which has been on the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009, in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley where abundant individuals have flown on 11.05.2008 (HANISCH 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008; in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 300 individuals each have flown on 15.07.2009 (HANISCH 2009, HORST GÜNTER NEUHOFF in HANISCH 2009) and 22.07.2009 (HANISCH 2009, DIRK FERBER in HANISCH 2009), respectively, which has been on the decreasing half moon on 15.07.2009 between the full moon on 07.07.2009 and the new moon on 22.07.2009 as well as on the new moon on 22.07.2009, respectively; in the Naafbachtal southeast of Overath east of Cologne where 25 individuals each, more than 90 individuals and 35 individuals have flown on 12.07.1996, 19.07.1996, 27.07.1996 and 31.07.1996, respectively (SCHÖPWINKEL 1997), which has been three days before and four days after the new moon on 15.07.1996, and three days before and one day after the full moon on 30.07.1996, respectively; and near Dover southeast of London in the southeastern part of England where masses of individuals have flown on 24.09.1919 (MATHEW 1919) which has been on the new moon on 24.09.1919.

Mass occurrences of large quantities of individuals of the Marbled White *Melanargia galathea* in the western part of Germany have been observed in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 30 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 50 individuals have flown on 28.07.1990 (KINKLER & HÜRTER 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where more than 10 individuals have flown on 28.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been two days after the full moon on 26.07.1991; and near Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 200 individuals and 150 individuals have flown on 06.07.1994 and 11.07.1994, respectively (BROSZKUS 1995) which has been three days before and two days after the new moon on 09.07.1994, respectively.

Similar melanistic individuals of the Marbled White *Melanargia galathea* as I have observed in Walldorf have been described as aberratio *hades* (REISS 1961) or forma *nigrata* (SCHRÖDER 1924) and have also been compared with the Ringlet *Aphantopus hyperantus* (WEYMER 1863a). Similar darkened and almost completely black individuals of the Marbled White *Melanargia galathea* as I have observed in Walldorf have also been captured twice near Oberkalbach south of Fulda (KLAUS NIMMERFROH in REISS 1961), once near Hilden southsoutheast of Düsseldorf (WEYMER 1863a), several times near Eller at the southeastern margin of the city of Düsseldorf (VOSS 1932, ZIELASKOWSKI 1951), once in the district Düsseltal in the northern part of the city of Düsseldorf (EDMUND MASSEAU in VOSS 1932), occasionally around Mainz and Wiesbaden (REICHENAU 1904), once in the Kaiserstuhl northwest of Freiburg im Breisgau (SCHRÖDER 1924), several times near Landau in der Pfalz (LATTIN, JÖST & HEUSER 1957); and occasionally in Rheinland-Pfalz, Nordrhein-Westfalen, Brandenburg, Saxonia and Silesia (STANDFUSS 1896), whereas DIEROFF (1909) has not discovered any black individual of the Marbled White *Melanargia galathea* among thousands of normal individuals which he has observed during the course of many years. A half-side combination of a normal individual and a melanistic individual the Marbled White *Melanargia galathea* has been figured by WITT (1972), with the melanistic half corresponding to the aberratio *hades* of REISS (1972), the forma *nigrata* of SCHRÖDER (1924) and the black variation which I have seen. Aspects of melanism and nigrism of the Marbled White *Melanargia galathea* have also been discussed by REICHL (1975) and WAGENER (1998). The capture of a smoky individual of the Marbled White *Melanargia gala-*

thea has been mentioned by MARCON (1975).

Similarly as I have seen only once each in 2008 and 2009 a single anomalous individual of a black variation among hundreds of white and yellowish white normal individuals of the Marbled White *Melanargia galathea*, EITSCHBERGER & LUKHTANOV (1992) have reported the observation and capture of a single totally melanistic individual among hundreds of normal white individuals of the Black-Veined White *Aporia crataegi,* whereas EITSCHBERGER & REISSINGER (1971) have not mentioned the occurrence of any dark individual of the Black-Veined White *Aporia crataegi* after having seen a broad abundance of specimens both in the field and in various collections.

DIEROFF (1909) has mentioned the occasional occurrence of completely black individuals of the Green-Veined White *Pieris napi*. MICHAEL KRAHL and M. TRAMPENAU (in EITSCHBERGER & STEINIGER 2003a) have discovered two totally melanistic individuals of the Pale Clouded Yellow *Colias hyale* among abundant normal yellow individuals near Pfaffendorf southwest of Görlitz in the northeastern part of Germany, and such entirely black individuals of the Pale Clouded Yellow *Colias hyale* have been described as aberratio *atava* (REUTTI 1898; figure in EBERT & RENNWALD 1991).

SPENGEL (1899), DIEROFF (1909), GUTH (1925) and STROBEL (1960, 1968) have reported the occasional occurrence of completely nigristic individuals of the Swallowtail *Papilio machaon*, and such totally black individuals of the Swallowtail *Papilio machaon* have been described as aberratio *niger* (REUTTI 1898; figure in EBERT & RENNWALD 1991) or aberratio *nigra* (SPENGEL 1899).

5.10 The Peacock Butterfly *Inachis io* based on own observations

In 2008, some single individuals of the aestival generation of the Peacock Butterfly *Inachis io* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have occasionally flown at the locality Nußloch since mid of June 2008, whereas on the day after the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Peacock Butterfly *Inachis io* in Nußloch around the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008 has taken place within the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 which has started on the full moon on 18.06.2008 and has ended after the new moon on 03.07.2008.

In 2009, some single individuals of the aestival generation of the Peacock Butterfly *Inachis io* have occasionally flown at the localities Nußloch and Tairnbach since mid of June 2009, whereas around the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline, with only a few single individuals having still been present several days after the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009, and no more individuals having been discovered some days before the full moon on 06.08.2009.

A second peak of the aestival generation of the Peacock Butterfly *Inachis io* has started to develop a few days after the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009 when after more than one week of interruption of occurrence, almost suddenly again quite some individuals have flown across the meadows around the airfield at the eastern margin of Walldorf and also across the meadows near the margin of the forest in Nußloch, and on the new moon on 20.08.2009, an increasing amount of individuals has already been esta-

blished at the localities Nußloch, Tairnbach and Walldorf. On the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009, numerous individuals of the Peacock Butterfly *Inachis io* have flown along the margin of the forest and across the meadows at the locality Tairnbach, and one day after the increasing half moon on 27.08.2009, also numerous individuals have flown through the vineyards and across the meadows near the margin of the forest at the locality Nußloch where the frequency of individuals has again considerably increased around the full moon on 04.09.2009. The numerous individuals of the Peacock Butterfly *Inachis io* at the locality Nußloch on and after the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009 as well as around the full moon on 04.09.2009 have particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards, with many individuals having sucked juice of overmature grapes and plums. The numerous individuals of the Peacock Butterfly *Inachis io* that have flown particularly frequently in the vineyards as well as around plum trees and bee hives in the meadows around the full moon on 04.09.2009 have been accompanied by various individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* and have also been associated with numerous individuals of the Speckled Wood *Pararge aegeria* and the Green Hawker *Aeshna viridis*. Frequency, behaviour and assemblage of the individuals of the Peacock Butterfly *Inachis io* as outlined above have continued and persisted beyond the decreasing half moon on 12.09.2009 until the new moon on 18.09.2009, and after the new moon on 18.09.2009, the abundance of individuals has started to decline, with only quite some individuals still having been present around the increasing half moon on 26.09.2009 and around the full moon on 04.10.2009, and after the full moon on 04.10.2009, the frequency of individuals has decreased further.

5.11 The Peacock Butterfly *Inachis io* based on literature evaluation

Mass flights of several hundreds or thousands of individuals of the Peacock Butterfly *Inachis io* Linnaeus 1758 (Lepidoptera: Nymphalidae) in the southwestern part of Germany have been observed near Pforzheim in the Enz valley eastsoutheast of Karlsruhe where abundant individuals have flown on 28.07.1973 (Eitschberger & Steiniger 1974b) which has been one day before the new moon on 29.07.1973, near Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg where 200 individuals have flown on 04.10.1966 (Heinz Gleffe in Harz 1967a) which has been five days after the full moon on 29.09.1966, and near Schopfheim in the Wiese valley in the southern part of the Black Forest eastnortheast of Lörrach where large amounts of individuals have flown on 09.08.1996 (D. Fritsch in Hensle 2000b) which has been two days after the decreasing half moon on 07.08.1996 between the full moon on 30.07.1996 and the new moon on 14.08.1996.

Mass flights of several hundreds or thousands of individuals of the Peacock Butterfly *Inachis io* in the southeastern part of Germany have been recorded in the Wertach valley around Kaufbeuren where hundreds of individuals have flown and have sit on flowers on 20.04.1996 – 22.04.1996 (Schubert 1997) which has been two to four days after the new moon on 18.04.1996; in the Gennachmoor and around the Alpsee in the vicinity of Füssen where abt. 200 – 325 individuals have flown and have sit on flowers daily on 01.08.1995, 10.08.1995 and other days in early August 1995 (Schubert 1997) which has been around and between the new moon on 27.07.1995 and the full moon on 10.08.1995; near Hopferau northwest of Füssen where abundant individuals have flown on 24.08.1995 (Schubert 1997) which has been two days before the new moon on 26.08.1995, near Berglern in the Isar valley northeast of München where abundant individuals have flown on 30.07.1973 (Eitschberger & Steiniger 1974b) which has been one day after the new moon on 29.07.1973, near Garching in the Isar valley northnortheast of München where abt. 320 individuals have flown on 10.09.2008 (Markus Schwibinger in Hensle 2009a) which has been five days before

the full moon on 15.09.2008, near Petershausen northnorthwest of München where abt. 200 individuals have flown on 18.09.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been three days after the full moon on 15.09.2008, at the Purtscheller Haus near Berchtesgaden where abt. 900 individuals have flown on 07.08.1973 (EITSCHBERGER & STEINIGER 1974b) which has been one day after the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, within and around Frauenau southeast of Zwiesel northeast of Deggendorf where several hundreds or even thousands of individuals have flown on 09.08.1996 – 11.08.1996 (HEINZE 1996) which has been three to five days before the new moon on 14.08.1996; and around Egglfing am Inn south of Bad Füssing southwest of Passau where abt. 150 individuals each have flown on 29.07.1979 and 02.08.1979 (REICHHOLF 1981) which has been five days after the new moon on 24.07.1979 as well as one day before the increasing half moon on 03.08.1979 between the new moon on 24.07.1979 and the full moon on 08.08.1979, respectively.

Mass flights of several hundreds or thousands of individuals of the Peacock Butterfly *Inachis io* in the northwestern part of Germany have been registered between Clausthal-Zellerfeld and Altenau in the western part of the Harz where more than 900 individuals have flown on 12.08.1973 (EITSCHBERGER & STEINIGER 1974b) which has been two days before the full moon on 14.08.1973, in Wolfenbüttel south of Braunschweig where abt. 100 individuals have flown on 02.08.2002 (HENSLE 2003) which has been one day after the decreasing half moon on 01.08.2002 between the full moon on 24.07.2002 and the new moon on 08.08.2002, around Clausthal-Zellerfeld and Bad Grund south-southwest of Goslar in the northwestern part of the Harz where abt. 600 individuals have been counted in the period of 06.08.1976 – 14.08.1976 (EITSCHBERGER & STEINIGER 1977c) which has been around the full moon on 10.08.1976, in Lage eastsoutheast of Bielefeld where abt. 100 individuals have flown on 29.07.2002 (HENSLE 2003) which has been five days after the full moon on 24.07.2002, between the island Föhr and Dagebüll northwest of Husum at the coast of the North Sea where abundant individuals have flown on 13.08.1969 (EITSCHBERGER 1970a) which has been on the new moon on 13.08.1969, on the Hallig Gröde northwest of Husum at the coast of the North Sea where thousands of individuals have flown and have sucked on flowers on 29.07.1995 (K. FLEETH in HENSLE 2000a) which has been two days after the new moon on 27.07.1995, on the island Sylt westnorthwest of Flensburg at the coast of the North Sea where abt. 200 individuals have flown and have sucked on flowers in Königshafen on 07.08.1975 (STEINIGER & EITSCHBERGER 1976a) which has been on the new moon on 07.08.1975, on the island Neuwerk northwest of Cuxhaven at the coast of the North Sea where thousands of individuals have flown and have sucked on flowers on 30.07.1995 (B. ALBERS in HENSLE 2000a) which has been three days after the new moon on 27.07.1995; on the island Helgoland in the North Sea northnorthwest of Bremerhaven where masses of individuals have flown in August 1938 (CASPERS in WARNECKE 1955) which has been around and between the new moon on 27.07.1938, the full moon on 11.08.1938 and the new moon on 25.08.1938; within the city of Hamburg at the coast of the North Sea where thousands of individuals have flown on 31.07.1995 – 06.08.1995 (R. MISFELDT in HENSLE 2000a) which has been around and between the new moon on 27.07.1995 and the full moon on 10.08.1995, near Aarhus at the coast of Baltic Sea in the western part of Denmark where abt. 200 individuals have flown on 04.08.2002 (HENSLE 2003) which has been four days before the new moon on 08.08.2002, and near Travemünde northeast of Lübeck at the coast of the Baltic Sea where abundant individuals have flown on 02.08.1969 and adjacent days (KARL CLEVE in EITSCHBERGER 1970a) which has been several days after the full moon on 29.07.1969.

Mass flights of several hundreds or thousands of individuals of the Peacock Butterfly *Inachis io* in the northeastern part of Germany have been recognized near Warnemünde north of Rostock at the coast of the Baltic Sea where abt. 70 individuals have flown on 22.08.1996 – 23.08.1996 (HENSLE 2000b) which has been on and one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, near Warnemünde north of Rostock at

the coast of the Baltic Sea where more than 300 individuals have flown in the last third of August 1996 (RUDNICK 1998) which has been around and between the new moon on 14.08.1996 and the full moon on 28.08.1996, in Boltenhagen northnortheast of Klütz westnorthwest of Wismar at the coast of the Baltic Sea where more than 400 individuals have flown on 26.07.1995 – 27.07.1995 (HENSLE 2000a) which has been on and one day before the new moon on 27.07.1995, at the Buger Hals in the northwestern part of the island Rügen at the coast of the Baltic Sea where more than 120 individuals have flown on 28.07.2002 (HENSLE 2003) which has been four days after the full moon on 24.07.2002, near Prora northnorthwest of Binz in the eastern part of the island Rügen at the coast of the Baltic Sea where abt. 100 individuals have flown on 21.07.2007 and abundant individuals have also flown at other localities around Prora around 21.07.2007 (DIETRICH RÖHRBEIN in HENSLE 2008a) which has been one day before the increasing half moon on 22.07.2007 between the new moon on 14.07.2007 and the full moon on 30.07.2007, in Raben north of Lutherstadt Wittenberg in the Elbe valley where abt. 100 individuals have flown on 18.07.2005 (HENSLE 2006a) which has been three days before the full moon on 21.07.2005, within and around Altenburg south of Leipzig where thousands of individuals have flown on 17.07.1995 – 19.07.1995 (HENSLE 2000a) which has been one to three days before the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995, near Reitzenhain east of Annaberg-Buchholz in the Erzgebirge where millions of individuals have flown on 18.08.1996 – 20.08.1996 (HENSLE 2000b) which has been four to six days after the new moon on 14.08.1996; around Wansdorf and Pausin westnorthwest of Berlin where abt. 70 individuals in total have flown in the period of 31.03.2007 – 23.04.2007 (HENSLE 2008a) which has been around and between the full moon on 02.04.2007, the new moon on 17.04.2007, and the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007; within and around Berlin and Potsdam where thousands of individuals have flown in the period of 18.07.1995 – 31.07.1995 (HENSLE 2000a) which has been several days before and after the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995 as well as around the new moon on 27.07.1995, near Satzung eastsoutheast of Annaberg-Buchholz where several hundreds of individuals daily have flown on 14.08.1991 – 16.08.1991 (SAEMANN 1992) which has been several days after the new moon on 10.08.1991, near Claußnitz north of Chemnitz where several thousands of individuals have flown on 21.07.1995 (WEISE 1996) which has been one day after the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995, and near Rosenhain northeast of Löbau westsouthwest of Görlitz where more than 500 individuals in total have flown on 25.07.1966 and adjacent days (HEINZ GLEFFE in HARZ 1967a) which has been on and around the increasing half moon on 25.07.1966 between the new moon on 18.07.1966 and the full moon on 01.08.1966.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in the southwestern, central and southeastern parts of Germany have also been confirmed in Mosbach in the Neckar valley east of Heidelberg in the southwestern part of Germany where 10 individuals have flown on 17.10.1966 (HEINZ GLEFFE in HARZ 1967a) which has been three days after the new moon on 14.10.1966, in Kirchheim unter Teck southeast of Stuttgart in the southwestern part of Germany where 20 individuals have been observed on 21.06.2003 (HENSLE 2004a) which has been on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, near Offenburg-Bühl in the southern part of the Upper Rhine valley in the southwestern part of Germany where more than 10 individuals have flown on 01.09.2008 (HENSLE 2009a) which has been two days after the new moon on 30.08.2008; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals and 25 individuals have flown on 09.04.1993 and 24.04.1994, respectively (S. JOUAUX in BROSZKUS 1995), which has been three days after the full moon on 06.04.1993 and one day before the full moon on 25.04.1994, respectively; near Schweinfurt northnortheast of Würzburg in the Main valley in the central part of Germany where more than 10 individuals have flown on 10.05.1970 (GLEFFE 1971) which has been

five days after the new moon on 05.05.1970, near Amöneburg east of Marburg in the Lahn valley in the central part of Germany where abt. 15 individuals have flown on 12.07.1974 (ZUCCHI 1975a) which has been one day before the decreasing half moon on 13.07.1974 between the full moon on 04.07.1974 and the new moon on 19.07.1974, and near Weißenstadt northwest of Wunsiedel in the Fichtelgebirge in the southeastern part of Germany where abt. 50 individuals have flown on 03.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been two days before the new moon on 05.08.1986.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in the western part of Germany have also been noticed in Arzbach in the southwestern part of the Westerwald eastnortheast of Koblenz where abt. 35 individuals have been registered on 20.07.1995 (J. ROSENBAUM in HENSLE 2000a) which has been on the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 25 individuals each have flown on 22.07.1991 and 28.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been four days before and two days after the full moon on 26.07.1991, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 10 individuals have flown on 21.07.1994 (BROSZKUS 1995) which has been one day before the full moon on 22.07.1994, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 50 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 12 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, near Bad Neuenahr-Ahrweiler in the Ahr valley in the northeastern part of the Eifel where abt. 35 individuals have been marked on 06.08.1976 – 11.08.1976 (EITSCHBERGER & STEINIGER 1977c) which has been around the full moon on 10.08.1976, and near Rech in the Ahr valley westsouthwest of Bad-Neuenahr-Ahrweiler in the northeastern part of the Eifel where 12 individuals have flown on 18.04.2008 (HEINZ STETZUHN in BOSSELMANN 2009) which has been three days before the full moon on 21.04.2008.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in the northwestern part of Germany have also been recorded in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 02.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992, near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where more than 20 individuals have flown on 15.08.1981 (WALFORT 1983) which has been on the full moon on 15.08.1981, near Gelting eastsoutheast of Flensburg at the coast of the Baltic Sea where abt. 25 individuals have flown on 19.07.2007 (D. SCHMIDT in HENSLE 2008a) which has been five days after the new moon on 14.07.2007, on the island Scharhörn northwest of Cuxhaven at the coast of the North Sea where abundant individuals have flown on 20.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been three days before the full moon on 23.08.1983, near Weißenhaus westnorthwest of Oldenburg in Holstein at the coast of the Baltic Sea where 70 individuals have flown on 01.08.2007 (HENSLE 2008a) which has been two days after the full moon on 30.07.2007, near Süsel southwest of Neustadt in Holstein at the coast of the Baltic Sea where 40 individuals have flown on 04.08.2007 (HENSLE 2008a) which has been one day before the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007, near Kanalpolder at the Dollart south of Emden at the coast of the North Sea where abt. 20 individuals have flown and have sit on flowers on 15.04.2007 (H. VON GÖNS in HENSLE 2008a) which has been one day after the new moon on 14.07.2007, and in the northern part of the Senne south of Augustdorf southeast of Bielefeld where abt. 40 individuals have flown on 21.08.1965 (HARBICH 1967) which has been five days before the new moon on 26.08.1965.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in the northeastern part of Germany have also been registered near Rostock and Warnemünde north of Rostock at the coast of the Baltic Sea where abundant individuals each have flown on 24.07.1994 (RUDNICK 1996a) and 01.06.2008 (E. HOSA in HENSLE 2009a) which has been two days after the full moon on 22.07.1994 and two days before the new moon on 03.06.2008, respectively; near Warnemünde north of Rostock at the coast of the Baltic Sea where 30 individuals have flown in the last third of April 1996 (RUDNICK 1998) which has been around and between the new moon on 18.04.1996 and the full moon on 03.05.1996; near Rerik west of Rostock at the coast of the Baltic Sea where more than 15 individuals in total have flown on 17.07.2006 and 21.07.2006 (HENSLE 2007a) which has been on the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006 as well as three days before the new moon on 24.07.2006, respectively; near Prora northnorthwest of Binz in the eastern part of the island Rügen at the coast of the Baltic Sea where 50 individuals have been counted on 31.07.2005 (DIETRICH RÖHRBEIN in HENSLE 2006a) which has been three days after the decreasing half moon on 28.07.2005 between the full moon on 21.07.2005 and the new moon on 05.08.2005, near Lubmin eastnortheast of Greifswald at the coast of the Baltic Sea where 20 individuals have been noticed on 01.08.2005 (HENSLE 2006a) which has been four days before the new moon on 05.08.2005, near Zingst on the Zingst northwest of Stralsund at the coast of the Baltic Sea where 100 individuals have been registered on 03.08.2005 (HENSLE 2006a) which has been two days before the new moon on 05.08.2005, near Heringsdorf on the island Usedom eastsoutheast of Wolgast at the coast of the Baltic Sea where 50 individuals have been recorded on 04.08.2005 (HENSLE 2006a) which has been one day before the new moon on 05.08.2005, near Frankfurt an der Oder east of Berlin where 50 individuals have been observed on 06.08.2005 (M. KÖPPEN in HENSLE 2006a) which has been one day after the new moon on 05.08.2005, and in the Fläming around Niemegk and Belzig southsouthwest of Potsdam where abt. 50 individuals have flown on 12.09.2006 (HENSLE 2007a) which has been two days before the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in Austria have also been recorded near Kalbling southeast of Admont in the Enns valley eastnortheast of Liezen in the central part of Austria where 50 individuals have flown on 02.08.1998 (HENSLE 2001f) which has been one day after the increasing half moon on 01.08.1998 between the new moon on 23.07.1998 and the full moon on 08.08.1998; near Gumpoldskirchen northnortheast of Baden southsouthwest of Vienna (CHRISTOPHER RABL in HENSLE 2007a) and near Knittelfeld in the Mur valley southwest of Leoben (HENSLE 2007a) in the eastern part of Austria where abt. 15 individuals and 20 individuals, respectively, have flown on 27.03.2006 which has been two days before the new moon on 29.03.2006; near Gosdorf eastsoutheast of Leibnitz in the southern part of Austria where 10 individuals have flown on 13.03.2008 (HENSLE 2009a) which has been one day before the increasing half moon on 14.03.2008 between the new moon on 07.03.2008 and the full moon on 21.03.2008, and in Kranebitten west of Innsbruck in the Inn valley in the western part of Austria where abundant individuals have flown and have sucked on flowers on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977.

Significant numbers of individuals of the Peacock Butterfly *Inachis io* in France and England have also been observed around Les Hautes Huttes and Hohrodberg northnorthwest of Munster in the southern part of the Vosges west of Colmar in the northeastern part of France where more than 20 individuals have flown on 22.07.2000 (HENSLE 2001b) which has been three days before the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000, and near Bexhill eastnortheast of Eastbourne southsoutheast of London in the southeastern part of England where numerous individuals have flown on 08.08.1924 (PEILE 1924) which has been one day before the increasing half moon on 09.08.1924 between the new moon on 31.07.1924 and the full moon on 14.08.1924.

5.12 The Brimstone *Gonepteryx rhamni* and the Silver-Washed Fritillary *Argynnis paphia* based on own observations

In 2008, some single individuals of the Brimstone *Gonepteryx rhamni* LINNAEUS 1758 (Lepidoptera: Pieridae) and the Silver-Washed Fritillary *Argynnis paphia* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have occasionally flown at the localities Nußloch, Rot and Tairnbach since the end of June 2008, whereas shortly after the new moon on 03.07.2008, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Brimstone *Gonepteryx rhamni* and the Silver-Washed Fritillary *Argynnis paphia* in Nußloch, Rot and Tairnbach around the new moon on 03.07.2008 has taken place at the end of the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 which has started on the full moon on 18.06.2008 and has ended after the new moon on 03.07.2008.

In 2007, the occurrence of numerous individuals of the Brimstone *Gonepteryx rhamni* and the Silver-Washed Fritillary *Argynnis paphia* has been observed at several localities around Calmbach and Wildbad in the Enz valley southsouthwest of Pforzheim in the northern part of the Black Forest in the southwestern part of Germany around the new moon on 13.08.2007 as well as around Abreschwiller in the Sarre valley south of Sarrebourg in the northern part of the Vosges in the northeastern part of France after the new moon on 14.07.2007 and around the new moon on 13.08.2007.

In 2009, some single individuals of the Silver-Washed Fritillary *Argynnis paphia* have occasionally flown at the localities Nußloch, Tairnbach and Walldorf since the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009, whereas several days after the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009, almost suddenly numerous individuals have appeared at the locality Tairnbach, and abt. one week to ten days later, the number of individuals has again started to decline, with only some single individuals having still been present around the new moon on 20.08.2009 as well as around the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009, and no more individuals having been discovered after the full moon on 04.09.2009.

5.13 The Brimstone *Gonepteryx rhamni* based on literature evaluation

Mass occurrences of large quantities of individuals of the Brimstone *Gonepteryx rhamni* LINNAEUS 1758 (Lepidoptera: Pieridae) in the northwestern part of Germany have been mentioned from the Hallig Gröde northwest of Husum at the coast of the North Sea where abundant individuals have flown from 06.08.1996 onwards (EITSCHBERGER & STEINIGER 1998) which has been one day before the decreasing half moon on 07.08.1996 between the full moon on 30.07.1996 and the new moon on 14.08.1996, from Travemünde northeast of Lübeck where abundant individuals have flown on 02.08.1969 and adjacent days (KARL CLEVE in EITSCHBERGER 1970a) which has been several days after the full moon on 29.07.1969, from Alt Garge eastsoutheast of Bleckede in the Elbe valley eastnortheast of Lüneburg where abt. 100 individuals have flown on 16.07.2007 (HENSLE 2008a) which has been two days after the new moon on 14.07.2007, from Hannover-Kananohe in the Leine valley where abt. 200 – 300 individuals have been estimated on 17.09.1976 (EITSCHBERGER & STEINIGER 1977a) which has been on the decreasing half moon on 17.09.1976 between the full moon on 08.09.1976 and the new moon on 23.09.1976, from Davensberg south of Münster where abt. 350 individuals have been registered on 26.07.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days after the new moon on 24.07.1979, from Warburg southeast of Paderborn where abundant individuals have flown on 06.08.1967 (HANS RETZLAFF in EITSCHBERGER in HARZ 1968a) which has

been on the new moon on 06.08.1967; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where 7 individuals and 8 individuals have flown on 06.09.1981 and 13.07.1982, respectively (WALFORT 1983), which has been one day before the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981, and two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, respectively; from Wetter in the Ruhr valley southsouthwest of Dortmund where several hundreds of individuals have flown on 05.08.1957 (HARKORT & WEIGT 1967) which has been five days before the full moon on 10.08.1957, from Lindlar eastnortheast of Cologne in the Middle Rhine valley where 20 individuals have flown on 29.07.1968 (ULF EITSCHBERGER in HARZ 1969) which has been four days after the full moon on 25.07.1968, from the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where 55 individuals have flown on 21.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been one day after the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968, from Bad Neuenahr-Ahrweiler in the Ahr valley northwest of Koblenz in the Middle Rhine valley where abt. 110 individuals have been recorded on 04.08.1979 (EITSCHBERGER & STEINIGER 1981a) which has been four days before the full moon on 08.08.1979, and from Beuern eastnortheast of Gießen where abt. 20 individuals have flown on 15.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been two days after the full moon on 13.04.1968.

Mass occurrences of large quantities of individuals of the Brimstone *Gonepteryx rhamni* in the southwestern part of Germany have been reported from Mainz at the northern margin of the Upper Rhine valley where abundant individuals have flown on 23.02.1903 (REICHENAU 1904) which has been four days before the new moon on 27.02.1903, from Dalheim south of Mainz in the northern part of the Upper Rhine valley where abt. 225 individuals have been monitored on 29.08.1979 – 30.08.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two and three days before the increasing half moon on 01.09.1979 between the new moon on 22.08.1979 and the full moon on 06.09.1979; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 20 individuals each have flown on 09.04.1993 and 28.05.1994 (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 06.04.1993 and three days after the full moon on 25.05.1994, respectively; from Altenbach eastnortheast of Schriesheim north of Heidelberg where more than 25 individuals have flown on 28.07.1968 (ULF EITSCHBERGER in HARZ 1969) which has been three days after the new moon on 25.07.1968; from Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg where abt. 35 individuals have flown in the period of 28.03.1968 – 19.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been around and between the new moon on 29.03.1968, the full moon on 13.04.1968, and the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968; from Bartholomä southwest of Aalen where abt. 25 individuals have flown on 24.04.1966 (BRUNO P. KREMER in HARZ 1967a) which has been four days after the new moon on 20.04.1966; and from Schweinfurt northnortheast of Würzburg in the Main valley in the central part of Germany where abt. 15 individuals,, abt. 50 individuals and abt. 20 individuals have been counted on 07.05.1970 and 16.08.1970 (EITSCHBERGER 1971a) as well as on 09.04.1971 (EITSCHBERGER 1972), respectively, which has been two days after the new moon on 05.05.1970, one day before the full moon on 17.08.1970 and one day before the full moon on 10.04.1971, respectively.

Mass occurrences of large quantities of individuals of the Brimstone *Gonepteryx rhamni* in the northeastern part of Germany have been notified from Berlin where numerous individuals have suddenly appeared on 12.07.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been three days before the increasing half moon on 15.07.1967 between the new moon on 07.07.1967 and the full moon on 21.07.1967, from the Leina forest near Altenburg south of Leipzig where abt. 200 individuals have been seen on 19.07.1993 – 20.07.1993 (EITSCHBERGER & STEINIGER 1995a) which has been on and one day after the new moon on 19.07.1993, from Waltersdorf in the Zittau Mountains southwest of Zit-

tau where masses of individuals have flown and have sucked on flowers on 22.08.1987 (EITSCHBERGER & STEINIGER 1989) which has been two days before the new moon on 24.08.1987, and from Rosenhain northeast of Löbau westsouthwest of Görlitz where more than 300 individuals in total have flown in the period of 25.07.1968 – 09.081968 (ULF EITSCHBERGER in HARZ 1969) which has been around and between the new moon on 25.07.1968 and the full moon on 08.08.1968.

Mass occurrences of large quantities of individuals of the Brimstone *Gonepteryx rhamni* in the southeastern part of Germany have been documented from Geltendorf northeast of Landsberg am Lech where abt. 80 individuals in total have flown on 20.04.1968 – 21.04.1968 and 25.05.1968 (ULF EITSCHBERGER in HARZ 1969) which has been on and one day after the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968, and two days before the new moon on 27.05.1968, respectively; from the vicinity of Oberstdorf south of Sonthofen where more than 15 individuals have flown on 20.09.1971 – 22.09.1971 (EITSCHBERGER 1972) which has been one to three days after the new moon on 19.09.1971, from the Iller valley around and between Fischen im Allgäu and Oberstdorf south of Sonthofen where abt. 40 individuals in total have flown on 21.09.1972 – 22.09.1972 (EITSCHBERGER 1973a) which has been one and two days before the full moon on 23.09.1972, from Ismaning northnortheast of München where abt. 20 individuals have flown on 03.08.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been one day after the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, from Gaden eastnortheast of Freising in the Isar valley northnortheast of München where more than 100 individuals have flown on 11.07.2008 (HEINRICH VOGEL in HENSLE 2009a) which has been one day after the increasing half moon on 10.07.2008 between the new moon on 03.07.2008 and the full moon on 18.07.2008, from Kleinlützel westnorthwest of Laufen in the Birs valley southwest of Basel in the northwestern part of Switzerland where abundant individuals have flown on 07.09.1976 (GEIGER 1976) which has been one day before the full moon on 08.09.1976, and from Lauwil southsoutheast of Basel in the northwestern part of Switzerland where numerous individuals have flown on 07.10.1976 – 08.10.1976 (EITSCHBERGER & STEINIGER 1977a) which has been on and one day before the full moon on 08.10.1976.

Significant quantities of individuals of the Brimstone *Gonepteryx rhamni* have also been reported from Pinneberg northwest of Hamburg at the coast of the North Sea in the northwestern part of Germany where 10 individuals have flown on 29.03.1968 – 30.03.1968 (ULF EITSCHBERGER in HARZ 1969) which has been on and one day after the new moon on 29.03.1968, from Warnemünde north of Rostock at the coast of the Baltic Sea in the northeastern part of Germany where abt. 15 individuals have flown in the last third of April 1996 (RUDNICK 1998) which has been around and between the new moon on 18.04.1996 and the full moon on 03.05.1996, from Damme southsouthwest of Vechta northnortheast of Osnabrück in the northwestern part of Germany where abt. 15 individuals have flown on 23.08.1968 (ULF EITSCHBERGER in HARZ 1969) which has been one day before the new moon on 24.08.1968, from the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where abt. 15 individuals have flown on 07.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been three days before the full moon on 10.06.1968, from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, from the Alzette valley near Bonnevoie at the southeastern margin of the city of Luxembourg in the southern part of Luxembourg where more than 10 individuals have flown on 28.03.1965 (RENÉ NEUMANN in EITSCHBERGER in HARZ 1969) which has been four days before the new moon on 01.04.1965, from Mosbach in the Neckar valley east of Heidelberg in the southwestern part of Germany where 15 individuals each have flown on 19.06.1968 and 20.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been one and two days after the decreasing half moon on 18.06.1968 between the full moon on 10.06.1968 and the new moon on 26.06.1968, from Kranebitten west of Innsbruck in the Inn valley

in the western part of Austria where abundant individuals have flown and have sucked on flowers on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977, and from Mittersill southsoutheast of Kufstein in the western part of Austria where abt. 10 individuals have flown on 22.08.1991 (EITSCHBERGER & STEINIGER 1992c) which has been three days before the full moon on 25.08.1991.

Mass occurrences of large quantities of individuals of the Brimstone *Gonepteryx rhamni* have been investigated particularly in the forests within and around Augsburg in the Lech valley in the south-eastern part of Germany (GEH 1998) where at least 50 individuals each have flown on 09.04.1992 and 11.04.1992 which has been two days before and on the increasing half moon on 11.04.1992 between the new moon on 03.04.1992 and the full moon on 17.04.1992, abt. 80 individuals have flown on 25.04.1992 which has been on the decreasing half moon on 25.04.1992 between the full moon on 17.04.1992 and the new moon on 02.05.1992, at least 60 individuals have flown on 18.03.1993 which has been five days before the new moon on 23.03.1993, more than 40 individuals have flown on 01.04.1993 which has been five days before the full moon on 06.04.1993, more than 60 individuals have flown on 20.04.1993 which has been two days before the new moon on 22.04.1993, more than 60 individuals have flown on 23.04.1994 which has been two days before the full moon on 25.04.1994, and more than 80 individuals have flown on 22.04.1995 which has been one day before the decreasing half moon on 23.04.1995 between the full moon on 15.04.1995 and the new moon on 29.04.1995.

5.14 The Silver-Washed Fritillary *Argynnis paphia* based on literature evaluation

Mass occurrences of large quantities of individuals of the Silver-Washed Fritillary *Argynnis paphia* LINNAEUS 1758 (Lepidoptera: Nymphalidae) in the northwestern part of Germany have been registered in the Bergeler Wald near Oelde southwest of Bielefeld where 20 individuals have flown on 23.08.2006 (KARSTEN HANNIG in SCHUMACHER 2007a) which has been on the new moon on 23.08.2006, in the Ville forest near Brühl southwest of Cologne in the Middle Rhine valley where 25 individuals have flown on 23.07.1991 (JELINEK 1992) which has been three days before the full moon on 26.07.1991; in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where abt. 100 individuals and 10 individuals have flown on 07.07.1976 (HANISCH 2009) and 06.07.2008 (KLAUS HANISCH in SCHUMACHER 2009) which has been four days before the full moon on 11.07.1976 and three days after the new moon on 03.07.2008, respectively; at the Erker Mühle in the district Rath at the eastern margin of the city of Cologne in the Middle Rhine valley where abt. 10 – 15 individuals have flown on 25.07.2006 (KLAUS HANISCH in SCHUMACHER 2007a) which has been one day after the new moon on 24.07.2006, near Diepeschrath in the vicinity of Bergisch Gladbach eastnortheast of Cologne where abt. 20 individuals have flown in the period of 08.07.2007 – 17.07.2007 (ROLAND KLEINSTÜCK in SCHUMACHER 2008a) which has been around and between the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007 as well as the new moon on 14.07.2007, in Hänscheid near Ruppichteroth eastnortheast of Siegburg where 50 individuals have flown on 24.07.2006 (SCHUMACHER 2007a) which has been on the new moon on 24.07.2006, in Wüstseifen near Hahnhof southsouthwest of Niederfischbach west of Siegen where abt. 10 individuals have flown on 13.08.1997 (FIEBER 1998) which has been one day after the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997; and near Bad Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 25 individuals in total have flown on 07.08.1973 and 09.08.1973 (HANS-JOACHIM WEIGT in HARKORT 1976) which has been one day after the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973 as well as five days before the full moon on 14.08.1973, respectively.

Mass occurrences of large quantities of individuals of the Silver-Washed Fritillary *Argynnis paphia* in the western and southwestern parts of Germany have been recorded in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where 5 individuals have flown on 24.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been two days before the full moon on 26.07.1991; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 – 20 individuals each have flown on 10.07.1992, 06.08.1992, 03.07.1994, 11.07.1994 and 02.08.1994 (BROSZKUS 1995, S. JOUAUX in BROSZKUS 1995) which has been four days before the full moon on 14.07.1992, on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, two days after the new moon on 09.07.1994, and two days after the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 27.07.2008 (ALFRED KLEIN & I. STIEGEMEYER in BOSSELMANN 2009) which has been two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals have flown on 16.07.1992 (BROSZKUS 1995) which has been two days after the full moon on 14.07.1992; and in the Kaiserstuhl northwest of Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany where the first single individuals have shown up on 11.06.1966, and several days after the new moon on 18.06.1966, numerous individuals have been observed, with the counting having revealed the flight of 50 individuals on 22.06.1966 and 20 individuals on 23.06.1966 (EBERT & RENNWALD 1991) which has been four and five days after the new moon on 18.06.1966, respectively.

5.15 The Wall Brown *Lasiommata megera* based on own observations

The Wall Brown *Lasiommata megera* LINNAEUS 1767 (Lepidoptera: Satyridae) has shown up at the locality Tairnbach with numerous individuals around the new moon on 01.08.2008, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Wall Brown *Lasiommata megera* in Tairnbach around the new moon on 01.08.2008 has taken place within the fourth period of summerly warm and sunny weather from 23.07.2008 to 07.08.2008 which has started before the decreasing half moon on 25.07.2008 and has ended before the increasing half moon on 08.08.2008.

5.16 The Wall Brown *Lasiommata megera,* the Large Wall Brown *Lasiommata maera* and the Woodland Brown *Lopinga achine* based on literature evaluation

Mass occurrences of large quantities of individuals of the Wall Brown *Lasiommata megera* LINNAEUS 1767 (Lepidoptera: Satyridae) have been recorded near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals and 10 individuals have flown on 06.08.1992 and 02.08.1994, respectively (BROSZKUS 1995), which has been on the in-

creasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, and five days before the new moon on 07.08.1994, respectively; near Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 15 individuals have flown on 14.08.1994 (S. JOUAUX in BROSZKUS 1995) which has been one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 26.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994, and near Knapsack southwest of Hürth southwest of Cologne in the northwestern part of Germany where 7 individuals have flown on 29.10.2004 (JELINEK 2006) which has been one day after the full moon on 28.10.2004.

Mass occurrences of large quantities of individuals of the Large Wall Brown *Lasiommata maera* LINNAEUS 1758 (Lepidoptera: Satyridae) have been registered near Dahlem northnortheast of Stadtkyll northwest of Daun in the northwestern part of the Eifel in the western part of Germany where abt. 20 individuals have flown on 11.06.2008 (JOCHEN RODENKIRCHEN in SCHUMACHER 2009) which has been one day after the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.08.2008, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 25.07.1984 (KINKLER & HÜRTER 1992) which has been three days before the new moon on 28.07.1984; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals each have flown on 09.05.1993, 16.05.1993 (S. JOUAUX in BROSZKUS 1995) and 27.07.2008 (ALFRED KLEIN & I. STIEGEMEYER in BOSSELMANN 2009) which has been three days after the full moon on 06.05.1993, five days before the new moon on 21.05.1993, and two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, respectively; near Raumünzach in the Murg valley south of Gaggenau southsoutheast of Rastatt in the southwestern part of Germany where abundant individuals have flown on 21.09.1951 (A. GREMMINGER in EBERT & RENNWALD 1993) which has been three days before the decreasing half moon on 24.09.1951 between the full moon on 15.09.1951 and the new moon on 01.10.1951, in the highlands of the Allgäu in Baden-Württemberg in the southwestern part of Germany where 60 individuals have flown on 31.07.1980 (T. MARKTANNER in EBERT & RENNWALD 1993) which has been four days after the full moon on 27.07.1980, and at the Hohentwiel west of Singen in the southwestern part of Germany where abt. 10 individuals have flown on 18.06.1921 (A. GREMMINGER in EBERT & RENNWALD 1993) which has been two days before the full moon on 20.06.1921.

Mass occurrences of large quantities of individuals of the Woodland Brown *Lopinga achine* (SCOPOLI 1763) (Lepidoptera: Satyridae) have been recognized in the Schwanheimer Wald at the southwestern margin of the city of Frankfurt am Main in the central part of Germany where abundant individuals have flown from 17.06.1894 onwards (REICHENAU 1904) which has been one day before the full moon on 18.06.1894, in the Durlacher Wald around the district Durlach at the eastern margin of the city of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany where masses of individuals have flown on 11.06.1880 (M. DAUB in EBERT & RENNWALD 1993) which has been four days after the new moon on 07.06.1880; at an unspecified locality in the southern part of the Upper Rhine valley where 20 individuals and abundant individuals have flown on

26.06.1988 (J. Berg, D. Doczkal & R. Herrmann in Ebert & Rennwald 1993) and 29.06.1988 (Erwin Rennwald in Ebert & Rennwald 1993), respectively, which has been three days before and on the full moon on 29.06.1988, respectively; and in the Altwarmbüchener Moor eastnortheast of Hannover in the northwestern part of Germany where 6 individuals have flown on 14.06.1944 (Warnecke 1955) which has been on the decreasing half moon on 14.06.1944 between the full moon on 06.06.1944 and the new moon on 20.06.1944.

5.17 The Swallowtail *Papilio machaon* based on own observations

In 2008, the aestival generation of the Swallowtail *Papilio machaon* Linnaeus 1758 (Lepidoptera: Papilionidae) has appeared in two distinct peaks at the localities Sankt Leon, Walldorf and Tairnbach. The first peak has been developed around the full moon on 16.08.2008 when numerous individuals of the Swallowtail *Papilio machaon* have flown around, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Swallowtail *Papilio machaon* in Sankt Leon, Walldorf and Tairnbach around the full moon on 16.08.2008 has taken place within the August cold of cooler and changeable weather (that has contained various intercalations of days of summerly warm and sunny weather) from 08.08.2008 to 23.08.2008 which has started on the increasing half moon on 08.08.2008 and has ended before the decreasing half moon on 24.08.2008.

The second peak of the aestival generation of the Swallowtail *Papilio machaon* has been established around the new moon on 30.08.2008 when again numerous individuals have flown around, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Swallowtail *Papilio machaon* in Sankt Leon, Walldorf and Tairnbach around the new moon on 30.08.2008 has taken place at the end of the fifth period of summerly warm and sunny weather from 24.08.2008 to 02.09.2008 which has started on the decreasing half moon on 24.08.2008 between the full moon on 16.08.2008 and the new moon on 30.08.2008, and has ended after the new moon on 30.08.2008.

In 2009, the aestival generation of the Swallowtail *Papilio machaon* has again appeared in two distinct peaks at the locality Walldorf. Some single individuals of the aestival generation of the Swallowtail *Papilio machaon* have occasionally flown at the localities Nußloch, Tairnbach and Walldorf since mid to end of June 2009, whereas a few days before the full moon on 07.07.2009, the first peak has been developed when almost suddenly numerous individuals have appeared at the locality Walldorf. During my entomological observations since 1964, I have never seen such an abundance of individuals of the Swallowtail *Papilio machaon* as a few days before the full moon on 07.07.2009 when the meadows around the airfield at the eastern margin of Walldorf have been full of light yellow and dark yellow individuals of the Swallowtail *Papilio machaon* which have flown around and have sucked at red and violet flowers, with sometimes up to five individuals having been observed within intervals of abt. 20 m length. The appearance of numerous individuals of the Swallowtail *Papilio machaon* has persisted with declining frequency until the new moon on 22.07.2009, and after the latter turning point of the lunar cycle, the number of individuals has rapidly decreased, with only a few single individuals having still been present several days after the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009, and no more individuals having been discovered some days before the full moon on 06.08.2009.

The second peak of the aestival generation of the Swallowtail *Papilio machaon* has started to develop a few days after the full moon on 06.08.2009 when after more than one week of interruption of

occurrence, almost suddenly again quite some individuals have flown across the meadows around the airfield at the eastern margin of Walldorf. Several days after the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009, almost suddenly already quite numerous individuals of the Swallowtail *Papilio machaon* have been present again, and a few days before the new moon on 20.08.2009, almost suddenly abundant individuals have flown around and have sucked at red and violet flowers almost everywhere within the meadows around the airfield at the eastern margin of Walldorf, with the frequency of individuals of the second peak around the new moon on 20.08.2009 having been almost the same as or even more than that of the first peak around the full moon on 07.07.2009. Apart from single individuals, also quite some pairs of males and females in copulation have flown across the meadows and have sit on red and violet flowers, with the flight of pairs of the Swallowtail *Papilio machaon* in copulation being a particularly attractive adventure due to the large size of the big yellow butterflies. Several days after the new moon on 20.08.2009, the number of individuals of the Swallowtail *Papilio machaon* has again started to decline. The lightest colour variations of the Swallowtail *Papilio machaon* have been yellowish white, and the darkest colour variations have been brownish yellow.

5.18 The Swallowtail *Papilio machaon* based on literature evaluation

Mass occurrences of large quantities of individuals of the Swallowtail *Papilio machaon* (Lepidoptera: Papilionidae) in the southwestern part of Germany have been reported from the vicinity of Dinkelsbühl northnorthwest of Nördlingen where very abundant individuals have flown and up to 30 individuals have been counted on a single field of clover at the end of July 1983 (EITSCHBERGER & STEINIGER 1985) which has been around the full moon on 24.07.1983, from Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg where more than 20 individuals have flown on 25.04.2007 (HENSLE 2008a) which has been one day after the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, from the Hohenhewen near Engen west of Stockach where abt. 30 individuals have flown on 19.05.2007 (RUDOLF HEGER in HENSLE 2008a) which has been three days after the new moon on 16.05.2007, from the Feldberg westsouthwest of Titisee-Neustadt in the southern part of the Black Forest southeast of Freiburg where 10 individuals have flown on 04.07.2006 (HENSLE 2007a) which has been one day after the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, from Flehingen southeast of Bruchsal where 45 individuals have flown on 15.08.1980 (EITSCHBERGER & STEINIGER 1981b) which has been five days after the new moon on 10.08.1980, from Mosbach (abt. 32 km eastsoutheast of Heidelberg) in the Neckar valley where several hundreds of individuals have flown on 24.07.1999 – 01.08.1999 (EITSCHBERGER & STEINIGER 2000b) which has been several days before and after the full moon on 28.07.1999; from the vicinity of Zeiskam eastnortheast of Landau in der Pfalz in the middle part of the Upper Rhine valley where 20 individuals and 50 individuals have flown on 26.07.1991 (KLAUS WEISS in HASSELBACH 1992) and 16.05.1992 (KLAUS WEISS in HASSELBACH 1993), respectively, which has been on the full moon on 26.07.1991 and on the full moon on 16.05.1992, respectively; from the vicinity of Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley where more than 30 individuals have flown on 19.05.1992 (ERWIN SEFRIN in HASSELBACH 1993) which has been three days after the full moon on 16.05.1992, from the vicinity of Rodenbach westnorthwest of Kaiserslautern where abt. 30 individuals have flown on 19.07.1992 (ALFRED KLEIN in HASSELBACH 1993) which has been five days after the full moon on 14.07.1992; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals each have flown on 09.05.1993 and 04.07.1993 (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 06.05.1993 and on the full moon on 04.07.1993, respectively; from the vicinity of Imsweiler southsouthwest of Rockenhausen westsouthwest of Kirchheim-Bolanden where 10 individuals have flown on 05.06.1993 (G. NEUMANN in HASSELBACH 1994) which has been one day after the full moon

on 04.06.1993, from Friedrichsthal northnortheast of Saarbrücken in the Saar valley where abt. 20 individuals have flown on 12.08.1973 (CLEVE 1974) which has been two days before the full moon on 14.08.1973, from Völklingen in the Saar valley westnorthwest of Saarbrücken where abt. 10 individuals have flown on 25.06.2008 (P. DIETRICH in HENSLE 2009a) which has been one day before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, from Herlheim south of Schweinfurt in the central part of Germany where at least 200 individuals have flown on 05.07.1976 – 10.07.1976 (LOBENSTEIN 1976) which has been on and several days after the increasing half moon on 05.07.1976 between the new moon on 27.06.1976 and the full moon on 11.07.1976, and from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 20 individuals have flown on 24.05.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been three days after the new moon on 21.05.1993.

Mass occurrences of large quantities of individuals of the Swallowtail *Papilio machaon* in the northwestern part of Germany have been mentioned from Garsdorf southwest of Grevenbroich southwest of Düsseldorf where abt. 15 individuals and more than 20 individuals have flown on 11.08.2001 (KUNZ 2002, JELINEK 2006) and 02.08.2002 (JELINEK 2006), respectively, which has been two days before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, and on the decreasing half moon on 02.08.2002 between the full moon on 24.07.2002 and the new moon on 08.08.2002, respectively; from Hückelhoven southwest of Mönchengladbach where 10 individuals and 55 individuals have flown on 13.08.2005 (PETER BARWINSKI in SCHUMACHER 2006) and 15.07.2006 (PETER BARWINSKI in SCHUMACHER 2007a), respectively, which has been on the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005 as well as four days after the full moon on 11.07.2006, respectively; from Ottbergen southsouthwest of Höxter in the Weser valley where 12 individuals have flown on 27.07.1968 (KARL CLEVE in HARZ 1969) which has been two days after the new moon on 25.07.1968, from the Karlsaue in Kassel in the Fulda valley where masses of individuals have flown and have sucked on flowers in mid of August 1992 (EITSCHBERGER & STEINIGER 1994a) which has been around the full moon on 13.08.1992, and from Borna southsoutheast of Leipzig in the northeastern part of Germany where at least 30 individuals have flown on 12.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been six days after the full moon on 06.05.1993.

Mass occurrences of large quantities of individuals of the Swallowtail *Papilio machaon* in Austria have been documented from Neustift im Stubaital southsouthwest of Innsbruck in the western part of Austria where at least 20 individuals and more than 10 individuals have flown on 12.08.2001 (EITSCHBERGER & STEINIGER 2002a) and 31.08.2002 (EITSCHBERGER & STEINIGER 2003a), respectively, which has been one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, and two days after the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.09.2002, respectively; from the Eichkogel near Guntramsdorf south of Vienna in the eastern part of Austria where 50 individuals have flown on 22.04.2007 (HENSLE 2008a) which has been two days before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, and from Hainburg in the Danube valley east of Vienna in the eastern part of Austria where abt. 150 individuals have flown on 18.07.1973 (P. FRÜHWIRTH in CLEVE 1974) which has been three days after the full moon on 15.07.1973.

Mass occurrences of large quantities of individuals of the Swallowtail *Papilio machaon* in Switzerland have been signaled from the Monte Bré east of Lugano in the southeastern part of Switzerland where up to abt. 15 individuals daily have flown on 22.04.1999 – 24.04.1999 (EITSCHBERGER & STEINIGER 2000b) which has been around the increasing half moon on 23.04.1999 between the new moon on 16.04.1999 and the full moon on 30.04.1999.

5.19 The Wood White *Leptidea sinapis* based on own observations

In 2008, the aestival generation of the Wood White *Leptidea sinapis* LINNAEUS 1758 (Lepidoptera: Pieridae) has shown up at the locality Tairnbach with numerous individuals around the full moon on 16.08.2008, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Wood White *Leptidea sinapis* in Tairnbach around the full moon on 16.08.2008 has taken place within the August cold of cooler and changeable weather (that has contained various intercalations of days of summerly warm and sunny weather) from 08.08.2008 to 23.08.2008 which has started on the increasing half moon on 08.08.2008 and has ended before the decreasing half moon on 24.08.2008.

In 2009, the vernal generation of the Wood White *Leptidea sinapis* has occurred at the locality Nußloch with numerous individuals around the new moon on 25.04.2009, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Wood White *Leptidea sinapis* in Nußloch around the new moon on 25.04.2009 has happened within the second period of dry and warm weather with temperatures of up to 20 – 25 °C from 19.04.2009 to 26.04.2009 which has started after the decreasing half moon on 17.04.2009 between the full moon on 09.04.2009 and the new moon on 25.04.2009, and has ended after the new moon on 25.04.2009.

The first peak of the aestival generation of the Wood White *Leptidea sinapis* has occurred at the locality Tairnbach with numerous individuals after the new moon on 22.06.2009, whereas only some single individuals have appeared earlier and after the full moon on 07.07.2009, the number of individuals has again started to decline. The second peak of the aestival generation of the Wood White *Leptidea sinapis* has been developed around the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009 when again almost suddenly numerous individuals have shown up at the locality Walldorf and also quite some individuals have appeared at the locality Tairnbach, whereas earlier only single individuals have been present. The frequency of individuals of the Wood White *Leptidea sinapis* at the locality Walldorf has been maintained beyond the full moon on 06.08.2009, and has then started to decline after the decreasing half moon on 13.08.2009 and has further diminished after the new moon on 20.08.2009, with only occasionally a few isolated individuals having been detected after the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009, and no more individuals having been discovered after the full moon on 04.09.2009.

5.20 The Wood White *Leptidea sinapis* based on literature evaluation

Mass occurrences of the Wood White *Leptidea sinapis* LINNAEUS 1758 (Lepidoptera: Pieridae) in the western part of Germany have been reported from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 50 individuals have flown on 13.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been two days after the full moon on 11.07.2006, from the Kalkarer Moor near Bad Münstereifel south of Euskirchen in the northwestern part of the Eifel where 10 individuals have flown on 13.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been two days after the full moon on 11.07.2006; from the former train station in Ahrdorf in the Ahr valley southeast of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel where 30 individuals each have flown on 30.07.1995 (KINKLER 1996) and 20.07.2008 (S. KINKLER & REIFENBERG in SCHUMACHER 2009) which has been three days after the new moon on 30.07.1995 and two days after the full moon on 18.07.2008, respectively; from an unspecified locality in the vicini-

ty of Koblenz in the Middle Rhine valley in the western part of Germany where more than 5 individuals have flown on 09.06.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993) which has been one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, from Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 5 individuals have flown on 06.07.1994 (BROSZKUS 1995) which has been three days before the new moon on 09.07.1994, from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 30.05.1992 (BROSZKUS 1995) which has been two days before the new moon on 01.06.1992, and from the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where more than 5 individuals have flown on 13.08.1993 (HASSELBACH 1994) which has been four days before the new moon on 17.08.1993.

Mass occurrences of the Wood White *Leptidea sinapis* in the northwestern part of Germany have been mentioned from the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where more than 30 individuals and at least 10 individuals have flown on 15.07.2009 (HANISCH 2009, HORST GÜNTER NEUHOFF in HANISCH 2009) and 22.07.2009 (HANISCH 2009), respectively, which has been on the decreasing half moon on 15.07.2009 between the full moon on 07.07.2009 and the new moon on 22.07.2009 as well as on the new moon on 22.07.2009, respectively; from Burbach-Holzhausen west of Haiger southeast of Siegen where 20 individuals have flown on 22.07.2004 – 29.07.2004 (VIKTOR FIEBER in SCHUMACHER 2006) which has been several days before and after the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004 as well as several days before the full moon on 31.07.2004, from Windeck-Dreisel westnorthwest of Wissen westsouthwest of Siegen where more than 30 individuals have flown on 12.07.2005 – 14.07.2005 (W. BECKERT in SCHUMACHER 2006) which has been a few days before and on the increasing half moon on 14.07.2005 between the new moon on 06.07.2005 and the full moon on 21.07.2005, from Rosenheim near Gebhardshain southwest of Betzdorf southwest of Siegen where 10 individuals have flown on 22.07.2006 (VIKTOR FIEBER in SCHUMACHER 2007a) which has been two days before the new moon on 24.07.2006, and from Elkenroth south of Betzdorf southwest of Siegen where abt. 15 individuals have flown on 24.07.2008 (VIKTOR FIEBER in SCHUMACHER 2009) which has been one day before the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008.

5.21 The Clouded Yellow *Colias croceus* based on own observations

In 2008, the aestival to automnal generation of the Clouded Yellow *Colias croceus* FOURCROY 1785 (Lepidoptera: Pieridae) has shown up at the localities Sankt Leon and Walldorf with numerous individuals around the new moon on 30.08.2008, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Clouded Yellow *Colias croceus* in Sankt Leon and Walldorf around the new moon on 30.08.2008 has taken place at the end of the fifth period of summerly warm and sunny weather from 24.08.2008 to 02.09.2008 which has started on the decreasing half moon on 24.08.2008 between the full moon on 16.08.2008 and the new moon on 30.08.2008, and has ended after the new moon on 30.08.2008.

In 2009, some single individuals of the aestival generation of the Clouded Yellow *Colias croceus* have occasionally flown at the localities Nußloch, Tairnbach and Walldorf since mid to end of June 2009, whereas a few days before the full moon on 07.07.2009, the first peak has started to develop when almost suddenly several individuals have appeared at the locality Walldorf, with the number of individuals then having slightly increased until almost suddenly numerous individuals having

been present before and on the new moon on 22.07.2009. The appearance of numerous individuals of the first peak of the aestival generation of the Clouded Yellow *Colias croceus* has persisted with fluctuating frequency beyond the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009 and has then started to diminuish, but the occurrence of quite some individuals has been maintained beyond the full moon on 06.08.2009.

The second peak of the aestival generation of the Clouded Yellow *Colias croceus* has started to develop after the full moon on 06.08.2009, and a few days after the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009, almost suddenly already various individuals of the Clouded Yellow *Colias croceus* have flown around at the locality Walldorf, with again numerous individuals having been present several days before the new moon on 20.08.2009. The frequency of individuals of the second peak of the aestival generation of the Clouded Yellow *Colias croceus* around the new moon on 20.08.2009 has been more or less the same as that of the first peak around the new moon on 22.07.2009, and abt. one week to ten days later, the number of individuals has again started to decline, with only several single or quite some individuals still having been discovered after the full moon on 04.09.2009 and after the new moon on 18.09.2009 and only a few dispersed individuals still having been detected after the increasing half moon on 26.09.2009 and around the full moon on 04.10.2009.

5.22 The Clouded Yellow *Colias croceus* based on literature evaluation

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* FOURCROY 1785 (Lepidoptera: Pieridae) have been abundantly reported in the literature. PEKARSKY (1960) has noticed several to many hundreds of individuals of the Clouded Yellow *Colias croceus* on fields and meadows around Gut Scheibenhardt south of Oberreut at the southern margin of the city of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 26.09.1958 which has been the first sunny, warm and dry day after a longer period of rainfalls, and on 09.10.1958 which has been a very warm day that has been terminated by a long-lasting thunderstorm in the evening. The mass flights of the Clouded Yellow *Colias croceus* around Gut Scheibenhardt on 26.09.1958 and 09.10.1958 (PEKARSKY 1960) have happened two days before the full moon on 28.09.1958 and three days before the new moon on 12.10.1958, respectively, whereas PEKARSKY (1960) has not registered a single individual on the next day after 26.09.1958. PEKARSKY (1955b) has discovered the sudden appearance of abundant individuals of the Clouded Yellow *Colias croceus* on a meadow near the margin of a forest around Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 27.08.1954 which has been one day before the new moon on 28.08.1954, whereas a few days later, he has not detected a single individual. J. GELBRECHT, K.H. SALPETER & F. THEIMER (in HENSLE 2009a) have counted 105 individuals in total on 09.09.2008, 13.09.2008 and 21.09.2008 in the vicinity of Calau-Mallenchen west of Cottbus in the northeastern part of Germany which has been several days before and after the full moon on 15.09.2008, respectively. HANS RETZLAFF (in EBERT & RENNWALD 1991) has observed abt. 150 individuals of the Clouded Yellow *Colias croceus* each on 11.10.1980, 12.10.1980 and 16.10.1980 near Albena northnortheast of Varna at the coast of the Black Sea in the eastern part of Bulgaria which has been a few days after the new moon on 09.10.1980 (this observation has also been mentioned in EITSCHBERGER & STEINIGER 1981b). VERENA SCHEIWILLER (in HENSLE 2006a) has noticed abt. 25 individuals of the Clouded Yellow *Colias croceus* on 17.07.2005 – 19.07.2005 near Haldenstein north of Chur and Felsberg west of Chur in the Alpine Rhine valley in the northeastern part of Switzerland which has been two to four days before the full moon on 21.07.2005.

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* in the southwestern and southeastern parts of Germany have also been documented within and around Freiburg

in the southern part of the Upper Rhine valley in the southwestern part of Germany where abt. 70 individuals have been counted in the period of 14.08.1982 – 01.09.1982 (EITSCHBERGER & STEINIGER 1984) which has been around and between the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982 as well as the new moon on 19.08.1982 and the full moon on 03.09.1982, near Denzlingen northnortheast of Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany where abt. 140 individuals have flown from 07.07.1982 onwards (EITSCHBERGER & STEINIGER 1984) which has been several days after the full moon on 06.07.1982, near Neustadt an der Weinstraße at the western margin of the middle part of the Upper Rhine valley in the southwestern part of Germany where abundant individuals have flown on 13.05.1958 (ROESLER 1960) which has been five days before the new moon on 18.05.1958, near Forchheim southsoutheast of Bamberg in the southeastern part of Germany where abt. 600 individuals have flown and have sucked on flowers on 04.08.1957 (SCHRÜFER in KOCH, WARNECKE & WITTSTADT 1958) which has been one day after the increasing half moon on 03.08.1957 between the new moon on 27.07.1957 and the full moon on 10.08.1957, and near Ebern southsouthwest of Coburg in the southeastern part of Germany where several hundreds of individuals have flown in August 1957 (RICHTER in KOCH, WARNECKE & WITTSTADT 1958) which has been around and between the full moon on 10.08.1957 and the new moon on 25.08.1957.

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* in the northeastern part of Germany have been registered near Leuna south of Merseburg in the Saale valley where abundant individuals have flown on 28.09.1958 (ENGELHARD in KOCH 1959) which has been on the full moon on 28.09.1958, near Artern in the Unstrut valley east of Bad Frankenhausen where abundant individuals have flown on 30.09.1958 and subsequently until mid of October 1958 (BECHERER in KOCH 1959) which has been around and between the full moon on 28.09.1958 and the new moon on 12.10.1958, within and around Leipzig where abt. 100 individuals per hour have flown on 29.09.1958 – 02.10.1958 (HERSCHEL in KOCH 1959) which has been one to four days after the full moon on 28.09.1958, and in Gera where abt. 15 individuals per hour have flown on 01.10.1958 (SCHNAPPAUF in KOCH 1959) which has been three days after the full moon on 28.09.1958.

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* in Austria have been recorded near Jennersdorf in the Raab valley and Strem northeast of Jennersdorf in the eastern part of Austria where abt. 50 individuals and abt. 100 individuals, respectively, have flown on 22.09.1994 (EITSCHBERGER & STEINIGER 1996a) which has been three days after the full moon on 19.09.1994; around Lienz in the Drau valley in the eastern part of Austria where masses of individuals have flown on 09.09.1994 (EITSCHBERGER & STEINIGER 1996a) which has been four days after the new moon on 05.09.1994, and around the Klopeiner See and Bleiburg east of Klagenfurt in the southern part of Austria where hundreds of individuals have flown on 20.08.1971 (FRIEDEL 1971) which has been on the new moon on 20.08.1971.

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* in Great Britain have been noticed near Dover, Folkestone and Sandgate southeast of London in the southeastern part of England where masses of individuals have flown in the period of 14.09.1879 – 22.09.1879 (COX 1879, EEDLE 1879) which has been around the new moon on 16.09.1879.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in the southwestern and southeastern parts of Germany have also been observed near Flehingen eastsoutheast of Bruchsal in the southwestern part of Germany where abt. 20 individuals have flown in the period of 14.08.1978 – 26.08.1978 (EITSCHBERGER & STEINIGER 1979) which has been around and between the increasing half moon on 12.08.1978 between the new moon on 03.08.1978 and the full moon on 18.08.1978 as well as the decreasing half moon on 26.08.1978 between the full moon on 18.08.1978 and the new

moon on 02.09.1978, between the district Rohrbach at the southern margin of the city of Heidelberg and Leimen south of Heidelberg in the middle part of the Upper Rhine valley in the southwestern part of Germany where 10 individuals have flown on 15.07.2006 (J. BASTIAN in HENSLE 2007a) which has been two days before the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, near Bürstadt northnorthwest of Heidelberg in the middle part of the Upper Rhine valley in the southwestern part of Germany where 20 individuals have flown on 15.08.1981 (PHILIPP MICHAEL KRISTAL in EITSCHBERGER & STEINIGER 1983) which has been on the full moon on 15.08.1981, near Rodenbach westnorthwest of Kaiserslautern in the southwestern part of Germany where more than 20 individuals have flown on 09.08.1998 (ALFRED KLEIN in HASSELBACH 2000) which has been one day after the full moon on 08.08.1998, near Engen northnorthwest of Singen in the southwestern part of Germany where abt. 25 individuals have flown on 24.10.2008 (F. NOWOTNE in HENSLE 2009a) which has been three days after the decreasing half moon on 21.10.2008 between the full moon on 14.10.2008 and the new moon on 29.10.2008; near Schwaigermoos between Schwaig and Attaching southeast of Freising in the Isar valley in the southeastern part of Germany where abt. 20 individuals and abt. 10 individuals have flown on 12.09.1979 and 19.09.1979, respectively (EITSCHBERGER & STEINIGER 1981a), which has been two days before the decreasing half moon on 14.09.1979 between the full moon on 06.09.1979 and the new moon on 21.09.1979 as well as two days before the new moon on 21.09.1979, respectively; and near Bad Aibling in the Mangfall valley west of Rosenheim in the southeastern part of Germany where abt. 10 individuals have flown on 10.04.2007 (G. SCHMIDT in HENSLE 2008a) which has been on the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in the western part of Germany have been recognized around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley where abundant individuals have flown from 13.08.1879 onwards and from 25.09.1888 onwards (REICHENAU 1904) which has been four days before the new moon on 17.08.1879 and five days after the full moon on 20.09.1888, respectively; near Überherrn westnorthwest of Saarbrücken and near Bliesmengen-Bolchen southeast of Saarbrücken in the Saar valley where 10 individuals and 12 individuals have flown on 07.08.2006 and 09.08.2006, respectively (HENSLE 2007a), which has been two days before and on the full moon on 09.08.2006, respectively; near Eimersdorf southwest of Rehlingen-Siersburg northnorthwest of Saarlouis in the Saar valley where 15 individuals have flown on 16.07.2006 (HENSLE 2007a) which has been one day before the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, and near Rengen north of Daun in the northwestern part of the Eifel where abt. 20 individuals have flown on 18.09.2003 (U. FLESCH in SCHUMACHER 2004b) which has been on the decreasing half moon on 18.09.2003 between the full moon on 10.09.2003 and the new moon on 26.09.2003.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in the northwestern part of Germany have been recorded near Garsdorf southwest of Grevenbroich southwest of Düsseldorf where abt. 10 individuals have flown on 24.07.2006 (HENSLE 2007a) which has been on the new moon on 24.07.2006, near Wuppertal eastnortheast of Düsseldorf where abundant individuals have flown on 18.08.1861 (WEYMER 1863b) which has been two days before the full moon on 20.08.1861, near Schwalmtal-Hagen westnorthwest of Mönchengladbach where more than 10 individuals have flown on 23.09.2003 (RUDI SELIGER in SCHUMACHER 2004b) which has been three days before the new moon on 26.09.2003, near Langenberg eastnortheast of Velbert northeast of Düsseldorf where 10 individuals have flown on 27.07.2006 (ARMIN DAHL in HENSLE 2007a) which has been three days after the new moon on 24.07.2006, near Breitscheid-Erdbach west of Herborn where more than 10 individuals have flown on 12.10.2003 (SCHUMACHER 2004b) which has been two days after the full moon on 10.10.2003, near Windeck-Roßbach westnorthwest of Wissen westsouthwest

of Siegen where 15 individuals have flown on 14.08.1998 – 18.08.1998 (W. BECKERT in SCHUMACHER 2001) which has been several days before and after the decreasing half moon on 15.08.1998 between the full moon on 08.08.1998 and the new moon on 22.08.1998, at the Eulenberg near Hennef in the Sieg valley northwest of Bonn where 12 individuals have flown on 11.10.2006 (SCHUMACHER 2007b) which has been four days after the full moon on 07.10.2006, and at the Ems estuary west of Emden at the coast of the North Sea where abt. 10 individuals have flown on 29.07.2008 (HENSLE 2009a) which has been three days before the new moon on 01.08.2008.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in Austria and Switzerland have been registered near Ebensee in the Traun valley south of the Traunsee in the western part of Austria where 25 individuals have flown on 27.09.2006 (R. RÖHRIG in HENSLE 2007a) which has been five days after the new moon on 22.09.2006, near Hinterriß northnortheast of Innsbruck in the western part of Austria where abt. 15 individuals have flown on 08.10.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been three days after the increasing half moon on 05.10.2008 between the new moon on 29.09.2008 and the full moon on 14.10.2008; near Knittelfeld in the Mur valley southwest of Leoben in the eastern part of Austria where 30 individuals and 120 individuals have flown on 31.10.2001 (EITSCHBERGER & STEINIGER 2002a) and in the period of 01.11.2008 – 17.11.2008 (HENSLE 2009a), respectively, which has been one day before the full moon on 01.11.2001, and around and between the new moon on 29.10.2008 and the full moon on 13.11.2008, respectively; near Knittelfeld in the Mur valley southwest of Leoben in the eastern part of Austria where 15 individuals each have flown on 30.07.2006, 05.08.2006, 10.08.2006 (HENSLE 2007a) and 17.11.2008 (HENSLE 2009a) which has been three days before and three days after the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, one day after the full moon on 09.08.2006, and four days after the full moon on 13.11.2008, respectively; near Illmitz and Podersdorf at Lake Neusiedl southeast of Vienna in the eastern part of Austria where 25 individuals and abt. 50 individuals have flown on 21.08.1971 and 20.08.1971 – 23.08.1971, respectively (NIPPEL 1972), which has been on and around the new moon on 21.08.1971; near Illmitz at Lake Neusiedl southeast of Vienna in the eastern part of Austria where abt. 20 individuals have flown on 27.08.1975 – 28.08.1975 (BURMANN & TARMANN 1978) which has been three to four days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975, near Dobrawa in the vicinity of Eberndorf south of Völkermarkt east of Klagenfurt in the southern part of Austria where more than 10 individuals have flown on 05.08.1976 (BURMANN & TARMANN 1979) which has been five days before the full moon on 10.08.1976, near Sissach eastsoutheast of Basel in the northwestern part of Switzerland where abt. 20 individuals have flown on 25.09.2006 (CHRISTOPHER RABL in HENSLE 2007a) which has been three days after the new moon on 22.09.2006, near Uster eastsoutheast of Zürich in the northeastern part of Switzerland where abundant individuals have flown on 11.08.1962 (HÄTTENSCHWILER in HARZ & WITTSTADT 1964) which has been four days before the full moon on 15.08.1962, and near Haldenstein north of Chur in the Alpine Rhine valley in the northeastern part of Switzerland where abt. 15 individuals have flown on 15.08.2007 (VERENA SCHEIWILLER in HENSLE 2008a) which has been two days after the new moon on 13.08.2007.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in France and Italy have been confirmed near Lodève northwest of Montpellier in the southeastern part of France where abt. 40 individuals in total and abt. 25 individuals in total have flown in the periods of 11.06.1989 – 24.06.1989 and 03.09.1989 – 17.09.1989, respectively (EITSCHBERGER & STEINIGER 1990a), which has been around and between the new moon on 03.06.1989 and the full moon on 19.06.1989 as well as around and between the new moon on 31.08.1989 and the full moon on 15.09.1989, respectively; near Lodève northwest of Montpellier in the southeastern part of France where 45 individuals in total have flown on 12.10.1991 – 18.10.1991 (EITSCHBERGER & STEINIGER 1992c) which has been around the increasing half moon on 16.10.1991 between the new moon on 08.10.1991 and the full

moon on 23.10.1991; near Crillon-le-Brave eastnortheast of Carpentras, near Brantes east of Carpentras and at the Mont Ventoux north of Carpentras north of Marseille in the southeastern part of France where up to 50 individuals daily have flown on 05.09.1991 – 19.09.1991 (EITSCHBERGER & STEINIGER 1992c) which has been around and between the new moon on 08.09.1991 and the full moon on 23.09.1991; near Digne-les-Bains northwest of Cannes in the southeastern part of France where abundant individuals have flown in the period of 16.06.1970 – 26.06.1970 (MAZZUCCO 1974) which has been around and between the full moon on 19.06.1970 as well as the decreasing half moon on 27.06.1970 between the full moon on 19.06.1970 and the new moon on 03.07.1970; at the Sellajoch and the Grödner Joch south and east of Wolkenstein southsoutheast of Brixen in Southern Tyrol in the northeastern part of Italy where abt. 10 individuals and abt. 15 individuals, respectively, have flown on 27.06.1976 (BURMANN & TARMANN 1979) which has been on the new moon on 27.06.1976; and in the Tinnesbach valley near Klausen northeast of Bolzano in Southern Tyrol in the northeastern part of Italy where abt. 20 individuals have flown on 14.08.1993 (EITSCHBERGER & STEINIGER 1995a) which has been three days before the new moon on 17.08.1993.

Significant quantities of individuals of the Clouded Yellow *Colias croceus* in Great Britain have been recognized near Gravesend eastsoutheast of London in the southeastern part of England where abundant individuals have flown on 05.08.1868 (BASDEN SMITH 1868) which has been two days after the full moon on 03.08.1868; near Bere Regis westnorthwest of Wareham westnorthwest of Bournemouth in the southwestern part of England where abt. 20 individuals and abt. 15 individuals have flown on 05.09.1928 and 08.09.1928, respectively (ANDREWES 1929), which has been two days before and one day after the decreasing half moon on 07.09.1928 between the full moon on 31.08.1928 and the new moon on 14.09.1928, respectively; and near Salisbury northwest of Southampton westsouthwest of London in the southern part of England where abt. 30 individuals have flown in the period of 09.08.1983 – 23.08.1983 (EITSCHBERGER & STEINIGER 1985) which has been around and between the new moon on 08.08.1983 and the full moon on 23.08.1983.

Mass flights of large quantities of individuals of the Clouded Yellow *Colias croceus* within and around Freiburg as well as in the Kaiserstuhl northwest of Freiburg in the southern part of the Upper Rhine valley and in the southern part of the Black Forest northeast, east and southeast of Freiburg in the southwestern part of Germany have been investigated by KELLER (1930) who has mentioned the occurrence of abundant individuals near Mengen in the vicinity of Freiburg on 17.08.1921 which has been one day before the full moon on 18.08.1921, and has described particularly the extraordinary mass flights in August 1928 when large quantities of individuals have been observed in the Kaiserstuhl on 02.08.1928 – 07.08.1928 and on 12.08.1928, near Mengen and Schallstadt in the vicinity of Freiburg on 11.08.1928, near Haslach and Sankt Georgen in the southern part of the Black Forest northeast and eastnortheast of Freiburg on 15.08.1928, in the Schönberg in the vicinity of Freiburg on 19.08.1928, and in the Tuniberg west of Freiburg on 26.08.1928, with these mass flights having happened around and between the full moon on 01.08.1928, the new moon on 15.08.1928 and the full moon on 31.08.1928. KELLER (1930) has also evaluated the results of a call for observations of mass flights of the Clouded Yellow *Colias croceus* at other localities in August 1928, and has listed reports of mass flights around München in the Isar valley in the southeastern part of Germany in August 1928 (F. LENZ in KELLER 1930), around Bamberg in the Main valley in the southeastern part of Germany in August 1928 (C. HOFMANN in KELLER 1930), around Konstanz at Lake Constance in the southwestern part of Germany in August 1928 (STADELHOFER in KELLER 1930), around Cannstatt in the Neckar valley at the eastern margin of the city of Stuttgart in the southwestern part of Germany from 19.08.1928 onwards (C. SCHNEIDER & A. WÖRZ in KELLER 1930), around Tübingen in the Neckar valley south of Stuttgart in the southwestern part of Germany in August 1928 (H. KAUFMANN in KELLER 1930), around Pforzheim in the southern part of the Kraichgau eastsoutheast of Karlsruhe in the southwestern part of Germany in mid of August 1928 (H. ROMETSCH in KELLER 1930), around Bretten in the southern part of the Kraichgau east of Karls-

ruhe in the southwestern part of Germany in August 1928 (H. SCHLÖRER in KELLER 1930), around Kehl northwest of Offenburg in the southern part of the Upper Rhine valley in the southwestern part of Germany in August 1928 (ALBERT MEYER in KELLER 1930), around Gernsbach in the Murg valley in the northern part of the Black Forest south of Karlsruhe in the southwestern part of Germany in August 1928 (ALBERT MEYER in KELLER 1930), around Heidelberg in the middle part of the Upper Rhine valley in the southwestern part of Germany in August 1928 (ALBERT MEYER in KELLER 1930), around Zimmern near Grünsfeld in the Tauber valley north of Bad Mergentheim in the southwestern part of Germany in August 1928 (A. SEITZ in KELLER 1930), around Neustadt an der Weinstraße at the western margin of the middle part of the Upper Rhine valley in the southwestern part of Germany in August 1928 (W. TRAUB in KELLER 1930), around Seeheim-Jugenheim south of Darmstadt in the northern part of the Upper Rhine valley in the southwestern part of Germany in mid of August 1928 (C. DIETZE in KELLER 1930), around Frankfurt am Main in the central part of Germany in August 1928 (P. STAUDER in KELLER 1930), around Weilburg in the Lahn valley westsouthwest of Gießen in the northwestern part of Germany in August 1928 (F. BURGER in KELLER 1930), around Gießen in the Lahn valley in the northwestern part of Germany in August 1928 (FRIEDRICH GEORG in KELLER 1930), around Koblenz in the Middle Rhine valley in the western part of Germany and around Limburg in the Lahn valley in the northwestern part of Germany from 19.08.1928 onwards (P. BECKENTHÄLER in KELLER 1930), around Aachen in the northwestern part of Germany in August 1928 (F. REINARTZ in KELLER 1930), around Meiningen in the Werra valley in the northeastern part of Germany in August 1928 (FIEDLER in KELLER 1930), around Leipzig and Halle in the Saale valley in the northeastern part of Germany in August 1928 (W. UDE in KELLER 1930), around Löderburg northwest of Staßfurt eastnortheast of Quedlinburg in the northeastern part of Germany in August 1928 (A. HANSEN in KELLER 1930), around Dammendorf and Grunow in the Lausitz west of Eisenhüttenstadt the northeastern part of Germany in August 1928 (W. WECKWORTH in KELLER 1930), and around Berlin in the northeastern part of Germany in August 1928 (RICHARD ALBRECHT in KELLER 1930), with this collection of localities of mass flights of the Clouded Yellow *Colias croceus* which have been established around and between the full moon on 01.08.1928, the new moon on 15.08.1928 and the full moon on 31.08.1928 being an outstanding example of the more or less simultaneous occurrence of mass flights of diurnal butterflies at numerous places over very large areas. Mass flights of the Clouded Yellow *Colias croceus* since the beginning of August 1928 around Frankfurt am Main and in other regions in the southwestern and southeastern parts of Germany have also been reported by STAUDER (1929).

Various examples of mass flights of the Clouded Yellow *Colias croceus* from the older literature are compiled and quoted in WILLIAMS (1930).

5.23 The Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* based on own observations

In 2007, the automnal generations of the Red Admiral *Vanessa atalanta* LINNAEUS 1758 (Lepidoptera: Nymphalidae) and the Comma Butterfly *Polygonia c-album* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have appeared almost suddenly at the locality Nußloch around the new moon on 11.09.2007 when numerous individuals have shown up almost from one day to the next, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The abundant individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* which have particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards have been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* LINNAEUS 1758 (Lepidoptera: Satyridae) and the Green Hawker *Aeshna viri-*

dis EVERSMANN 1836 (Odonata: Aeshnidae) especially in the vineyards, with many individuals having sucked juice of overmature grapes and plums. The abundant individuals of the Red Admiral *Vanessa atalanta* have flown around and have sit on the fruits almost everywhere, with the sudden appearance of the significant frequency of individuals around the new moon on 11.09.2007 having happened like a mass flight.

In 2008, the emergence of the automnal generations of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* at the locality Nußloch has not been so accentuated as in 2007, but nevertheless a clear tendency has been developed, with quite some fresh individuals having almost suddenly been present a few days before the new moon on 29.09.2008, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The numerous individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* have again particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards. The various individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* have again been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* and the Green Hawker *Aeshna viridis* especially in the vineyards, with many individuals having sucked juice of overmature grapes and plums.

In 2008, the aestival generation of the Comma Butterfly *Polygonia c-album* has shown up at the localities Nußloch, Rot and Tairnbach with the almost sudden appearance of numerous individuals shortly after the new moon on 03.07.2008, whereas only some single individuals have appeared earlier and abt. one week to ten days later, the number of individuals has again started to decline. The appearance of the peak numbers of the Comma Butterfly *Polygonia c-album* in Nußloch, Rot and Tairnbach around the new moon on 03.07.2008 has taken place at the end of the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 which has started on the full moon on 18.06.2008 and has ended after the new moon on 03.07.2008.

In 2009, the first peak of the aestival generation of the Comma Butterfly *Polygonia c-album* has been established at the localities Nußloch and Tairnbach a few days before the new moon on 22.06.2009 when almost suddenly numerous individuals have started to fly around, whereas only some single individuals have been present earlier, and the appearance of individuals has continued with declining frequency beyond the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009 and has then started to diminuish further, with only some single individuals having still been present after the full moon on 06.08.2009. The second peak of the aestival generation of the Comma Butterfly *Polygonia c-album* has started to develop around the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009 when again quite some individuals have flown along the margin of the forest as well as across the meadows and through the vineyards near the forest at the locality Nußloch, and a few days after the new moon on 20.08.2009, almost suddenly numerous individuals have been present, whereas abt. one week to ten days later, the number of individuals has again started to decline, but quite some individuals have still been present after the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009. The number of individuals of the Comma Butterfly *Polygonia c-album* has then again increased a few days before the full moon on 04.09.2009 when abundant individuals have flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards, with many individuals having sucked juice of overmature grapes and plums. Frequency, behaviour and assemblage of the individuals of the Comma Butterfly *Polygonia c-album* as outlined above have continued and persisted beyond the decreasing half moon on 12.09.2009 and the new moon on 18.09.2009, whereas the abundance has started to decline after the increasing half moon on 26.09.2009 and only quite some individuals have still been present around the full moon

on 04.10.2009, and after the full moon on 04.10.2009, the frequency of individuals has decreased further.

In 2009, the aestival generation of the Red Admiral *Vanessa atalanta* has started with a few single individuals at the localities Nußloch, Tairnbach and Walldorf since mid to end of July 2009, whereas around the full moon on 06.08.2009, almost suddenly quite some individuals have been present in Nußloch, and abt. one week to ten days later, the number of individuals has again started to decline, with only a few single individuals having been discovered around the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009. The frequency of individuals of the Red Admiral *Vanessa atalanta* has then again increased after the new moon on 20.08.2009 when again almost suddenly quite some individuals have been present in Nußloch, and a few days before the full moon on 04.09.2009, almost suddenly numerous individuals have flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards, with many individuals having sucked juice of overmature grapes and plums. The various individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* have again been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* and the Green Hawker *Aeshna viridis* especially in the vineyards, and around the full moon on 04.09.2009, they have also been associated with numerous individuals of the Peacock Butterfly *Inachis io* which has also flown particularly frequently in the vineyards as well as around plum trees and bee hives in the meadows. Frequency, behaviour and assemblage of the individuals of the Red Admiral *Vanessa atalanta* as outlined above have continued and persisted beyond the decreasing half moon on 12.09.2009, and around the new moon on 18.09.2009, the abundance of individuals has again considerably increased within a couple of days and has reached almost the level of the mass flight around the new moon on 11.09.2007. The abundant individuals of the Red Admiral *Vanessa atalanta* have flown around and have sit on the fruits almost everywhere, with the sudden appearance of the significant frequency of individuals around the new moon on 18.09.2009 having happened like a mass flight. Around the increasing half moon on 26.09.2009 between the new moon on 18.09.2009 and the full moon on 04.10.2009, the abundance of individuals of the Red Admiral *Vanessa atalanta* has significantly diminished, and the mass occurrence has been substituted by the presence of only quite some individuals within a few days, with this considerably reduced frequency of individuals having persisted beyond the full moon on 04.10.2009, and after the full moon on 04.10.2009, the frequency of individuals has decreased further.

5.24 The Red Admiral *Vanessa atalanta* based on literature evaluation

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* Linnaeus 1758 (Lepidoptera: Nymphalidae) at the coast of the North Sea in the northwestern part of Germany have been observed on the island Helgoland northnorthwest of Bremerhaven where abundant individuals each and hundreds of individuals have flown on 25.08.1873 (Heinrich Gätke in Seitz 1936), in August 1976 (Schurian 1977) and on 13.06.2007 and 13.08.2007 (T. Falke in Hensle 2008a), respectively, which has been two days after the new moon on 23.08.1873, around and between the full moon on 09.08.1976 and the new moon on 20.08.1976, two days before the new moon on 15.06.2007 and on the new moon on 13.08.2007, respectively; on the Düne east of Helgoland northnorthwest of Bremerhaven where numerous individuals have flown on 31.05.2008 (T. Falke in Hensle 2009a) which has been three days before the new moon on 03.06.2008; on the island Sylt westnorthwest of Flensburg where abundant individuals each have flown on 16.08.1973 (Schurian 1974) and around 20.08.1976 (Schurian 1977) which has been two days after the full moon on 14.08.1973 and around the full moon on 20.08.1976, respectively; on the island Sylt westnorthwest of Flensburg where masses of individuals have flown on 21.08.1996 (Harbich 1998) which has

been two days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, around Westerland at the western margin of the central part of the island Sylt westnorthwest of Flensburg where thousands of individuals have flown on 09.08.2003 – 10.08.2003 (BARWINSKI 2004, HENSLE 2004a) which has been two and three days before the full moon on 12.08.2003, on the island Römö south of Esbjerg in the southwestern part of Denmark where 60 individuals have flown on 15.08.1973 (SCHURIAN 1974) which has been one day after the full moon on 14.08.1973; on the Hallig Gröde northwest of Husum where hundreds of individuals and numerous individuals each have flown on 13.08.1977 – 15.08.1977 (LOBENSTEIN 1978) as well as on 07.09.2000 and 01.10.2000 (HENSLE 2001b), respectively, which has been on and two days before the new moon on 15.08.1977, one day after the increasing half moon on 06.09.2000 between the new moon on 29.08.2000 and the full moon on 13.09.2000, and four days after the new moon on 27.09.2000, respectively; on the Hallig Gröde northwest of Husum where several hundreds of individuals each have flown and have sucked juice on overmature fruits on 03.08.1999 and 04.09.1999 – 07.09.1999 (HENSLE 2001a) which has been two days before the decreasing half moon on 05.08.1999 between the full moon on 28.07.1999 and the new moon on 11.08.1999 as well as several days before the new moon on 10.09.1999, respectively; on the Hallig Gröde northwest of Husum where abundant individuals each have flown on 26.08.2001, 21.09.2001 and 22.10.2001 (HENSLE 2002a) which has been on the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, four days after the new moon on 17.09.2001, and three days before the increasing half moon on 25.10.2001 between the new moon on 16.10.2001 and the full moon on 01.11.2001, respectively; near Schlüttsiel southsoutheast of Dagebüll northnorthwest of Husum where abt. 300 individuals have flown on 05.10.1968 (BRUNO P. KREMER in HARZ 1969) which has been one day before the full moon on 06.10.1968; in Sankt Peter-Ording southwest of Husum where hundreds or thousands of individuals have flown daily on 15.08.1966 – 20.08.1966 (ACHIM PFEIFFER in HARZ 1967a) and numerous individuals have flown on 15.09.1997 (HENSLE 2000c) which has been one day before and several days after the new moon on 16.08.1966 as well as one day before the full moon on 16.09.1997, respectively; on the island Baltrum northeast of Norden where abt. 250 individuals have flown on 15.10.2005 – 16.10.2005 (J. KAMP in HENSLE 2006a) which has been one and two days before the full moon on 17.10.2005, in the vicinity of Bremerhaven and Hannover where numerous individuals have flown on 01.10.1973 (SCHURIAN 1974) which has been five days after the new moon on 26.09.1973, in Schiffdorf east of Bremerhaven where abundant individuals have flown on 23.08.002 (HENSLE 2003) which has been two days after the full moon on 21.08.2002, around the mouth of the river Weser near Bremerhaven where abt. 170 individuals have flown on 03.10.1982 (STEINIGER & EITSCHBERGER 1985) which has been on the full moon on 03.10.1982; on the island Pagensand in the mouth of the river Elbe northwest of Hamburg where abt. 30 individuals, abt. 150 individuals, abt. 120 individuals and abt. 20 individuals have flown on 25.09.1997 – 28.09.1997 (HENSLE 2000c), in the period of 09.09.2000 – 04.10.2000 (HENSLE 2002a), on 05.09.2001 – 06.09.2001 (HENSLE 2002a) and on 07.11.2002 (HENSLE 2003), respectively, which has been three to six days before the new moon on 01.10.1997, around and between the full moon on 13.09.2001 and the new moon on 27.09.2001, two and three days after the full moon on 03.09.2001, and three days after the full moon on 04.11.2002, respectively; around Hamburg where abundant individuals have flown on 22.05.1920 – 23.05.1920 (SELZER in WARNECKE 1924) which has been four to five days after the new moon on 18.05.1920; in the vicinity of Hamburg, Kiel and Herzberg am Harz southeast of Osterode where numerous individuals have flown on 04.10.1973 – 06.10.1973 (SCHURIAN 1974) which has been around the increasing half moon on 05.10.1973 between the new moon on 26.09.1973 and the full moon on 12.10.1973; at the mouth of the river Ems south of Emden where more than 50 individuals have flown on 02.10.2007 (HENSLE 2008a) which has been one day before the decreasing half moon on 03.10.2007 between the full moon on 26.09.2007 and the new moon on 11.10.2007, around Hamburg where abundant individuals have flown on 22.05.1920 – 23.05.1920 (SELZER in WARNECKE 1955) which has been four to five days after the new moon on 18.05.1920, near Greetsiel northnorthwest of Emden where 35

individuals have flown on 08.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been on the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, and near Zaandam in the eastern part of Zaanstad northnorthwest of Amsterdam in the western part of the Netherlands where several thousands of individuals have flown on 26.08.1950 (B.J. LEMPKE in WARNECKE 1955) which has been one day before the full moon on 27.08.1950.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* at the coast of the Baltic Sea in the northeastern part of Germany have been recorded on the island Fehmarn northeast of Heiligenhafen where abt. 40 individuals have sit around the roots of two oaks wherein ants have nested on 16.08.1982 – 22.08.1982 (STEINIGER & EITSCHBERGER 1985) which has been several days before and after the new moon on 19.08.1982, in Rostock where very abundant individuals have flown from end of September 1958 to mid of October 1958 (F.P. MÜLLER in KOCH 1959) which has been around and between the full moon on 28.09.1958 and the new moon on 12.10.1958, in Saßnitz in the northeastern part of the island Rügen where more than 60 freshly emerged individuals have assembled under a birch and have flown on 12.10.2000 (HENSLE 2001b) which has been one day before the full moon on 13.10.2000; near Seedorf southsoutheast of Binz in the southeastern part of the island Rügen where more than 20 individuals have sucked juice on overmature fruits on 31.10.2000 – 08.11.2000 (HENSLE 2001b) and abt. 20 individuals have flown on 27.10.2001 – 30.10.2001 (HENSLE 2002a) which has been around and between the new moon on 27.10.2000 and the full moon on 12.11.2000, and two to five days before the full moon on 01.11.2001, respectively; on the island Hyllekrog south of Lolland in the southeastern part of Denmark where abt. 50 individuals have flown on 04.08.2002 (HENSLE 2003) which has been four days before the new moon on 08.08.2002, on the island Falster in the southeastern part of Denmark where abt. 100 individuals have flown on 31.07.2007 (J. STOLT in HENSLE 2008a) which has been one day after the full moon on 30.07.2007, on the island Mön in the southeastern part of Denmark where abt. 300 individuals have flown on 02.07.2007 (K. OLSEN in HENSLE 2008a) which has been two days after the full moon on 30.06.2007, and on the island Samsö southsoutheast of Aarhus in the western part of Denmark where more than 50 individuals have flown on 07.08.2008 (M. WEDEL-HEINEN in HENSLE 2009a) which has been one day before the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the northeastern part of Germany have also been noticed near Prenzlau where abundant individuals have flown at the end of August 1960 (KOCH 1961) which has been around the increasing half moon on 30.08.1960 between the new moon on 22.08.1960 and the full moon on 05.09.1960, near Finow west of Eberswalde northnortheast of Berlin where abundant individuals have flown from the beginning of August 1960 onwards (KOCH 1961) which has been around the full moon on 07.08.1960, near Gransee northnorthwest of Oranienburg northnorthwest of Berlin where abundant individuals have flown from mid to end of August 1960 (KOCH 1961) which has been around and between the decreasing half moon on 15.08.1960 between the full moon on 07.08.1960 and the new moon on 22.08.1960 as well as the increasing half moon on 30.08.1960 between the new moon on 22.08.1960 and the full moon on 05.09.1960, near Magdeburg in the Elbe valley (BEER in KOCH, ALBERTI & HANNEMANN 1962) and near Heygendorf in the Unstrut valley east of Artern east of Bad Frankenhausen (BECHERER in KOCH, ALBERTI & HANNEMANN 1962) where abt. 30 individuals each have flown on 10.10.1961 which has been one day after the new moon on 09.10.1961, near Hohendodeleben in the Elbe valley west of Magdeburg where more than 15 individuals have flown at the end of September 1961 and the beginning of October 1961 (BLOBNER in KOCH, ALBERTI & HANNEMANN 1962) which has been around and between the full moon on 24.09.1961 and the new moon on 09.10.1961, near Wolferstedt southeast of Sangerhausen where numerous individuals have flown on 06.09.1957 – 08.09.1957 (KAMES in KOCH, WARNECKE & WITTSTADT 1958) which has been one to three days before the full moon on 09.09.1957, in Nordhausen where abt. 10 individuals have flown

on 22.10.1961 (THELEMANN in KOCH, ALBERTI & HANNEMANN 1962) which has been two days before the full moon on 24.10.1961, in Halle in the Saale valley where numerous individuals have flown in the period of 06.09.1958 – 14.09.1958 (KAMES in KOCH 1959) which has been around and between the decreasing half moon on 07.09.1958 between the full moon on 29.08.1958 and the new moon on 13.09.1958 as well as the new moon on 13.09.1958, near Bad Blankenburg in the Schwarza valley northwest of Saalfeld where abundant individuals have flown on 10.08.1958 (STEUER in KOCH 1959) which has been five days before the new moon on 15.08.1958, in Gera where abundant individuals have flown on 01.10.1958 (SCHNAPPAUF in KOCH 1959) which has been three days after the full moon on 28.09.1958, in Niederwartha westnorthwest of Cossebaude westnorthwest of Dresden in the Elbe valley where abt. 50 individuals have flown on 17.06.1958 (HOFMANN in KOCH 1959) which has been on the new moon on 17.06.1958, in Königsbrück northnortheast of Dresden in the Elbe valley where abt. 35 individuals per hour have flown on 10.10.1958 (TECHRITZ in KOCH 1959) which has been two days before the new moon on 12.10.1958, and near Hoyerswerda south of Cottbus where more than 100 individuals have flown on 15.09.2001 (HENSLE 2002a) which has been two days before the new moon on 17.09.2001.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the northwestern part of Germany have also been recorded in the Teufelsmoor north of Bremen where abundant individuals have flown on 11.09.1974 (SCHURIAN 1975) which has been one day after the decreasing half moon on 10.09.1974 between the full moon on 01.09.1974 and the new moon on 16.09.1974, near Syke south of Bremen where abt. 300 individuals have been observed on 30.10.2005 (V. BISCHOFF in HENSLE 2006a) which has been three days before the new moon on 03.11.2005, near Gelting eastsoutheast of Flensburg where abt. 25 individuals have flown on 01.10.1982 (STEINIGER & EITSCHBERGER 1985) which has been two days before the full moon on 03.10.1982; near Bleckede in the Elbe valley eastnortheast of Lüneburg where abt. 40 individuals each have flown on 03.07.2007 and 06.07.2007 (H. MÜLLER-SCHERZ in HENSLE 2008a), abundant individuals have flown on 22.07.2008 (H. MÜLLER-SCHERZ in HENSLE 2009a), and abt. 200 individuals have flown and have sit on flowers in gardens in Alt Garge southeast of Bleckede on 28.07.2007 (H. MÜLLER-SCHERZ in HENSLE 2008a) which has been three days after the full moon on 30.06.2007 as well as one day before the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007, three days before the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, and two days before the full moon on 30.07.2007, respectively; near Brackede in the Elbe valley south of Boizenburg northeast of Lüneburg where more than 10 individuals have flown on 07.09.2002 (HENSLE 2003) which has been on the new moon on 07.09.2002, near Garstedt westnorthwest of Lüneburg where abt. 20 individuals have flown on 29.09.1990 (STEINIGER & EITSCHBERGER 1992) which has been one day after the increasing half moon on 28.09.1990 between the new moon on 19.09.1990 and the full moon on 04.10.1990, in the vicinity of Celle northnortheast of Hannover where up to 60 individuals have flown at the end of July 1968 (BRUNO P. KREMER in HARZ 1969) which has been around the new moon on 25.07.1968, near Jöllenbeck north of Bielefeld where more than 20 individuals have flown on 19.09.1991 (RETZLAFF 1992) which has been three days after the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, near Augustdorf southeast of Bielefeld where abt. 100 individuals have flown and have sucked on flowers on 01.09.1991 (RETZLAFF 1992) which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; around Schloß Holte southsoutheast of Bielefeld where abt. 20 individuals have flown and abt. 25 individuals have sucked juice on overmature fruits on 13.09.1991 and 18.09.1991, respectively (RETZLAFF 1992), which has been three days before and two days after, respectively, the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991; around Schloß Holte southsoutheast of Bielefeld where abt. 40 individuals have been registered on 28.08.1982 – 29.08.1982 (STEINIGER & EITSCHBERGER 1985) which has been one and two days after the increasing

half moon on 27.08.1982 between the new moon on 19.08.1982 and the full moon on 03.09.1982, near Lemgo east of Bielefeld where abt. 30 individuals have flown on 18.10.2000 (HENSLE 2001b) which has been five days after the full moon on 13.10.2000; near Bad Driburg east of Paderborn and Bad Lippspringe northeast of Paderborn where abt. 25 individuals each have flown on 01.09.1991 and 30.08.1991, respectively (RETZLAFF 1992), which has been one and three days before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, respectively; near Staumühle northwest of Bad Lippspringe north to northeast of Paderborn where abt. 60 individuals have flown and have sucked on flowers on 28.08.1991 (RETZLAFF 1992) which has been three days after the full moon on 25.08.1991, in Schalke in the northern part of the city of Gelsenkirchen where 80 individuals have flown on 17.09.1997 (HENSLE 2000c) which has been one day after the full moon on 16.09.1997, in Ergste south of Schwerte southsoutheast of Dortmund where 15 individuals have flown on 11.09.1997 (HENSLE 2000c) which has been five days before the full moon on 16.09.1997, in Düsseldorf where abt. 50 individuals in total have sucked juice on fallen fruits from the end of September 1971 to the end of October 1971 (KREMER 1972) which has been around and between the increasing half moon on 28.09.1971 between the new moon on 19.09.1971 and the full moon on 04.10.1971 as well as the increasing half moon on 28.10.1971 between the new moon on 19.10.1971 and the full moon on 03.11.1971, in Warburg northwest of Kassel and in Bad Driburg east of Paderborn where abt. 40 individuals each have flown on 16.09.1997 (HENSLE 2000c) which has been on the full moon on 16.09.1997, between Bad Driburg and Brakel east of Paderborn where 15 individuals have flown on 13.10.2001 (HENSLE 2002a) which has been three days before the new moon on 16.10.2001, near Alhausen and Reelsen north and northeast of Bad Driburg east of Paderborn where abundant individuals have flown on 08.09.2002 (HENSLE 2003) which has been one day after the new moon on 07.09.2002, near Willebadessen southeast of Paderborn where 25 individuals have flown on 14.10.2001 (HENSLE 2002a) which has been two days before the new moon on 16.10.2001, near Bad Driburg and Willebadessen east and southeast of Paderborn where 40 individuals in total have flown in the period of 14.09.2007 – 23.09.2007 (HENSLE 2008a) which has been around and between the new moon on 11.09.2007 and the full moon on 26.09.2007, near Gödenstorf westsouthwest of Lüneburg where abt. 60 individuals have been observed on 05.09.1982 (STEINIGER & EITSCHBERGER 1985) which has been two days after the new moon on 03.09.1982, in Bad Bevensen southsoutheast of Lüneburg where abt. 30 individuals have flown on 10.09.1995 (HENSLE 2000a) which has been one day after the full moon on 09.09.1995; between Winsen an der Luhe and Radbruch northwest of Lüneburg where abt. 20 individuals each have flown on 22.10.2000 (HENSLE 2001b) and 26.08.2001 (HENSLE 2002a) which has been one day after the decreasing half moon on 21.10.2000 between the full moon on 13.10.2000 and the new moon on 27.10.2000, and on the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; in Oedelsheim in the Weser valley northnorthwest of Hannoversch Münden where 10 individuals have flown on 26.08.2002 (HENSLE 2003) which has been three days before the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.07.2002, in Elkeringhausen eastnortheast of Winterberg where abundant individuals have flown on 12.09.1995 (HENSLE 2000a) which has been three days after the full moon on 09.09.1995, in the district Flittard at the northern margin of the city of Cologne in the Middle Rhine valley where up to 20 individuals daily have flown on 18.09.1976 – 22.09.1976 (GIERLING 1977) which has been one to five days before the new moon on 23.09.1976; around Bonn in the Middle Rhine valley where abundant individuals each have flown from 27.08.1958 onwards and from 28.08.1960 onwards (ROER 1959, 1961) which has been two days before the full moon on 29.08.1958 as well as two days before the increasing half moon on 30.08.1960 between the new moon on 22.08.1960 and the full moon on 05.09.1960, respectively; near Apeldoorn eastsoutheast of Amsterdam in the central part of the Netherlands where abt. 500 individuals and abt. 150 individuals have flown on 06.09.1958 and 08.09.1959, respectively (ROER 1961), which has been one day before the decreasing half moon on 07.09.1958 between the full moon on 29.08.1958 and the new moon on 13.09.1958 as well as five days after

the new moon on 03.09.1959, respectively; near Virton southwest of Arlon in the eastern part of Belgium where 30 individuals have flown on 15.09.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been one day after the new moon on 14.09.1966, and near Rottershausen northnorthwest of Schweinfurt in the Main valley in the central part of Germany where more than 20 individuals have flown on 10.09.1991 (BUCHSBAUM 1994) which has been two days after the new moon on 08.09.1991.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the southwestern part of Germany have been monitored around Denzlingen northnortheast of Freiburg in the southern part of the Upper Rhine valley where hundreds or even thousands of individuals have flown on 19.10.1982 and adjacent days (STEINIGER & EITSCHBERGER 1985) which has been two days after the new moon on 17.10.1982, near Freiburg in the southern part of the Upper Rhine valley where numerous individuals have flown on 14.09.1997 (HENSLE 2000c) which has been two days before the full moon on 16.09.1997, near Ihringen westnorthwest of Freiburg and Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley where up to abt. 40 individuals daily have flown on 31.10.1999 – 01.11.1999 (HENSLE 2001a) which has been on and one day before the decreasing half moon on 01.11.1999 between the full moon on 24.10.1999 and the new moon on 08.11.1999, near Bötzingen northwest of Freiburg in the southern part of the Upper Rhine valley where 20 individuals have flown on 22.02.2007 (HENSLE 2008a) which has been five days after the new moon on 17.02.2007; near Sankt Märgen in the southern part of the Black Forest east of Freiburg where numerous individuals each have flown on 22.10.2000 (HENSLE 2001b) and 13.09.2007 (J. HURST in HENSLE 2008a) which has been one day after the decreasing half moon on 21.10.2000 between the full moon on 13.10.2000 and the new moon on 27.10.2000, and two days after the new moon on 11.09.2007, respectively; near Höchenschwand southeast of Todtnau and at the Belchen southeast of Münstertal westnorthwest of Todtnau in the southern part of the Black Forest eastsoutheast of Bad Krozingen where abt. 30 individuals in total have flown on 03.10.2007 (K. SECKINGER & G. PAULUS in HENSLE 2008a) which has been on the decreasing half moon on 03.10.2007 between the full moon on 26.09.2007 and the new moon on 11.10.2007, near Grißheim southsouthwest of Bad Krozingen in the southern part of the Upper Rhine valley where 10 individuals have flown on 13.06.1998 (HENSLE 2001f) which has been three days after the full moon on 10.06.1998; at the Feldberg southwest of Titisee-Neustadt and near Löffingen southeast of Titisee-Neustadt in the southern part of the Black Forest where 30 individuals each have flown on 18.09.1997 and 22.09.1997, respectively (HENSLE 2000c), which has been two and six days after the full moon on 16.09.1997, respectively; at the Schluchsee north of Sankt Blasien north of Waldshut-Tiengen in the southern part of the Black Forest where abundant individuals have flown on 17.09.1961 (WEINFURTER 1966) which has been one day before the increasing half moon on 18.09.1961 between the new moon on 10.09.1961 and the full moon on 24.09.1961, in Friedrichshafen at Lake Constance where more than 30 individuals have flown on 01.10.1979 – 03.10.1979 (STEINIGER & EITSCHBERGER 1981) which has been two to four days before the full moon on 05.10.1979, near Schopfloch south of Kirchheim unter Teck eastsoutheast of Stuttgart where abt. 85 individuals have flown on 03.10.1973 (SCHURIAN 1974) which has been two days before the increasing half moon on 05.10.1973 between the new moon on 26.09.1973 and the full moon on 12.10.1973, near Aichtal-Grötzingen southsoutheast of Stuttgart where abt. 10 individuals have flown on 08.10.2006 (J. MAYER in HENSLE 2007a) which has been one day after the full moon on 07.10.2006, and near Steinheim am Albuch southsouthwest of Aalen where abt. 15 individuals in total have flown on 09.09.2007 – 10.09.2007 (HENSLE 2008a) which has been one and two days before the new moon on 11.09.2007.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the southeastern part of Germany have been documented near Mistelgau westsouthwest of Bayreuth where abundant individuals have sucked juice on fallen fruits on 16.08.1973 (SCHURIAN 1974) which has

been two days after the full moon on 14.08.1973, in Maxhütte-Haidhof in the Regen valley north of Regensburg where abt. 60 individuals have sucked juice on fallen fruits on 06.09.1972 (SCHURIAN 1973) which has been one day before the new moon on 07.09.1972; in Lenggries in the Isar valley south of Bad Tölz where thousands of individuals have flown on 24.09.1967 (BRUNO P. KREMER & BARBARA MANSEL in HARZ 1968a) and in the last week of September 1975 (SCHURIAN 1976) which has been three days before the decreasing half moon on 27.09.1967 between the full moon on 18.09.1967 and the new moon on 03.10.1967 as well as around the full moon on 20.09.1976, respectively; near Moosburg in the Isar valley northnortheast of München where abt. 10 individuals have flown on 24.02.2007 (HENSLE 2008a) which has been on the increasing half moon on 24.02.2007 between the new moon on 17.02.2007 and the full moon on 04.03.2007, near Oberstdorf south of Sonthofen where abundant individuals have flown at the end of September 1968 (BRUNO P. KREMER in HARZ 1969) which has been around and between the new moon on 22.09.1968 and the full moon on 06.10.1968, at the Nebelhorn east of Oberstdorf south of Sonthofen where 20 individuals have flown on 29.09.1967 (BRUNO P. KREMER & BARBARA MANSEL in HARZ 1968a) which has been four days before the new moon on 03.10.1967, around Fischen im Allgäu and Oberstdorf south of Sonthofen where 35 individuals have flown and have sucked on flowers on 03.10.1973 (SCHURIAN 1974) which has been two days before the increasing half moon on 05.10.1973 between the new moon on 26.09.1973 and the full moon on 12.10.1973; around Fischen im Allgäu south of Sonthofen where abt. 50 individuals in total and abt. 170 individuals in total have flown in the periods of 19.09.1971 – 09.10.1971 (KREMER 1972) and 17.09.1972 – 07.10.1972 (SCHURIAN 1973), respectively, which has been around and between the new moon on 19.09.1971 and the full moon on 04.10.1971, and around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the new moon on 07.10.1972, respectively; in Garmisch-Partenkirchen where 35 individuals have flown on 15.09.1983 (STEINIGER & EITSCHBERGER 1985) which has been on the increasing half moon on 15.09.1983 between the new moon on 07.09.1983 and the full moon on 22.09.1983, around Tegernsee west of Rosenheim where abt. 85 individuals have sucked juice on fallen fruits below a tree on 24.10.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been two days after the increasing half moon on 22.10.1966 between the new moon on 14.10.1966 and the full moon on 29.10.1966, and in Salz south of Bad Neustadt an der Saale where more than 20 individuals have flown on 31.08.1978 (HEIMO HARBICH in SCHURIAN 1979) which has been two days before the new moon on 02.09.1978.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the western part of Austria have been recorded near Salzburg in the Salzach valley where abt. 25 individuals have flown on 11.10.1993 (STEINIGER & EITSCHBERGER 1985) which has been four days before the new moon on 15.10.1993, near Golling in the Salzach valley southsoutheast of Salzburg where at least 50 individuals have flown on 17.09.2008 (ERICH SCHNÖLL in HENSLE 2009a) which has been two days after the full moon on 15.09.2008, at the Gerlos-Platte northwest of Krimml in the Salzach valley southwest of Kitzbühel where 15 individuals have flown on 29.08.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been two days before the full moon on 31.08.1966; within the city of Innsbruck in the Inn valley where masses of individuals have sucked on flowers and on fallen fruits on 21.09.1975 – 25.09.1975 and 29.09.1975 – 01.10.1975 (BURMANN & TARMANN 1978) which has been one to five days after the full moon on 20.09.1975 as well as on and a few days after the decreasing half moon on 29.09.1975 between the full moon on 20.09.1975 and the new moon on 05.10.1975, respectively; within and around Innsbruck in the Inn valley where masses of individuals have flown and have sucked juice on fallen fruits on 02.10.1976 – 06.10.1976, 12.10.1976 – 13.10.1976 and 23.10.1976 – 31.10.1976 (BURMANN & TARMANN 1979) which has been around and between the increasing half moon on 01.10.1976 between the new moon on 23.09.1976 and the full moon on 08.10.1976 as well as the full moon on 08.10.1976, four to five days after the full moon on 08.10.1976, and around and between the new moon on 23.10.1976 as well as the increasing half moon on 30.10.1976 between the new moon on 23.10.1976 and the full moon on 06.11.1976, re-

spectively; in Völs west of Innsbruck in the Inn valley where abundant individuals have flown on 17.09.1975 – 24.09.1975 (BURMANN & TARMANN 1978) which has been around the full moon on 20.09.1975, in Kranebitten west of Innsbruck in the Inn valley where abundant individuals have flown and have sucked on flowers on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977; at the Hinterhornalm and in the Wipptal north of Gnadenwald northeast of Hall in Tirol in the Inn valley eastnortheast of Innsbruck where abt. 10 individuals and masses of individuals have flown on 05.10.1976 and 12.10.1976 – 13.10.1976, respectively (BURMANN & TARMANN 1979), which has been three days before and four to five days after the full moon on 08.10.1976, respectively; around Neustift im Stubaital southsouthwest of Innsbruck where masses of individuals have flown on 12.10.1976 – 13.10.1976 (BURMANN & TARMANN 1979) which has been four to five days after the full moon on 08.10.1976, at the Sonnwendjoch in the Rofangebirge north of Jenbach in the Inn valley eastnortheast of Innsbruck where hundreds of individuals have flown on 17.09.1975 (BURMANN & TARMANN 1978) which has been three days before the full moon on 20.09.1975, near Bezau eastsoutheast of Bregenz where abt. 30 individuals have flown on 13.09.1990 (J. NIEDERSTRASSER in STEINIGER & EITSCHBERGER 1992) which has been one day after the decreasing half moon on 12.09.1990 between the full moon on 05.09.1990 and the new moon on 19.09.1990, near Bregenz in the Alpine Rhine valley where 15 individuals have sucked juice on fallen fruits on 25.09.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been four days before the full moon on 29.09.1966, near Dornbirn in the Alpine Rhine valley south of Bregenz where abt. 50 individuals have flown on 22.09.1991 (STEINIGER & EITSCHBERGER 1994) which has been two days before the full moon on 24.09.1991, near Hohenems in the Alpine Rhine valley south of Bregenz where 50 individuals have flown on 23.09.1997 (HENSLE 2000c) which has been one day before the decreasing half moon on 24.09.1997 between the full moon on 16.09.1997 and the new moon on 01.10.1997, at the Hochjoch near Schruns southeast of Bludenz where abt. 50 individuals have flown on 27.03.2006 (L. MÖSSINGER in HENSLE 2007a) which has been two days before the new moon on 29.03.2006, near Wildschönau southsouthwest of Kufstein where 60 individuals have flown on 22.09.1991 – 28.09.1991 (STEINIGER & EITSCHBERGER 1994) which has been several days before and after the full moon on 24.09.1991, near Zell am Pettenfürst and Ampflwang am Hausruck northnorthwest of Vöcklabruck southwest of Wels where abundant individuals have flown and have sucked juice on fallen fruits at the beginning of October 1936 (FOLTIN 1937) which has been around and between the full moon on 30.09.1936 and the new moon on 15.10.1936, and near Ottensheim in the Danube valley westnorthwest of Linz where abt. 15 individuals have sucked juice on fallen fruits on 01.10.1975 (BURMANN & TARMANN 1978) which has been two days after the decreasing half moon on 29.09.1975 between the full moon on 20.09.1975 and the new moon on 05.10.1975.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in the eastern part of Austria have been registered in Lienz where up to 30 individuals daily have sucked juice on fallen fruits from 15.08.1974 onwards (SCHURIAN 1975) which has been two days before as well as after the new moon on 17.08.1974, near Deutschlandsberg southsouthwest of Graz where 20 individuals have sucked juice on fallen fruits on 22.10.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been on the increasing half moon on 22.10.1966 between the new moon on 14.10.1966 and the full moon on 29.10.1966; near Knittelfeld in the Mur valley southwest of Leoben where 10 individuals each have flown and have sucked juice on flowers and fruits on 09.10.1976 (BURMANN & TARMANN 1979), 28.09.1977 (BURMANN & TARMANN 1979), 31.10.2001 (HENSLE 2002a) and 09.07.2008 (HENSLE 2009a) which has been one day after the full moon on 08.10.1976, one day after the full moon on 27.09.1977, one day before the full moon on 01.11.2001, and one day before the increasing half moon on 10.07.2008 between the new moon on 03.07.2008 and the full moon on 18.07.2008, respectively; near Scheifling westsouthwest of Judenburg southwest of Leoben where abt. 15 individuals have flown on 13.06.2002 (HENSLE 2003) which has been two days after the new moon on 11.06.2002, near Dürnstein westsouthwest of Krems in the Danube valley where abt. 10 indivi-

duals have flown on 06.03.2007 (CHRISTOPHER RABL in HENSLE 2008a) which has been two days after the full moon on 04.03.2007, and near Illmitz at Lake Neusiedl southeast of Vienna where numerous individuals have flown in the period of 15.09.1975 – 24.09.1975 (BURMANN & TARMANN 1978) which has been around and between the increasing half moon on 13.09.1975 between the new moon on 05.09.1975 and the full moon on 20.09.1975 as well as the full moon on 20.09.1975.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in Switzerland have been registered near Aeschiried southeast of Spiez at Lake Thun in the northwestern part of Switzerland where abt. 40 individuals have flown on 03.10.2007 (K. ZBINDEN in HENSLE 2008a) which has been on the decreasing half moon on 03.10.2007 between the full moon on 26.09.2007 and the new moon on 11.10.2007, near Adelboden south of Spiez at Lake Thun in the northwestern part of Switzerland where more than 50 individuals have flown on 08.10.2007 – 09.10.2007 (M. FLURI in HENSLE 2008a) which has been three and two days before the new moon on 11.10.2007, at the Axalp near Meiringen eastnortheast of Interlaken in the central part of Switzerland where 20 individuals have flown on 08.10.1995 (HENSLE 2000a) which has been on the full moon on 08.10.1995, at the Jochpaß near Engelberg southsoutheast of Luzern in the northeastern part of Switzerland where 30 individuals have flown on 05.10.1995 (HENSLE 2000a) which has been three days before the full moon on 08.10.1995, near Uster eastsoutheast of Zürich in the northeastern part of Switzerland where abt. 50 individuals daily have flown in the period of 16.08.1967 – 02.09.1967 (BRUNO P. KREMER & BARBARA MANSEL in HARZ 1968a) which has been around and between the full moon on 20.08.1967 and the new moon on 04.09.1967; near Reichenburg southeast of Zürich in the northeastern part of Switzerland where 20 individuals each have sucked juice at a bleeding birch on 20.09.1973 and 03.10.1973 (SCHURIAN 1974) which has been on the decreasing half moon on 20.09.1973 between the full moon on 12.09.1973 and the new moon on 26.09.1973, and two days before the increasing half moon on 05.10.1973 between the new moon on 26.09.1973 and the full moon on 12.10.1973, respectively; at the Col du Pillon east of Les Diablerets eastnortheast of Monthey in the Rhône valley in the southwestern part of Switzerland where hundreds of individuals have flown on 22.09.2007 (M. FANKHAUSER in HENSLE 2008a) which has been four days before the full moon on 26.09.2007, and in the Zermatt valley southsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where abundant individuals have flown on 30.08.1961 (HARZ 1965c) which has been four days after the full moon on 26.08.1961.

Mass flights of large quantities of individuals of the Red Admiral *Vanessa atalanta* in Great Britain have been recognized around Pembroke westnorthwest of Swansea in the southwestern part of England where masses of individuals have flown on 10.09.1959 – 11.09.1959 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been on and one day after the increasing half moon on 10.09.1959 between the new moon on 03.09.1959 and the full moon on 17.09.1959; in the St. Bride ´s Bay south of St. David´s and north of Martins´s Haven northnorthwest of Pembroke westnorthwest of Swansea in the southwestern part of England where hundreds of individuals and abundant individuals have flown on 10.09.1959 and 11.09.1959, respectively (SAGE 1960), which has been on and one day after the increasing half moon on 10.09.1959 between the new moon on 03.09.1959 and the full moon on 17.09.1959, respectively; on the Scilly Islands west of Plymouth in the southwestern part of England where hundreds of individuals have flown in mid of September 1959 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been around the full moon on 17.09.1959, on the Scilly Islands west of Plymouth in the southwestern part of England where hundreds of individuals daily have flown on 12.09.1959 – 19.09.1959 (WORMS 1960) which has been around the full moon on 16.09.1959, around Dorking southsouthwest of Epsom southsouthwest of London in the southeastern part of England where abt. 20 individuals have flown on 26.09.1933 (BUCKSTONE 1938) which has been one day before the increasing half moon on 27.09.1933 between the new moon on 19.09.1933 and the full moon on 03.10.1933, near Bexhill eastnortheast of Eastbourne southsoutheast of London in the southeastern part of England where

numerous individuals have flown on 08.08.1924 (PEILE 1924) which has been one day before the increasing half moon on 09.08.1924 between the new moon on 31.07.1924 and the full moon on 14.08.1924, near Ilford eastnortheast of London in the southeastern part of England where abundant individuals have flown in mid of September 1903 (MURRAY 1903) which has been around the new moon on 21.09.1903, and on the Shetland Islands north of Aberdeen in the northern part of Scotland where masses of individuals have flown at the end of June 1959 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been around the decreasing half moon on 28.06.1959 between the full moon on 20.06.1959 and the new moon on 06.07.1959.

5.25 The Comma Butterfly *Polygonia c-album* based on literature evaluation

Mass occurrences of large quantities of individuals of the Comma Butterfly *Polygonia c-album* LINNAEUS 1758 (Lepidoptera: Nymphalidae) in the northwestern and western parts of Germany have been reported from Aken in the Elbe valley west of Dessau in the northwestern part of Germany on 25.06.2005 – 26.06.2005 (ERNST GÖRGNER in HENSLE 2006a) which has been three and four days after the full moon on 22.06.2005, from Bleckede in the Elbe valley eastnortheast of Lüneburg in the northwestern part of Germany on 24.09.2005 (H. MÜLLER-SCHERZ in HENSLE 2006a) which has been one day before the decreasing half moon on 25.09.2005 between the full moon on 18.09.2005 and the new moon on 03.10.2005, from Uelzen southsoutheast of Lüneburg in the northwestern part of Germany on 30.06.1983 (STEINIGER & EITSCHBERGER 1985) which has been five days after the full moon on 25.06.1983, from the Wenigerbachtal southeast of Overath east of Cologne in the northwestern part of Germany on 17.07.1996 (SCHÖPWINKEL 1997) which has been two days after the new moon on 15.07.1997, from Berus north of Überherrn west of Saarbrücken in the western part of Germany on 02.07.2006 (HENSLE 2007a) which has been one day before the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 02.08.1994 (BROSZKUS 1995) which has been five days before the new moon on 07.08.1994.

Mass occurrences of large quantities of individuals of the Comma Butterfly *Polygonia c-album* in the southwestern part of Germany have been documented from Weiher southeast of Mörlenbach in the western part of the Odenwald eastnortheast of Weinheim on 21.03.2005 (HENSLE 2006a) which has been four days before the full moon on 25.03.2005, from Offenburg-Rammersweier in the southern part of the Upper Rhine valley on 12.10.2005 – 20.10.2005 (INGO NIKUSCH in HENSLE 2006a) which has been around and between the increasing half moon on 10.10.2005 between the new moon on 03.10.2005 and the full moon on 17.10.2005 as well as the decreasing half moon on 25.10.2005 between the full moon on 17.10.2005 and the new moon on 02.11.2005, from Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley on 20.03.2005 (HENSLE 2006a) which has been five days before the full moon on 25.03.2005; from Vogtsburg-Oberbergen northwest of Freiburg in the southern part of the Upper Rhine valley on 17.06.2006 (HENSLE 2007a) and 08.03.2007 (HENSLE 2008a) which has been one day before the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006 as well as four days after the full moon on 04.03.2007, respectively; from Unterensingen southeast of Stuttgart on 30.03.1998 (HENSLE 2001f) which has been two days after the new moon on 28.03.1998, and from Kreenheinstetten northeast of Leibertingen northnorthwest of Meßkirch on 25.07.2007 (HENSLE 2008a) which has been five days before the full moon on 30.07.2007.

Mass occurrences of large quantities of individuals of the Comma Butterfly *Polygonia c-album* have also been mentioned from Chorin-Senftenhütte northnortheast of Eberswalde north of Berlin in the northeastern part of Germany on 03.07.2005 (C. TRAPP in HENSLE 2006a) which has been three

days before the new moon on 06.07.2005, from Altenburg south of Leipzig in the northeastern part of Germany on 03.07.2005 (A. NAUMANN in HENSLE 2006a) which has been three days before the new moon on 06.07.2005; from Lengenfeld north of Krems in the Danube valley westnorthwest of Vienna in the eastern part of Austria on 26.03.2005 (CHRISTOPHER RABL in HENSLE 2006a), 27.03.2006 and 01.04.2006 (CHRISTOPHER RABL in HENSLE 2007a), and 12.03.2007 and 06.06.2007 (CHRISTOPHER RABL in HENSLE 2008a) which has been one day after the full moon on 25.03.2005, two days before and three days after the new moon on 29.03.2006, on the decreasing half moon on 12.03.2007 between the full moon on 04.03.2007 and the new moon on 19.03.2007, and five days after the full moon on 01.06.2007, respectively; and from Heiteren southeast of Colmar in the southern part of the Upper Rhine valley in the northeastern part of France on 24.02.2008 (HENSLE 2009a) which has been three days after the full moon on 21.02.2008.

A mass emergence of abt. 200 individuals of the Comma Butterfly *Polygonia c-album* in the period of mid to end of July 2002 terminating a breeding experiment in Cologne in the Middle Rhine valley in the northwestern part of Germany (A. BREUER in HENSLE 2003) has happened around and between the new moon on 10.07.2002 and the full moon on 24.07.2002.

5.26 The Painted Lady *Vanessa cardui* based on own observations

The vernal generation of the Painted Lady *Vanessa cardui* LINNAEUS 1758 (Lepidoptera: Nymphalidae) has suddenly appeared at the locality Walldorf with numerous individuals on the full moon on 09.05.2009, whereas no individuals have been observed earlier. An exceptionally spectacular swarming of the Painted Lady *Vanessa cardui* has happened from the full moon on 09.05.2009 to the new moon on 24.05.2009 and even some days beyond the latter turning point of the lunar cycle when in most of the gardens within the town of Walldorf as well as in the fields and meadows around Walldorf, numerous individuals have flown around from the early morning until the evening, and the same phenomenon has been observed at numerous other localities in the surroundings of Walldorf including Nußloch, Rot, Tairnbach and many others. It has been the first time during my entomological observations since 1964 that such an extraordinary swarming of the Painted Lady *Vanessa cardui* has taken place in such an outstanding manner that it has not been possible to overlook its abundant occurrence in most of the gardens, fields and meadows, and the flying of numerous individuals has happened at almost every corner. After the new moon on 24.05.2009, the frequency of individuals of the Painted Lady *Vanessa cardui* has started to decline rapidly, and only some single individuals have been observed from the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009 until a few days before the full moon on 07.07.2009, with apart from old damaged individuals from time to time also some new fresh individuals having appeared.

The aestival generation of the Painted Lady *Vanessa cardui* has occurred with a significant second peak of the distribution of the frequency of individuals at the localities Nußloch, Tairnbach and Walldorf a few days before the full moon on 07.07.2009 when again suddenly numerous individuals have flown around in the meadows and gardens in contrast to the presence of only some single individuals from the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009 until a few days before the full moon on 07.07.2009. The swarming of the Painted Lady *Vanessa cardui* during the second peak of the distribution of the frequency of individuals representing the aestival generation has been similarly pronounced as during the first peak of the distribution of the frequency of individuals constituting the vernal generation, with on most days abundant individuals having flown around and having sit particularly on red and violet flowers and subordinately also on yellow and blue flowers in fields and gardens from the early morning until the evening.

The extraordinary swarming of the aestival generation of the Painted Lady *Vanessa cardui* comprising the second peak of the distribution of the frequency of individuals which has started a few days before the full moon on 07.07.2009 has persisted until the new moon on 22.07.2009 and has then continued with gradually declining frequency of individuals, but still with maintenance of the occurrence of numerous individuals, beyond the full moon on 06.08.2009 and the decreasing half moon on 13.08.2009, with the abundance of individuals then having again significantly diminished around the new moon on 20.08.2009. The decreasing tendency of the frequency of individuals of the Painted Lady *Vanessa cardui* has continued after the latter turning point of the lunar cycle, and only single individuals have still been encountered from the increasing half moon on 27.08.2009 to the full moon on 04.10.2009 and beyond. The swarming of the vernal and aestival generations of the Painted Lady *Vanessa cardui* has been so accentuated that some individuals have even flown during light rainfall, light to moderate wind and light to dark cloudy sky without sunshine from the early morning onwards as well as in front of approaching thunderstorms with moderate to strong wind and dark cloudy sky, and some individuals have even flown around the balconies in the second to fourth floors of various houses in Walldorf and other localities. Various individuals of the Painted Lady *Vanessa cardui* have also been killed on streets and ways by the traffic, with this phenomenon also not having been observed before in such an accentuated manner as in 2009. Extraordinary swarming of the Painted Lady *Vanessa cardui* in the region of the Neckar valley between Heidelberg and Stuttgart has also happened in 1918 and 1958 (Roer 1958).

5.27 The Painted Lady *Vanessa cardui* based on literature evaluation

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* Linnaeus 1758 (Lepidoptera: Nymphalidae) in the southwestern part of Germany have been documented in the vicinity of Alzey in the northern part of the Upper Rhine valley where abt. 15 individuals have flown per minute on 05.06.1996 (Hasselbach 1997) which has been four days after the full moon on 01.06.1996, in Leimen-St. Ilgen (abt. 7 km south of Heidelberg) in the middle part of the Upper Rhine valley where abt. 50 individuals have flown per hour on 07.06.1996 (Hensle 2000b) which has been two days before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, in the surroundings of Bürstadt (abt. 30 km north-northwest of Heidelberg) in the middle part of the Upper Rhine valley where the peak distribution with the flight of hundreds of individuals has been registered in mid of August 1972 (Eitschberger 1973b) which has been around and between the new moon on 09.08.1972 and the full moon on 24.08.1972, in the vicinity of Bürstadt where abundant individuals have flown on 14.08.1975 (Eitschberger & Steiniger 1976b) which has been one day before the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975, in the vicinity of Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where masses of individuals have flown at the end of May 2003 and at the beginning of June 2003 (Erwin Sefrin in Hasselbach 2004) which has been around the new moon on 31.05.2003; in Mosbach (abt. 32 km eastsoutheast of Heidelberg) in the Neckar valley where more than 1.000 individuals have been counted in the period of 29.05.1996 – 28.06.1996 (Hensle 2000b) which has been around and between the full moon on 01.06.1996, the new moon on 16.06.1996 and the full moon on 01.07.1996; in Mosbach where more than 40 individuals and abt. 50 individuals have flown in the period of 19.10.1995 – 30.10.1995 (Hensle 2000a) and on 11.06.2007 (Hensle 2008a), respectively, which has been around and between the decreasing half moon on 17.10.1995 between the full moon on 08.10.1995 and the new moon on 24.10.1995 as well as the increasing half moon on 31.10.1995 between the new moon on 24.10.1995 and the full moon on 07.11.1995, and four days before the new moon on 15.06.2007, respectively; near Flehingen eastsoutheast of Bruchsal where up to 15 individuals daily have flown in the period of 15.09.2001 – 12.10.2001 (Hensle 2002a) which has been around and between the new moon on

17.09.2001, the full moon on 02.10.2001 and the new moon on 16.10.2001; around Karlsruhe in the middle part of the Upper Rhine valley where abundant individuals each have flown on 20.05.1956 (HOFMANN in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) and 29.06.1963 (HARBICH & WITTSTADT 1964) which has been four days before the full moon on 24.05.1956 as well as on the increasing half moon on 29.06.1963 between the new moon on 21.06.1963 and the full moon on 07.07.1963, respectively; around Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley where abundant individuals have suddenly appeared on 27.08.1954 (PEKARSKY 1955b) which has been one day before the new moon on 28.08.1954, near Neustadt an der Weinstraße at the western margin of the middle part of the Upper Rhine valley where masses of individuals have flown from the end of the first week of May 1958 onwards (ROESLER 1960) which has been around and several days after the full moon on 03.05.1958, near Annweiler am Trifels westnorthwest of Landau in der Pfalz where abundant individuals have flown on 26.05.1931 (LATTIN, JÖST & HEUSER 1957) which has been five days before the full moon on 31.05.1957; within and around Freiburg in the southern part of the Upper Rhine valley where masses of individuals have flown on 18.07.1926 (ONDARZA 1926) and abt. 30 – 50 individuals have flown daily from 09.06.1996 onwards (HENSLE 2000b) which has been one day before the increasing half moon on 19.07.1926 between the new moon on 09.07.1926 and the full moon on 25.07.1926, and on and after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, respectively; around Istein westnorthwest of Efringen-Kirchen north of Basel in the southern part of the Upper Rhine valley where abt. 200 individuals have flown on 29.05.1996 – 09.06.1996 (HENSLE 2000b) which has been around and between the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996 as well as the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996; in Grißheim southwest of Bad Krozingen in the southern part of the Upper Rhine valley on 15.06.2002 and 17.06.2002 (HENSLE 2003) which has been four and six days after the new moon on 11.06.2002, respectively; around and between Triberg and Sankt Blasien in the southern part of the Black Forest around 05.06.1958 (WEINFURTER 1966) which has been four days before the full moon on 01.06.1958; in the Höllental between Kirchzarten and Oberhöllsteig eastsoutheast of Freiburg in the southern part of the Black Forest where masses of individuals have flown on 13.07.1926 and 18.07.1926 (ONDARZA 1926) which has been four days after the new moon on 09.07.1926 as well as one day before the increasing half moon on 19.07.1926 between the new moon on 09.07.1926 and the full moon on 25.07.1926, respectively; at the Feldberg southwest of Titisee-Neustadt in the southern part of the Black Forest where hundreds of individuals have flown on 04.06.1996 (HENSLE 2000b) which has been three days after the full moon on 01.06.1996, at the Schluchsee south of Titisee-Neustadt in the southern part of the Black Forest where masses of individuals have flown on 14.07.1926 (ONDARZA 1926) which has been five days after the new moon on 09.07.1926, around Langenenslingen and Mengen northeast and eastsoutheast of Sigmaringen in the Danube valley where abt. 100 individuals have flown on 07.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been one day before the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, near Saulgau eastsoutheast of Sigmaringen in the Danube valley where abt. 100 individuals have flown on 16.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been one day after the full moon on 15.06.1992, around Stuttgart in the Neckar valley where masses of individuals have flown on 20.05.1958 (HELLER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; HELLER in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been two days after the new moon on 18.05.1958, near Nufringen southwest of Böblingen southwest of Stuttgart where abt. 15 individuals have flown on 06.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been five days after the new moon on 01.06.1992, near Pfullingen south of Reutlingen where more than 10 individuals have flown on 17.06.2002 (HENSLE 2003) which has been one day before the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, near Steinheim am Albuch westnorthwest of Heidenheim an der Brenz south of Aalen where abt. 25 individuals have flown on 03.06.2007 (HENSLE 2008a) which has been two days after the full moon

on 01.06.2007, near Söhnstetten west of Heidenheim an der Brenz south of Aalen where more than 10 individuals have flown on 24.05.2007 (H. BÖCKELMANN in HENSLE 2008a) which has been one day after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, around Konstanz at Lake Constance where hundreds of individuals have flown on 04.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been three days after the new moon on 01.06.1992, in the Zengermoos near Mariabrunn northeast of Eriskirch southeast of Friedrichshafen at Lake Constance where abt. 500 individuals have flown on 21.08.1975 (EITSCHBERGER & STEINIGER 1976b) which has been on the full moon on 21.08.1975, near Ebern southsouthwest of Coburg in the southeastern part of Germany where more than 200 individuals have flown on 25.08.1956 (RICHTER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) which has been four days after the full moon on 21.08.1956, and in the vicinity of Bad Neustadt an der Saale north of Schweinfurt in the central part of Germany where the peak distribution with the flight of thousands of individuals has been determined in the first week of August 1996 (HARBICH 1998) which has been around and between the full moon on 30.07.1996 and the new moon on 14.08.1996.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* at the coast of the North Sea in the northwestern part of Germany have been recorded on the island Helgoland north-northwest of Bremerhaven where abt. 4.000 individuals have flown on 04.06.2007 (T. FALKE in HENSLE 2008a) which has been three days after the full moon on 01.06.2007; on the Hallig Gröde westnorthwest of Husum where hundreds of individuals have flown on 13.08.1977 – 15.08.1977 (LOBENSTEIN 1978) and numerous individuals each have flown on 26.05.2002, 06.06.2002 and 18.06.2002 (HENSLE 2003) which has been on and two days before the new moon on 15.08.1977, on the full moon on 26.05.2002, five days before the new moon on 11.06.2002, and on the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; near Schlüttsiel southsoutheast of Dagebüll northnorthwest of Husum where hundreds of individuals have flown on 05.10.1968 (ULF EITSCHBERGER in HARZ 1969) which has been one day before the full moon on 06.10.1968, in the vicinity of Sankt Peter-Ording southwest of Husum where tens of thousands of individuals have flown on 18.08.1996 – 22.08.1996 (HARBICH 1998) which has been around and between the new moon on 14.08.1996 and the full moon on 28.08.1996, on the island Sylt westnorthwest of Flensburg where masses of individuals have flown on 21.08.1996 (HARBICH 1998) which has been two days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, around Westerland at the western margin of the central part of the island Sylt westnorthwest of Flensburg where thousands of individuals have flown on 09.08.2003 – 10.08.2003 (BARWINSKI 2004) which has been two and three days before the full moon on 12.08.2003, near Margrethe Kog around Esbjerg in the southwestern part of Denmark where abt. 1.000 individuals have flown on 11.06.2007 (K. OLSEN in HENSLE 2008a) which has been four days before the new moon on 15.06.2007, near Schiffdorf east of Bremerhaven where abt. 30 individuals have flown on 22.08.1996 (HENSLE 2000b) which has been one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, near Hamburg-Blankenese where abt. 25 individuals have flown on 17.06.1952 (WARNECKE 1955) which has been five days before the new moon on 22.06.1952, in Hamburg-Moorheide where abt. 20 individuals have flown on 22.08.1996 (HENSLE 2000b) which has been one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, near Emden and Hinte-Suurhusen north of Emden where more than 40 individuals in total have flown on 15.06.2002 – 23.06.2002 (HENSLE 2003) which has been around the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, and in Bunderhammrich north of Bunde west of Leer where masses of individuals have flown on 24.06.2002 (HENSLE 2003) which has been on the full moon on 24.06.2002.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* at the coast of the

Baltic Sea in the northwestern part of Germany have been noticed near Westfehmarn and Petersdorf in the western part of the island Fehmarn where abt. 20 individuals each have flown on 03.06.2007 (L.E. JONAS in HENSLE 2008a) and 04.06.2007 (M. KLÖSKES in HENSLE 2008a), respectively, which has been two and three days after the full moon on 01.06.2007, respectively; near Kosel northwest of Eckernförde and near Neuharmhorst southwest of Oldenburg in Holstein where abt. 20 – 25 individuals have flown on 06.06.2007 (D. SCHMIDT in HENSLE 2008a) and 08.06.2007 (HENSLE 2008a), respectively, which has been two days before and on the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, respectively; around Kiel where abundant individuals have been present in the period of 08.07.1969 – 08.08.1969 (EITSCHBERGER 1970b) which has started one day after the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969, and has ended two days after the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969; near Gedser at the southern tip of the island Falster in the southeastern part of Denmark where 100 individuals and 75 individuals have flown on 03.06.2007 (H. LIND in HENSLE 2008a) and 02.08.2007 (K. OLSEN in HENSLE 2008a), respectively, which has been two days after the full moon on 01.06.2007 and three days after the full moon on 30.07.2007, respectively; and at the southern tip of the island Gotland in the Baltic Sea in the southeastern part of Sweden where 400 individuals have flown on 04.06.2007 (B. JONSSON in HENSLE 2008a) which has been three days after the full moon on 01.06.2007.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* at the coast of the Baltic Sea in the northeastern part of Germany have been recognized on the Bug peninsula in the northwestern part of the island Rügen on 16.06.2002 – 21.06.2002 (HENSLE 2003) which has been three days before and three days after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; in the vicinity of Saßnitz in the northeastern part of the island Rügen where more than 400 individuals have been observed on 19.06.2002 (REINHARD BÜLTE in HENSLE 2003) which has been one day after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, near Prora northnorthwest of Binz in the eastern part of the island Rügen where 10 individuals have flown on 28.07.2007 (DIETRICH RÖHRBEIN in HENSLE 2008a) which has been two days before the full moon on 30.07.2007, near Lubkow southwest of Prora northnorthwest of Binz in the eastern part of the island Rügen where abt. 100 individuals have flown on 03.06.2007 (DIETRICH RÖHRBEIN in HENSLE 2008a) which has been two days after the full moon on 01.06.2007, near Warnemünde north of Rostock where more than 100 individuals have flown in the first third of August 1996 (RUDNICK 1998) which has been around and between the full moon on 30.07.1996 and the new moon on 14.08.1996, near Warnemünde north of Rostock where abt. 70 individuals in total have flown on 10.08.1996 – 11.08.1996 (HENSLE 2000b) which has been three to four days before the new moon on 14.08.1996, and on the island Poel north of Wismar where abundant individuals have flown at the end of July 1958 (GERISCH in KOCH 1959) which has been around the full moon on 30.07.1958.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the northwestern part of Germany have also been registered near Augustdorf southeast of Bielefeld where abt. 80 individuals have flown and have sucked on flowers on 01.09.1991 (RETZLAFF 1992) which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; near Bad Driburg east of Paderborn and Neuenheerse eastsoutheast of Paderborn where 10 individuals each have flown and have sucked on flowers on 29.08.1991 and 21.08.1991, respectively (RETZLAFF 1992), which has been four days after and before, respectively, the full moon on 25.08.1991; in Warstein southeast of Soest where more than 40 individuals in total have flown on 16.06.2002 and 19.06.2002 (HENSLE 2003) which has been two days before and one day after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; in the vicinity of Uelzen southsoutheast of Lüneburg

where abundant individuals have flown on 13.05.1982 – 31.05.1982 (STEINIGER & EITSCHBERGER 1985) which has been around and between the full moon on 07.05.1982 and the new moon on 23.05.1982, near Müden in the Aller valley westnorthwest of Gifhorn westnorthwest of Wolfsburg where 15 individuals have flown on 09.06.2007 (HENSLE 2008a) which has been one day after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 13.06.2007, near Bannetze northnortheast of Wietze in the Aller valley north of Hannover where abt. 30 individuals have flown on 13.07.1968 (ULF EITSCHBERGER in HARZ 1969) which has been three days after the full moon on 10.07.1968, near Rohrsen northnorthwest of Bad Münder am Deister southwest of Hannover where numerous individuals have flown on 03.09.1972 (EITSCHBERGER 1973b) which has been four days before the new moon on 07.09.1972, in Porta Westfalica south of Minden in the Weser valley where 30 individuals have flown on 21.08.1991 (STEINIGER & EITSCHBERGER 1994) which has been three days after the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991, in Göttingen in the Leine valley where more than 40 individuals have flown on 11.06.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been one day before the decreasing half moon on 12.06.1966 between the full moon on 03.06.1966 and the new moon on 18.06.1966, in Moringen in the Leine valley north of Göttingen where large amounts of individuals have flown on 06.06.1996 (HENSLE 2000b) which has been five days after the full moon on 01.06.1996, in Dortmund where abundant individuals have flown on 14.08.1991 (STEINIGER & EITSCHBERGER 1994) which has been four days after the new moon on 10.08.1991; near Dortmund where abundant individuals and up to 30 individuals daily have flown on 31.05.1958 – 01.06.1958 (HARKORT & WEIGT 1967) and in the period of 02.09.1962 – 15.09.1962 (WILHELM HARKORT in HARZ & WITTSTADT 1964), respectively, which has been one day before and on the full moon on 01.06.1958 as well as around and between the new moon on 30.08.1962 and the full moon on 14.09.1962, respectively; in Heinsberg north of Aachen where 50 individuals have flown on 02.06.1996 – 03.06.1996 (HENSLE 2000b) which has been one and two days after the full moon on 01.06.1996, and in Herzogenrath-Aisdorf north of Aachen where abt. 40 individuals have been noted on 04.06.1996 (HENSLE 2000b) which has been three days after the full moon on 01.06.1996.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the southeastern part of Germany have been noted within and around München in the Isar valley on 01.06.2003 as well as between München and Stuttgart on 02.06.2003 where millions of individuals in total have flown (REICHHOLF & SAKAMOTO 2005) which has been one and two days after the new moon on 31.05.2003, respectively; within and around München in the Isar valley where the peak distribution with mass flights of tens of thousands of individuals has been confirmed on 22.05.2006 and 09.07.2006 – 15.07.2006 (REICHHOLF & SAKAMOTO 2006) which has been two days after the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006 as well as several days before and after the full moon on 11.07.2006, respectively; within and around München in the Isar valley where masses of individuals have flown around on 13.06.1939 according to a note in a regional newspaper (H. ERDL in EITSCHBERGER & STEINIGER 1977c) which has been several days before the new moon on 17.06.1939, near Wartenberg southsoutheast of Moosburg an der Isar northeast of München where more than 100 individuals have flown on 23.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been three days before the new moon on 26.06.1968, near Gaden eastnortheast of Freising in the Isar valley northnortheast of München where abt. 20 individuals have flown on 17.06.1978 (STEINIGER & EITSCHBERGER 1979) which has been three days before the full moon on 20.06.1978, in the Erdinger Moos around Erding northeast of München where masses of individuals have flown in the period of 15.07.1977 – 05.08.1977 (STEINIGER & EITSCHBERGER 1978) which has been around and between the new moon on 16.07.1977 and the full moon on 30.07.1977; in the Gennachmoor as well as around Alpsee, Bannwaldsee and Dachssee in the vicinity of Füssen where hundreds of individuals have flown daily on 06.06.1996, 15.06.1996 and 17.06.1996 (SCHUBERT 1997) which has been five days after the full moon on 01.06.1996 as well as one day before and one day after the new moon on 16.06.1996, re-

spectively; around Schirnding northeast of Marktredwitz where masses of individuals have flown on 08.08.1976 (EITSCHBERGER & STEINIGER 1977c) which has been two days before the new moon on 10.08.1976, near Strullendorf-Mistendorf southeast of Bamberg where abt. 15 individuals have flown on 24.05.2007 – 26.05.2007 (HEINRICH VOGEL & B. SCHNEIDER in HENSLE 2008a) which has been one to three days after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, at the Tatzelwurm near Bayrischzell southsouthwest of Rosenheim where abt. 200 individuals have flown on 18.08.1978 (STEINIGER & EITSCHBERGER 1979) which has been on the full moon on 18.08.1978, in Burghausen in the Salzach valley east of München where hundreds of thousands of individuals have flown on 09.05.1988 – 13.05.1988 (SAGE 1989, WALTER SAGE in STEINIGER & EITSCHBERGER 1992) which has been a few days before and after the decreasing half moon on 10.05.1988 between the full moon on 01.05.1988 and the new moon on 16.05.1988, in Haiming northnortheast of Burghausen in the Salzach valley east of München where abt. 50 individuals have flown on 23.06.1991 – 24.06.1991 (STEINIGER & EITSCHBERGER 1994) which has been three and four days before the full moon on 27.06.1991, in Niedergottsau west of Kirchdorf am Inn northeast of Burghausen in the Salzach valley east of München where abt. 100 individuals have been observed on 20.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been five days after the full moon on 15.06.1992, around Kallmünz in the Naab valley northnorthwest of Regensburg where abt. 40 individuals have flown on 15.08.1978 (STEINIGER & EITSCHBERGER 1979) which has been three days before the full moon on 18.08.1978, in Passau in the Danube valley on 25.05.1958 – 26.05.1958 (WEINFURTER 1966) which has been one and two days before the increasing half moon on 27.05.1958 between the new moon on 18.05.1958 and the full moon on 01.06.1958, and near Eggolsheim-Rettern north of Forchheim north of Nürnberg where 20 individuals have flown on 25.05.2007 (J. MAYROCK in HENSLE 2008a) which has been two days after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the central to southwestern parts of Germany have also been confirmed near Zellingen in the Main valley northnorthwest of Würzburg in the central part of Germany where masses of individuals have flown from 09.06.1996 onwards (HENSLE 2000b) which has been on and after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Oberntief northnorthwest of Bad Windsheim southeast of Würzburg in the central part of Germany where 80 individuals have been counted on 07.06.1996 (HENSLE 2000b) which has been two days before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Obereisenheim northwest of Volkach in the Main valley eastnortheast of Würzburg in the central part of Germany where 30 individuals have flown on 09.06.1996 (HENSLE 2000b) which has been on the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Flomborn southsoutheast of Alzey southsouthwest of Mainz in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 20 individuals have flown on 11.10.1968 (ULF EITSCHBERGER in HARZ 1969) which has been five days after the full moon on 06.10.1968, near Mainz at the transition from the Middle Rhine valley into the Upper Rhine valley in the southwestern part of Germany where abt. 100 individuals have flown on 24.08.1962 (GASSER in HARZ & WITTSTADT 1964) which has been one day after the decreasing half moon on 23.08.1962 between the full moon on 15.08.1962 and the new moon on 30.08.1962, and near Ingelheim westsouthwest of Mainz in the southwestern part of Germany where masses of individuals have flown on 25.07.1977 – 31.07.1977 (STEINIGER & EITSCHBERGER 1978) which has been around and between the increasing half moon on 24.07.1977 between the new moon on 16.07.1977 and the full moon on 30.07.1977 as well as the full moon on 30.07.1977.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the western part of Germany have also been recorded near Niederkumbd north of Simmern in the eastern part of the Hunsrück where abt. 100 individuals have flown daily on 12.08.2002 – 14.08.2002 (HENSLE

2003) which has been four to six days after the new moon on 08.08.2002, near Niederkumbd north of Simmern in the eastern part of the Hunsrück where abt. 50 individuals have sucked on flowers on 18.09.1997 (HENSLE 2000c) which has been two days after the full moon on 16.09.1997, near Hüttersdorf westnorthwest of Lebach westsouthwest of Sankt Wendel in the southern part of the Saar area where abt. 80 individuals in total have flown in the period of 02.06.1996 – 13.06.1996 (HENSLE 2000b) which has been around and between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Ottweiler south of Sankt Wendel in the southern part of the Saar area where abt. 35 individuals have been observed on 08.08.1972 (EITSCHBERGER 1973b, SCHMIDT-KOEHL 1977) which has been one day before the new moon on 09.08.1972, near Friedrichsthal northnortheast of Saarbrücken in the southern part of the Saar area where abt. 50 individuals daily have flown for several days from 10.08.1970 onwards (E.L. BRAUN in SCHMIDT-KOEHL 1977) which has been around the increasing half moon on 11.08.1970 between the new moon on 02.08.1970 and the full moon on 17.08.1970, near Homburg northeast of Saarbrücken in the southern part of the Saar area where masses of individuals have flown on 19.05.1958 (DIETER MÜTING in SCHMIDT-KOEHL 1977) which has been one day after the new moon on 18.05.1958, near Perl in the Moselle valley southsouthwest of Trier where 50 individuals in total have flown in the period of 24.05.1996 – 09.06.1996 (HENSLE 2000b) which has been around and between the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996 as well as the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, in Stadtkyll in the Kyll valley northwest of Daun where more than 10 individuals have flown on 14.06.2002 – 17.06.2002 (HENSLE 2003) which has been around and between the new moon on 11.06.2002 as well as the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, and in Kaub northnorthwest of Bingen in the Middle Rhine valley where abt. 50 individuals have been observed on 04.06.1996 (HENSLE 2000b) which has been three days after the full moon on 01.06.1996.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the northeastern part of Germany have also been registered in the vicinity of Neuruppin northnorthwest of Berlin where abt. 90 individuals have flown on 24.06.1956 (STEIL in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) which has been one day after the full moon on 23.06.1956, near Stendal westnorthwest of Brandenburg an der Havel where numerous individuals have flown from the beginning to mid of August 1958 (KOLAR in KOCH 1959) which has been around and between the full moon on 30.07.1958 and the new moon on 15.08.1958, near Magdeburg in the Elbe valley where abundant individuals have flown on 04.08.1958 (BEER in KOCH 1959) which has been five days after the full moon on 30.07.1958, in Hohendodeleben in the Elbe valley west of Magdeburg where hundreds of individuals have flown on 08.06.1996 and 10.06.1996 (HENSLE 2000b) which has been one day before and one day after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Jessnitz in the Mulde valley north of Wolfen where abt. 300 individuals have flown on 04.05.1996 (HENSLE 2000b) which has been one day after the full moon on 03.05.1996, near Halle-Brokdorf in the Saale valley where abt. 15 individuals have flown on 21.07.2007 (HENSLE 2008a) which has been one day before the increasing half moon on 22.07.2007 between the new moon on 14.07.2007 and the full moon on 30.07.2007, near Plötzkau in the Saale valley southsouthwest of Bernburg where abt. 300 individuals have flown on 05.05.1996 (HENSLE 2000b) which has been two days after the full moon on 03.05.1996, near Weimar east of Erfurt where masses of individuals have flown and have sucked on flowers on 28.07.1931 (JAUBITZER in SEITZ 1931) which has been one day before the full moon on 29.07.1931, near Apolda in the Ilm valley northnorthwest of Jena where abt. 1.000 individuals have assembled on 26.05.1996 like clouds above the plum trees which have been planted like avenues (HENSLE 2000b) which has been on the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996, near Nordhausen where abt. 60 individuals have flown at the end of September 1958 (FRITZSCHE in KOCH 1959) which has been around the full moon

on 28.09.1958, in Seega in the Wipper valley southeast of Nordhausen where abundant individuals have flown on 05.06.1996 (HENSLE 2000b) which has been four days after the full moon on 01.06.1996, in Roßla eastsoutheast of Nordhausen where hundreds of individuals have flown on 08.06.1996 – 09.06.1996 (HENSLE 2000b) which has been on and one day before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Bad Langensalza northwest of Erfurt where numerous individuals have flown on 07.06.1958 (THUST in KOCH 1959) which has been three days before the decreasing half moon on 10.06.1958 between the full moon on 01.06.1958 and the new moon on 17.06.1958, near Bösenbrunn south of Plauen where 25 individuals have flown on 09.06.2007 (U. FISCHER in HENSLE 2008a) which has been one day after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, near Frankenberg northeast of Chemnitz where 20 individuals have flown on 30.05.2007 (F. HOHENSTEIN in HENSLE 2008a) which has been two days before the full moon on 01.06.2007, in Grossenhain northnorthwest of Dresden in the Elbe valley where abundant individuals have flown on 02.06.1958 – 06.06.1958 (SCHÖNFELDER in KOCH 1959) which has been one to five days after the full moon on 01.06.1958, in Coswig in the Elbe valley westnorthwest of Dresden where abt. 20 individuals have flown on 03.05.1996 (HENSLE 2000b) which has been on the full moon on 03.05.1996, in Schullwitz in the Elbe valley east of Dresden where more than 100 individuals have flown daily on 07.06.1996 – 11.06.1996 (HENSLE 2000b) which has been several days before and after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, in Rehefeld-Zaunhaus southwest of Altenberg where abt. 50 individuals daily have flown and have sucked on flowers in the period of 15.09.1961 – 23.09.1961 (AUERSWALD in KOCH, ALBERTI & HANNEMANN 1962) which has been around and between the new moon on 10.09.1962 and the full moon on 24.09.1962, near Löbau westsouthwest of Görlitz where more than 100 individuals have flown on 16.08.1964 (HARZ 1965c) which has been on the increasing half moon on 16.08.1964 between the new moon on 07.08.1964 and the full moon on 23.08.1964; and in Rosenhain northeast of Löbau westsouthwest of Görlitz where 50 individuals and 30 individuals have flown on 11.08.1968 (ULF EITSCHBERGER in HARZ 1969) and 23.08.1972 (EITSCHBERGER 1973b), respectively, which has been three days after the full moon on 08.08.1968 and one day before the full moon on 24.08.1972, respectively.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the southwestern, northwestern and northeastern parts of France have been recorded at the Gulf of Biscaya west of Bordeaux in the southwestern part of France where annual mass flights have happened in the years 1966 – 1974 which have lasted for abt. one week each, with the mass flight in mid of August 1974 (EITSCHBERGER & STEINIGER 1975b) having been developed around the new moon on 17.08.1974; near Mimizan southwest of Bordeaux in the southwestern part of France where abt. 30 individuals have flown on 03.08.1995 (HENSLE 2000a) which has been on the increasing half moon on 03.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, in the southern part of France where millions of individuals have flown around on 20.04.1988 and adjacent days (JÜRGEN THIELE in EBERT & RENNWALD 1991) which has been four days after the new moon on 16.04.1988, near Port-Vendres southsoutheast of Perpignan in the southwestern part of France where thousands of individuals have flown in clouds over the sea at the end of May 1996 (C. FINK in HENSLE 2000b) which has been around the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996, near Banyuls-sur-Mer south of Port-Vendres southsoutheast of Perpignan in the southwestern part of France where thousands of individuals have flown at the end of May 1923 (HARZ 1975) which has been around the full moon on 30.05.1923, near Trouville-sur-Mer southsouthwest of Le Havre northwest of Paris in the northwestern part of France where masses of individuals have flown on 12.08.1879 (HAWKSHAW 1879) which has been one day after the decreasing half moon on 11.08.1879 between the full moon on 02.08.1879 and the new moon on 17.08.1879, near Laval in the Mayenne valley eastsoutheast of Rennes in the northwestern part of France where 50 individuals have flown on 02.10.2003 (HENSLE 2004a) which has

been on the increasing half moon on 02.10.2003 between the new moon on 26.06.2003 and the full moon on 10.10.2003, and near Verdun eastnortheast of Metz in the northeastern part of France where abt. 20 individuals have flown on 18.06.2000 (HENSLE 2001b) which has been one day after the full moon on 17.06.2000.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the southeastern part of France have been registered near Aups north of Salernes and near Tourtour eastnortheast of Salernes northnortheast of Toulon where abt. 500 individuals and thousands of individuals have flown on 16.05.1996 – 18.05.1996 (HENSLE 2000b) and 03.06.1996 – 10.06.1996 (UDO LUY in HENSLE 2000b) which has been around the new moon on 17.05.1996 and several days after the new moon on 01.06.1996, respectively; between Hyères east of Toulon and Antibes east of Cannes where millions of individuals have flown on 05.05.1907 – 08.05.1907 (HARZ 1975) which has been on and several days after the decreasing half moon on 05.05.1907 between the full moon on 28.04.1907 and the new moon on 12.05.1907, at the Côte des Maures between Marseille and Nice where masses of individuals have flown on 23.05.1925 (HARZ 1975) which has been one day after the new moon on 22.05.1925, near Hyères east of Toulon where thousands of individuals have flown on 01.04.1928 (HARZ 1975) which has been four days before the full moon on 05.04.1928, near Sète southwest of Montpellier where more than 80 individuals have flown on 29.05.1995 (HENSLE 2000a) which has been on the new moon on 29.05.1995, near Crillon-le-Brave eastnortheast of Carpentras north of Marseille where abt. 100 individuals each have flown on 13.05.1990 – 14.05.1990 and 17.05.1990 (STEINIGER & EITSCHBERGER 1992) which has been several days after the full moon on 09.05.1990; near Crillon-le-Brave eastnortheast of Carpentras and at the Mont Ventoux north of Carpentras north of Marseille where abt. 300 individuals and abt. 1.500 individuals have flown on 21.06.1996 and 24.06.1996 (HENSLE 2000b), respectively, which has been four days and one day before the increasing half moon on 25.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, respectively; at the Vercors near La Chapelle-en-Vercors east of Valence southsoutheast of Lyon where masses of individuals have flown and have sit on flowers on 25.06.1996 – 01.07.1996 (HENSLE 2000b) which has been around and between the increasing half moon on 25.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996 as well as the full moon on 01.07.1996, near Orange north of Avignon and Cavaillon southeast of Avignon northnorthwest of Marseille where 100 individuals each have flown on 18.05.1990 (STEINIGER & EITSCHBERGER 1992) which has been on the decreasing half moon on 18.05.1990 between the full moon on 09.05.1990 and the new moon on 24.05.1990; near Saint-Rémy-de-Provence southsoutheast of Avignon as well as near Les Baux south of Avignon, Tarascon southsouthwest of Avignon and Cavaillon southeast of Avignon northnorthwest of Marseille where abt. 150 individuals as well as abt. 500 individuals in total have flown on 19.05.1990 (STEINIGER & EITSCHBERGER 1992) which has been one day after the decreasing half moon on 18.05.1990 between the full moon on 09.05.1990 and the new moon on 24.05.1990; near Bonnieux east of Cavaillon north of Marseille where abt. 600 individuals have flown on 21.05.1990 (STEINIGER & EITSCHBERGER 1992) which has been three days before the new moon on 24.05.1990; near Lodève northwest of Montpellier where more than 100 individuals and more than 500 individuals have flown on 07.04.2000 and 18.04.2000 (HENSLE 2001b), respectively, which has been three days after the new moon on 04.04.2000 and on the full moon on 18.04.2000, respectively; near Nîmes northwest of Marseille where masses of individuals have flown on 20.07.1926 (HARZ 1975) which has been five days before the full moon on 25.07.1926, and at the Col des Grands Vents near Arâches northnorthwest of Saint-Gervais-les-Bains east of Annecy where masses of individuals have flown on 18.07.1926 (SCHWEIZER ENTOMOLOGISCHER ANZEIGER 1926b) which has been one day before the increasing half moon on 19.06.1926 between the new moon on 10.06.1926 and the full moon on 25.07.1926.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the eastern part of Austria have been registered near Deutschlandsberg southwest of Graz where 15 individuals

have flown on 25.09.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been four days before the full moon on 29.09.1966, between Deutschlandsberg and Wolfsberg southwest of Graz where abundant individuals have flown on 04.06.2003 (HARBICH 2004) which has been four days after the new moon on 31.05.2003, near Pottschach southwest of Ternitz southsouthwest of Wiener Neustadt where abundant individuals have flown on 11.08.1962 – 16.08.1962 (PREISSECKER in HARZ & WITTSTADT 1964) which has been around the full moon on 15.08.1962, within and around Vienna in the Danube valley where masses of individuals have flown at the end of June 1958 (MAZZUCCO, PREISSECKER & BRACHINGER in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959; MAZZUCCO, PREISSECKER & BRACHINGER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959) which has been around the full moon on 01.07.1958; near Spillern in the Danube valley northwest of Vienna where several hundreds or even thousands of individuals each have occurred on meadows on 17.05.1988 and 12.07.1995 (STRAKA 2000) which has been two days after the new moon on 15.05.1988 and on the full moon on 12.07.1995, respectively; in Retz and Oberretzbach northeast of Retz northnorthwest of Hollabrunn northnorthwest of Vienna where abt. 15 individuals have flown on 11.05.2000 – 13.05.2000 (HENSLE 2001b) which has been on and a few days after the increasing half moon on 11.05.2000 between the new moon on 04.05.2000 and the full moon on 18.05.2000, near Retz northnorthwest of Hollabrunn northnorthwest of Vienna where 20 individuals have flown on 12.06.2007 (HENSLE 2008a) which has been three days before the new moon on 15.06.2007, in Raabs in the Thaya valley northwest of Vienna where abt. 100 individuals have flown on 19.05.1996 (HENSLE 2000b) which has been two days after the new moon on 17.05.1996; near Knittelfeld in the Mur valley southwest of Leoben where more than 20 individuals, 150 individuals, abt. 25 individuals and abt. 20 individuals each have flown on 29.05.1995 – 31.05.1995 (HENSLE 2000a), 25.05.1996 (HENSLE 2000b), 03.05.1998 – 06.05.1998 (HENSLE 2001f), 06.06.2000 – 08.06.2000 (HENSLE 2001b) and 19.05.2001 (HENSLE 2002a), respectively, which has been on and a few days after the new moon on 29.05.1995, one day before the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996, around the increasing half moon on 04.05.1998 between the new moon on 26.04.1998 and the full moon on 11.05.1998, several days after the new moon on 02.06.2000, and four days before the new moon on 23.05.2001, respectively; near Oberkurzheim northeast of Pöls in the Mur valley southwest of Leoben where abt. 15 individuals have flown on 11.08.1966 and at the Reichenstein southeast of Eisenerz northwest of Leoben in the eastern part of Austria where 20 individuals have flown on 09.08.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been one day after and one day before, respectively, the decreasing half moon on 10.08.1966 between the full moon on 01.08.1966 and the new moon on 16.08.1966; and in Sankt Paul im Lavanttal southsoutheast of Wolfsberg where 10 individuals have flown on 15.06.1998 (HENSLE 2001f) which has been five days after the full moon on 10.06.1998.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the western part of Austria have been recognized near Biberbach northnorthwest of Waidhofen in the Ybbs valley where thousands of individuals have flown on 11.06.1996 (HENSLE 2000b) which has been two days after the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, in Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 50 individuals have flown in the period of 25.05.1996 – 11.06.1996 (HENSLE 2000b) which has been around and between the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996 as well as the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996; in Salzburg in the Salzach valley where masses of individuals as well as abt. 40 individuals each have flown on 11.06.1878 (HARZ 1975) as well as on 25.05.1995 and 31.07.1995 (HENSLE 2000a), respectively, which has been four days before the full moon on 15.06.1878, four days before the new moon on 29.05.1995 and four days after the new moon on 27.07.1995, respectively; within and around Salzburg in the Salzach valley where large amounts of individuals have flown in the period of 24.05.1996 – 15.06.1996 (HENSLE 2000b) which has been around and between the increasing half moon on 26.05.1996 between the

new moon on 17.05.1996 and the full moon on 01.06.1996 as well as around the new moon on 16.06.1996; within and around Salzburg in the Salzach valley where masses of individuals each have flown on 08.06.1878 and 11.06.1879 – 16.06.1879 (Fritsch 1879a) which has been one day before the increasing half moon on 09.06.1878 between the new moon on 01.06.1878 and the full moon on 15.06.1878, and around the decreasing half moon on 12.06.1879 between the full moon on 04.06.1879 and the new moon on 19.06.1879, respectively; in Großgmain southsouthwest of Salzburg in the Salzach valley where more than 30 individuals have flown on 30.05.1996 (Hensle 2000b) which has been two days before the full moon on 01.06.1996, in Seekirchen north of Salzburg in the Salzach valley where abt. 30 individuals have flown on 03.06.1995 (Hensle 2000a) which has been five days after the new moon on 29.05.1995, in Ebenau east of Salzburg in the Salzach valley where 15 individuals have flown on 25.05.1996 (Hensle 2000b) which has been one day before the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996, within and around Sankt Leonhard im Pitztal southsoutheast of Imst where masses of individuals have flown on 23.07.1928 – 25.07.1928 (Bergmann 1931) which has been on and a few days before the increasing half moon on 25.07.1928 between the new moon on 17.07.1928 and the full moon on 01.08.1928, in Innsbruck in the Inn valley where more than 10 individuals have flown on 25.03.1977 – 26.03.1977 (Burmann & Tarmann 1979) which has been two and three days before the increasing half moon on 28.03.1977 between the new moon on 19.03.1977 and the full moon on 04.04.1977, in Kranebitten west of Innsbruck in the Inn valley where abundant individuals have flown and have sucked on flowers on 27.07.1977 (Burmann & Tarmann 1979) which has been three days before the full moon on 30.07.1977, in Hall in Tirol in the Inn valley east of Innsbruck where 20 individuals have flown on 21.07.1966 (Achim Pfeiffer in Harz 1967a) which has been three days after the new moon on 18.07.1966, in the Stubach valley south of Uttendorf southsoutheast of Kitzbühel where abt. 50 individuals have flown on 07.06.1970 (Mazzucco 1974) which has been three days after the new moon on 04.06.1970, at the Thaurer Alm near Rum east of Innsbruck in the Inn valley where more than 20 individuals have flown on 02.09.1975 (Kappeller in Burmann & Tarmann 1978) which has been three days before the new moon on 05.09.1975, around Mayrhofen in the Ziller valley eastsoutheast of Innsbruck where abundant individuals have flown on 10.09.1968 – 11.09.1968 (Ulf Eitschberger in Harz 1969) which has been three and four days after the full moon on 07.09.1968, in the Tuxer Tal southeast of Innsbruck where abundant individuals have flown on 14.06.1964 – 20.06.1964 (Heinz Männel in Harz 1965c) which has been around the increasing half moon on 18.06.1964 between the new moon on 10.06.1964 and the full moon on 25.06.1964, in the Venna valley southeast of Gries am Brenner southsoutheast of Innsbruck on 13.07.1958 (Karl Burmann in Koch, Warnecke, Wittstadt & Mazzucco 1959) which has been three days before the new moon on 16.07.1958, in Dornbirn in the Alpine Rhine valley south of Bregenz where 20 individuals have flown on 29.05.1966 (Achim Pfeiffer in Harz 1967a) which has been one day after the increasing half moon on 28.05.1966 between the new moon on 20.05.1966 and the full moon on 03.06.1966; near Klagenfurt in the southern part of Austria where hundreds of individuals, more than 600 individuals and abt. 15 individuals have flown on 02.06.1968 – 07.06.1968 (Ulf Eitschberger in Harz 1969), 02.06.1969 – 08.06.1969 (Eitschberger 1970b) and 10.05.2001 (Hensle 2002a), respectively, which has been around the increasing half moon on 05.06.1968 between the new moon on 27.05.1968 and the full moon on 10.06.1968, around and between the full moon on 31.05.1969 as well as the decreasing half moon on 08.06.1969 between the full moon on 31.05.1969 and the new moon on 15.06.1969, and three days after the full moon on 07.05.2001, respectively; near Jablonec northnortheast of Prague in the northern part of Czechia where masses of individuals have flown on 31.05.1923 (Wünsch 1923) which has been one day after the full moon on 30.05.1923, near Liberec northnortheast of Prague in the northern part of Czechia where masses of individuals have flown on 30.09.1962 (Musil in Harz & Wittstadt 1964) which has been two days after the new moon on 28.09.1962, and near Fagaras eastnortheast of Sibiu northnorthwest of Bucharest in the eastern part of Romania where masses of individuals have flown on 20.05.1888 – 24.05.1888 (Aigner-Abafi 1901) which has been one to five

days before the full moon on 25.05.1888.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in Great Britain have been recorded around London and its vicinity in the southeastern part of England where abundant individuals have flown from 24.05.1892 onwards (ADKIN 1892) which has been around the new moon on 26.05.1892, near Brentwood east of London in the southeastern part of England where numerous individuals have flown on 29.05.1892 (ADKIN 1892) which has been three days after the new moon on 26.05.1892, within and around Enfield in the northern part of the city of London where masses of individuals have flown at the end of May 1892 and at the beginning of June 1892 (SYKES 1892) which has been around and between the new moon on 26.05.1892 and the full moon on 10.06.1892, near Woodham southsoutheast of Slough west of London in the southeastern part of England where more than 50 individuals have flown on 21.09.1903 (RAYNOR 1903) which has been on the new moon on 21.09.1903, near Sheerness eastsoutheast of London in the southeastern part of England where abundant individuals have flown on 17.06.1894 (WALKER 1894) which has been one day before the full moon on 18.06.1894, near Bexley east of London in the southeastern part of England where masses of individuals have flown on 24.09.1903 (NEWMAN 1903) which has been three days after the new moon on 21.08.1903, in Sussex south of London in the southeastern part of England where masses of individuals have flown on 24.05.1922 – 25.05.1922 (HARZ 1975) which has been one and two days before the new moon on 26.05.1922, near Ipswich eastnortheast of London in the southeastern part of England where masses of individuals have flown on 24.09.1903 (SPARKE 1903) which has been three days after the new moon on 21.09.1903, near Ilford eastnortheast of London in the southeastern part of England where abundant individuals have flown in mid of September 1903 (MURRAY 1903) which has been around the new moon on 21.09.1903, near Eastbourne southsoutheast of London in the southeastern part of England where masses of individuals have flown on 03.06.1906 (ADKIN 1906) which has been three days before the full moon on 06.06.1906, near Frindsbury northwest of Gillingham eastsoutheast of London in the southeastern part of England where abundant individuals have flown on 25.09.1903 (OVENDEN 1903) which has been four days after the new moon on 21.09.1903; within and around Dovercourt southwest of Harwich eastnortheast of London in the southeastern part of England where hundreds of individuals daily have flown each on 22.09.1903 (MATHEW 1903) and 04.06.1906 – 07.06.1906 (MATHEW 1906) which has been one day after the new moon on 21.09.1903 and around the full moon on 06.06.1906, respectively; between Southminster and Tillingham southsouthwest of Colchester eastnortheast of London in the southeastern part of England where abundant individuals have flown on 26.09.1903 (HARRISON 1903) which has been five days after the new moon on 21.09.1903, near Cromer northnortheast of Norwich in the southeastern part of England where abundant individuals have flown in the last week of August 1868 (SMITH 1868) which has been around and between the increasing half moon on 26.08.1868 between the new moon on 18.08.1868 and the full moon on 02.09.1868 as well as the full moon on 02.09.1868; near Bere Alston in the Tamar valley north of Plymouth in the southwestern part of England where masses of individuals have flown on 30.05.1996 and 06.06.1996 – 08.06.1996 (BOGUE 1996) which has been two days before the full moon on 01.06.1996 as well as around the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, respectively; near Little Comberton northnortheast of Tewkesbury and Upton upon Severn eastsoutheast of Great Malvern southsouthwest of Birmingham in the southwestern part of England where masses of individuals have flown on 08.06.1996 – 13.06.1996 (WHITEHEAD 1996) which has been around the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, near Rotherham eastsoutheast of Manchester in the northwestern part of England where abundant individuals each have flown on 28.05.1892, 02.06.1892 and 07.06.1892 (ADKIN 1892) which has been two days after the new moon on 26.05.1892, one day before the increasing half moon on 03.06.1892 between the new moon on 26.05.1892 and the full moon on 10.06.1892, and three days before the full moon on 10.06.1892, respectively; near Hartlepool southsoutheast of Newcastle-upon-Tyne in the north-

eastern part of England where masses of individuals have flown on 10.07.1883 (Robson 1883) which has been three days before the increasing half moon on 13.07.1883 between the new moon on 04.07.1883 and the full moon on 20.07.1883; and between Castle Eden and Ryhope south of Sunderland southsoutheast of Newcastle-upon-Tyne in the northeastern part of England where masses of individuals have flown on 23.09.1903 (Milburn 1903) which has been two days after the new moon on 21.09.1903.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the northwestern and southwestern parts of Switzerland have been documented near Bärschwil east of Delémont in the Birs valley southsouthwest of Basel in the northwestern part of Switzerland where abundant individuals have flown on 17.06.1926 (Schweizer Entomologischer Anzeiger 1926a) which has been two days before the increasing half moon on 19.06.1926 between the new moon on 10.06.1926 and the full moon on 25.06.1926, near Jens southsoutheast of Biel northwest of Bern in the northwestern part of Switzerland where 20 individuals have flown on 21.06.2002 (Hensle 2003) which has been three days before the full moon on 24.06.2002, near Bern in the Aare valley in the northwestern part of Switzerland where more than 10 individuals have flown on 15.06.2002 (Hensle 2003) which has been four days after the new moon on 11.06.2002, near Grandson north of Yverdon-les-Bains in the Vaud north of Lausanne in the southwestern part of Switzerland where masses of individuals have flown on 08.06.1826 – 10.06.1826 (Linstow 1913, Harz 1975) which has been three to five days after the new moon on 05.06.1826, near Geneva at the southwestern margin of Lake Geneva in the southwestern part of Switzerland where masses of individuals have flown on 26.10.1827 (Prevost in Hagen 1861, Linstow 1913) which has been two days before the increasing half moon on 28.10.1827 between the new moon on 20.10.1827 and the full moon on 03.11.1827, near Avully southwest of Geneva in the southwestern part of Switzerland where masses of individuals have flown on 06.08.1903 (Harz 1975) which has been two days before the full moon on 08.08.1903, and north of Martigny in the Rhône valley upstream of Lake Geneva in the southwestern part of Switzerland where abt. 100 individuals have flown up the slopes on 12.05.2001 – 13.05.2001 (Hensle 2002a) which has been three and four days before the decreasing half moon on 16.05.2001 between the full moon on 07.05.2001 and the new moon on 23.05.2001.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in the southeastern and northeastern parts of Switzerland have been verified near Ausserberg northwest of Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where 10 individuals have flown on 23.06.1999 (Hensle 2001a) which has been two days after the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 29.06.1999, in Zürich in the northeastern part of Switzerland where masses of individuals have flown for three days in the second half of June 1925 (Harz 1975) which has been around the new moon on 21.06.1925, in Oerlikon north of Zürich in the northeastern part of Switzerland where abundant individuals have flown on 25.05.1931 (Fischer 1937) which has been on the increasing half moon on 25.05.1931 between the new moon on 17.05.1931 and the full moon on 31.05.1931, near Hinwil eastsoutheast of Zürich in the northeastern part of Switzerland where more than 20 individuals have flown on 15.06.1992 (Eitschberger & Steiniger 1994) which has been on the full moon on 15.06.1992, near Siebnen southeast of Zürich in the northeastern part of Switzerland where abt. 50 individuals have flown on 18.08.1966 (Achim Pfeiffer in Harz 1967a) which has been two days after the new moon on 16.08.1966, in Nuolen west of Wangen southeast of Zürich in the northeastern part of Switzerland where 20 individuals have flown on 30.08.1966 (Achim Pfeiffer in Harz 1967a) which has been one day before the full moon on 31.08.1966; near Uster eastsoutheast of Zürich in the northeastern part of Switzerland where more than 25 individuals and abt. 35 individuals have flown on 24.08.1968 and 01.09.1968, respectively (Ulf Eitschberger in Harz 1969), which has been on the new moon on 24.08.1968 as well as on the increasing half moon on 01.09.1968 between the new moon on 24.08.1968 and the full moon on 07.09.1968, respectively; at

the margin of the city of Chur in the Alpine Rhine valley in the northeastern part of Switzerland where abt. 20 individuals have flown and have sucked on flowers on 26.08.2005 (HEINER ZIEGLER in HENSLE 2006a) which has been on the decreasing half moon on 26.08.2005 between the full moon on 20.08.2005 and the new moon on 03.09.2005, near Arosa southeast of Chur in the northeastern part of Switzerland where abundant individuals have flown at the end of September 1932 (FISCHER 1937) which has been around the new moon on 30.09.1932, and around Bargella and Gaflei east of Vaduz in Liechtenstein where hundreds of individuals have flown on 15.06.1992 – 16.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been on and one day after the full moon on 15.06.1992.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* in Italy, Hungary, Slovakia and Slovenia have been confirmed near Bolzano and at the Stilfserjoch north of Bórmio west of Bolzano in the northeastern part of Italy where 30 individuals each have flown on 26.07.1966 and 29.07.1966 (ACHIM PFEIFFER in HARZ 1967a) which has been one day after the increasing half moon on 25.07.1966 between the new moon on 18.07.1966 and the full moon on 01.08.1966, and three days before the full moon on 01.08.1966, respectively; around Samnaun westnorthwest of Nauders in the northeastern part of Italy where abt. 300 individuals have flown on 24.07.1977 (STEINIGER & EITSCHBERGER 1978) which has been on the increasing half moon on 24.07.1977 between the new moon on 16.07.1977 and the full moon on 30.07.1977, near Veröcze north of Budapest in the northern part of Hungary where masses of individuals have flown on 12.07.1903 – 19.07.1903 (AIGNER-ABAFI 1904) which has been around and between the full moon on 09.07.1903 as well as the decreasing half moon on 18.07.1903 between the full moon on 09.07.1903 and the new moon on 24.07.1903, around Szolnok eastsoutheast of Budapest in the eastern part of Hungary where masses of individuals have flown on 13.07.1903 (P. VÁGÓ in AIGNER-ABAFI 1904) which has been four days after the full moon on 09.07.1903, near Dobsiná south of Poprad in the eastern part of Slovakia where masses of individuals have flown in the first week of July 1903 (J. KOVÁCS in AIGNER-ABAFI 1904) which has been around the full moon on 09.07.1903, around Strbské Pleso westnorthwest of Poprad in the eastern part of Slovakia where masses of individuals have flown on 16.07.1903 – 20.07.1903 (KARL MEISSNER in AIGNER-ABAFI 1904) which has been around the decreasing half moon on 18.07.1903 between the full moon on 09.07.1903 and the new moon on 24.07.1903, and in the Krainer Karst northeast of Ljubljana in the northern part of Slovenia where masses of individuals have flown on 03.06.1928 (HAFNER 1928) which has been on the full moon on 03.06.1928.

Mass flights of large quantities of individuals of the Painted Lady *Vanessa cardui* have also been registered on the island Borkum northwest of Emden at the coast of the North Sea in the northwestern part of Germany on 28.05.1931 (WARNECKE 1931a, 1931b) which has been three days before the full moon on 31.05.1931, around Ilmenau in the Ilm valley in the northeastern part of Germany on 26.05.1931 and following days (DÖRING 1931) which has been several to five days before the full moon on 31.05.1931, around Schwäbisch Hall in the Kocher valley in the southwestern part of Germany on 24.05.1931 (RENNER 1931) which has been seven days before the full moon on 31.05.1931; as well as around Frankfurt am Main in the central part of Germany (AMEND in WARNECKE 1931a), around Bremen in the northwestern part of Germany (FIEBIG in WARNECKE 1931a) and around Bredstedt northnorthwest of Husum in the northwestern part of Germany (W. WOLF in WARNECKE 1931a) around mid of May 1931 which has been around the new moon on 17.05.1931, or in May 1931 which has been around and between the full moon on 02.05.1931, the new moon on 17.05.1931 and the full moon on 31.05.1931.

Mass flights of thousands of individuals of the Painted Lady *Vanessa cardui* within and around Stuttgart in the Neckar valley in the southwestern part of Germany as well as in other areas have been documented by FRITSCH (1879), KATTER (1879a), EIMER (1880), KRAUSS (1880), LINSTOW (1913) and HARZ (1975) who have collected and evaluated the reports of numerous observers during the

extraordinary widespread distribution of mass flights in June 1879 which have been noticed on one of the last three days in May 1879 in the vicinity of Mikulov in the eastern part of Czechia north of Vienna (Friedenfeldt in Katter 1879a), on 31.05.1879 between Toulon and Marseille in the southeastern part of France (Harz 1975), on 05.06.1879 at the Sankt Gotthard-Hospiz south of Andermatt in the southeastern part of Switzerland (Katter 1879a), on 01.06.1879 – 08.06.1879 in Stuttgart and its surroundings (Julius Hoffmann in Katter 1879a), on 03.06.1879 – 08.06.1879 in Strasbourg in the Upper Rhine valley in the northeastern part of France (Katter 1879a), on 07.06.1879 in Tettnang northnorthwest of Lindau at Lake Constance in the southwestern part of Germany (Krauss 1880) and in Augsburg in the Lech valley in the southeastern part of Germany (J. Schweiger in Katter 1879b); on 07.06.1879 in Karlsruhe, Bühl, Bischheim north of Strasbourg, Kehl and Rheinweiler north of Basel in the Upper Rhine valley in the southwestern part of Germany as well as in Zürich, Wettswil am Albis southwest of Zürich, Wetzikon eastsoutheast of Zürich (Fritsch 1879a, Katter 1879a), Sankt Gallen and Glossau westsouthwest of Sankt Gallen in the northeastern part of Switzerland (Katter 1879a); on 08.06.1879 in Böblingen southwest of Stuttgart and around Schwäbisch Hall in the Kocher valley in the southwestern part of Germany (Eimer 1880), in Wetzikon eastsoutheast of Zürich (Fritsch 1879a, Katter 1879a) and Chur in the Alpine Rhine valley in the northeastern part of Switzerland as well as in Vienna and its surroundings and in Graz and its vicinity in the eastern part of Austria (Katter 1879a, Rogenhofer 1879, Linstow 1913); on 09.06.1879 in Fellbach in the Rems valley eastnortheast of Stuttgart (Krauss 1880) and in Offenburg in the southern part of the Upper Rhine valley in the southwestern part of Germany (Eimer 1880) as well as in Olomouc southeast of Prague in the western part of Czechia (Katter 1879a, Rogenhofer 1879, Linstow 1913); on 10.06.1879 in Stuttgart-Feuerbach and Stuttgart-Solitude (Krauss 1880) as well as around Stuttgart and near Weichering southwest of Ingolstadt in the Danube valley (Eimer 1880), around Lausanne and Morges west of Lausanne at the northern margin of Lake Geneva in the southwestern part of Switzerland (Forel 1879), and near Rennes in the northwestern part of France (Oberthür & Oberthür 1879); on 10.06.1879 in Angers southwest of Paris in the northwestern part of France (Decharme in Katter 1879a), on 11.06.1879 in Eutingen at the northeastern margin of the city of Pforzheim in the Enz valley northwest of Stuttgart (Eimer 1880, Fraas in Krauss 1880) as well as in Reutlingen and Metzingen south of Stuttgart (Eimer 1880, Eimer in Krauss 1880, Knapp in Eimer 1880), in Tübingen southsouthwest of Stuttgart, in Nürtingen southeast of Stuttgart, in Calw in the Nagold valley westsouthwest of Stuttgart and in Neu-Ulm east of Ulm in the Danube valley in the southwestern part of Germany (Eimer 1880); on 11.06.1879 in Porrentruy westnorthwest of Delémont in the northwestern part of Switzerland (Spiess in Katter 1879b) and in Steyr southsoutheast of Linz in the western part of Austria (Grosz in Katter 1879a) as well as in Mainz and its surroundings in the Upper Rhine valley in the central part of Germany (Reichenau 1904, Linstow 1913), on 11.06.1879 – 16.06.1879 within and around Salzburg in the Salzach valley in the western part of Austria (Fritsch 1879a), on 12.06.1879 in Loucen between Nymburk and Mladá Boleslav northeast of Prague in the western part of Czechia (V. Fric in Katter 1879a), on 14.06.1879 in Stuttgart-Untertürkheim (Eimer 1880, Krauss 1880); on 15.06.1879 in Waiblingen in the Rems valley eastnortheast of Stuttgart (Eimer 1880, Krauss 1880), in Heiligkreuztal southsouthwest of Riedlingen in the Danube valley (Krauss 1880) and in Bregenz south of Lindau at Lake Constance in the southwestern part of Germany (Eimer 1880); on 15.06.1879 in Paris in the northwestern part of France (Katter 1879a), on 16.06.1879 in Weingarten northnortheast of Lindau in the southwestern part of Germany (Eimer 1880), on 19.06.1879 in Karlsruhe in the middle part of the Upper Rhine valley (Eimer 1880); on 20.06.1879 within Stuttgart and around Eningen unter Achalm southeast of Reutlingen (Krauss 1880) as well as in Tübingen southsouthwest of Stuttgart, in Stuttgart-Hohenheim and in Freudenstadt in the northern part of the Black Forest in the southwestern part of Germany (Eimer 1880); on 21.06.1879 between Friedrichshafen and Lindau at Lake Constance (Krauss 1880) as well as in Tübingen and Rottenburg southsouthwest of Stuttgart and in Freudenstadt in the northern part of the Black Forest in the southwestern part of Germany (Eimer 1880), and in the second half to the last third of June 1879 in Wismar at the coast of the Baltic Sea in the northeastern

part of Germany (SCHMIDT in KATTER 1879a), with this collection of localities of mass flights of the Painted Lady *Vanessa cardui* which have been established around and between the full moon on 04.06.1879 and the new moon on 19.06.1879 being an outstanding example of the more or less simultaneous occurrence of mass flights of diurnal butterflies at numerous places over very large areas. Later in the year, mass flights of the Painted Lady *Vanessa cardui* have also been recorded in Salzburg in the Salzach valley in the western part of Austria from 25.07.1879 onwards and from 26.08.1879 onwards (FRITSCH 1879b) which has been two days before the increasing half moon on 27.07.1879 between the new moon on 19.07.1879 and the full moon on 02.08.1879, and one day after the increasing half moon on 25.08.1879 between the new moon on 17.08.1879 and the full moon on 31.08.1879, respectively; and near Wehlen in the Elbe valley east of Pirna eastsoutheast of Dresden in the northeastern part of Germany in the first half of September 1879 (THWAITES 1879) which has been around and between the full moon on 31.08.1879 and the new moon on 16.09.1879.

Mass flights of hundreds, thousands or even millions of individuals of the Painted Lady *Vanessa cardui* at various localities in Germany and adjacent areas during the extraordinary swarming periods in 2003 have been collected and evaluated by HENSLE & RENNWALD (2004). During the exceptional swarming periods in 2003, mass flights of hundreds, thousands or even millions of individuals of the Painted Lady *Vanessa cardui* have been registered at the Kahler Asten westsouthwest of Winterberg in the northwestern part of Germany on 21.04.2003 (J. KAMP in HENSLE & RENNWALD 2004) which has been five days after the full moon on 16.05.2003; in Wittislingen eastsoutheast of Heidenheim an der Brenz in the southwestern part of Germany on 04.05.2003 and 12.07.2003 (S. URBAN in HENSLE & RENNWALD 2004) which has been three days after the new moon on 01.05.2003 and one day before the full moon on 13.07.2003, respectively; in Boizenburg in the Elbe valley northeast of Lüneburg in the northwestern part of Germany on 20.05.2003 (KLAUS DETTMANN in HENSLE & RENNWALD 2004) which has been four days after the full moon on 16.05.2003, in Wetzikon eastsoutheast of Zürich in the northeastern part of Switzerland on 26.05.2003 – 29.05.2003 (E. WEIDMANN in HENSLE & RENNWALD 2004) which has been two to five days before the new moon on 31.05.2003, in Ertingen east of Sigmaringen in the Danube valley in the southwestern part of Germany (H. EISELE in HENSLE & RENNWALD 2004) and in Roggwil in the Aare valley northeast of Langenthal in the northwestern part of Switzerland (BETTINA HÜSER in HENSLE & RENNWALD 2004) on 30.05.2003 which has been one day before the new moon on 31.05.2003, in Dietikon west of Zürich in the northeastern part of Switzerland on 31.05.2003 – 07.06.2003 (VERENA SCHEIWILLER in HENSLE & RENNWALD 2004) which has been around and between the new moon on 31.05.2003 as well as the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, around Bernau northeast of Berlin in the northeastern part of Germany on 31.05.2003 – 01.06.2003 (M. MODROW in HENSLE & RENNWALD 2004) which has been on and one day after the new moon on 31.05.2003, between Bad Schussenried northnorthwest of Bad Waldsee and Memmingen in the Iller valley in the southeastern part of Germany as well as between Memmingen and Salzburg in the Salzach valley in the western part of Austria (JÜRGEN HENSLE in HENSLE & RENNWALD 2004) and in the Kleines Walsertal between Mittelberg in the western part of Austria and Oberstdorf south of Sonthofen in the southeastern part of Germany (E. HAAS in HENSLE & RENNWALD 2004) on 01.06.2003 which has been one day after the new moon on 31.05.2003, in Wendlingen in the Neckar valley southeast of Stuttgart in the southwestern part of Germany on 01.06.2003 – 02.06.2003 (E. LOSER in HENSLE & RENNWALD 2004) which has been one and two days after the new moon on 31.05.2003, in Ummendorf southeast of Biberach an der Riß in the southeastern part of Germany (MARTIN STEHLE in HENSLE & RENNWALD 2004) and in Niederwalgern in the Lahn valley southsouthwest of Marburg in the northwestern part of Germany (M. SOMMERHAGE, S. WALTHER & M. KRAFT in HENSLE & RENNWALD 2004) on 02.06.2003 which has been two days after the new moon on 31.05.2003, in Salz south of Bad Neustadt an der Saale in the northwestern part of Germany on 02.06.2003 – 04.06.2003 (HEIMO HARBICH in HENSLE & RENNWALD 2004) which has been two to five days after the new moon on 31.05.2003, in Butzbach north of Frankfurt am Main in the central part

of Germany on 03.06.2003 – 08.06.2003 (OTFRIED LEGLER in HENSLE & RENNWALD 2004) which has been several days after the new moon on 31.05.2003 as well as around the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, around Ulm in the Danube valley and Laupheim southsouthwest of Ulm in the southwestern part of Germany on 04.06.2003 and adjacent days (K. BOMMER in HENSLE & RENNWALD 2004) which has been five days after the new moon on 31.05.2003, in Le Vigan southsouthwest of Brive-la-Gaillarde east of Bordeaux in the southwestern part of France on 06.06.2003 (WALTER SCHÖN in HENSLE & RENNWALD 2004) which has been one day before the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003; in Augsburg in the Lech valley in the southeastern part of Germany (HERMANN STICKROTH in HENSLE & RENNWALD 2004, HERMANN STICKROTH in GEH 2004), in Friedberg eastsoutheast of Augsburg in the southeastern part of Germany (WOLFGANG RAAB in HENSLE & RENNWALD 2004), in Trier-Feyen in the Moselle valley in the western part of Germany (MATTHIAS WEITZEL in HENSLE & RENNWALD 2004) and in Treben north of Altenburg south of Leipzig in the northeastern part of Germany (EGON JUNGMANN in HENSLE & RENNWALD 2004) on 07.06.2003 which has been on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003; in Bad Sooden-Allendorf in the Werra valley northnorthwest of Eschwege in the northwestern part of Germany on 09.06.2003 (REINHARD BÜLTE in HENSLE & RENNWALD 2004) which has been two days after the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, in Illmitz at Lake Neusiedl south of Neusiedl am See southeast of Vienna (B. JAKOBS in HENSLE & RENNWALD 2004) as well as between Hollabrunn and Retz northnorthwest of Hollabrunn northnorthwest of Vienna (HERMANN KÜHNERT in HENSLE & RENNWALD 2004) in the eastern part of Austria on 10.06.2003 which has been four days before the full moon on 14.06.2003, in Promoisel near Sagard westnorthwest of Saßnitz in the northeastern part of the island Rügen and in Selow north of Bützow southsouthwest of Rostock in the northeastern part of Germany on 12.06.2003 (REINHARD BÜLTE in HENSLE & RENNWALD 2004) which has been two days before the full moon on 14.06.2003, at La Tournette near Annecy eastnortheast of Lyon in the southeastern part of France on 14.06.2003 (JÜRGEN HENSLE in HENSLE & RENNWALD 2004) which has been on the full moon on 14.06.2003, in Oberreit southwest of Moosburg in the Isar valley northnortheast of München in the southeastern part of Germany at the beginning of July 2003 (HEINRICH VOGEL in HENSLE & RENNWALD 2004) which has been several days after the new moon on 29.06.2003, near Montabaur eastnortheast of Koblenz in the western part of Germany on 31.07.2003 (R. WENDT in HENSLE & RENNWALD 2004) which has been two days after the new moon on 29.06.2003, in Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 02.08.2003 (ERWIN RENNWALD in HENSLE & RENNWALD 2004) which has been four days after the new moon on 29.07.2003, and around Westerland at the western margin of the central part of the island Sylt westnorthwest of Flensburg at the coast of the North Sea in the northwestern part of Germany on 09.08.2003 – 10.08.2003 (BARWINSKI 2004, PETER BARWINSKI in HENSLE & RENNWALD 2004) which has been two and three days before the full moon on 12.08.2003.

Mass flights of hundreds or thousands of individuals of the Painted Lady *Vanessa cardui* during the extraordinary swarming periods in 2003 have also been documented near Harburg northnorthwest of Donauwörth in the southeastern part of Germany on 01.05.2003 (EBERHARD PFEUFFER in GEH 2004) which has been on the new moon on 01.05.2003, near Eichstätt in the Altmühl valley northwest of Ingolstadt in the southeastern part of Germany on 04.05.2003 (EBERHARD PFEUFFER in GEH 2004) which has been three days after the new moon on 01.05.2003; near Lechau in the Lech valley north and south of Augsburg in the southeastern part of Germany on 10.05.2003 – 11.05.2003 and 18.05.2003 (EBERHARD PFEUFFER in GEH 2004) which has been one and two days after the increasing half moon on 09.05.2003 between the new moon on 01.05.2003 and the full moon on 16.05.2003 as well as two days after the full moon on 16.05.2003, respectively; near Todtenweis southeast of Meitingen in the Lech valley north of Augsburg in the southeastern part of Germany on 17.05.2003 (EBERHARD PFEUFFER in GEH 2004) which has been one day after the full moon on 16.05.2003, near

Solnhofen in the Altmühl valley southeast of Treuchtlingen northnortheast of Donauwörth in the southeastern part of Germany on 24.05.2003 (EBERHARD PFEUFFER in GEH 2004) which has been one day after the decreasing half moon on 23.05.2003 between the full moon on 16.05.2003 and the new moon on 31.05.2003, in Augsburg in the Lech valley in the southeastern part of Germany on 01.06.2003 – 02.06.2003 (GEH 2004) which has been one and two days after the new moon on 31.05.2003, and in the Naab valley and the Laber valley west of Regensburg in the southeastern part of Germany on 07.06.2003 – 09.06.2003 .(GEH 2004) which has been on and two days after the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003.

Mass flights of hundreds or thousands of individuals of the Painted Lady *Vanessa cardui* during the extraordinary swarming periods in 2003 have also been confirmed near Lyon in the Rhône valley in the southeastern part of France on 03.05.2003 (REZBANYAI-RESER 2003) which has been two days after the new moon on 01.05.2003, near Fuldera westnorthwest of Santa Maria im Münstertal east-southeast of Davos in the southeastern part of Switzerland on 30.05.2003 (REZBANYAI-RESER 2003) which has been one day before the new moon on 31.05.2003, around Landquart in the Alpine Rhine valley in the northeastern part of Switzerland as well as between Landquart and Luzern in the central part of Switzerland and between Luzern and Solothurn in the northwestern part of Switzerland on 31.05.2003 (REZBANYAI-RESER 2003) which has been on the new moon on 31.05.2003, in Biberist southsoutheast of Solothurn in the Aare valley in the northwestern part of Switzerland on 01.06.2003 – 02.06.2003 (REZBANYAI-RESER 2003) which has been one and two days after the new moon on 31.05.2003, in Feldbrunnen north of Solothurn in the northwestern part of Switzerland on 30.05.2003 – 03.06.2003 (HANSJÜRG GEIGER in REZBANYAI-RESER 2003) which has been one day before and several days after the new moon on 31.05.2003, and in Zürich in the northeastern part of Switzerland on 02.06.2003 – 03.06.2003 (EUGEN PLEISCH in REZBANYAI-RESER 2003) which has been two and three days after the new moon on 31.05.2003.

Mass flights of hundreds or thousands of individuals of the Painted Lady *Vanessa cardui* at various localities in Germany and adjacent areas during the season in 2006 have been collected and evaluated by HENSLE (2007a). During the season in 2006, mass flights of hundreds or thousands of individuals of the Painted Lady *Vanessa cardui* have been registered near Knittelfeld in the Mur valley southwest of Leoben in the eastern part of Austria on 25.04.2006 – 26.04.2006, 10.05.2006 – 15.05.2006 and 10.07.2006 – 13.07.2006 (HENSLE 2007a) which has been one and two days before the new moon on 27.04.2006, several days before and after the full moon on 13.05.2006, and several days before and after the full moon on 11.07.2006, respectively; near Großkarolinenfeld north of Rosenheim and near Kolbermoor west of Rosenheim in the southeastern part of Germany on 19.05.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been one day before the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006; in Pasing at the southwestern margin of the city of München (S. BRAUN in HENSLE 2007a), in Harlaching at the southern margin of the city of München (ANNETTE VON SCHOLLEY-PFAB in HENSLE 2007a), in Freising (M. DÖRNER & K. NEUHAUS in HENSLE 2007a) and Moosburg (HEINRICH VOGEL in HENSLE 2007a) in the Isar valley northnortheast of München, in Schwabhausen (MARKUS SCHWIBINGER in HENSLE 2007a) and Dachau (R. HALLER in HENSLE 2007a) northwest of München, and in Bad Birnbach in the Rott valley southwest of Passau (GEORG STAHLBAUER in HENSLE 2007a) in the southeastern part of Germany as well as near Zürich in the northeastern part of Switzerland on 22.05.2006 which has been two days after the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006; near Lengenfeld north of Krems in the Danube valley westnorthwest of Vienna and near Neusiedl am See southeast of Vienna in the eastern part of Austria on 22.05.2006 and 07.07.2006 – 08.07.2006 (CHRISTOPHER RABL in HENSLE 2007a) which has been two days after the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006 as well as three and four days before the full moon on

11.07.2006, respectively; in Göttlesbrunn northwest of Bruck an der Leitha southeast of Vienna in the eastern part of Austria on 23.05.2006 and 05.07.2006 – 10.07.2006 (HENSLE 2007a) which has been four days before the new moon on 27.05.2006 and several days before the full moon on 11.07.2006, respectively; near Leimersheim northnorthwest of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany on 24.05.2006 (T. SCHULTE in HENSLE 2007a) which has been three days before the new moon on 27.05.2006, near Kandersteg south of Spiez at Lake Thun in the central part of Switzerland on 07.06.2006 (I. DANIELS in HENSLE 2007a) which has been four days before the full moon on 11.06.2006, near Bedretto southwest of Airolo south of Andermatt in the central part of Switzerland on 10.06.2006 (HENSLE 2007a) which has been one day before the full moon on 11.06.2006, near Ismaning and Hallbergmoos in the Isar valley northnortheast of München on 12.06.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been one day after the full moon on 11.06.2006, near Krems and Lengenfeld westsouthwest of Langenlois north of Krems in the Danube valley (CHRISTOPHER RABL in HENSLE 2007a) and near Allerheiligen in the Mürz valley northeast of Leoben (G. RASPOTNIK in HENSLE 2007a) in the eastern part of Austria on 07.07.2006 – 08.07.2006 which has been three and four days before the full moon on 11.07.2006, near Graz in the Mur valley in the eastern part of Austria on 08.07.2006 – 09.07.2006 (J. GILLMANN & J. HASIBA in HENSLE 2007a) which has been two and three days before the full moon on 11.07.2006, near Krimml westsouthwest of Mittersill in the western part of Austria on 10.07.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been one day before the full moon on 11.07.2006, near Baden southsouthwest of Vienna (CHRISTOPHER RABL in HENSLE 2007a) and near Schwarzau am Steinfelde southsouthwest of Wiener Neustadt (S. STRENG in HENSLE 2007a) in the eastern part of Austria on 09.07.2006 which has been two days before the full moon on 11.07.2006, near Golling in the Salzach valley southsoutheast of Salzburg in the western part of Austria on 13.07.2006 (ERICH SCHNÖLL in HENSLE 2007a) which has been two days after the full moon on 11.07.2006, on the Theresienwiese in the central part of the city of München in the Isar valley in the southeastern part of Germany on 11.07.2006 (MARKUS SCHWIBINGER in HENSLE 2007a) which has been on the full moon on 11.07.2006, and in the Branten valley near Leifers south of Bolzano in Southern Tyrol in the northeastern part of Italy on 10.09.2006 (E. HERKENBERG in HENSLE 2007a) which has been three days after the full moon on 07.09.2006.

Various examples of mass flights of the Painted Lady *Vanessa cardui* from the older literature are compiled and quoted in WILLIAMS (1930) and WILLIAMS, COCKBILL, GIBBS & DOWNES (1942).

5.28 The Ringlet *Aphantopus hyperantus* and the Six-Spot Burnet *Zygaena filipendulae* based on own observations

Some single individuals of the Ringlet *Aphantopus hyperantus* LINNAEUS 1758 (Lepidoptera: Satyridae) and the Six-Spot Burnet *Zygaena filipendulae* LINNAEUS 1758 (Lepidoptera: Zygaenidae) have occasionally flown at the locality Tairnbach since mid to end of June 2009, whereas a few days before the full moon on 07.07.2009, almost suddenly numerous individuals have appeared, and abt. one week to ten days later, the number of individuals has again started to decline, with only some single individuals having still been present several days before the new moon on 22.07.2009. A few days after the new moon on 22.07.2009, again only still some single individuals of the Ringlet *Aphantopus hyperantus* have been encountered, whereas the Six-Spot Burnet *Zygaena filipendulae* has developed a second peak with the renewed almost sudden appearance of numerous individuals which have flown around and have sit on violet and red flowers in the meadows and along the ways near the margin of the forest at the locality Tairnbach beyond the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009 when the number of individuals has again started to decline, with only some single individuals having still

been present around the full moon on 06.08.2009, and no more individuals of the Six-Spot Burnet *Zygaena filipendulae* having been discovered around the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009.

5.29 The Ringlet *Aphantopus hyperantus* based on literature evaluation

Mass occurrences of large quantities of individuals of the Ringlet *Aphantopus hyperantus* LINNAEUS 1758 (Lepidoptera: Satyridae) have been recognized in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 30 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 02.08.1980 (KINKLER 1987) which has been two days before the decreasing half moon on 04.08.1980 between the full moon on 27.07.1980 and the new moon on 10.08.1980, in the vicinity of Erftstadt southsouthwest of Cologne in the northwestern part of Germany where more than 10 individuals have flown on 12.06.2000 (JELINEK 2006) which has been four days before the full moon on 16.06.2000; near the district Dellbrück at the eastern margin and in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured daily on 05.07.1994, 12.07.1994 – 15.07.1994 and 19.07.1994 – 22.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three to six days after the new moon on 09.07.1994, and on and up to three days before the full moon on 22.07.1994, respectively; near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 200 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 30 individuals each have flown on 30.06.1994, 03.07.1994 and 06.07.1994 (BROSZKUS 1995, S. JOUAUX in BROSZKUS 1995) which has been one day before and two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994 as well as three days before the new moon on 09.07.1994, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals have flown on 27.07.2008 (ALFRED KLEIN & I. STIEGEMEYER in BOSSELMANN 2009) which has been two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, near Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; near Zeiskam eastnortheast of Landau in der Pfalz in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 10 individuals and 5 individuals have flown in the period of 14.07.2002 – 20.07.2002 (KLAUS WEISS in HASSELBACH 2003) and on 21.06.2003 (KLAUS WEISS in HASSELBACH 2004), respectively, which has been around and between the new moon on 10.07.2002 as well as the increasing half moon on 17.07.2002 between the new moon on 10.07.2002 and the full moon on 24.07.2002, and on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; and at an unspecified locality in the southwestern part of Germany where 20 individuals have flown on 02.07.1999 (HASSELBACH 2001) which has been four days after the full moon on 28.06.1999.

5.30 The Six-Spot Burnet *Zygaena filipendulae* based on literature evaluation

Mass occurrences of large quantities of individuals of the Six-Spot Burnet *Zygaena filipendulae* LINNAEUS 1758 (Lepidoptera: Zygaenidae) have been registered near Frechen westsouthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 150 individuals have been counted on 12.08.1991 (JELINEK 1992, 2006) and more than 300 individuals have been registered on 05.08.1992 (JELINEK 2006) which has been two days after the new moon on 10.08.1991 as well as one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, respectively; in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, near Ballweiler in the vicinity of Blieskastel east of Saarbrücken in the southern part of the Saar area in the western part of Germany where hundreds of individuals have flown on 02.06.1968 (SCHMIDT-KOEHL 1977) which has been three days before the increasing half moon on 05.06.1968 between the new moon on 27.05.1968 and the full moon on 10.06.1968; in the vicinity of Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where many individuals and more than 5 individuals have flown from 20.07.1997 onwards (ERWIN SEFRIN in HASSELBACH 1999) and on 06.08.2001 (ERWIN SEFRIN in HASSELBACH 2002), respectively, which has been around the full moon on 22.07.1997 and two days after the full moon on 04.08.2001, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where up to 20 individuals have flown on 30.07.2001 (KLAUS WEISS in HASSELBACH 2002) which has been five days before the full moon on 04.08.2001, and at an unspecified locality in the southwestern part of Germany where masses of individuals have flown on 17.07.1997 (HASSELBACH 1999) which has been five days before the full moon on 22.07.1997.

5.31 The Purple Emperor *Apatura iris* based on own observations

In 2009, some single individuals of the vernal to aestival generation of the Purple Emperor *Apatura iris* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have occasionally flown at the localities Nußloch and Tairnbach since the beginning of June 2009 after the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009, whereas two days after the decreasing half moon on 15.06.2009 between the full moon on 07.06.2009 and the new moon on 22.06.2009, almost suddenly up to 5 individuals have appeared at the locality Nußloch, and during the next days, again only single individuals have shown up in Nußloch and Tairnbach, with the last individuals having been detected before the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009. The aestival generation of the Purple Emperor *Apatura iris* has started to develop a few days after the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009 when again suddenly several individuals have flown around at the locality Nußloch, whereas no individuals have been discovered before. After the new moon on 20.08.2009, again only a few isolated individuals of the Purple Emperor *Apatura iris* have been occasionally detected, and after the full moon on 04.09.2009, no more individuals have been encountered.

In 2008, several individuals of the vernal to aestival generation of the Purple Emperor *Apatura iris* have been observed at the locality Tairnbach around the increasing half moon on 10.06.2008 bet-

ween the new moon on 03.06.2008 and the full moon on 18.06.2008, whereas earlier and later, only occasionally single individuals have been noticed.

5.32 The Purple Emperor *Apatura iris* and the Lesser Purple Emperor *Apatura ilia* based on literature evaluation

Mass assemblages of numerous individuals of the Purple Emperor *Apatura iris* LINNAEUS 1758 (Lepidoptera: Nymphalidae) and the Lesser Purple Emperor *Apatura ilia* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Nymphalidae) have been discovered in Schriesheim (abt. 7 km north of Heidelberg) near the western margin of the Odenwald in the southwestern part of Germany in July 1925 where abt. 40 – 50 individuals each have been noticed sitting on the floor around two moist patches on a way in the forest near the entrance of the Spatschlucht in a side valley north of the Kanzelbach valley east of Schriesheim (TRIPPEL 1954), with this mass assemblage having probably happened between and around the full moon on 06.07.1925 and the new moon on 20.07.1925.

Significant quantities of individuals of the Purple Emperor *Apatura iris* and the Lesser Purple Emperor *Apatura ilia* have also been recorded near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals and 10 individuals, respectively, have flown on 03.07.1994 (S. JOUAUX in BROSZKUS 1995) which has been two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 10 individuals have flown on 26.06.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993) which has been four days before the new moon on 30.06.1992.

Mass occurrences of large quantities of individuals of the Purple Emperor *Apatura iris* have also been confirmed in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 20 individuals have flown on 12.07.1970 (HANS BROCHHAUS & WILLIBALD SCHMITZ in KINKLER, SCHMITZ & NIPPEL 1971) which has been on the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970, in the Linxbach region near Ottweiler south of Sankt Wendel in the southern part of the Saar area in the western part of Germany where abt. 30 individuals have flown in an hour at the beginning of July 1971 (R. KNAPP in SCHMIDT-KOEHL 1977) which has been around the full moon on 08.07.1971, and at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 15 individuals have flown on 26.06.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993) which has been four days before the new moon on 30.06.1992. A peak occurrence of the Purple Emperor *Apatura iris* has also been registered around the Federsee northeast of Bad Buchau northnorthwest of Bad Waldsee in the southwestern part of Germany where the appearance of 8 individuals has been observed on 08.07.1975 which have then been seen for several weeks until 15.08.1975 (MEINEKE 1978), with the breakout of the 8 individuals having happened one day before the new moon on 09.07.1975.

Significant quantities of individuals of the Purple Emperor *Apatura iris* have also been encountered near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 30.06.1994 (S. JOUAUX in BROSZKUS 1995) which has been two days before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, near Ingelheim west of Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where 5 individuals have flown on 19.07.1995 (R. ALBERT in HASSELBACH 1996) which has been one day before the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995, in the vicinity

of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 5 individuals each have flown on 31.08.1994 – 01.09.1994 (HASSELBACH 1995a) which has been four to five days before the new moon on 05.09.1994, in the vicinity of Orbis northnorthwest of Kirchheim-Bolanden in the southwestern part of Germany where abt. 5 individuals have flown on 13.07.1997 (BERND STEUERWALD in HASSELBACH 1999) which has been on the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals, more than 10 individuals and 5 individuals have flown on 09.06.1993, 30.06.1993 and 09.07.1993, respectively (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994), which has been five days after the full moon on 04.06.1993, and four days before and five days after the full moon on 04.07.1993, respectively; in theWahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals and 7 individuals have flown on 28.06.2009 and 29.06.2009, respectively (HANISCH 2009), which has been one day before and on the decreasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009; and near Kierspe in the Volme valley southsouthwest of Lüdenscheid in the northwestern part of Germany where abt. 5 individuals have flown on 21.07.1970 – 27.07.1970 (HANS-GÜNTHER KAMP & MICHAEL TREIMER in HARKORT 1971) which has been around and between the full moon on 18.07.1970 as well as the decreasing half moon on 26.07.1970 between the full moon on 18.07.1970 and the new moon on 02.08.1970.

Significant quantities of individuals of the Lesser Purple Emperor *Apatura ilia* have also been recorded in Nettebach near Bradsenmühle around Nassau and Bad Ems in the Lahn valley eastsoutheast of Koblenz in the western part of Germany where 5 individuals have flown on 05.07.1992 (KLENK & MADER in KINKLER 1993) which has been three days before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals have flown on 30.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been four days before the full moon on 04.07.1993, near Ludweiler-Warndt westsouthwest of Saarbrücken in the southern part of the Saar area in the western part of Germany where 5 individuals have been captured on 09.07.1973 (SCHMIDT-KOEHL 1977) which has been one day after the increasing half moon on 08.07.1973 between the new moon on 30.06.1973 and the full moon on 15.07.1973, and near Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where several individuals have flown on 05.07.1996 (ERWIN SEFRIN in HASSELBACH 1997) which has been four days after the full moon on 01.07.1996.

5.33 The Common Blue *Polyommatus icarus* based on own observations

Some single individuals of the Common Blue *Polyommatus icarus* ROTTEMBURG 1775 (Lepidoptera: Lycaenidae) have occasionally flown at the localities Nußloch, Tairnbach and Walldorf since the beginning to mid of July 2009, whereas a few days after the new moon on 22.07.2009, almost suddenly numerous individuals have shown up at the localities Tairnbach and Walldorf. The abundance of individuals of the Common Blue *Polyommatus icarus* has persisted beyond the full moon on 06.08.2009 and has then started to decline, with only considerably less individuals having still been present around the new moon on 20.08.2009 and the diminution of the frequency of individuals having continued after the latter turning point of the lunar cycle.

The abundance of individuals of the Common Blue *Polyommatus icarus* several days after the new moon on 22.07.2009 at the locality Tairnbach has been particularly striking and has been much more pronounced than that at the locality Walldorf during the first couple of days of its appearance,

whereas a few days after its breakout, more or less the same quantity of individuals as in Tairnbach or even more individuals of the Common Blue *Polyommatus icarus* than in Tairnbach have flown around in Walldorf. The numerous individuals of the Common Blue *Polyommatus icarus* in Walldorf have particularly flown in fields with abundant red and violet flowers east of the town.

5.34 The Common Blue *Polyommatus icarus* based on literature evaluation

Mass occurrences of large quantities of individuals of the Common Blue *Polyommatus icarus* ROTTEMBURG 1775 (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been recognized in the northern part of the Senne south of Augustdorf southeast of Bielefeld where abt. 60 individuals have flown on 01.09.1991 (RETZLAFF 1992) which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where 15 individuals have flown on 30.05.1982 (WALFORT 1983) which has been on the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley where abundant individuals have flown on 11.05.2008 (HANISCH 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008; and near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 31.05.1994 and 22.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the decreasing half moon on 02.06.1994 between the full moon on 25.05.1994 and the new moon on 09.06.1994, and on the full moon on 22.07.1994, respectively;

Mass occurrences of large quantities of individuals of the Common Blue *Polyommatus icarus* in the western part of Germany have been identified in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 25 individuals have flown on 19.05.1990 (KINKLER & HÜRTER 1992) which has been five days before the full moon on 24.05.1990, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where more than 5 individuals have flown on 15.08.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been five days after the new moon on 10.08.1991; and around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz where abundant individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980.

Mass occurrences of large quantities of individuals of the Common Blue *Polyommatus icarus* in the southwestern part of Germany have been identified near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals each have flown on 30.05.1992 and 22.06.1992 (BROSZKUS 1995) which has been two days before the new moon on 01.06.1992, and two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, respectively; and near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals each have flown on 09.05.1993 and 04.07.1993 (S. JOUAUX in BROSZKUS 1995) as well as 10 individuals each have flown on 12.08.1978 – 13.08.1978 (SWOBODA 1983), 22.06.1992 (BROSZKUS 1995) and 14.08.1994 (S. JOUAUX in BROSZKUS 1995), respectively, which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, three days after the full moon on 06.05.1993, on the full moon on 04.07.1993, one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, and on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, respectively.

5.35 The Map Butterfly *Araschnia levana* based on own observations

Some single individuals of the aestival generation (forma *prorsa*) of the Map Butterfly *Araschnia levana* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have occasionally flown at the localities Nußloch and Tairnbach since the beginning of August 2009, whereas a few days after the new moon on 20.08.2009, almost suddenly numerous individuals have been present, and abt. one week to ten days later, the number of individuals has again started to decline, with only single individuals still having been discovered after the increasing half moon on 27.08.2009 and after the full moon on 04.09.2009, whereas no more individuals have been detected around the decreasing half moon on 12.09.2009 and around the new moon on 18.09.2009.

5.36 The Map Butterfly *Araschnia levana* based on literature evaluation

Mass occurrences of large quantities of individuals of the Map Butterfly *Araschnia levana* LINNAEUS 1758 (Lepidoptera: Nymphalidae) have been registered near Hiltrup south of Münster in the northwestern part of Germany where abt. 50 individuals have flown on 28.07.1968 (HARKORT & WEIGT 1969, H. HEDDERGOTT in HARKORT & WEIGT 1969) which has been three days after the new moon on 25.07.1968, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 70 individuals have flown on 06.08.1992 (KINKLER & HÜRTER 1992) which has been on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 25 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982; near Gronenborn in the vicinity of Leverkusen in the Middle Rhine valley in the northwestern part of Germany where abt. 10 individuals in total have flown on 29.08.2007 and 16.09.2007 (HELMUT KINKLER in SCHUMACHER 2008a) which has been one day after the full moon on 28.08.2007 and five days after the new moon on 11.09.2007, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals each have flown on 10.07.1992, 06.08.1992 and 02.08.1994 (BROSZKUS 1995) which has been four days before the full moon on 14.07.1992, on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, and five days before the new moon on 07.08.1994, respectively; and from Nahbollenbach and Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals and more than 5 individuals have flown on 06.05.1993 and 22.05.1993, respectively (BROSZKUS 1995), which has been on the full moon on 06.05.1993 and one day after the new moon on 21.05.1993, respectively.

5.37 The Small Tortoiseshell *Aglais urticae* based on own observations

The Small Tortoiseshell *Aglais urticae* LINNAEUS 1758 (Lepidoptera: Nymphalidae) has formerly been one of the most common representatives of the family Nymphalidae of the diurnal butterflies in mixed meadows and at forest margins in spring and early summer together with the Peacock Butterfly *Inachis io* and in late summer and early autumn in addition also with the Red Admiral *Vanessa atalanta*. All three species hibernate as adults and start to fly in early spring already during the first sunny days, with in some years a few individuals showing up on warm and bright days even already in January and February. The Peacock Butterfly *Inachis io* and the Red Admiral *Vanessa atalanta* are nowadays still very common and continue to occur in every year with numerous to abun-

dant individuals, whereas the Small Tortoiseshell *Aglais urticae* has almost disappeared in the region around Walldorf. During my regular entomological observations at the localities Nußloch, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009, I have discovered only occasionally a few single individuals of the Small Tortoiseshell *Aglais urticae,* and at other localities, I have also only rarely encountered a few isolated individuals, whereas during my occasional entomological observations at various localities from 1964 to 1979 (MADER 2009b), the Small Tortoiseshell *Aglais urticae* has been similarly widespread as the Peacock Butterfly *Inachis io* and the Red Admiral *Vanessa atalanta*, and has in some regions occasionally even been the most common nymphalid butterfly.

Because the larvae of the Small Tortoiseshell *Aglais urticae* require predominantly the stinging nettle for feeding, one of the reasons for its almost complete disappearance could be the exaggerated mowing of the seams and patches of stinging nettle along roads, paved ways, creeks and railways as well as in fields and gardens, but on the other hand, the frequent repetition of the mowing of the bands and spots of stinging nettle along the traffic lines and in cultivated land should also have affected the Peacock Butterfly *Inachis io* which, however, does not indicate any decline with respect to its former frequency, but has been able to maintain its abundance. The phenomenon of the almost complete disappearance of the Small Tortoiseshell *Aglais urticae* in the region around Walldorf in comparison to its formerly abundant occurrence and in contrast to the maintenance of the frequency of the Peacock Butterfly *Inachis io* needs further evaluation. The significant reduction of the abundance of individuals of the Small Tortoiseshell *Aglais urticae* during the last 25 years has also been investigated by REICHHOLF (2005a, 2005b)

5.38 The Small Tortoiseshell *Aglais urticae* based on literature evaluation

Mass flights of several hundreds or thousands of individuals of the Small Tortoiseshell *Aglais urticae* LINNAEUS 1758 (Lepidoptera: Nymphalidae) in the northeastern part of Germany have been observed near Warnemünde north of Rostock at the coast of the Baltic Sea in the last third of August 1996 (RUDNICK 1998) which has been around and between the new moon on 14.08.1996 and the full moon on 28.08.1996, near Warnemünde north of Rostock at the coast of the Baltic Sea on 22.08.1996 – 23.08.1996 (HENSLE 2000b) which has been on and one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, on the island Rügen northeast of Stralsund at the coast of the Baltic Sea on 19.08.1991 – 24.08.1991 (R. VON SELLE in RETZLAFF 1992) which has been around and between the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991 as well as the full moon on 25.08.1991, and near Röpzig south of Halle in the Saale valley on 07.08.1927 (BANDERMANN 1927a) which has been one day after the increasing half moon on 06.08.1927 between the new moon on 28.07.1927 and the full moon on 13.08.1927.

Mass flights of several hundreds or thousands of individuals of the Small Tortoiseshell *Aglais urticae* at the coast of the North Sea in the northwestern part of Germany have been registered on the Hallig Gröde northwest of Husum on 31.08.1995 – 01.09.1995 (HENSLE 2000a) which has been five to six days after the new moon on 26.08.1995, around the train station of Esens westnorthwest of Wilhelmshaven in mid to end of August 1991 (RETTIG in EITSCHBERGER & STEINIGER 1994) which has been around the full moon on 25.08.1991, within the city of Hamburg on 20.08.1995 – 26.08.1995 (HENSLE 2000a) which has been on and several days before the new moon on 26.08.1995, near Bremerhaven on 28.08.1975 and 31.08.1975 (STEINIGER & EITSCHBERGER 1976a) which has been before and on the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 06.09.1975, and in Norddeich northwest of Norden on 24.08.1990 (H. FISCHER in STEINIGER & EITSCHBERGER 1992) which has been four days after the new moon on 20.08.1990.

Mass flights of several hundreds or thousands of individuals of the Small Tortoiseshell *Aglais urticae* in the northwestern part of Germany have also been recorded near Bleckede in the Elbe valley eastnortheast of Lüneburg on 03.10.2005 (H. MÜLLER-SCHERZ in HENSLE 2006a) which has been on the new moon on 03.10.2005, in Lüneburg on 27.08.2005 (FRANK ALLMER in HENSLE 2006a) which has been one day after the decreasing half moon on 26.08.2005 between the full moon on 19.08.2005 and the new moon on 03.09.2005, in the Lüneburger Heide around Lüneburg on 28.08.1991 – 04.09.1991 (EITSCHBERGER & STEINIGER 1994) which has been around and between the full moon on 25.08.1991 and the new moon on 08.09.1991, between Kirchberg and Seesen in the northwestern part of the Harz on 30.08.1961 (GARLING 1963b) which has been four days after the full moon on 26.08.1961, around Clausthal-Zellerfeld and Bad Grund southsouthwest of Goslar in the northwestern part of the Harz in the period of 06.08.1976 – 14.08.1976 (EITSCHBERGER & STEINIGER 1977c) which has been around the full moon on 10.08.1976, on the Brocken southsoutheast of Bad Harzburg in the central part of the Harz on 25.08.2002 (HENSLE 2003) which has been four days after the full moon on 21.08.2002, near Holtum northnortheast of Verden in the Aller valley eastsoutheast of Bremen on 07.09.1991 (RETZLAFF 1992) which has been one day before the new moon on 08.09.1991, near Lage-Lopshorn northwest of Detmold in the Teutoburger Wald on 17.06.1959 (RETZLAFF 1964) which has been three days before the full moon on 20.06.1959, in Bielefeld-Jöllenbeck on 10.09.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994) which has been two days after the new moon on 08.09.1991, near Oerlinghausen southeast of Bielefeld in the Teutoburger Wald on 20.07.1963 (RETZLAFF 1964) which has been on the new moon on 20.07.1963; between Bielefeld and Paderborn on 26.08.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994) and 30.08.1991 (RETZLAFF 1992) which has been one and five days after the full moon on 25.08.1991, respectively; between Bielefeld and Bad Lippspringe on 30.08.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994) which has been five days after the full moon on 25.08.1991; in Herford northeast of Bielefeld on 02.09.1991 – 06.09.1991 (RETZLAFF 1992) and 13.09.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994) which has been around and between the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and three days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, respectively; in the northern part of the Senne south of Augustdorf southeast of Bielefeld on 30.08.1991 – 01.09.1991 (RETZLAFF 1992) and 14.09.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994) which has been five days after the full moon on 25.08.1991, one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, respectively; around Schloß Holte southsoutheast of Bielefeld on 01.09.1991 – 06.09.1991 (RETZLAFF 1992) which has been around and between the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991 as well as the new moon on 08.09.1991, near Borgholzhausen westnorthwest of Bielefeld on 03.08.2005 (J. PETERS in HENSLE 2006a) which has been two days before the new moon on 05.08.2005, near Winterberg-Niedersfeld south of Brilon on 18.08.2005 (HENSLE 2006a) which has been one day before the full moon on 19.08.2005, in Cologne in the Middle Rhine valley on 04.09.1991 (STEINIGER & EITSCHBERGER 1994) which has been two days after the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; and around Dormagen and Pulheim northnorthwest of Cologne in the Middle Rhine valley on 06.07.1982 – 08.07.1982 and 30.07.1982 – 04.08.1982 (HALFENBERG & BRENNER 1989) which has been on and several days after the full moon on 06.07.1982 as well as on and several days before the full moon on 04.08.1982, respectively.

Mass flights of several hundreds or thousands of individuals of the Small Tortoiseshell *Aglais urticae* in the southwestern and southeastern parts of Germany as well as in adjacent areas have been recorded within and around Pforzheim in the Enz valley in the northern part of the Black Forest in the southwestern part of Germany on 22.06.1979 – 28.06.1979 (STEINIGER & EITSCHBERGER 1981)

which has been several days before and after the new moon on 24.06.1979, around Schärding and Neuhaus am Inn south of Passau in the southeastern part of Germany on 23.03.1974 (REICHHOLF 1978) which has been on the new moon on 23.03.1974, near Murnau am Staffelsee northnortheast of Garmisch-Partenkirchen in the southeastern part of Germany on 26.02.2008 (P. SCHERSACH & A. STRENG in HENSLE 2009a) which has been five days after the full moon on 21.02.2008; at the Zugspitzplatt and near the Zugspitz chapel southwest of Garmisch-Partenkirchen in the southeastern part of Germany on 23.08.1990 (STEINIGER & EITSCHBERGER 1992) and 16.07.2006 (W. BÖHME in HENSLE 2007a) which has been three days after the new moon on 20.08.1990 as well as one day before the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, respectively; at the Wallberg near Rottach-Egern at the Tegernsee southwest of Rosenheim in the southeastern part of Germany on 11.08.2005 (HEINRICH VOGEL in HENSLE 2006a) which has been two days before the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005, in Oberengstringen north of Zürich in the northeastern part of Switzerland on 20.05.1964 – 22.05.1964 (GULL in HARZ 1965c) which has been one to three days after the increasing half moon on 19.05.1964 between the new moon on 11.05.1964 and the full moon on 26.05.1964, in Hautcharage northnorthwest of Esch-sur-Alzette in the southern part of Luxembourg on 19.04.1968 (HEINZ GLEFFE in HARZ 1969) which has been one day before the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968, and in the mountains east of Annecy eastnortheast of Lyon in the southeastern part of France on 14.06.2003 – 15.06.2003 (HENSLE 2004a) which has been on and one day after the full moon on 14.06.2003.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in the northwestern part of Germany have also been mentioned from Sankt Peter-Ording southwest of Husum at the coast of the North Sea on 13.09.1976 (EITSCHBERGER & STEINIGER 1977c) which has been five days after the full moon on 08.09.1976, from Brake near the mouth of the river Weser south of Bremerhaven at the coast of the North Sea on 24.08.1997 (HENSLE 2000c) which has been two days before the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 01.09.1997, from Emden at the coast of the North Sea on 30.08.2008 (HENSLE 2009a) which has been on the new moon on 30.08.2008, from Leer-Loga southeast of Emden at the coast of the North Sea on 07.09.2005 (HENSLE 2006a) which has been four days after the new moon on 03.09.2005, from Timmendorfer Strand northnortheast of Lübeck at the coast of the Baltic Sea on 08.09.1973 (EITSCHBERGER & STEINIGER 1974b) which has been four days before the full moon on 12.09.1973, from Scharbeutz north of Lübeck at the coast of the Baltic Sea on 31.08.1974 (EITSCHBERGER & STEINIGER 1975b) which has been one day before the full moon on 01.09.1974, from Mentrup southeast of Hagen am Teutoburger Wald south of Osnabrück on 12.09.1966 (HEINZ GLEFFE in HARZ 1967a) which has been two days before the new moon on 14.09.1966, from Münster on 05.09.1973 (EITSCHBERGER & STEINIGER 1974b) which has been on the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, from the Kahler Asten southwest of Winterberg south of Brilon on 01.09.2006 (HENSLE 2007a) which has been one day after the increasing half moon on 31.08.2006 between the new moon on 23.08.2006 and the full moon on 07.09.2006, from Elz northnorthwest of Limburg in the Lahn valley on 14.06.1976 (EITSCHBERGER & STEINIGER 1977c) which has been two days after the full moon on 12.06.1976, from the Heidelstein near Bischofsheim an der Rhön southeast of Fulda on 12.08.2005 (HEIMO HARBICH in HENSLE 2006a) which has been one day before the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel on 06.09.1981 (WALFORT 1983) which has been one day before the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981, from Bergisch Gladbach eastnortheast of Cologne in the Middle Rhine valley on 08.10.1966 (HEINZ GLEFFE in HARZ 1967a) which has been on the decreasing half moon on 08.10.1966 between the full moon on 29.09.1966 and the new moon on 14.10.1966, and from the district Sürth at the southern

margin of the city of Cologne in the Middle Rhine valley on 07.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in the northeastern part of Germany have also been reported from Warnemünde north of Rostock at the coast of the Baltic Sea on 04.07.1992 (RUDNICK 1994) and in the first third of August 1996 (RUDNICK 1998) which has been four days after the new moon on 30.06.1992 as well as around and between the full moon on 30.07.1996 and the new moon on 14.08.1996, respectively; from Boltenhagen northnortheast of Klütz westnorthwest of Wismar at the coast of the Baltic Sea on 13.08.1995 (HENSLE 2000a) which has been three days after the full moon on 10.08.1995, from Zingst on the Zingst northwest of Stralsund on 03.08.2005 (HENSLE 2006a) which has been two days before the new moon on 05.08.2005, from the vicinity of Saßnitz in the northeastern part of the island Rügen at the coast of the Baltic Sea on 19.06.2002 (REINHARD BÜLTE in HENSLE 2003) which has been one day after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, from Gedser at the southern tip of the island Falster at the coast of the Baltic Sea in the southeastern part of Denmark on 15.09.1995 (HENSLE 2000a) which has been two days before the decreasing half moon on 17.09.1995 between the full moon on 09.09.1995 and the new moon on 24.09.1995, from Zeitz in the Weiße Elster valley northnortheast of Gera on 31.07.2005 (GERD LINTZMEYER in HENSLE 2006a) which has been three days after the decreasing half moon on 28.07.2005 between the full moon on 21.07.2005 and the new moon on 05.08.2005; from Satzung eastsoutheast of Annaberg-Buchholz on 14.07.1986 – 15.07.1986, 16.07.1987 – 17.07.1987 and 14.08.1991 – 16.08.1991 (SAEMANN 1992) which has been on and one day before the increasing half moon on 15.07.1986 between the new moon on 07.07.1986 and the full moon on 21.07.1986, one and two days before the decreasing half moon on 18.07.1987 between the full moon on 11.07.1987 and the new moon on 25.07.1987, and several days after the new moon on 10.08.1991, respectively; and from Sondershausen northeast of Mühlhausen on 16.08.2002 (HENSLE 2003) which has been one day after the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in the western and southwestern parts of Germany have also been documented from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany on 23.07.1980 (KINKLER 1987) which has been four days before the full moon on 27.07.1980; from Rech in the Ahr valley westsouthwest of Bad-Neuenahr-Ahrweiler in the northeastern part of the Eifel in the western part of Germany on 18.04.2008 (HEINZ STETZUHN in BOSSELMANN 2009) which has been three days before the full moon on 21.04.2008, and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany on 14.03.1993 and 09.04.1993 (S. JOUAUX in BROSZKUS 1995) which has been two days before the decreasing half moon on 16.03.1993 between the full moon on 08.03.1993 and the new moon on 23.03.1993, and three days after the full moon on 06.04.1993, respectively.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in the southeastern part of Germany have also been confirmed from the Schneeberg east of Bischofsgrün in the Fichtelgebirge west of Wunsiedel on 30.09.1967 (HEINZ GLEFFE in HARZ 1968a) which has been three days before the new moon on 03.10.1967, from the Großer Arber west of Bayerisch Eisenstein northnorthwest of Zwiesel where abt. 20 individuals have flown on 26.08.2001 (HENSLE 2002a) which has been on the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the

full moon on 03.09.2001, from Lenggries in the Isar valley south of Bad Tölz on 26.09.1967 – 28.09.1967 (KARL CLEVE in GLEFFE in HARZ 1968a) which has been one day before and after the decreasing half moon on 27.09.1967 between the full moon on 18.09.1967 and the new moon on 03.10.1967, from the Fockenstein near Bad Wiessee at the Tegernsee southwest of Rosenheim on 12.08.2005 (K. HORN in HENSLE 2006a) which has been one day before the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005, and from Oberstdorf south of Sonthofen where abundant individuals have flown in the period of 15.09.1967 – 08.10.1967 (HEINZ GLEFFE in HARZ 1968a) which has been around and between the increasing half moon on 12.09.1967 between the new moon on 04.09.1967 and the full moon on 18.09.1967 as well as the decreasing half moon on 27.09.1967 between the full moon on 18.09.1967 and the new moon on 03.10.1967.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in the western part of Austria have also been noticed near Hinterriß northnortheast of Innsbruck on 24.06.2008 (P. SCHERSACH in HENSLE 2009a) which has been two days before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, in Kranebitten west of Innsbruck in the Inn valley on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977, near Hintertux westsouthwest of Mayrhofen southsoutheast of Innsbruck on 05.09.2005 (MARKUS SCHWIBINGER in HENSLE 2006a) which has been two days after the new moon on 03.09.2005, near Fügen in the Ziller valley southsoutheast of Jenbach eastnortheast of Innsbruck on 14.05.2008 (P. SCHERSACH in HENSLE 2009a) which has been two days after the increasing half moon on 12.05.2008 between the new moon on 05.08.2008 and the full moon on 20.05.2008, near Maurach northeast of Bad Gastein on 11.08.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been three days after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, near Vent southwest of Sölden on 19.08.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been one day after the full moon on 18.08.2008, near Kalbling southeast of Admont in the Enns valley eastnortheast of Liezen and at the Großglockner southeast of Mittersill southsoutheast of Kitzbühel where 115 individuals in total have flown on 02.08.1998 (HENSLE 2001f) which has been one day after the increasing half moon on 01.08.1998 between the new moon on 23.07.1998 and the full moon on 08.08.1998, at the Großglockner southeast of Mittersill southsoutheast of Kitzbühel on 05.08.1961 (RETZLAFF 1964) which has been one day after the increasing half moon on 04.08.1961 between the full moon on 27.07.1961 and the new moon on 11.08.1961, in Klagenfurt in the southern part of Austria where abt. 20 individuals have flown on 10.03.1970 – 12.03.1970 (GLEFFE 1971) which has been three to five days after the new moon on 07.03.1970, and near Retz northnorthwest of Hollabrunn northnorthwest of Vienna in the eastern part of Austria where 15 individuals have flown on 23.05.2002 (HENSLE 2003) which has been three days before the full moon on 26.05.2002.

Mass flights of numerous individuals of the Small Tortoiseshell *Aglais urticae* in Switzerland, Italy and France have also been noticed near Amden north of the Walensee eastsoutheast of Zürich in the northeastern part of Switzerland on 22.06.2008 (VERENA SCHEIWILLER in HENSLE 2009a) which has been four days after the full moon on 18.06.2008, near Bürglen east of Altdorf southeast of Luzern in the northeastern part of Switzerland on 24.06.2008 (VERENA SCHEIWILLER in HENSLE 2009a) which has been two days before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, at the Glacier du Trient southwest of Val-d´Illiez northwest of Martigny in the southwestern part of Switzerland on 23.06.1975 (STEINIGER & EITSCHBERGER 1976a) which has been on the full moon on 23.06.1975, near Vernagt westnorthwest of Merano in the northeastern part of Italy on 30.07.1978 (STEINIGER & EITSCHBERGER 1979) which has been five days before the new moon on 04.08.1978, in Manderen eastnortheast of Sierck northeast of Thionville in the northeastern part of France where abt. 20 individuals have flown on 28.06.2000 (HENSLE 2001b) which has been two days after the decreasing half moon on 26.06.2000 between the

full moon on 17.06.2000 and the new moon on 01.07.2000; around Les Hautes Huttes and Hohrodberg northnorthwest of Munster in the southern part of the Vosges west of Colmar in the northeastern part of France where more than 25 individuals have flown on 22.07.2000 (HENSLE 2001b) which has been three days before the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000, and near Noyers-sur-Jabron westnorthwest of Château-Arnoux-Saint-Auban northwest of Cannes in the southeastern part of France on 18.06.2008 (HENSLE 2009a) which has been on the full moon on 18.06.2008.

5.39 The Pale Clouded Yellow *Colias hyale*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have always registered various individuals of the Pale Clouded Yellow *Colias hyale* LINNAEUS 1758 (Lepidoptera: Pieridae) which have flown in changing frequency from early spring to late autumn. Because the Pale Clouded Yellow *Colias hyale* belongs to the most common butterflies and is almost always present in different abundance with a fluent transition between the successive generations and without development of pronounced peaks of occurrence, I have not monitored the distribution of this background yellow (male) and greenish white (female) butterfly in detail, and therefore I do not include this standard yellow (male) and greenish white (female) butterfly into the selenocyclical interpretation of my own observations of the short-term population dynamics of various butterflies. Some examples of mass occurrences of the Pale Clouded Yellow *Colias hyale* and the Moorland Clouded Yellow *Colias palaeno* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows. The Berger´s Clouded Yellow *Colias alfacariensis* RIBBE 1905 (that is also known under its younger synonym *Colias australis* VERITY 1911) which is very similar to the Pale Clouded Yellow *Colias hyale* in such a degree that both species cannot be distinguished with final certainty during the observation of flying individuals in the field without anatomical examination of specimens has not been considered here.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in the southwestern part of Germany have been reported from Biberach west of Neckarsulm in the Neckar valley where at least 150 – 200 individuals have flown on 15.09.1962 (HERMANN WANNER in REISSINGER 1964) which has been one day after the full moon on 14.09.1962, from Böckingen at the southwestern margin of the city of Heilbronn in the Neckar valley where abt. 70 individuals each have flown on 27.07.1963 and 24.08.1963 (HERBERT RUDOLPH in HARBICH & WITTSTADT 1964) which has been two days before the increasing half moon on 29.07.1963 between the new moon on 20.07.1963 and the full moon on 05.08.1963 as well as five days after the new moon on 19.08.1963, respectively; from Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley where abundant individuals have flown on 27.08.1954 (PEKARSKY 1955b) which has been one day before the new moon on 28.08.1954, and from Dettenheim-Rußheim westnorthwest of Bruchsal in the middle part of the Upper Rhine valley where more than 50 individuals have flown on 16.07.1991 (EITSCHBERGER & STEINIGER 1992c) which has been five days after the new moon on 11.07.1991.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in the southeastern part of Germany have been mentioned from Rügersgrün eastsoutheast of Marktleuthen and Raumetengrün north of Marktleuthen north of Wunsiedel in the Fichtelgebirge south of Hof where more than 100 individuals have flown and have sucked on flowers on every field of lucerne on 24.08.1990 – 25.08.1990 (EITSCHBERGER & STEINIGER 1992a) which has been four to five days after the new moon on 20.08.1990, from Marktleuthen north of Wunsiedel in the Fichtelgebirge south of Hof where abundant individuals have flown on 25.08.2001 – 26.08.2001 (EITSCHBERGER & STEINIGER 2002a) which has been on and one day before the increasing half moon on 26.08.2001

between the new moon on 19.08.2001 and the full moon on 03.09.2001, from Weigendorf-Oed east of Nürnberg where thousands of individuals have flown on 05.09.1992 – 15.09.1992 (EITSCHBERGER & STEINIGER 1994a) which has been before and after the full moon on 12.09.1992, from Oberambach westnorthwest of Moosburg in the Isar valley northnortheast of München where 20 individuals have flown on 29.04.2007 (HENSLE 2008a) which has been three days before the full moon on 02.05.2007, and from Arzmoostal east of the Wendelstein south of Rosenheim where abt. 20 individuals have flown on 06.09.1990 (EITSCHBERGER & STEINIGER 1992a) which has been one day after the full moon on 05.09.1990.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in the northwestern part of Germany have been documented from Bedburg westnorthwest of Cologne in the Middle Rhine valley where 55 individuals have flown on 24.07.2006 (HENSLE 2007a) which has been on the new moon on 24.07.2006; from the northern part of the Wahner Heide between Rösrath and Altenrath eastsoutheast of Cologne in the Middle Rhine valley where 20 individuals and abt. 100 individuals have flown on 20.07.2006 and 21.07.2006, respectively (HANISCH 2009), which has been three and four days before the new moon on 24.07.2006, respectively; from Hennef-Geistingen in the Sieg valley eastnortheast of Bonn where 10 individuals have flown on 20.09.2005 (SCHUMACHER 2006) which has been two days after the full moon on 18.09.2005, from Erdbach east of Breitscheid westnorthwest of Herborn where more than 50 individuals have flown on 12.10.2003 (SCHUMACHER 2004a) which has been two days after the full moon on 10.10.2003, from Windeck-Obernau west of Wissen westsouthwest of Siegen where 20 individuals have flown on 11.09.2006 (W. BECKERT in SCHUMACHER 2007a) which has been three days before the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006, from the Diemel valley near Liebenau eastsoutheast of Warburg southsoutheast of Paderborn where 30 individuals have flown on 02.10.1971 (RETZLAFF 1973) which has been two days before the full moon on 04.10.1971, from Willebadessen southeast of Paderborn where 50 individuals have flown on 16.09.2006 (HENSLE 2007a) which has been two days after the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006, from the Jayne valley near Weende at the northern margin of the city of Göttingen where hundreds of individuals have flown on 21.07.1934 (FINKE 1934b) which has been five days before the full moon on 26.07.1934; from the district Altenwerder in the southwestern part of the city of Hamburg at the coast of the North Sea where abundant individuals each have flown on 03.06.1951 and 17.06.1951 (P. KLÜSS in WARNECKE 1955) which has been one day before the new moon on 04.06.1951 and two days before the full moon on 19.06.1951, respectively; from Lübeck at the coast of the Baltic Sea where masses of individuals have flown on 09.10.1947 – 10.10.1947 (VÖGLER-SCHERF in WARNECKE 1955) which has been four to five days before the new moon on 14.10.1947, from Kanzem in the Saar valley south of Konz in the western part of Germany where 30 individuals have flown on 13.09.1990 (EITSCHBERGER & STEINIGER 1992a) which has been one day after the decreasing half moon on 12.09.1990 between the full moon on 05.09.1990 and the new moon on 19.09.1990, and from Rengen north of Daun in the northwestern part of the Eifel in the western part of Germany where abt. 25 individuals have flown on 18.09.2003 (U. FLESCH in SCHUMACHER 2004a) which has been on the decreasing half moon on 18.09.2003 between the full moon on 10.09.2003 and the new moon on 26.09.2003.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in the northeastern part of Germany have been registered from Bollersdorf east of Strausberg eastnortheast of Berlin where 15 individuals have flown on 05.05.2007 (HENSLE 2008a) which has been three days after the full moon on 02.05.2007, from the Klietzer Heide east and southeast of Klietz northwest of Brandenburg an der Havel where abt. 115 individuals have flown on 24.08.1999 (EITSCHBERGER & STEINIGER 2000b) which has been two days before the full moon on 26.08.1999, from the Döberitzer Heide near Kartzow north of Brandenburg an der Havel where 50 individuals have flown on 31.07.2008 (HENSLE 2009a) which has been one day before the new moon on 01.08.2008; from

Peenemünde eastnortheast of Greifswald at the coast of the Baltic Sea where 25 individuals in total have flown on 21.07.1992 and 24.07.1992 (EITSCHBERGER & STEINIGER 1994a) which has been two days before and one day after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, respectively; from Leipzig-Lützschena where 20 individuals have flown on 10.10.2008 (D. WAGLER & H. WAGLER in HENSLE 2009a) which has been four days before the full moon on 14.10.2008, from Altenburg south of Leipzig where abundant individuals have flown and have sucked on flowers in the period of 18.07.1993 – 07.08.1993 (EITSCHBERGER & STEINIGER 1995a) which has been around and between the new moon on 19.07.1993 and the full moon on 02.08.1993, from the region between Altenburg and Borna south of Leipzig where masses of individuals have flown in mid of July 1994 (EITSCHBERGER & STEINIGER 1996a) which has been around the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, from Dresden in the Elbe valley where abundant individuals have flown from the beginning to mid of September 1958 (HABERKORN in KOCH 1959) which has been around and between the full moon on 29.08.1958 and the new moon on 13.09.1958, from Zschocken eastsoutheast of Zwickau where 50 individuals have flown on 16.07.2007 (U. FISCHER in HENSLE 2008a) which has been two days after the new moon on 14.07.2007, and from Löbau westsouthwest of Görlitz where abt. 50 individuals have flown on 30.09.1956 (SCHOLZ in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) which has been two days after the decreasing half moon on 28.09.1956 between the full moon on 20.09.1956 and the new moon on 04.10.1956.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in Austria and Switzerland have been recorded from Neusiedl am See eastsoutheast of Vienna in the eastern part of Austria where abundant individuals have flown on 01.08.1987 (EITSCHBERGER & STEINIGER 1989) which has been two days before the increasing half moon on 03.08.1987 between the new moon on 25.07.1987 and the full moon on 09.08.1987, from Edelschrott southwest of Graz in the eastern part of Austria where abt. 20 individuals have flown on 17.04.2007 (T. BAUER in HENSLE 2008a) which has been on the new moon on 17.04.2007, from Amden eastsoutheast of Zürich in the northeastern part of Switzerland where abt. 15 individuals have flown on 03.06.2007 (VERENA SCHEIWILLER in HENSLE 2008a) which has been two days after the full moon on 01.06.2007, and from Schanf northeast of Samedan southsoutheast of Davos in the southeastern part of Switzerland where abt. 20 individuals have flown on 23.09.2005 (VERENA SCHEIWILLER in HENSLE 2006a) which has been two days before the decreasing half moon on 25.09.2005 between the full moon on 18.09.2005 and the new moon on 03.10.2005.

Mass occurrences of large quantities of individuals of the Pale Clouded Yellow *Colias hyale* in the southeastern part of England in Great Britain have been recognized near Gravesend eastsoutheast of London where 50 individuals have been captured on 05.08.1868 (BASDEN SMITH 1868) which has been two days after the full moon on 03.08.1868, near Colchester eastnortheast of London where 12 individuals have been captured on 15.08.1868 (HARWOOD 1868) which has been three days before the new moon on 18.08.1868, near Ramsgate and Deal eastsoutheast of Southend-on-Sea east of London where more than 20 individuals have been captured on 10.08.1868 (JONES 1868) which has been two days before the decreasing half moon on 12.08.1868 between the full moon on 03.08.1868 and the new moon on 18.08.1868, and near Cromer northnortheast of Norwich where abundant individuals have flown in the last week of August 1868 (SMITH 1868) which has been around and between the increasing half moon on 26.08.1868 between the new moon on 18.08.1868 and the full moon on 02.09.1868 as well as the full moon on 02.09.1868.

5.40 The Moorland Clouded Yellow *Colias palaeno*

Mass occurrences of large quantities of individuals of the Moorland Clouded Yellow *Colias*

palaeno LINNAEUS 1761 (Lepidoptera: Pieridae) have been witnessed in the moorland of Hinterzarten southeast of Freiburg in the southern part of the Black Forest in the southwestern part of Germany where on 27.06.1882 – 29.06.1882, abundant individuals have flown around; on 03.07.1886 – 07.07.1886, 50 males and 20 females have been observed; and on 03.07.1892, 115 males and 24 females have been seen (M. DAUB in EBERT & RENNWALD 1991) which has been a few days before the full moon on 01.07.1882, several days after the new moon on 01.07.1886, and one day after the increasing half moon on 02.07.1892 between the new moon on 24.06.1892 and the full moon on 10.07.1892, respectively. Mass occurrences of large quantities of individuals of the Moorland Clouded Yellow *Colias palaeno* have also been registered in the moorland around Schonach north of Furtwangen eastnortheast of Freiburg in the southern part of the Black Forest in the southwestern part of Germany where abt. a dozen individuals have flown on 16.06.1960 (WEINFURTER 1966) which has been one day before the decreasing half moon on 17.06.1960 between the full moon on 09.06.1960 and the new moon on 24.06.1960, and in the moorland around the Federsee northeast of Bad Buchau northnorthwest of Bad Waldsee in the southwestern part of Germany where abt. 200 individuals have been counted in the period of 22.06.1975 – 10.07.1975 (MEINEKE 1978) which has been around and between the full moon on 23.06.1975 and the new moon on 09.07.1975.

5.41 The Scarce Swallowtail *Iphiclides podalirius*

During my entomological observations, I have so far not discovered any individuals of the Scarce Swallowtail *Iphiclides podalirius* SCOPOLI 1763 (Lepidoptera: Papilionidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany. I have up to now only seen individuals of the Scarce Swallowtail *Iphiclides podalirius* in the regions within and around the valleys of Moselle, Meuse, Marne and Seine between Paris and Metz in the northwestern and northeastern parts of France during my biogeographical mapping of the distribution of nesting sites of the synanthropic Delta Mud Wasp *Delta unguiculatum* (VILLERS 1879) (Hymenoptera: Eumenidae) on the walls of buildings within towns and villages in summer 2000 (MADER 2000) and on the island Rhodos in the southeastern part of Greece during a holiday with my parents in spring 1965. In the regions within and around the valleys of Moselle, Meuse, Marne and Seine between Paris and Metz in the northwestern and northeastern parts of France, I have recognized the flight of abundant individuals of the Scarce Swallowtail *Iphiclides podalirius* at the margins of fields and meadows when driving through the country in summer 2000. Some examples of peak occurrences of the Scarce Swallowtail *Iphiclides podalirius* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* have been registered in Braubach southsoutheast of Koblenz in the Middle Rhine valley in the western part of Germany in the years 1979 – 1980, 1985 – 1990 and 1992 – 1993 (EITSCHBERGER & STEINIGER 1981a, 1981b, 1987, 1989, 1990a, 1990b, 1992a, 1994a, 1995a). Peak occurrences of the Scarce Swallowtail *Iphiclides podalirius* in Braubach have been particularly observed and documented on 02.06.1979 – 05.06.1979 when in total 12 individuals have been monitored (EITSCHBERGER & STEINIGER 1981a), 21.05.1980 – 26.05.1980 when in total 58 individuals have been noticed (EITSCHBERGER & STEINIGER 1981b), 25.05.1985 – 06.06.1985 when in total 59 individuals have been confirmed (EITSCHBERGER & STEINIGER 1987); 17.05.1986 and 25.05.1986 when 3 individuals and 4 individuals, respectively, have been seen (EITSCHBERGER & STEINIGER 1988); 09.05.1987 when 40 individuals have been counted (EITSCHBERGER & STEINIGER 1989), 23.05.1988 when 8 individuals have been detected (EITSCHBERGER & STEINIGER 1990b), 07.05.1989 and 17.05.1989 – 18.05.1989 when in total 15 individuals have been discovered (EITSCHBERGER & STEINIGER 1990a), 04.05.1990 when 12 individuals have been seen (EITSCHBERGER & STEINIGER 1992a), 05.05.1992 – 29.05.1992

when in total 86 individuals have been recorded (EITSCHBERGER & STEINIGER 1994a); and 27.04.1993, 29.04.1993 and 09.05.1993 when 18 individuals, 22 individuals and 20 individuals have been counted, respectively (EITSCHBERGER & STEINIGER 1995a). The peak occurrence of the Scarce Swallowtail *Iphiclides podalirius* in Braubach on 02.06.1979 – 05.06.1979 (EITSCHBERGER & STEINIGER 1981a) has happened before and after the increasing half moon on 03.06.1979 between new moon on 25.05.1979 and the full moon on 10.06.1979, the peak occurrence on 21.05.1980 – 26.05.1980 (EITSCHBERGER & STEINIGER 1981b) has been established before and after the increasing half moon on 22.05.1980 between the new moon on 14.05.1980 and the full moon on 29.05.1980; the peak occurrences on 17.05.1986 and 25.05.1986 (EITSCHBERGER & STEINIGER 1988) have been placed one day before the decreasing half moon on 18.05.1986 between the new moon on 09.05.1986 and the full moon on 23.05.1986, and two days after the full moon on 23.05.1986, respectively; the peak occurrence on 25.05.1985 – 06.06.1985 (EITSCHBERGER & STEINIGER 1987) has taken place around and between the new moon on 19.05.1985, the increasing half moon on 28.05.1985 and the full moon on 03.06.1985; the peak occurrence on 09.05.1987 (EITSCHBERGER & STEINIGER 1989) has been expressed four days before the full moon on 13.05.1987, the peak occurrence on 23.05.1988 (EITSCHBERGER & STEINIGER 1990b) has been developed one day before the increasing half moon on 24.05.1988 between the new moon on 15.05.1988 and the full moon on 31.05.1988; the peak occurrences on 07.05.1989 and 17.05.1989 – 18.05.1989 (EITSCHBERGER & STEINIGER 1990a) have shown up two days after the new moon on 05.05.1989 and a few days before the full moon on 20.05.1989, respectively; the peak occurrence on 04.05.1990 (EITSCHBERGER & STEINIGER 1992a) has been manifested five days before the full moon on 09.05.1990; the peak occurrences on 05.05.1992 – 29.05.1992 (EITSCHBERGER & STEINIGER 1994a) have happened around and between the new moon on 02.05.1992, the full moon on 16.05.1992 and the new moon on 01.06.1992; and the peak occurrences on 27.04.1993, 29.04.1993 and 09.05.1993 (EITSCHBERGER & STEINIGER 1995a) have been established a few days before the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 09.05.1993 as well as several days before the full moon on 06.05.1993, respectively. Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* have also been confirmed in Kaub southsoutheast of Koblenz in the Middle Rhine valley in the western part of Germany on 23.05.1979 – 03.06.1979 when in total 29 individuals have flown (EITSCHBERGER & STEINIGER 1981a), with this peak occurrence having taken place around and between the new moon on 25.05.1979 as well as the increasing half moon on 03.06.1979 between the new moon on 25.05.1979 and the full moon on 10.06.1979; around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany on 14.06.1980 – 15.06.1980 when 15 individuals in total have flown (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; and at unspecified localities in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany on 23.04.1993, 09.05.1993, 23.05.1993 and 24.05.1993 when 4 individuals each, 7 individuals and 4 individuals have flown, respectively (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994), which has been two days after the new moon on 21.04.1993, three days after the full moon on 06.05.1993, and two and three days after the new moon on 21.05.1993, respectively.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the southeastern part of Germany have been registered in the Naab valley near its mouth into the Danube valley around the ruin of the castle at the western margin of Regensburg in the Naab valley on 24.07.1988 when 7 individuals have been seen (EITSCHBERGER & STEINIGER 1990b) and on 22.05.1989 when again 7 individuals have been detected (EITSCHBERGER & STEINIGER 1990a) which has been five days before the full moon on 29.07.1988 and two days after the full moon on 20.05.1989, respectively; in the Naab valley near Kallmünz northnorthwest of Regensburg on 24.05.1993 when 6 individuals have been noticed (EITSCHBERGER & STEINIGER 1995a) which has been three days after the new moon on 21.05.1993, as well as on 22.04.2007 when 6 individuals have flown (MARKUS SCHWIBINGER in HENSLE 2008a) which has been two days before the increasing half

moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007; in the Altmühl valley near Kelheim southwest of Regensburg on 23.04.2007 when 4 individuals have flown (R. THANNEMANN in HENSLE 2008a) which has been one day before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, in the Altmühl valley at the margin of the city of Eichstätt northwest of Ingolstadt on 28.04.2007 when 4 individuals have flown (O. BÖCK in HENSLE 2008a) which has been four days before the full moon on 02.05.2007, in the Altmühl valley near Mörnsheim westsouthwest of Eichstätt westnorthwest of Ingolstadt on 01.05.2007 when 4 individuals have flown (JOCHEN GOLDSCHE in HENSLE 2008a) which has been one day before the full moon on 02.05.2007, and around Bayreuth on 15.05.1966 when 8 individuals have been observed (BRUNO P. KREMER in HARZ 1967a) which has been two days after the decreasing half moon on 13.05.1966 between the full moon on 04.05.1966 and the new moon on 20.05.1966.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the northeastern part of Germany have been recorded in the Saale valley near Jena eastsoutheast of Weimar on 20.08.1922 when abundant individuals have been assembled in a quantity as being usual for the Large White *Pieris brassicae* and the Small White *Pieris rapae* (B. FRITZSCHE in HARZ 1965a), on 05.05.1990 when 23 individuals have flown (EITSCHBERGER & STEINIGER 1992a), on 30.04.1993 when 12 individuals have been counted (EITSCHBERGER & STEINIGER 1995a), on 21.05.2001 when numerous individuals have been observed (EITSCHBERGER & STEINIGER 2002a) and on 08.05.2003 when 10 individuals have been noted (EITSCHBERGER & STEINIGER 2004a) which has been two days before the new moon on 22.08.1922, four days before the full moon on 09.05.1990, on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, two days before the new moon on 23.05.2001, and one day before the increasing half moon on 09.05.2003 between the new moon on 01.05.2003 and the full moon on 16.05.2003, respectively; in the Gera valley near Plaue southsouthwest of Erfurt on 22.05.1989 when 10 individuals have been seen (EITSCHBERGER & STEINIGER 1990a) which has been two days after the full moon on 20.05.1989; in the Gera valley near Arnstadt and Gossel southwest of Arnstadt southsouthwest of Erfurt on 08.05.1993 – 09.05.1993 and 25.05.1993 – 26.05.1993, respectively, when 4 individuals each have flown (EITSCHBERGER & STEINIGER 1995a) which has been two and three days after the full moon on 06.05.1993 as well as four and five days after the new moon on 21.05.1993, respectively; in the Elbe valley near Weinböhla northwest of Dresden on 26.05.1980 when 5 individuals have flown (EITSCHBERGER & STEINIGER 1981b) which has been three days before the full moon on 29.05.1980, and in the Elbe valley near Radebeul northwest of Dresden on 01.06.1984 (EITSCHBERGER & STEINIGER 1986) and in mid of August 1988 (EITSCHBERGER & STEINIGER 1990b) when 5 individuals each have been observed which has been two days after the new moon on 30.05.1984 and around the new moon on 12.08.1988, respectively.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the western part of Germany have also been recognized in the Ahr valley near Bad Neuenahr on 28.08.1961 when more than 100 individuals have flown (KREMER in HARZ & WITTSTADT 1964) which has been two days after the full moon on 26.08.1961, in the Moselle valley near Kobern southwest of Koblenz on 16.06.1986 – 17.06.1986 when 6 individuals in total have flown (EITSCHBERGER & STEINIGER 1988) which has been on and one day after the increasing half moon on 16.06.1986 between the new moon on 07.06.1986 and the full moon on 22.06.1986, in the Moselle valley near Kail southwest of Koblenz on 16.05.1992 when more than 8 individuals have been observed (EITSCHBERGER & STEINIGER 1994a) which has been on the full moon on 16.05.1992, in the Moselle valley near Burgen eastnortheast of Cochem on 16.06.1983 when 5 individuals have flown (EITSCHBERGER & STEINIGER 1985) which has been five days after the new moon on 11.06.1983; in the Moselle valley near Ediger-Eller south of Cochem on 15.04.2007 and 22.04.2007 when 12 individuals in total have flown (HENSLE 2008a) which has been two days before and five days after the

new moon on 17.04.2007, respectively; in the Middle Rhine valley near Lorch northnorthwest of Bingen on 16.04.2007, 28.04.2007 and 01.05.2007 when 42 individuals in total have flown (JÜRGEN RODELAND in HENSLE 2008a) which has been one day before the new moon on 17.04.2007 as well as four days and one day before the full moon on 02.05.2007, respectively; and near Leiningen south-southeast of Emmelshausen southsouthwest of Boppard on 25.05.1997 when abt. 5 individuals have flown (WERNER HARTEL in HASSELBACH 1999) which has been three days after the full moon on 22.05.1997.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the southwestern part of Germany have been identified in the Nahe valley near Schloß-böckelheim southwest of Bad Kreuznach on 27.05.1985 when 10 individuals have been recorded (EITSCHBERGER & STEINIGER 1987), on 24.05.1987 when 5 individuals have been registered (EITSCH-BERGER & STEINIGER 1989), on 10.05.2008 when 4 individuals have been observed (HENSLE 2009a), and on 27.07.2008 when 7 individuals have been noticed (ALFRED KLEIN & I. STIEGEMEYER in BOSSEL-MANN 2009) which has been one day before the increasing half moon on 28.05.1985 between the new moon on 19.05.1985 and the full moon on 03.06.1985, three days before the new moon on 27.05.1987, two days before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008, and two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, respectively; in the Nahe valley near Oberhausen southwest of Bad Kreuznach on 19.05.1985 when 8 individuals have been noticed (EITSCHBERGER & STEINIGER 1987), on 03.05.2005 when 4 individuals have been counted (HASSELBACH 2006) and on 07.05.2006 when 5 individuals have been recorded (T. SCHMIDT in HENSLE 2007a) which has been on the new moon on 19.05.1985, five days before the new moon on 08.05.2005, and two days after the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006, respectively; in the Nahe valley near Bad Münster am Stein southsouthwest of Bad Kreuznach on 27.07.1982 and 01.08.1982 when 5 individuals each have flown (EITSCHBERGER & STEINIGER 1984) and on 06.05.2006 when 14 individuals have flown (T. WESTMEIER in HENSLE 2007a) which has been one day before and four days after the increasing half moon on 28.07.1982 between the new moon on 20.07.1982 and the full moon on 04.08.1982, and one day after the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006, respectively; in the Nahe valley near Schloßböckelheim westsouthwest of Bad Kreuznach on 09.05.1993 when 10 individuals have flown (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 06.05.1993, near Sponheim westnorthwest of Bad Kreuz-nach on 08.05.2008 when 5 individuals have flown (RAINER MICHALSKI in BOSSELMANN 2009) which has been three days after the new moon on 05.05.2008, in the Glan valley within and around Mei-senheim southsouthwest of Bad Kreuznach on 15.07.2007 – 01.08.2007 when 9 individuals in total have flown (H.J. PASCHKE in HENSLE 2008a) which has been around and between the new moon on 14.07.2007 and the full moon on 30.07.2007; near Wendelsheim southeast of Bad Kreuznach on 06.05.2006 – 07.05.2006 and 14.05.2006 when 18 individuals in total have been counted (T. SCHMIDT in HENSLE 2007a) which has been one and two days after the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006 as well as one day before the full moon on 13.05.2006, respectively; in the Steinheimer Heide (Schäfhalde) near Steinheim southeast of Schwäbisch Hall on 13.05.1947 – 14.05.1947 when abundant individuals have been assembled on two to three trees (E. KUCH in HARZ 1965a) which has been one day before and on the decreasing half moon on 14.05.1947 between the full moon on 05.05.1947 and the new moon on 20.05.1947, in the northern vicinity of Neuburg in the Danube valley west of Ingolstadt on 17.05.1966 when 12 individuals have flown (BRUNO P. KREMER in HARZ 1967a) which has been three days before the new moon on 20.05.1966, and in Wiehre at the southeastern margin of Freiburg in the southern part of the Upper Rhine valley in July 1953 when abt. 20 individuals have sit together around a puddle on the yard of a brewery (W. BACK in EBERT & RENNWALD 1991) which has probably been around and between the new moon on 11.07.1953 and the full moon on 26.07.1953.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the central part of Germany have been confirmed in the Main valley around Würzburg on 14.05.1966 when 6 individuals have flown (BRUNO P. KREMER in HARZ 1967a) which has been one day after the decreasing half moon on 13.05.1966 between the full moon on 04.05.1966 and the new moon on 20.05.1966, in the Main valley near Erlabrunn northnorthwest of Würzburg on 17.05.1985 when 4 individuals have flown (EITSCHBERGER & STEINIGER 1987) which has been two days before the new moon on 19.05.1985, in the Main valley near Thüngersheim northnorthwest of Würzburg on 24.05.1992 when 8 individuals have been observed (EITSCHBERGER & STEINIGER 1994a) which has been one day before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992; in the Main valley near Retzbach northnorthwest of Würzburg on 17.06.1984 and 16.05.1985 when 5 individuals (EITSCHBERGER & STEINIGER 1986) and 10 individuals (EITSCHBERGER & STEINIGER 1987) have flown, respectively, which has been four days after the full moon on 13.06.1984 and three days before the new moon on 19.05.1985, respectively; and in the Main valley near Karlstadt northnorthwest of Würzburg on 29.04.2007 when 4 individuals have flown (HENSLE 2008a) which has been three days before the full moon on 02.05.2007.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in the eastern part of Austria have been recognized at the Rabenstein near Sankt Paul im Lavanttal southsoutheast of Wolfsberg on 02.05.1993 and 01.06.1993 when 7 individuals in total have flown (EITSCHBERGER & STEINIGER 1995a) which has been four days before the full moon on 06.05.1993 and three days before the full moon on 04.06.1993, respectively; near Krems and Rohrendorf east of Krems in the Danube valley on 11.04.2007 and 25.04.2007 when 12 individuals in total have flown (CHRISTOPHER RABL & D. RABL in HENSLE 2008a) which has been one day after the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007, and one day after the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, respectively; near Spitz southwest of Krems in the Danube valley on 05.07.2002 – 10.07.2002 when 22 individuals in total have flown (EITSCHBERGER & STEINIGER 2003a) which has been on and several days before the new moon on 10.07.2002, near Lengenfeld north of Krems in the Danube valley on 13.07.2006 – 18.07.2006 (CHRISTOPHER RABL in HENSLE 2007a) which has been around and between the full moon on 11.07.2006 as well as the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006; near Dürnstein westsouthwest of Krems in the Danube valley on 20.05.2006 when 4 individuals have flown (CHRISTOPHER RABL in HENSLE 2007a) and on 03.07.2007 when 5 individuals have flown (CHRISTOPHER RABL in HENSLE 2008a) which has been on the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006, and three days after the full moon on 30.06.2007, respectively; in Retz-Windmühle northnorthwest of Hollabrunn northnorthwest of Vienna on 22.05.1993 when 8 individuals have flown (EITSCHBERGER & STEINIGER 1995a) which has been one day after the new moon on 21.05.1993, within and around Retz northnorthwest of Hollabrunn northnorthwest of Vienna on 15.06.2007 – 25.06.2007 when 7 individuals in total have flown (HENSLE 2008a) which has been around and between the new moon on 15.06.2007 and the full moon on 30.06.2007, at the Bisamberg near Langenzersdorf in the Danube valley north of Vienna on 22.06.2007 when 31 individuals have flown (HENSLE 2008a) which has been on the increasing half moon on 22.06.2007 between the new moon on 15.06.2007 and the full moon on 30.06.2007, at the Eichkogel near Mödling southsouthwest of Vienna in mid of May 1963 when 20 individuals have been registered (H.J. NOLLEN in HARZ 1965a) which has been around the decreasing half moon on 17.05.1963 between the full moon on 08.05.1963 and the new moon on 23.05.1963, at the Eichkogel near Guntramsdorf south of Vienna on 22.04.2007 when 20 individuals have flown (HENSLE 2008a) which has been two days before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, near Baden southsouthwest of Vienna on 09.07.2006 when 8 individuals have flown (CHRISTOPHER RABL in HENSLE 2007a) which has been two days before the full moon on 11.07.2006, at the Hundsheimer Kogel

near Hainburg in the Danube valley east of Vienna on 28.07.1997 when abt. 30 individuals have flown (EITSCHBERGER & STEINIGER 1999a) which has been one day after the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997; at the Hundsheimer Berg near Hainburg in the Danube valley east of Vienna on 21.07.2006 when 7 individuals have flown (HENSLE 2007a) and on 29.04.2007 when 20 individuals have flown (HENSLE 2008a) which has been three days before the new moon on 24.07.2006 and three days before the full moon on 02.05.2007, respectively; at the Braunsberg near Hainburg in the Danube valley east of Vienna on 23.05.1992 when 7 individuals have flown (EITSCHBERGER & STEINIGER 1994a) and on 19.08.2007 when 8 individuals have flown (MARKUS SCHWIBINGER in HENSLE 2008a) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, and two days before the increasing half moon on 21.08.2007 between the new moon on 13.08.2007 and the full moon on 28.08.2007, respectively; near Schwarzau am Steinfelde southsouthwest of Wiener Neustadt on 22.07.2006 – 23.07.2006 when 8 individuals have flown (S. STRENG in HENSLE 2007a) which has been one and two days before the new moon on 24.07.2006; near Sollenau north of Wiener Neustadt on 13.07.2006 and 22.07.2006 when 7 individuals in total have flown (HENSLE 2007a) which has been two days after the full moon on 11.07.2006 and two days before the new moon on 24.07.2006, respectively; within and around Vienna on 05.05.2006 – 23.05.2006 and 12.07.2006 – 30.07.2006 when 22 individuals and 26 individuals have been counted, respectively (CHRISTOPHER RABL, D. GRUBER & H. KAYSER in HENSLE 2007a), which has been around and between the new moon on 27.04.2006, the full moon on 13.05.2006 and the new moon on 27.05.2006 as well as around and between the full moon on 11.07.2006 and the new moon on 24.07.2006, respectively; near Bruck an der Leitha eastsoutheast of Vienna on 15.04.2007 and 22.04.2007 when 8 individuals in total have flown (HENSLE 2008a) which has been two days before the new moon on 17.04.2007 as well as two days before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, respectively; near Göttlesbrunn northwest of Bruck an der Leitha eastsoutheast of Vienna on 11.07.2006 – 28.07.2006 when 6 individuals in total have flown (HENSLE 2007a) which has been around and between the full moon on 11.07.2006 and the new moon on 24.07.2006, near Jois southsoutheast of Bruck an der Leitha eastsoutheast of Vienna on 27.07.2006 when 8 individuals have flown (HENSLE 2007a) which has been three days after the new moon on 24.07.2006, at Lake Neusiedl southeast of Vienna on 28.07.1986 – 31.07.1986 when 14 individuals have flown (EITSCHBERGER & STEINIGER 1988) which has been around the decreasing half moon on 29.07.1986 between the full moon on 21.07.1986 and the new moon on 05.08.1986, near Breitenbrunn at Lake Neusiedl northeast of Eisenstadt southeast of Vienna on 27.04.2003 when 10 individuals have flown (HERMANN KÜHNERT in EITSCHBERGER & STEINIGER 2004a) which has been four days before the new moon on 01.05.2003, near Stoob northnorthwest of Oberpullendorf eastnortheast of Kirschschlag in der Buckligen Welt on 20.06.2000 when 15 individuals have flown (EITSCHBERGER & STEINIGER 2001) which has been three days after the full moon on 17.06.2000, near Edelschrott westsouthwest of Graz on 21.07.2007 – 25.07.2007 when 4 individuals in total have flown (W. KAURZINEK in HENSLE 2008a) which has been around the increasing half moon on 22.07.2007 between the new moon on 14.07.2007 and the full moon on 30.07.2007, near Leibnitz in the Mur valley southsoutheast of Graz on 14.05.2000 when 10 individuals have flown (EITSCHBERGER & STEINIGER 2001) which has been one day before the increasing half moon on 11.05.2000 between the new moon on 04.05.2000 and the full moon on 18.05.2000, and at the Kalvarienberg near Zirl in the Inn valley west of Innsbruck in the western part of Austria on 21.05.2005 when 20 individuals have been counted (HENSLE 2006a) which has been two days before the full moon on 23.05.2005.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in Switzerland have been recorded near Fully northeast of Martigny in the Rhône valley in the southwestern part of Switzerland on 15.04.2007 when 26 individuals have flown (HENSLE 2008a) which has been two days before the new moon on 17.04.2007; near Neubrück in the Matter valley

south of Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland on 19.07.2001 when five individuals have flown (EITSCHBERGER & STEINIGER 2002a) which has been one day before the new moon on 20.07.2001, and on 27.07.2002 when 10 individuals have flown (EITSCHBERGER & STEINIGER 2003a) which has been three days after the full moon on 24.07.2002; near Leuk west of Brig in the Rhône valley in the southeastern part of Switzerland on 01.05.2006 and 13.06.2006 when 9 individuals and 8 individuals, respectively, have flown (K. BLASSMANN in HENSLE 2007a) which has been four days after the new moon on 27.04.2006 and two days after the full moon on 11.06.2006, respectively; near Feschel northeast of Leuk west of Brig in the Rhône valley in the southeastern part of Switzerland on 04.06.2001 when 6 individuals have flown (EITSCHBERGER & STEINIGER 2002a) which has been two days before the full moon on 06.06.2001, near Bratsch west of Brig in the Rhône valley in the southeastern part of Switzerland on 14.05.2006 when 6 individuals have flown (U. DIETZEL in HENSLE 2007a) which has been one day after the full moon on 13.05.2006, near Hohtenn west of Brig in the Rhône valley in the southeastern part of Switzerland on 14.06.2008 and 21.06.2008 when 8 individuals in total have been counted (HENSLE 2009a) which has been four days before and three days after the full moon on 18.06.2008, respectively; near Stalden south of Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland on 23.07.2006 when 4 individuals have flown (A. ZUBER in HENSLE 2007a) which has been one day before the new moon on 24.07.2006, at the Monte Bré east of Lugano in the southeastern part of Switzerland where up to 8 individuals daily have flown on 22.04.1999 – 24.04.1999 (EITSCHBERGER & STEINIGER 2000b) which has been around the increasing half moon on 23.04.1999 between the new moon on 16.04.1999 and the full moon on 30.04.1999, in the Binn valley near Lax south of Chur in the northeastern part of Switzerland on 22.07.2007 and 24.07.2007 when 7 individuals in total have flown (S. KRÄHENBÜHL in HENSLE 2008a) which has been on and two days after the increasing half moon on 22.07.2007 between the new moon on 14.07.2007 and the full moon on 30.07.2007, and at the Monte Generoso near Castel San Pietro eastsoutheast of Mendrisio southsoutheast of Lugano in the southeastern part of Switzerland on 05.07.2006 when 10 individuals have flown (G. ACKERMANN in HENSLE 2007a) which has been two days after the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006.

Peak occurrences of significant quantities of individuals of the Scarce Swallowtail *Iphiclides podalirius* in France have been identified near Graissessac northwest of Lodève northwest of Montpellier in the southeastern part of France in the period of 23.07.1987 – 06.08.1987 when abt. 500 individuals in total have flown (EITSCHBERGER & STEINIGER 1989) which has been around and between the new moon on 25.07.1987 as well as the increasing half moon on 03.08.1987 between the new moon on 25.07.1987 and the full moon on 09.08.1987, near Saint-Jean-de-Buèges northnorthwest of Montpellier in the southeastern part of France where 50 individuals have flown on 04.07.2008 (MARKUS SCHWIBINGER in HENSLE 2009a) which has been one day after the new moon on 03.07.2008, and near Vauvenargues east of Aix-en-Provence northeast of Marseille in the southeastern part of France on 19.05.1989 – 21.05.1989 when 12 individuals in total have flown (EITSCHBERGER & STEINIGER 1990 a) which has been around the full moon on 20.05.1989.

5.42 The Large White *Pieris brassicae*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have always registered various individuals of the Large White *Pieris brassicae* LINNAEUS 1758 (Lepidoptera: Pieridae), the Small White *Pieris rapae* LINNAEUS 1758 (Lepidoptera: Pieridae) and the Green-Veined White *Pieris napi* LINNAEUS 1758 (Lepidoptera: Pieridae) which have flown in changing frequency from early spring to late autumn. Because the Small White *Pieris rapae* and the Green-Veined White *Pieris napi* belong to the most common butterflies and are almost always present in different abundance with a fluent transition between the

successive generations and without development of pronounced peaks of occurrence, I have not monitored the distribution of these background white butterflies in detail, and therefore I do not include these standard white butterflies into the selenocyclical interpretation of my own observations of the short-term population dynamics of various butterflies. The Large White *Pieris brassicae* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007 – 2009, and therefore its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle, whereas during the periods of its abundant occurrence in fields around Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley in the western part of Germany between 1964 and 1972, I have not documented its population dynamics. Similarly, I have also not recorded the frequency of occurrence of various butterflies on the island Teneriffa during a holiday with my parents in spring 1968 where I have had the occasion to observe several to numerous individuals each of the Canarian Large White *Pieris cheiranthi* (HÜBNER 1808) (Lepidoptera: Pieridae), the Indian Red Admiral *Vanessa indica* (HERBST 1794) (Lepidoptera: Nymphalidae) and the Plain Tiger *Danaus chrysippus* LINNAEUS 1758 (Lepidoptera: Danaidae). Some examples of mass occurrences of the Large White *Pieris brassicae,* the Small White *Pieris rapae* and the Green-Veined White *Pieris napi* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* and the Small White *Pieris rapae* in the northwestern part of Germany have been reported from the island Mellum north of Wilhelmshaven at the coast of the North Sea where several thousands of individuals have flown on 14.06.1980 (EITSCHBERGER & STEINIGER 1981b) which has been two days after the new moon on 12.06.1980; from the Hallig Gröde northwest of Husum at the coast of the North Sea where abundant or even several thousands of individuals each have flown on 25.05.1979 – 31.05.1979 (EITSCHBERGER & STEINIGER 1981b), 18.08.1979 (EITSCHBERGER & STEINIGER 1981a), 14.06.1980 (EITSCHBERGER & STEINIGER 1981b), 23.08.1994 – 24.08.1994 (EITSCHBERGER & STEINIGER 1996a), 11.08.1996 (EITSCHBERGER & STEINIGER 1998) and 20.08.2002 – 25.08.2002 (EITSCHBERGER & STEINIGER 2003a) which has been around the new moon on 26.05.1979, three days after the decreasing half moon on 15.08.1979 between the full moon on 08.08.1979 and the new moon on 22.08.1979, two days after the new moon on 12.06.1980, two and three days after the full moon on 21.08.1994, three days before the new moon on 14.08.1996, and several days before and after the full moon on 21.08.2002, respectively; from the German Bay northeast of Cuxhaven at the coast of the North Sea where abundant individuals have flown on 28.07.1982 (ULRICH PAUKSTADT in EITSCHBERGER & STEINIGER 1984) which has been on the increasing half moon on 28.07.1982 between the new moon on 20.07.1982 and the full moon on 04.08.1982, from Uelzen southsoutheast of Lüneburg where abundant individuals have flown on 26.07.1985 (EITSCHBERGER & STEINIGER 1987) which has been on the increasing half moon on 26.07.1985 between the new moon on 17.07.1985 and the full moon on 01.08.1985, from the Kiel Bay abt. 20 km east of the light tower of Kiel at the coast of the Baltic Sea where several hundreds of individuals have flown on 17.07.1982 (ULRICH PAUKSTADT in EITSCHBERGER & STEINIGER 1984) which has been two days after the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, from the Mecklenburg Bay northeast of Lübeck at the coast of the Baltic Sea where several hundreds of individuals have flown on 27.07.1982 (ULRICH PAUKSTADT in EITSCHBERGER & STEINIGER 1984) which has been one day before the increasing half moon on 28.07.1982 between the new moon on 20.07.1982 and the full moon on 04.08.1982, from Eastbourne southsoutheast of London in the southeastern part of England where masses of individuals have flown in the period of 28.07.1917 – 05.08.1917 (ADKIN 1918) which has been around and between the increasing half moon on 26.07.1917 between the new moon on 19.07.1917 and the full moon on 03.08.1917 as well as the full moon on 03.08.1917, from Bexhill eastnortheast of Eastbourne southsoutheast of London where masses of individuals have flown on 08.08.1924 (PEILE 1924) which has been one day before the increasing

half moon on 09.08.1924 between the new moon on 31.07.1924 and the full moon on 14.08.1924, from Hunstanton northwest of Norwich in the southeastern part of England where abundant individuals have flown at the end of May 1887 (BARRETT 1887) which has been around and between the new moon on 22.05.1887 and the full moon on 05.06.1887, and from Roxburgh southsoutheast of Edinburgh in the northeastern part of England where masses of individuals have flown in the second half of August 1887 (ELLIOT 1887) which has been around the full moon on 03.08.1887.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* and the Small White *Pieris rapae* in the northeastern part of Germany have been mentioned from the western margin of the Fischland between Wustrow and Dierhagen northwest of Ribnitz-Damgarten at the coast of the Baltic Sea where several hundreds or even thousands of individuals in total have flown on 09.07.1994 – 14.07.1994 (RUDNICK 1996b) which has been a few days after the new moon on 08.07.1994; from Rostock and Warnemünde north of Rostock at the coast of the Baltic Sea where hundreds or thousands of individuals each have flown on 04.07.1992 – 12.07.1992 (RUDNICK 1994), 19.07.1994 – 24.07.1994 (RUDNICK 1996a) and in the first third of August 1996 (RUDNICK 1998) which has been around and between the new moon on 30.06.1992 and the full moon on 14.07.1992, around the full moon on 22.07.1994, and around and between the full moon on 30.07.1996 and the new moon on 14.08.1996, respectively; from Putbus in the southern part of the island Rügen east-northeast of Stralsund at the coast of the Baltic Sea where hundreds of individuals have flown on 04.09.1994 (RUDNICK 1996a) which has been one day before the new moon on 05.09.1994, from the Klützer Winkel westnorthwest of Wismar at the coast of the Baltic Sea where several thousands of individuals have flown on 25.07.1985 – 26.07.1985 (HOPPE 1988) which has been one day before and on the increasing half moon on 26.07.1985 between the new moon on 18.07.1985 and the full moon on 31.07.1985, from Schweinfurt northnortheast of Würzburg in the Main valley in the central part of Germany where abt. 20 – 30 individuals have flown on 15.05.1969 (EITSCHBERGER 1970a) which has been one day before the new moon on 16.05.1969, and from Schopfloch southsouthwest of Feuchtwangen in the southwestern part of Germany where abt. 1.000 individuals in total have flown on 06.08.1962 (HARZ & WITTSTADT 1964) which has been three days before the increasing half moon on 09.08.1962 between the new moon on 31.07.1962 and the full moon on 15.08.1962.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae,* the Small White *Pieris rapae* and the Green-Veined White *Pieris napi* in the northwestern and northeastern parts of Germany have been described from the Hallig Gröde northwest of Husum at the coast of the North Sea in the northwestern part of Germany where abundant individuals each have flown on 09.07.2002 – 14.07.2002, 27.07.2002 – 29.07.2002 and 07.08.2002 (EITSCHBERGER & STEINIGER 2003a) which has been several days before and after the new moon on 10.07.2002, three to five days after the full moon on 24.07.2002, and one day before the new moon on 08.08.2002, respectively; from Wischhafen eastsoutheast of Glückstadt westnorthwest of Hamburg at the coast of the North Sea in the northwestern part of Germany where hundreds of individuals have flown on 05.08.1969 (EITSCHBERGER 1970a) which has been one day before the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969, from Kiel at the coast of the Baltic Sea in the northwestern part of Germany where abundant individuals have flown in the period of 24.07.1969 – 02.08.1969 (EITSCHBERGER 1970a) which has been around and between the increasing half moon on 23.07.1969 between the new moon on 14.07.1969 and the full moon on 29.07.1969 as well as the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969, from the Strander Bucht northnortheast of Kiel at the coast of the Baltic Sea in the northwestern part of Germany where abundant individuals have flown on 27.07.1986 (EITSCHBERGER & STEINIGER 1988) which has been two days before the decreasing half moon on 29.07.1986 between the full moon on 21.07.1986 and the new moon on 05.08.1986; from Warnemünde and Diedrichshagen north of Rostock at the coast of the Baltic Sea in the northeastern part of Germany where several hundreds or even thousands of individuals have flown on

30.06.1992, 04.07.1992 and 12.07.1992 (RUDNICK 1996b) which has been around and between the new moon on 30.06.1992 and the full moon on 14.07.1992; from Rostock and Warnemünde north of Rostock at the coast of the Baltic Sea in the northeastern part of Germany where thousands of individuals have flown on 19.07.1994 – 24.07.1994 (RUDNICK 1996a) which has been around the full moon on 22.07.1994, from Kemtau southsoutheast of Chemnitz in the northeastern part of Germany where masses of individuals have flown on 04.08.1937 (HANS FRIEDEMANN in WENZEL 1937a) which has been two days before the new moon on 06.08.1937, from the Jayne valley near Weende at the northern margin of the city of Göttingen in the northwestern part of Germany where thousands of individuals have flown in the second half of July 1934 (FINKE 1934a) which has been around and between the new moon on 11.07.1934 and the full moon on 26.07.1934, and from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 100 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae,* the Small White *Pieris rapae* and the Green-Veined White *Pieris napi* in the southwestern and southeastern parts of Germany have been notified from Schloßböckelheim and Niederhausen in the Nahe valley west-southwest of Bad Kreuznach in the southwestern part of Germany where abundant individuals have flown on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; from Reichenau northwest of Konstanz at Lake Constance in the southwestern part of Germany where masses of individuals each have flown at the beginning of August 1917 and at the beginning of August 1937 (HANS REITHINGER in WENZEL 1937a) which has been around the full moon on 03.08.1917 and around the new moon on 06.08.1937, respectively; from Neuschönau north-northwest of Freyung north of Passau in the southeastern part of Germany where abundant individuals have flown on 19.08.1971 (EITSCHBERGER 1972) which has been two days before the new moon on 21.08.1971, from Hohenschwangau southeast of Füssen in the southeastern part of Germany where abt. 80 individuals have flown on 25.08.1972 (EITSCHBERGER 1973a) which has been one day after the full moon on 24.08.1972, and from Eastbourne southsoutheast of London in the southeastern part of England where abundant individuals have flown in the period of 14.07.1917 – 22.07.1917 (ADKIN 1918) which has been around the new moon on 19.07.1917.

Mass occurrences of large quantities of individuals of the Large White *Pieris brassicae* at the coast of the North Sea in the northwestern part of Germany have also been mentioned from the island Helgoland northnorthwest of Bremerhaven where more than 10 individuals, abt. 15 individuals, abt. 80 individuals and abt. 50 individuals have flown on 17.05.1970 (EITSCHBERGER 1971a), 22.06.1971 (EITSCHBERGER 1972), 27.06.1972 (EITSCHBERGER 1973a) and 23.08.1985 (EITSCHBERGER & STEINIGER 1987), respectively, which has been four days before the full moon on 21.05.1970, one day before the new moon on 23.06.1971, one day after the full moon on 26.06.1972, and one day before the increasing half moon on 24.08.1985 between the new moon on 16.08.1985 and the full moon on 30.08.1985, respectively; from the vicinity of the islands Norderney north of Norden and Wangerooge northnorthwest of Wilhelmshaven where masses of individuals have flown at the beginning of July 1872 (SCHULTE 1877) which has been around the new moon on 05.07.1872, from the island Langeoog northwest of Wilhelmshaven where more than 20 individuals have flown on 27.08.1984 – 30.08.1984 (EITSCHBERGER & STEINIGER 1986) which has been one to four days after the new moon on 26.08.1984, from Bremerhaven where abt. 60 individuals have flown in the period of 29.08.1972 – 19.09.1972 (EITSCHBERGER 1973a) which has been around and between the decreasing half moon on 01.09.1972 between the full moon on 24.08.1972 and the new moon on 07.09.1972 as well as the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972; from the island Scharhörn northwest of Cuxhaven where abt. 200 individuals and abt.

100 – 300 individuals have flown daily on 01.06.1978 and 31.07.1978 – 01.08.1978, respectively (EITSCHBERGER & STEINIGER 1979), which has been four days before the new moon on 05.06.1978 and two to three days before the new moon on 03.08.1978, respectively; from Duhnen northwest of Cuxhaven where several thousands of individuals have flown on 28.06.1992 (EITSCHBERGER & STEINIGER 1994a) and 30.06.1992 (KISTNER 1994) which has been two days before and on the new moon on 30.06.1992, respectively; from the Hallig Gröde northwest of Husum where abundant individuals have flown on 08.06.1988 (EITSCHBERGER & STEINIGER 1990b), 06.07.1992 (EITSCHBERGER & STEINIGER 1994a), 05.08.1997 (EITSCHBERGER & STEINIGER 1999a), 29.07.1999 (EITSCHBERGER & STEINIGER 2000b) and 10.09.2002 – 11.09.2002 (EITSCHBERGER & STEINIGER 2003a) which has been on the decreasing half moon on 08.06.1988 between the full moon on 31.05.1988 and the new moon on 14.06.1988, two days before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, two days after the new moon on 03.08.1997, one day after the full moon on 28.07.1999, and two and three days before the increasing half moon on 13.09.2002 between the new moon on 07.09.2002 and the full moon on 21.09.2002, respectively; from the island Sylt westnorthwest of Flensburg where several tens of thousands of individuals have flown on 18.09.1959 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been one day after the full moon on 17.09.1959, from Esbjerg in the southwestern part of Denmark where abt. 20 individuals have flown on 18.08.1969 (EITSCHBERGER 1970a) which has been five days after the new moon on 13.08.1969, from the island Föhr and Dagebüll northwest of Husum where thousands of individuals have flown on 13.08.1969 (EITSCHBERGER 1970a) which has been on the new moon on 13.08.1969, from the island Pellworm westnorthwest of Husum where 20 individuals have flown on 18.08.1985 (EITSCHBERGER & STEINIGER 1987) which has been two days after the new moon on 16.08.1985; from Husum, Sankt Peter-Ording and the island Föhr where thousands of individuals have flown in the days before and around 09.08.1969 (EITSCHBERGER 1970a) which has been around and between the full moon on 29.07.1969, the decreasing half moon on 06.08.1969 and the new moon on 13.08.1969; from Westerrönfeld south of Rendsburg where more than 100 individuals have flown on 18.08.1964 (HARZ 1965c) which has been five days before the full moon on 23.08.1964; from the highway between Lüneburg, Hamburg and Rendsburg where masses of individuals have flown on 01.08.1969 (EITSCHBERGER 1970a) which has been two days after the full moon on 29.07.1969; from the highway between Owschlag, Rendsburg, Nortorf, Neumünster, Bad Segeberg and Bad Oldesloe where thousands of individuals have flown on 04.08.1969 (EITSCHBERGER 1970a) which has been two days before the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969; from the highway between Bispingen, Walsrode and Bremen where thousands of individuals have flown on 09.08.1969 (EITSCHBERGER 1970a) which has been four days before the new moon on 13.08.1969; from Pinneberg northwest of Hamburg where more than 20 individuals have flown on 11.05.1969 – 14.05.1969 (EITSCHBERGER 1970a) which has been around and between the decreasing half moon on 09.05.1969 between the full moon on 02.05.1969 and the new moon on 16.05.1969 as well as the new moon on 16.05.1969, from the vicinity of Quickborn north of Hamburg where masses of individuals have flown on 21.07.1937 (WARNECKE 1937) which has been two days before the full moon on 23.07.1937, from Hamburg where thousands of individuals have flown from the end of July 1915 onwards (SELZER 1918) which has been around and between the full moon on 26.07.1915 and the new moon on 11.08.1915, from Wedel west of Hamburg where abt. 60 individuals have flown on 22.09.1964 (HARZ 1965c) which has been one day after the full moon on 21.09.1964, from the island Pagensand in the Elbe river westnorthwest of Hamburg close to its mouth into the North Sea where abt. 15 individuals have flown on 28.08.2002 (EITSCHBERGER & STEINIGER 2003a) which has been one day before the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.09.2002; from the mouth of the Elbe river near Bremerhaven and the island Spiekeroog northnorthwest of Wilhelmshaven where masses of individuals have flown on 17.07.1868 (BUCHENAU 1873, F. BUCHENAU in LINSTOW 1913) and 18.07.1868 (HÄPKE 1873, L. HÄPKE in LINSTOW 1913), respectively, which has been one and two days before the new moon on 19.07.1868, respectively;

from Greetsiel northnorthwest of Emden where abundant individuals have flown on 08.06.1992 (STEINIGER & EITSCHBERGER 1994) which has been on the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, and from Emden and its surroundings where in total several thousands of individuals have flown on 08.08.1979 – 18.08.1979 (RETTIG 1981) which has been around and between the full moon on 08.08.1979 and the decreasing half moon on 15.08.1979 before the new moon on 22.08.1979.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* at the coast of the North Sea in Denmark, Netherlands and England have also been reported from the island Römö south of Esbjerg in the southwestern part of Denmark where abundant individuals have flown on 05.08.1972 (EITSCHBERGER 1973a) which has been two days after the decreasing half moon on 03.08.1972 between the full moon on 26.07.1972 and the new moon on 09.08.1972, from Den Helder north of Amsterdam in the northwestern part of the Netherlands where abt. 150 – 200 individuals have been observed on 30.07.1979 – 01.08.1979 (EITSCHBERGER & STEINIGER 1981a) which has been one to three days before the increasing half moon on 02.08.1979 between the new moon on 24.07.1979 and the full moon on 08.08.1979, from Noordwijk aan Zee northeast of Rotterdam in the northwestern part of the Netherlands where masses of individuals have flown on 15.07.1855 (LINSTOW 1913) which has been one day after the new moon on 14.07.1855, from Harpenden northnorthwest of London in the southeastern part of England where abundant individuals have flown in the period of 14.07.1940 – 07.08.1940 (WILLIAMS, COCKBILL, GIBBS & DOWNES 1942) which has been around and between the full moon on 19.07.1940 and the new moon on 03.08.1940, from Bradwell-on-Sea east of Chelmsford eastnortheast of London in the southeastern part of England where thousands of individuals have flown on 18.07.1992 (CROME 1992, EITSCHBERGER & STEINIGER 1994a) which has been four days after the full moon on 14.07.1992, from Cambridge northnortheast of London in the southeastern part of England where thousands of individuals have flown around 25.07.1992 (CROME 1992) which has been several days before the new moon on 29.07.1992, from Dovercourt southwest of Harwich eastnortheast of London in the southeastern part of England where masses of individuals have flown on 11.08.1892 – 15.08.1892 (KERRY 1892) which has been around and between the full moon on 08.08.1892 as well as the decreasing half moon on 16.08.1892 between the full moon on 08.08.1892 and the new moon on 22.08.1892, from the vicinity of Norwich and the Channel south of Norwich northeast of London in the northeastern part of England where masses of individuals have flown at the end of August 1849 (CROMPTON 1870) which has been around and between the new moon on 18.08.1849 and the full moon on 02.09.1849, from Hilbre Point southwest of Hoylake north of Liverpool in the northwestern part of England where masses of individuals have flown on 21.05.1940 (BLACKLER 1940) which has been on the full moon on 21.05.1940, from Bere Regis westnorthwest of Wareham westnorthwest of Bournemouth in the southwestern part of England where abt. 10 individuals have flown on 05.09.1928 (ANDREWES 1929) which has been two days before the decreasing half moon on 07.09.1928 between the full moon on 31.08.1928 and the new moon on 14.09.1928, from Penzance west of Plymouth in the southwestern part of England where abundant individuals have flown in the period of 16.05.1933 – 26.05.1933 (ADKIN 1933) which has been around and between the decreasing half moon on 17.05.1933 between the full moon on 10.05.1933 and the new moon on 24.05.1933 as well as the new moon on 24.05.1933, from Eastbourne southsoutheast of London in the southeastern part of England where abundant individuals have flown on 07.08.1924 – 08.08.1924 (ADKIN 1924) which has been one and two days before the increasing half moon on 09.08.1924 between the new moon on 31.07.1924 and the full moon on 14.08.1924, and from the island Ischia southeast of Nápoli in the southern part of Italy where thousands of individuals have flown on 21.07.1976 (LUGERT 1977) which has been six days before the new moon on 27.07.1976.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* at the coast of the Baltic Sea in the northwestern part of Germany have also been registered from Kiel, from the island

Fehmarn eastnortheast of Kiel, and from Pelzerhaken east of Neustadt in Holstein southeast of Kiel where masses of individuals have flown on abt. 15.07.1937 – 22.07.1937 (WARNECKE 1937) which has been around and between the increasing half moon on 16.07.1937 between the new moon on 08.07.1937 and the full moon on 23.07.1937 as well as the full moon on 23.07.1937; from Eckernförde northwest of Kiel where several hundreds or even thousands of individuals have flown on 03.08.1969 (EITSCHBERGER 1970a) which has been five days after the full moon on 29.07.1969, from the Kieler Förder around Strande and Bad Schilksee northnortheast of Kiel where abundant individuals have flown on 09.08.1936 – 16.08.1936 (BLUNCK 1954) which has been one and several days after the decreasing half moon on 10.08.1936 between the full moon on 03.08.1936 and the new moon on 17.08.1936 as well as one and several days before the new moon on 17.08.1936, from the vicinity of Flensburg where masses of individuals have flown on 31.07.1937 (WARNECKE 1937) which has been on the decreasing half moon on 31.07.1937 between the full moon on 23.07.1937 and the new moon on 06.08.1937, from Travemünde northeast of Lübeck where thousands of individuals have flown on 02.08.1969 and adjacent days (KARL CLEVE in EITSCHBERGER 1970a) which has been several days after the full moon on 29.07.1969; from the highway B 206 between Lübeck and Bad Segeberg where abt. 650 individuals and abt. 200 individuals have flown in the morning and in the afternoon, respectively, on 03.08.1978 (EITSCHBERGER & STEINIGER 1979), which has been on the new moon on 03.08.1978; from Owschlag northnorthwest of Rendsburg where abundant individuals have flown on 01.08.1969 (EITSCHBERGER 1970a) which has been three days after the full moon on 29.07.1969, and from the Aalkante near Rendsburg where abt. 500 individuals have flown on 30.07.1969 (EITSCHBERGER 1970a) which has been one day after the full moon on 29.07.1969. Mass flights of large quantities of individuals of the Large White *Pieris brassicae* at the coast of the Baltic Sea in the northwestern part of Germany have also been reflected in the distribution of large amounts of dead individuals on the roads in the region around and between Lübeck, Ratzeburg, Mölln, Besenthal and Lauenburg in the period from end of July 1978 to beginning of August 1978 (EITSCHBERGER & STEINIGER 1979), with these mass finds of dead individuals mirroring mass flights having been made around the new moon on 03.08.1978.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* at the coast of the Baltic Sea in the northeastern part of Germany have also been recorded from Boltenhagen northnortheast of Klütz westnorthwest of Wismar where masses of individuals and abt. 50 individuals have flown and have sucked on flowers from mid to end of July 1988 (H. VIERKE in EITSCHBERGER & STEINIGER 1990b) and on 20.07.1992 – 21.07.1992 (EITSCHBERGER & STEINIGER 1994a) which has been around and between the new moon on 14.07.1988 and the full moon on 29.07.1988, and two and three days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, respectively; from Rerik west of Rostock where abt. 200 – 300 individuals have flown on 20.08.1972 (EITSCHBERGER 1973a) which has been four days before the full moon on 24.08.1972, from Markgrafenheide north of Rostock where masses of individuals have flown on 29.05.1982 – 02.06.1982 (EITSCHBERGER & STEINIGER 1984) which has been around the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982; from Warnemünde north of Rostock where abt. 20 – 25 individuals each have flown on 11.08.1996 and 22.08.1996 (EITSCHBERGER & STEINIGER 1998) which has been three days before the new moon on 14.08.1996 as well as one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, respectively; from Heiligendamm east of Kühlungsborn westnorthwest of Rostock where abundant individuals have flown on 07.06.1973 (EITSCHBERGER & STEINIGER 1974a) which has been one day before the increasing half moon on 08.06.1973 between the new moon on 01.06.1973 and the full moon on 15.06.1973, from Gnoien and its surroundings eastsoutheast of Rostock where abt. 1.500 individuals have been counted on 01.08.2005 – 05.08.2005 (HENSLE 2006a) which has been on and several days before the new moon on 05.08.2005, from Dierhagen westnorthwest of Ribnitz-Damgarten where masses of individuals have flown on 09.07.1959 (HOFFMANN in KOCH 1960) which has been three days after the new

moon on 06.07.1959, from Ahrenshoop in the southern part of the Darß northnorthwest of Ribnitz-Damgarten where masses of individuals have flown on 07.07.1959 (BERGER in KOCH 1960; BERGER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been one day after the new moon on 06.07.1959, from the Borgwallsee southwest of Stralsund where many thousands of individuals have flown on 01.08.1900 (KRÜGER 1900) which has been several days after the new moon on 26.07.1900; from the Buger Hals in the northern part of the island Rügen where abt. 40 individuals and abt. 300 individuals have flown on 18.07.1999 and 19.07.1999, respectively (EITSCHBERGER & STEINIGER 2000b), as well as more than 15 individuals have flown on 28.07.2002 (EITSCHBERGER & STEINIGER 2003a) which has been two and three days before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999 as well as four days after the full moon on 24.07.2002, respectively; from Dranske in the northern part of the island Rügen where abt. 80 individuals and abt. 110 individuals have flown on 27.07.1999 and 05.08.1999, respectively (EITSCHBERGER & STEINIGER 2000b), which has been one day before the full moon on 28.07.1999 as well as on the decreasing half moon on 05.08.1999 between the full moon on 28.07.1999 and the new moon on 11.08.1999, respectively; from Ralswiek in the central part of the island Rügen where abt. 60 individuals have flown on 25.07.1999 (EITSCHBERGER & STEINIGER 2000b) which has been three days before the full moon on 28.07.1999, from Bergen in the central part of the island Rügen where abt. 20 individuals have flown on 29.07.1999 (EITSCHBERGER & STEINIGER 2000b) which has been one day after the full moon on 28.07.1999, from Ückeritz in the northern part of the island Usedom eastsoutheast of Wolgast where abundant individuals have flown on 03.08.1972 (EITSCHBERGER 1973a) which has been on the decreasing half moon on 03.08.1972 between the full moon on 26.07.1972 and the new moon on 09.08.1972, from Zinnowitz in the northern part of the island Usedom northeast of Wolgast where numerous individuals have flown on 29.07.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the increasing half moon on 27.07.1993 between the new moon on 19.07.1993 and the full moon on 02.08.1993, from Zingst on the Zingst northwest of Stralsund where more than 30 individuals have flown on 29.07.2002 (EITSCHBERGER & STEINIGER 2003a) which has been five days after the full moon on 24.07.2002, from Neuhaus and Dierhagen at the western margin of the Rostocker Heide west of Ribnitz-Damgarten where abt. 500 individuals have flown on 26.05.1985 (RUDNICK 1988) which has been six days after the new moon on 20.05.1985, from Tutow southsouthwest of Greifswald where abt. 40 individuals have flown on 07.09.2007 (HENSLE 2008a) which has been four days before the new moon on 11.09.2007, and from Tallinn (formerly Reval) at the coast of the Baltic Sea in the northwestern part of Estonia on 25.05.1852 – 28.05.1852 (MAYDELL in KÖPPEN 1871) which has been around the increasing half moon on 27.05.1852 between the new moon on 19.05.1852 and the full moon on 02.06.1852.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the northwestern part of Germany have also been reported from the northern part of the Lüneburger Heide around Lüneburg where masses of individuals have flown on 15.05.1959 – 18.05.1959 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1960) which has been around the increasing half moon on 16.05.1959 between the new moon on 07.05.1959 and the full moon on 22.05.1959, from Mentrup south of Hagen am Teutoburger Wald southsouthwest of Osnabrück where abundant individuals have flown on 26.07.1966 (KÖLLNER 1968) which has been one day after the increasing half moon on 25.07.1966 between the new moon on 18.07.1966 and the full moon on 01.08.1966, from Mardorf northwest of the Steinhuder Meer westnorthwest of Hannover where masses of individuals have flown on 22.07.1937 (BARTH 1938, BLUNCK 1954) which has been one day before the full moon on 23.07.1937; from Lingen in the Ems valley where abundant individuals and abt. 40 individuals have flown on 30.05.1978 and 15.08.1978, respectively (EITSCHBERGER & STEINIGER 1979), which has been on the decreasing half moon on 30.05.1978 between the full moon on 22.05.1978 and the new moon on 05.06.1978, and three days before the full moon on 18.08.1978, respectively; from Schloß Holte southsoutheast of Bielefeld where abt. 20 individuals each have flown on 08.05.1966,

13.05.1966 and 15.05.1966 (KÖLLNER 1968) which has been four days after the full moon on 04.05.1966 as well as on and two days after the decreasing half moon on 13.05.1966 between the full moon on 04.05.1966 and the new moon on 20.05.1966, respectively; from Lavesum north of Haltern north of Recklinghausen where abt. 250 individuals have flown in the period of 20.07.1976 – 14.08.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the new moon on 27.07.1976 and the full moon on 10.08.1976, from Warburg westnorthwest of Kassel where abt. 20 individuals have flown on 18.07.1973 (EITSCHBERGER & STEINIGER 1974a) which has been three days after the full moon on 15.07.1973, from Elten northwest of Emmerich in the Lower Rhine valley where abt. 65 individuals in total and more than 80 individuals in total have flown in the periods of 31.07.1968 – 24.08.1968 (ULF EITSCHBERGER in HARZ 1969) and 16.08.1969 – 25.08.1969 (EITSCHBERGER 1970a), respectively, which has been around and between the new moon on 25.07.1968, the full moon on 08.08.1968 and the new moon on 24.08.1968, as well as around and between the new moon on 13.08.1969 and the full moon on 27.08.1969, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where more than 10 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, from the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach where more than 40 individuals have flown on 07.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been three days before the full moon on 10.06.1968, from Dortmund where abt. 50 individuals in total have flown in the period of 10.08.1968 – 28.08.1968 (ULF EITSCHBERGER in HARZ 1969) which has been around and between the full moon on 08.08.1968 and the new moon on 24.08.1968; from Dortmund where thousands of individuals each have flown on 03.08.1882 (ALTUM 1897: quoted in WILLIAMS 1930, ROER 1955) and in August 1897 (ANONYMUS 1897: quoted in WILLIAMS 1930, ROER 1955) which has been four days after the full moon on 30.07.1882 as well as around and between the new moon on 29.07.1897, the full moon on 12.08.1897 and the new moon on 28.08.1897, respectively; from Cologne in the Middle Rhine valley where abundant individuals have flown on 28.06.1968 – 29.06.1968 (ULF EITSCHBERGER in HARZ 1969) which has been two and three days after the new moon on 26.06.1968, and from Bergisch Gladbach eastnortheast of Cologne in the Middle Rhine valley where abt. 20 individuals have flown on 02.09.1968 – 06.09.1968 (ULF EITSCHBERGER in HARZ 1969) which has been around and between the increasing half moon on 02.09.1968 between the new moon on 25.07.1968 and the full moon on 08.08.1968 as well as the full moon on 08.08.1968.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the western part of Germany have also been signaled from Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 50 individuals each have flown on 24.07.1994 and 31.07.1994 (BROSZKUS 1995) which has been two days after the full moon on 22.07.1994 as well as on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, respectively; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 10 individuals have flown on 24.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been two days before the full moon on 26.07.1991; from Friedrichsthal north of Saarbrücken in the southern part of the Saar area where abt. 20 individuals and abt. 40 individuals have flown and have sucked on flowers on 04.05.1969 and in the period of 15.09.1969 – 06.10.1969, respectively (EITSCHBERGER 1970a), which has been two days after the full moon on 02.05.1969, and around and between the increasing half moon on 20.09.1969 between the new moon on 11.09.1969 and the full moon on 25.09.1969 as well as the decreasing half moon on 04.10.1969 between the full moon on 25.09.1969 and the new moon on 11.10.1969, respectively; and from several localities in the northern part of the Saar area including Bosen northnorthwest of Sankt Wendel on 29.07.1978, Sötern northnorthwest of Sankt Wendel on 31.07.1978, Neunkirchen on 06.08.1978, Oberthal near Nohfelden north of Sankt Wendel on 12.08.1978 and Homburg on 18.08.1978, where abundant individuals have flown each (EITSCHBERGER & STEINIGER 1979) which has been around and between the new moon on 03.08.1978, the increasing half moon on 12.08.1978 and the full moon on 18.08.1978.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the central part of Germany have also been documented from Bad Camberg in the Taunus southwest of Limburg an der Lahn northwest of Frankfurt am Main where numerous individuals have flown on 01.09.1962 (JANDER in HARZ & WITTSTADT 1964) which has been two days after the new moon on 30.08.1962, from Amöneburg east of Marburg in the Lahn valley where abt. 35 individuals have flown on 12.07.1974 (ZUCCHI 1975a) which has been one day before the decreasing half moon on 13.07.1974 between the full moon on 04.07.1974 and the new moon on 19.07.1974, from Frankfurt am Main where masses of individuals have flown in the first half of August 1927 (AUE 1927) which has been around and between the new moon on 28.07.1927 and the full moon on 13.08.1927, from Randersacker in the Main valley southeast of Würzburg where numerous individuals have flown on 14.07.1971 (EITSCHBERGER 1972) which has been two days before the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971; from the vicinity of Würzburg in the Main valley where abt. 30 individuals and abt. 35 individuals have flown in the periods of 23.07.1969 – 09.08.1969 (EITSCHBERGER 1970a) and 09.07.1971 – 24.07.1971 (EITSCHBERGER 1972), respectively, which has been around and between the increasing half moon on 23.07.1969 between the new moon on 14.07.1969 and the full moon on 29.07.1969 as well as the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969, and around and between the full moon on 08.07.1971 and the new moon on 22.07.1971, respectively; from Schweinfurt northnortheast of Würzburg in the Main valley where abt. 25 individuals each have flown on 07.06.1970 and 13.06.1970 and abt. 70 individuals have flown on 20.06.1970 (EITSCHBERGER 1971a) which has been three days after the new moon on 04.06.1970, on the increasing half moon on 13.06.1970 between the new moon on 04.06.1970 and the full moon on 19.06.1970, and one day after the full moon on 19.06.1970, respectively; and from Schweinfurt northnortheast of Würzburg in the Main valley where abt. 50 individuals and abt. 25 individuals have flown on 08.05.1971 and 09.05.1971, respectively (EITSCHBERGER 1972), which has been one and two days before the full moon on 10.05.1971, respectively.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the southwestern part of Germany have also been confirmed from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where abt. 10 individuals have flown on 14.08.1994 (S. JOUAUX in BROSZKUS 1995) which has been one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, from Pirmasens southsouthwest of Kaiserslautern in the Palatinate Forest where abt. 100 individuals in total have flown in the period of 15.08.1970 – 05.09.1970 (EITSCHBERGER 1971a) which has been around and between the full moon on 17.08.1970 and the new moon on 01.09.1970, from Ludwigshafen in the middle part of the Upper Rhine valley where 60 individuals have been counted on 29.08.1975 (EITSCHBERGER & STEINIGER 1976a) which has been two days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975; from Heidelberg and Neckargemünd eastsoutheast of Heidelberg in the Neckar valley where numerous individuals have flown on 20.07.1989 and 23.07.1989, respectively (EITSCHBERGER & STEINIGER 1990a), which has been two and five days after the full moon on 18.07.1989, respectively; from Guttenbach south of Neckargerach in the Neckar valley northnorthwest of Mosbach east of Heidelberg where abundant individuals each have flown on 20.07.1964 (HARZ 1965c) and 18.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been four days before the full moon on 24.07.1964 and five days after the full moon on 13.04.1968, respectively; from Mosbach in the Neckar valley east of Heidelberg where abt. 15 individuals have flown on 30.05.1988 (EITSCHBERGER & STEINIGER 1990b) which has been one day before the full moon on 31.05.1988, from Pforzheim in the northern part of the Black Forest southeast of Karlsruhe where 40 individuals have been counted on 31.07.1979 (EITSCHBERGER & STEINIGER 1981a) which has been two days before the increasing half moon between the new moon on 24.07.1979 and the full moon on 08.08.1979, from Mulhouse in the southern part of the Upper Rhine valley in the northeastern part of France where masses of individuals have flown at the end of June 1917 or

at the beginning of July 1917 (CASPARY 1930) which has been around the full moon on 05.07.1917; from Geisingen eastsoutheast of Donaueschingen in the Danube valley and Hondingen northeast of Blumberg southeast of Donaueschingen where abt. 35 individuals and abt. 20 individuals, respectively, have flown on 03.06.1972 (EITSCHBERGER 1973a) which has been two days before the decreasing half moon on 05.06.1972 between the full moon on 28.05.1972 and the new moon on 11.06.1972; from Wiblingen south of Ulm in the Danube valley where abt. 15 individuals have flown on 12.06.1970 (EITSCHBERGER 1971a) which has been one day before the increasing half moon on 13.06.1970 between the new moon on 04.06.1970 and the full moon on 19.06.1970, from Salem northwest of Friedrichshafen at Lake Constance where 30 – 50 individuals have flown within one hour on 29.07.1981 (EITSCHBERGER & STEINIGER 1983) which has been two days before the full moon on 31.07.1981, and from Herrenstetten in the Iller valley south of Illertissen where abt. 30 individuals have flown on 11.05.1966 (KÖLLNER 1968) which has been two days before the decreasing half moon on 13.05.1966 between the full moon on 04.05.1966 and the new moon on 20.05.1966.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the southeastern part of Germany have also been verified from Hof where hundreds of thousands of individuals have flown on 29.07.1908 (BLAHA 1908) which has been one day after the new moon on 28.07.1908, from Kulmbach southwest of Hof where abundant individuals have flown on 26.07.1777 (KAPP 1777) which has been five days after the full moon on 21.07.1777, from Meußelsdorf west of Marktredwitz southsoutheast of Hof where millions of individuals have flown on 28.07.1906 (METZGER 1906) which has been one day before the increasing half moon on 29.07.1906 between the new moon on 21.07.1906 and the full moon on 04.08.1906, from Bamberg where hundreds of thousands of individuals have flown on 27.07.1908 – 30.07.1908 (GRUND 1908) which has been around the new moon on 28.07.1908, from Kleinmeinfeld and Achtel southeast of Hartenstein westnorthwest of Sulzbach-Rosenberg where thousands of individuals have flown on 30.07.1967 (H. KRUMPHOLZ in EITSCHBERGER in HARZ 1968a) which has been on the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, from the Purtscheller Haus near Berchtesgaden where abundant individuals have flown on 07.08.1973 (EITSCHBERGER & STEINIGER 1974a) which has been one day after the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, from Schliersee southwest of Rosenheim where abt. 40 individuals have flown on 01.08.1969 (EITSCHBERGER 1970a) which has been three days after the full moon on 29.07.1969, from Nannhofen and Oberschweinbach northnorthwest of Fürstenfeldbruck southeast of Augsburg where more than 20 individuals have flown on 27.07.1969 (EITSCHBERGER 1970a) which has been two days before the full moon on 29.07.1969; from Penzing northeast of Landsberg am Lech where abt. 10 individuals and abt. 15 individuals have flown on 26.07.1969 and 09.08.1969, respectively (EITSCHBERGER 1970a), which has been three days before the full moon on 29.07.1969 and four days before the new moon on 13.08.1969, respectively; and also from Kaufbeuren and Irsee northwest of Kaufbeuren northeast of Kempten where abundant individuals each have flown on 26.05.1974 and 02.06.1974, respectively (EITSCHBERGER & STEINIGER 1975a), which has been five days after the new moon on 21.05.1974 and three days before the full moon on 05.06.1974, respectively.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the northeastern part of Germany have also been mentioned from Berlin where masses of individuals and abt. 400 individuals have flown on 03.08.1923 (SCHUSTER 1924) and in the mid of July 1961 (KLEMSTEIN in KOCH, ALBERTI & HANNEMANN 1962), respectively, which has been two days before the decreasing half moon on 05.08.1923 between the full moon on 27.07.1923 and the new moon on 12.08.1923, and around the new moon on 12.07.1961, respectively; from Berlin-Wilhelmsruh where abt. 150 individuals have flown on 21.08.1962 (KATZWINKEL in HARZ & WITTSTADT 1964) which has been two days before the decreasing half moon on 23.08.1962 between the full moon on 15.08.1962 and the new moon on 30.08.1962; from Strausberg eastnortheast of Berlin and the Werbellinsee northwest

of Eberswalde northnortheast of Berlin where abt. 300 individuals (Reischock in Koch, Alberti & Hannemann 1962) and several hundreds of individuals daily (Richert in Koch, Alberti & Hannemann 1962), respectively, have flown at the beginning of August 1961 which has been around and between the full moon on 27.07.1961 and the new moon on 11.08.1961; from the vicinity of Grünau and Schönefeld southsoutheast of Berlin where several thousands of individuals have flown on 21.08.1962 (Haeger in Harz & Wittstadt 1964) which has been two days before the decreasing half moon on 23.08.1962 between the full moon on 15.08.1962 and the new moon on 30.08.1962, from Nowawes near Potsdam where masses of individuals have flown at the beginning of August 1927 (Meissner 1927) which has been around and between the new moon on 28.07.1927 and the full moon on 13.08.1927, from Neuruppin northwest of Berlin where abundant individuals have flown on 26.07.1958 (Steil in Koch 1959) which has been four days before the full moon on 30.07.1958, from Havelberg in the Elbe valley eastsoutheast of Wittenberge where abundant individuals have flown on 15.07.1961 (Ursula Weise in Koch, Alberti & Hannemann 1962) which has been three days after the new moon on 12.07.1961, from Seehausen south of Prenzlau and Osterburg northnorthwest of Stendal where up to several thousands of individuals each have flown on 08.07.1959 (Hoffmann in Koch 1960) which has been two days after the new moon on 06.07.1959, from the Brocken southwest of Wernigerode where abundant individuals have flown on 04.08.1937 (Wenzel 1937a, 1937b) which has been two days before the new moon on 06.08.1937, from Arnstadt southsouthwest of Erfurt where masses of individuals have flown on 23.07.1928 – 25.07.1928 (Bergmann 1931) which has been on and a few days before the increasing half moon on 25.07.1928 between the new moon on 17.07.1928 and the full moon on 01.08.1928, from Weimar east of Erfurt where masses of individuals have flown on 28.07.1931 (Jaubitzer in Seitz 1931) which has been one day before the full moon on 29.07.1931; from Apolda in the Ilm valley northnorthwest of Jena in the Saale valley where abt. 200 individuals and 10 individuals have flown on 19.07.2006 (H. Schnöde in Hensle 2007a) and 10.06.2008 (H. Schnöde in Hensle 2009a), respectively, which has been two days after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, and on the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.06.2008, respectively; from Paulinzella eastnortheast of Ilmenau in the Ilm valley where numerous individuals have flown on 18.06.1957 (Wunder in Koch, Warnecke & Wittstadt 1958) which has been three days before the decreasing half moon on 21.06.1957 between the full moon on 12.06.1957 and the new moon on 27.06.1957; from Halle in the Saale valley as well as from Bennstedt, Benchlitz and Passendorf in the vicinity of Halle in the Saale valley where millions of individuals have flown on 05.08.1927 (Bandermann 1927a, 1927b) as well as at the end of July 1937 and at the beginning of August 1937 (Bandermann 1937, Franz Bandermann in Wenzel 1937a) which has been one day before the increasing half moon on 06.08.1927 between the new moon on 28.07.1927 and the full moon on 13.08.1927, and around and between the full moon on 23.07.1937 and the new moon on 06.08.1937, respectively; from Blankenstein in the Saale valley southeast of Lobenstein where several hundreds of individuals have flown on 01.08.1961 (Link in Koch, Alberti & Hannemann 1962) which has been four days after the full moon on 27.07.1961, from Köthen westsouthwest of Dessau where 10 individuals have flown on 13.05.2008 (M. Basler in Hensle 2009a) which has been one day after the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008; from the region south of the line connecting Dresden, Zeitz and Erfurt where millions of individuals in total have flown in the period of 05.08.1956 – 22.08.1956 (Koch, Warnecke, Wittstadt & Mazzucco 1958) which has been around and between the new moon on 06.08.1956 and the full moon on 21.08.1956; from the valleys of Danube, Inn, Isar, Salzach and Enns as well as adjacent regions in Germany and Austria where millions of individuals in total have flown on 05.08.1956 – 08.08.1956 (Koch, Warnecke, Wittstadt & Mazzucco 1958) which has been around the new moon on 06.08.1956; from Königsbrück northnortheast of Dresden in the Elbe valley where several thousands of individuals have flown on 15.07.1958 – 16.07.1958 (Techritz in Koch 1959; Techritz in Koch, Warnecke, Wittstadt & Mazzucco 1959; Techritz in Warnecke, Wittstadt, Koch & Mazzuc-

CO 1959) which has been one day before and on the new moon on 16.07.1958, from Altstadt west-southwest of Stolpen northnortheast of Pirna in the Elbe valley where many thousands of individuals have flown on 30.07.1900 (GRUND 1900) which has been four days after the new moon on 26.07.1900, from Zeitz in the Weiße Elster valley northnortheast of Gera where 50 individuals have flown on 11.09.2008 (GERD LINTZMEYER in HENSLE 2009a) which has been four days before the full moon on 15.09.2008, from Rehefeld-Zaunhaus southwest of Altenberg where abundant individuals have flown on 05.08.1958 – 08.08.1958 (SKELL in KOCH 1959) which has been on and a few days before the decreasing half moon on 08.08.1958 between the full moon on 30.07.1958 and the new moon on 15.08.1958, from Chemnitz where masses of individuals have flown on 29.07.1908 – 30.07.1908 (ANSCHÜTZ 1909) which has been one and two days after the new moon on 28.07.1908, from Rosenhain northeast of Löbau westsouthwest of Görlitz where abundant individuals have flown in the period of 21.09.1971 – 07.10.1971 (EITSCHBERGER 1972) which has been around and between the new moon on 19.09.1971 and the full moon on 07.10.1971, from Satzung eastsoutheast of Annaberg-Buchholz where several hundreds of individuals daily have flown on 14.08.1991 – 16.08.1991 (SAEMANN 1992) which has been several days after the new moon on 10.08.1991, from Frankenau west of Mittweida north of Chemnitz where 50 individuals have flown on 17.07.2008 (HENSLE 2009a) which has been one day before the full moon on 18.07.2008, and from Oelsnitz and Bad Elster southsoutheast of Plauen as well as other localities in their vicinity where hundreds of thousands of individuals have flown on 27.07.1908 – 30.07.1908 (BLAHA 1908, GRUND 1908) which has been around the new moon on 28.07.1908.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the western part of Austria have been documented from Salzburg in the Salzach valley where abundant individuals have flown on 01.09.1962 (MAZZUCCO in HARZ & WITTSTADT 1964) which has been one day after the new moon on 31.07.1962, from Bad Hofgastein southeast of Zell am See where masses of individuals have flown on 13.08.1925 (W.J. PENDLEBURY in ANDREWES 1929) which has been one day after the decreasing half moon on 12.08.1925 between the full moon on 04.08.1925 and the new moon on 19.08.1925, from Sankt Leonhard im Pitztal southsoutheast of Imst where masses of individuals have flown on 23.07.1928 – 25.07.1928 (BERGMANN 1931) which has been on and a few days before the increasing half moon on 25.07.1928 between the new moon on 17.07.1928 and the full moon on 01.08.1928, from Mayrhofen in the Ziller valley eastsoutheast of Innsbruck where numerous individuals have flown on 03.09.1973 (SCHONMANN in EITSCHBERGER & STEINIGER 1974a) which has been two days before the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, from the Ötz valley between Sautens and Sölden southwest of Innsbruck where masses of individuals have flown on 20.07.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been two days before the full moon on 22.07.1967, from Leopoldsberg east-northeast of Sankt Marienkirchen an der Polsenz northnorthwest of Wels where 20 individuals have flown on 31.07.1968 (ULF EITSCHBERGER in HARZ 1969) which has been two days before the increasing half moon on 02.08.1968 between the new moon on 25.07.1968 and the full moon on 08.08.1968, from Vöcklabruck southwest of Wels where masses of individuals have flown on 23.07.1937 (FOLTIN 1938) which has been on the full moon on 23.07.1937, from Kefermarkt northeast of Neumarkt am Mühlkreis northeast of Linz where masses of individuals have flown on 15.07.1937 (FOLTIN 1938) which has been one day before the increasing half moon on 16.07.1937 between the new moon on 08.07.1937 and the full moon on 23.07.1937, from the Großglockner southeast of Mittersill southsoutheast of Kitzbühel where hundreds of individuals have flown on 24.07.1994 (EITSCHBERGER & STEINIGER 1996a) which has been two days after the full moon on 22.07.1994, from Freistadt where abt. 15 individuals have flown on 18.09.1969 (EITSCHBERGER 1970a) which has been two days before the increasing half moon on 20.09.1969 between the new moon on 11.09.1969 and the full moon on 25.09.1969, and from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where masses of individuals have flown on 28.08.1969 (MAZZUCCO 1974) which has been one day after the full moon on 27.08.1969.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in the eastern part of Austria and in Switzerland have been notified from Krieglach in the Mürz valley northeast of Leoben in the eastern part of Austria where masses of individuals have flown from 30.07.1908 onwards (HOFFMANN 1908) which has been two days after the new moon on 28.07.1908, from the Mur valley between Knittelfeld and Murau southwest to westsouthwest of Leoben as well as the Gurk valley between Weitensfeld and Althofen northnorthwest to northnortheast of Klagenfurt where masses of individuals have flown on 17.07.1958 (BÖHM in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959) which has been one day after the new moon on 16.07.1958, from the vicinity of Samoarsee and Niedertal southwest of Obergurgl northwest of Merano in the eastern part of Austria where hundreds or even thousands of individuals have flown on 27.07.1962 (HAYEK in HARZ & WITTSTADT 1964) which has been four days before the new moon on 31.07.1962, from Göttlesbrunn northwest of Bruck an der Leitha eastsoutheast of Vienna in the eastern part of Austria where abt. 100 individuals have flown on 02.07.2006 (HENSLE 2007a) which has been one day before the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, from Siegendorf south of Eisenstadt east of Wiener Neustadt in the eastern part of Austria where abt. 50 individuals have flown on 25.06.2008 (A. WOLF in HENSLE 2009a) which has been one day before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, from the region around Lake Geneva in the southwestern part of Switzerland where masses of individuals have flown on 18.07.1917 – 24.07.1917 and 28.07.1917 – 03.08.1917 (PICTET 1918a, 1918b) which has been around and between the new moon on 19.07.1917 and the full moon on 03.08.1917, and from Uster eastsoutheast of Zürich in the northeastern part of Switzerland where very abundant individuals, 30 individuals and abundant individuals have flown in the period of 12.08.1967 – 03.09.1967 (ULF EITSCHBERGER in HARZ 1968a), on 27.08.1968 (ULF EITSCHBERGER in HARZ 1969) and in the period of 30.07.1969 – 16.08.1969 (EITSCHBERGER 1970a), respectively, which has been around and between the increasing half moon on 13.08.1967 between the new moon on 06.08.1967 and the full moon on 20.08.1967 as well as the new moon on 04.09.1967, around and between the full moon on 29.07.1969 and the new moon on 13.08.1969, and three days after the new moon on 24.08.1968, respectively.

Mass flights of large quantities of individuals of the Large White *Pieris brassicae* in France have also been quoted from Lorient northwest of Saint-Nazaire in the northwestern part of France where abundant individuals have flown on 26.07.1975 – 29.07.1975 (EITSCHBERGER & STEINIGER 1976) which has been around and between the full moon on 23.07.1975 as well as the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, from Cuigy-en-Bray west of Beauvais north of Paris in the northwestern part of France where masses of individuals have flown on 25.07.1834 (LEFEBVRE in HAGEN 1861) which has been five days after the full moon on 20.07.1834, from La Rochelle northnorthwest of Bordeaux in the southwestern part of France where thousands of individuals have flown on 29.06.1964 (EITSCHBERGER 1972) which has been four days after the full moon on 25.06.1964, and from Saint-Cannat north of Marseille in the southeastern part of France where abundant individuals have flown on 05.04.2003 (R. ÖHRLEIN in EITSCHBERGER & STEINIGER 2004a) which has been four days after the new moon on 01.04.2003.

Various examples of mass flights of the Large White *Pieris brassicae* from the older literature are compiled and quoted in WILLIAMS (1930, 1939) and WILLIAMS, COCKBILL, GIBBS & DOWNES (1942).

5.43 The Small White *Pieris rapae*

Mass flights of large quantities of individuals of the Small White *Pieris rapae* LINNAEUS 1758 (Lepidoptera: Pieridae) at the coast of the Baltic Sea in the northeastern part of Germany have been documented from Dranske in the northern part of the island Rügen where abt. 45 individuals, more than

20 individuals and more than 80 individuals have flown on 13.07.1999, 14.07.1999 and 18.08.1999, respectively (EITSCHBERGER & STEINIGER 2000b), as well as abt. 95 individuals have flown on 08.07.2001 (EITSCHBERGER & STEINIGER 2002a) which has been on and one day after the new moon on 13.07.1999, two days before the increasing half moon on 20.08.1999 between the new moon on 11.08.1999 and the full moon on 26.08.1999, and three days after the full moon on 05.07.2001, respectively; from the Buger Hals in the northern part of the island Rügen where abt. 20 individuals have flown on 18.07.1999 (EITSCHBERGER & STEINIGER 2000b) and more than 30 individuals have flown on 28.07.2002 (EITSCHBERGER & STEINIGER 2003a) which has been three days before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999 as well as four days after the full moon on 24.07.2002, respectively; from Altenkirchen and Nonnevitz westnorthwest of Altenkirchen in the northern part of the island Rügen where abt. 30 individuals and abt. 20 individuals, respectively, have flown on 08.07.2002 (EITSCHBERGER & STEINIGER 2003a) which has been two days before the new moon on 10.07.2002; from Wittow west of Altenkirchen in the northern part of the island Rügen where more than 15 individuals and more than 20 individuals have flown on 23.09.2000 (EITSCHBERGER & STEINIGER 2001) and 08.09.2002 (EITSCHBERGER & STEINIGER 2003a), respectively, which has been one day after the decreasing half moon on 22.09.2000 between the full moon on 13.09.2000 and the new moon on 27.09.2000, and one day after the new moon on 07.09.2002, respectively; from Göhren southsoutheast of Binz in the southeastern part of the island Rügen where abt. 50 individuals have flown on 21.06.2000 (EITSCHBERGER & STEINIGER 2001) which has been four days after the full moon on 17.06.2000, from Wustrow on the Darß north of Ribnitz-Damgarten where abt. 20 individuals have flown on 13.07.1994 (EITSCHBERGER & STEINIGER 1996a) which has been four days after the new moon on 09.07.1994, from Prerow on the Darß north of Ribnitz-Damgarten where more than 350 individuals have been counted on 20.08.2002 (EITSCHBERGER & STEINIGER 2003a) which has been one day before the full moon on 21.08.2002, from Tutow southsouthwest of Greifswald where abt. 440 individuals have flown on 07.09.2007 (HENSLE 2008a) which has been four days before the new moon on 11.09.2007, from Kummerow west of Greifswald where 40 individuals have flown on 21.08.1994 (RUDNICK 1996a) which has been on the full moon on 21.08.1994, from the island Usedom eastsoutheast of Wolgast eastsoutheast of Greifswald where masses of individuals have flown from 10.07.1937 onwards (ERNST URBAHN in WENZEL 1937a) which has been two days after the new moon on 08.07.1937, from Owschlag northnorthwest of Rendsburg in the northwestern part of Germany where masses of individuals have flown on 02.08.1969 – 03.08.1969 (EITSCHBERGER 1970a) which has been four and five days after the full moon on 29.07.1969, and from Gedser at the southern tip of the island Falster in the southeastern part of Denmark where abt. 100 individuals have flown on 23.07.1994 (RUDNICK 1996a) which has been one day after the full moon on 22.07.1994.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* at the coast of the North Sea in the northwestern part of Germany have been mentioned from List and Königshafen on the island Sylt westnorthwest of Flensburg where abt. 200 individuals and abt. 100 individuals, respectively, have flown on 07.08.1975 (EITSCHBERGER & STEINIGER 1976a) which has been on the new moon on 07.08.1975; from the island Helgoland northnorthwest of Bremerhaven where abt. 20 individuals, abt. 30 individuals and abt. 100 individuals have flown on 27.06.1972 (EITSCHBERGER 1973a), 05.09.1973 – 07.09.1973 (EITSCHBERGER & STEINIGER 1974a) and 21.05.2005 – 22.05.2005 (JÜRGEN RODELAND in HENSLE 2006a), respectively, which has been one day after the full moon on 26.06.1972, on and a few days after the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, and one and two days before the full moon on 23.05.2005, respectively; from the Hallig Gröde northwest of Husum where abundant individuals have flown on 01.09.2001 (EITSCHBERGER & STEINIGER 2002a) as well as on 04.09.2002 and 10.09.2002 (EITSCHBERGER & STEINIGER 2003a) which has been two days before the full moon on 03.09.2001 as well as three days before and three days after the new moon on 07.09.2002, respectively; from Bremerhaven where thousands of individuals in total have flown on 28.08.1975 and

31.08.1975 (EITSCHBERGER & STEINIGER 1976a) which has been three days before and on the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975, respectively; and from Inverness in the northeastern part of Scotland where abundant individuals have flown in the period of abt. 25.08.1887 – 30.08.1887 (CLARKE 1887) which has been around and between the new moon on 19.08.1887 and the full moon on 02.09.1887.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the northwestern part of Germany have also been reported from Sieversdorf northnorthwest of Eutin northnorthwest of Lübeck where 20 individuals have flown on 01.05.2005 (HENSLE 2006a) which has been on the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005, from Bleckede in the Elbe valley eastnortheast of Lüneburg where 30 individuals have flown on 29.07.2006 (H. MÜLLER-SCHERZ in HENSLE 2007a) which has been five days after the new moon on 24.07.2006, from Garstedt westnorthwest of Lüneburg where more than 20 individuals have flown on 16.05.1981 (EITSCHBERGER & STEINIGER 1983) which has been two days before the full moon on 18.05.1981, from Jöllenbeck north of Bielefeld where abt. 300 individuals have flown on 10.09.1991 (EITSCHBERGER & STEINIGER 1992c, RETZLAFF 1992) which has been two days after the new moon on 08.09.1991; from Schloß Holte southsoutheast of Bielefeld where more than 15 individuals and abt. 30 individuals have flown on 12.08.1972 (EITSCHBERGER 1973a) and 02.09.1991 (EITSCHBERGER & STEINIGER 1992c, RETZLAFF 1992), respectively, which has been three days after the new moon on 09.08.1972, and on the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, respectively; from Augustdorf southeast of Bielefeld where abt. 300 individuals and abt. 600 individuals have flown on 01.09.1991 and 14.09.1991, respectively (EITSCHBERGER & STEINIGER 1992c, RETZLAFF 1992), which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991, respectively; from Lage eastsoutheast of Bielefeld where abt. 120 individuals, more than 50 individuals in total and abt. 15 individuals have flown on 29.07.2002 (EITSCHBERGER & STEINIGER 2003a), 18.08.2005 and 29.08.2005 (HENSLE 2006a) and 01.09.2007 (HENSLE 2008a), respectively, which has been five days after the full moon on 24.07.2002, one day before the full moon on 19.08.2005, three days after the decreasing half moon on 26.08.2005 between the full moon on 19.08.2005 and the new moon on 03.09.2005, and four days after the full moon on 28.08.2007, respectively; from Heessen north of Hamm where masses of individuals have flown on 17.05.1964 (HARZ 1965c) which has been two days before the increasing half moon on 19.05.1964 between the new moon on 11.05.1964 and the full moon on 26.05.1964; from Elten northwest of Emmerich in the Lower Rhine valley where abt. 25 individuals and more than 40 individuals have flown in the periods of 05.09.1969 – 14.09.1969 (EITSCHBERGER 1970a) and 27.07.1970 – 09.08.1970 (EITSCHBERGER 1971a), respectively, which has been around and between the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and the new moon on 11.09.1969 as well as the new moon on 11.09.1969, and around and between the decreasing half moon on 26.07.1970 between the full moon on 18.07.1970 and the new moon on 02.08.1970 as well as the increasing half moon on 11.08.1970 between the new moon on 02.08.1970 and the full moon on 17.08.1970, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where 15 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, from the Witte Venn near Alstätte westnorthwest of Ahaus where 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 22.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the full moon on 22.07.1994, from Bad Hönningen in the Middle Rhine valley northnorthwest of Neuwied where abt. 100 individuals have flown on 09.09.1991

(EITSCHBERGER & STEINIGER 1992c) which has been one day after the new moon on 08.09.1991; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals, 15 individuals, 10 individuals, 20 individuals, 15 individuals, 10 individuals and 40 individuals have flown on 10.07.1992, 18.07.1992, 04.08.1993, 30.06.1994, 06.07.1994, 11.07.1994 and 24.07.1994, respectively (BROSZKUS 1995), which has been four days before and four days after the full moon on 14.07.1992, two days after the full moon on 02.08.1993, two days before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, three days before and two days after the new moon on 09.07.1994, and two days after the full moon on 22.07.1994, respectively.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the central part of Germany have been documented from Rüsselsheim east of Mainz where abundant individuals have flown on 06.08.1975 (EITSCHBERGER & STEINIGER 1976) which has been one day before the new moon on 07.08.1975, from Randersacker in the Main valley southeast of Würzburg where numerous individuals have flown on 14.07.1971 (EITSCHBERGER 1972) which has been two days before the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971; and from Schweinfurt in the Main valley northeast of Würzburg where abt. 30 individuals, abt. 20 individuals and abt. 100 individuals have flown on 06.06.1970 – 14.06.1970 (EITSCHBERGER 1971a), on 20.05.1971 and 04.09.1971 (EITSCHBERGER 1972) as well as on 11.08.1973 (EITSCHBERGER & STEINIGER 1974a), respectively, which has been around and between the new moon on 04.06.1970 as well as the increasing half moon on 13.06.1970 between the new moon on 04.06.1970 and the full moon on 19.06.1970, two days after the decreasing half moon on 18.05.1971 between the full moon on 10.05.1971 and the new moon on 24.05.1971, one day before the full moon on 05.09.1971, and three days before the full moon on 14.08.1973, respectively.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the southwestern part of Germany have been mentioned from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 30 individuals each and 15 individuals have flown on 09.04.1993, 08.05.1993, 04.07.1993 and 24.04.1994, respectively (S. JOUAUX in BROSZKUS 1995), which has been three days after the full moon on 06.04.1993, two days after the full moon on 06.05.1993, on the full moon on 04.07.1993 and one day before the full moon on 25.04.1994, respectively; from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals have flown on 02.07.1994 (S. JOUAUX in BROSZKUS 1995) which has been one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, from Pirmasens southsouthwest of Kaiserslautern in the Palatinate Forest where abt. 50 individuals in total have flown in the period of 15.08.1970 – 25.08.1970 (EITSCHBERGER 1971a) which has been around and between the full moon on 17.08.1970 as well as the decreasing half moon on 24.08.1970 between the full moon on 17.08.1970 and the new moon on 01.09.1970, from Dieburg eastnortheast of Darmstadt where abundant individuals have flown on 10.07.1966 – 13.07.1966 (KÖLLNER 1968) which has been several days before and after the decreasing half moon on 11.07.1966 between the full moon on 02.07.1966 and the new moon on 18.07.1966, from Edingen northwest of Heidelberg in the Neckar valley where abt. 20 individuals have flown on 05.10.1989 (EITSCHBERGER & STEINIGER 1990a) which has been three days before the increasing half moon on 08.10.1989 between the new moon on 30.09.1989 and the full moon on 14.10.1989, from Leimen-St. Ilgen south of Heidelberg in the middle part of the Upper Rhine valley where 70 individuals have flown on 11.09.2008 (HENSLE 2009a) which has been four days before the full moon on 15.09.2008; from Guttenbach south of Neckargerach in the Neckar valley northnorthwest of Mosbach east of Heidelberg where hundreds of individuals have flown on 28.07.1964 (HARZ 1965c) and very abundant individuals have flown on 01.09.1965 – 08.09.1965 (HARBICH 1967) which has been four days after the full moon on 24.07.1964 as well as several days before and after the increasing half moon on 03.09.1965 between the new moon on 26.08.1965 and the full moon on 11.09.1965, respectively;

from Mosbach in the Neckar valley east of Heidelberg where hundreds of individuals, abt. 150 individuals, abt. 25 individuals and abt. 35 individuals have flown on 14.07.1969 (EITSCHBERGER 1970a) as well as on 26.05.1988, 27.05.1988 and 30.05.1988 (EITSCHBERGER & STEINIGER 1990b), respectively, which has been on the new moon on 14.07.1969 as well as several days before the full moon on 31.05.1988, respectively; from Heilbronn in the Neckar valley where numerous individuals have flown on 19.06.1967 – 24.06.1967 (ULF EITSCHBERGER in HARZ 1968a) which has been around the full moon on 22.06.1967, from Muggensturm east of Rastatt in the middle part of the Upper Rhine valley where abt. 5.000 individuals have been observed on 21.07.2005 (HENSLE 2006a) which has been on the full moon on 21.07.2005, from Kehl northwest of Offenburg in the southern part of the Upper Rhine valley where 25 individuals have flown on 05.09.2006 (INGO NIKUSCH in HENSLE 2007a) which has been two days before the full moon on 07.09.2006, from Ihringen westnorthwest of Freiburg in the southern part of the Upper Rhine valley where abt. 20 individuals have flown on 11.03.2007 (J. HURST in HENSLE 2008a) which has been one day before the decreasing half moon on 12.03.2007 between the full moon on 04.03.2007 and the new moon on 19.03.2007; from Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley where more than 20 individuals, 25 individuals and abt. 40 individuals have flown on 06.05.2007 (HENSLE 2008a) as well as on 02.08.2008 and 11.09.2008 (HENSLE 2009a), respectively, which has been four days after the full moon on 02.05.2007, one day after the new moon on 01.08.2008 and four days before the full moon on 15.09.2008, respectively; from the southern margin of the Schluchsee south of Titisee-Neustadt in the southern part of the Black Forest where abt. 60 individuals in total have flown on 13.07.1978 – 14.07.1978 (EITSCHBERGER & STEINIGER 1979) which has been on and one day before the increasing half moon on 14.07.1978 between the new moon on 05.07.1978 and the full moon on 20.07.1978, from Schwenningen where abt. 35 individuals in total have flown on 24.08.1972 – 31.08.1972 (EITSCHBERGER 1973a) which has been around and between the full moon on 24.08.1972 as well as the decreasing half moon on 01.09.1972 between the full moon on 24.08.1972 and the new moon on 07.09.1972, from Friedrichshafen at Lake Constance where more than 50 individuals in total have flown on 27.09.1979 – 01.10.1979 (EITSCHBERGER & STEINIGER 1981a) which has been around the increasing half moon on 30.09.1979 between the new moon on 21.09.1979 and the full moon on 05.10.1979, from Bittenbrunn west of Neuburg in the Danube valley where abundant individuals have flown on 10.08.1966 (KÖLLNER 1968) which has been on the decreasing half moon on 10.08.1966 between the full moon on 01.08.1966 and the new moon on 16.08.1966, from Donaueschingen in the Danube valley south of Villingen-Schwenningen where abt. 60 individuals in total have flown on 31.07.1973 – 01.08.1973 (EITSCHBERGER & STEINIGER 1974a) which has been two and three days after the new moon on 29.07.1973; and from Geisingen in the Danube valley southwest of Tuttlingen where abt. 45 individuals in total have flown on 21.07.1973 and 24.07.1973 (EITSCHBERGER & STEINIGER 1974a) which has been three days before and on the decreasing half moon on 24.07.1973 between the full moon on 15.07.1973 and the new moon on 29.07.1973, respectively.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the southeastern part of Germany have been confirmed from Marktleuthen north of Wunsiedel in the Fichtelgebirge south of Hof where abt. 30 individuals in total have flown on 14.10.2000 – 15.10.2000 (EITSCHBERGER & STEINIGER 2001) which has been one and two days after the full moon on 13.10.2000, from Bad Birnbach and Kößlarn south of Bad Birnbach in the Rott valley southwest of Passau where abundant individuals have flown on 08.07.2006 (GEORG STAHLBAUER in HENSLE 2007a) which has been three days before the full moon on 11.07.2006, from Schliersee southwest of Rosenheim where more than 30 individuals have flown on 01.08.1969 (EITSCHBERGER 1970a) which has been two days after the full moon on 29.07.1969, from Landsberg in the Lech valley where more than 25 individuals have flown on 30.08.1969 (EITSCHBERGER 1970a) which has been three days after the full moon on 27.08.1969; from Penzing northeast of Landsberg am Lech where abt. 50 individuals each and abt. 25 individuals have flown on 26.07.1969, 09.08.1969 and 30.08.1969 (EITSCHBERGER 1970a), respectively, which has been three days before the full moon on 29.07.1969, four days

before the new moon on 13.08.1969 and three days after the full moon on 27.08.1969, respectively; from Augsburg in the Lech valley where abt. 50 individuals have flown on 27.05.1973 (EITSCHBERGER & STEINIGER 1974a) which has been five days before the new moon on 01.06.1973; from Fischen im Allgäu in the Iller valley south of Sonthofen where abt. 15 individuals, 30 individuals and more than 25 individuals in total have flown on 05.10.1969 (EITSCHBERGER 1970a), 29.06.1970 (EITSCHBERGER 1971a) and in the period of 20.09.1972 – 05.10.1972 (EITSCHBERGER 1973a), respectively, which has been one day after the decreasing half moon on 04.10.1969 between the full moon on 25.09.1969 and the new moon on 11.10.1969, two days after the decreasing half moon on 27.06.1970 between the full moon on 19.06.1970 and the new moon on 03.07.1970, and around and between the full moon on 23.09.1972 and the new moon on 07.10.1972, respectively; from the vicinity of Oberstdorf south of Sonthofen where more than 80 individuals in total have flown in the period of 20.09.1971 – 07.10.1971 (EITSCHBERGER 1972) which has been around and between the new moon on 19.09.1971 and the full moon on 04.10.1971; from the Nebelhorn east and eastnortheast of Oberstdorf south of Sonthofen where abt. 50 individuals and abt. 15 individuals have flown on 29.09.1969 and 09.10.1969 (EITSCHBERGER 1970a), respectively, which has been four days after the full moon on 25.09.1969 and two days before the new moon on 11.10.1969, respectively; and from Tiefenbach and Rohrmoos in the vicinity of Oberstdorf south of Sonthofen where abt. 50 individuals daily have flown on 07.10.1969 – 08.10.1969 (EITSCHBERGER 1970a) which has been three and four days before the new moon on 11.10.1969.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the northeastern part of Germany have also been registered from Sondershausen northeast of Mühlhausen where abt. 150 individuals have flown on 16.08.2002 (EITSCHBERGER & STEINIGER 2003a) which has been one day after the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, from Rädigke north of Lutherstadt Wittenberge in the Elbe valley where 20 individuals have flown on 27.05.2006 (HENSLE 2007a) which has been on the new moon on 27.05.2006, from Luckenwalde-Frankenfelde southsouthwest of Berlin where 20 individuals have flown on 19.05.2008 (HENSLE 2009a) which has been one day before the full moon on 20.05.2008, from Oranienburg north of Berlin where abt. 100 individuals have flown on 05.07.1959 (EISEN in KOCH 1960) which has been one day before the new moon on 06.07.1959, from the Döberitzer Heide near Döberitz northnorthwest of Brandenburg an der Havel where abt. 100 individuals have flown on 31.07.2008 (HENSLE 2009a) which has been one day before the new moon on 01.08.2008; from Eisenach where abundant individuals each have flown on 10.08.1958 – 11.08.1958 (BORNEMANN in KOCH 1959) and 09.07.1959 (BORNEMANN in KOCH 1960) which has been four to five days before the new moon on 15.08.1958 and three days after the new moon on 06.07.1959, respectively; from Kranichfeld southeast of Erfurt where masses of individuals have flown on 14.06.1988 (EITSCHBERGER & STEINIGER 1990b) which has been on the new moon on 14.06.1988, from Mockzig southsoutheast of Altenburg south of Leipzig where thousands of individuals have flown on 19.08.1995 – 22.08.1995 (EITSCHBERGER & STEINIGER 1996b) which has been on and three days after the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, from the railway line between Leipzig and Riesa in the Elbe valley northwest of Dresden where masses of individuals have flown on 20.07.1958 (KNORKE in KOCH 1959; KNORKE in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been four days after the new moon on 16.07.1958, and from Zeitz in the Weiße Elster valley northnortheast of Gera where 10 individuals have flown on 13.09.2007 (GERD LINTZMEYER in HENSLE 2008a) which has been two days after the new moon on 11.09.2007.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the western part of Austria have been reported from the vicinity of Obertraun and Hallstatt south of Bad Ischl eastsoutheast of Salzburg where tens of thousands of individuals have flown on 22.07.1917 – 26.07.1917 (STAUDER 1920) which has been several days after the new moon on 19.07.1917, from

the Tappenkarsee eastnortheast of Bad Hofgastein eastsoutheast of Zell am See where thousands of individuals have flown on 12.07.1976 (BURMANN & TARMANN 1979) which has been one day after the full moon on 11.07.1976, from the Sticklerhütte near Sankt Michael im Lungau where numerous individuals have flown on 25.08.1976 (BURMANN & TARMANN 1979) which has been on the new moon on 25.08.1976, from Völs west of Innsbruck in the Inn valley where abundant individuals have flown on 17.09.1975 – 24.09.1975 (BURMANN & TARMANN 1978) which has been around the full moon on 20.09.1975, from the Stillupp valley south of Mayrhofen in the Ziller valley southeast of Innsbruck where abt. 600 individuals have flown on 10.09.1969 (EITSCHBERGER 1970a) which has been one day before the new moon on 11.09.1969, from the Großglockner southeast of Mittersill southsoutheast of Kitzbühel where hundreds of individuals have flown on 24.07.1994 (EITSCHBERGER & STEINIGER 1996a) which has been two days after the full moon on 22.07.1994, from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 1.000 individuals have flown on 01.08.1967 (KARL CLEVE in EITSCHBERGER in HARZ 1968a) which has been two days after the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, from Freistadt where abt. 100 individuals have flown on 08.09.1969 (EITSCHBERGER 1970a) which has been three days before the new moon on 11.09.1969, and from Urfahr at the northern margin of the city of Linz in the Danube valley where 30 individuals have flown on 28.08.1975 (BURMANN & TARMANN 1978) which has been three days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in the eastern part of Austria and in Switzerland have been signaled from Vienna in the eastern part of Austria where 30 individuals have flown on 27.07.2008 (A. TIMAR in HENSLE 2009a) which has been two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008; from Rutzendorf in the Marchfeld eastsoutheast of Vienna in the eastern part of Austria where several thousands of individuals in total have flown on 29.06.1999 and 14.07.1999 (STRAKA 2000) which has been on the full moon on 29.06.1999 and one day before the new moon on 13.07.1999, respectively; from Donnerskirchen northeast of Eisenstadt southsoutheast of Vienna in the eastern part of Austria where 20 individuals have flown on 27.08.2007 (HENSLE 2008a) which has been one day before the full moon on 28.08.2007, from Hallau west of Schaffhausen in the northwestern part of Switzerland where 300 individuals have flown on 29.08.2008 (HENSLE 2009a) which has been one day before the new moon on 30.08.2008, from Spreitenbach westnorthwest of Zürich in the northeastern part of Switzerland where more than 15 individuals have flown on 11.08.2008 (VERENA SCHEIWILLER in HENSLE 2009a) which has been three days after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, and from the Marais des Monneaux near Chavannes-le-Veyron northnorthwest of Lausanne at Lake Geneva in the southwestern part of Switzerland where large quantities of individuals have sit on moist places of a dried pond on 02.07.1975 (CHERIX-VERREY & CHERIX-VERREY 1977) which has been on the decreasing half moon on 02.07.1975 between the full moon on 23.06.1975 and the new moon on 09.07.1975.

Mass flights of large quantities of individuals of the Small White *Pieris rapae* in Great Britain have been notified from Longbenton westnorthwest of Benton north of Newcastle-upon-Tyne in the northeastern part of England where masses of individuals have flown on 24.08.1869 – 28.08.1869 (BOLD 1869) which has been several days after the full moon on 22.08.1869; from the St. Bride´s Bay south of St. David´s and north of Martin´s Haven northnorthwest of Pembroke westnorthwest of Swansea in the southwestern part of England where abt. 50 individuals and abundant individuals have flown on 10.09.1959 and 11.09.1959, respectively (SAGE 1960), which has been on and one day after the increasing half moon on 10.09.1959 between the new moon on 03.09.1959 and the full moon on 17.09.1959, respectively; from Bere Regis westnorthwest of Wareham westnorthwest of Bournemouth in the southwestern part of England where abundant individuals have flown on

05.09.1928 – 08.09.1928 (ANDREWES 1929) which has been around the decreasing half moon on 07.09.1928 between the full moon on 31.08.1928 and the new moon on 14.09.1928, from Penzance west of Plymouth in the southwestern part of England where numerous individuals have flown in the period of 16.05.1933 – 26.05.1933 (ADKIN 1933) which has been around and between the decreasing half moon on 17.05.1933 between the full moon on 10.05.1933 and the new moon on 24.05.1933 as well as the new moon on 24.05.1933, from Broadwater near Worthing west of Brighton in the southeastern part of England where masses of individuals have flown at the beginning of August 1887 (ANDERSON 1887) which has been around the full moon on 03.08.1887.

Various examples of mass flights of the Small White *Pieris rapae* from the older literature are compiled and quoted in WILLIAMS (1930).

5.44 The Green-Veined White *Pieris napi*

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* LINNAEUS 1758 (Lepidoptera: Pieridae) in the southwestern part of Germany have been documented from the wet meadows of the Gottesheimer Ried northwest of Freiburg in the southern part of the Upper Rhine valley where thousands of males each have slowly flown around in the search for females on 20.08.1985 and 20.08.1986 (ERWIN RENNWALD in EBERT & RENNWALD 1991) which has been four days after the new moon on 16.08.1985 and one day after the full moon on 19.08.1986, respectively; from Vogtsburg-Oberbergen northwest of Freiburg in the southern part of the Upper Rhine valley where abundant individuals have flown on 22.06.1964 – 24.06.1964 (HARZ 1965c) which has been one to three days before the full moon on 25.06.1964; from Mosbach east of Heidelberg in the Neckar valley where masses of individuals have flown on 19.04.1968 (ULF EITSCHBERGER in HARZ 1969) as well as 50 individuals and 35 individuals have flown on 26.05.1988 and 30.05.1988, respectively (EITSCHBERGER & STEINIGER 1990b), which has been one day before the decreasing half moon on 20.04.1968 between the full moon on 13.08.1968 and the new moon on 27.04.1968, and one and five days before the full moon on 31.05.1988, respectively; from Reichenbuch eastsoutheast of Neckargerach in the Neckar valley northnorthwest of Mosbach where 30 individuals have flown on 09.07.1971 (EITSCHBERGER 1972) which has been one day after the full moon on 08.07.1971, from Ueberau eastsoutheast of Reinheim eastsoutheast of Darmstadt where more than 35 individuals in total have flown in the period of 18.09.1969 – 09.10.1969 (EITSCHBERGER 1970a) which has been around and between the increasing half moon on 20.09.1969 between the new moon on 11.09.1969 and the full moon on 25.09.1969 as well as the decreasing half moon on 04.10.1969 between the full moon on 25.09.1969 and the new moon on 11.10.1969, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals have flown on 09.04.1993 (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 06.04.1993, from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals have flown on 02.07.1994 (BROSZKUS 1995) which has been one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, from Nahbollenbach in the Nahe valley eastnortheast of Idar-Oberstein where 10 individuals have flown on 05.05.1993 (BROSZKUS 1995) which has been one day before the full moon on 06.05.1993, from Schweinfurt northnortheast of Würzburg in the Main valley in the central part of Germany where abt. 100 individuals and abt. 45 individuals in total have flown on 12.07.1970 (EITSCHBERGER 1971a) and in the period of 07.08.1972 – 15.08.1972 (EITSCHBERGER 1973a) which has been on the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970, and around the new moon on 09.08.1972, respectively; and from Randersacker in the Main valley southeast of Würzburg and Dornheim southeast of Iphofen southeast of Würzburg in the central part of Germany where more than 100 individuals each have flown on 14.07.1971 as well as on 15.07.1971 and 17.07.1971, respectively (EITSCHBERGER 1972), which has been two days

before as well as one day before and one day after, respectively, the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971.

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* in the northwestern part of Germany have also been registered from Bremerhaven at the coast of the North Sea where abt. 30 individuals in total have flown in the period of 05.07.1972 – 18.07.1972 (EITSCHBERGER 1973a) which has been around and between the decreasing half moon on 05.07.1972 between the full moon on 26.06.1972 and the new moon on 10.07.1972 as well as the increasing half moon on 19.07.1972 between the new moon on 10.07.1972 and the full moon on 26.07.1972, from the island Helgoland in the North Sea northnorthwest of Bremerhaven where abundant individuals have flown on 12.07.1969 – 19.07.1969 (EITSCHBERGER 1970a) which has been around the new moon on 14.07.1969; from Bleckede in the Elbe valley eastnortheast of Lüneburg where abt. 500 individuals, abt. 300 individuals and abt. 500 individuals have flown on 07.05.2006 (HENSLE 2007a), 24.06.2006 (HENSLE 2007a) and 26.04.2007 (HENSLE 2008a), respectively, which has been two days after the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006, one day before the new moon on 25.06.2006, and two days after the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, respectively; from Bleckede in the Elbe valley eastnortheast of Lüneburg where 20 individuals, 50 individuals and more than 600 individuals have flown on 24.05.2007 (HENSLE 2008a), 27.04.2008 (HENSLE 2009a) and 05.07.2008 (HENSLE 2009a), respectively, which has been one day after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, two days after the new moon on 03.07.2008, and one day before the decreasing half moon on 28.04.2008 between the full moon on 20.04.2008 and the new moon on 05.05.2008, respectively; from Hessisch Lichtenau southeast of Kassel where more than 60 individuals in total have flown in the period of 19.06.1976 – 30.06.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the decreasing half moon on 20.06.1976 between the full moon on 12.06.1976 and the new moon on 27.06.1976 as well as the new moon on 27.06.1976, from Warburg northwest of Kassel where more than 250 individuals have flown on 17.07.1971 (EITSCHBERGER 1972) which has been one day after the decreasing half moon on 16.07.1971 between the full moon on 08.07.1971 and the new moon on 22.07.1971, from Bielefeld where 25 individuals have flown on 01.08.1971 (EITSCHBERGER 1972) which has been one day after the increasing half moon on 31.07.1971 between the new moon on 22.07.1971 and the full moon on 06.08.1971; from Schloß Holte southsoutheast of Bielefeld where abt. 150 individuals and abt. 4.000 individuals have flown on 21.04.1968 (ULF EITSCHBERGER in HARZ 1969) and 26.07.1970 (EITSCHBERGER 1971a), respectively, which has been one day after the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968, and on the decreasing half moon on 26.07.1970 between the full moon on 18.07.1970 and the new moon on 02.08.1970, respectively; from Soltau where abt. 120 individuals in total have flown in the period of 04.07.1976 – 21.07.1976 (EITSCHBERGER & STEINIGER 1977a) which has been around and between the increasing half moon on 05.07.1976 between the new moon on 27.06.1976 and the full moon on 11.07.1976 as well as the decreasing half moon on 20.07.1976 between the full moon on 11.07.1976 and the new moon on 27.07.1976, from Elten northwest of Emmerich in the Lower Rhine valley where abt. 120 individuals in total have flown in the period of 17.04.1968 – 30.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been around and between the full moon on 13.04.1968 and the new moon on 27.04.1968, from the Witte Venn near Alstätte westnorthwest of Ahaus where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where abt. 40 individuals and 20 individuals have flown on 15.08.1981 and 13.07.1982, respectively (WALFORT 1983), which has been on the full moon on 15.08.1981 as well as two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, respectively; from the Paulinenhof in the district Stammheim at the northeastern margin of the city

of Cologne in the Middle Rhine valley where abt. 40 individuals have flown on 08.09.1975 – 09.09.1975 (EITSCHBERGER & STEINIGER 1976) which has been three to four days after the new moon on 05.09.1975, from the district Sürth at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 07.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, and from Bergisch Gladbach eastnortheast of Cologne in the Middle Rhine valley where abt. 25 individuals in total have flown on 17.04.1968 – 22.04.1968 (ULF EITSCHBERGER in HARZ 1969) which has been around the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968.

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* in the western part of Germany have been quoted from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 25 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, from the Königsbruch near Homburg eastnortheast of Saarbrücken in the southern part of the Saar area where hundreds of individuals have flown on 14.05.1967 (SCHMIDT-KOEHL 1977) which has been five days after the new moon on 09.05.1967; from Friedrichsthal northnortheast of Saarbrücken in the southern part of the Saar area where masses of individuals each have flown on 31.07.1965 and 30.08.1965 (E.L. BRAUN in SCHMIDT-KOEHL 1977) which has been three days after the new moon on 28.07.1965 and four days after the new moon on 26.08.1965, respectively; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 30 individuals have flown on 24.07.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been two days before the full moon on 26.07.1991; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück where abt. 10 individuals each have flown on 12.05.1992, 10.07.1992, 06.08.1992, 10.08.1993, 30.06.1994 and 06.07.1994 (BROSZKUS 1995) which has been four days before the full moon on 16.05.1992, four days before the full moon on 14.07.1992, on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, one day before the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and three days before the new moon on 09.07.1994, respectively.

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* in the northeastern part of Germany have also been recorded from Dierhagen westnorthwest of Ribnitz-Damgarten at the coast of the Baltic Sea where masses of individuals have flown on 09.07.1959 (HOFFMANN in KOCH 1960) which has been three days after the new moon on 06.07.1959, from Seehausen south of Prenzlau and Osterburg northnorthwest of Stendal where up to several thousands of individuals have flown on 08.07.1959 (HOFFMANN in KOCH 1960) which has been two days after the new moon on 06.07.1959, from Wöplitz east of Havelberg in the Elbe valley where abt. 20 individuals have flown on 04.04.1994 (EITSCHBERGER & STEINIGER 1996a) which has been one day after the decreasing half moon on 03.04.1994 between the full moon on 27.03.1994 and the new moon on 10.04.1994; from the Pfaueninsel in Berlin where 30 individuals and 80 individuals have flown on 22.04.1968 and 30.07.1968, respectively (ULF EITSCHBERGER in HARZ 1969), which has been two days after the decreasing half moon on 20.04.1968 between the full moon on 13.04.1968 and the new moon on 27.04.1968 as well as five days after the new moon on 25.07.1968, respectively; from Dallgow-Döberitz westnorthwest of Berlin where 100 individuals have flown on 31.07.2008 (HENSLE 2009a) which has been one day before the new moon on 01.08.2008, from Lindow westsouthwest of Eisenhüttenstadt eastsoutheast of Berlin where 100 individuals have flown on 26.06.2008 (HENSLE 2009a) which has been on the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008; from Bennstedt, Passendorf and Schlettau in the vicinity of Halle in the Saale valley where masses of individuals have flown on 11.08.1937 –

19.08.1937 (BANDERMANN 1937) which has been around and between the new moon on 06.08.1937 and the full moon on 21.08.1937; from Rosenhain northeast of Löbau westsouthwest of Görlitz where abundant individuals have flown on 03.07.1966 – 10.07.1966 (G. SCHOLZ in KÖLLNER 1968) which has been several days after the full moon on 02.07.1966 as well as several days before the decreasing half moon on 11.07.1966 between the full moon on 02.07.1966 and the new moon on 18.07.1966; and from Zeitz in the Weiße Elster valley northnortheast of Gera where abt. 10 individuals each have flown on 13.05.2007 (GERD LINTZMEYER in HENSLE 2008a) and 28.09.2008 (GERD LINTZMEYER in HENSLE 2009a) which has been three days before the new moon on 16.05.2007 and one day before the new moon on 29.09.2008, respectively.

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* in the southeastern part of Germany have been recognized from the region around and between Erlangen and Forchheim north of Nürnberg as well as the Fichtelgebirge in the region around Wunsiedel south of Hof where thousands of individuals have flown on 26.07.1979 – 31.07.1979 (EITSCHBERGER & STEINIGER 1981a) which has been around and between the new moon on 24.07.1979 and the increasing half moon on 02.08.1979 before the full moon on 08.08.1979, from Franken southeast of Weißenstadt and Marktleuthen in the Fichtelgebirge south of Hof where more than 150 individuals have flown on 08.05.1976 – 09.05.1976 (EITSCHBERGER & STEINIGER 1977a) which has been on and one day after the increasing half moon on 08.05.1976 between the new moon on 29.04.1976 and the full moon on 13.05.1976, from Neudes south of Marktleuthen in the Fichtelgebirge south of Hof where abt. 225 individuals have flown on 11.05.1976 – 12.05.1976 (EITSCHBERGER & STEINIGER 1977a) which has been one and two days before the full moon on 13.05.1976, from Vordorfer Mühle northnorthwest of Tröstau westsouthwest of Wunsiedel in the Fichtelgebirge south of Hof where abt. 150 individuals have flown on 15.05.1976 (EITSCHBERGER & STEINIGER 1977a) which has been two days after the full moon on 13.05.1976, from the Zengermoos near Schwaigermoos east of Attaching southeast of Freising where abt. 200 – 250 individuals have been encountered in an overgrown field on 06.09.1971 (EITSCHBERGER 1972) which has been one day after the full moon on 05.09.1971, from Gröbenzell westnorthwest of München in the Isar valley where abt. 600 individuals and from Kaufering north of Landsberg am Lech where 25 individuals have flown on 24.07.1971 (EITSCHBERGER 1972) which has been one day before the new moon on 25.07.1971; from Penzing northeast of Landsberg am Lech where abt. 60 individuals, abt. 150 individuals, abt. 70 individuals and abt. 40 individuals have flown on 30.07.1968 (ULF EITSCHBERGER in HARZ 1969) as well as on 26.07.1969, 09.08.1969 and 30.08.1969 (EITSCHBERGER 1970a), respectively, which has been five days after the new moon on 25.07.1968, three days before the full moon on 29.07.1969, four days before the new moon on 13.08.1969 and three days after the full moon on 27.08.1969, respectively; from Fischen im Allgäu in the Iller valley south of Sonthofen where abt. 100 individuals in total have flown in the period of 21.09.1969 – 10.10.1969 (EITSCHBERGER 1970a) which has been around and between the increasing half moon on 20.09.1969 between the new moon on 11.09.1969 and the full moon on 25.09.1969 as well as the new moon on 11.10.1969, and from Dörndorf northeast of Denkendorf north of Ingolstadt where abt. 100 individuals have flown on 02.05.1976 (EITSCHBERGER & STEINIGER 1977a) which has been three days after the new moon on 29.04.1976.

Mass flights of large quantities of individuals of the Green-Veined White *Pieris napi* in Austria, France and England have been realized from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where abt. 1.000 individuals have flown on 01.08.1967 (KARL CLEVE in EITSCHBERGER in HARZ 1968a) which has been two days after the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, from Freistadt in the western part of Austria where abt. 50 individuals have flown on 08.09.1969 (EITSCHBERGER 1970a) which has been three days before the new moon on 11.09.1969, from Wiener Neustadt south of Vienna in the eastern part of Austria where hundreds of individuals have flown on 11.07.1995 (EITSCHBERGER & STEINIGER 1996b) which has been one day before the full moon on

12.07.1995, from Hohenau in the March valley northeast of Vienna in the eastern part of Austria where 100 individuals have flown on 09.04.2007 (W. SCHWEIGHOFER in HENSLE 2008a) which has been one day before the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007, from Lorient northwest of Saint-Nazaire in the northwestern part of France where masses of individuals have flown on 26.07.1975 – 29.07.1975 (EITSCHBERGER & STEINIGER 1976) which has been around and between the full moon on 23.07.1975 as well as the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, from Bere Regis westnorthwest of Wareham westnorthwest of Bournemouth in the southwestern part of England where abundant individuals have flown on 05.09.1928 – 08.09.1928 (ANDREWES 1929) which has been around the decreasing half moon on 07.09.1928 between the full moon on 31.08.1928 and the new moon on 14.09.1928, and from Penzance west of Plymouth in the southwestern part of England where numerous individuals have flown in the period of 16.05.1933 – 26.05.1933 (ADKIN 1933) which has been around and between the decreasing half moon on 17.05.1933 between the full moon on 10.05.1933 and the new moon on 24.05.1933 as well as the new moon on 24.05.1933.

The peak distribution of the aestival generation of the Green-Veined White *Pieris napi* in Friedrichsthal north of Saarbrücken in the southern part of the Saar area in the western part of Germany, in Radwang southsoutheast of Dinkelsbühl in the Wörnitz valley in the southwestern part of Germany, in Gröbenzell westnorthwest of München in the Isar valley in the southeastern part of Germany, in Rosenhain northeast of Löbau westsouthwest of Görlitz in the northeastern part of Germany and in Budel northwest of Weert southeast of Eindhoven in the southeastern part of the Netherlands has been established at the end of July 1967 (ULF EITSCHBERGER in HARZ 1968a) which has been around the decreasing half moon on 30.07.1967 between the new moon on 21.07.1967 and the full moon on 06.08.1967.

5.45 The Bath White *Pontia daplidice*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have so far only discovered one single individual of the Bath White *Pontia daplidice* LINNAEUS 1758 (Lepidoptera: Pieridae)in a meadow at the highway B 294 in the vicinity of Bauschlott north of Pforzheim in the southwestern part of the Kraichgau in the southwestern part of Germany in August 2007. Apart from this single individual, I have up to now only seen occasionally a few single individuals of the Bath White *Pontia daplidice* on the island Rhodos in the southeastern part of Greece during a holiday with my parents in spring 1965 and on the island Teneriffa during a holiday with my parents in spring 1968. Some examples of mass occurrences of the Bath White *Pontia daplidice* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in the northeastern part of Germany have been documented from Altwarp east of Ueckermünde eastnortheast of Neubrandenburg where 20 individuals have flown on 27.07.1992 (EITSCHBERGER & STEINIGER 1994a) which has been two days before the new moon on 29.07.1992, from Peenemünde eastnortheast of Greifswald at the coast of the Baltic Sea where 15 individuals have flown on 24.07.1992 (EITSCHBERGER & STEINIGER 1994a) which has been one day after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992; from Ludwigslust south of Schwerin where 5 individuals, 20 individuals and more than 30 individuals have been observed on 24.07.1993 (EITSCHBERGER & STEINIGER 1995a), 29.07.1994 and 14.08.1994 (EITSCHBERGER & STEINIGER 1996a), respectively, which has been three days before the increasing half moon on 27.07.1993 between the new moon on 19.07.1993 and the full moon on 02.08.1993, two days before the decrea-

sing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, and one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, respectively; from the districts Pankow and Blankenfelde in the northern part of the city of Berlin where more than 300 individuals in total have been recorded in the period of 04.08.1992 – 30.08.1992 (EITSCHBERGER & STEINIGER 1994a) which has been around and between the new moon on 29.07.1992, the full moon on 13.08.1992 and the new moon on 28.08.1992; from Herzfelde northeast of Rüdersdorf and Woltersdorf southsouthwest of Rüdersdorf east of Berlin where abt. 15 individuals in total, 10 individuals in total and 5 individuals have flown on 06.08.1983 and 16.08.1983, 09.08.1983, and 12.08.1983, and 14.08.1983, respectively (EITSCHBERGER & STEINIGER 1985), which has been around and between the decreasing half moon on 03.08.1983 between the full moon on 24.07.1983 and the new moon on 08.08.1983 as well as the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983, respectively; from Neuhof south of Zossen south of Berlin where 8 individuals each and 15 individuals have flown on 29.04.1978, 29.07.1978 and 30.07.1978, respectively (EITSCHBERGER & STEINIGER 1979), which has been one day before the decreasing half moon on 30.04.1978 between the full moon on 23.04.1978 and the new moon on 07.05.1978, and two and three days after the decreasing half moon on 27.07.1978 between the full moon on 20.07.1978 and the new moon on 03.08.1978, respectively; from Rangsdorf south of Berlin where 6 individuals have flown on 10.07.1976 (EITSCHBERGER & STEINIGER 1977a) which has been one day before the full moon on 11.07.1976; from Dalchau near Arneburg northeast of Stendal where more than 10 individuals in total have flown on 22.06.1993 and 29.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the new moon on 20.06.1993 as well as two days after the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 03.07.1993, respectively; from the Klietzer Heide east and southeast of Klietz northwest of Brandenburg an der Havel where 6 individuals have flown on 24.08.1999 (EITSCHBERGER & STEINIGER 2000b) which has been two days before the full moon on 26.08.1999, from Garz northnorthwest of Brandenburg an der Havel where 13 individuals have flown on 12.09.1999 (EITSCHBERGER & STEINIGER 2000b) which has been two days after the new moon on 10.09.1999, from Schollene-Ferchels northwest of Rathenow northnorthwest of Brandenburg an der Havel where abt. 30 individuals have flown and have sucked on flowers on 31.07.1991 (EITSCHBERGER & STEINIGER 1992c) which has been five days after the full moon on 26.07.1991, and from the Döberitzer Heide around Döberitz northwest of Brandenburg an der Havel where 6 individuals have flown on 20.06.1992 (EITSCHBERGER & STEINIGER 1994a) which has been five days after the full moon on 15.06.1992.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in the northeastern part of Germany have also been signaled from Vogelsang northeast of Eisenhüttenstadt in the Oder valley and Gledeberg west of Salzwedel west of the Elbe valley where 10 – 15 individuals and 20 individuals have been observed on 16.08.1992 and 13.08.1992, respectively (EITSCHBERGER & STEINIGER 1994a), which has been three days after and on the full moon on 13.08.1992, respectively; from Wriezen in the Oder valley northeast of Berlin where more than 20 individuals have been encountered on 08.08.1998 (EITSCHBERGER & STEINIGER 2000a) which has been on the full moon on 08.08.1998, from Boizenburg in the Elbe valley eastnortheast of Lüneburg where numerous individuals have flown on 07.08.1992 (EITSCHBERGER & STEINIGER 1994a) which has been one day after the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, from Dömitz eastnortheast of Dannenberg in the Elbe valley where 6 individuals have flown on 05.08.1991 (EITSCHBERGER & STEINIGER 1992c) which has been one day after the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, from Schnackenburg westnorthwest of Wittenberge in the Elbe valley where 15 individuals have flown along the river on 29.07.1973 (EITSCHBERGER & STEINIGER 1974a) which has been on the new moon on 29.07.1973, from Gartow westnorthwest of Wittenberge in the Elbe valley where 10 individuals each have been registered on 06.08.1976 and 13.08.1976 (EITSCHBERGER & STEINIGER 1977a)

which has been four days before and three days after the full moon on 10.08.1976, respectively; from Lenzen westnorthwest of Wittenberge in the Elbe valley where abt. 25 individuals have flown on 15.06.1992 (EITSCHBERGER & STEINIGER 1994a) which has been on the full moon on 15.06.1992, from Havelberg southeast of Wittenberge in the Elbe valley where 15 individuals have been monitored on 24.07.1998 (EITSCHBERGER & STEINIGER 2000a) which has been one day before the new moon on 23.07.1998; from Havelberg southeast of Wittenberge in the Elbe valley and Rehberg southeast of Neubrandenburg where 10 individuals and 12 individuals, respectively, have been recorded on 30.08.1999 (EITSCHBERGER & STEINIGER 2000b) which has been four days after the full moon on 26.08.1999; from Wöplitz east of Havelberg southeast of Wittenberge in the Elbe valley where 10 individuals each have flown on 25.07.1993 and 16.08.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days before the increasing half moon on 27.07.1993 between the new moon on 19.07.1993 and the full moon on 02.08.1993, and one day before the new moon on 17.08.1993, respectively; from Schönfeld south of Havelberg southeast of Wittenberge in the Elbe valley where 5 individuals have flown on 21.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been one day after the new moon on 20.06.1993; from Magdeburg in the Elbe valley where 12 individuals and 11 individuals have been counted on 27.07.1992 and 28.07.1992, respectively (EITSCHBERGER & STEINIGER 1994a), which has been one and two days before the new moon on 29.07.1992, respectively; from Wolmirstedt north of Magdeburg in the Elbe valley where 8 individuals and 23 individuals have been noticed on 27.07.1992 and 28.07.1992, respectively (EITSCHBERGER & STEINIGER 1994a), which has been one and two days before the new moon on 29.07.1992, respectively; from Salzwedel south of the Elbe valley where abt. 30 individuals have been registered on 10.07.2001 (EITSCHBERGER & STEINIGER 2002a) which has been five days after the full moon on 05.07.2001, and from Klotzsche north of Dresden in the Elbe valley where 7 individuals have flown on 03.07.1983 (EITSCHBERGER & STEINIGER 1985) which has been one day before the decreasing half moon on 04.07.1983 between the full moon on 25.06.1983 and the new moon on 10.07.1983.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in the northeastern part of Germany have also been reported from Tautenburg eastsoutheast of Dornburg northnortheast of Jena in the Saale valley where 20 individuals have been detected on 14.08.1993 (JUNGMANN 1995, EITSCHBERGER & STEINIGER 1995a) which has been three days before the new moon on 17.08.1993, from Beichlingen northnortheast of Sömmerda northnorthwest of Weimar where abt. 15 individuals have been registered on 22.08.1993 (EITSCHBERGER & STEINIGER 1995a) which has been five days after the new moon on 17.08.1993, from Schmücke near Harras east of Hildburghausen where 6 individuals have flown on 08.08.1995 (EITSCHBERGER & STEINIGER 1996b) which has been two days before the full moon on 10.08.1995; from the district Heiterblick at the northeastern margin of the city of Leipzig where abt. 10 individuals in total each and abt. 20 individuals in total have flown on 05.08.1990 and 25.08.1990 (EITSCHBERGER & STEINIGER 1992a), in the period of 19.06.1993 – 04.07.1993, and on 03.08.1993 and 15.08.1993 (EITSCHBERGER & STEINIGER 1995a), respectively, which has been one day before the full moon on 06.08.1990, five days after the new moon on 20.08.1990, around and between the new moon on 20.06.1993 and the full moon on 04.06.1993, one day after the full moon on 02.08.1993 and two days before the new moon on 17.08.1993, respectively; from Altenburg south of Leipzig where abt. 100 individuals in total have been noticed in the period of 28.08.2003 – 15.09.2003 (EGON JUNGMANN in EITSCHBERGER & STEINIGER 2004a) which has been around and between the new moon on 27.08.2003 and the full moon on 10.09.2003; from Ramsdorf east of Lucka south of Leipzig where abt. 90 individuals in total have flown on 05.08.1995 and 11.08.1995 (EITSCHBERGER & STEINIGER 1996b) which has been on the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995 as well as one day after the full moon on 10.08.1995, respectively; from Thräna southsoutheast of Borna, Ramsdorf east of Lucka westsouthwest of Borna and Falkenhain southsouthwest of Lucka westsouthwest of Borna northnortheast of Altenburg south of Leipzig where 10 individuals each have flown on 30.04.1990, 27.07.1990, 21.06.1992, 20.07.1992, 25.07.1992 and

23.04.1993; 15 individuals each have flown on 03.08.1992 and 08.06.1993, and 40 individuals have flown on 23.07.1989 (JUNGMANN 1995) which has been five days after the new moon on 25.04.1990, five days after the new moon on 22.07.1990, three days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, three days before and two days after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, two days after the new moon on 21.04.1993, five days after the new moon on 29.07.1992, four days after the full moon on 04.06.1993, and three days before the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, respectively; from Oberrothenbach north of Zwickau in the Zwickauer Mulde valley where more than 5 individuals and abt. 10 individuals have been observed on 20.08.1993 (EITSCHBERGER & STEINIGER 1995a) and 22.08.1994 (EITSCHBERGER & STEINIGER 1996a), respectively, which has been three days after the new moon on 17.08.1993 and one day after the full moon on 21.08.1994, respectively; from Dennheritz north of Zwickau where more than 5 individuals have flown on 01.08.1995 (EITSCHBERGER & STEINIGER 1996b) which has been five days after the new moon on 27.07.1995, from Guttau northeast of Bautzen where 15 individuals have flown on 07.08.1983 – 11.08.1983 (EITSCHBERGER & STEINIGER 1985) which has been around the new moon on 08.08.1983, from Knappenrode eastsoutheast of Hoyerswerda where more than 50 individuals in total have flown on 17.06.1983 and 21.06.1983 (EITSCHBERGER & STEINIGER 1985) which has been one day before and three days after the increasing half moon on 18.06.1983 between the new moon on 11.06.1983 and the full moon on 25.06.1983, respectively; from Bernstadt auf dem Eigen north of Zittau southsouthwest of Görlitz where more than 200 individuals daily have been observed on 20.08.2003 – 26.08.2003 (M. LUDWIG in EITSCHBERGER & STEINIGER 2004a) which has been several days before the new moon on 27.08.2003; and from Sondershausen in the Wipper valley south of Nordhausen where abt. 120 individuals and abt. 60 individuals have been counted on 16.08.2002 and 17.08.2002, respectively (EITSCHBERGER & STEINIGER 2003a), which has been one and two days after the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, respectively.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in the northwestern part of Germany have been mentioned from Schattin southeast of Lübeck where 12 individuals have been counted on 18.06.2000 (EITSCHBERGER & STEINIGER 2001) which has been one day after the full moon on 17.06.2000, from Horsten southwest of Wilhelmshaven where at least 12 individuals have flown on 28.06.1992 (RETTIG in EITSCHBERGER & STEINIGER 1994a) which has been two days before the new moon on 30.06.1992, from the left border of the river Weser between Esenshamm and Elsfleth southeast of Wilhelmshaven where at least 20 individuals in total have been observed on 02.07.2002 – 08.07.2002 (EITSCHBERGER & STEINIGER 2003a) which has been several days before the new moon on 10.07.2002, from Faßberg southsoutheast of Munster southsouthwest of Lüneburg where 5 individuals have flown on 08.05.1993 (EITSCHBERGER & STEINIGER 1995a) which has been two days after the full moon on 06.05.1993, from Eschede northnortheast of Celle northnortheast of Hannover where 8 individuals have flown on 30.06.1993 (EITSCHBERGER & STEINIGER 1995a) which has been three days before the full moon on 03.07.1993, from Sassenburg-Westerbeck northwest of Wolfsburg where 5 individuals have flown on 02.08.1993 (EITSCHBERGER & STEINIGER 1995a) which has been on the full moon on 02.08.1993, from Brackwede south of Bielefeld where abt. 10 individuals have flown on 21.08.1947 (CRETSCHMAR & SCHREIER in RETZLAFF 1973) which has been five days after the new moon on 16.08.1947, from Augustdorf southeast of Bielefeld where abt. 25 individuals have flown on 07.08.1995 (EITSCHBERGER & STEINIGER 1996b) which has been three days before the full moon on 10.08.1995, from Monheim southsoutheast of Düsseldorf in the Middle Rhine valley where 20 individuals have flown on 16.08.2006 (BÖHM & KRUSE in SCHUMACHER 2007b) which has been on the decreasing half moon on 16.08.2006 between the full moon on 09.08.2006 and the new moon on 23.08.2006, from the district Stockum in the northern part of the city of Düsseldorf in the Middle Rhine valley where abt. 30 individuals have flown on

26.08.2006 (BÖHM in SCHUMACHER 2007b) which has been three days after the new moon on 23.08.2006, and from the Wolferskopf near Haustadt northnortheast of Beckingen north of Dillingen in the Saar valley in the western part of Germany where abt. 200 individuals have flown on 15.05.1992 (EITSCHBERGER & STEINIGER 1995a) which has been one day before the full moon on 16.05.1992.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in the southwestern and southeastern parts of Germany have been mentioned from Regensburg in the Danube valley in the southeastern part of Germany where abundant individuals have flown on 24.07.1932 (JÜNGLING 1934) which has been two days before the decreasing half moon on 26.07.1932 between the full moon on 17.07.1932 and the new moon on 02.08.1932, from Rheinweiler southsouthwest of Bad Bellingen north of Basel at the southern end of the Upper Rhine valley in the southwestern part of Germany where abt. 20 individuals in total have flown in the period of 23.04.1995 – 07.05.1995 (EITSCHBERGER & STEINIGER 1996b) which has been around and between the decreasing half moon on 23.04.1995 between the full moon on 15.04.1995 and the new moon on 29.04.1995 as well as the increasing half moon on 08.05.1995 between the new moon on 29.04.1995 and the full moon on 14.05.1995, and from the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where 5 individuals have flown on 01.09.1994 (HASSELBACH 1995a) which has been four days before the new moon on 05.09.1994.

Mass occurrences of large quantities of individuals of the Bath White *Pontia daplidice* in Austria, Italy, France, England and Poland have been signaled from Retz northnorthwest of Hollabrunn northnorthwest of Vienna in the eastern part of Austria where 10 individuals have flown on 23.05.2002 (EITSCHBERGER & STEINIGER 2003a) which has been three days before the full moon on 26.05.2002, from Illmitz at Lake Neusiedl southeast of Vienna in the eastern part of Austria where 5 individuals have flown on 21.08.1971 (EITSCHBERGER 1972) which has been on the new moon on 21.08.1971; from Breitenbrunn at Lake Neusiedl southsouthwest of Vienna in the eastern part of Austria where abt. 30 individuals, abt. 200 individuals and 50 individuals have been observed on 21.08.1975 (BURMANN & TARMANN 1978), 25.08.1977 (SCHINTLMEISTER in BURMANN & TARMANN 1979) and 07.04.1999 (EITSCHBERGER & STEINIGER 2000b), respectively, which has been on the full moon on 21.08.1975, three days before the full moon on 28.08.1977, and three days before the decreasing half moon on 10.04.1999 between the full moon on 01.04.1999 and the new moon on 16.04.1999, respectively; from Laas and Spondinig west of Laas in the Etsch valley eastsoutheast of Merano in Southern Tyrol in the northeastern part of Italy where abt. 60 individuals in total have flown on 24.07.1976 and 29.07.1976 (RÖSSLER in BURMANN & TARMANN 1979) which has been three days before and two days after the new moon on 27.07.1976, respectively; from Bormes east of Toulon in the southeastern part of France where 6 individuals have flown on 12.07.1968 (ULF EITSCHBERGER in HARZ 1969) which has been two days after the full moon on 10.07.1968, from Saint-Martin-du-Crau westnorthwest of Marseille in the southeastern part of France where abt. 1.000 individuals have flown on 14.09.2006 (A. LOISI in HENSLE 2007a) which has been on the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006, from Saint-Martin-du-Crau and Saintes-Maries-de-la-Mer westnorthwest of Marseille in the southeastern part of France where abt. 60 individuals in total have flown in the period of 28.06.2007 – 05.07.2007 (HENSLE 2008a) which has been around and between the full moon on 30.06.2007 as well as the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007, from Durdle Door west of Lulworth Cove westsouthwest of Poole in the southwestern part of England where hundreds of individuals have flown at the end of July 1906 and at the beginning of August 1906 (F.L. BLATHWAYTE in FROHAWK 1938) which has been around and between the new moon on 21.07.1906 and the full moon on 04.08.1906, and from Klon (formerly Liebenberg) in the vicinity of Szczytno (formerly Ortelsburg) southeast of Olsztyn (formerly Allenstein) in the northeastern part of Poland where masses of individuals have flown on 12.08.1929 (HELLMANN

1929) which has been one day before the increasing half moon on 13.08.1929 between the new moon on 05.08.1929 and the full moon on 20.08.1929.

5.46 The Eastern Bath White *Pontia edusa*

Mass occurrences of large quantities of individuals of the Eastern Bath White *Pontia edusa* (Fabricius 1776) (Lepidoptera: Pieridae) in the northwestern part of Germany have been noted in Porz at the southeastern margin of the city of Cologne in the Middle Rhine valley where abundant individuals each have flown on 27.07.1947 and 15.09.1947 (Ernst Schaaf in Kinkler, Schmitz & Nippel 1971; Ernst Schaaf in Hanisch & Jelinek 2006) which has been two days after the increasing half moon on 25.07.1947 between the new moon on 18.07.1947 and the full moon on 02.08.1947 as well as one day after the new moon on 14.09.1947, respectively; in Porz-Langel at the southeastern margin of the city of Cologne in the Middle Rhine valley where 10 – 15 individuals daily, 10 – 20 individuals daily and abt. 5 individuals have flown on 08.08.1993 – 09.08.1993 (Risch 1993, Hanisch 2009), 08.08.2006 – 09.08.2006 (Klaus Hanisch in Hensle 2007a, Klaus Hanisch in Schumacher 2007b, Hanisch 2009) and 26.08.2006 (Abel & Hillig in Hanisch 2009), respectively, which has been two and three days before the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, one day before and on the full moon on 09.08.2006, and three days after the new moon on 23.08.2006, respectively; in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley where abt. 10 individuals daily have flown on 08.08.2006 – 09.08.2006 (Hanisch & Jelinek 2006) which has been one day before and on the new moon on 09.08.2006; in the districts Kaiserswerth and Bockum at the northern margin of the city of Düsseldorf in the Middle Rhine valley where more than 30 individuals have flown on 26.08.2006 as well as more than 15 individuals each have flown on 12.08.2006 and 01.09.2006 (Klaus Böhm & Kai Kruse in Hanisch & Jelinek 2006) which has been three days after the new moon on 23.08.2006, three days after the full moon on 09.08.2006, and one day after the increasing half moon on 31.08.2006 between the new moon on 23.08.2006 and the full moon on 07.09.2006, respectively; near Monheim northnortheast of Cologne in the Middle Rhine valley where 20 individuals have flown on 16.08.2006 (Klaus Böhm & Kai Kruse in Hanisch & Jelinek 2006) which has been on the decreasing half moon on 16.08.2006 between the full moon on 09.08.2006 and the new moon on 23.08.2006, in the northern part of the Senne south of Augustdorf southeast of Bielefeld where more than 10 individuals have flown on 01.09.1991 (Retzlaff 1992, Kuhlmann in Retzlaff 1992) which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and near Binnen-Glissen westsouthwest of Nienburg in the Weser valley northwest of Hannover where 12 individuals have flown on 22.04.2007 (E. Dallmeyer in Hensle 2008a) which has been two days before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007.

Mass occurrences of large quantities of individuals of the Eastern Bath White *Pontia edusa* in the northeastern part of Germany have been recorded near Bielen eastsoutheast of Nordhausen where 15 individuals in total have flown in the period of 20.08.2006 – 05.09.2006 (R. Krause in Hensle 2007a) which has been around and between the new moon on 23.08.2006 and the full moon on 07.09.2006, in Niemegk north of Lutherstadt Wittenberg where abt. 25 individuals have sucked on flowers on 31.07.2005 (Hensle 2006a) which has been five days before the new moon on 05.08.2005, in Raben north of Lutherstadt Wittenberg in the Elbe valley where 6 individuals have flown on 03.07.2006 (Hensle 2007a) which has been on the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, near Neues Lager west of Jüterbog eastnortheast of Lutherstadt Wittenberg where more than 15 individuals have flown on 14.07.2007 (Hensle 2008a) which has been two days after the new moon on 14.07.2007; near Aken

west of Dessau and Kleinzerbst northnorthwest of Dessau in the Elbe valley where abt. 25 individuals in total have flown on 19.06.2005 – 20.06.2005 (ERNST GÖRGNER in HENSLE 2006a) and 7 individuals have flown on 03.08.2006 (HENSLE 2007a) which has been two and three days before the full moon on 22.06.2005 as well as one day after the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, respectively; near Wolfen northnorthwest of Leipzig where more than 30 individuals in total have flown in the period of 18.04.2005 – 28.04.2005 (J. KELLNER in HENSLE 2006a) which has been around and between the increasing half moon on 16.04.2005 between the new moon on 08.04.2005 and the full moon on 24.04.2005 as well as the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005, near Pausin westnorthwest of Berlin where 8 individuals have flown on 13.04.2007 (HENSLE 2008a) which has been four days before the new moon on 17.04.2007, near Altlandsberg east of Berlin where abt. 25 individuals have flown on 29.07.2006 (K. TAUCHERT in HENSLE 2007a) which has been five days after the new moon on 24.07.2006, and near Stahnsdorf east of Potsdam southsouthwest of Berlin where 5 individuals have flown on 11.07.2007 (H. VOIGT in HENSLE 2008a) which has been three days before the new moon on 14.07.2007.

Mass occurrences of large quantities of individuals of the Eastern Bath White *Pontia edusa* in the northeastern part of Germany have also been recognized near Könnern in the Saale valley northnorthwest of Halle where 8 individuals have flown on 18.06.2005 (ERNST GÖRGNER in HENSLE 2006a) which has been four days before the full moon on 22.06.2005, near Apolda in the Ilm valley northnorthwest of Jena where 15 individuals in total have flown on 17.04.2007 – 29.04.2007 (H. SCHNOEDE in HENSLE 2008a) which has been around and between the new moon on 17.04.2007 and the full moon on 01.06.2007, near Süptitz north of Delitzsch north of Leipzig where 5 individuals have flown on 03.05.2007 (J. PHILIPP in HENSLE 2008a) which has been one day after the full moon on 02.05.2007, near Neukirchen northeast of Reinsberg westsouthwest of Dresden in the Elbe valley where 20 individuals have flown on 18.07.2006 (M. OLIAS in HENSLE 2007a) which has been one day after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, near Lakoma northnortheast of Cottbus in the Spree valley where abt. 100 individuals have flown on 19.08.2005 (G. HERMANN in HENSLE 2006a) which has been on the full moon on 19.08.2005, between Döbbrick north of Cottbus and Schmogrow northwest of Cottbus in the Spree valley where 12 individuals have flown on 10.08.2006 (HENSLE 2007a) which has been one day after the full moon on 09.08.2006, near Sprey in the Spree valley east of Hoyerswerda where 5 individuals have flown on 01.05.2006 (M. TRAMPENAU in HENSLE 2007a) which has been four days after the new moon on 27.04.2006, near Bärwalde in the Spree valley east of Hoyerswerda where 5 individuals have flown on 11.06.2006 – 12.06.2006 (M. TRAMPENAU in HENSLE 2007a) which has been on and one day after the full moon on 11.06.2006; near Klein Radisch and Reichwalde in the Spree valley eastsoutheast of Hoyerswerda where 8 individuals and 5 individuals have flown on 17.08.2006 and 27.08.2006, respectively (M. TRAMPENAU in HENSLE 2007a) which has been one day after the decreasing half moon on 16.08.2006 between the full moon on 09.08.2006 and the new moon on 23.08.2006 as well as four days after the new moon on 23.08.2006, respectively; near Mücka southsoutheast of Weißwasser where 7 individuals have flown on 18.07.2006 (M. TRAMPENAU in HENSLE 2007a) which has been one day after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006; and in the Zeitz forest near Zeitz in the Weiße Elster valley northnortheast of Gera where 12 individuals in total have flown on 14.08.2007 and 18.08.2007 (GERD LINTZMEYER in HENSLE 2008a) which has been one and five days after the new moon on 13.08.2007, respectively.

Mass occurrences of large quantities of individuals of the Eastern Bath White *Pontia edusa* in the eastern part of Austria have been registered at the Salmannsdorfer Höhe near Vienna where 10 individuals have flown on 25.08.2007 (H. BRUCKNER in HENSLE 2008a) which has been three days before the full moon on 28.08.2007, in the district Heiligenstadt of the city of Vienna where 6 individuals

have flown on 03.09.2007 (HENSLE 2008a) which has been one day before the decreasing half moon on 04.09.2007 between the full moon on 28.08.2007 and the new moon on 11.09.2007, near Schwechat southeast of Vienna where 6 individuals have flown on 22.09.2007 (HENSLE 2008a) which has been four days before the full moon on 26.09.2007, near Fischamend in the Danube valley eastsoutheast of Vienna where 20 individuals have flown on 14.09.2007 (HENSLE 2008a) which has been three days after the new moon on 11.09.2007, at the Eichkogel near Guntramsdorf south of Vienna where 6 individuals have flown on 02.09.2007 (HENSLE 2008a) which has been five days after the full moon on 28.08.2007; near Baden southsouthwest of Vienna where 12 individuals and 8 individuals in total have flown on 09.07.2006 (CHRISTOPHER RABL in HENSLE 2007a) as well as on 29.07.2007 and 14.09.2007 (CHRISTOPHER RABL in HENSLE 2008a), respectively, which has been two days before the full moon on 11.07.2006, one day before the full moon on 30.07.2007 and three days after the new moon on 11.09.2007, respectively; near Sollenau north of Wiener Neustadt where abt. 25 individuals, 65 individuals and 8 individuals have flown on 13.07.2006 (HENSLE 2007a), 22.07.2006 (HENSLE 2007a) and 18.08.2007 (MARKUS SCHWIBINGER in HENSLE 2008a), respectively, which has been two days after the full moon on 11.07.2006, two days before the new moon on 24.06.2006, and three days before the increasing half moon on 21.08.2007 between the new moon on 13.08.2007 and the full moon on 28.08.2007, respectively; in the Wien valley near the district Weidlingau of the city of Vienna where 10 individuals have flown on 14.04.2007 (HENSLE 2008a) which has been three days before the new moon on 17.04.2007; near Göttlesbrunn-Arbesthal northwest of Bruck an der Leitha eastsoutheast of Vienna where 7 individuals and 8 individuals have flown on 14.07.2006 and 20.07.2006 – 08.08.2006 (HENSLE 2007a), respectively, which has been three days after the full moon on 11.07.2006 as well as around and between the new moon on 24.07.2006 and the full moon on 09.08.2006, respectively; near Breitenbrunn, Winden am See and Donnerskirchen west and westsouthwest of Neusiedl am See eastsoutheast of Vienna where 5 individuals each have flown on 16.08.2007, 17.08.2007 and 18.08.2007, respectively (MARKUS SCHWIBINGER in HENSLE 2008a), which has been three, four and five days after the new moon on 13.08.2007, respectively; near Donnerskirchen westsouthwest of Neusiedl am See eastsoutheast of Vienna where more than 60 individuals in total have flown on 27.08.2007 – 28.08.2007 and 17.09.2007 (HENSLE 2008a) which has been one day before and on the full moon on 28.08.2007 as well as two days before the increasing half moon on 19.09.2007 between the new moon on 11.09.2007 and the full moon on 26.09.2007, respectively; near Purbach at Lake Neusiedl northeast of Eisenstadt southeast of Vienna where abt. 15 individuals have flown on 26.08.2007 (HENSLE 2008a) which has been two days before the full moon on 28.08.2007; and near Rohrendorf east of Krems in the Danube valley where 10 individuals in total have flown on 30.06.2007 and 20.09.2007 (CHRISTOPHER RABL in HENSLE 2008a) which has been on the full moon on 30.06.2007 as well as one day after the increasing half moon on 19.09.2007 between the new moon on 11.09.2007 and the full moon on 26.09.2007, respectively.

5.47 The Apollo *Parnassius apollo*

During my entomological observations, I have so far not discovered any individuals of the Apollo *Parnassius apollo* LINNAEUS 1758 (Lepidoptera: Papilionidae) and the Clouded Apollo *Parnassius mnemosyne* LINNAEUS 1758 (Lepidoptera: Papilionidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany. I have up to now only seen individuals of the Apollo *Parnassius apollo* on the island Rhodos in the southeastern part of Greece during a holiday with my parents in spring 1965. Some examples of peak occurrences of the Apollo *Parnassius apollo* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass flights of large quantities of individuals of the Apollo *Parnassius apollo* have been particular-

ly investigated around Winningen and Kobern-Gondorf in the Moselle valley southwest of Koblenz in the western part of Germany where peaks of mass occurrences with daily flights between abt. 25 and more than 200 individuals have been determined in the period of 20.06.1999 – 28.06.1999 (ROBERT JUNG in HASSELBACH 1996) which has been around and between the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 29.06.1999 as well as the full moon on 29.06.1999, in the period of 08.06.2001 – 23.06.2001 (ROBERT JUNG in HASSELBACH 1996) which has been around and between the full moon on 06.06.2001 and the new moon on 21.06.2001, in the period of 07.06.2004 – 10.06.2004 (DÖTSCH 2005, 2006a) which has been several days before and after the decreasing half moon on 09.06.2004 between the full moon on 03.06.2004 and the new moon on 17.06.2004, in the period of 16.06.2004 – 19.06.2004 (DÖTSCH 2005, 2006a) which has been several days before and after the new moon on 17.06.2004, in the period of 24.06.2004 – 30.06.2004 (DÖTSCH 2005) which has been around and between the increasing half moon on 25.06.2004 between the new moon on 17.06.2004 and the full moon on 02.07.2004 as well as the full moon on 02.07.2004, in the period of 14.06.2005 – 28.06.2005 (DÖTSCH 2006b) which has been around and between the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.05.2005 as well as the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005, in the period of 24.05.2007 – 26.05.2007 (DÖTSCH 2007) which has been one to three days after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, in the period of 02.06.2007 – 10.06.2007 (DÖTSCH 2007) which has been around and between the full moon on 01.06.2007 as well as the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, in the period of 16.06.2007 – 19.06.2007 (DÖTSCH 2007) which has been one to four days after the new moon on 15.06.2007; and (for the interval between Winningen east of Kobern-Gondorf and Hatzenport southsouthwest of Kobern-Gondorf) in the periods of 02.06.2008 – 12.06.2008 and 22.06.2008 – 04.07.2008 (DÖTSCH 2009) which has been around and between the new moon on 03.06.2008 as well as the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.08.2008, and around and between the full moon on 18.06.2008 and the new moon on 03.07.2008, respectively. Mass occurrences of large quantities of individuals of the Apollo *Parnassius apollo* around Winningen and Kobern-Gondorf have also been confirmed on 08.07.1995, 15.07.1995 and 23.06.1996 when more than 100 individuals, more than 30 individuals (ROBERT JUNG in HASSELBACH 1996) and abt. 20 individuals (ROBERT JUNG in HASSELBACH 1997), respectively, have been recorded which has been four days before and three days after the full moon on 12.07.1995, and two days before the increasing half moon on 25.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, respectively; on 27.06.1998 when abt. 40 individuals have been counted (ALBRECHT & STENGER 1999) which has been three days after the new moon on 24.06.1998, and on 08.06.2007 when abt. 95 individuals have been registered (FRANZ DÖTSCH in SCHUMACHER 2008a) which has been on the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007. Mass occurrences of large quantities of individuals of the Apollo *Parnassius apollo* in the Moselle valley southwest of Koblenz have also been reported from Klotten northeast of Cochem where abundant individuals have flown in the period of 09.07.1995 – 16.07.1995 (BREHM & BREHM 1997) which has been several days before and after the full moon on 12.07.1995, and where abt. 10 individuals have flown on 10.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been one day before the full moon on 11.07.2006; and from an unspecified locality where abt. 20 individuals each have flown on 16.06.1996 and 20.06.1996 (J. STRUBEL in HASSELBACH 1997) which has been on and four days after the new moon on 16.06.1996, respectively. The so-called Moselle Apollo from its typical locality Winningen has been named *Parnassius apollo vinningensis* STICHEL 1899 (overviews of the distribution of the subspecies of the Apollo *Parnassius apollo* are also given by PAGENSTECHER 1909a and CAPDEVILLE 1978 – 1980).

Mass flights of large quantities of individuals of the Apollo *Parnassius apollo* in the Moselle valley

southwest of Koblenz have also been documented at various localities in 1989 where peaks of mass occurrences with daily flights between abt. 10 and more than 100 individuals have been determined around Winningen and Kobern each on 17.06.1989 – 19.06.1989 and 25.06.1989 – 28.06.1989 (KINKLER 1990a, WIERIG in KINKLER 1990a); around Kattenes on 17.06.1989, 23.06.1989 – 25.06.1989 and 06.07.1989 (KINKLER 1990a, HANS-ARNOLD HÜRTER in KINKLER 1990a); around Alken on 26.06.1989 (REHNELT in KINKLER 1990a), around Karden on 18.06.1989 and 27.06.1989 (KINKLER 1990a, WIERIG in KINKLER 1990a), around Pommern eastnortheast of Cochem on 26.06.1989 – 27.06.1989 (REHNELT in KINKLER 1990a, WIERIG in KINKLER 1990a), around Klotten northeast of Cochem on 27.06.1989 and 06.07.1989 (WIERIG in KINKLER 1990a), around Cochem-Cond on 18.06.1989 – 07.07.1989 (KINKLER 1990a, REHNELT in KINKLER 1990a, WIERIG in KINKLER 1990a), and around Ediger-Eller south of Cochem on 06.07.1989 – 07.07.1989 (WIERIG in KINKLER 1990a), with these mass flights having been established around and between the full moon on 19.06.1989, the decreasing half moon on 27.06.1989 and the new moon on 03.07.1989. Significant amounts of individuals of the Apollo *Parnassius apollo* in the Moselle valley southwest of Koblenz have also been observed around Cochem-Cond where 10 individuals have flown on 13.06.1988 (KINKLER 1989a, HANS-ARNOLD HÜRTER in KINKLER 1989a) which has been one day before the new moon on 14.06.1988, around Pommern where 5 individuals have flown on 06.06.1997 (KINKLER 1998, SCHIFFER in KINKLER 1998) which has been one day after the new moon on 05.06.1997, around Valwig where abt. 5 individuals have flown on 17.06.2006 (JÜRGEN EIMERS in SCHUMACHER 2007a) which has been one day before the increasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006; and at unspecified localities where abt. 40 individuals in total and abt. 65 individuals have flown on 25.06.1990 (HASSELBACH 1991) and 14.06.1992 (KLAUS BITTNER in HASSELBACH 1991), respectively, which has been three days after the new moon on 22.06.1990 and one day before the full moon on 15.06.1992, respectively.

Mass flights of large quantities of individuals of the Apollo *Parnassius apollo* in the Moselle valley southwest of Koblenz have also been documented at various localities in 1987 where peaks of mass occurrences with daily flights between abt. 20 and more than 70 individuals have been determined around Cochem on 23.06.1987 (LENZ 1987), around Cochem-Cond on 23.06.1987 – 24.06.1987 and 09.07.1987 – 12.07.1987 (LENZ 1987), around Bremm southsouthwest of Cochem on 08.07.1987 (HERMANN SCHAUSTEN in LENZ 1987), around Klotten northeast of Cochem on 23.06.1987 – 30.06.1987 and 04.07.1987 – 14.07.1987 (LENZ 1987), and around Valwig east of Cochem on 24.06.1987 and 12.07.1987 (LENZ 1987), with these mass flights having been developed around and between the new moon on 26.06.1987, the increasing half moon on 05.07.1987 and the full moon on 11.07.1987.

Mass flights of large quantities of individuals of the Apollo *Parnassius apollo* in the Moselle valley southwest of Koblenz have also been documented at various localities in 1986 where peaks of mass occurrences with daily flights between abt. 25 and abt. 50 individuals have been determined around Winningen on 27.06.1986 and 30.06.1986, around Kobern on 28.06.1986, and around Kattenes on 01.07.1986 and 04.07.1986 (RICHARZ, NEUMANN & WIPKING 1989), with these mass flights having happened around and between the full moon on 22.06.1986, the decreasing half moon on 30.06.1986 and the new moon on 07.07.1986.

Mass flights of large quantities of individuals of the Apollo *Parnassius apollo* in the Moselle valley southwest of Koblenz have also been documented at various localities in 1985 where peaks of mass occurrences with daily flights between abt. 20 and abt. 40 individuals have been determined around Winningen on 07.07.1985 – 16.07.1985 (KINKLER 1985; KARL THEO BIRK, HANS-ARNOLD HÜRTER & HANS-DIETER BOURQUIN in KINKLER 1985), around Kobern on 07.07.1985 and 11.07.1985 (KINKLER 1985; KARL THEO BIRK, HANS-ARNOLD HÜRTER & HANS-DIETER BOURQUIN in KINKLER 1985), around Kattenes on 07.07.1985 (KINKLER 1985; KARL THEO BIRK, HANS-ARNOLD HÜRTER, JOCHEN RODENKIRCHEN

& HANS-DIETER BOURQUIN in KINKLER 1985), around Pommern eastnortheast of Cochem on 07.07.1985 – 21.07.1985 (KINKLER 1985; KARL THEO BIRK, HANS-ARNOLD HÜRTER & HANS-DIETER BOURQUIN in KINKLER 1985), and around Klotten northeast of Cochem on 07.07.1985 – 20.07.1985 (KINKLER 1985; KARL THEO BIRK, HANS-ARNOLD HÜRTER, JOCHEN RODENKIRCHEN & HANS-DIETER BOURQUIN in KINKLER 1985), with these mass flights having been manifested around and between the full moon on 02.07.1985, the decreasing half moon on 11.07.1985 and the new moon on 17.07.1985.

Mass occurrences of large quantities of individuals of the Apollo *Parnassius apollo* have also been mentioned by A. GREMMINGER (in EBERT & RENNWALD 1991) from the Hohentwiel at the western margin of Singen westnorthwest of Konstanz in the southwestern part of Germany where on 26.07.1914, he has observed that a collector has caught numerous individuals and on 08.06.1921, he has captured 15 males and 2 females, with these mass occurrences having been developed three days after the new moon on 23.07.1914 and two days after the new moon on 06.06.1921, respectively.

5.48 The Purple Hairstreak *Quercusia quercus* and the Brown Hairstreak *Thecla betulae*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have so far only discovered a few single individuals of the Purple Hairstreak *Quercusia quercus* LINNAEUS 1758 (Lepidoptera: Lycaenidae) and the Brown Hairstreak *Thecla betulae* LINNAEUS 1758 (Lepidoptera: Lycaenidae) at the localities Nußloch and Rot in summer 2008. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Purple Hairstreak *Quercusia quercus* and the Brown Hairstreak *Thecla betulae* on the island Teneriffa during a holiday with my parents in spring 1968, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Purple Hairstreak *Quercusia quercus* and the Brown Hairstreak *Thecla betulae* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Purple Hairstreak *Quercusia quercus* have been documented by GIERLING (1978a, 1978b) and VÖLKER (1978). GIERLING (1978a) has observed in total several thousands of individuals of the Purple Hairstreak *Quercusia quercus* which have flown in the Idienbach valley near Bad Neuenahr-Ahrweiler in the Ahr valley in the northeastern part of the Eifel in the western part of Germany on 06.08.1976 – 11.08.1976, with these mass flights having been established a few days before and after the full moon on 10.08.1976. VÖLKER (1978) has seen abundant individuals of the Purple Hairstreak *Quercusia quercus* which have flown at the southwestern margin of the city of Braunschweig in the northwestern part of Germany at more or less the same time in early August 1976. SEIDLEIN (in GIERLING 1978b) has registered abundant individuals of the Purple Hairstreak *Quercusia quercus* in the vicinity of Schweinfurt in the Main valley northeast of Würzburg in the central part of Germany at more or less the same time in early August 1976, and SOER (in GIERLING 1978b) has noticed thousands of individuals of the Purple Hairstreak *Quercusia quercus* in a forest north of Hanau east of Frankfurt am Main in the central part of Germany at more or less the same time in early August 1976 or in early to mid of July 1976. Other mass occurrences of the Purple Hairstreak *Quercusia quercus* in early to mid of July 1976 have been recorded by BREGULLA (in GIERLING 1978b) in the northern part of the city of Münster in the northwestern part of Germany, by DEMANDT (in GIERLING 1978b) in Altenstadt-Lindheim northeast of Frankfurt am Main in the central part of Germany, by FÜLDNER (in GIERLING 1978b) in the vicinity of Bruchsal in the middle part of the Upper Rhine valley in the southwestern part of Germany, by GOLTZ (in GIERLING 1978b) in the Lower Rhine valley in the northwestern part of Germa-

ny, and by SCHUH (in GIERLING 1978b) around Mannheim and at several localities in the Saarland in the southwestern part of Germany, with these mass occurrences having been developed around and between the full moon on 11.07.1976, the new moon on 27.07.1976 and the full moon on 10.08.1976.

Mass occurrences of large quantities of individuals of the Purple Hairstreak *Quercusia quercus* have also been mentioned from the forests around Hardheim west of Tauberbischofsheim in the southwestern part of Germany where tens of thousands of individuals have flown from 20.07.1983 to the beginning of August 1983 (F. VOGEL in EBERT & RENNWALD 1993) which has been around and between the full moon on 24.07.1983 and the new moon on 08.08.1983; from the forests around Ober-Olm southwest of Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where masses of individuals each have flown on 15.07.1877, 22.07.1880 and 16.07.1882 (REICHENAU 1904) which has been four days after the new moon on 11.07.1877, one day after the full moon on 21.07.1880 and one day after the new moon on 15.07.1882, respectively; from the vicinity of Hintertiefenbach eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where more than 5 individuals have flown on 30.06.2002 (E. HEINEN in HASSELBACH 2003) which has been two days before the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 5 and abt. 10 individuals have flown on 01.09.1991 and 05.09.1991, respectively (HANS KWIATKOWSKI in HASSELBACH 1992), which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991 as well as three days before the new moon on 08.09.1991, respectively; from the northern part of the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 300 individuals have flown on 04.07.1976 (WILLIBALD SCHMITZ in HANISCH 2009) which has been one day before the increasing half moon on 05.07.1976 between the new moon on 27.06.1976 and the full moon on 11.07.1976, from Königsforst and Wahner Heide east and southeast of Cologne in the northwestern part of Germany where more than 100 individuals have flown in July 2008 (HANISCH 2009) which has been around and between the full moon on 07.07.2009 and the new moon on 22.07.2009, from the Lörsfelder Busch/Dickbusch near Kerpen westsouthwest of Cologne in the northwestern part of Germany where abt. 50 individuals have flown on 28.07.1990 (JELINEK 2006) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, and from Hiltrup and Davert south of Münster in the northwestern part of Germany where abt. 30 individuals have flown on 28.07.1968 (HARKORT & WEIGT 1969, H. HEDDERGOTT in HARKORT & WEIGT 1969, H. HEDDERGOTT in HARKORT 1976) which has been three days after the new moon on 25.07.1968.

Mass occurrences of large quantities of individuals of the Brown Hairstreak *Thecla betulae* have been reported from the vicinity of Alton westsouthwest of London in the southeastern part of England where numerous individuals have flown on 06.09.1919 (STOWELL 1919) which has been four days before the full moon on 10.09.1919.

5.49 The Camberwell Beauty *Nymphalis antiopa*

During my entomological observations, I have so far not discovered any individuals of the Camberwell Beauty *Nymphalis antiopa* LINNAEUS 1758 (Lepidoptera: Nymphalidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe. Some examples of mass occurrences of the Camberwell Beauty *Nymphalis antiopa* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Camberwell Beauty *Nymphalis antiopa* in the southwestern part of Germany have been reported from an unspecified locality in the northeastern part of the Black Forest where abt. 50 individuals have sucked sap on a hedge of abt. 60 m length which has been freshly cut shortly before so that the juice has run in streams on 20.04.1987 (EBERT & RENNWALD 1991) which has been six days after the full moon on 14.04.1987, from the vicinity of Bad Dürkheim at the western margin of the middle part of the Upper Rhine valley where abt. 50 individuals have sucked sap on bleeding birches on 21.03.1974 (EITSCHBERGER & STEINIGER 1977c) which has been two days before the new moon on 23.03.1974, and from Schierstein at the western margin of the city of Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where abundant individuals have flown on 27.09.1888 (REICHENAU 1904) which has been two days before the decreasing half moon on 29.09.1888 between the full moon on 20.09.1888 and the new moon on 05.10.1888. A mass emergence of abt. 100 individuals of the Camberwell Beauty *Nymphalis antiopa* on 08.08.1976 – 11.08.1976 terminating a breeding experiment in Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg in the southwestern part of Germany (EITSCHBERGER & STEINIGER 1977c) has happened a few days before and after the full moon on 10.08.1976, and a mass emergence of abt. 450 individuals from 07.08.1986 onwards at the end of a breeding experiment at the same locality (STEINIGER & EITSCHBERGER 1988) has taken place two days after the new moon on 05.08.1986 and later.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in the southwestern part of Germany have also been recorded near Forbach in the Murg valley southsoutheast of Rastatt where 8 individuals in total have flown on 25.08.1985 – 29.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been one to five days before the full moon on 30.08.1985, in the Laufbach valley near Lauf in the northern part of the Black Forest south of Bühl where 4 individuals have flown on 11.05.1986 (STEINIGER & EITSCHBERGER 1988) which has been two days after the new moon on 09.05.1986; near Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg where 9 individuals in total and 13 individuals in total have been counted in the periods of 13.08.1985 – 30.08.1985 and 10.09.1985 – 28.09.1985, respectively (STEINIGER & EITSCHBERGER 1987), which has been around and between the new moon on 16.08.1985 and the full moon on 30.08.1985 as well as around and between the new moon on 14.09.1985 and the full moon on 29.09.1985, respectively; in Simonswald and Oberbiederbach northwest and northnorthwest of Furtwangen in the southern part of the Black Forest eastnortheast of Freiburg where 6 individuals and 5 individuals have been observed on 16.05.1985 and 09.08.1985, respectively (STEINIGER & EITSCHBERGER 1987), which has been four days before the new moon on 20.05.1985 as well as on the decreasing half moon on 09.08.1985 between the full moon on 01.08.1985 and the new moon on 16.08.1985, respectively; in Lenzkirch in the southern part of the Black Forest eastsoutheast of Freiburg where abt. 10 individuals have flown on 23.04.1987 (STEINIGER & EITSCHBERGER 1989) which has been two days after the decreasing half moon on 21.04.1987 between the full moon on 14.04.1987 and the new moon on 28.04.1987, in the vicinity of Freiburg in the southern part of the Upper Rhine valley where 16 individuals have been counted on 19.04.1987 (STEINIGER & EITSCHBERGER 1989) which has been two days before the decreasing half moon on 21.04.1987 between the full moon on 14.04.1987 and the new moon on 28.04.1987, in the Erlenbachtal near Grafenhausen east of Sankt Blasien north of Waldshut-Tiengen in the southern part of the Black Forest where 8 individuals have flown on 30.04.2005 (G. HERMANN in HENSLE 2006a) which has been one day before the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005, and in Geislingen westnorthwest of Balingen where 5 individuals have been noted on 16.04.2003 (B. SCHLUDE in HENSLE 2004a) which has been on the full moon on 16.04.2003.

Mass occurrences of large quantities of individuals of the Camberwell Beauty *Nymphalis antiopa* in the southeastern part of Germany have been documented from the Fichtelgebirge around and between Wunsiedel and Marktleuthen south of Hof where abt. 30 individuals have sucked sap on

bleeding aspens on 12.08.1963 (CASPERS in HARBICH & WITTSTADT 1964) which has been one day before the decreasing half moon on 13.08.1963 between the full moon on 05.08.1963 and the new moon on 19.08.1963.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in the southeastern part of Germany have also been recognized in Muggendorf northeast of Forchheim north of Nürnberg where 7 individuals have been observed on 09.05.1987 – 10.05.1987 (STEINIGER & EITSCHBERGER 1989) which has been three and four days before the full moon on 13.05.1987, near Allersberg east of Roth southsoutheast of Nürnberg where 4 individuals have sucked juice on overmature cherries on 18.07.2006 (W. BACKFISCH in HENSLE 2007a) which has been one day after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, near Presseck westnorthwest of Münchberg where 4 individuals have flown on 10.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been five days after the new moon on 05.08.1986, in Obernzell in the Danube valley east of Passau where 13 individuals have been monitored on 22.04.1985 (STEINIGER & EITSCHBERGER 1987) which has been two days after the new moon on 20.04.1985; at the Große Rachel near Sankt Oswald northeast of Grafenau north of Passau where 8 individuals in total have flown on 30.07.2003 – 04.08.2003 (J. KAMP in HENSLE 2004a) which has been several days after the new moon on 29.07.2003, near Drachselsried northwest of Zwiesel northnortheast of Deggendorf where 15 individuals have flown on 27.03.2007 (F. MÜLLER in HENSLE 2008a) which has been two days after the increasing half moon on 25.03.2007 between the new moon on 19.03.2007 and the full moon on 02.04.2007, near Marktleuthen in the Fichtelgebirge south of Hof where abt. 10 individuals have flown on 22.08.1991 – 23.08.1991 (STEINIGER & EITSCHBERGER 1994) which has been two to three days before the full moon on 25.08.1991, near Wunsiedel in the Fichtelgebirge south of Hof where 10 individuals have flown on 16.05.1992 (STEINIGER & EITSCHBERGER 1994) which has been on the full moon on 16.05.1992, and near Windischeschenbach north of Weiden in der Oberpfalz where 4 individuals have flown on 22.05.1985 (STEINIGER & EITSCHBERGER 1987) which has been two days after the new moon on 20.05.1985.

Mass occurrences of large quantities of individuals of the Camberwell Beauty *Nymphalis antiopa* in the northeastern part of Germany have been mentioned from Gehlberg westsouthwest of Ilmenau where 20 individuals in total have flown on 07.08.1992 – 12.08.1992 (STEINIGER & EITSCHBERGER 1994) which has been around and between the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992 as well as the full moon on 13.08.1992, from the Dresdner Heide northeast of Dresden in the Elbe valley where 20 individuals have flown on 30.07.1983 (STEINIGER & EITSCHBERGER 1985) which has been four days before the decreasing half moon on 03.08.1983 between the full moon on 24.07.1983 and the new moon on 08.08.1983, from Niesky northnorthwest of Görlitz where 22 individuals in total have been counted on 03.08.1985 – 09.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been around and between the full moon on 01.08.1985 as well as the decreasing half moon on 09.08.1985 between the full moon on 01.08.1985 and the new moon on 16.08.1985, from Joachimsthal northnorthwest of Eberswalde where 99 individuals in total have been counted in the period of 31.07.1995 – 11.08.1995 (HANS-JOACHIM VAN LOH in HENSLE 2001e) which has been around and between the new moon on 27.07.1995 and the full moon on 10.08.1995, and from Müllrose southsouthwest of Frankfurt an der Oder where abt. 40 – 80 individuals have flown on 25.07.2008 (M. ZAPLATA in HENSLE 2009a) which has been on the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in the northeastern part of Germany have also been verified near Ilmenau in the Ilm valley eastnortheast of Suhl where 5 individuals and 7 individuals have flown on 13.04.1991 – 14.04.1991 and 22.04.1992, respectively (STEINIGER & EITSCHBERGER 1994), which has been on and one day before the new moon

on 14.04.1991 as well as five days after the full moon on 17.04.1992, respectively; near Jena in the Saale valley where 6 individuals and 21 individuals in total have flown on 17.05.1986 and in the period of 20.07.1986 – 15.08.1986, respectively (STEINIGER & EITSCHBERGER 1988), which has been one day before the increasing half moon on 18.05.1986 between the new moon on 09.05.1986 and the full moon on 23.05.1986, and around and between the full moon on 21.07.1986, the new moon on 05.08.1986 and the full moon on 19.08.1986, respectively; near Kahla south of Jena in the Saale valley where 5 individuals have flown on 16.03.1990 (STEINIGER & EITSCHBERGER 1992) which has been five days after the full moon on 11.03.1990, near Hohenwarte eastsoutheast of Saalfeld in the Saale valley where 5 individuals have flown on 16.08.1992 (STEINIGER & EITSCHBERGER 1994) which has been three days after the full moon on 13.08.1992, near Satzung eastsoutheast of Annaberg-Buchholz where 8 individuals in total have flown on 05.08.1992 and 07.08.1992 (STEINIGER & EITSCHBERGER 1994) which has been one day before and after the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, near Fraureuth westsouthwest of Zwickau where 5 individuals have flown on 01.05.1983 (STEINIGER & EITSCHBERGER 1985) which has been four days after the full moon on 27.04.1983; within the city of Hoyerswerda south of Cottbus where 4 individuals in total have flown on 16.07.2003 and 19.07.2003 (HENSLE 2004a) which has been three and six days after the full moon on 13.07.2003, respectively; near Bärwalde in the Spree valley east of Hoyerswerda where 12 individuals in total have flown on 18.04.2006 and 20.04.2006 as well as on 13.05.2006 and 17.05.2006 (M. TRAMPENAU in HENSLE 2007a) which has been five days after the full moon on 13.04.2006, one day before the decreasing half moon on 21.04.2006 between the full moon on 13.04.2006 and the new moon on 27.04.2006, and on and four days after the full moon on 13.05.2006, respectively; near Lohsa-Lippen in the Spree valley eastsoutheast of Hoyerswerda where 7 individuals have flown on 06.07.2007 (M. TRAMPENAU in HENSLE 2008a) which has been one day before the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007, near Guttau northeast of Bautzen where 5 individuals have flown on 10.08.1983 – 12.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been two to four days after the new moon on 08.08.1983, near Hohendubrau-Dauban westnorthwest of Görlitz where 8 individuals have flown on 19.07.2006 (M. TRAMPENAU in HENSLE 2007a) which has been two days after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006; near Zeitz in the Weiße Elster valley northnortheast of Gera where 16 individuals in total and 6 individuals in total have been registered on 09.07.2003 – 15.07.2003 (GERD LINTZMEYER in HENSLE 2004a) and 21.07.2006 – 27.07.2006 (GERD LINTZMEYER in HENSLE 2007a), respectively, which has been several days before and after the full moon on 13.07.2003 as well as several days before and after the new moon on 24.07.2006, respectively; in the Dresdner Heide northeast of Dresden in the Elbe valley where 15 individuals and 12 individuals have flown on 27.04.1986 and 26.07.1986, respectively (STEINIGER & EITSCHBERGER 1988), which has been three days after the full moon on 24.04.1986 and five days after the full moon on 21.07.1986, respectively; in the Dresdner Heide northeast of Dresden in the Elbe valley where 7 individuals in total have flown on 01.05.1987 and 09.05.1987 (STEINIGER & EITSCHBERGER 1989) which has been three days after the new moon on 28.04.1987 as well as two days after the increasing half moon on 07.05.1987 between the new moon on 28.04.1987 and the full moon on 13.05.1987, respectively; near Langenbach northwest of Aue where 15 individuals in total have flown in the period of 19.08.1985 – 30.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been around and between the new moon on 16.08.1985 and the full moon on 30.08.1985, near Albernau southsouthwest of Aue where 4 individuals have flown on 04.05.2006 (S. THOSS in HENSLE 2007a) which has been one day before the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006, in Löbau westsouthwest of Görlitz where 15 individuals have sucked juice on fallen fruits on 14.08.1963 (GEORG SCHOLZ in HARBICH & WITTSTADT 1964) which has been one day after the decreasing half moon on 13.08.1963 between the full moon on 05.08.1963 and the new moon on 19.08.1963, in the Glücksburger Heide east of Seyda east of Lutherstadt Wittenberg in the Elbe valley where 15 individuals have flown on 23.04.2005 (J. KELL-

NER in HENSLE 2006a) which has been one day before the full moon on 24.04.2005, in the vicinity of Havelberg in the Elbe valley eastsoutheast of Wittenberge where 7 individuals in total have flown on 02.03.1997 – 10.03.1997 (HENSLE 2001h) which has been around and between the decreasing half moon on 03.03.1997 between the full moon on 22.02.1997 and the new moon on 09.03.1997 as well as the new moon on 09.03.1997, in Wiesenburg southwest of Potsdam where 9 individuals in total have flown in the period of 03.09.1987 – 17.09.1987 (STEINIGER & EITSCHBERGER 1989) which has been around and between the full moon on 07.09.1987 and the new moon on 23.09.1987, near Wansdorf northwest of Berlin where 5 individuals have been discovered on 22.03.2005 (B. KRÜGER in HENSLE 2006a) which has been three days before the full moon on 25.03.2005, and near Lubkow east of Bergen in the southeastern part of the island Rügen at the coast of the Baltic Sea where 5 individuals have flown on 30.04.2000 – 03.05.2000 (HENSLE 2001b) which has been one to four days before the new moon on 04.05.2000.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in the northwestern part of Germany have been notified in Göhrde eastsoutheast of Lüneburg where 12 individuals in total have flown on 25.08.1985 and 28.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been two and five days before the full moon on 30.08.1985, respectively; in Dahlenburg eastsoutheast of Lüneburg where 12 individuals have flown on 24.04.1987 (STEINIGER & EITSCHBERGER 1989) which has been four days before the new moon on 28.04.1987, in the vicinity of Celle northnortheast of Hannover where 7 individuals in total have flown on 08.08.1983 – 12.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been on and several days after the new moon on 08.08.1983, and near Völklingen in the Saar valley westnorthwest of Saarbrücken where 4 individuals have flown on 25.06.2008 (P. DIETRICH in HENSLE 2009a) which has been one day before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in Austria have been encountered near Golling southsoutheast of Salzburg in the Salzach valley in the western part of Austria where 4 individuals and 8 individuals have flown on 20.05.2006 and 24.09.2006 – 25.09.2006, respectively (ERICH SCHNÖLL in HENSLE 2007a), which has been on the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006, and two and three days after the new moon on 22.09.2006, respectively; near Spielberg west of Knittelfeld in the Mur valley southwest of Leoben in the eastern part of Austria where 13 individuals have flown on 07.05.2008 (D. ELSER in HENSLE 2009a) which has been two days after the new moon on 05.05.2008, near Lengenfeld north of Krems in the Danube valley northwest of Vienna in the eastern part of Austria where 8 individuals have been observed on 14.07.2003 (CHRISTOPHER RABL in HENSLE 2004a) which has been one day after the full moon on 13.07.2003, near Langschlag south of Weitra westnorthwest of Vienna in the eastern part of Austria where 5 individuals have flown on 26.07.2003 (CHRISTOPHER RABL in HENSLE 2004a) which has been three days before the new moon on 29.07.2003, and in the Leithagebirge between Eisenstadt and Mannersdorf southeast of Vienna in the eastern part of Austria where 10 individuals in total have flown in the period of 02.05.1997 – 10.05.1997 (HENSLE 2001h) which has been around and between the new moon on 06.05.1997 as well as the increasing half moon on 15.05.1997 between the new moon on 06.05.1997 and the full moon on 22.05.1997.

Significant numbers of individuals of the Camberwell Beauty *Nymphalis antiopa* in Switzerland, France and Poland have been observed near Haldenstein north of Chur in the Alpine Rhine valley in the northeastern part of Switzerland where 15 individuals have flown on 26.04.2008 (HENSLE 2009a) which has been two days before the decreasing half moon on 28.04.2008 between the full moon on 20.04.2008 and the new moon on 03.06.2008; near Maggia in the Maggia valley northwest of Ascona in the southeastern part of Switzerland where 11 individuals in total have flown on 06.04.1999 and 09.04.1999 (HENSLE 2001k) which has been one and four days before the decreasing half moon

on 10.04.1999 between the full moon on 31.03.1999 and the new moon on 16.04.1999, respectively; near Vicosoprano northwest of Ascona in the southeastern part of Switzerland where 10 individuals have flown on 11.04.2007 (HENSLE 2008a) which has been one day after the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007, near Soulac-sur-Mer at the mouth of the Gironde northnorthwest of Bordeaux in the southwestern part of France where 10 individuals have flown on 04.07.1976 (EITSCHBERGER & STEINIGER 1977c) which has been one day before the increasing half moon on 05.07.1976 between the new moon on 27.06.1976 and the full moon on 11.07.1976, and near Czersk south of Koscierzyna southsouthwest of Gdansk in the northeastern part of Poland where 8 individuals have sit on stems of birch trees on 21.05.2003 (KLAUS DETTMANN in HENSLE 2004a) which has been two days before the decreasing half moon on 23.05.2003 between the full moon on 16.05.2003 and the new moon on 31.05.2003.

5.50 The Large Tortoiseshell *Nymphalis polychloros*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Large Tortoiseshell *Nymphalis polychloros* LINNAEUS 1758 (Lepidoptera: Nymphalidae) at the localities Nußloch and Tairnbach in spring 2007. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Large Tortoiseshell *Nymphalis polychloros* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Large Tortoiseshell *Nymphalis polychloros* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Large Tortoiseshell *Nymphalis polychloros* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the northwestern part of Germany have been noticed in the Dhünn valley southeast of Burscheid and southwest of Wermelskirchen northeast of Leverkusen where hundreds of individuals have flown and have assembled on excrements in June 1921 (KARL STAMM in KINKLER, SCHMITZ & NIPPEL 1971) which has been around and between the new moon on 05.07.1921 and the full moon on 19.07.1921.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the northwestern part of Germany have also been identified between the district Rath at the eastern margin of the city of Cologne and Leidenhausen east of Cologne in the Middle Rhine valley where abt. 10 individuals in total have flown from the end of February 1961 to the beginning of March 1961 (HANISCH 2009) which has been around the full moon on 02.03.1961, and in the Friesheimer Busch near Friesheim southsouthwest of Erftstadt southsouthwest of Cologne where abt. 5 individuals have flown on 07.04.1996 (JELINEK 2006) which has been four days after the full moon on 03.04.1996.

Mass occurrences of large quantities of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the western part of Germany have been registered near Klotten northeast of Cochem in the Moselle valley where 20 individuals have flown on 12.07.1986 (STEINIGER & EITSCHBERGER 1988) which has been three days before the increasing half moon on 15.07.1986 between the new moon on 07.07.1986 and the full moon on 21.07.1986.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the western part of Germany have also been recorded near Irrhausen southwest of Prüm in the northwestern part of the Eifel where 5 individuals have flown on 10.08.1986 – 11.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been three to four days before the increasing half moon on 14.08.1986 between the new moon on 05.08.1986 and the full moon on 19.08.1986, in Treis-Karden east of Cochem in the Moselle valley where 5 individuals have been noted on 21.07.1985 (STEINIGER & EITSCHBERGER 1987) which has been three days after the new moon on 18.07.1985; near Klotten northeast of Cochem in the Moselle valley where 5 individuals each have flown on 24.03.2005 (M. DERRA in SCHUMACHER 2006) and 12.05.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been one day before the full moon on 25.03.2005 and one day before the full moon on 13.05.2006, respectively; near Lorch northnorthwest of Bingen in the Middle Rhine valley where 8 individuals have flown on 14.04.1987 (STEINIGER & EITSCHBERGER 1989) which has been on the full moon on 14.04.1987, near Ingelheim west of Mainz at the northern margin of the Upper Rhine valley where 4 individuals have flown on 12.07.1993 (R. ALBERT in HASSELBACH 1995b) which has been on the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, near Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 5 individuals have flown on 03.07.1994 (S. JOUAUX in BROSZKUS 1995) which has been two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and near Weinähr in the Lahn valley east of Nassau eastsoutheast of Koblenz where 6 individuals in total have been registered on 18.03.2005 – 23.03.2005 (RAINER ROTH in HENSLE 2006a) which has been several days before the full moon on 25.03.2005.

Mass occurrences of large quantities of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the southwestern part of Germany have been recognized in Büchelberg northwest of Berg westsouthwest of Karlsruhe in the middle part of the Upper Rhine valley where 35 individuals and abt. 125 individuals have flown on 07.04.2006 (HENSLE 2007a) and 27.03.2007 – 05.04.2007 (G. RENNWALD in HENSLE 2008a), respectively, which has been two days after the increasing half moon on 05.04.2006 between the new moon on 29.03.2006 and the full moon on 13.04.2006 as well as several days before and after the full moon on 02.04.2007, respectively.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the southwestern part of Germany have also been confirmed near Groß-Gerau southeast of Mainz in the northern part of the Upper Rhine valley where 8 individuals and 15 individuals have sucked juice on bleeding trees on 13.03.1993 and 20.03.1993, respectively (HENSLE 2001c), which has been five days after the full moon on 08.03.1993 and three days before the new moon on 23.03.1993, respectively; near Mörlenbach-Weiher eastnortheast of Weinheim in the western part of the Odenwald where 9 individuals have sucked sap on bleeding trees on 21.03.2005 (HENSLE 2006a) which has been four days before the full moon on 25.03.2005, near Bammental southeast of Heidelberg where 15 individuals have flown on 23.02.2008 (J. BASTIAN in HENSLE 2009a) which has been two days after the full moon on 21.02.2008, near Zeiskam eastnortheast of Landau in der Pfalz in the middle part of the Upper Rhine valley where 4 individuals have flown on 20.07.2002 (KLAUS WEISS in HASSELBACH 2003) which has been four days before the full moon on 24.07.2002; near Forbach in the Murg valley in the northern part of the Black Forest southsoutheast of Rastatt where 5 individuals have flown on 25.08.1985 and 27.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been three and five days before the full moon on 30.08.1985, respectively; near Glottertal in the southern part of the Black Forest eastnortheast of Freiburg where 12 individuals have flown on 04.03.2007 (E. HOCH in HENSLE 2008a) which has been on the full moon on 04.03.2007, near Grißheim southwest of Bad Krozingen in the southern part of the Upper Rhine valley where 8 individuals have flown on 22.06.2006 (HENSLE 2007a) which has been three days before the new moon on 25.06.2006, at the Belchen southeast of Münstertal in the southern part of the Black Forest southeast of Bad Krozingen where 5 individuals have flown on 10.07.2001 (HENSLE 2002a) which has been five days after

the full moon on 05.07.2001, near Filderstadt-Plattenhardt south of Stuttgart where 5 individuals have flown on 17.04.1987 – 18.04.1987 (STEINIGER & EITSCHBERGER 1989) which has been three to four days after the full moon on 14.04.1987, around Frickenhausen and Beuren northeast of Reutlingen where 8 individuals in total have flown on 24.03.2005 (HENSLE 2006a) which has been one day before the full moon on 25.03.2005, near Kirchheim unter Teck and Wernau in the Neckar valley eastsoutheast of Stuttgart where 13 individuals in total have been counted on 18.03.2005 – 26.03.2005 (D. HOLDER in HENSLE 2006a) which has been several days before and after the full moon on 25.03.2005, at the Jesinger Halde near Kirchheim unter Teck in the Neckar valley eastsoutheast of Stuttgart where 15 individuals have been registered on 01.04.2006 (HENSLE 2007a) which has been three days after the new moon on 29.03.2006, and in the Birkenweiher near Tettnang-Neuhäusle eastnortheast of Friedrichshafen at Lake Constance where 4 individuals have flown on 01.05.2006 (RUDOLF REITEMEIER in HENSLE 2007a) which has been four days after the new moon on 27.04.2006.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the central part of Germany have been verified near Duttenbrunn northwest of Würzburg where 4 individuals have flown on 17.04.1983 (STEINIGER & EITSCHBERGER 1985) which has been four days after the new moon on 13.04.1983, near Arnstein north of Würzburg where 7 individuals have flown on 06.04.2006 (W. KNORZ in HENSLE 2007a) which has been one day after the increasing half moon on 05.04.2006 between the new moon on 29.03.2006 and the full moon on 13.04.2006; near Ramsthal, Oerlenbach-Rottershausen and Stadtlauringen south, southwest and east of Bad Kissingen northnorthwest of Schweinfurt where abt. 5 individuals, abt. 15 individuals and abt. 5 individuals, respectively, have flown on 12.03.2007 – 13.03.2007 (HENSLE 2008a) which has been on and one day after the decreasing half moon on 12.03.2007 between the full moon on 04.03.2007 and the new moon on 19.03.2007; and near Unsleben northeast of Bad Neustadt an der Saale north of Schweinfurt where 5 individuals have flown on 04.04.2007 (HENSLE 2008a) which has been two days after the full moon on 02.04.2007.

Mass occurrences of large quantities of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the southeastern part of Germany have been documented in Wellheim northwest of Neuburg an der Donau where 20 individuals have been observed on 08.07.1973 (EITSCHBERGER & STEINIGER 1974b) which has been on the increasing half moon on 08.07.1973 between the new moon on 30.06.1973 and the full moon on 15.07.1973; and in the vicinity of Augsburg in the Lech valley where abt. 20 individuals in total have been noticed on 17.06.1973 and 04.08.1973 (EITSCHBERGER & STEINIGER 1974b) which has been two days after the full moon on 15.06.1973 as well as two days before the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, respectively.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the southeastern part of Germany have also been registered in Poppenhausen west of Coburg where 7 individuals have been observed on 14.07.1985 (STEINIGER & EITSCHBERGER 1987) which has been four days before the new moon on 18.07.1985

Mass occurrences of large quantities of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the northeastern part of Germany have been noticed at the margin of the city of Zeitz in the Weiße Elster valley northnortheast of Gera where more than 25 individuals in total have flown in the period of 02.07.2006 – 16.07.2006 (GERD LINTZMEYER in HENSLE 2007a) which has been around and between the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the new moon on 11.07.2006 as well as the increasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, near Altenburg south of Leipzig where abt. 35 individuals have flown on 29.06.1993 (HENSLE 2001c) which has been five days before the full

moon on 04.07.1993, in the Leina forest near Altenburg south of Leipzig where abt. 100 individuals have flown on sunny ways in the forest on 24.06.2003 (HENSLE 2004a) which has been three days after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, near Schiebelau south of Jena in the Saale valley where abt. 45 individuals in total have flown in the period of 14.04.2007 – 05.05.2007 (F. HÜNEFELD in HENSLE 2008a) which has been around and between the new moon on 17.04.2007 and the full moon on 02.05.2007, and near Oelknitz south of Rothenstein south of Jena in the Saale valley where abt. 20 individuals have flown on 15.03.2008 (F. HÜNEFELD in HENSLE 2009a) which has been one day after the increasing half moon on 14.03.2008 between the new moon on 07.03.2008 and the full moon on 21.03.2008.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in the northeastern part of Germany have also been recorded near Seibis westnorthwest of Blankenstein northwest of Hof where 7 individuals have flown on 06.04.2007 (J. PHILIPP in HENSLE 2008a) which has been four days after the full moon on 02.04.2007, near Westhausen southsouthwest of Hildburghausen where 5 individuals have flown on 09.07.1992 (STEINIGER & EITSCHBERGER 1994) which has been five days before the full moon on 14.07.1992, in the Leina forest near Altenburg south of Leipzig where 10 individuals in total each have been recorded on 23.04.2006 – 24.04.2006 and 01.07.2006 – 04.07.2006 (A. NAUMANN in HENSLE 2007a) which has been three and four days before the new moon on 27.04.2006 as well as several days before and after the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, respectively; in the Zeitz forest near Koßweda around Zeitz in the Weiße Elster valley northnortheast of Gera where 9 individuals have flown on 15.06.2007 (J. PHILIPP in HENSLE 2008a) which has been on the new moon on 15.06.2007; in Nordhausen south of the Harz where 8 individuals in total and 5 individuals have flown on 02.09.2006 – 10.09.2006 (U. PATZIG in HENSLE 2007a) and 27.03.2007 (U. PATZIG in HENSLE 2008a), respectively, which has been several days before and after the full moon on 07.09.2006, and two days after the increasing half moon on 25.03.2007 between the new moon on 19.03.2007 and the full moon on 02.04.2007, respectively; and in Oker southeast of Goslar in the northwestern part of Germany and in Rosenhain northeast of Löbau westsouthwest of Görlitz in the northeastern part of Germany where the peak of abundance has been reached on 05.08.1966 – 09.08.1966 (BRUNO P. KREMER in HARZ 1967a) which has been around and between the full moon on 01.08.1966 as well as the decreasing half moon on 10.08.1966 between the full moon on 01.08.1966 and the new moon on 16.08.1966.

Significant numbers of individuals of the Large Tortoiseshell *Nymphalis polychloros* in Austria, Switzerland, Italy, Luxembourg and France have been recognized in Lengenfeld north of Krems in the Danube valley westnorthwest of Vienna in the eastern part of Austria where 6 individuals have been discovered on 02.04.2006 – 04.04.2006 (CHRISTOPHER RABL in HENSLE 2007a) which has been one to three days before the increasing half moon on 05.04.2006 between the new moon on 29.03.2006 and the full moon on 13.04.2006, near Donnerskirchen northeast of Eisenstadt southeast of Vienna in the eastern part of Austria where 9 individuals have flown on 09.04.2006 (CHRISTOPHER RABL in HENSLE 2007a) which has been four days before the full moon on 13.04.2006, near Arogno southsoutheast of Lugano in the southeastern part of Switzerland where 4 individuals have flown on 25.03.2006 (HENSLE 2007a) which has been four days before the new moon on 29.03.2006, near Lavertezzo northnortheast of Locarno in the southeastern part of Switzerland where 4 individuals have flown on 18.04.2006 (HENSLE 2007a) which has been five days after the full moon on 13.04.2006, near Avegno northnorthwest of Locarno in the southeastern part of Switzerland where 5 individuals have flown on 21.04.2006 (HENSLE 2007a) which has been on the decreasing half moon on 21.04.2006 between the full moon on 13.04.2006 and the new moon on 27.04.2006, near Leifers south of Bolzano in Southern Tyrol in the northeastern part of Italy where 7 individuals in total have flown on 04.04.2007 – 05.04.2007 (HENSLE 2008a) which has been two and three days after the full moon on 02.04.2007, near Clervaux northwest of Vianden in the northern part of

Luxembourg where 11 individuals have flown on 31.07.1996 (HENSLE 2001g) which has been one day after the full moon on 30.07.1996, and near Heiteren southeast of Colmar in the southern part of the Upper Rhine valley in the northeastern part of France where 15 individuals have flown on 24.02.2008 (HENSLE 2009a) which has been three days after the full moon on 21.02.2008.

5.51 The Grayling *Hipparchia semele*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have so far only identified a few single individuals of the Grayling *Hipparchia semele* LINNAEUS 1758 (Lepidoptera: Satyridae) at some localities which is certainly in considerable degree the result of my only accessory monitoring of the background brown butterflies including apart from the Grayling *Hipparchia semele* also the Meadow Brown *Maniola jurtina*, the Speckled Wood *Pararge aegeria,* the Wall Brown *Lasiommata megera,* the Gatekeeper *Pyronia tithonus*, the Pearly Heath *Coenonympha arcania*, the Small Heath *Coenonympha pamphilus* and the Ringlet *Aphantopus hyperantus.* Some examples of mass occurrences of the Grayling *Hipparchia semele* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* at the coast of the North Sea in the northwestern part of Germany have been noticed on the island Langeoog northwest of Wilhelmshaven where 25 individuals have been observed on 19.08.2001 (HENSLE 2002a) which has been on the new moon on 19.08.2001, on the island Spiekeroog northwest of Wilhelmshaven where 30 individuals have flown on 19.07.1992 (STEINIGER & EITSCHBERGER 1994) which has been five days after the full moon on 14.07.1992, on the island Wangerooge northnorthwest of Wilhelmshaven where 20 individuals in total have flown on 03.09.1987 – 09.09.1987 (STEINIGER & EITSCHBERGER 1989) which has been around and between the increasing half moon on 02.09.1987 between the new moon on 24.08.1987 and the full moon on 07.09.1987 as well as the full moon on 07.09.1987; on the island Norderney north of Norden where more than 200 individuals and 140 individuals have flown on 19.07.2003 (HENSLE 2004a) and 18.07.2005 (HENSLE 2006a), respectively, which has been three days before the decreasing half moon on 21.07.2003 between the full moon on 13.07.2003 and the new moon on 29.07.2003 as well as three days before the full moon on 21.07.2005, respectively; on the island Juist north of Emden where abt. 200 individuals have been counted on 19.07.1994 (HENSLE 2002c) which has been three days before the full moon on 22.07.1994, on the island Borkum northwest of Emden where abt. 10 individuals have flown on 16.07.2002 (HENSLE 2003) which has been one day before the increasing half moon on 17.06.2002 between the new moon on 10.06.2002 and the full moon on 24.06.2002, at the Ems estuary west of Emden where more than 20 individuals in total have flown in the period of 15.07.1995 – 06.08.1995 (HENSLE 2002d) which has been around and between the full moon on 12.07.1995 as well as the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, at the Ems estuary near Knock westsouthwest of Emden where abt. 10 individuals have flown on 22.07.2001 (HENSLE 2002a) which has been two days after the new moon on 20.07.2001, on the island Ameland northwest of Groningen in the northeastern part of the Netherlands where more than 50 individuals have been observed on 28.07.1997 (HENSLE 2002f) which has been one day after the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997; on the island Amrum westnorthwest of Husum where abt. 250 individuals in total and more than 50 individuals have been registered in the period of 23.07.1982 – 09.08.1982 (STEINIGER & EITSCHBERGER 1985) and on 29.08.2005 (JÜRGEN RODELAND in HENSLE 2006a), respectively, which has been around and between the new moon on 20.07.1982, the full moon on 04.08.1982 and the new moon on 19.08.1982, as well as three days after the decreasing half moon on 26.08.2005 between the full moon on 19.08.2005 and the new

moon on 03.09.2005, respectively; near Kampen in the northern part of the island Sylt northwest of Husum where abt. 10 individuals have flown on 23.07.1996 (HENSLE 2002e) which has been one day before the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 30.07.1996, around List in the northern part of the island Sylt northwest of Husum where abt. 275 individuals in total have been monitored in the period of 29.07.1997 – 08.08.1997 (HENSLE 2002f) which has been around and between the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997 as well as around and between the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997; and around Blavand northwest of Esbjerg in the southwestern part of Denmark where abundant and in parts masses of individuals have flown in the period of 27.07.1985 – 23.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been around and between the full moon on 01.08.1985, the new moon on 16.08.1985 and the full moon on 30.08.1985.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* in the northwestern part of Germany have also been recognized near Behringen southwest of Lüneburg where abt. 170 individuals in total have been observed on 25.07.1999 and 02.08.1999 (HENSLE 2002h) which has been three days before and five days after the full moon on 28.07.1999, respectively; near Niederhaverbeck northwest of Bispingen westsouthwest of Lüneburg where abt. 25 individuals and more than 20 individuals have been counted on 19.07.1992 and 21.07.1992, respectively (STEINIGER & EITSCHBERGER 1994), which has been five days after the full moon on 14.07.1992 and five days before the full moon on 26.07.1992, respectively; near Bodenteich southsoutheast of Uelzen southsoutheast of Lüneburg where abt. 25 individuals have flown on 17.08.1985 (STEINIGER & EITSCHBERGER 1987) which has been one day after the new moon on 16.08.1985; near Wahrenholz northnorthwest of Wolfsburg where more than 10 individuals in total have flown on 20.08.2006 and 25.08.2006 (J. WAGNER in HENSLE 2007a) which has been three days before and two days after the new moon on 23.08.2006, respectively; near Munster northnortheast of Hannover where 20 individuals have been registered on 24.08.2001 (HENSLE 2002a) which has been two days before the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, near Bramsche-Wackum southsoutheast of Lingen where 8 individuals have flown on 10.08.1986 (STEINIGER & EITSCHBERGER 1988) which has been five days after the new moon on 05.08.1986, near Künsebeck southsoutheast of Halle westnorthwest of Bielefeld as well as in the northern part of the Senne south of Augustdorf southeast of Bielefeld where 150 individuals have flown on 02.08.1991 (BIERMANN in RETZLAFF 1992) which has been two days before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991; near Augustdorf southeast of Bielefeld where abt. 20 individuals, abt. 1.000 individuals, abt. 100 individuals and abt. 220 individuals have flown on 25.08.1986 (STEINIGER & EITSCHBERGER 1989) as well as on 21.07.1991, 30.08.1991 and 01.09.1991 (RETZLAFF 1992, STEINIGER & EITSCHBERGER 1994), respectively, which has been three days before the decreasing half moon on 28.08.1986 between the full moon on 19.08.1986 and the new moon on 04.09.1986, two days after the increasing half moon on 19.07.1991 between the new moon on 14.07.1991 and the full moon on 26.07.1991, five days after the full moon on 25.08.1991, and one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, respectively; near Hövelhof northnorthwest of Paderborn where 12 individuals have flown on 02.08.1986 (STEINIGER & EITSCHBERGER 1989) which has been three days before the new moon on 05.08.1986; and near Bad Lippspringe northeast of Paderborn where abt. 400 individuals in total have flown in the period of 15.07.1990 – 28.07.1990 (STEINIGER & EITSCHBERGER 1992), abt. 1.000 individuals have flown on 05.08.1990 (STEINIGER & EITSCHBERGER 1992), abt. 300 individuals have flown on 11.08.1990 (STEINIGER & EITSCHBERGER 1992) and abt. 110 individuals have flown on 30.08.1991 (STEINIGER & EITSCHBERGER 1994) which has been around and between the decreasing half moon on 16.07.1990 between the full moon on 08.07.1990 and the new moon on 22.07.1990 as well as the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, one day

before the full moon on 06.08.1990, five days after the full moon on 06.08.1990, and five days after the full moon on 25.08.1991, respectively.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* in the northwestern part of Germany have also been registered in the Teverener Heide north of Teveren southwest of Geilenkirchen north of Aachen where abt. 20 individuals, abt. 100 individuals, abt. 50 individuals and abt. 25 individuals have flown on 27.07.1991, 14.08.1991, 23.07.1992 and 25.08.1992, respectively (STEINIGER & EITSCHBERGER 1994), which has been one day after the full moon on 26.07.1991, four days after the new moon on 10.08.1991, on the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, and three days before the new moon on 28.08.1992, respectively; in the Teverener Heide north of Teveren southwest of Geilenkirchen north of Aachen where abt. 100 individuals, abt. 10 individuals and abt. 15 individuals in total have flown on 14.08.1991 (HÜCKER in KINKLER 1992), 27.07.1996 (HENSLE 2002e), 06.07.2001 and 24.08.2001 (PETER BARWINSKI in SCHUMACHER 2002), and 17.07.2007 (HENSLE 2008a), respectively, which has been four days after the new moon on 10.08.1991, three days before the full moon on 30.07.1996, one day after the full moon on 05.07.2001, five days after the new moon on 19.08.2001, and three days after the new moon on 14.07.2007, respectively; near Drove south of Düren in the Rur valley in the northwestern part of the Eifel where abt. 100 individuals have flown on 25.08.1996 (KINKLER 1997) which has been three days before the full moon on 28.08.1996, near Kalenberg southsouthwest of Mechernich in the northwestern part of the Eifel where 7 individuals have flown on 30.08.2005 (SCHUMACHER 2006) which has been four days before the new moon on 03.09.2005; near Langenthal southwest of Bad Karlshafen in the Weser valley where abt. 70 individuals, abt. 15 individuals, abt. 80 individuals and abt. 20 individuals have flown on 12.08.1990 (STEINIGER & EITSCHBERGER 1992), 21.07.1994 (HENSLE 2002c), 04.08.1995 (HENSLE 2002d) and 09.08.1997 (HENSLE 2002f), respectively, which has been two days before the decreasing half moon on 14.08.1990 between the full moon on 06.08.1990 and the new moon on 20.08.1990, one day before the full moon on 22.07.1994, one day before the decreasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, and three days before the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997, respectively; near Trendelburg south of Bad Karlshafen in the Weser valley where 25 individuals and abt. 120 individuals in total have been recognized on 17.07.1992 (STEINIGER & EITSCHBERGER 1994) as well as on 08.08.1996 and 17.08.1996 – 18.08.1996 (HENSLE 2002e), respectively, which has been three days after the full moon on 14.07.1992, one day after the decreasing half moon on 07.08.1996 between the full moon on 30.07.1996 and the new moon on 14.08.1996, and three and four days after the new moon on 14.08.1996, respectively; near Sielen southwest of Trendelburg south of Bad Karlshafen in the Weser valley where abundant individuals have flown on 27.07.1990 (STEINIGER & EITSCHBERGER 1992) which has been three days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, and around Karlstadt and Gössenheim northnorthwest of Würzburg in the Main valley in the central part of Germany where 10 individuals have flown on 16.08.2008 – 17.08.2008 (S. KINKLER in HENSLE 2009a) which has been on and one day after the full moon on 16.08.2008.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* in the southwestern part of Germany have been confirmed around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley where abundant individuals have flown on 14.07.1903 (REICHENAU 1904) which has been five days after the full moon on 09.07.1903, near Ludwigswinkel southsoutheast of Pirmasens southsouthwest of Kaiserslautern in the Palatinate Forest where 20 individuals have flown on 30.09.2006 (T. SCHULTE in HENSLE 2007a) which has been on the increasing half moon on 30.09.2006 between the new moon on 22.09.2006 and the full moon on 07.10.2006, near Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück where abt. 10 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been five days after the full moon

on 14.06.2003, near Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach where 8 individuals have flown on 21.08.1987 (STEINIGER & EITSCHBERGER 1989) which has been three days before the new moon on 24.08.1987; near Ihringen westnorthwest of Freiburg in the southern part of the Upper Rhine valley where abt. 10 individuals, abt. 20 individuals and abt. 60 individuals have been noticed on 15.08.1987 (STEINIGER & EITSCHBERGER 1989) as well as on 11.08.1982 and 27.07.1983 (STEINIGER & EITSCHBERGER 1985), respectively, which has been three days after the full moon on 09.08.1987, two days before the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, and three days after the full moon on 24.07.1983, respectively; near Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley where abt. 30 individuals in total have flown at the margin of a deciduous forest on 09.08.2003 and 16.08.2003 (HENSLE 2004a) which has been three days before and four days after the full moon on 12.08.2003, respectively; in the Kaiserstuhl northwest of Freiburg where abt. 25 individuals in total have been found near Eichstetten and Vogtsburg-Schelingen on 06.07.2006 – 10.07.2006 (J. BASTIAN in HENSLE 2007a) as well as 15 individuals and more than 20 individuals have been observed at the Badberg near Vogtsburg-Altvogtsburg on 31.08.2006 and 10.09.2006, respectively (HENSLE 2007a), which has been several days before the full moon on 11.07.2006, on the increasing half moon on 31.08.2006 between the new moon on 23.08.2006 and the full moon on 07.09.2006, and three days after the full moon on 07.09.2006, respectively; and near Vogtsburg-Schelingen in the Kaiserstuhl northwest of Freiburg where 10 individuals each have flown on 24.08.1985 (STEINIGER & EITSCHBERGER 1987) as well as on 09.07.2005 and 12.07.2005 (HENSLE 2006a) which has been on the increasing half moon on 24.08.1985 between the new moon on 16.08.1985 and the full moon on 30.08.1985, three days after the new moon on 06.07.2005, and two days before the increasing half moon on 14.07.2005 between the new moon on 06.07.2005 and the full moon on 21.07.2005, respectively.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* at the coast of the Baltic Sea in the northeastern part of Germany have been registered on the island Hiddensee north of Stralsund where abt. 400 individuals in total and abt. 10 individuals have flown on 21.07.1992 – 01.08.1992 (STEINIGER & EITSCHBERGER 1994) and 25.07.2001 (HENSLE 2002a), respectively, which has been around and between the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992 as well as the new moon on 29.07.1992, and five days after the new moon on 20.07.2001, respectively; on the peninsula Bug in the northwestern part of the island Rügen where abt. 250 individuals in total, more than 400 individuals in total, more than 60 individuals in total and more than 70 individuals in total have been observed in the periods of 16.07.1997 – 16.08.1997 (HENSLE 2002f), 18.07.2001 – 29.08.2001 (HENSLE 2002a), 11.08.2002 – 01.09.2002 (HENSLE 2003) and 29.07.2003 – 25.08.2003 (HENSLE 2004a), respectively, which has been around and between the full moon on 20.07.1997 and the new moon on 18.08.1997; around and between the new moon on 20.07.2001, the full moon on 04.08.2001, the new moon on 19.08.2001 and the full moon on 03.09.2001; around and between the new moon on 08.08.2002, the full moon on 21.08.2002 and the new moon on 07.09.2002; and around and between the new moon on 29.07.2003, the full moon on 12.08.2003 and the new moon on 27.08.2003, respectively; near Prora northnorthwest of Binz in the eastern part of the island Rügen where abt. 200 individuals each have flown and have sucked on flowers on 01.08.2002 – 04.08.2002 and 17.08.2002 – 18.08.2002 (HENSLE 2003) as well as on 08.08.2003 (DIETRICH RÖHRBEIN in HENSLE 2004a) which has been on and up to three days after the decreasing half moon on 01.08.2002 between the full moon on 24.07.2002 and the new moon on 08.08.2002, three to four days before the full moon on 21.08.2002 and four days before the full moon on 12.08.2003, respectively; near Prora northnorthwest of Binz in the eastern part of the island Rügen where abt. 10 individuals each and at least 15 individuals have flown on 09.07.2005 (DIETRICH RÖHRBEIN in HENSLE 2006a), 19.07.2006 (DIETRICH RÖHRBEIN in HENSLE 2007a), 08.07.2007 (DIETRICH RÖHRBEIN in HENSLE 2008a) and 06.07.2008 (DIETRICH RÖHRBEIN in HENSLE 2009a), respectively, which has been three days after the new moon on 06.07.2005, two

days after the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, one day after the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007, and three days after the new moon on 03.07.2008, respectively; and near Zingst on the Zingst northwest of Stralsund where abt. 100 individuals have flown on 03.08.2005 (HENSLE 2006a) which has been two days before the new moon on 05.08.2005.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* in the northeastern part of Germany have also been recognized near Neuermark-Lübars in the Elbe valley northeast of Stendal where abt. 10 individuals have flown on 21.08.1996 (HENSLE 2002e) which has been two days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996; near Klietz northeast of Stendal where abt. 50 individuals in total have flown on 30.07.1997 and 20.08.1997 (HENSLE 2002f) and abt. 30 individuals have flown on 04.08.2005 (HENSLE 2006a) which has been three days after the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997, two days after the full moon on 18.08.1997 and one day before the new moon on 05.08.2005, respectively; near Schollene northwest of Rathenow northnorthwest of Brandenburg an der Havel where abt. 25 individuals, abt. 8 individuals and abt. 10 individuals have flown on 30.07.1988, 10.08.1989 (STEINIGER & EITSCHBERGER 1992) and 31.07.1991 (STEINIGER & EITSCHBERGER 1994), respectively, which has been one day after the full moon on 29.07.1988, on the increasing half moon on 10.08.1989 between the new moon on 01.08.1989 and the full moon on 17.08.1989, and five days after the full moon on 26.07.1991, respectively; at the Schollener See near Schollene northwest of Rathenow northnorthwest of Brandenburg an der Havel where abt. 10 individuals have flown on 29.06.2005 (HENSLE 2006a) which has been one day after the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005, near Schollene-Ferchels northwest of Rathenow northnorthwest of Brandenburg an der Havel where 15 individuals have flown on 12.08.2008 (HENSLE 2009a) which has been four days before the full moon on 16.08.2008, near Altes Lager westnorthwest of Jüterbog eastnortheast of Lutherstadt Wittenberg where abt. 15 individuals have flown on 05.08.2007 (HENSLE 2008a) which has been on the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007; near Oranienbaum southwest of Lutherstadt Wittenberg in the Elbe valley where more than 2.500 individuals have been counted in the period of 12.07.1995 – 16.08.1995 (HENSLE 2002d) which has been around and between the full moon on 12.07.1995, the new moon on 27.07.1995, the full moon on 10.08.1995 and the new moon on 26.08.1995; near Röpzig south of Halle in the Saale valley where hundreds of individuals have flown on 07.08.1927 (BANDERMANN 1927a) which has been one day after the increasing half moon on 06.08.1927 between the new moon on 28.07.1927 and the full moon on 13.08.1927; near Holzhausen westnorthwest and Gossel southwest of Arnstadt southsouthwest of Erfurt where 8 individuals and 13 individuals have flown on 05.08.1991 and 24.07.1992, respectively (STEINIGER & EITSCHBERGER 1994), which has been one day after the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, and one day after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, respectively; near Gossel southwest of Arnstadt southsouthwest of Erfurt where 5 individuals have flown on 06.07.1994 (HENSLE 2002c) which has been two days before the new moon on 08.07.1994, near Ohrdruf southwest of Erfurt where more than 10 individuals have flown on 02.08.1992 (STEINIGER & EITSCHBERGER 1994) which has been four days after the new moon on 29.07.1992, around Wohlmuthausen in the Rhön west of Meiningen in the Werra valley where 20 individuals have been recorded on 21.08.1996 (HENSLE 2002d) which has been two days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996; in the Dresdner Heide northeast of Dresden in the Elbe valley where 17 individuals in total have flown on 10.07.1986 and 26.07.1986 (STEINIGER & EITSCHBERGER 1988) which has been three days after the new moon on 07.07.1986 as well as three

days before the decreasing half moon on 29.07.1986 between the full moon on 21.07.1986 and the new moon on 05.08.1986, respectively; near Dresden-Heller in the Elbe valley where abt. 55 individuals have been counted on 20.08.1999 (HENSLE 2002h) which has been on the increasing half moon on 20.08.1999 between the new moon on 11.08.1999 and the full moon on 26.08.1999, near Hoyerswerda south of Cottbus where more than 10 individuals have flown on 17.08.2006 (HENSLE 2007a) which has been one day after the decreasing half moon on 16.08.2006 between the full moon on 09.08.2006 and the new moon on 23.08.2006, in the Kühnichter Heide northeast of Hoyerswerda where more than 20 individuals in total have flown in the period of 16.07.2002 – 03.08.2002 (HENSLE 2003) which has been around and between the increasing half moon on 17.07.2002 between the new moon on 10.07.2002 and the full moon on 21.07.2002 as well as the decreasing half moon on 01.08.2002 between the full moon on 21.07.2002 and the new moon on 08.08.2002, and near Lakoma northnortheast of Cottbus in the Spree valley where abt. 10 individuals have flown on 19.08.2005 (G. HERMANN in HENSLE 2006a) which has been on the full moon on 19.08.2005.

Mass occurrences of large quantities of individuals of the Grayling *Hipparchia semele* in Austria, Switzerland, Italy and France have been identified near Sollenau north of Wiener Neustadt in the eastern part of Austria where 60 individuals have been counted within a limited region of the natural steppe and several thousands of individuals have been estimated within the whole area of the natural steppe on 06.07.2008 (HENSLE 2009a) which has been three days after the new moon on 03.07.2008, near Felixdorf north of Wiener Neustadt in the eastern part of Austria where 200 individuals have flown within a limited region and several thousands of individuals have been estimated within the whole area on 31.08.2008 (HENSLE 2009a) which has been one day after the new moon on 30.08.2008, on the Blauenweide north of Blauen southsouthwest of Basel in the northwestern part of Switzerland where 25 individuals have flown on 29.08.2005 (BETTINA HÜSER in HENSLE 2006a) which has been three days after the decreasing half moon on 26.08.2005 between the full moon on 19.08.2005 and the new moon on 03.09.2005, around Brig in the Rhône valley in the southeastern part of Switzerland where abt. 10 individuals in total have flown on 21.08.1993 – 27.08.1993 (HENSLE 2002b) which has been around and between the new moon on 17.08.1993 and the full moon on 01.09.1993; near Martisberg northeast of Brig in the Rhône valley in the southeastern part of Switzerland where abt. 15 individuals and abt. 40 individuals have flown on 17.07.1997 (HENSLE 2002f) and 10.07.2005 (HENSLE 2006a), respectively, which has been three days before the full moon on 20.07.1997 and four days after the new moon on 06.07.2005, respectively; near Visp and Ausserberg northwest of Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where more than 10 individuals have flown on 14.07.1998 – 15.07.1998 (HENSLE 2002g) which has been two and three days before the decreasing half moon on 17.07.1998 between the full moon on 09.07.1998 and the new moon on 23.07.1998, near Betten northeast of Brig in the Rhône valley in the southeastern part of Switzerland where 20 individuals have flown on 06.07.2006 (HENSLE 2007a) which has been three days after the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006; near Santa Maria im Münstertal und Müstair im Münstertal eastsoutheast of Davos in the southeastern part of Switzerland where 50 individuals each have flown on 25.08.2007 and 26.08.2007, respectively (HENSLE 2008a), which has been three and two days before the full moon on 28.08.2007, respectively; near Mals-Pramajur in the Etsch valley westnorthwest of Merano in Southern Tyrol in the northeastern part of Italy where 50 individuals have flown on 26.07.2008 (HENSLE 2009a) which has been one day after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, near Vingrau northwest of Perpignan and Fraisse-des-Corbières north of Perpignan in the southwestern part of France where more than 50 individuals in total have flown on 01.07.1993 – 02.07.1993 (HENSLE 2002b) which has been one and two days before the full moon on 03.07.1993, and near Crillon-le-Brave and Crestet northnortheast of Carpentras as well as at the Mont Ventoux north of Carpentras north of Marseille in the southeastern part of France where 120

individuals in total have flown in the period of 22.08.1993 – 06.09.1993 (HENSLE 2002b) which has been around and between the new moon on 17.08.1993 and the full moon on 01.09.1993.

5.52 The White Admiral *Limenitis camilla* and the Poplar Admiral *Limenitis populi*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals each of the White Admiral *Limenitis camilla* LINNAEUS 1763 (Lepidoptera: Nymphalidae) and the Poplar Admiral *Limenitis populi* LINNAEUS 1758 (Lepidoptera: Nymphalidae) at the localities Nußloch and Tairnbach in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the White Admiral *Limenitis camilla* and the Poplar Admiral *Limenitis populi* in the vicinity of Mülheim-Kärlich northwest of Koblenz as well as within and around Neuwied and Koblenz in the Neuwied Basin in the Middle Rhine valley in the western part of Germany between 1964 and 1972, and in Walldorf between 1972 and 1979. In addition to the aforementioned records, I have also observed a single individual of the Poplar Admiral *Limenitis populi* at the train station of Abreschwiller in the Sarre valley south of Sarrebourg in the northern part of the Vosges in the northeastern part of France after the new moon on 14.07.2007. Because the White Admiral *Limenitis camilla* and the Poplar Admiral *Limenitis populi* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007 – 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the White Admiral *Limenitis camilla* and the Poplar Admiral *Limenitis populi* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of the White Admiral *Limenitis camilla* have been registered near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 12 individuals have flown on 03.07.1994 (S. JOUAUX in BROSZKUS 1995) which has been two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994; in the Linxbach region near Ottweiler south of Sankt Wendel in the southern part of the Saar area in the western part of Germany where dozens of individuals have flown in July 1973 (R. KNAPP in SCHMIDT-KOEHL 1977) which has been around and between the new moon on 30.06.1973, the full moon on 15.07.1973 and the new moon on 29.07.1973; and in Hirtzfelden northnortheast of Mulhouse in the southern part of the Upper Rhine valley in the northeastern part of France where abundant individuals have sit on the moist floor around puddles in June 1981 (B. REICHENBACH in EBERT & RENNWALD 1991) which has been around and between the new moon on 02.06.1981, the full moon on 17.06.1981 and the new moon on 01.07.1981. Significant quantities of individuals of the White Admiral *Limenitis camilla* have also been encountered near Bad Sobernheim and Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 16.07.1992 (BROSZKUS 1995) and 04.07.1993 (S. JOUAUX in BROSZKUS 1995), respectively, which has been two days after the full moon on 14.07.1992 and on the full moon on 04.07.1993, respectively; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 5 individuals each and abt. 10 individuals have flown on 26.06.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993), 30.06.1993 and 09.07.1993, respectively (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994), which has been four days before the new moon on 30.06.1992, and four days before and five days after the full moon on 04.07.1993, respectively; near Hiltrup south of Münster in the northwestern part of Germany where 5 individuals have flown on 28.07.1968 (HARKORT & WEIGT 1969) which has been three days after the new moon on 25.07.1968, and in the New Forest near Lyndhurst westsouthwest of Southampton in the southeastern part of

England where 5 individuals have been captured on 02.08.1887 (SANDFORD 1887) which has been one day before the full moon on 03.08.1887.

A mass occurrence of the Poplar Admiral *Limenitis populi* has been reported from the Eifgenbachtal between Burscheid and Wermelskirchen northeast of Leverkusen in the northwestern part of Germany where abundant individuals have flown on 24.06.1936 (KARL STAMM in KINKLER, SCHMITZ & NIPPEL 1971) which has been five days after the new moon on 19.06.1936.

5.53 The Small Copper *Lycaena phlaeas*, the Large Copper *Lycaena dispar* and the Purple-Shot Copper *Lycaena alciphron*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Small Copper *Lycaena phlaeas* LINNAEUS 1761 (Lepidoptera: Lycaenidae) among the community of the background brown small butterflies which includes apart from the Small Copper *Lycaena phlaeas* also the Small Heath *Coenonympha pamphilus* and the Silver-Spotted Skipper *Hesperia comma.* I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Small Copper *Lycaena phlaeas* which would permit a selenocyclical evaluation of its population dynamics, and therefore my own observations of its distribution are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Small Copper *Lycaena phlaeas* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Small Copper *Lycaena phlaeas* in the southwestern, western and southeastern parts of Germany have been registered near Rheinmünster-Söllingen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 120 individuals and abt. 20 individuals have flown on 31.08.2005 (HENSLE 2006a) and 28.07.2007 (J. PHILIPP in HENSLE 2008a), respectively, which has been three days before the new moon on 03.09.2005 and two days before the full moon on 30.07.2007, respectively; near Rheinmünster-Söllingen and Rheinmünster-Stollhofen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 300 individuals in total have flown in the period of 08.05.2006 – 17.05.2006 (HENSLE 2007a) which has been several days before and after the full moon on 13.05.2006, near Rheinmünster-Stollhofen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 80 individuals have flown on 27.07.2006 (HENSLE 2007a) which has been three days after the new moon on 24.07.2006; near Rheinmünster-Stollhofen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where 20 individuals and 50 individuals have flown on 06.05.2008 and 15.07.2008, respectively (HENSLE 2009a), which has been one day after the new moon on 05.05.2008 and three days before the full moon on 18.07.2008, respectively; near Ortenberg southeast of Offenburg in the southern part of the Upper Rhine valley in the southwestern part of Germany where abt. 25 individuals and abt. 15 individuals have flown on 20.10.2008 and 03.11.2008, respectively (HENSLE 2009a), which has been one day before the decreasing half moon on 21.10.2008 between the full moon on 14.10.2008 and the new moon on 29.10.2008, and three days before the increasing half moon on 06.11.2008 between the new moon on 29.10.2008 and the full moon on 13.11.2008, respectively; near Reitscheid in the vicinity of Sankt Wendel northnortheast of Saarbrücken in the southern part of the Saar area in the western part of Germany where 7 individuals have been captured on 24.10.1971 (SCHMIDT-KOEHL 1977) which has been five days after the new moon on 19.10.1971, in Naßweiler southwest of Saarbrücken in the western part of Germany where 30 individuals have been observed on 05.05.2006 (HENSLE 2007a) which has been on the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full

moon on 13.05.2006, near Großrosseln-Emmersweiler south of Völklingen in the western part of Germany where 50 individuals have flown on 01.07.2007 (HENSLE 2008a) which has been one day after the full moon on 30.06.2007, near Kanzem south of Konz in the Saar valley in the western part of Germany where abt. 10 individuals have flown on 10.04.1990 (STEINIGER & EITSCHBERGER 1992) which has been on the full moon on 10.04.1990, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals have flown on 03.08.1991 (HANS KWIATKOWSKI in HASSELBACH 1992) which has been one day before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, near Schönaich south of Stuttgart in the southwestern part of Germany where more than 20 individuals have flown on 04.10.2007 (HENSLE 2008a) which has been one day after the decreasing half moon on 03.10.2007 between the full moon on 26.09.2007 and the new moon on 11.10.2007, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 28.07.1990 (KINKLER & HÜRTER 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, in the Leipheimer Moos near Leipheim in the Danube valley eastnortheast of Ulm in the southwestern part of Germany where more than 150 individuals have flown on 01.07.2007 (HENSLE 2008a) which has been one day after the full moon on 30.06.2007; and near Inkofen southsoutheast of Regensburg in the southeastern part of Germany where 30 individuals have flown on 01.07.2007 (HEINRICH VOGEL in HENSLE 2008a) which has been one day after the full moon on 30.06.2007.

Mass occurrences of large quantities of individuals of the Small Copper *Lycaena phlaeas* in the northwestern and northeastern parts of Germany have been recognized in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 30 individuals have flown on 11.05.2008 (HANISCH 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008, near Augustdorf southeast of Bielefeld in the northwestern part of Germany where more than 35 individuals have flown on 14.09.1991 (RETZLAFF 1992) which has been two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, near Egestorf westsouthwest of Lüneburg in the northwestern part of Germany where 10 individuals have flown on 01.08.1998 (HENSLE 2002g) which has been on the increasing half moon on 01.08.1998 between the new moon on 23.07.1998 and the full moon on 08.08.1998, near Bleckede in the Elbe valley eastnortheast of Lüneburg in the northwestern part of Germany where 10 individuals have flown on 20.09.2008 (HENSLE 2009a) which has been two days before the decreasing half moon on 22.09.2008 between the full moon on 15.09.2008 and the new moon on 29.09.2008, in the Nemitzer Heide eastnortheast of Lüchow north of Salzwedel in the northwestern part of Germany where 12 individuals have flown on 28.04.1990 (STEINIGER & EITSCHBERGER 1992) which has been three days after the new moon on 25.04.1990; and in the Döberitzer Heide north of Döberitz northwest of Brandenburg an der Havel in the northeastern part of Germany where 75 individuals in total have flown on 24.04.2007 and 04.05.2007 (HENSLE 2008a) which has been on the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007 as well as two days after the full moon on 02.05.2007, respectively.

Mass occurrences of large quantities of individuals of the Small Copper *Lycaena phlaeas* in Austria, France and Italy have been recorded near Edelschrott southwest of Graz in the eastern part of Austria where 10 individuals have flown on 12.03.2007 (T. BAUER in HENSLE 2008a) which has been on the decreasing half moon on 12.03.2007 between the full moon on 04.03.2007 and the new moon on 19.03.2007, near Rechnitz eastnortheast of Oberwart in the eastern part of Austria where 15 individuals have flown on 03.05.2008 (A. WOLF in HENSLE 2009a) which has been two days before the new moon on 05.05.2008, near Hirschegg eastnortheast of Bad Sankt Leonhard im

Lavanttal in the eastern part of Austria where abt. 50 individuals have flown on 12.05.2008 (T. BAUER in HENSLE 2009a) which has been on the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008; near Retz northnorthwest of Hollabrunn northnorthwest of Vienna in the eastern part of Austria where abt. 15 individuals in total and abt. 10 individuals have flown on 09.05.1996 – 15.05.1996 (HENSLE 2002e) and 25.05.2002 (HENSLE 2003), respectively, which has been around and between the decreasing half moon on 11.05.1996 between the full moon on 03.05.1996 and the new moon on 17.05.1996 as well as the new moon on 17.05.1996, and one day before the full moon on 26.05.2002, respectively; near Bédarieux northwest of Montpellier in the southeastern part of France where abt. 25 individuals in total have flown on 06.08.1997 – 10.08.1997 (HENSLE 2002f) which has been around and between the new moon on 03.08.1997 as well as the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997, near Le Bousquet-d´Orb north of Bédarieux northwest of Montpellier in the southeastern part of France where abt. 50 individuals in total have flown in the period of 19.06.1993 – 30.06.1993 (HENSLE 2002b) which has been around and between the new moon on 20.06.1993 and the full moon on 03.07.1993, and near Naturno eastsoutheast of Merano in Southern Tyrol in the northeastern part of Italy where more than 30 individuals have flown on 03.10.1997 – 04.10.1997 (HENSLE 2002f) which has been two and three days after the new moon on 01.10.1997.

Mass occurrences of large quantities of individuals of the Small Copper *Lycaena phlaeas* have also been registered near Sibbersdorf northeast of Eutin northnorthwest of Lübeck in the northwestern part of Germany, near Ringstedt south of Bederkesa eastnortheast of Bremerhaven in the northwestern part of Germany, near Kleinpöchlarn west of Melk in the Danube valley west of Vienna in the eastern part of Austria and near Knittelfeld in the Mur valley southwest of Leoben in the eastern part of Austria where abundant individuals each have flown in the period of 25.09.2003 – 03.10.2003 (HENSLE 2004a) which has been around and between the new moon on 26.09.2003 as well as the increasing half moon on 02.10.2003 between the new moon on 26.09.2003 and the full moon on 10.10.2003.

Significant quantities of individuals of the Large Copper *Lycaena dispar* HAWORTH 1803 (Lepidoptera: Lycaenidae) have been signaled from an unspecified locality in the southern part of the Palatinate Forest south to southeast of Pirmasens in the southwestern part of Germany where 5 individuals each have flown on 06.08.1997 (HASSELBACH 1999) and 05.08.2002 (HASSELBACH 2003) which has been three days after the new moon on 03.08.1997 and three days before the new moon on 08.08.2002, respectively.

Significant quantities of individuals of the Purple-Shot Copper *Lycaena alciphron* ROTTEMBURG 1775 (Lepidoptera: Lycaenidae) have been found in the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 5 individuals each have flown on 28.06.1994 and 11.07.1994 (HASSELBACH 1995a) which has been five days after the full moon on 23.06.1994 and two days after the new moon on 09.07.1994, respectively; and at an unspecified locality in the southwestern part of Germany where 5 individuals have flown on 09.07.1997 (HASSELBACH 1999) which has been five days after the new moon on 04.07.1997.

5.54 The Dark Green Fritillary *Argynnis aglaja and* the Niobe Fritillary *Argynnis niobe*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a single individual of the Dark Green Fritillary *Argynnis aglaja* LINNAEUS 1758 (Lepidoptera: Nymphalidae) or the Niobe Fritillary *Argynnis niobe* LINNAEUS 1758 (Lepidoptera: Nymphalidae) at the locality Walldorf in June 2007. Apart from this single indivi-

dual, I have up to now only seen occasionally a few single individuals of the Dark Green Fritillary *Argynnis aglaja* or the Niobe Fritillary *Argynnis niobe* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Dark Green Fritillary *Argynnis aglaja and* the Niobe Fritillary *Argynnis niobe* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Dark Green Fritillary *Argynnis aglaja* have been confirmed near the Rhein-Weser-Turm eastsoutheast of Kirchhundem northnortheast of Siegen in the northwestern part of Germany where more than 50 individuals have flown on 03.08.1968 (HARKORT & WEIGT 1969, HEINRICH LINKE in HARKORT & WEIGT 1969) which has been five days before the full moon on 08.08.1968; near Bad Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 5 individuals in total have flown on 07.08.1973 and 10.08.1973 (HANS-JOACHIM WEIGT in HARKORT 1976) which has been one day after the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973 as well as four days before the full moon on 14.08.1973, respectively; near Rennerod northeast of Westerburg in the northwestern part of Germany where 30 individuals have flown on 16.07.2007 (VIKTOR FIEBER in SCHUMACHER 2008a) which has been two days after the new moon on 14.07.2007, in the Wahner Heide east of Cologne in the Middle Rhine valley in the northwestern part of Germany where 10 individuals in total have flown in the period of 29.06.2009 – 13.07.2009 (WERNER FUNKEN in HANISCH 2009) which has been around and between the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009 as well as the decreasing half moon on 15.07.2009 between the full moon on 07.07.2009 and the new moon on 22.07.2009, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 15 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, around Welling east of Mayen in the southeastern part of the Eifel in the western part of Germany where 20 individuals have flown on 09.07.1992 (HERBERT GILGENBACH in HASSELBACH 1993) which has been one day after the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992; and near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals, 10 individuals and 20 individuals have flown on 10.07.1992, 30.06.1994 and 06.07.1994, respectively (BROSZKUS 1995), which has been four days before the full moon on 14.07.1992, two days before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and three days before the new moon on 09.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Niobe Fritillary *Argynnis niobe* have been noticed in Breinigerberg near Breinig southeast of Aachen in the northwestern part of Germany where 15 individuals have flown on 04.07.1993 (HILLIG in KINKLER 1994) which has been on the full moon on 04.07.1993, at the Schlangenberg near Breinig southeast of Aachen in the northwestern part of Germany where 15 individuals in total have flown on 24.07.2000 – 01.08.2000 (BERNHARD THEISSEN in SCHUMACHER 2001) which has been around and between the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000 as well as the new moon on 31.07.2000, in the vicinity of Stolberg east of Aachen in the northwestern part of Germany where more than 30 individuals have flown in July 2005 (D. LÜCK in SCHUMACHER 2006) which has been around and between the new moon on 06.07.2005 and the full moon on 21.07.2005;

and in the Wahner Heide east of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 10 individuals each have flown on 25.06.1961 and 17.06.1962 (HANISCH 2009) which has been three days before the full moon on 28.06.1961 and one day before the full moon on 18.06.1962, respectively.

5.55 The Small Pearl-Bordered Fritillary *Boloria selene,* the Pearl-Bordered Fritillary *Boloria euphrosyne* and the Violet Fritillary *Boloria dia*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Fritillary *Boloria* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Fritillary *Boloria* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Fritillary *Boloria* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Fritillary *Boloria* during my observations in the field. Some examples of mass occurrences of several species of the Fritillary *Boloria* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Small Pearl-Bordered Fritillary *Boloria selene* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Nymphalidae) have been noticed in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 20 individuals, abt. 40 individuals each and abt. 25 individuals have flown on 25.07.2003 (SCHUMACHER 2004a) as well as in the period of 15.05.2009 – 25.05.2009, on 01.08.2009 and on 04.08.2009 (HANISCH 2009), respectively, which has been four days before the new moon on 29.07.2003, around and between the decreasing half moon on 17.05.2009 between the full moon on 09.05.2009 and the new moon on 24.05.2009 as well as the new moon on 24.05.2009, and two and five days before the full moon on 06.08.2009, respectively; in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 15 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, near Benfe east of Netphen eastnortheast of Siegen in the northwestern part of Germany where abt. 15 – 20 individuals have flown on 19.06.1988 (ROLF TWARDELLA in FIEBER 1989) which has been five days after the new moon on 14.06.1988, in the Schwarzbach valley near Kirchhundem northnortheast of Siegen in the northwestern part of Germany where 80 individuals have flown on 02.07.2006 (KLAUS MEYER in SCHUMACHER 2007a) which has been one day before the increasing half moon on 03.07.2006 between the new moon on 25.06.2006 and the full moon on 11.07.2006, near Altenteich westsouthwest of Erndtebrück northeast of Siegen where 60 individuals have flown on 27.06.1992 (ARTUR FRANZ in FIEBER 1994) which has been three days before the new moon on 30.06.1992, near Lützel westsouthwest of Erndtebrück northeast of Siegen where abt. 20 – 30 individuals have flown on 08.07.1992 (ROLF TWARDELLA in FIEBER 1994) which has been on the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, and near Land´s End westsouthwest of Penzance west of Plymouth in the southwestern part of England where numerous individuals have flown on 23.05.1933 (ADKIN 1933) which has been one day before the new moon on 24.05.1933.

Significant quantities of individuals of the Pearl-Bordered Fritillary *Boloria euphrosyne* Linnaeus 1758 (Lepidoptera: Nymphalidae) have been encountered in the Urft valley near Nettersheim south-southwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 10 individuals have flown on 01.06.1991 (Kinkler & Hürter 1992) which has been four days after the full moon on 28.05.1991, in the Kammerforst around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where abundant individuals have flown on 21.05.1902 (Reichenau 1904) which has been one day before the full moon on 22.05.1902, and near Bad Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 5 individuals have flown on 27.05.1929 (Georg Kuhlmann in Harkort 1976) which has been four days after the full moon on 23.05.1929.

Mass occurrences of large quantities of individuals of the Violet Fritillary *Boloria dia* Linnaeus 1767 (Lepidoptera: Nymphalidae) have been described from Oberwesel southsoutheast of Koblenz in the Middle Rhine valley in the western part of Germany where 25 individuals have flown on 16.07.1994 – 17.07.1994 (Kinkler 1994) which has been one day before and on the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, and from an unspecified locality in the southwestern part of Germany where 50 individuals have flown on 08.08.1992 (Hasselbach 1993) which has been five days before the full moon on 13.08.1992.

5.56 The Glanville Fritillary *Melitaea cinxia,* the False Heath Fritillary *Melitaea diamina* and the Spotted Fritillary *Melitaea didyma*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Fritillary *Melitaea* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Fritillary *Melitaea* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Fritillary *Melitaea* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Fritillary *Melitaea* during my observations in the field. Some examples of mass occurrences of several species of the Fritillary *Melitaea* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Glanville Fritillary *Melitaea cinxia* Linnaeus 1758 (Lepidoptera: Nymphalidae) have been noticed near Dahlem northnortheast of Stadtkyll northwest of Daun in the northwestern part of the Eifel in the western part of Germany where more than 100 individuals in total have been encountered on 30.05.2004 and 05.06.2004 (Schumacher 2005a, Ralph Adam & Klaus Meyer in Schumacher 2005a) which has been four days before and two days after the full moon on 03.06.2004, respectively; around Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where more than 20 individuals in total have flown on 14.06.1980 – 15.06.1980 (Nippel 1980) which has been two and three days after the new moon on 12.06.1980; at unspecified localities in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 25 individuals, more than 30 individuals and abt. 30 individuals have flown on 22.05.1993,

24.05.1993 and 06.06.1993, respectively (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1994), which has been one and three days after the new moon on 21.05.1993, and two days after the full moon on 04.06.1993, respectively; near Kirn in the Nahe valley northeast of Idar-Oberstein in the southwestern part of Germany where abt. 10 individuals have flown on 01.06.2002 (Schumacher 2003) which has been two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and in the Königsforst east of Cologne in the Middle Rhine valley in the northwestern part of Germany where numerous individuals have flown on 23.05.1953 (Leo Ditgens in Kinkler, Schmitz & Nippel 1971) which has been five days before the full moon on 28.05.1953.

Mass occurrences of large quantities of individuals of the False Heath Fritillary *Melitaea diamina* Lang 1789 (Lepidoptera: Nymphalidae) have been confirmed near Kirn in the Nahe valley northeast of Idar-Oberstein in the southwestern part of Germany where abt. 20 individuals have flown on 01.06.2002 (Schumacher 2003) which has been two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 06.06.1998 (Hillig in Kinkler 1998) which has been four days before the full moon on 10.06.1998, near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 30.06.1994 (Broszkus 1995) which has been one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 10 individuals have flown on 29.05.1993 (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1994) which has been on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have flown on 11.06.1951 (Josef Pascher in Kinkler, Schmitz & Nippel 1971; Josef Pascher in Hanisch 2009) which has been two days before the increasing half moon on 13.06.1951 between the new moon on 04.06.1951 and the full moon on 19.06.1951.

Mass occurrences of large quantities of individuals of the Spotted Fritillary *Melitaea didyma* Esper 1779 (Lepidoptera: Nymphalidae) have been reported from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 16.06.1992 (Broszkus 1995) which has been one day after the full moon on 15.06.1992, from Kaub northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where 20 individuals have flown on 07.07.1995 (Kinkler 1996, Hans-Arnold Hürter & A. Schmidt in Kinkler 1996) which has been five days before the full moon on 12.07.1995; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals each, abt. 10 individuals, more than 5 individuals and abt. 10 individuals have flown on 24.07.1991, 10.08.1991 (Hans Kwiatkowski in Hasselbach 1992), 22.06.1992, 26.06.1992 (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1993) and 23.05.1993 (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1994), respectively, which has been two days before the full moon on 26.07.1991, on the new moon on 10.08.1991, two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, four days before the new moon on 30.06.1992 and two days after the new moon on 21.05.1993, respectively; from Valwig in the Moselle valley eastsoutheast of Cochem in the western part of Germany where abt. 10 individuals and 5 individuals have flown on 23.05.2008 (Heinz Stetzuhn in Bosselmann 2009) and 08.06.2008 (Helmut Arenz in Bosselmann 2009), respectively, which has been three days after the full moon on 20.05.2008 and five days after the new moon on 03.06.2008, respectively; from an unspecified locality in the Moselle valley in the western part of Germany where abt. 5 individuals and more than 5 individuals have flown on 15.05.2002 (Hasselbach 2003) and 13.06.2005

(HASSELBACH 2006), respectively, which has been three days after the new moon on 12.05.2002, and two days before the increasing half moon on 15.06.2005 between the new moon on 06.05.2005 and the full moon on 22.05.2005, respectively; and from Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been two days before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003.

5.57 The Heath Fritillary *Melitaea athalia* and the Nickerl´s Fritillary *Melitaea aurelia*

Mass occurrences of large quantities of individuals of the Heath Fritillary *Melitaea athalia* ROTTEMBURG 1775 (Lepidoptera: Nymphalidae) have been registered near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 15 individuals and 20 individuals have flown on 30.05.1992, 16.06.1992 and 05.06.1993, respectively (BROSZKUS 1995), which has been two days before the new moon on 01.06.1992, one day after the full moon on 15.06.1992 and one day after the full moon on 04.06.1993, respectively; in the vicinity of Kirchheim-Bolanden southwest of Alzey in the southwestern part of Germany where 10 individuals each and 100 individuals have flown on 23.05.1992, 18.06.1992 and 04.07.1992, respectively (RÜDIGER VIESSMANN in HASSELBACH 1993), which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, three days after the full moon on 15.06.1992 and four days after the new moon on 30.06.1992, respectively; near Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where masses of individuals and abundant individuals each have flown on 19.06.1896 as well as on 02.06.1880 and 17.06.1904, respectively (REICHENAU 1904), which has been one day after the increasing half moon on 18.06.1896 between the new moon on 11.06.1896 and the full moon on 25.06.1896, two days after the decreasing half moon on 31.05.1880 between the full moon on 24.05.1880 and the new moon on 08.06.1880, and four days before the new moon on 17.06.1904, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 30.06.1994 (BROSZKUS 1995) which has been one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, near Erbach north of Rheinböllen westnorthwest of Bingen in the western part of Germany where 40 individuals have been counted on 23.06.2001 (HELMUT KINKLER in SCHUMACHER 2002) which has been two days after the new moon on 21.06.2001; around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 10 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 20 individuals have flown on 09.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been five days after the full moon on 04.06.1993, around Welling east of Mayen in the southeastern part of the Eifel in the western part of Germany where 12 individuals have flown on 09.07.1992 (HERBERT GILGENBACH in HASSELBACH 1993) which has been one day after the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, near Haiger-Offdilln southeast of Siegen in the northwestern part of Germany where 7 individuals have flown on 18.07.2008 (H. SCHÄFER in SCHUMACHER 2009) which has been on the full moon on 18.07.2008, at the Obernau-Talsperre east of Netphen northeast of Siegen in the northwestern part of Germany where more than 5 individuals have flown on 10.06.2004 (VIKTOR FIEBER in SCHUMACHER 2006) which has been one day after the decreasing half moon on 09.06.2004 between the full moon on 03.06.2004 and the new moon on 17.06.2004, near Gernsdorf eastnortheast of Wilnsdorf eastsoutheast of Siegen in the northwestern part of Germany where 15 individuals have flown on 25.06.2006 (PETER FASEL in SCHUMACHER 2007a) which has been on the

new moon on 25.06.2006, and in theWahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals have flown on 29.05.1943 (JOSEF PASCHER in HANISCH 2009) which has been four days before the new moon on 02.06.1943.

Mass occurrences of large quantities of individuals of the Nickerl´s Fritillary *Melitaea aurelia* NICKERL 1850 (Lepidoptera: Nymphalidae) have been noted at the Biesberg near Muldenau westnorthwest of Embken eastsoutheast of Nideggen in the northwestern part of the Eifel in the western part of Germany where 10 individuals and abt. 100 individuals have flown on 20.06.1995 (KINKLER 1996) and 04.06.1998 (KINKLER 1998), respectively, which has been on the decreasing half moon on 20.06.1995 between the full moon on 13.06.1995 and the new moon on 27.06.1995, and one day after the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, respectively; in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals and 15 individuals have flown on 17.06.1990 (KINKLER 1990b) and 15.06.1992 (KINKLER & HÜRTER 1992), respectively, which has been on the decreasing half moon on 17.06.1990 between the full moon on 08.06.1990 and the new moon on 22.06.1990, and on the full moon on 15.06.1992, respectively; near Dahlem southwest of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 09.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been two days before the full moon on 11.07.2006; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals and 50 individuals have flown on 16.06.1992 and 05.06.1993, respectively (BROSZKUS 1995), which has been one day after the full moon on 15.06.1992 and one day after the full moon on 04.06.1993, respectively; and near Martinstein in the Nahe valley westnorthwest of Bad Sobernheim in the southwestern part of Germany where 5 individuals have flown on 14.06.1992 (BROSZKUS 1995) which has been one day before the full moon on 15.06.1992.

5.58 The Bog Fritillary *Boloria eunomia*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Fritillaries *Boloria, Brenthis* and *Euphydryas* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Fritillaries *Boloria, Brenthis* and *Euphydryas* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Fritillaries *Boloria, Brenthis* and *Euphydryas* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Fritillaries *Boloria, Brenthis* and *Euphydryas* during my observations in the field. Some examples of mass occurrences of several species of the Fritillaries *Boloria, Brenthis* and *Euphydryas* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Bog Fritillary *Boloria eunomia* ESPER 1799 (Lepidoptera: Nymphalidae) in the northwestern part of the Eifel in the western part of Germany have been noted near Rengen north of Daun where 50 individuals have flown on 16.06.1986

(FLESCH in KINKLER 1994) which has been on the increasing half moon on 16.06.1986 between the new moon on 07.06.1986 and the full moon on 22.06.1986; near Daun and in the Sangweiher near Schalkenmehren southsoutheast of Daun where 10 individuals and 15 individuals, respectively, have flown in June 1991 (FLESCH & WEBER in KINKLER 1994) which has been around and between the full moon on 28.05.1991, the new moon on 12.06.1991 and the full moon on 27.06.1991; in the Wirft valley near Stadtkyll northwest of Daun where abt. 20 individuals each have flown in June 1991 (WEBER in KINKLER 1994) as well as on 20.06.1998 and 15.06.1999 (WERNER KUNZ in KINKLER 2000) which has been around and between the full moon on 28.05.1991, the new moon on 12.06.1991 and the full moon on 27.06.1991, four days before the new moon on 24.06.1998 and two days after the new moon on 13.06.1999, respectively; in the Simmelbach valley near Dahlem northnortheast of Stadtkyll northwest of Daun where 10 individuals have flown on 15.06.1996 (HILLIG in KINKLER 2000) which has been one day before the new moon on 16.06.1996, in the Kaucherbach valley near Dahlem northnortheast of Stadtkyll northwest of Daun where 30 individuals have flown on 15.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been two days before the decreasing half moon on 17.07.2006 between the full moon on 11.07.2006 and the new moon on 24.07.2006, in the Nonnenbach valley near Blankenheim northnorthwest of Daun where 30 individuals have flown on 10.06.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been one day before the full moon on 11.06.2006, in the Kall valley near Simmerath northnortheast of Monschau where abt. 10 individuals have flown on 10.06.2008 (SCHUMACHER 2009) which has been on the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.06.2008, in the Perlenbach valley and the Fuhrtsbach valley near Monschau where 40 individuals have flown on 16.06.1997 (BERNHARD THEISSEN in SCHUMACHER 2001) which has been four days before the full moon on 20.06.1997, at an unspecified locality in the vicinity of Mayen in the southeastern part of the Eifel where abt. 5 individuals have flown on 13.06.1992 (JÜRGEN BOSSELMANN & CHRISTIAN DIETZEN in HASSELBACH 1993) which has been two days before the full moon on 15.06.1992; and near Erbach north of Rheinböllen in the eastern part of the Hunsrück westnorthwest of Bingen where abt. 5 individuals and abt. 200 individuals have been encountered on 02.06.2000 (J. BEGER in SCHUMACHER 2003) and 01.06.2002 (SCHUMACHER 2003), respectively, which has been on the new moon on 02.06.2000 as well as two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

5.59 The Cranberry Fritillary *Boloria aquilonaris*

Mass occurrences of large quantities of individuals of the Cranberry Fritillary *Boloria aquilonaris* STICHEL 1908 (Lepidoptera: Nymphalidae) have been found in the vicinity of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 40 individuals have flown on 13.07.2005 (JOCHEN RODENKIRCHEN in SCHUMACHER 2006) which has been one day before the increasing half moon on 14.07.2005 between the new moon on 06.07.2005 and the full moon on 21.07.2005, and near Strohn southsoutheast of Daun in the southwestern part of the Eifel in the western part of Germany where more than 150 individuals have flown on 14.06.2003 (SCHUMACHER 2004a) which has been on the full moon on 14.06.2003.

Significant quantities of individuals of the Cranberry Fritillary *Boloria aquilonaris* have also been identified in Morbach-Rehbruch northwest of Idar-Oberstein in the central part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 27.06.1990 (WALTER BROSZKUS & PETER FÖHST in KINKLER 1990b) which has been five days after the new moon on 22.06.1990, and in Kallbenden in the Kall valley near Konzen north of Monschau in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 20.06.2000 (BERNHARD THEISSEN in SCHUMACHER 2001) which has been three days after the full moon on 17.06.2000.

5.60 The Lesser Marbled Fritillary *Brenthis ino*

Mass occurrences of large quantities of individuals of the Lesser Marbled Fritillary *Brenthis ino* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Nymphalidae) have been registered near the Rhein-Weser-Turm eastsoutheast of Kirchhundem northnortheast of Siegen in the northwestern part of Germany where more than 20 individuals have flown on 03.08.1968 (HARKORT & WEIGT 1969, HEINRICH LINKE in HARKORT & WEIGT 1969) which has been five days before the full moon on 08.08.1968; near Deuz and Irmgarteichen east of Siegen in the northwestern part of Germany where 10 individuals and 20 individuals in total have flown on 24.06.1974 as well as on 17.06.1974 and 24.06.1974, respectively (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976), which has been three days before and four days after the new moon on 20.06.1974, respectively; near Netphen-Schellenbach eastnortheast of Siegen in the northwestern part of Germany where abt. 30 – 40 individuals have flown on 02.07.1992 (ROLF TWARDELLA in FIEBER 1994) which has been two days after the new moon on 30.06.1992, in the Roßbach valley near Windeck-Roßbach in the Sieg valley eastnortheast of Wissen eastsoutheast of Siegen in the northwestern part of Germany where more than 50 individuals have flown on 26.06.2008 (SCHUMACHER 2009) which has been on the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, in the Elsebachtal near Ergste southsouthwest of Schwerte southsouthwest of Dortmund in the northwestern part of Germany where 7 individuals in total have flown in the period of 06.07.1958 – 12.07.1958 (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976) which has been around and between the full moon on 01.07.1958 and the new moon on 16.07.1958, in the Eifgenbachtal between Burscheid and Wermelskirchen northeast of Leverkusen in the northwestern part of Germany where abt. 10 individuals have flown on 25.06.2008 (KARL-HEINZ JELINEK in SCHUMACHER 2009) which has been one day before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, in the Naafbachtal southeast of Overath east of Cologne in the northwestern part of Germany where more than 15 individuals have flown on 18.06.1996 (SCHÖPWINKEL 1997) which has been two days after the new moon on 16.06.1996; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals and 15 individuals each have flown on 10.07.1992, 30.06.1994 and 06.07.1994, respectively (BROSZKUS 1995), which has been four days before the full moon on 14.07.1992, one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and three days before the new moon on 09.07.1994, respectively; and at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 10 individuals have flown on 09.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been five days after the full moon on 04.06.1993.

5.61 The Marsh Fritillary *Euphydryas aurinia*

Mass occurrences of large quantities of individuals of the Marsh Fritillary *Euphydryas aurinia* ROTTEMBURG 1775 (Lepidoptera: Nymphalidae) have been found at the Fuchskaute eastsoutheast of Willingen eastnortheast of Bad Marienberg in the Westerwald in the northwestern part of Germany where 50 individuals have flown on 28.05.1995 (HILLIG in KINKLER 1996) which has been one day before the new moon on 29.05.1995, in the Röspe valley between Erndtebrück and Röspe north of Erndtebrück southeast of Siegen in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1969 (HANS-JOACHIM WEIGT in HARKORT 1971) which has been two days before the new moon on 14.07.1969; and near Alendorf southsouthwest of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 40 individuals have flown on 15.06.1986 (M. DERRA in SCHUMACHER 2001) which has been one day before the increasing half moon on 16.06.1986 between the new moon on 07.06.1986 and the full moon on

22.06.1986, 20 individuals have flown on 05.07.1987 (M. DERRA in SCHUMACHER 2001) which has been on the increasing half moon on 05.07.1987 between the new moon on 26.06.1987 and the full moon on 11.07.1987, and 10 individuals have flown on 27.05.1989 (M. DERRA in SCHUMACHER 2001) which has been two days before the decreasing half moon on 29.05.1989 between the full moon on 20.05.1989 and the new moon on 03.06.1989.

5.62 The Duke of Burgundy Fritillary *Hamearis lucina*

During my entomological observations, I have so far not discovered any individuals of the Duke of Burgundy Fritillary *Hamearis lucina* LINNAEUS 1758 (Lepidoptera: Nemeobiidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe. Some examples of mass occurrences of the Duke of Burgundy Fritillary *Hamearis lucina* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Duke of Burgundy Fritillary *Hamearis lucina* have been observed in the region around Lichtenstein southsoutheast of Reutlingen in the southwestern part of Germany where several hundreds of individuals have been present on 30.05.1937 (SCHNEIDER 1937) which has been five days after the full moon on 25.05.1937; near Nettersheim in the Urft valley south of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 19.05.1990 (KINKLER & HÜRTER 1992) and 15 individuals have flown on 17.05.1998 (KINKLER 1998) which has been five days before the new moon on 24.05.1990 as well as three days before the decreasing half moon on 20.05.1998 between the full moon on 11.05.1998 and the new moon on 25.05.1998, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 09.05.1993 (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 06.05.1993, around Loreley and Bornich southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where abt. 10 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals each and more than 10 individuals have flown on 23.05.1991 (HANS KWIATKOWSKI in HASSELBACH 1992), 05.05.1992 and 13.05.1992 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1993), respectively, which has been five days before the full moon on 28.05.1991, three days after the new moon on 02.05.1992 and two days before the full moon on 15.06.1992, respectively; near Westernohe eastnortheast of Westerburg in the Westerwald in the northwestern part of Germany where abt. 5 individuals have flown on 22.05.2006 (RAINER ROTH in SCHUMACHER 2007a) which has been five days before the new moon on 27.05.2006, and near Amdorf west of Herborn in the northwestern part of Germany where abt. 5 individuals have flown on 06.05.2007 (SCHUMACHER 2008a) which has been four days after the full moon on 02.05.2007.

5.63 The Meadow Brown *Maniola jurtina*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Meadow Brown *Maniola jurtina* LINNAEUS 1758 (Lepidoptera: Satyridae) among the community of the background brown butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Meadow Brown *Maniola jurtina* which would permit a selenocyclical evaluation of its population dynamics, which is certainly in considerable degree the result of my only accessory monitoring

of the background brown butterflies including apart from the Meadow Brown *Maniola jurtina* also the Speckled Wood *Pararge aegeria,* the Wall Brown *Lasiommata megera,* the Grayling *Hipparchia semele,* the Gatekeeper *Pyronia tithonus*, the Pearly Heath *Coenonympha arcania*, the Small Heath *Coenonympha pamphilus* and the Ringlet *Aphantopus hyperantus,* and therefore my own observations of the distribution of the Meadow Brown *Maniola jurtina* are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Meadow Brown *Maniola jurtina* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Meadow Brown *Maniola jurtina* have been recognized in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 28.07.1990 (KINKLER & HÜRTER 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, near Lichtenhagen northwest of Schermbeck east-northeast of Wesel in the northwestern part of Germany where 150 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, near the district Dellbrück at the eastern margin and in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 22.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the full moon on 22.07.1994; in the districts Niehl and Riehl at the northern margin and near the district Sürth at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured daily on 01.07.1993, 07.07.1993 – 08.07.1993 and 07.07.1992, respectively (WIPKING, FORST, KUHNA & SCHMITZ 1996), which has been three days before and three to four days after the full moon on 04.07.1993, and one day before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, respectively; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 15 individuals and abt. 30 individuals have flown on 28.07.1991 and 03.08.1991, respectively (HANS KWIATKOWSKI in HASSELBACH 1992), which has been two days after the full moon on 26.07.1991 as well as one day before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, respectively; around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 15 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 – 30 individuals each have flown on 22.06.1992, 28.06.1992, 16.07.1992, 02.07.1993 and 02.07.1994 (BROSZKUS 1995) which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, two days before the new moon on 30.06.1992, two days after the full moon on 14.07.1992, two days before the full moon on 04.07.1993, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 20 – 30 individuals each have flown on 10.07.1992, 28.06.1994, 30.06.1994 and 06.07.1994; 75 individuals have flown on 03.07.1994, 40 individuals each have flown on

10.07.1994 and 11.07.1994, and 15 individuals have flown on 24.07.1994 (Broszkus 1995, S. Jouaux in Broszkus 1995) which has been four days before the full moon on 14.07.1992, one and three days before as well as two and five days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, one and two days after the new moon on 09.07.1994, and two days after the full moon on 22.07.1994, respectively; and around Graben-Neudorf westnorthwest of Bruchsal in the middle part of the Upper Rhine valley in the southwestern part of Germany where abundant individuals have flown on 13.07.1919 (Gremminger 1925) which has been on the full moon on 13.07.1919.

5.64 The Gatekeeper *Pyronia tithonus*

Mass occurrences of large quantities of individuals of the Gatekeeper *Pyronia tithonus* Linnaeus 1771 (Lepidoptera: Satyridae) have been mentioned from the Hartshoper Moor near Sophienhamm west of Rendsburg in the northwestern part of Germany where abt. 5 individuals have been captured on 25.07.1914 (J. Mahrt in Warnecke 1955) which has been two days after the new moon on 23.07.1914; from the Teverener Heide north of Teveren southwest of Geilenkirchen north of Aachen in the northwestern part of Germany where abt.150 individuals and abt. 350 individuals have flown on 20.07.2002 (Peter Barwinski in Schumacher 2003) and 24.07.2004 (Peter Barwinski in Schumacher 2005a), respectively, which has been four days before the full moon on 24.07.2002 as well as one day before the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004, respectively; from Übach-Palenberg northnortheast of Aachen in the northwestern part of Germany where abt. 150 individuals have flown on 28.07.2004 (Peter Barwinski in Schumacher 2005a) which has been three days before the full moon on 31.07.2004; from Garsdorf southwest of Grevenbroich southwest of Düsseldorf in the northwestern part of Germany where up to 40 individuals daily have flown in the period of 15.07.2001 – 23.08.2001 (Kunz 2002) which has been around and between the new moon on 20.07.2001, the full moon on 04.08.2001 and the new moon on 19.08.2001; from theWahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where masses of individuals and abundant individuals have flown on 03.07.1932 and 22.07.1960, respectively (Ditgens in Helmut Kinkler in Hanisch 2009) which has been on the new moon on 03.07.1932 and one day before the new moon on 23.07.1960, respectively; from Drove south of Düren in the Rur valley in the northwestern part of the Eifel in the western part of Germany where abt. 100 individuals have flown on 25.08.1996 (Kinkler 1997) which has been three days before the full moon on 28.08.1996; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 25 individuals, 10 individuals, more than 15 individuals and abt. 25 individuals have flown on 15.08.1991 (Hans Kwiatkowski in Hasselbach 1992), 15.07.1992, 11.08.1992 and 18.08.1992 (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1993), respectively, which has been five days after the new moon on 10.08.1991, one day after the full moon on 14.07.1992, and two days before and five days after the full moon on 13.08.1992, respectively; from Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where abt. 10 individuals in total have flown on 14.06.1980 – 15.06.1980 (Nippel 1980) which has been two and three days after the new moon on 12.06.1980; from Bad Sobernheim and Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals each have flown on 16.07.1992 (Broszkus 1995) and 04.07.1993 (S. Jouaux in Broszkus 1995), respectively, which has been two days after the full moon on 14.07.1992 and on the full moon on 04.07.1993, respectively; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 500 individuals have flown on 24.07.2004 (Schumacher 2005a) which has been one day before the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004; and from un-

specified localities in the southwestern part of Germany where 10 individuals and 100 individuals have flown on 22.07.1992 and 08.08.1992 (HASSELBACH 1993) which has been one day before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, and five days before the full moon on 13.08.1992, respectively.

5.65 The Speckled Wood *Pararge aegeria*

Mass occurrences of large quantities of individuals of the Speckled Wood *Pararge aegeria* LINNAEUS 1758 (Lepidoptera: Satyridae) have been recognized in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 19.05.1990 (KINKLER & HÜRTER 1992) which has been five days before the new moon on 24.05.1990, in the Wenigerbachtal southeast of Overath east of Cologne in the northwestern part of Germany where abt. 10 individuals have flown on 26.07.1996 (SCHÖPWINKEL 1997) which has been four days before the full moon on 30.07.1996, near Kerpen westsouthwest of Cologne in the northwestern part of Germany where abt. 5 individuals have flown on 01.04.1990 (JELINEK 2006) which has been two days before the increasing half moon on 03.04.1990 between the new moon on 26.03.1990 and the full moon on 10.04.1990, near Remagen in the Middle Rhine valley southsoutheast of Bonn where more than 5 individuals have flown on 06.05.2008 (HEINZ STETZUHN in BOSSELMANN 2009) which has been one day after the new moon on 05.05.2008, and in Wüstseifen near Hahnhof southsouthwest of Niederfischbach west of Siegen in the northwestern part of Germany where abt. 10 individuals have flown on 17.08.1997 (FIEBER 1998) which has been one day before the full moon on 18.08.1997.

5.66 The Pearly Heath *Coenonympha arcania*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Pearly Heath *Coenonympha arcania* LINNAEUS 1761 (Lepidoptera: Satyridae) and the Small Heath *Coenonympha pamphilus* LINNAEUS 1758 (Lepidoptera: Satyridae) among the community of the background brown butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Pearly Heath *Coenonympha arcania* and the Small Heath *Coenonympha pamphilus* which would permit a selenocyclical evaluation of its population dynamics, which is certainly in considerable degree the result of my only accessory monitoring of the background brown butterflies including apart from the Pearly Heath *Coenonympha arcania* and the Small Heath *Coenonympha pamphilus* also the Meadow Brown *Maniola jurtina,* the Speckled Wood *Pararge aegeria,* the Wall Brown *Lasiommata megera,* the Grayling *Hipparchia semele,* the Gatekeeper *Pyronia tithonus* and the Ringlet *Aphantopus hyperantus,* and therefore my own observations of the distribution of the Pearly Heath *Coenonympha arcania* and the Small Heath *Coenonympha pamphilus* are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Pearly Heath *Coenonympha arcania,* the Small Heath *Coenonympha pamphilus* and the Large Heath *Coenonympha tullia* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Pearly Heath *Coenonympha arcania* have been registered at the Süselberg near Niederndorf south of Freudenberg west of Siegen in the northwestern part of Germany where abt. 80 – 100 individuals have been observed on 19.06.1988 (FIEBER 1989) which has been five days after the new moon on 14.06.1988, abt. 20 – 25 individuals have been recorded on 19.06.1989 (FIEBER 1991a) which has been on the full moon on 19.06.1989; abt.

25 – 30 individuals and abt. 45 – 50 individuals have been counted on 23.05.1990 and 01.06.1990, respectively (FIEBER 1991b), which has been one day before the new moon on 24.05.1990 as well as on the increasing half moon on 01.06.1990 between the new moon on 24.05.1990 and the full moon on 08.06.1990, respectively; abt. 20 – 25 individuals have been confirmed on 02.07.1991 (FIEBER 1992) which has been five days after the full moon on 27.06.1991, and abt. 20 – 30 individuals have been noted on 07.06.1992 (CHRISTIAN ANTON in FIEBER 1994) which has been one day before the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992.

Mass occurrences of the Pearly Heath *Coenonympha arcania* have also been mentioned from the Hohe Meile near Lübeck in the northwestern part of Germany where very abundant individuals have flown on 27.06.1943 (W. WOLF in WARNECKE 1955) which has been five days before the new moon on 02.07.1943, from the Bannauer Moor north of Gudow east of Hamburg in the northwestern part of Germany where abundant individuals have flown on 31.05.1953 (P. KLÜSS in WARNECKE 1955) which has been three days after the full moon on 28.05.1953, from Neunkirchen south of Siegen in the northwestern part of Germany where abt. 30 – 40 individuals have flown on 17.06.1992 (ROLF TWARDELLA in FIEBER 1994) which has been two days after the full moon on 15.06.1992, from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 30 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 23.07.1980 (KINKLER 1987) which has been four days before the full moon on 27.07.1980; and from the Helingsbach valley near Dreiborn westnorthwest of Schleiden westsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 30 individuals have been observed in the period of 25.05.2007 – 19.06.2007 (JOHN in SCHUMACHER 2008a) which has been around and between the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and the increasing half moon on 22.06.2007 between the new moon on 15.06.2007 and the full moon on 30.06.2007.

Mass occurrences of the Pearly Heath *Coenonympha arcania* have also been signaled from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals, 10 individuals and 20 individuals have flown on 10.07.1992, 30.06.1994 (BROSZKUS 1995) and 03.07.1994 (S. JOUAUX in BROSZKUS 1995), respectively, which has been four days before the full moon on 14.07.1992, and two days before and two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; from Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 06.07.1879, 08.06.1880, 23.06.1881, 07.07.1901, 30.06.1903 and 20.06.1904 (REICHENAU 1904) which has been two days after the full moon on 04.07.1879, on the new moon on 08.06.1880, three days before the new moon on 26.06.1881, three days before the decreasing half moon on 10.07.1901 between the full moon on 01.07.1901 and the new moon on 16.07.1901, five days after the new moon on 25.06.1903, and one day before the increasing half moon on 21.06.1904 between the new moon on 13.06.1904 and the full moon on 27.06.1904, respectively; and from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 100 individuals as well as 10 individuals each have flown on 05.06.1993 as well as on 30.05.1992, 22.06.1992 and 02.07.1994, respectively (BROSZKUS 1995), which has been two days before the new moon on 01.06.1992, two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, one day after the full moon on 04.06.1993 and two days before the full moon on 04.07.1994, respectively.

5.67 The Small Heath *Coenonympha pamphilus,* the Large Heath *Coenonympha tullia* and the Chestnut Heath *Coenonympha glycerion*

Mass occurrences of large quantities of individuals of the Small Heath *Coenonympha pamphilus* LINNAEUS 1758 (Lepidoptera: Satyridae) have been recognized near Zeiskam eastnortheast of Landau in der Pfalz in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 20 individuals have flown in the period of 04.08.2002 – 10.08.2002 (KLAUS WEISS in HASSELBACH 2003) which has been around the new moon on 08.08.2002; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals each have flown on 16.06.1992 and 05.06.1993 as well as 10 – 15 individuals each have flown on 30.05.1992, 22.06.1992, 18.05.1993 and 02.07.1994, respectively (BROSZKUS 1995), which has been two days before the new moon on 01.06.1992, one day after the full moon on 15.06.1992, two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, three days before the new moon on 21.05.1993, one day after the full moon on 04.06.1993, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; and in the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 15 individuals have flown on 20.05.1991 (HASSELBACH 1992) which has been one day before the increasing half moon on 21.05.1991 between the new moon on 14.05.1991 and the full moon on 28.05.1991.

Mass occurrences of large quantities of individuals of the Small Heath *Coenonympha pamphilus* have also been observed near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals each have flown on 30.06.1994 and 02.08.1994 (BROSZKUS 1995) which has been one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and five days before new moon on 07.08.1994, respectively; in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 30 individuals have flown on 11.05.2008 (HANISCH 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008, and in the Sythener Hochmoor near Sythen northeast of Haltern north of Recklinghausen in the northwestern part of Germany where abundant individuals have flown on 21.06.1947 (ZIELASKOWSKI 1951, FUST in ZIELASKOWSKI 1951) which has been two days after the new moon on 19.06.1947.

Significant quantities of individuals of the Large Heath *Coenonympha tullia* (MÜLLER 1764) (Lepidoptera: Satyridae) have been identified in the Neustädter Moor northwest of Ströhen eastsoutheast of Diepholz southeast of Vechta in the northwestern part of Germany where 5 individuals have flown on 01.07.1992 (HINZ in KINKLER 1993) which has been one day after the new moon on 30.06.1992.

Significant quantities of individuals of the Chestnut Heath *Coenonympha glycerion* BORKHAUSEN 1788 (Lepidoptera: Satyridae) have been encountered near Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 15.07.1876, 22.07.1877, 06.07.1879, 23.06.1881 and 04.07.1904 (REICHENAU 1904) which has been on the decreasing half moon on 15.07.1876 between the full moon on 06.07.1876 and the new moon on 21.07.1876, three days before the full moon on 25.07.1877, two days after the full moon on 04.07.1879, three days before the new moon on 26.06.1881, and two days before the decreasing half moon on 06.07.1904 between the full moon on 27.06.1904 and the new moon on 13.07.1904, respectively; and at the Hohe Meile near Lübeck in the northwestern part of Germany where very abundant individuals have flown on 27.06.1943 (W. WOLF in WARNECKE 1955) which has been five days before the new moon on 02.07.1943.

5.68 The Great Banded Grayling *Brintesia circe,* the Woodland Grayling *Hipparchia fagi,* the Rock Grayling *Hipparchia alcyone* and the Hermit *Chazara briseis*

During my entomological observations, I have so far not discovered any individuals of the Great Banded Grayling *Brintesia circe* FABRICIUS 1775 (Lepidoptera: Satyridae), the Woodland Grayling *Hipparchia fagi* (SCOPOLI 1763) (Lepidoptera: Satyridae), the Rock Grayling *Hipparchia alcyone* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Satyridae) and the Hermit *Chazara briseis* LINNAEUS 1764 (Lepidoptera: Satyridae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe. Some examples of mass occurrences of the Great Banded Grayling *Brintesia circe,* the Woodland Grayling *Hipparchia fagi*, the Rock Grayling *Hipparchia alcyone* and the Hermit *Chazara briseis* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Great Banded Grayling *Brintesia circe* have been confirmed near Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where more than 50 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been two days before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003; in the vicinity of Fischbach southwest of Dahn southeast of Pirmasens in the Palatinate Forest in the southwestern part of Germany where abt. 10 individuals in total have flown on 03.07.2005 and 09.07.2005 (UWE EISENBERG in HASSELBACH 2006) which has been three days before and three days after the new moon on 06.07.2005, respectively; and near Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 5 individuals each have flown on 06.08.1994 (HASSELBACH 1995a) and 17.07.1997 (HASSELBACH 1997) which has been one day before the new moon on 07.08.1994 and five days before the full moon on 22.07.1997, respectively.

Significant quantities of individuals of the Woodland Grayling *Hipparchia fagi* have been encountered near Sankt Goarshausen in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where abundant individuals have flown on 19.07.1894 (BASTELBERGER in REICHENAU 1904) which has been two days after the full moon on 17.07.1894.

Significant quantities of individuals of the Rock Grayling *Hipparchia alcyone* have been found in the Nahe valley in the vicinity of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals and 7 individuals have flown on 27.06.2003 and 04.07.2003, respectively (HASSELBACH 2004), which has been two days before and five days after the new moon on 29.06.2003, respectively.

Mass occurrences of large quantities of individuals of the Hermit *Chazara briseis* have been confirmed near Röpzig south of Halle in the Saale valley in the northeastern part of Germany where hundreds of individuals have flown on 07.08.1927 (BANDERMANN 1927a) which has been one day after the increasing half moon on 06.08.1927 between the new moon on 28.07.1927 and the full moon on 13.08.1927, and near Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 15.07.1992 (OLIVER SCHMITZ in KINKLER 1993) which has been one day after the full moon on 14.07.1992.

5.69 The Scotch Argus *Erebia aethiops,* the Arran Brown *Erebia ligea* and the Woodland Ringlet *Erebia medusa*

During my entomological observations at localities in the surroundings of Heidelberg and Mann-

heim, I have so far not discovered any individuals of the Arran Brown *Erebia ligea* LINNAEUS 1758 (Lepidoptera: Satyridae) or the Woodland Ringlet *Erebia medusa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Satyridae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. I have up to now only seen occasionally a few single or some scattered individuals of the Arran Brown *Erebia ligea* or the Woodland Ringlet *Erebia medusa* in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Morbach in the Hunsrück in 1972 and in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982. In addition, I have not determined the species of the Arran Brown *Erebia ligea* or the Woodland Ringlet *Erebia medusa* during my observations in the field. Some examples of mass occurrences of the Scotch Argus *Erebia aethiops,* the Arran Brown *Erebia ligea* and the Woodland Ringlet *Erebia medusa* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Scotch Argus *Erebia aethiops* ESPER 1777 (Lepidoptera: Satyridae) have been recognized in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 200 individuals have flown on 28.07.1990 (KINKLER & HÜRTER 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990; around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where abundant individuals have flown on 13.08.1876, 16.08.1879, 06.08.1880, 18.08.1891 and 14.08.1892 (REICHENAU 1904) which has been on the decreasing half moon on 13.08.1876 between the full moon on 05.08.1876 and the new moon on 19.08.1876, one day before the full moon on 17.08.1879, on the full moon on 06.08.1880, two days before the full moon on 20.08.1891, and two days before the decreasing half moon on 16.08.1892 between the full moon on 08.08.1892 and the new moon on 22.08.1892, respectively; at an unspecified locality in the southwestern part of Germany where 15 individuals have flown on 08.08.1992 (HASSELBACH 1993) which has been five days before the full moon on 13.08.1992, and near Satzung eastsoutheast of Annaberg-Buchholz in the northeastern part of Germany where abundant individuals have flown in the period of 07.07.1986 – 19.07.1986 (SAEMANN 1992) which has been around and between the new moon on 07.07.1986 and the full moon on 21.07.1986.

Mass occurrences of large quantities of individuals of the Arran Brown *Erebia ligea* have been registered in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 30 individuals each have flown on 21.07.1992 (KINKLER & HÜRTER 1992) and 24.07.2004 (U. FLESCH in SCHUMACHER 2005a) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992 as well as one day before the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004, respectively; near Brilon in the northwestern part of Germany where 7 individuals have flown on 11.08.1926 (H. HEDDERGOTT in HARKORT & WEIGT 1969) which has been three days after the new moon on 08.08.1926, in the Dornbruch near Olpe northnorthwest of Siegen in the northwestern part of Germany where very abundant individuals have flown on 14.07.1957 (MARTIN JUNG in HARKORT 1976) which has been two days after the full moon on 12.07.1957, near Sassmannshausen northwest of Bad Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 200 individuals have flown on 10.08.1973 (HANS-JOACHIM WEIGT in HARKORT 1976) which has been four days before the full moon on 14.08.1973, and near Satzung eastsoutheast of Annaberg-Buchholz in the northeastern part of Germany where several hundreds of individuals daily have flown on 05.08.1991 – 06.08.1991 (SAEMANN 1992) which has been four to five days before the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Woodland Ringlet *Erebia medusa* have

been noticed near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals and 10 individuals have flown on 30.05.1992 and 18.05.1993, respectively (Broszkus 1995), which has been two days before the new moon on 01.06.1992 and three days before the new moon on 21.05.1993, respectively; near Idar-Oberstein in the Nahe valley in the southwestern part of Germany where 5 individuals have flown on 03.05.2005 (Hasselbach 2006) which has been five days before the new moon on 08.05.2005, near Erbach north of Rheinböllen westnorthwest of Bingen in the western part of Germany where abt. 80 individuals have flown on 01.06.2002 (Schumacher 2003) which has been two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002; at unspecified localities in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 10 individuals and abt. 30 individuals have flown on 16.05.1993 and 22.05.1993, respectively (Hans Kwiatkowski & Irene Kwiatkowski in Hasselbach 1994), which has been five days before and one day after the new moon on 21.05.1993, respectively; in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 19.05.1990 (Kinkler & Hürter 1992) which has been five days before the new moon on 24.05.1990, near Irmgarteichen east of Siegen in the northwestern part of Germany where 30 individuals have flown on 06.06.1974 (Harkort 1976, Hans-Joachim Weigt in Harkort 1976) which has been one day after the full moon on 05.06.1974, near Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 100 individuals have flown on 17.06.1974 (Hans-Joachim Weigt in Harkort 1976) which has been three days before the new moon on 20.06.1974, and in the Ville forest in the vicinity of Erftstadt southsouthwest of Cologne in the northwestern part of Germany where masses of individuals have flown on 28.05.1964 (Helmut Kinkler in Jelinek 2006) which has been two days after the full moon on 26.05.1964.

5.70 The Scarce Copper *Lycaena virgaureae* and the Sooty Copper *Lycaena tityrus*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Scarce Copper *Lycaena virgaureae* (Linnaeus) 1758 (Lepidoptera: Lycaenidae) at the localities Nußloch, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Scarce Copper *Lycaena virgaureae* in the vicinity of Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley in the western part of Germany between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Scarce Copper *Lycaena virgaureae* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007 – 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Scarce Copper *Lycaena virgaureae* and the Sooty Copper *Lycaena tityrus* (Poda 1761) (Lepidoptera: Lycaenidae) are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Scarce Copper *Lycaena virgaureae* have been noticed in the Hardtwald north of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany where 180 individuals have been captured on 04.07.1920 (Karl Strobel in Ebert & Rennwald 1993) and very abundant individuals have flown on 24.07.1900 (M. Daub in Ebert & Rennwald 1993) which has been three days after the full moon on 01.07.1920 and two days before the new moon on 26.07.1900, respectively; at an unspecified locality in the south-

western part of Germany where abt. 25 individuals and abt. 15 individuals have flown on 31.07.1978 (A. NOWOSAD in EBERT & RENNWALD 1993) and 09.07.1997 (HASSELBACH 1999), respectively, which has been four days before the new moon on 04.08.1978 and five days after the new moon on 04.07.1997, respectively; in the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where more than 5 individuals and more than 20 individuals have flown on 07.08.1993 (HASSELBACH 1994) and 11.07.1994 (HASSELBACH 1995a) which has been five days after the full moon on 02.08.1993 and two days after the new moon on 09.07.1994, respectively; in the Trupbacher Heide near Trupbach west of Siegen in the Sieg valley in the northwestern part of Germany where 25 individuals have flown on 03.07.2005 (VIKTOR FIEBER in SCHUMACHER 2006) which has been two days after the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005, at the Hohe Bracht near Oberhundem east of Kirchhundem northnortheast of Siegen in the northwestern part of Germany where 25 individuals have flown on 01.08.1999 (KLAUS MEYER in SCHUMACHER 2001) which has been four days after the full moon on 28.07.1999, at the Fuchskaute eastsoutheast of Willingen west of Herborn in the northwestern part of Germany where 10 individuals have flown on 18.07.1999 (B. NIEMEYER & SIGBERT WAGENER in SCHUMACHER 2001) which has been five days after the new moon on 13.07.1999, near Stimmstamm northnortheast of Meschede west of Brilon in the northwestern part of Germany where more than 5 individuals have flown on 03.08.1974 (ADOLF BENNEWITZ in HARKORT 1976) which has been on the full moon on 03.08.1974, near Wenholthausen southwest of Meschede westsouthwest of Brilon in the northwestern part of Germany where 50 individuals have flown on 30.07.1938 (HILLMANN in HARKORT 1976) which has been three days after the new moon on 27.07.1938, near Valbert west of Attendorn southeast of Lüdenscheid in the northwestern part of Germany where 10 individuals have flown on 02.08.1970 (HANS-JOACHIM WEIGT in HARKORT 1976) which has been on the new moon on 02.08.1970; near Bad Laasphe and Sassmannshausen northwest of Bad Laasphe in the Lahn valley eastnortheast of Siegen in the northwestern part of Germany where 7 individuals and 30 individuals have flown on 09.08.1973 and 10.08.1973, respectively (HANS-JOACHIM WEIGT in HARKORT 1976), which has been five and four days before the full moon on 14.08.1973, respectively; and near Satzung eastsoutheast of Annaberg-Buchholz in the northeastern part of Germany where abundant individuals daily have flown on 05.08.1991 – 06.08.1991 (SAEMANN 1992) which has been four to five days before the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Sooty Copper *Lycaena tityrus* have been found in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals, abt. 10 individuals, abt. 20 individuals and more than 5 individuals have flown on 24.05.2009, in the period of 12.07.2009 – 22.07.2009, on 24.07.2009 and on 01.08.2009, respectively (HANISCH 2009), which has been on the new moon on 24.05.2009, around and between the decreasing half moon on 15.07.2009 between the full moon on 07.07.2009 and the new moon on 22.07.2009 as well as the new moon on 22.07.2009, two days after the new moon on 22.07.2009, and five days before the full moon on 06.08.2009, respectively; at the Süselberg near Niederndorf south of Freudenberg west of Siegen in the northwestern part of Germany where abt. 50 individuals have been observed on 30.07.1989 (FIEBER 1991a) which has been two days before the new moon on 01.08.1989; and abt. 10 individuals each have flown on 19.05.1990 and 23.05.1990 (FIEBER 1991b) which has been five days and one day before the new moon on 24.05.1990, respectively; near Kreuztal-Fellinghausen north of Siegen where abt. 10 individuals have flown on 09.08.1992 (ROLF TWARDELLA in FIEBER 1994) which has been four days before the full moon on 13.08.1992; in the Naafbachtal southeast of Overath east of Cologne in the northwestern part of Germany where abt. 10 individuals each have flown on 20.08.1996 and 23.08.1996 (SCHÖPWINKEL 1997) which has been three days before and on the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, respectively; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 5 individuals each have flown on 25.08.1991 (HANS KWIATKOWSKI in

HASSELBACH 1992) and 06.08.1992 (HANS KWIATKOWSKI in HASSELBACH 1993) which has been on the full moon on 25.08.1991, and on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, respectively; and near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 02.08.1994 (BROSZKUS 1995) which has been five days before the new moon on 07.08.1994.

5.71 The Violet Copper *Lycaena helle* and the Purple-Edged Copper *Lycaena hippothoe*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Violet Copper *Lycaena helle* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Lycaenidae) and the Purple-Edged Copper *Lycaena hippothoe* LINNAEUS 1761 (Lepidoptera: Lycaenidae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Violet Copper *Lycaena helle* and the Purple-Edged Copper *Lycaena hippothoe* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Violet Copper *Lycaena helle* and the Purple-Edged Copper *Lycaena hippothoe* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Violet Copper *Lycaena helle* and the Purple-Edged Copper *Lycaena hippothoe* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Violet Copper *Lycaena helle* have been described from the Wirft valley near Stadtkyll northwest of Daun in the northwestern part of the Eifel in the western part of Germany where abt. 20 individuals each have flown on 20.06.1998 and 15.06.1999 (WERNER KUNZ in KINKLER 2000) which has been four days before the new moon on 24.06.1998 and two days after the new moon on 13.06.1999, respectively; from the Nonnenbach valley near Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 30.05.2004 (SCHUMACHER 2005a, KLAUS MEYER in SCHUMACHER 2005a) which has been four days before the full moon on 03.06.2004, from the Rohrvenn near Roth north of Prüm in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 16.05.2005 (M. DERRA in SCHUMACHER 2006) which has been on the increasing half moon on 16.05.2005 between the new moon on 08.05.2005 and the full moon on 23.05.2005; from the Perlenbach valley and the Fuhrtsbach valley near Monschau in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals each have flown on 27.05.1997 and 12.06.1998, respectively (BERNHARD THEISSEN in SCHUMACHER 2001), which has been five days after the full moon on 22.05.1997 and two days after the full moon on 10.06.1998, respectively; from Kesternich east of Simmerath northnortheast of Monschau in the northwestern part of the Eifel in the western part of Germany where abt. 25 individuals in total have flown on 01.05.2007 and 25.05.2007 (HAESE in SCHUMACHER 2008a) which has been one day before the full moon on 02.05.2007 as well as two days after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, respectively; from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Ger-

many where abt. 15 individuals and abt. 20 individuals have flown on 24.05.1990 (HASSELBACH 1991) and 31.05.1991 (HASSELBACH 1992), respectively, which has been on the new moon on 24.05.1990 and three days after the full moon on 28.05.1991, respectively; and from Burbach west of Haiger southsoutheast of Siegen in the northwestern part of Germany where more than 100 individuals have flown on 06.06.2004 (SCHUMACHER 2005a, KLAUS MEYER in SCHUMACHER 2005a) which has been three days after the full moon on 03.06.2004.

Mass occurrences of large quantities of individuals of the Purple-Edged Copper *Lycaena hippothoe* have been registered near Waldkönigen northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where abt. 15 individuals have flown on 22.06.2002 (U. FLESCH in SCHUMACHER 2003) which has been two days before the full moon on 24.06.2002, near Erbach north of Rheinböllen in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 23.06.2001 (SCHUMACHER 2002) which has been two days after the new moon on 21.06.2001, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 15 individuals have flown on 06.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been two days after the full moon on 04.06.1993, at the Fuchskaute eastsoutheast of Willingen west of Herborn in the northwestern part of Germany where abt. 10 – 15 individuals have flown on 05.07.1998 (SCHUMACHER 2001) which has been four days before the full moon on 09.07.1998, near Amdorf west of Herborn in the northwestern part of Germany where 5 individuals have flown on 18.06.2006 (RAINER ROTH in SCHUMACHER 2007a) which has been on the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abundant individuals have flown on 03.06.1934 (LEO DITGENS in KINKLER, SCHMITZ & NIPPEL 1971) which has been two days before the decreasing half moon on 05.06.1934 between the full moon on 25.05.1934 and the new moon on 05.06.1934.

5.72 The Short-Tailed Blue *Everes argiades*

During my entomological observations, I have so far not recognized any individuals of the Short-Tailed Blue *Everes argiades* PALLAS 1771 (Lepidoptera: Lycaenidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe, which is in parts certainly the consequence of the easy overlooking of its typical short tails during the inspection of the community of small blue butterflies with quite similar appearance of different members in the field as well as of the focus of my studies on the larger butterflies. Some examples of mass occurrences of the Short-Tailed Blue *Everes argiades* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Short-Tailed Blue *Everes argiades* within and around Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany have been reported from Denzlingen northnortheast of Freiburg where more than 100 individuals in total and abt. 60 individuals in total have flown in the periods of 11.08.1982 – 30.08.1982 and 04.09.1982 – 21.09.1982, respectively (STEINIGER & EITSCHBERGER 1985), which has been around and between the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982 as well as the increasing half moon on 27.08.1982 between the new moon on 19.08.1982 and the full moon on 03.09.1982, and around and between the full moon on 03.09.1982 and the new moon on 17.09.1982, respectively; from Wasser south of Emmendingen northnortheast of Freiburg where more than 15 individuals each have flown on 04.08.1983 and 19.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been one day after the decreasing half moon

on 03.08.1983 between the full moon on 24.07.1983 and the new moon on 08.08.1983 as well as three days after the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983, respectively; from Sexau-Lörch southeast of Emmendingen northeast of Freiburg where abt. 35 individuals in total each have flown on 09.07.1983 – 11.07.1983 and in the period of 12.08.1983 – 19.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been around the new moon on 10.07.1983 as well as around the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1982, respectively; from Waldkirch-Buchholz southeast of Emmendingen northeast of Freiburg where abt. 140 individuals have flown and have sucked on flowers from 10.07.1983 onwards (STEINIGER & EITSCHBERGER 1985) which has been on and after the new moon on 10.07.1983; from Unterglottertal eastnortheast of Freiburg, Heuweiler northnortheast of Freiburg and Holzhausen northnorthwest of Freiburg where abt. 30 individuals, abt. 25 individuals and abt. 90 individuals, respectively, have flown on 13.08.1983 – 14.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been two and three days before the increasing half moon on 16.08.1983 between the new moon on 08.08.1983 and the full moon on 23.08.1983; from Buchheim northnorthwest of Freiburg where abt. 10 individuals have flown and have sucked on flowers on 20.08.1983 (STEINIGER & EITSCHBERGER 1985) which has been three days before the full moon on 23.08.1983, from Eichstetten northnorthwest of Freiburg where abt. 15 individuals have flown on 19.08.1995 (HENSLE 2002d) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, from Endingen am Kaiserstuhl northnorthwest of Freiburg where 12 individuals have flown on 21.04.2007 (L. MÖSSINGER in HENSLE 2008a) which has been four days after the new moon on 17.04.2007, from Kiechlinsbergen southsouthwest of Endingen am Kaiserstuhl where abt. 10 individuals have flown on 17.06.2000 – 19.06.2000 (HENSLE 2002i) which has been on and a few days after the full moon on 17.06.2000; and from Gottenheim northwest of Freiburg where abt. 10 individuals each have flown on 20.08.1983 (STEINIGER & EITSCHBERGER 1985) and 18.07.1985 (STEINIGER & EITSCHBERGER 1987), respectively, which has been three days before the full moon on 23.08.1983 and one day after the new moon on 17.07.1985, respectively.

Mass occurrences of large quantities of individuals of the Short-Tailed Blue *Everes argiades* in the southwestern part of Germany have also been mentioned from Maulbronn-Schmie northeast of Pforzheim where 17 individuals have flown on 06.08.2006 (K. HOFSÄSS in HENSLE 2007a) which has been three days before the full moon on 09.08.2006, from Dahn southeast of Pirmasens southsouthwest of Kaiserslautern in the Palatinate Forest where 50 individuals have flown on 26.08.2008 (G. SCHWAB in HENSLE 2009a) which has been four days before the new moon on 30.08.2008, from Ketsch westsouthwest of Heidelberg in the middle part of the Upper Rhine valley where 6 individuals have flown on 22.08.1974 (EITSCHBERGER & STEINIGER 1975c) which has been five days after the new moon on 17.08.1974; from Baden-Baden in the northern part of the Black Forest where abt. 10 individuals in total have flown on 15.08.2005 and 19.08.2005 (S. FAUQUEMBERG & V. FAUQUEMBERG in HENSLE 2006a) which has been four days before and on the full moon on 19.08.2005, respectively; from Mahlberg southsouthwest of Lahr in the southern part of the Upper Rhine valley where abt. 12 individuals have flown on 12.08.1973 – 13.08.1973 (EITSCHBERGER & STEINIGER 1974c) which has been one and two days before the full moon on 14.08.1973, from Kippenheim southsouthwest of Lahr in the southern part of the Upper Rhine valley where 30 individuals have flown on 28.07.2006 (HENSLE 2007a) which has been four days after the new moon on 24.07.2006, from Amstetten southsoutheast of Geislingen an der Steige northnorthwest of Ulm where 8 individuals have flown on 17.08.2006 (HENSLE 2007a) which has been one day after the decreasing half moon on 16.08.2006 between the full moon on 09.08.2006 and the new moon on 23.08.2006, from Waldshut in the Hochrhein valley where abt. 10 individuals have flown on 09.08.2008 (B. EDINGER in HENSLE 2009a) which has been one day after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, from Konstanz at Lake Constance where 15 individuals have flown on 01.09.1973 – 02.09.1973 (EITSCHBERGER & STEINIGER 1974c) which has

been four and five days after the new moon on 28.08.1973; from Igersheim east of Bad Mergentheim and Königheim west of Tauberbischofsheim in the Tauber valley where 5 individuals each have flown on 22.08.2008 and 24.08.2008, respectively (M. WELZ in HENSLE 2009a), which has been two days before and on the decreasing half moon on 24.08.2008 between the full moon on 16.08.2008 and the new moon on 30.08.2008, respectively; from Furth im Wald east of Schwandorf in the southeastern part of Germany where 10 individuals in total have flown in the period of 27.07.1973 – 06.08.1973 (EITSCHBERGER & STEINIGER 1974c) which has been around and between the new moon on 29.07.1973 as well as the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, and from Zangenstein northeast of Schwandorf in the southeastern part of Germany where more than 20 individuals in total have flown on 28.07.1975 – 04.08.1985 (STEINIGER & EITSCHBERGER 1976b) which has been around the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975.

Mass occurrences of large quantities of individuals of the Short-Tailed Blue *Everes argiades* in the eastern part of Austria have been reported from Zöbing in the Kamp valley north of Langenlois where 15 individuals have flown on 13.04.2007 (CHRISTOPHER RABL in HENSLE 2008a) which has been four days before the new moon on 17.04.2007, from the Rindfleischberg near Kleinpöchlarn west of Melk in the Danube valley where 30 individuals have flown on15.04.2007 (W. SCHWEIGHOFER in HENSLE 2008a) which has been two days before the new moon on 17.04.2007, from Köflach west of Graz where abt. 10 individuals have flown on 26.04.2007 (T. BAUER in HENSLE 2008a) which has been two days after the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, from Jennersdorf in the Raab valley where 6 individuals have flown on 27.07.2008 (A. WOLF in HENSLE 2009a) which has been two days after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, from the Leithagebirge north of Eisenstadt southsoutheast of Vienna where 7 individuals have flown on 27.07.1976 (BURMANN & TARMANN 1979) which has been on the new moon on 27.07.1976; and from Bad Füssing northeast of Braunau in the Inn valley in the western part of Austria where 12 individuals each have flown on 01.08.2007 (SAGE 2007) and 01.08.2008 (WALTER SAGE in HENSLE 2009a) which has been two days after the full moon on 30.07.2007 and on the new moon on 01.08.2008, respectively.

Mass occurrences of large quantities of individuals of the Short-Tailed Blue *Everes argiades* in Switzerland have been signaled from Dornach in the Birs valley south of Basel in the northwestern part of Switzerland where abt. 25 individuals have flown on 13.08.2008 (B. EDINGER in HENSLE 2009a) which has been three days before the full moon on 16.08.2008, and from Locarno at the northern margin of the Lago Maggiore in the southeastern part of Switzerland where 13 individuals in total have flown on 06.08.2008 and 09.08.2008 (T. KISSLING in HENSLE 2009a) which has been two days before and one day after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, respectively.

Mass occurrences of large quantities of individuals of the Short-Tailed Blue *Everes argiades* in France have been notified from Marckolsheim northeast of Colmar in the southern part of the Upper Rhine valley in the northeastern part of France where abt. 10 individuals have flown on 28.08.1994 (HENSLE 2002c) which has been two days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, from Gurs northwest of Oloron-Sainte-Marie west of Pau west of Toulouse in the southwestern part of France where 70 individuals have flown on 04.09.1972 (STEINIGER 1973b) which has been three days before the new moon on 07.09.1972, and from Saint-Vincent-de-Tyrosse northnortheast of Bayonne and Campagne west of Mont-de-Marsan eastnortheast of Bayonne in the southwestern part of France where abt. 15 individuals have flown on 06.09.1972 (STEINIGER 1973b) which has been one day before the new moon on 07.09.1972.

5.73 The Dusky Large Blue *Maculinea nausithous*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Blue *Maculinea* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Blue *Maculinea* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. I have also observed some scattered individuals of the Blue *Maculinea* in wet meadows close to a creek in the Bruche valley between Urmatt and Mutzig westsouthwest of Strasbourg in the northern part of the Vosges in the northeastern part of France around the new moon on 13.08.2007. Because the Blue *Maculinea* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Blue *Maculinea* during my observations in the field. Some examples of mass occurrences of several species of the Blue *Maculinea* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Dusky Large Blue *Maculinea nausithous* Bergsträsser 1779 (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been observed near Breidenbach southsoutheast of Bad Laasphe east of Siegen where abt. 15 – 20 individuals have flown on 20.07.1992 (Rolf Twardella in Fieber 1992) which has been three days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, near Elkenroth south of Betzdorf southsouthwest of Siegen where abt. 120 individuals have been counted on 23.07.1992 (Fieber 1994) which has been on the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, near Wüstseifen near Hahnhof southsouthwest of Niederfischbach west of Siegen where abt. 30 individuals have flown on 28.07.1997 (Fieber 1998) which has been one day after the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997, near Gernsdorf northeast of Wilnsdorf southeast of Siegen where 5 individuals have flown on 28.07.2006 (Peter Fasel in Schumacher 2007a) which has been four days after the new moon on 24.07.2006, near Niederndorf southsoutheast of Freudenberg west of Siegen where 7 individuals have flown on 20.07.2006 (Viktor Fieber in Schumacher 2007a) which has been four days before the new moon on 24.07.2006, near Untershausen south of Montabaur eastnortheast of Koblenz where 15 individuals have flown on 02.08.2008 (S. Kinkler & Reifenberg in Schumacher 2009) which has been one day after the new moon on 01.08.2008, near Obererbach northwest of Limburg in the Lahn valley where more than 20 individuals have flown as well as between Elz and Malmeneich northnorthwest of Elz northwest of Limburg in the Lahn valley where abt. 10 individuals have flown on 20.07.1990 (Hans-Arnold Hürter in Kinkler 1990b) which has been two days before the new moon on 22.07.1990, near Windeck-Dreisel westnorthwest of Wissen westsouthwest of Siegen where abt. 10 individuals have flown on 21.07.1983 (Oliver Schmitz in Kinkler, Schmitz, Nippel & Swoboda 1992) which has been four days before the full moon on 25.07.1983, near Welschneudorf southsouthwest of Montabaur eastnortheast of Koblenz where 8 individuals each have been observed on 02.08.2008 and 03.08.2008 (S. Kinkler & Reifenberg in Schumacher 2009) which has been one and two days after the new moon on 01.08.2008; near Roßbach westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen where more than 30 individuals and abt. 50 individuals in total have flown on 02.08.1990 (Kinkler, Schmitz, Nippel & Swoboda 1992) and in the period of 19.07.1999 –

26.07.1999 (W. Beckert in Kinkler 2000), respectively, which has been four days before the full moon on 06.08.1990, and around and between the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999 as well as the full moon on 28.07.1999, respectively; near Haiger-Offdilln southeast of Siegen where 5 individuals have flown on 22.07.2008 (H. Schäfer in Schumacher 2009) which has been four days after the full moon on 18.07.2008; near Nutscheid-Kaltbachtal southwest of Waldbröl west of Siegen where abt. 15 individuals in total and abt. 5 individuals have flown on 23.07.1972 and 06.08.1972 as well as on 22.07.1973, respectively (Kinkler, Schmitz, Nippel & Swoboda 1992), which has been three days before the full moon on 26.07.1992, three days before the new moon on 09.08.1972 and three days before the full moon on 25.07.1973, respectively; respectively; near Löhndorf westsouthwest of Sinzig in the Middle Rhine valley southsoutheast of Bonn where 5 individuals have flown on 04.08.1988 (Ladda in Kinkler 1990b) which has been one day before the decreasing half moon on 05.08.1988 between the full moon on 29.07.1988 and the new moon on 12.08.1988, in the Kalkarer Moor near Bad Münstereifel south of Euskirchen in the northwestern part of the Eifel where 10 individuals have flown on 13.07.2006 (Robert Boczki in Schumacher 2007a) which has been two days after the full moon on 11.07.2006; near Sankt-Augustin-Hangelar and Siegburg-Buisdorf northeast of Bonn in the Middle Rhine valley where abt. 1.000 individuals and 40 individuals, respectively, have flown in August 1991 (Lopata in Kinkler 1993) which has been around and between the full moon on 26.07.1991, the new moon on 10.08.1991 and the full moon on 25.08.1991; near Porz at the southeastern margin of the city of Cologne in the Middle Rhine valley where abundant individuals have flown on 09.08.1953 (Leo Ditgens in Kinkler, Schmitz & Nippel 1971) which has been on the new moon on 09.08.1953, and in the district Urdenbach at the southern margin of the city of Düsseldorf where abundant individuals each have flown on 27.07.1968 and 23.07.1969 (Helmut Kinkler in Kinkler, Schmitz & Nippel 1971) which has been two days after the new moon on 25.07.1968 as well as one day before the increasing half moon on 24.07.1969 between the new moon on 14.07.1969 and the full moon on 29.07.1969, respectively.

5.74 The Alcon Blue *Maculinea alcon*, the Large Blue *Maculinea arion*, the Rebel´s Blue *Maculinea rebeli* and the Scarce Large Blue *Maculinea teleius*

Mass occurrences of large quantities of individuals of the Alcon Blue *Maculinea alcon* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been noted in the Gildehauser Venn near Gildehaus west of Bad Bentheim southsoutheast of Nordhorn where more than 30 individuals and 5 individuals have flown on 12.07.1989 (Hans-Arnold Hürter & Lange in Kinkler 1990b) and 27.07.1992 (Hinz in Kinkler 1993), respectively, which has been on the increasing half moon on 12.07.1989 between the new moon on 03.07.1989 and the full moon on 18.07.1989, and two days before the new moon on 29.07.1992, respectively; in the Merfelder Bruch south of Merfeld west of Dülmen in the northwestern part of Germany where more than 10 individuals and abt. 25 individuals in total have flown on 17.07.1974 (Harkort 1976, Josef Schäfer & Hans-Joachim Weigt in Harkort 1976) as well as on 23.07.1971 and 25.07.1971 (Josef Schäfer in Harkort 1976), respectively, which has been two days before the new moon on 19.07.1974 as well as one and three days after the new moon on 22.07.1971, respectively; in the Witte Venn near Alstätte westnorthwest of Ahaus where abt. 10 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975, near Eller at the southeastern margin of the city of Düsseldorf where abundant individuals have flown on 22.07.1934 (Karl Oertel in Kinkler, Schmitz & Nippel 1971) which has been four days before the full moon on 26.07.1934, and at the Höneberg near Ripsdorf south of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel where 7 individuals have flown on 22.06.1993 (Hillig in Kinkler 1994) which has been two days after the new moon on 20.06.1993.

Mass occurrences of large quantities of individuals of the Large Blue *Maculinea arion* LINNAEUS 1758 (Lepidoptera: Lycaenidae) in the southwestern part of Germany have been confirmed near Schloßböckelheim westsouthwest of Bad Kreuznach in the Nahe valley where 30 individuals have flown on 13.07.1997 (SCHUMACHER 2001) which has been on the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997; near Waldböckelheim westsouthwest of Bad Kreuznach in the Nahe valley where abt. 5 individuals have flown on 05.07.1987 (FÖRSTER, OTTMÜLLER & OLIVER SCHMITZ in KINKLER 1990b) which has been on the increasing half moon on 05.07.1987 between the new moon on 26.06.1987 and the full moon on 11.07.1987; in the vicinity of Fischbach southwest of Dahn southeast of Pirmasens in the Palatinate Forest in the southwestern part of Germany where abt. 5 individuals in total have flown on 03.07.2005 and 09.07.2005 (UWE EISENBERG in HASSELBACH 2006) which has been three days before and three days after the new moon on 06.07.2005, respectively; and at an unspecified locality in the southern part of the Palatinate Forest south to southeast of Pirmasens in the southwestern part of Germany where more than 10 individuals have flown on 09.07.2002 (HASSELBACH 2003) which has been one day before the new moon on 10.07.2002.

Mass occurrences of large quantities of individuals of the Rebel´s Blue *Maculinea rebeli* HIRSCHKE 1904 (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been found near Willebadessen southeast of Paderborn where abt. 60 individuals have flown on 29.06.2003 (RUDOLF PÄHLER in SCHUMACHER 2004a) which has been on the new moon on 29.06.2003; and near Trendelburg and Liebenau southwest of Trendelburg south of Bad Karlshafen in the Weser valley where 5 individuals and 20 individuals, respectively, have flown on 02.07.1992 (HINZ in KINKLER 1993) which has been two days after the new moon on 30.06.1992.

Mass occurrences of large quantities of individuals of the Scarce Large Blue *Maculinea teleius* BERGSTRÄSSER 1779 (Lepidoptera: Lycaenidae) have been recorded near Obererbach northwest of Limburg in the Lahn valley in the northwestern part of Germany where more than 20 individuals have flown on 20.07.1990 (HANS-ARNOLD HÜRTER in KINKLER 1990b) which has been two days before the new moon on 22.07.1990; near Windeck-Dreisel westnorthwest of Wissen westsouthwest of Siegen in the northwestern part of Germany where abt. 100 individuals and more than 60 individuals have flown on 21.07.1983 (OLIVER SCHMITZ in KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992) and 12.07.2005 – 14.07.2005 (W. BECKERT in SCHUMACHER 2006), respectively, which has been four days before the full moon on 25.07.1983 as well as a few days before and on the increasing half moon on 14.07.2005 between the new moon on 06.07.2005 and the full moon on 21.07.2005, respectively; near Nutscheid-Kaltbachtal southwest of Waldbröl west of Siegen in the northwestern part of Germany where abt. 15 individuals in total have flown on 23.07.1972 and 06.08.1972 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992) which has been three days before the full moon on 26.07.1992 and three days before the new moon on 09.08.1972, respectively; near Ötzingen-Sainerholz north of Montabaur in the western part of the Westerwald northeast of Koblenz where 25 individuals have flown on 21.07.2002 (VIKTOR FIEBER in SCHUMACHER 2003) which has been three days before the full moon on 24.07.2002; and in the Wollmatinger Ried near Wollmatingen north of Konstanz at Lake Constance in the southwestern part of Germany where abt. 40 individuals, abt. 75 individuals and abt. 40 individuals have flown on 02.07.1982, 07.07.1983 and 25.06.1986, respectively (EBERT & RENNWALD 1993), which has been four days before the full moon on 06.07.1982, three days before the new moon on 10.07.1983 and three days after the full moon on 22.06.1986, respectively.

5.75 The Mazarine Blue *Polyommatus semiargus* and the Adonis Blue *Polyommatus bellargus*

Mass occurrences of large quantities of individuals of the Mazarine Blue *Polyommatus semiargus*

ROTTEMBURG 1775 (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been reported from Kalenberg southwest of Mechernich in the northwestern part of the Eifel where 25 individuals have flown on 18.07.1995 (HANS-ARNOLD HÜRTER in KINKLER 1996) which has been two days before the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995, from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 15 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992; from the Helingsbach valley near Dreiborn westnorthwest of Schleiden westsouthwest of Mechernich in the northwestern part of the Eifel where 30 individuals in total have been observed in the period of 18.05.2007 – 30.06.2007 (JOHN in SCHUMACHER 2008a) which has been around and between the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and the increasing half moon on 22.06.2007 between the new moon on 15.06.2007 and the full moon on 30.06.2007; from Dahlem southwest of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel where abt. 5 individuals have flown on 15.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been four days after the full moon on 11.07.2006, from an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where 12 individuals have flown on 08.07.1992 (HANS KWIATKOWSKI in HASSELBACH 1993) which has been on the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, from Warstein eastnortheast of Arnsberg where abt. 20 individuals have flown on 19.06.2002 (HANS RETZLAFF in SCHUMACHER 2006) which has been one day after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, from Deuz east of Siegen in the Sieg valley where 20 individuals have flown on 24.06.1974 (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976) which has been four days after the new moon on 20.06.1974, from the Trupbacher Heide near Trupbach west of Siegen in the Sieg valley where 20 individuals have flown on 24.06.2005 (VIKTOR FIEBER in SCHUMACHER 2006) which has been two days after the full moon on 22.06.2005, and from Warstein southeast of Soest where 10 individuals have flown on 14.07.1975 (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976) which has been five days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Adonis Blue *Polyommatus bellargus* ROTTEMBURG 1775 (Lepidoptera: Lycaenidae) have been recognized near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 50 individuals have flown on 12.06.1994 (S. JOUAUX in BROSZKUS 1995), abt. 15 individuals have flown on 14.08.1994 (S. JOUAUX in BROSZKUS 1995), 10 individuals have flown on 03.06.1995 (HILLIG in KINKLER 1996), 10 individuals have flown on 23.05.1998 (HILLIG in KINKLER 1998) and 10 individuals have flown on 02.06.2000 (M. DERRA in SCHUMACHER 2001) which has been three days after the new moon on 09.06.1994, one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, five days after the new moon on 29.05.1995, two days before the new moon on 23.05.1998 and on the new moon on 02.06.2000, respectively; and in the Dellbrücker Heide near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abundant individuals have flown on 26.07.1958 (CLEMENS CASPERS in KINKLER, SCHMITZ & NIPPEL 1971) which has been four days before the full moon on 30.07.1958.

5.76 The Silver-Studded Blue *Plebejus argus*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Blues *Plebejus* and *Pseudophilotes* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single indivi-

duals of the Blues *Plebejus* and *Pseudophilotes* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Blues *Plebejus* and *Pseudophilotes* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Blues *Plebejus* and *Pseudophilotes* during my observations in the field. Some examples of mass occurrences of several species of the Blues *Plebejus* and *Philotes* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Silver-Studded Blue *Plebejus argus* LINNAEUS 1758 (Lepidoptera: Lycaenidae) in the western part of Germany have been registered near Dahlem northnortheast of Stadtkyll northwest of Daun in the northwestern part of the Eifel where abt. 10.000 individuals and more than 500 individuals have been encountered on 21.06.2008 (S. KINKLER & REIFENBERG in SCHUMACHER 2009) and 04.07.2004 (SCHUMACHER 2005a), respectively, which has been three days after the full moon on 18.06.2008 and two days after the full moon on 02.07.2004, respectively; at the former train station in Ahrdorf in the Ahr valley southeast of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel where abt. 1.000 individuals have flown on 26.06.1988 (KINKLER 1989a, HANS-ARNOLD HÜRTER & NIPPEL in KINKLER 1989a) which has been three days before the full moon on 29.06.1988, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 70 individuals have flown on 17.06.1990 (KINKLER & HÜRTER 1992) which has been five days before the new moon on 22.06.1990; near Waldkönigen northnorthwest of Daun in the northwestern part of the Eifel where abt. 20 individuals in total have flown on 31.07.2004 and 29.08.2004 (U. FLESCH in SCHUMACHER 2005a) and abt. 400 individuals have flown on 24.06.2006 (U. FLESCH in SCHUMACHER 2007a) which has been on the full moon on 31.07.2004, one day before the full moon on 30.08.2004 and one day before the new moon on 25.06.2006, respectively; in the vicinity of Mayen in the southeastern part of the Eifel where 15 individuals and 5 individuals have flown on 30.08.1991 (JÜRGEN BOSSELMANN in HASSELBACH 1992) and 01.07.1994 (JÜRGEN BOSSELMANN in HASSELBACH 1995a), respectively, which has been five days after the full moon on 25.08.1991 as well as on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 20 individuals have flown on 10.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and in the Ville near Brühl southsouthwest of Cologne where masses of individuals have flown on 08.07.1955 (FORST in JELINEK 2006) which has been three days after the full moon on 05.07.1955.

Mass occurrences of large quantities of individuals of the Silver-Studded Blue *Plebejus argus* in the northwestern part of Germany have been recorded in the Weierbach valley near Oberdresselndorf westsouthwest of Haiger southeast of Siegen where abt. 100 individuals have flown on 05.07.1998 (SCHUMACHER 2001) which has been four days before the full moon on 09.07.1998, near Wüstseifen near Hahnhof southsouthwest of Niederfischbach west of Siegen where abt. 5 individuals have flown on 05.06.2002 (VIKTOR FIEBER in SCHUMACHER 2003) which has been two days after the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002; in the Trupbacher Heide near Trupbach west of Siegen in the Sieg valley where 40 individuals in total have flown on 24.06.2005 and 03.07.2005 (VIKTOR FIEBER in SCHUMACHER 2006) which has been two days after the full moon on 22.06.2005 and three days before the new moon on 06.06.2005, respectively; near Lünen and Lippolthausen west of Lünen north of Dortmund where

abt. 5 individuals each have flown on 26.07.1938 (WIECHERT in HARKORT & WEIGT 1969, WIECHERT in HARKORT 1976) and 24.07.1932 (H. HEDDERGOTT in HARKORT & WEIGT 1969), respectively, which has been one day after the new moon on 27.07.1938 as well as two days before the decreasing half moon on 26.07.1932 between the full moon on 17.07.1932 and the new moon on 02.08.1932, respectively; and near Hausdülmen southwest of Dülmen where 30 individuals have flown on 17.07.1974 (HARKORT 1976, JOSEF SCHÄFER & HANS-JOACHIM WEIGT in HARKORT 1976) which has been two days before the new moon on 19.07.1974.

5.77 The Baton Blue *Pseudophilotes baton*

Mass occurrences of large quantities of individuals of the Baton Blue *Pseudophilotes baton* BERGSTRÄSSER 1779 (Lepidoptera: Lycaenidae) have been noted near Wildenburg southeast of Hellenthal southeast of Monschau in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 15.06.1997 (PFRINDER in KINKLER 1997) which has been five days before the full moon on 20.06.1997, near Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 15 individuals have flown on 19.06.2003 (KLAUS MEYER & ANDREAS WERNO in SCHUMACHER 2005a) which has been two days before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, near Bornich southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 5 individuals have flown on 05.08.1989 (M. DERRA in SCHUMACHER 2001) which has been four days after the new moon on 01.08.1989; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 15 individuals each have flown on 08.07.1992 (HANS KWIATKOWSKI in HASSELBACH 1993) and 06.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been on the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, and two days after the full moon on 04.06.1993, respectively; and at an unspecified locality in the southwestern part of Germany where 12 individuals have flown on 19.05.1997 (HASSELBACH 1999) which has been three days before the full moon on 22.05.1997.

5.78 The Amanda´s Blue *Plebicula amanda* and the Turquoise Blue *Plebicula dorylas*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Blue *Plebicula* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Blue *Plebicula* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Blue *Plebicula* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Blue *Plebicula* during my observations in the field. Some examples of mass occurrences of several species of the Blue *Plebicula* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Amanda´s Blue *Plebicula amanda* SCHNEIDER 1792 (Lepidoptera: Lycaenidae) in the northeastern part of Germany have been documented from Jöhstadt southsoutheast of Annaberg-Buchholz where abt. 50 individuals in total have

flown in the period of 24.06.2008 – 23.07.2008 (R. KLEMM in HENSLE 2009a) which has been around and between the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, the increasing half moon on 10.07.2008 between the new moon on 03.07.2008 and the full moon on 18.08.2008, and the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, respectively; from Oybin south-southwest of Zittau where abt. 10 individuals have flown on 24.06.2008 (M. KRAHL in HENSLE 2009a) which has been two days before the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, from Roßwein west of Dresden where 25 individuals have been observed on 24.07.2006 (HENSLE 2007a) which has been on the new moon on 24.07.2006, near Lubmin eastnortheast of Greifswald at the coast of the Baltic Sea where 7 individuals have been registered on 14.07.2006 (KARL-HEINZ JELINEK in HENSLE 2007a) which has been three days after the full moon on 11.07.2006; near Kienbaum east of Rüdersdorf east of Berlin where 20 individuals have flown on 08.06.2007 (HENSLE 2008a) which has been on the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, near Kartzow northnorthwest of Brandenburg an der Havel where 10 individuals have been observed on 04.06.2008 (HENSLE 2009a) which has been one day after the new moon on 03.06.2008, and near Wurzbach west of Lobenstein southsoutheast of Saalfeld where abt. 10 individuals have flown on 08.07.2007 (J. PHILIPP in HENSLE 2008a) which has been one day after the decreasing half moon on 07.07.2007 between the full moon on 30.06.2007 and the new moon on 14.07.2007.

Mass occurrences of large quantities of individuals of the Amanda´s Blue *Plebicula amanda* in the northwestern and southeastern parts of Germany as well as in the eastern part of Austria have been confirmed near Uelzen southsoutheast of Lüneburg in the northwestern part of Germany where abt. 15 individuals in total have been noticed on 10.06.2008 and 14.06.2008 (H. GÖTTSCHE in HENSLE 2009a) which has been on and four days after the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.06.2008, respectively; in the eastern part of the island Sylt northnorthwest of Husum at the coast of the North Sea in the northwestern part of Germany where more than 10 individuals have flown on 22.07.1996 – 23.07.1996 (HENSLE 2002e) which has been one and two days before the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 30.07.1996; near Franken southeast of Weißenstadt south of Hof in the southeastern part of Germany where 8 individuals have flown in total on 21.06.2006 and 23.06.2006 (HENSLE 2007a) which has been four and two days before the new moon on 25.06.2006, respectively; and near Langschlag west of Großgerungs westsouthwest of Zwettl in the eastern part of Austria where 10 individuals have flown on 25.06.2007 (HENSLE 2008a) which has been three days after the increasing half moon on 22.06.2007 between the new moon on 15.06.2007 and the full moon on 30.06.2007.

Mass occurrences of large quantities of individuals of the Turquoise Blue *Plebicula dorylas* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Lycaenidae) have been observed at the Niesenberg near Weinsheim eastnortheast of Prüm in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 15.07.1995 (HILLIG & HANS-ARNOLD HÜRTER in KINKLER 1996) which has been three days after the full moon on 12.07.1995, and near Alendorf south of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 05.07.1986 (M. DERRA in SCHUMACHER 2001) which has been two days before the new moon on 07.07.1986.

5.79 The Little Blue *Cupido minimus*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Little Blue *Cupido minimus* FUESSLY 1775

(Lepidoptera: Lycaenidae) among the community of the background blue butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Little Blue *Cupido minimus* which would permit a selenocyclical evaluation of its population dynamics, which is certainly in considerable degree the result of my only accessory monitoring of the background blue butterflies, and therefore my own observations of the distribution of the Little Blue *Cupido minimus* are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Little Blue *Cupido minimus* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Little Blue *Cupido minimus* in the northwestern part of Germany have been discovered near Willebadessen southeast of Paderborn where abt. 30 individuals have flown on 08.06.1969 (RETZLAFF 1973) which has been one day before the decreasing half moon on 09.06.1969 between the full moon on 31.05.1969 and the new moon on 14.06.1969, abt. 20 individuals have flown on 17.06.1970 (RETZLAFF 1973) which has been two days before the full moon on 19.06.1970, and abt. 20 individuals have flown on 04.06.1972 (ROBENZ in RETZLAFF 1973) which has been one day before the decreasing half moon on 05.06.1972 between the full moon on 28.05.1972 and the new moon on 11.06.1972; near Warstein eastnortheast of Arnsberg where more than 350 individuals have been observed on 19.06.2002 (HANS RETZLAFF in SCHUMACHER 2006) which has been one day after the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002; near Letmathe in the Lenne valley southsoutheast of Dortmund where abundant individuals and abt. 10 individuals have flown in the period of 05.06.1965 – 20.06.1965 and on 04.06.1966, respectively (HARKORT & WEIGT 1967), which has been around and between the increasing half moon on 07.06.1965 between the new moon on 30.05.1965 and the full moon on 14.06.1965 as well as the full moon on 14.06.1965, and one day after the full moon on 03.06.1966, respectively; near Heggen in the Bigge valley southsouthwest of Finnentrop northnortheast of Attendorn where more than 50 individuals have flown in June 1995 (DIRR, IMMEKUS & BERND SCHMITZ in KINKLER 1996) which has been around and between the new moon on 29.05.1995, the full moon on 13.06.1995 and the new moon on 27.06.1995; and near Rosenheim in the vicinity of Gebhardshain southwest of Betzdorf southwest of Siegen where abt. 10 individuals have flown on 22.07.2006 (VIKTOR FIEBER in SCHUMACHER 2007a) which has been two days before the new moon on 24.07.2006.

Mass occurrences of large quantities of individuals of the Little Blue *Cupido minimus* in the western part of Germany have been encountered in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel where 20 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, around Loreley and Bornich southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz where more than 5 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where abt. 25 individuals and abt. 40 individuals have flown on 22.05.1993 and 06.06.1993, respectively (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994), which has been one day after the new moon on 21.05.1993 and two days after the full moon on 04.06.1993, respectively; and in the vicinity of Mayen in the southeastern part of the Eifel where abt. 50 individuals have flown on 08.06.2002 (TALIA BOSSELMANN in HASSELBACH 2003) which has been three days before the new moon on 11.06.2002.

Mass occurrences of large quantities of individuals of the Little Blue *Cupido minimus* in the central part of Germany have been observed around Mainz at the northern margin of the Upper Rhine valley where masses of individuals have flown on 31.05.1880 (REICHENAU 1904) which has been on the decreasing half moon on 31.05.1880 between the full moon on 24.05.1880 and the new moon on

08.06.1880.

5.80 The Green-Underside Blue *Glaucopsyche alexis*

Mass occurrences of large quantities of individuals of the Green-Underside Blue *Glaucopsyche alexis* PODA 1761 (Lepidoptera: Lycaenidae) have been detected near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals have flown on 03.06.1995 (HILLIG & HANS-ARNOLD HÜRTER in KINKLER 1996) which has been five days after the new moon on 29.05.1995, near Kirn in the Nahe valley northeast of Idar-Oberstein in the southwestern part of Germany where abt. 5 individuals have flown on 01.06.2002 (SCHUMACHER 2003) which has been two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 25 individuals have flown on 06.06.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been two days after the full moon on 04.06.1993.

5.81 The Reverdin´s Blue *Plebejus argyrognomon*

Mass occurrences of large quantities of individuals of the Reverdin´s Blue *Plebejus argyrognomon* BERGSTRÄSSER 1779 (Lepidoptera: Lycaenidae) have been identified around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where masses of individuals each have flown on 22.07.1881 and 02.07.1882 (REICHENAU 1904) which has been four days before the new moon on 26.07.1881 and one day after the full moon on 01.07.1882, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals each have flown on 12.08.1988 (HANS-ARNOLD HÜRTER in KINKLER 1989b) and 02.06.2000 – 10.06.2000 (M. DERRA in SCHUMACHER 2001) which has been on the new moon on 12.08.1988 as well as on and several days after the new moon on 02.06.2000, respectively; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals each have flown on 30.05.1992 and 16.06.1992 (WALTER BROSZKUS in KINKLER 1993, BROSZKUS 1995), 100 individuals have flown on 05.06.1993 (BROSZKUS 1995) and 20 individuals have flown on 10.08.2000 (M. DERRA in SCHUMACHER 2001) which has been two days before the new moon on 01.06.1992, one day after the full moon on 15.06.1992, one day after the full moon on 04.06.1993 and five days before the full moon on 15.08.2000, respectively; and in the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where more than 15 individuals have flown on 20.05.1993 (HASSELBACH 1994) which has been one day before the new moon on 21.05.1993.

5.82 The Chalk-Hill Blue *Polyommatus coridon*

Mass occurrences of large quantities of individuals of the Chalk-Hill Blue *Polyommatus coridon* (PODA 1761) (Lepidoptera: Lycaenidae) have been mentioned from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 100 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, from the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 40 individuals have flown on 28.07.1990 (KINKLER & HÜRTER 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990; from Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany

where numerous individuals each have flown on 15.07.1882 and 25.07.1902 (REICHENAU 1904) which has been on the new moon on 15.07.1882 and five days after the full moon on 20.07.1902, respectively; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 14.08.1994 (S. JOUAUX in BROSZKUS 1995) which has been one day before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, from the Rotenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 27.07.2005 (UWE EISENBERG in HASSELBACH 2006) which has been one day before the decreasing half moon on 28.07.2005 between the full moon on 21.07.2005 and the new moon on 05.08.2005, and from the vicinity of Orbis northnorthwest of Kirchheim-Bolanden in the southwestern part of Germany where more than 200 individuals have flown on 17.08.1998 (BERND STEUERWALD in HASSELBACH 2000) which has been five days before the new moon on 22.08.1998.

5.83 The Chequered Blue *Scolitantides orion*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Chequered Blue *Scolitantides orion* PALLAS 1771 (Lepidoptera: Lycaenidae) and the Brown Argus *Aricia agestis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Lycaenidae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Chequered Blue *Scolitantides orion* and the Brown Argus *Aricia agestis* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Chequered Blue *Scolitantides orion* and the Brown Argus *Aricia agestis* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Chequered Blue *Scolitantides orion* and the Brown Argus *Aricia agestis* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Chequered Blue *Scolitantides orion* in the western part of Germany have been observed around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz where more than 10 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; at the Loreley southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz where abt. 10 – 15 individuals have flown on 15.05.1988 (M. DERRA in SCHUMACHER 2001) which has been on the new moon on 15.05.1988, near Kestert in the Middle Rhine valley southsoutheast of Koblenz where 10 individuals have flown on 31.05.1996 (HILLIG in KINKLER 1997) which has been one day before the full moon on 01.06.1996, near Oberwesel in the Middle Rhine valley southsoutheast of Koblenz where 20 individuals have flown on 11.05.1993 (KINKLER 1996) which has been five days after the full moon on 06.05.1993, and at the Lennig near Oberwesel in the Middle Rhine valley northnorthwest of Bingen where abt. 40 individuals have been captured at the end of May 1885 (A. FUCHS in REICHENAU 1904) which has been around the full

moon on 28.05.1885.

5.84 The Brown Argus *Aricia agestis*

Mass occurrences of large quantities of individuals of the Brown Argus *Aricia agestis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Lycaenidae) have been noted near Alendorf south of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 27.05.2005 (SCHUMACHER 2006) which has been four days after the full moon on 23.05.2005, in the vicinity of Mayen in the southeastern part of the Eifel in the western part of Germany where 20 individuals have flown on 15.07.1997 (JÜRGEN BOSSELMANN in HASSELBACH 1997) which has been five days before the full moon on 20.07.1997, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992; around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 19.05.1882 and 21.07.1882 (REICHENAU 1904) which has been two days after the new moon on 17.05.1882 as well as three days before the increasing half moon on 24.07.1882 between the new moon on 15.07.1882 and the full moon on 30.07.1882, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 28.05.1994 (S. JOUAUX in BROSZKUS 1995) which has been three days after the full moon on 25.05.1994, and near Hörbach west of Herborn northwest of Wetzlar in the northwestern part of Germany where 7 individuals have flown on 28.07.2006 (RAINER ROTH in SCHUMACHER 2007a) which has been four days after the new moon on 24.07.2006.

5.85 The Holly Blue *Celastrina argiolus* and the Long-Tailed Blue *Lampides boeticus*

During my entomological observations, I have so far not recognized any individuals of the Long-Tailed Blue *Lampides boeticus* LINNAEUS 1767 (Lepidoptera: Lycaenidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe, which is in parts certainly the consequence of the easy overlooking of its typical little tails during the inspection of the community of small blue butterflies with quite similar appearance of different members in the field as well as of the focus of my studies on the larger butterflies. On the other hand, I have so far only discovered a few single individuals of the Holly Blue *Celastrina argiolus* LINNAEUS 1758 (Lepidoptera: Lycaenidae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Holly Blue *Celastrina argiolus* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Holly Blue *Celastrina argiolus* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Holly Blue *Celastrina argiolus* and the Long-Tailed Blue *Lampides boeticus* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Holly Blue *Celastrina argiolus* have been recognized around Bergheim west of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 40 individuals have flown on 18.07.1998 (JELINEK 2000) which has been five

days before the new moon on 23.07.1998, in the district Gremberghoven at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abundant individuals have flown on 11.05.2008 (HANISCH 2009) which has been one day before the increasing half moon on 12.05.2008 between the new moon on 05.05.2008 and the full moon on 20.05.2008; in the Ville forest near Erftstadt-Liblar and Erftstadt-Bliesheim southwest of Cologne in the northwestern part of Germany where 20 individuals and abt. 25 individuals have flown on 07.07.1998 and 26.07.1998, respectively (JELINEK 2006), which has been two days before the full moon on 09.07.1998 and three days before the new moon on 23.07.1998, respectively; in the Bist valley near Differten westsouthwest of Völklingen in the southern part of the Saar area in the western part of Germany where 12 individuals have been observed in an hour on 18.04.1971 (SCHMIDT-KOEHL 1977) which has been one day before the decreasing half moon on 19.04.1971 between the full moon on 10.04.1971 and the new moon on 25.04.1971, in the vicinity of Mayen in the southeastern part of the Eifel in the western part of Germany where 5 individuals have flown on 20.07.1992 (JÜRGEN BOSSELMANN in HASSELBACH 1993) which has been three days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, and in the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 20 individuals have flown on 08.07.1993 (HASSELBACH 1994) which has been four days after the full moon on 04.07.1993.

Mass occurrences of large quantities of individuals of the Long-Tailed Blue *Lampides boeticus* have been discovered in Mannheim in the middle part of the Upper Rhine valley in the southwestern part of Germany where abundant individuals have flown on 01.09.1958 – 03.09.1958 (TRAUGOTT HOHENADEL in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; HOHENADEL 1960; TRAUGOTT HOHENADEL in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1960) which has been three to five days after the full moon on 29.08.1958, in Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley in the southwestern part of Germany where more than 10 individuals have flown on 17.08.2003 (HENSLE 2004b) which has been five days after the full moon on 12.08.2003, in the vicinity of Basel at the southern end of the Upper Rhine valley in the northwestern part of Switzerland where abundant individuals have flown on 05.08.2003 (M. WILHELM in HENSLE 2004a) which has been on the increasing half moon on 05.08.2003 between the new moon on 31.05.2003 and the full moon on 12.08.2003, and near Bédarieux northwest of Montpellier in the southeastern part of France where abt. 70 individuals in total have flown on 06.08.1997 – 10.08.1997 (HENSLE 2002f) which has been around and between the new moon on 03.08.1997 as well as the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997.

5.86 The Lang´s Short-Tailed Blue *Syntarucus pirithous*

During my entomological observations, I have so far not recognized any individuals of the Lang´s Short-Tailed Blue *Syntarucus pirithous* LINNAEUS 1767 (Lepidoptera: Lycaenidae) and the Geranium Bronze *Cacyreus marshalli* BUTLER 1898 (Lepidoptera: Lycaenidae) at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany and Europe. Some examples of mass occurrences of the Lang´s Short-Tailed Blue *Syntarucus pirithous* and the Geranium Bronze *Cacyreus marshalli* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Lang´s Short-Tailed Blue *Syntarucus pirithous* have been recognized near Llauro north of Céret southwest of Perpignan in the southwestern part of France where abt. 90 individuals have flown on 17.07.2008 (HENSLE 2009a) which has been one day before the full moon on 18.07.2008, in La Londe-les-Maures and Le Lavandou eastnortheast of Hyères east of Toulon in the southeastern part of France where more than 50 indi-

viduals in total have flown on 30.09.2006 – 04.10.2006 (HENSLE 2007a) which has been around and between the increasing half moon on 30.09.2006 between the new moon on 22.09.2006 and the full moon on 07.10.2006 as well as the full moon on 07.10.2006, and near Mandelieu-la-Napoule west-southwest of Cannes in the southeastern part of France where 10 individuals have flown on 06.10.2003 – 15.10.2003 (S. RATERING in HENSLE 2004a) which has been around the full moon on 10.10.2003.

5.87 The Geranium Bronze *Cacyreus marshalli*

Mass occurrences of large quantities of individuals of the Geranium Bronze *Cacyreus marshalli* BUTLER 1898 (Lepidoptera: Lycaenidae) have been registered near Locarno at the northern margin of the Lago Maggiore in the southeastern part of Switzerland where 12 individuals, abt. 10 individuals and abt. 25 individuals in total have flown on 23.07.2003 – 24.07.2003 (AISTLEITNER 2003, ULRICH AISTLEITNER in HENSLE 2004a), 07.08.2007 – 08.08.2007 (T. KISSLING in HENSLE 2008 a), and 07.08.2008 – 08.08.2008 and 13.08.2008 (T. KISSLING in HENSLE 2009 a), respectively, which has been two and three days after the decreasing half moon on 21.07.2003 between the full moon on 13.07.2003 and the new moon on 29.07.2003, two and three days after the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007, one day before and on the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, and three days before the full moon on 16.08.2008, respectively; near Intragna westnorthwest of Locarno in the southeastern part of Switzerland where abt. 80 individuals have flown on 24.10.2007 (A. MÉGROZ in HENSLE 2008a) which has been two days before the full moon on 26.10.2007, near Bayonne southwest of Bordeaux in the southwestern part of France where abt. 10 individuals in total have flown on 20.07.2005 – 29.07.2005 (KARL-HEINZ JELINEK in HENSLE 2006a) which has been around and between the full moon on 21.07.2005 as well as the decreasing half moon on 28.07.2005 between the full moon on 21.07.2005 and the new moon on 05.08.2005, near Bollène in the Rhône valley north of Avignon northnorthwest of Marseille in the southeastern part of France where 12 individuals have flown on 28.09.2006 (JOCHEN GOLDSCHE in HENSLE 2007a) which has been four days before the new moon on 22.09.2006, in Lodève northwest of Montpellier in the southeastern part of France where abt. 20 individuals have flown on 07.09.1999 – 09.09.1999 (HENSLE 2002h) which has been a few days before and on the new moon on 09.09.1999, in Aigues Mortes west of Montpellier in the southeastern part of France where more than 20 individuals have flown on 05.10.2006 (HENSLE 2007a) which has been two days before the full moon on 07.10.2006, and within the cities of Varese and Saluzzo northwest of Milano in the northeastern part of Italy where 40 individuals in total have flown on 04.09.2005 (HENSLE 2006a) which has been one day after the new moon on 03.09.2005.

5.88 The Green Hairstreak *Callophrys rubi*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Green Hairstreak *Callophrys rubi* LINNAEUS 1758 (Lepidoptera: Lycaenidae) at the localities Nußloch, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Green Hairstreak *Callophrys rubi* in the vicinity of Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley in the western part of Germany between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Green Hairstreak *Callophrys rubi* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomologi-

cal observations in 2007 – 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Green Hairstreak *Callophrys rubi* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Green Hairstreak *Callophrys rubi* have been observed in the Krollbach valley in the northern part of the Senne south of Augustdorf southeast of Bielefeld in the northwestern part of Germany where several hundreds of individuals have flown on 18.05.1951 (RETZLAFF 1973) which has been three days before the full moon on 21.05.1951, in the Holte forest near Schloß Holte southsoutheast of Bielefeld in the northwestern part of Germany where several hundreds of individuals have flown on 28.05.1959 (RETZLAFF 1973) which has been two days before the decreasing half moon on 30.05.1959 between the full moon on 22.05.1959 and the new moon on 30.05.1959, in the Rübenbuschtal in the vicinity of Königshoven near Bedburg westnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 20 individuals have flown on 20.05.2004 (JELINEK 2006) which has been one day after the new moon on 19.05.2004, in Königshoven near Bedburg westnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 15 individuals have flown on 21.05.2006 (KARL-HEINZ JELINEK in SCHUMACHER 2007a) which has been one day after the decreasing half moon on 20.05.2006 between the full moon on 13.05.2006 and the new moon on 27.05.2006; in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals each have flown on 28.04.1961 (HANISCH 2009) and 30.05.1966 (WILLIBALD SCHMITZ in HANISCH 2009), respectively, which has been two days before the full moon on 30.04.1961 and four days before the full moon on 03.06.1966, respectively; in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals have flown on 15.05.1992 (KINKLER & HÜRTER 1992) which has been one day before the full moon on 16.05.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 28.05.1967 (KINKLER 1987) which has been five days after the full moon on 23.05.1967, near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 24.04.1994 (S. JOUAUX in BROSZKUS 1995) which has been one day before the full moon on 25.04.1994, and near Oberhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals have flown on 01.05.2005 (UWE EISENBERG in HASSELBACH 2006) which has been on the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005.

5.89 The Sloe Hairstreak *Nordmannia acaciae* and the Ilex Hairstreak *Nordmannia ilicis*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Hairstreak *Nordmannia* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Hairstreak *Nordmannia* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Hairstreak *Nordmannia* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomologi-

cal observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Hairstreak *Nordmannia* during my observations in the field. Some examples of mass occurrences of several species of the Hairstreak *Nordmannia* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Sloe Hairstreak *Nordmannia acaciae* FABRICIUS 1787 (Lepidoptera: Lycaenidae) have been documented from Gersheim southwest of Saarbrücken in the southern part of the Saar area in the western part of Germany where abundant individuals have flown in mid to end of June 1976 (SCHMIDT-KOEHL 1977) which has been around and between the full moon on 12.06.1976 and the new moon on 27.06.1976, from Dörscheid and Kaub in the Middle Rhine valley northnorthwest of Bingen in the western part of Germany where 20 individuals in total have flown on 10.07.1991 (HÜCKER in KINKLER 1992) which has been one day before the new moon on 11.07.1991, from Kaub northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where 5 individuals have flown on 07.07.1995 (HANS-ARNOLD HÜRTER, HELMUT KINKLER & A. SCHMIDT in KINKLER 1996) which has been five days before the full moon on 12.07.1995, from Lorch northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where numerous individuals have flown on 11.06.1865 (ADOLF RÖSSLER in REICHENAU 1904) which has been two days after the full moon on 09.06.1865; from the vicinity of Alzey in the northern part of the Upper Rhine valley in the southwestern part of Germany where abt. 10 individuals and more than 5 individuals have flown on 19.06.1994 and 25.06.1994, respectively (HASSELBACH 1995a), which has been four days before and two days after the full moon on 23.06.1994, respectively; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals and 25 individuals have flown on 04.07.1993 and 12.06.1994, respectively (S. JOUAUX in BROSZKUS 1995), which has been on the full moon on 04.07.1993 and three days after the new moon on 09.06.1994, respectively.

Mass occurrences of large quantities of individuals of the Ilex Hairstreak *Nordmannia ilicis* ESPER 1779 (Lepidoptera: Lycaenidae) in the northwestern part of Germany have been registered near Dreis-Tiefenbach northnortheast of Siegen where abt. 10 – 15 individuals have sucked on blackberries on 10.07.1988 (ARTUR FRANZ in FIEBER 1989) which has been four days before the new moon on 14.07.1988, near Kreuztal-Fellinghausen north of Siegen where 20 individuals have been observed at the beginning of July 1992 (FIEBER 1994, FUHRMANN in FIEBER 1994) which has been several days after the new moon on 30.06.1992, near Helden eastsoutheast of Attendorn in the Bigge valley northnortheast of Olpe where 5 individuals have flown on 31.07.1992 (BERND SCHMITZ in KINKLER 1993) which has been two days after the new moon on 29.07.1992, near Lavesum north of Haltern in the Lippe valley north of Recklinghausen where 20 individuals have flown on 13.07.1986 (M. DERRA in SCHUMACHER 2001) which has been two days before the increasing half moon on 15.07.1986 between the new moon on 07.07.1986 and the full moon on 21.07.1986; in the Königsforst east of Cologne in the Middle Rhine valley where abt. 7 individuals in total have flown on 17.06.1960 and 26.06.1960 (HANISCH 2009) which has been on the decreasing half moon on 17.06.1960 between the full moon on 09.06.1960 and the new moon on 24.06.1960 as well as two days after the new moon on 24.06.1960, respectively; in the Dellbrücker Heide near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley where 10 individuals have flown on 16.06.1960 (CLEMENS CASPERS in KINKLER, SCHMITZ & NIPPEL 1971) which has been one day before the decreasing half moon on 17.06.1960 between the full moon on 09.06.1960 and the new moon on 24.06.1960, in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where abundant individuals have flown on 12.07.1970 (HANS BROCHHAUS & WILLIBALD SCHMITZ in KINKLER, SCHMITZ & NIPPEL 1971; WILLIBALD SCHMITZ in HANISCH 2009) which has been on the increasing half moon on 12.07.1970 between the new moon on

03.07.1970 and the full moon on 18.07.1970; and around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 02.07.1880 and 22.06.1904 (REICHENAU 1904) which has been five days before the new moon on 07.07.1880 and five days before the full moon on 27.06.1904, respectively.

5.90 The Mallow Skipper *Carcharodus alceae* and the Marbled Skipper *Carcharodus lavaterae*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Mallow Skipper *Carcharodus alceae* ESPER 1780 (Lepidoptera: Hesperiidae) and the Chequered Skipper *Carterocephalus palaemon* PALLAS 1771 (Lepidoptera: Hesperiidae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Mallow Skipper *Carcharodus alceae* and the Chequered Skipper *Carterocephalus palaemon* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Mallow Skipper *Carcharodus alceae* and the Chequered Skipper *Carterocephalus palaemon* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Mallow Skipper *Carcharodus alceae* and the Chequered Skipper *Carterocephalus palaemon* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Mallow Skipper *Carcharodus alceae* have been detected near Kobern-Gondorf in the Moselle valley southwest of Koblenz in the western part of Germany where 25 individuals each have flown on 30.07.1991 and 21.08.1991 (KINKLER 1992) which has been four days after the full moon on 26.07.1991 and four days before the full moon on 25.08.1991, respectively; in the Dortebach valley near Klotten northeast of Cochem in the Moselle valley in the western part of Germany where 20 individuals have flown on 10.07.2006 (ROBERT BOCZKI in SCHUMACHER 2007a) which has been one day before the full moon on 11.07.2006, and near Breitscheid-Erdbach west of Herborn in the northwestern part of Germany where 10 individuals have flown on 26.07.1995 (VOLKER PELZ & HEINZ SCHUMACHER in KINKLER 1996) which has been one day before the new moon on 27.07.1995.

Significant quantities of individuals of the Marbled Skipper *Carcharodus lavaterae* (ESPER 1783) (Lepidoptera: Hesperiidae) have been encountered around Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown on 02.07.1882 (REICHENAU 1904) which has been one day after the full moon on 01.07.1882.

5.91 The Chequered Skipper *Carterocephalus palaemon*

Mass occurrences of large quantities of individuals of the Chequered Skipper *Carterocephalus palaemon* PALLAS 1771 (Lepidoptera: Hesperiidae) have been discovered near Beckum-Paterholz northeast of Hamm in the northwestern part of Germany where 10 individuals have flown on 19.05.1974 (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976) which has been two days before

the new moon on 21.05.1974, near Neuhaus in the Arnsberger Wald north of Arnsberg in the northwestern part of Germany where abundant individuals have flown on 12.07.1970 (JOACHIM POKORNY in HARKORT 1976) which has been on the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970, near Lützel westsouthwest of Erndtebrück northeast of Siegen in the northwestern part of Germany where abt. 20 individuals have flown on 31.05.1992 (ARTUR FRANZ in FIEBER 1994) which has been one day before the new moon on 01.06.1992; around Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 28.05.1879, 31.05.1880, 03.06.1881 and 11.06.1900 (REICHENAU 1904) which has been two days before the increasing half moon on 30.05.1877 between the new moon on 21.05.1879 and the full moon on 04.06.1879, on the decreasing half moon on 31.05.1880 between the full moon on 24.05.1880 and the new moon on 08.06.1880, three days before the increasing half moon on 06.06.1881 between the new moon on 28.05.1881 and the full moon on 12.06.1881, and two days before the full moon on 13.06.1900, respectively; around Loreley, Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 25 individuals in total have flown on 14.06.1980 – 15.06.1980 (NIPPEL 1980) which has been two and three days after the new moon on 12.06.1980; at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley where abt. 10 individuals have flown on 29.05.1993 (HANS KWIATKOWSKI & IRENE KWIATKOWSKI in HASSELBACH 1994) which has been on the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, and near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 5 individuals have flown on 30.05.1982 (WALFORT 1983) which has been on the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982.

5.92 The Dingy Skipper *Erynnis tages*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Dingy Skipper *Erynnis tages* LINNAEUS 1758 (Lepidoptera: Hesperiidae) and the Large Skipper *Ochlodes venatus* BREMER & GREY 1852 (Lepidoptera: Hesperiidae) at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Dingy Skipper *Erynnis tages* and the Large Skipper *Ochlodes venatus* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, in Banfe westsouthwest of Bad Laasphe in the Wittgensteiner Land eastnortheast of Siegen between 1973 and 1982, and in Walldorf between 1972 and 1979. Because the Dingy Skipper *Erynnis tages* and the Large Skipper *Ochlodes venatus* have only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, their frequency of appearance is insufficient for a sound analysis of their correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Dingy Skipper *Erynnis tages* and the Large Skipper *Ochlodes venatus* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Dingy Skipper *Erynnis tages* have been recognized in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have flown on 30.05.2003 (HEINZ SCHU-

macher in Hanisch 2009) which has been one day before the new moon on 31.05.2003, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 19.05.1990 (Kinkler & Hürter 1992) which has been five days before the full moon on 24.05.1990; around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 30.04.1876 and 03.05.1882 (Reichenau 1904) which has been one day before the increasing half moon on 01.05.1876 between the new moon on 24.04.1876 and the full moon on 08.05.1876, and on the full moon on 03.05.1882, respectively; and near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 30.05.1992 (Broszkus 1995) which has been two days before the new moon on 01.06.1992.

5.93 The Large Skipper *Ochlodes venatus*

Mass occurrences of large quantities of individuals of the Large Skipper *Ochlodes venatus* Bremer & Grey 1852 (Lepidoptera: Hesperiidae) have been encountered in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 25 individuals have flown on 21.07.1992 (Kinkler & Hürter 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 08.06.1980 (Kinkler 1987) which has been one day after the decreasing half moon on 07.06.1980 between the full moon on 30.05.1980 and the new moon on 12.06.1980, in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975, near Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 20 individuals have flown on 13.07.1982 (Walfort 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, at an unspecified locality in the vicinity of Koblenz in the Middle Rhine valley in the western part of Germany where more than 5 individuals have flown on 28.07.1991 (Hans Kwiatkowski in Hasselbach 1992) which has been two days after the full moon on 26.07.1991, around Bornich and Dörscheid southeast of Sankt Goar in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 10 individuals each have flown on 14.06.1980 – 15.06.1980 (Nippel 1980) which has been two and three days after the new moon on 12.06.1980, and around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where very abundant individuals have flown on 20.06.1904 (Reichenau 1904) which has been one day before the increasing half moon on 21.06.1904 between the new moon on 13.06.1904 and the full moon on 27.06.1904.

5.94 The Large Grizzled Skipper *Pyrgus alveus,* the Grizzled Skipper *Pyrgus malvae* and the Safflower Skipper *Pyrgus fritillarius*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Skipper *Pyrgus* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Skipper *Pyrgus* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because

the Skipper *Pyrgus* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Skipper *Pyrgus* during my observations in the field. Some examples of mass occurrences of several species of the Skipper *Pyrgus* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Large Grizzled Skipper *Pyrgus alveus* HÜBNER 1803 (Lepidoptera: Hesperiidae) have been noticed near Alendorf south of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 5 individuals and 20 individuals have flown on 17.06.2005 (SCHUMACHER 2006) and 10.06.2006 (ROBERT BOCZKI in SCHUMACHER 2007a), respectively, which has been five days before the full moon on 22.06.2005 and one day before the full moon on 11.06.2006, respectively.

Significant quantities of individuals of the Grizzled Skipper *Pyrgus malvae* (LINNAEUS 1758) (Lepidoptera: Hesperiidae) have been encountered around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 30.04.1876, 13.05.1881 and 03.05.1882 (REICHENAU 1904) which has been one day before the increasing half moon on 01.05.1876 between the new moon on 24.04.1876 and the full moon on 08.05.1876, on the full moon on 13.05.1881 and on the full moon on 03.05.1882, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 02.06.1991 (BROSZKUS 1995), which has been five days after the full moon on 28.05.1991, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 7 individuals have flown on 15.05.1992 (KINKLER & HÜRTER 1992) which has been one day before the full moon on 16.05.1992, and near Warburg southsoutheast of Paderborn in the northwestern part of Germany where abundant individuals have flown on 14.05.1969 (ROBENZ in HARKORT 1976) which has been two days before the new moon on 16.05.1969.

Mass occurrences of large quantities of individuals of the Safflower Skipper *Pyrgus fritillarius* PODA 1761 (Lepidoptera: Hesperiidae) have been reported from Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 25 individuals have flown on 21.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 35 individuals and 5 individuals have flown on 12.06.1994 (S. JOUAUX in BROSZKUS 1995) and 03.06.1995 (HILLIG & HANS-ARNOLD HÜRTER in KINKLER 1996), respectively, which has been three days after the new moon on 09.06.1994 and five days after the new moon on 29.05.1995, respectively.

5.95 The Red Underwing Skipper *Spialia sertorius* and the Silver-Spotted Skipper *Hesperia comma*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Silver-Spotted Skipper *Hesperia comma* LINNAEUS 1758 (Lepidoptera: Hesperiidae) among the community of the background brown butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Silver-Spotted Skipper *Hesperia comma* which would permit a selenocyclical evaluation of its population dynamics, which is certainly in considerable degree the result of my

only accessory monitoring of the background brown butterflies, and therefore my own observations of the distribution of the Silver-Spotted Skipper *Hesperia comma* are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Silver-Spotted Skipper *Hesperia comma* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Red Underwing Skipper *Spialia sertorius* HOFFMANNSEGG 1804 (Lepidoptera: Hesperiidae) have been discovered near Lengerich southwest of Osnabrück in the northwestern part of Germany where abt. 25 individuals have flown on 08.06.1975 (HARKORT 1976, JOSEF SCHÄFER & HANS-JOACHIM WEIGT in HARKORT 1976) which has been one day before the new moon on 09.06.1975, near Willebadessen southeast of Paderborn in the northwestern part of Germany where abt. 30 individuals and abt. 20 individuals have flown on 08.06.1969 and 17.06.1969, respectively (RETZLAFF 1973), which has been one day before the decreasing half moon on 09.06.1969 between the full moon on 31.05.1969 and the new moon on 14.06.1969 as well as three days after the new moon on 17.06.1969, respectively; abt. 15 individuals have flown on 17.06.1970 (RETZLAFF 1973) which has been two days before the full moon on 19.06.1970, and abt. 20 individuals have flown on 04.06.1972 (ROBENZ in RETZLAFF 1973) which has been one day before the decreasing half moon on 05.06.1972 between the full moon on 28.05.1972 and the new moon on 11.06.1972; and in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 19.05.1990 (KINKLER & HÜRTER 1992) which has been five days before the full moon on 24.05.1990.

Significant quantities of individuals of the Silver-Spotted Skipper *Hesperia comma* have been detected around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where abundant individuals have flown on 19.07.1900 (REICHENAU 1904) which has been one day before the decreasing half moon on 20.07.1900 between the full moon on 12.07.1900 and the new moon on 26.07.1900, near Marsberg-Udorf eastnortheast of Brilon in the northwestern part of Germany where more than 5 individuals have flown on 08.08.1994 (GASSE in KINKLER 1996) which has been one day after the new moon on 07.08.1994, near Breitscheid-Hörbach westsouthwest of Herborn northwest of Wetzlar in the northwestern part of Germany where 12 individuals have flown on 28.07.1994 (HEINZ SCHUMACHER in KINKLER 1994, 1997) which has been three days before the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, and near Sechshelden eastnortheast of Haiger southeast of Siegen in the northwestern part of Germany where 5 individuals have flown on 28.06.2006 (H. SCHÄFER in SCHUMACHER 2009) which has been three days after the new moon on 25.06.2006.

Significant quantities of individuals of the Silver-Spotted Skipper *Hesperia comma* have also been observed in the northern and southern parts of the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals and abt. 10 individuals each have flown on 21.08.1993 (OLIVER SCHMITZ in HANISCH 2009), 01.08.2009 (HANISCH 2009) and 10.08.2009 (WILLI WÜNSCH & HEIDE GOSPODINOVA in HANISCH 2009), respectively, which has been four days after the new moon on 17.08.1993, and five days before and four days after the full moon on 06.08.2009, respectively; near Brüggen westnorthwest of Mönchengladbach in the northwestern part of Germany where abt. 10 individuals in total have flown in the period of 13.08.1997 – 23.08.1997 (THOMAS in KINKLER 1998) which has been around the full moon on 18.08.1997; and in the Westruper Heide eastsoutheast of Haltern north of Recklinghausen in the northwestern part of Germany where more than 10 individuals and 40 individuals have flown on 09.08.1973 and 15.08.1973, respectively (HARKORT 1976, HANS-JOACHIM WEIGT in HARKORT 1976), which has been five days before and one day after the full moon on 14.08.1973, respectively.

5.96 The Lulworth Skipper *Thymelicus acteon* and the Small Skipper *Thymelicus sylvestris*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Skipper *Thymelicus* at the localities Nußloch, Rot, Sankt Leon, Tairnbach and Walldorf in 2007, 2008 and 2009. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Skipper *Thymelicus* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Skipper *Thymelicus* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. In addition, I have not determined the species of the Skipper *Thymelicus* during my observations in the field. Some examples of mass occurrences of several species of the Skipper *Thymelicus* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Lulworth Skipper *Thymelicus acteon* Rottemburg 1775 (Lepidoptera: Hesperiidae) have been observed near Kattenes in the Moselle valley southwest of Koblenz in the western part of Germany where 30 individuals have flown on 08.07.1995 (Heinz Schumacher in Kinkler 1996) which has been four days before the full moon on 12.07.1995; near Bad Sobernheim and Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals and 5 individuals have flown on 16.07.1992 (Broszkus 1995) and 01.07.2000 (M. Derra in Schumacher 2001), respectively, which has been two days after the full moon on 14.07.1992 and on the new moon on 01.07.2000, respectively; in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 13.08.1991 (Kinkler & Hürter 1992) which has been three days after the new moon on 10.08.1991, near Amdorf west of Herborn northwest of Wetzlar in the northwestern part of Germany where 10 individuals have flown on 26.07.1995 (Volker Pelz & Heinz Schumacher in Kinkler 1996) which has been one day before the new moon on 27.07.1995, and near Lengerich southwest of Osnabrück in the northwestern part of Germany where 5 individuals have flown on 10.07.1986 (Hinz in Kinkler 1993) which has been three days after the new moon on 07.07.1986.

Mass occurrences of large quantities of individuals of the Small Skipper *Thymelicus sylvestris* Poda 1761 (Lepidoptera: Hesperiidae) have been encountered in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975, in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 30 individuals have flown on 28.07.1990 (Kinkler & Hürter 1992) which has been two days before the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 13.07.1970 (Kinkler 1987) which has been five days before the full moon on 18.07.1970; near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 28.06.1994, 05.07.1994, 12.07.1994 and 19.07.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been five days after the full moon on 23.06.1994, four days before and three days after the new moon on 09.07.1994, and three days before the full moon

on 22.07.1994, respectively; in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 01.07.1993 and 08.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before and four days after the full moon on 04.07.1993, respectively; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 20 individuals, 40 individuals and abundant individuals each have flown on 10.07.1992, 27.06.1994, 06.07.1994 and 11.07.1994, respectively (BROSZKUS 1995), which has been four days before the full moon on 14.07.1992, four days after the full moon on 23.06.1994, and three days before and two days after the new moon on 09.07.1994, respectively; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 20 individuals and 10 individuals have flown on 16.06.1992, 22.06.1992 and 02.07.1994, respectively (BROSZKUS 1995), which has been one day after the full moon on 15.06.1992, two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals have flown on 04.07.1993 (S. JOUAUX in BROSZKUS 1995) which has been on the full moon on 04.07.1993; and at an unspecified locality in the southwestern part of Germany where abt. 50 individuals have flown on 25.07.1999 (HASSELBACH 2001) which has been three days before the full moon on 28.07.1999.

5.97 The Essex Skipper *Thymelicus lineola*

Mass occurrences of large quantities of individuals of the Essex Skipper *Thymelicus lineola* OCHSENHEIMER 1808 (Lepidoptera: Hesperiidae) have been recognized in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 21.07.1992 (KINKLER & HÜRTER 1992) which has been two days before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 25 individuals have flown on 13.07.1970 (KINKLER 1987) which has been five days before the full moon on 18.07.1970; near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 09.07.1994, respectively; in the district Sürth at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 07.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 50 individuals, 30 individuals, 250 individuals and very numerous individuals have flown on 10.07.1992, 30.06.1994 and 03.07.1994 as well as in the period of 06.07.1994 – 24.07.1994, respectively (BROSZKUS 1995, S. JOUAUX in BROSZKUS 1995), which has been four days before the full moon on 14.07.1992, one day before and two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and around and between the new moon on 09.07.1994 and the full moon on 22.07.1994, respectively; near Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals and 10 individuals have flown on 02.07.1993 and 02.07.1994, respectively (BROSZKUS 1995), which has been two days before the full moon on 04.07.1993, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively;

and in the vicinity of Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where many individuals have flown on 04.07.1998 (Erwin Sefrin in Hasselbach 2000) which has been five days before the full moon on 09.07.1998.

5.98 The Large Chequered Skipper *Heteropterus morpheus*

Mass occurrences of large quantities of individuals of the Large Chequered Skipper *Heteropterus morpheus* Pallas 1771 (Lepidoptera: Hesperiidae) have been identified in the Neustädter Moor northwest of Ströhen eastsoutheast of Diepholz southeast of Vechta in the northwestern part of Germany where 10 individuals have flown on 01.07.1992 (Hinz in Kinkler 1993) which has been one day after the new moon on 30.06.1992.

5.99 The Eastern Tiger Swallowtail *Papilio glaucus*

In addition to the aforementioned Palaearctic diurnal butterflies, I have also had the opportunity to observe some examples of Nearctic diurnal butterflies. I have seen numerous individuals of the Eastern Tiger Swallowtail *Papilio glaucus* Linnaeus 1758 (Lepidoptera: Papilionidae) during a geological excursion to the Grand Canyon in Arizona in the western part of the United States of America in mid to late August or early September 1982 following my attendance of a sedimentological congress in Hamilton in Ontario in Canada. The trip has included a walk from the southern rim of the Grand Canyon at Grand Canyon Village northnorthwest of Flagstaff north of Phoenix down on the Kaibab Trail to the Colorado River on the first day, an overnight stay at the Phantom Ranch at the Colorado River, and a walk from the Colorado River up on the Bright Angel Trail to the southern rim of the Grand Canyon at Grand Canyon Village on the second day. The walk down on the Kaibab Trail in the afternoon of the first day has unfortunately been in dull cloudy weather without sunshine, whereas the walk up on the Bright Angel Trail from the late morning to the early afternoon of the second day has luckily been in bright sunshine, and at several levels of the terraced gorge complex of the Grand Canyon, numerous individuals of the Eastern Tiger Swallowtail *Papilio glaucus* have flown in abt. 2 – 5 m height above the ground in full sunlight. The Eastern Tiger Swallowtail *Papilio glaucus* reaches up to 16.5 cm wing-spread and is thus considerably larger than the Mid-European Swallowtail *Papilio machaon* which attains only up to 8 cm wing-spread, and the double size of the Eastern Tiger Swallowtail *Papilio glaucus* is the reason why its flight is much more impressive and amazing in comparison to that of the Mid-European Swallowtail *Papilio machaon* which achieves only half the size of its Nearctic relative.

It has been a marvellous adventure to observe the big yellow individuals of the Eastern Tiger Swallowtail *Papilio glaucus* flying and gliding to and fro along the Bright Angel Trail and adjacent side creeks of the Colorado River as well as circling above the heads of the hikers in the perfect illumination of the bright sunshine and with the spectacular background skyline of the terraced gorge complex of the Grand Canyon. The numerous individuals of the Eastern Tiger Swallowtail *Papilio glaucus* have particularly flown in the middle part of the terraced gorge complex of the Grand Canyon where red Permian and Triassic fluvial sandstones and mudstones are exposed above the major unconformity which is visible for many kilometres in the extraordinary extensive panorama outcrop, and where also abundant agave plants are distributed in numerous isolated patches consisting of one or a few shrubs each. The various individuals of the Eastern Tiger Swallowtail *Papilio glaucus* have also flown and glided around the pole-like inflorescences of the numerous isolated agave plants which are dispersed on the flats and slopes of the different terraces of the gorge complex of

the Grand Canyon. The flight of the numerous individuals of the Eastern Tiger Swallowtail *Papilio glaucus* on the Bright Angel Trail during my visit of the Grand Canyon in Arizona in the western part of the United States of America in mid to late August or early September 1982 (time zone: Mountain Standard Time) has probably been developed around and between the new moon on 18.08.1982 and the full moon on 03.09.1982.

I have also seen abundant individuals of small brown satyrid butterflies when driving on the road between Nuevo Laredo and Monterrey in the northeastern part of Mexico on a sightseeing excursion during my attendance of a petroleum conference in San Antonio in Texas in the southwestern part of the United States of America in late September to early October 1989. The masses of small brown satyrid butterflies have flown along and across the road between Nuevo Laredo and Monterrey like clouds and have been assembled at bushes and flowers in the villages in such quantities that it has not been possible to overlook them even during driving. I have never seen such large amounts of butterflies in extensive aggregations of thousands of flying individuals as having been manifested around the road between Nuevo Laredo and Monterrey anywhere before and after. The flight of the abundant individuals of small brown satyrid butterflies around the road during my visit of Nuevo Laredo and Monterrey in the northeastern part of Mexico in late September to early October 1989 (time zone: Central Standard Time) has probably been established around the new moon on 29.09.1989.

6 Relationships of swarm phases, mass flights and peak occurrences of nocturnal butterflies with the new moon and full moon phases of the lunar cycle

In addition to the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* and other beetles with the new moon and full moon phases, also the correlations of mass flights and peak occurrences of diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the turning points of the lunar cycle are outlined as follows. The observations and analysis of the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species with the new moon and full moon phases of the lunar cycle are the base for the selenocyclical evaluation of the short-term population dynamics of the treated diurnal and crepuscular insects. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

6.1 The Tau Emperor *Aglia tau*

The Tau Emperor *Aglia tau* (Linnaeus 1761) (Lepidoptera: Saturniidae) belongs together with the Orange Tip *Anthocharis cardamines* to the first butterflies which appear in early spring with a newly developed vernal generation of individuals that have freshly emerged from the pupae in the first period of dry and warm weather with temperatures of up to 20 – 25 °C in the current year, whereas many other butterflies showing up in early spring represent in fact the automnal generation of the preceding year, with the adults having hibernated after having already emerged from the pupae in the autumn of the previous year. Similarly as applying for the Orange Tip *Anthocharis cardamines,* the appearance of the Tau Emperor *Aglia tau* represents therefore an excellent indicator of the entomological beginning of spring with emergence of new generations of imaginal stages of insects

from the pupae in the current year. During my occasional entomological observations between 1964 and 2006 as well as during my regular entomological observations in 2007, 2008 and 2009, I have always been particularly attracted by the appearance of the Tau Emperor *Aglia tau* in early spring. The flight of the Tau Emperor *Aglia tau* is especially fascinating due to the pronounced light brown shining of its wings in both open sunshine and overcast or shaded daylight which makes it easily recognizable among various dark brown to blackish brown butterflies flying across meadows or along forest margins even over larger distances, and is also striking as a consequence of its often restless flight in frequently ziczac pattern through the forest and along the forest margins.

In 2009, I have observed the first individuals of the Tau Emperor *Aglia tau* at the locality Nußloch a few days before the decreasing half moon on 17.04.2009 between the full moon on 09.04.2009 and the new moon on 25.04.2009, and from two days after the decreasing half moon on 17.04.2009 until one day after the new moon on 25.04.2009, I have seen 3 – 5 individuals per day flying along and around the margin of the forest. After the new moon on 25.04.2009, the quantity of individuals of the Tau Emperor *Aglia tau* has rapidly declined, and I have registered only 1 – 2 individuals per day flying along and around the margin of the forest at the locality Nußloch from the increasing half moon on 01.05.2009 until a few days before the full moon on 09.05.2009 when I have discovered the last single individuals.

In 2010, no individuals of the Tau Emperor *Aglia tau* have flown in Nußloch several days before the new moon on 14.04.2010, whereas a few days after the new moon on 14.04.2010, a single individual has flown in Tairnbach on 17.04.2010, and a single individual each has flown in Nußloch on 18.04.2010, 19.04.2010 and 20.04.2010, thereby confirming the breakout of the new generation around the new moon on 14.04.2010. On the following days, 2 individuals the Tau Emperor *Aglia tau* have flown in Nußloch on 23.04.2010, one individual each has flown in Nußloch and Tairnbach on 24.04.2010, one individual has flown in Nußloch on 27.04.2010, and 2 individuals have flown in Nußloch on 28.04.2010.

Significant quantities of individuals of the Tau Emperor *Aglia tau* have also been recognized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 5 individuals have flown on 30.04.1994 (Broszkus 1996a) which has been five days after the full moon on 25.04.1994.

6.2 The Jersey Tiger *Euplagia quadripunctaria* based on own observations

In 2009, the Jersey Tiger *Euplagia quadripunctaria* (Poda 1761) (Lepidoptera: Arctiidae) has suddenly appeared a few days after the full moon on 06.08.2009 when several individuals have flown along and around the margin of the forest at the locality Nußloch, whereas only occasionally some isolated individuals have been observed before the full moon on 06.08.2009 and after the new moon on 20.08.2009, and no more individuals have been discovered after the full moon on 04.09.2009.

In 2008, the nearly instantaneous occurrence of the Jersey Tiger *Euplagia quadripunctaria* has also been observed in early to mid of August 2008 at the localities Nußloch, Rot and Tairnbach, with the breakout probably having been related either with the new moon on 01.08.2008 or with the full moon on 16.08.2008.

6.3 The Jersey Tiger *Euplagia quadripunctaria* based on literature evaluation

Mass occurrences of large quantities of individuals of the Jersey Tiger *Euplagia quadripunctaria*

(Poda 1761) (Lepidoptera: Arctiidae) in the southwestern part of Germany have been reported from Mühltal southsoutheast of Darmstadt in the northern part of the Odenwald on 04.08.1998 when 40 individuals have been recorded (Eitschberger & Steiniger 2000c) which has been four days before the full moon on 08.08.1998, from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach on 12.08.1978 – 13.08.1978 when 20 individuals have been confirmed (Swoboda 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, from Bruchsal (abt. 31 km southsouthwest of Heidelberg) in the middle part of the Upper Rhine valley on 06.08.1992 when abt. 160 individuals have sit on flowers (Eitschberger & Steiniger 1994b) which has been on the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, from the Heuchelberg near Eppingen south of Sinsheim in the northern part of the Kraichgau on 10.08.2004 when 100 individuals have sit on flowers (Walter Schön in Hensle 2005) which has been three days after the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004; from Heilbronn in the Neckar valley in the northern part of the Kraichgau on 09.08.2002 when 30 individuals have been registered (Eitschberger & Steiniger 2003b) which has been one day after the new moon on 08.08.2002, as well as on 31.07.2006 when abt. 40 individuals have been noticed (W. Klaiber in Hensle 2007b) which has been three days before the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006; from Schwäbisch Hall in the Kocher valley eastsouteast of Heilbronn on 26.07.2008 when 30 individuals have been recognized (C. Steudtner in Hensle 2009b) which has been one day after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, from Gausbach north of Forbach in the Murg valley in the northern part of the Black Forest southsoutheast of Rastatt on 08.08.2003 when abt. 30 individuals have flown (Eitschberger & Steiniger 2004b) which has been three days after the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, from Ihringen westnorthwest of Freiburg in the southern part of the Upper Rhine valley on 07.08.1993 when more than 15 individuals have flown (Eitschberger & Steiniger 1995b) which has been five days after the full moon on 02.08.1993, from Horben south of Freiburg in the southern part of the Black Forest on 22.08.1991 when more than 50 individuals have flown around and have sit on flowers (Eitschberger & Steiniger 1992b) which has been three days before the full moon on 25.08.1991; from Dettingen in the Erms valley southeast of Stuttgart on 06.08.1986 when in total 172 individuals have flown around and have sit on flowers (K. Baumann in Ebert 1997) which has been one day after the new moon on 05.08.1986, on 12.08.1991 when in total 570 individuals have flown around and have sit on flowers (K. Baumann in Ebert 1997, Pretscher 2000) which has been two days after the new moon on 10.08.1991, on 05.08.1998 when 70 individuals have been counted (Eitschberger & Steiniger 2000c) which has been three days before the full moon on 08.08.1998, and on 12.08.2007 when more than 50 individuals have been noticed (S. Przybilla in Hensle 2008b) which has been one day before the new moon on 13.08.2007; from Wiesensteig southeast of Stuttgart on 12.08.1953 when in total abt. 100 individuals have flown around and have sit on flowers (Günter Baisch in Ebert 1997) which has been three days after the new moon on 09.08.1953, from Kohlberg eastnortheast of Metzingen northeast of Reutlingen on 06.08.1995 when 15 individuals have flown (Eitschberger & Steiniger 1996d) which has been four days before the full moon on 10.08.1995, from Tübingen in the Neckar valley southsouthwest of Stuttgart on 10.08.2008 when 30 individuals have been registered (Hensle 2009b) which has been two days after the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, from Bad Boll south of Göppingen eastsoutheast of Stuttgart on 08.08.1998 when 60 individuals have been noticed (Eitschberger & Steiniger 2000c) which has been on the full moon on 08.08.1998, from Inzigkofen westsouthwest of Sigmaringen in the Danube valley on 04.08.1929 when considerably more than 60 individuals have flown around and have sit on flowers (G. Reich in Ebert 1997) which has been one day before the new moon on 05.08.1929, and from an unspecified locality where abt. 30 individuals have flown on 17.08.1991 (Hasselbach 1992) which has been one day before the increasing

half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991.

Mass occurrences of large quantities of individuals of the Jersey Tiger *Euplagia quadripunctaria* in the western part of Germany have been documented from Bacharach northwest of Bingen in the Middle Rhine valley on 24.07.1993 when 30 individuals have flown around and have sit on flowers (EITSCHBERGER & STEINIGER 1995b) which has been five days after the new moon on 19.07.1993, from Lahnstein southsoutheast of Koblenz in the Middle Rhine valley on 26.07.2008 when 40 individuals have been observed (K. HIRSINGER in HENSLE 2009b) which has been one day after the decreasing half moon on 25.07.2008 between the full moon on 18.07.2008 and the new moon on 01.08.2008, from Eitorf in the Sieg valley east of Hennef eastnortheast of Bonn in the Middle Rhine valley on 11.08.2000 when abt. 10 individuals have flown around and have sit on flowers (RALPH ADAM in SCHUMACHER 2001) which has been four days before the full moon on 15.08.2000, from Bad Honnef southeast of Bonn in the Middle Rhine valley on 07.08.1994 when 40 individuals have flown around and have sit on flowers (EITSCHBERGER & STEINIGER 1996c) which has been on the new moon on 07.08.1994, and from Winningen and Kattenes in the Moselle valley southwest of Koblenz on 19.07.1997 – 20.07.1997 when abt. 50 individuals in total have flown around and have sit on flowers (ALBRECHT & STENGER 1999, EITSCHBERGER & STEINIGER 1999b) which has been one day before and on the full moon on 20.07.1997.

Mass occurrences of large quantities of individuals of the Jersey Tiger *Euplagia quadripunctaria* in the northwestern part of Germany have been reported from Bergheim west of Cologne on 07.08.1998 when abt. 40 individuals have been observed (JELINEK 2000, 2002) which has been one day before the full moon on 08.08.1998, on 25.07.1999 when abt. 45 individuals have been counted (JELINEK 2002) which has been three days before the full moon on 28.07.1999, on 30.07.2000 when 15 individuals have been registered (JELINEK 2002) which has been one day before the new moon on 31.07.2000, and on 24.07.2006 when 7 individuals have been noticed (KARL-HEINZ JELINEK in SCHUMACHER 2007a) which has been on the new moon on 24.07.2006; from the district Ensen at the southern margin of the city of Cologne in the Middle Rhine valley where 15 individuals have been monitored on 31.07.2006 (KLAUS HANISCH in SCHUMACHER 2007a) which has been two days before the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, from Alsdorf northnortheast of Aachen where abt. 30 individuals have been recorded on 11.08.2004 (PETER BARWINSKI in SCHUMACHER 2005a) which has been five days before the new moon on 16.08.2004; and from Übach-Palenberg northnortheast of Aachen on 14.08.2002 – 15.08.2002 when abt. 30 individuals in total have been recorded (BARWINSKI 2003, EITSCHBERGER & STEINIGER 2003b) which has been one day before and on the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, as well as on 02.08.2003 – 05.08.2003 when abt. 15 individuals in total have been registered (EITSCHBERGER & STEINIGER 2004b) which has been on and a few days before the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, as well as on 15.08.2004 when abt. 90 individuals have been counted (PETER BARWINSKI in HENSLE 2005, PETER BARWINSKI in SCHUMACHER 2005a) which has been one day before the new moon on 16.08.2004.

Mass occurrences of large quantities of individuals of the Jersey Tiger *Euplagia quadripunctaria* in the northeastern part of Germany have been mentioned from Hohenwarte in the Saale valley southeast of Saalfeld on 24.08.1991 when abt. 120 individuals have flown around and have sit on flowers (EITSCHBERGER & STEINIGER 1992b) as well as on 16.08.1992 when abt. 50 – 60 individuals have flown around and have sit on flowers (EITSCHBERGER & STEINIGER 1994b) which has been one day before the full moon on 25.08.1991 and three days after the full moon on 13.08.1992, respectively; from Ehrenberg east of Kriebstein northnortheast of Chemnitz on 26.07.2007 – 07.08.2007 when more than 120 individuals in total have flown around and have sit on flowers (M. EIGNER in HENSLE 2008b) which has been around and between the full moon on 30.07.2007, the decreasing half moon

on 05.08.007 and the new moon on 13.08.2007; from Heidenau and Dohna eastsoutheast of Dresden on 20.08.1999 when 25 individuals in total have flown around and have sit on flowers (EITSCHBERGER & STEINIGER 2000d) which has been on the increasing half moon on 20.08.1999 between the new moon on 11.08.1999 and the full moon on 26.08.1999, and from Müglitztal south of Dresden in the Elbe valley on 07.08.2007 when abt. 40 individuals have flown around and have sit on flowers (S. WALTER in HENSLE 2008b) which has been two days after the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007.

Mass occurrences of large quantities of individuals of the Jersey Tiger *Euplagia quadripunctaria* in Switzerland and Austria have been notified from Haldenstein at the northern margin of the city of Chur in the Alpine Rhine valley in the southeastern part of Switzerland on 05.08.2005 when abt. 50 individuals have sit on flowers (HENSLE 2006b) and on 15.08.2007 when more than 25 individuals have been observed (VERENA SCHEIWILLER in HENSLE 2008b) which has been on the new moon on 05.08.2005 and two days after the new moon on 13.08.2007, respectively; from Baltschieder and Neubrück near Visp west of Brig in the Rhône valley in the southeastern part of Switzerland on 19.07.2001 when abt. 20 individuals each have flown (EITSCHBERGER & STEINIGER 2002b) which has been one day before the new moon on 20.07.2001, from Ettenau in the Salzach valley northnorthwest of Oberndorf northnorthwest of Salzburg in the western part of Austria on 02.08.2003 when abt. 150 individuals have flown and have sit on flowers (WALTER SAGE in EITSCHBERGER & STEINIGER 2004b) which has been three days before the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, from Spitz northwest of Sankt Pölten west of Vienna in the Danube valley in the eastern part of Austria on 04.07.2002 – 09.07.2002 when 40 individuals in total have been counted (EITSCHBERGER & STEINIGER 2003b) which has been several days before the new moon on 10.07.2002, from the Pielach valley around Kirchberg an der Pielach and Rabenstein an der Pielach southsouthwest of Sankt Pölten in the eastern part of Austria on 10.08.1991 when very abundant individuals have flown and have sit on flowers (EITSCHBERGER & STEINIGER 1992b) which has been on the new moon on 10.08.1991, and from Dürnstein west of Krems west of Vienna in the Danube valley in the eastern part of Austria on 10.08.2006 when abt. 40 individuals have been observed (CHRISTOPHER RABL in HENSLE 2007b) which has been one day after the full moon on 09.08.2006.

Particularly famous are the annual mass assemblages of thousands of individuals of the Jersey Tiger *Euplagia quadripunctaria* on trees, bushes and rock walls in the so-called butterfly valley of Petaloudes in the northern part of the island Rhodos in the southeastern part of Greece which are described and figured among others by MERTENS (1959), LINDNER (1963), HEDIGER (1965), ELGER (1969), LENAU-JÜRGENS (1971) and PRETSCHER (2000).

6.4 The Convolvulus Hawk-Moth *Agrius convolvuli*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim or in other parts of Germany, I have so far only discovered a single individual of the Convolvulus Hawk-Moth *Agrius convolvuli* LINNAEUS 1758 (Lepidoptera: Sphingidae) which has sit on the vertical wall of a concrete pillar of the fence of a house at the locality Walldorf in autumn 2006. Apart from this single individual, I have up to now only seen occasionally a few single individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* on the island Teneriffa during a holiday with my parents in spring 1968. Some examples of mass occurrences of the Convolvulus Hawk-Moth *Agrius convolvuli* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Convolvulus Hawk-Moth *Agrius convol-*

vuli in Germany and Switzerland have been mentioned from Forchheim northnortheast of Erlangen north of Nürnberg in the southeastern part of Germany where abt. 30 individuals have flown on 12.10.1968 (HEIMO HARBICH in HARZ 1969) which has been three days before the decreasing half moon on 15.10.1968 between the full moon on 06.10.1968 and the new moon on 22.10.1968, from Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown on 19.09.1881 (REICHENAU 1904) which has been four days before the new moon on 23.09.1881, from Singen in the southwestern part of Germany where abt. 30 individuals have been observed in sunlight on 14.07.1984 (HARBICH 1986) which has been one day after the full moon on 13.07.1984, and from the Col du Bretolet south of Montreux in the southwestern part of Switzerland where abt. 15 individuals have flown on 07.10.1981 – 08.10.1981 (KÖHLER 1983) which has been several days before the full moon on 13.10.1981.

Mass occurrences of large quantities of individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* in the western part of Austria have been reported from Lanersbach in the Tuxer Tal southeast of Innsbruck where 70 individuals have flown on 18.06.1964 (HEINZ MÄNNEL in HARZ 1965c) which has been on the increasing half moon on 18.06.1964 between the new moon on 10.06.1964 and the full moon on 24.06.1964, from the Tuxer Tal southeast of Innsbruck where abundant individuals have flown on 18.06.1970 (HARZ 1975) which has been one day before the full moon on 19.06.1970; from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 50 individuals, abt. 10 individuals, abt. 5 individuals and abt. 40 individuals daily have flown on 15.09.1969 – 16.09.1969, 01.08.1970, 20.09.1970 – 22.09.1970 and 16.08.1971, respectively (MAZZUCCO 1974), which has been several days after the new moon on 11.09.1969, one day before the new moon on 02.08.1970, around the decreasing half moon on 23.09.1970 between the full moon on 15.09.1970 and the new moon on 30.09.1970, and four days before the new moon on 20.08.1971, respectively; and from Salzburg in the Salzach valley where masses of individuals have been registered in the second half of August 1992 (GERNOT EMBACHER in HARBICH 1994) which has been around and between the full moon on 13.08.1992 and the new moon on 28.08.1992.

Mass occurrences of large quantities of individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* in the eastern part of Austria have been signaled from Graz and Weiz-Eibisberg northnortheast of Graz where 40 individuals and 50 individuals, respectively, have flown on 20.08.1970 (HARBICH 1971) which has been three days after the full moon on 17.08.1970; from Riegersburg westnorthwest of Jennersdorf eastsoutheast of Graz where abt. 15 individuals have flown and have sucked on flowers on 21.08.1970 (HARBICH 1972) which has been four days after the full moon on 17.08.1970, from Kapfenstein southwest of Jennersdorf eastsoutheast of Graz where 7 individuals have flown on 28.06.1976 – 01.07.1976 (BURMANN & TARMANN 1979) which has been one to four days after the new moon on 27.06.1976, from Kitzeck im Sausal in the Sulm valley westsouthwest of Leibnitz where abt. 30 individuals have flown on 22.06.1976 (BURMANN & TARMANN 1979) which has been five days before the new moon on 27.06.1976; from Lake Neusiedl southeast of Vienna where abt. 80 individuals in total have flown in the period of 01.09.1969 – 20.09.1969 (HARBICH 1970, MAZZUCCO 1974) which has been around and between the full moon on 27.08.1969, the new moon on 11.09.1969 and the full moon on 25.09.1969; and from Illmitz at Lake Neusiedl eastsoutheast of Eisenstadt southeast of Vienna where more than 5 individuals in total have flown on 22.06.1976 – 25.06.1976 (BURMANN & TARMANN 1979) which has been two to five days before the new moon on 27.06.1976.

Mass occurrences of large quantities of individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* in France, Italy and Finland have been mentioned from Les Mées westsouthwest of Digne-les-Bains northwest of Cannes in the southeastern part of France where 20 individuals in total have flown on 28.07.1973 – 04.08.1973 (HARBICH 1974) which has been several days before and after the new moon on 29.07.1973; from Lake Garda east of Milano in the northeastern part of Italy where

abt. 30 individuals and abt. 25 individuals have flown and have sucked on flowers on 24.08.1979 and 25.08.1979, respectively (HARBICH 1981), which has been two and three days after the new moon on 22.08.1979, respectively; and from Houtskari in the southwestern part of Finland where 75 individuals in total have been registered in the period of 14.08.1992 – 11.09.1992 (BRUUN in HARBICH 1994) which has been around and between the full moon on 13.08.1992, the new moon on 28.08.1992 and the full moon on 12.09.1992.

Significant quantities of individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* in Germany have also been registered in Rastatt southwest of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany where 5 individuals in total have flown in the period of 26.08.1976 – 10.09.1976 (HARBICH 1977) which has been around and between the new moon on 25.08.1976 and the full moon on 08.09.1976, in Dinkelsbühl northnortheast of Aalen in the southwestern part of Germany where up to 15 individuals daily have flown and have sucked on flowers in the second week of July 1982 (HARBICH 1984) which has been around and between the full moon on 06.07.1982 and the new moon on 20.07.1982; in Steißlingen southsouthwest of Stockach in the southwestern part of Germany where 12 individuals in total have flown in the period of 20.08.1993 – 18.09.1993 (HARBICH 1995) which has been around and between the new moon on 17.08.1993, the full moon on 01.09.1993 and the new moon on 16.09.1993; in Kulmbach in the southeastern part of Germany where numerous individuals have flown and have sucked on flowers in the last weeks of May 1984 (HARBICH 1986) which has been around and between the full moon on 15.05.1984 and the new moon on 30.05.1984, in Mariabrunn northnortheast of Hallbergmoos northeast of München in the southeastern part of Germany where 4 individuals have flown in mid of July 1976 (HARBICH 1977) which has been several days after the full moon on 11.07.1976; in Vienenburg southeast of Salzgitter in the northwestern part of Germany where 3 individuals have flown on 19.09.1972 (HARBICH 1973) as well as 6 individuals in total have flown on 02.09.1975 and 08.09.1975 (HARBICH 1976) which has been four days before the full moon on 23.09.1972 as well as three days before and three days after the new moon on 05.09.1975, respectively; in Gera in the northeastern part of Germany where 10 individuals have flown at the end of September 1960 (JÄNICKE & RÜDIGER in KOCH 1961) which has been around the increasing half moon on 29.09.1960 between the new moon on 20.09.1960 and the full moon on 05.10.1960, in Dresden in the Elbe valley in the northeastern part of Germany where 4 individuals have sucked on flowers on 13.09.1999 (HARBICH 2000) which has been four days after the new moon on 09.09.1999; and in Zwickau in the northeastern part of Germany where 5 individuals each have flown at the end of September 1956 (HAHN in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) and in mid of September 1960 (HAHN in KOCH 1961) which has been around the decreasing half moon on 28.09.1956 between the full moon on 20.09.1956 and the new moon on 04.10.1956, and around the decreasing half moon on 13.09.1960 between the full moon on 05.09.1960 and the new moon on 20.09.1960, respectively.

Significant quantities of individuals of the Convolvulus Hawk-Moth *Agrius convolvuli* in Austria, Switzerland and France have also been recorded at the Packer-Stausee westsouthwest of Graz in the eastern part of Austria where 5 individuals and 8 individuals have flown on 19.08.1970 and 20.08.1970, respectively (HARBICH 1971), which has been two and three days after the full moon on 17.08.1970, respectively; at Lake Neusiedl southeast of Vienna in the eastern part of Austria where 8 individuals and 6 individuals have flown at the beginning of September 1968 (HEIMO HARBICH in HARZ 1969) and on 31.08.1973 (HARBICH 1974), respectively, which has been around and between the new moon on 24.08.1968 and the full moon on 07.09.1968 as well as three days after the new moon on 28.08.1973, respectively; at the Col du Bretolet south of Montreux in the southwestern part of Switzerland where 5 individuals each have flown on 20.08.1976 and 21.08.1976 (HARBICH 1977) which has been five and four days before the new moon on 25.08.1976; and in Les Plans westnorthwest of Lodève westnorthwest of Montpellier in the southeastern part of France where 15 individuals in total have flown in the crepuscular period in the evening in the period of 23.08.1986

– 06.09.1986 (HARBICH 1988) which has been around and between the full moon on 19.08.1986 and the new moon on 04.09.1986, 12 individuals in total have flown in the period of 30.08.1991 – 06.09.1991 (HARBICH 1992) which has been around and between the full moon on 25.08.1991 and the new moon on 08.09.1991, and 4 individuals in total have flown in the period of 12.10.1991 – 18.10.1991 (HARBICH 1992) which has been around and between the new moon on 08.10.1991 and the full moon on 23.10.1991.

6.5 The Hummingbird Hawk-Moth *Macroglossum stellatarum*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have repeatedly noticed a few single or several scattered individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* (LINNAEUS 1758) (Lepidoptera: Sphingidae) at the localities Nußloch, Rot, Sankt Leon, Walldorf and Tairnbach in 2007, 2008 and 2009. Apart from these single or scattered individuals, I have also seen occasionally a few single or several scattered individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Hummingbird Hawk-Moth *Macroglossum stellatarum* has only occurred as a few single or several scattered individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Hummingbird Hawk-Moth *Macroglossum stellatarum* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Significant quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in the southeastern part of Germany and in Austria have been notified from Herrsching am Ammersee and surroundings southwest of München where abundant individuals have flown since mid of May 1928 (LENZ 1928) which has been four days before the new moon on 19.05.1928, from Niederneuching southsouthwest of Erding northeast of München where abt. 10 individuals have flown on 08.06.1968 (HEIMO HARBICH in HARZ 1969) which has been two days before the full moon on 10.06.1968, from Moosburg in the Isar valley northnortheast of München where more than 15 individuals in total have been observed on 13.06.2005 – 28.06.2005 (HEINRICH VOGEL in HARBICH 2006) and from Lengenfeld north of Krems in the Danube valley westnorthwest of Vienna in the eastern part of Austria where 25 individuals in total have been registered in the period of 12.06.2005 – 26.06.2005 (CHRISTOPHER RABL in HARBICH 2006) which has been around and between the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005 as well as around and between the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in the southwestern part of Germany have been mentioned from Illertissen in the Iller valley southsoutheast of Ulm where abt. 30 individuals have flown and have sit on flowers (HARZ 1967a) which has been two days after the new moon on 18.06.1966, from Göppingen in the Fils valley eastsoutheast of Stuttgart where hundreds of individuals have flown around 21.06.1954 (RUDOLF SIEGEL in HARZ 1965b) which has been around the full moon on 16.06.1954; from Kirchheim unter Teck eastsoutheast of Stuttgart where more than 100 individuals have flown on one day and Tauberbischofsheim in the Tauber valley southwest of Würzburg where more than 300 individuals have flown on one day in August 2003 (HARBICH 2004) which has been around and between

the new moon on 29.07.2003, the full moon on 12.08.2003 and the new moon on 27.08.2003; from the Kaiserstuhl northwest of Freiburg in the southern part of the Upper Rhine valley where 20 individuals have flown on 24.06.1964 (HARZ 1965c) which has been on the full moon on 24.06.1964, from Eichstetten northnorthwest of Freiburg in the southern part of the Upper Rhine valley where more than 5 individuals in total have been noticed on 26.08.2005 – 28.08.2005 (JÜRGEN HENSLE in HARBICH 2006) which has been on and several days after the decreasing half moon on 26.08.2005 between the full moon on 19.08.2005 and the new moon on 03.09.2005, from Denzlingen northnortheast of Freiburg in the southern part of the Upper Rhine valley where up to 11 individuals daily have flown and have sucked on flowers around the end of June 1982 (HARBICH 1984) which has been around and between the new moon on 21.06.1982 and the full moon on 06.07.1982; from the Zengermoos near Mariabrunn northeast of Eriskirch southeast of Friedrichshafen at Lake Constance where 50 individuals in total have flown in the period of 03.08.1974 – 15.08.1974 (HARBICH 1975) as well as abt. 20 individuals each have flown at the beginning of August 1977 (HARBICH 1978) and in the period from end of July 1979 to the beginning of August 1979 (HARBICH 1981) which has been around and between the full moon on 03.08.1974 and the new moon on 17.08.1974, around and between the full moon on 30.07.1977 and the new moon on 14.08.1977, and around and between the new moon on 24.07.1979 and the full moon on 08.08.1979, respectively; from Dinkelsbühl northnortheast of Aalen where 10 individuals have flown on 01.06.1981 (HARBICH 1983) which has been one day before the new moon on 02.06.1981, from the vicinity of Zeiskam eastnortheast of Landau in der Pfalz where 5 individuals have flown on 02.09.2001 (KLAUS WEISS in HASSELBACH 2002) which has been one day before the full moon on 03.09.2001, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 50 individuals have flown on 10.06.2007 (ANDREAS WERNO in SCHUMACHER 2008b) which has been two days after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and from Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück where more than 100 individuals in total have flown on 19.06.2003 and 21.06.2003 (ANDREAS WERNO in SCHUMACHER 2005b) which has been on and two days before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in the western part of Germany have been confirmed from Warmsroth west of Bingen where abt. 5 individuals have flown on 12.08.2003 (J. BEGER in SCHUMACHER 2004b) which has been on the full moon on 12.08.2003; from the Rotbach valley near Olewig southeast of Trier in the Moselle valley where abt. 60 individuals have flown in the period of 12.08.2003 – 14.09.2003 (JAKOBS in SCHUMACHER 2004b) which has been around and between the full moon on 12.08.2003, the new moon on 27.08.2003 and the full moon on 10.09.2003; from Sötenich south of Kall in the Urft valley southwest of Mechernich in the northwestern part of the Eifel where 10 individuals have flown on 17.06.2006 (WILLIBALD SCHMITZ in SCHUMACHER 2007b) which has been one day before the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, and from Salz south of Bad Neustadt an der Saale and Unsleben southsouthwest of Mellrichstadt in the central part of Germany where 10 individuals each have been observed in mid of September 2002 (HARBICH 2003) which has been around and between the new moon on 07.09.2002 and the full moon on 21.09.2002.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in the western part of Austria have been recognized around Salzburg in the Salzach valley where masses of individuals have flown on 23.06.1962 (KARL MAZZUCCO in HARZ & WITTSTADT 1964) which has been five days after the full moon on 18.06.1962, within and around Innsbruck in the Inn valley where hundreds of individuals have flown and have sucked on flowers on 04.09.1976 – 13.09.1976 (BURMANN & TARMANN 1979) which has been around the full moon on 08.09.1976, in the vicinity of Reutte in the Lech valley southsoutheast of Füssen where several

dozens of individuals have flown and have sucked on flowers on 04.09.1976 – 13.09.1976 (BURMANN & TARMANN 1979) which has been around the full moon on 08.09.1976; in the Ötz valley between Sölden and Imst in the Inn valley westsouthwest of Innsbruck, in the Stubai valley near Fulpmes southsouthwest of Innsbruck, in the Ziller valley between Mayrhofen and Jenbach in the Inn valley east of Innsbruck, and in the Paznaun valley near Ischgl southwest of Landeck southwest of Innsbruck where abundant individuals each have flown and have sucked on flowers in the period of 04.09.1976 – 13.09.1976 (BURMANN & TARMANN 1979) which has been around the full moon on 08.09.1976; in Sankt Anton am Arlberg west of Landeck where 10 individuals have flown on 26.07.2003 (HARBICH 2004) which has been three days before the new moon on 29.07.2003, in Kitzbühel southeast of Kufstein where numerous individuals have flown and have sucked on flowers in the period of 04.09.1976 – 13.09.1976 (BURMANN & TARMANN 1979) which has been around the full moon on 08.09.1976, and at the Kreuzkogel southeast of Admont in the Enns valley eastnortheast of Liezen in the central part of Austria where 10 individuals have flown on 29.05.1965 (HARBICH 1967) which has been one day before the new moon on 30.05.1967.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in the eastern part of Austria have been noticed in Kraubath in the Mur valley southwest of Leoben northwest of Graz where 10 individuals have flown on 01.07.2003 (HARBICH 2004) which has been two days after the new moon on 29.06.2003, in Kammern im Liesingtal west of Leoben northwest of Graz where 15 individuals have flown on 07.07.2003 (HARBICH 2004) which has been on the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, between Deutschlandsberg and Wolfsberg southwest of Graz where abundant individuals have flown on 04.06.2003 (HARBICH 2004) which has been four days after the new moon on 31.05.2003, and in Emmersdorf in the Danube valley north of Melk west of Vienna where 15 individuals have flown on 20.06.2000 (HARBICH 2001) which has been three days after the full moon on 17.06.2000.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in Switzerland have been recorded near Twann southwest of Biel in the northwestern part of Switzerland where 10 individuals have flown and have sucked on flowers on 07.06.2006 (HARBICH 2007) which has been three days after the increasing half moon on 04.06.2006 between the new moon on 27.05.2006 and the full moon on 11.06.2006, in Interlaken southeast of Bern in the central part of Switzerland where 8 individuals have flown on 02.09.2003 (HARBICH 2004) which has been one day before the increasing half moon on 03.09.2003 between the new moon on 27.08.2003 and the full moon on 10.09.2003; at the Jungfraujoch southsoutheast of Wengen southsoutheast of Interlaken in the central part of Switzerland where abundant individuals have flown 16.03.2003 or 16.03.2004 (URSULA AGGET in HARBICH 2005) which has been two days before the full moon on 18.03.2003 or four days before the new moon on 20.03.2004, respectively; in Lenk north of Sierre in the Rhône valley in the southeastern part of Switzerland where 13 individuals have flown on 21.08.2003 (HARBICH 2004) which has been one day after the decreasing half moon on 20.08.2003 between the full moon on 12.08.2003 and the new moon on 27.08.2003, near Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where 10 individuals have flown on 09.07.2001 (HARBICH 2002) which has been four days after the full moon on 05.07.2001, and in Zermatt southsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where 10 individuals have flown on 14.09.2003 (HARBICH 2004) which has been four days after the full moon on 10.09.2003.

Mass occurrences of large quantities of individuals of the Hummingbird Hawk-Moth *Macroglossum stellatarum* in France and Italy have been registered in Les Mées westsouthwest of Digne-les-Bains northwest of Cannes in the southeastern part of France where abt. 100 individuals in total have flown in the periods of 29.05.1972 – 08.06.1972 and 27.06.1972 – 10.07.1972 (HARBICH 1973)

as well as 20 individuals in total have flown in the period of 28.07.1973 – 04.08.1973 (HARBICH 1974) which has been around and between the full moon on 28.05.1972 and the new moon on 11.06.1972, around and between the full moon on 26.06.1972 and the new moon on 10.07.1972, and several days before and after the new moon on 29.07.1973, respectively; in Crillon-le-Brave northnortheast of Carpentras south of Lyon in the southeastern part of France where up to 15 individuals have flown daily in the period from end of August 1992 to mid of September 1992 (HARBICH 1994) which has been around and between the new moon on 28.08.1992 and the full moon on 12.09.1992; in Les Plans westnorthwest of Lodève westnorthwest of Montpellier in the southeastern part of France where 18 individuals in total and 17 individuals in total have flown in the periods of 28.06.1988 – 09.07.1988 and 11.08.1988 – 22.08.1988, respectively (HARBICH 1990), which has been around and between the full moon on 29.06.1988 and the new moon on 13.07.1988 as well as around and between the new moon on 12.08.1988 and the full moon on 27.08.1988, respectively; at the Sellajoch south of Wolkenstein southsoutheast of Brixen in Southern Tyrol in the northeastern part of Italy where abt. 15 individuals have flown on 27.06.1976 (BURMANN & TARMANN 1979) which has been on the new moon on 27.06.1976, and at Lake Garda east of Milano in the northeastern part of Italy where abt. 50 individuals have flown in the period of 20.06.1969 – 05.07.1969 (HARBICH1970) which has been around and between the new moon on 14.06.1969, the full moon on 29.06.1969 and the new moon on 14.07.1969.

6.6 The Red Underwing *Catocala nupta,* the Yellow Underwing *Catocala nymphaea* and the Yellow Underwing *Catocala conversa*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered one single individual each of the Red Underwing *Catocala nupta* (LINNAEUS 1767) (Lepidoptera: Noctuidae) which has flown in the wood storage place of a sawmill in the Odenwald around Lindenfels northeast of Weinheim in the early afternoon of a day in summer 2007 and which has sit on the vertical wall below the roof of a house in the district Gartenstadt at the northeastern margin of the city of Mannheim in the late afternoon of a day in summer 2008. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Red Underwing *Catocala nupta* in the vicinity of Mülheim-Kärlich northwest of Koblenz as well as within and around Neuwied and Koblenz in the Neuwied Basin in the Middle Rhine valley in the western part of Germany between 1964 and 1972, whereas I have hitherto only seen once a single individual of the Blue Underwing *Catocala fraxini* LINNAEUS 1758 (Lepidoptera: Noctuidae) which has sit on the vertical wall below the roof of a house in Neuwied in the late morning of a day in summer between 1968 and 1972, and I have so far not found any individuals of the Yellow Underwing *Catocala nymphaea* ESPER 1787 (Lepidoptera: Noctuidae) and the Yellow Underwing *Catocala conversa* ESPER 1787 (Lepidoptera: Noctuidae). I have also seen some isolated individuals of the Red Underwing *Catocala nupta* in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Red Underwing *Catocala nupta* and other underwings are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

A mass assemblage of large quantities of individuals of the Red Underwing *Catocala nupta* has been witnessed in Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley in the southwestern part of Germany where 11 individuals have sit on walls of houses and on trees on 09.09.1955 (PEKARSKY 1956) which has been one day before the decreasing half moon between the full moon on 02.09.1955 and the new moon on 16.09.1955.

Mass occurrences of large quantities of individuals of the Yellow Underwing *Catocala nymphaea* have been registered within and around Soustelle northnorthwest of Alès northnorthwest of Nîmes

in the southeastern part of France where thousands of individuals have flown on 05.07.1987 (ESSAYAN 1989, PAUL ZEDI in REZBANYAI-RESER & SCHAEFER 1989) which has been on the increasing half moon on 05.07.1987 between the new moon on 26.06.1987 and the full moon on 11.07.1987, within and around Lodève westnorthwest of Montpellier in the southeastern part of France where up to 20 individuals daily have flown in the period of 27.06.1987 – 10.07.1987 (JÜRGEN THIELE in REZBANYAI-RESER & SCHAEFER 1989) which has been around and between the new moon on 26.06.1987 and the full moon on 11.07.1987, and on the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where more than 25 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987.

A mass occurrence of large quantities of individuals of the Yellow Underwing *Catocala conversa* has been recorded within and around Lodève westnorthwest of Montpellier in the southeastern part of France where up to 20 individuals daily have flown in the period of 27.06.1987 – 10.07.1987 (JÜRGEN THIELE in REZBANYAI-RESER & SCHAEFER 1989) which has been around and between the new moon on 26.06.1987 and the full moon on 11.07.1987.

6.7 The Rosy Underwing *Catocala electa*, the Light Crimson Underwing *Catocala promissa* and the Dark Crimson Underwing *Catocala sponsa*

Mass occurrences of large quantities of individuals of the Rosy Underwing *Catocala electa* (VIEWEG 1790) (Lepidoptera: Noctuidae) have been encountered in Hockenheim southwest of Heidelberg in the middle part of the Upper Rhine valley in the southwestern part of Germany where more than 15 individuals in total have flown on 16.07.1976 and 18.07.1976 (LOBENSTEIN 1977) which has been on and two days after the new moon on 16.07.1976, near Ichenheim westsouthwest of Offenburg and Kappel southsouthwest of Lahr in the southern part of the Upper Rhine valley in the southwestern part of Germany where 18 individuals in total have flown on 21.08.1991 (RENNWALD 1992) which has been four days before the full moon on 25.08.1991; in Mariabrunn northwest of Eriskirch southeast of Friedrichshafen at Lake Constance in the southwestern part of Germany where 7 individuals in total and abt. 20 individuals in total have flown in the periods of 03.08.1974 – 14.08.1974 (ZUCCHI 1975b) and 16.08.1975 – 04.09.1975 (ZUCCHI 1976), respectively, which has been around and between the full moon on 03.08.1974 as well as the decreasing half moon on 12.08.1974 between the full moon on 03.08.1974 and the new moon on 17.08.1974, and around and between the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975 as well as the new moon on 05.09.1975, respectively; in Hallbergmoos in the Isar valley northnortheast of München in the southeastern part of Germany where more than 25 individuals in total have flown in the period of 20.07.1976 – 16.08.1976 (LOBENSTEIN 1977) which has been around and between the new moon on 16.07.1976, the full moon on 30.07.1976 and the new moon on 15.08.1976; and in Sankt Margarethen southeast of Eisenstadt southsoutheast of Vienna in the eastern part of Austria where 5 individuals have flown on 15.08.1974 which has been two days before the new moon on 17.08.1974.

Mass occurrences of large quantities of individuals of the Light Crimson Underwing *Catocala promissa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in the Auer Wald near Windeck-Au westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where abt. 45 individuals in total have been observed in the period of 05.08.2002 – 18.08.2002 (W. BECKERT in SCHUMACHER 2003) which has been around and between the new moon on 08.08.2002 and the full moon on 21.08.2002; in Windeck-Roßbach in the Sieg valley northnorthwest of Hamm westsouthwest of Siegen in the northwestern part of Germany where 5 individuals and abt. 15 individuals in total have flown on 23.07.2000 (W.

BECKERT in SCHUMACHER 2001) and in the period of 30.07.2001 – 30.08.2001 (W. BECKERT in SCHUMACHER 2002), respectively, which has been two days before the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000, and around and between the full moon on 04.08.2001, the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; in Windeck-Gierzhagen in the Sieg valley northnorthwest of Hamm westsouthwest of Siegen in the northwestern part of Germany where 5 individuals have flown on 02.08.2002 (SCHUMACHER 2003) which has been one day after the decreasing half moon on 01.08.2002 between the full moon on 24.07.2002 and the new moon on 08.08.2002, in Reichshof-Brüchermühle eastsoutheast of Wiehl westnorthwest of Siegen in the northwestern part of Germany where abt. 5 individuals have flown on 14.07.2008 (KLAUS MEYER in SCHUMACHER 2009) which has been four days before the full moon on 18.07.2008, in Klotten in the Moselle valley northeast of Cochem in the western part of Germany where 7 individuals have flown on 22.07.1996 (HEINZ SCHUMACHER in KINKLER 1997) which has been two days before the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 30.07.1996, near Seibersbach southeast of Rheinböllen northwest of Bad Kreuznach in the western part of Germany where more than 15 individuals in total have been monitored in the period of 29.07.2004 – 09.08.2004 (ERNST ZEBE in SCHUMACHER 2006) which has been around and between the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004 as well as the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004, and within and around Lodève westnorthwest of Montpellier in the southeastern part of France where up to 20 individuals daily have flown in the period of 27.06.1987 – 10.07.1987 (JÜRGEN THIELE in REZBANYAI-RESER & SCHAEFER 1989) which has been around and between the new moon on 26.06.1987 and the full moon on 11.07.1987.

Mass occurrences of large quantities of individuals of the Dark Crimson Underwing *Catocala sponsa* (LINNAEUS 1767) (Lepidoptera: Noctuidae) have been confirmed in Lüchow north of Salzwedel in the northwestern part of Germany where abt. 10 individuals have flown on 29.07.1981 – 30.07.1981 (LOBENSTEIN 1983) which has been one and two days before the new moon on 31.07.1981; near the Husar in Wuppertal-Elberfeld eastnortheast of Düsseldorf in the northwestern part of Germany where abundant individuals have flown and have sucked sap on bleeding trees in the period from 26.07.1868 to the end of August 1868 (WEYMER 1978) which has been around and between the increasing half moon on 27.07.1868 between the new moon on 20.07.1868 and the full moon on 03.08.1868 as well as the full moon on 03.08.1868, the new moon on 18.08.1868 and the full moon on 02.09.1868; near Windeck-Au westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where abt. 5 individuals and abt. 40 individuals have been observed on 06.08.2000 – 07.08.2000 (W. BECKERT in SCHUMACHER 2001) and in the period of 04.08.2002 – 24.08.2002 (W. BECKERT in SCHUMACHER 2003), respectively, which has been one and two days before the increasing half moon on 08.08.2000 between the new moon on 31.07.2000 and the full moon on 15.08.2000, and around and between the new moon on 08.08.2002 and the full moon on 21.08.2002, respectively; near Klotten northeast of Cochem in the Mosel valley in the western part of Germany where more than 30 individuals have flown on 06.08.2004 (RUDI SELIGER in SCHUMACHER 2005a) which has been one day before the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004, near Kaub northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where 6 individuals have flown on 16.07.1977 (LOBENSTEIN 1981a) which has been on the new moon on 16.07.1977, in the vicinity of Schweinfurt in the Main valley northnortheast of Würzburg in the central part of Germany where abt. 25 individuals have flown on 16.07.1976 – 20.07.1976 (LOBENSTEIN 1977) which has been on and four days after the new moon on 16.07.1976; in Zell near Üchtelhausen northnortheast of Schweinfurt in the Main valley in the central part of Germany where 18 individuals in total have flown in the period of 31.07.1979 – 16.08.1979 (LOBENSTEIN 1981a) which has been around and between the increasing half moon on 02.08.1979 between the new moon on

24.07.1979 and the full moon on 08.08.1979 as well as the decreasing half moon on 15.08.1979 between the full moon on 08.08.1979 and the new moon on 22.08.1979, and around and between the full moon on 06.09.1979 and the new moon on 21.09.1979, respectively; in Eyershausen east of Bad Königshofen im Grabfeld northnortheast of Schweinfurt in the central part of Germany where 5 individuals in total have flown on 17.08.1980 and 28.08.1980 (LOBENSTEIN 1981b) which has been two days before the increasing half moon on 19.08.1980 between the new moon on 10.08.1980 and the full moon on 26.08.1980 as well as two days after the full moon on 26.08.1980, respectively; at the Hoher Landsberg northnortheast of Uffenheim northwest of Bad Windsheim in the central part of Germany where 6 individuals have flown on 29.07.1975 (ZUCCHI 1976) which has been three days before the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, near Staffelstein in the Main valley northnortheast of Bamberg in the southeastern part of Germany where 10 individuals have flown on 05.08.1979 (LOBENSTEIN 1981a) which has been three days before the full moon on 08.08.1979; near Lorsch north of Heidelberg in the middle part of the Upper Rhine valley in the southwestern part of Germany where 5 individuals in total have flown on 11.08.1978 and 14.08.1978 (LOBENSTEIN 1979) which has been one day before and two days after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, respectively; in Tübingen in the Neckar valley southsouthwest of Stuttgart in the southwestern part of Germany where 7 individuals have flown on 08.08.1976 – 09.08.1976 (LOBENSTEIN 1977) which has been one and two days after the decreasing half moon on 07.08.1976 between the full moon on 30.07.1976 and the new moon on 15.08.1976; and in Tübingen in the Neckar valley southsouthwest of Stuttgart in the southwestern part of Germany where 15 individuals in total and 12 individuals in total have flown in the periods of 13.08.1979 – 30.08.1979 and 03.09.1979 – 19.09.1979, respectively (LOBENSTEIN 1981a), which has been around and between the decreasing half moon on 15.08.1979 between the full moon on 08.08.1979 and the new moon on 22.08.1979 as well as the increasing half moon on 31.08.1979 between the new moon on 22.08.1979 and the full moon on 06.09.1979.

6.8 The Blue Underwing *Catocala fraxini,* the Old Lady *Mormo maura* and the Lunar Double-Stripe *Minucia lunaris*

Mass occurrences of large quantities of individuals of the Blue Underwing *Catocala fraxini* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been recognized in Coburg in the southeastern part of Germany where 15 individuals in total have flown in the period of 22.08.1976 – 14.09.1976 (LOBENSTEIN 1977) which has been around and between the increasing half moon on 23.08.1976 between the new moon on 15.08.1976 and the full moon on 28.08.1976 as well as the new moon on 13.09.1976, in Kallmünz in the Naab valley northnorthwest of Regensburg in the southeastern part of Germany where 7 individuals have flown on 23.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been one day after the decreasing half moon on 22.08.1973 between the full moon on 14.08.1973 and the new moon on 28.08.1973; in Nabburg in the Naab valley northnortheast of Schwandorf in the southeastern part of Germany where 8 individuals in total have flown on 10.08.1973, 21.08.1973 and 28.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been four days before the full moon on 14.08.1973, one day before the decreasing half moon on 22.08.1973 between the full moon on 14.08.1973 and the new moon on 28.08.1973, and on the new moon on 28.08.1973, respectively; in Freising in the Isar valley northnortheast of München in the southeastern part of Germany where 8 individuals in total have flown in the period of 24.08.1979 – 30.08.1979 (LOBENSTEIN 1981a) which has been several days after the new moon on 22.08.1979 as well as one and a few days before the increasing half moon on 31.08.1979 between the new moon on 22.08.1979 and the full moon on 06.09.1979, in Isarau near Wang in the Isar valley north of Moosburg northnortheast of München in the southeastern part of Germany where 17 individuals in total have flown in the period of 21.08.1977 – 08.09.1977 (LOBENSTEIN 1978) which has been around

and between the increasing half moon on 23.08.1977 between the new moon on 15.08.1977 and the full moon on 28.08.1977 as well as the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, in Zwickau in the northeastern part of Germany where abundant individuals have flown and have sucked on flowers from the beginning to mid of September 1958 (MARSCHNER & HAHN in KOCH 1959) which has been around and between the full moon on 29.08.1958 and the new moon on 13.09.1958, and in Neukollm westnorthwest of Wittichenau southwest of Hoyerswerda in the northeastern part of Germany where 8 individuals have flown on 29.08.1991 (RENNWALD 1992) which has been four days after the full moon on 25.08.1991.

Mass occurrences of large quantities of individuals of the Old Lady *Mormo maura* (LINNAEUS 1758) (Lepidoptera: Noctuidae) have been identified at the Koster Brücke in Bochum-Stiepel in the northwestern part of Germany where very abundant individuals have flown on 15.08.1926 (ZIELASKOWSKI 1951) which has been two days before the increasing half moon on 17.08.1926 between the new moon on 08.08.1926 and the full moon on 23.08.1926.

Mass occurrences of large quantities of individuals of the Lunar Double-Stripe *Minucia lunaris* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in the Westruper Heide eastsoutheast of Haltern north of Recklinghausen in the northwestern part of Germany where abundant individuals have flown on 25.05.1937 (ZIELASKOWSKI 1951) which has been on the full moon on 25.05.1937.

6.9 The Silver Y *Autographa gamma*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Silver Y *Autographa gamma* LINNAEUS 1758 (Lepidoptera: Noctuidae) among the community of the background brown small butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Silver Y *Autographa gamma* which would permit a selenocyclical evaluation of its population dynamics, and therefore my own observations of its distribution are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Silver Y *Autographa gamma* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* at the coast of the North Sea in the northwestern part of Germany have been mentioned from the island Helgoland northnorthwest of Bremerhaven where myriads of individuals, millions of individuals, more than 75 individuals and more than 40 individuals have flown on 12.08.1877 (HEINRICH GÄTKE in FRAENKEL 1932), 15.08.1882 – 19.08.1882 (HEINRICH GÄTKE in DALLA TORRE 1889, K.W. VON DALLA TORRE in LINSTOW 1913, HEINRICH GÄTKE in FRAENKEL 1932), 03.09.1973 and 04.09.1973, respectively (THOMAS MEINEKE in MÜLLER-KÖLLGES 1974), which has been three days after the new moon on 09.08.1877, several days after the new moon on 13.08.1882, and one and two days before the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973; from List on the island Sylt westnorthwest of Flensburg where abundant individuals have flown in the period of 15.09.1969 – 28.09.1969 (KINKLER & SCHMITZ 1970) which has been around and between the new moon on 11.09.1969 and the full moon on 25.09.1969, from Morsum on the island Sylt westnorthwest of Flensburg where hundreds of individuals have flown on 09.08.1975 (ZUCCHI 1976) which has been two days after the new moon on 07.08.1975, from Skallingen and Blavand northwest of Esbjerg in the southwestern part of Denmark where several thousands of individuals have flown on 11.08.1977 (LOBENSTEIN 1978, 1984) which has been four days

before the new moon on 15.08.1977, from the island Römö south of Esbjerg in the southwestern part of Denmark where abundant individuals have flown on 05.08.1972 (EITSCHBERGER 1973a) which has been two days after the decreasing half moon on 03.08.1972 between the full moon on 26.07.1972 and the new moon on 09.08.1972, from Glücksburg northeast of Flensburg at the coast of the Baltic Sea where abt. 50 individuals in total have flown and have sucked on flowers in the period of 23.07.1968 – 06.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around and between the new moon on 25.07.1968 and the full moon on 08.08.1968, from the island Amrum westnorthwest of Husum where hundreds of individuals have flown in mid of August 1958 (EMEIS in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; EMEIS in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been around the new moon on 15.08.1958, from the Hallig Hooge westnorthwest of Husum where more than 500 individuals have flown on 09.10.1969 (KINKLER & SCHMITZ 1970) which has been two days before the new moon on 11.10.1969; from the Hallig Gröde northwest of Husum where hundreds of individuals and several tens of thousands of individuals have flown on 13.08.1977 – 15.08.1977 (LOBENSTEIN 1978, 1984) and 23.08.1994 (K. FLEETH in RENNWALD 1996) which has been on and two days before the new moon on 15.08.1977 as well as two days after the full moon on 21.08.1994, respectively; from Sankt Peter-Ording southwest of Husum where 30 individuals in total have flown in the period of 01.08.1967 – 09.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been several days after the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967 as well as around the new moon on 06.08.1967, from the island Trischen north of Cuxhaven where abt. 1.000 individuals have flown and have sucked on flowers on 20.08.1976 (LOBENSTEIN 1977) which has been five days after the new moon on 15.08.1976, from the island Scharhörn northwest of Cuxhaven where more than 20 individuals have flown on 21.08.1978 (LOBENSTEIN 1979) which has been three days after the full moon on 18.08.1978, from Cuxhaven where abt. 250 individuals have flown and have sucked on flowers on 05.06.1993 (RENNWALD 1995) which has been one day after the full moon on 04.06.1993, from Bremerhaven where several thousands of individuals have flown on 30.08.1975 – 31.08.1975 (ZUCCHI 1976) which has been on and one day before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975, from Pinneberg northwest of Hamburg where abt. 125 individuals have flown on 05.08.1969 – 06.08.1969 (KINKLER & SCHMITZ 1970) which has been on and one day before the decreasing half moon on 06.08.1969 between the full moon on 31.07.1969 and the new moon on 13.08.1969, from Bremen where abt. 30 individuals have flown and have sucked on flowers on 26.05.1969 (KINKLER & SCHMITZ 1970) which has been one day after the increasing half moon on 25.05.1969 between the new moon on 16.05.1969 and the full moon on 31.05.1969, from Greetsiel northnorthwest of Emden where 45 individuals have flown and have sucked on flowers on 25.08.1991 (RENNWALD 1992) which has been on the full moon on 25.08.1991, from Leer-Loga southeast of Emden where abt. 250 individuals have flown and have sucked on flowers on 28.09.1991 (RENNWALD 1992) which has been five days after the full moon on 23.09.1991, and from Oostvoorne west of Rotterdam in the southwestern part of the Netherlands where hundreds of thousands of individuals have flown and have sucked on flowers on 04.09.1991 (RENNWALD 1992) which has been four days before the new moon on 08.09.1991.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the northwestern part of Germany have also been reported from Behringen southwest of Lüneburg where masses of individuals have flown and have sucked on flowers on 06.08.1969 – 08.08.1969 (KINKLER & SCHMITZ 1970) which has been on and several days after the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969, from Garstedt westnorthwest of Lüneburg where abt. 350 individuals have flown and have sucked on flowers on 24.08.1991 (RENNWALD 1992) which has been one day before the full moon on 25.08.1991, from Oerrel southwest of Wittingen northnorthwest of Wolfsburg where several hundreds of individuals have flown on 24.08.1984 (WOLF 1987) which has been two days before the new moon on 26.08.1984, from

Hannover where abundant individuals have flown from mid of July 1987 onwards (WOLF 1989) which has been around and between the full moon on 11.07.1987 and the new moon on 25.07.1987, from Werlte west of Cloppenburg where more than 80 individuals have flown on 15.08.1977 (LOBENSTEIN 1978, 1984) which has been on the new moon on 15.08.1977, from Harsewinkel west-northwest of Gütersloh where 10 individuals have flown on 03.08.1991 (RETZLAFF 1992) which has been one day before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991; from Detmold southeast of Bielefeld where abt. 120 individuals, abt. 5.000 individuals and abt. 2.500 individuals have flown and have sucked on flowers on 24.08.1991, 01.09.1991 and 14.09.1991, respectively (RENNWALD 1992), which has been one day before the full moon on 25.08.1991, one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and two days before the increasing half moon on 14.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991, respectively; from Augustdorf southeast of Bielefeld where several thousands of individuals, abt. 120 individuals, abt. 250 individuals and abt. 100 individuals have flown on 25.09.1965 (HARBICH 1967) as well as on 24.08.1991, 14.09.1991 and 21.09.1991 (RETZLAFF 1992), respectively, which has been on the new moon on 25.09.1965, one day before the full moon on 25.08.1991, two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, and three days before the full moon on 24.09.1991, respectively; from the northern part of the Senne south of Augustdorf southeast of Bielefeld and the southern part of the Senne northwest of Bad Lippspringe north to northeast of Paderborn where abt. 5.000 individuals and abt. 10.000 individuals have flown on 01.09.1991 and 30.08.1991, respectively (RETZLAFF 1992), which has been one day before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, and five days after the full moon on 25.08.1991, respectively; from the Kammersenne south and southeast of Bielefeld where abt. 3.500 individuals have flown on 14.09.1991 (RETZLAFF 1992) which has been two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991, from Staumühle northwest of Bad Lippspringe north to northeast of Paderborn where 80 individuals have flown on 27.07.1991 (RETZLAFF 1992) which has been one day after the full moon on 26.07.1991; from Leopoldshöhe east of Bielefeld where abt. 300 individuals, abt. 1.000 individuals and abt. 500 individuals each have flown on 30.08.1991, 01.09.1991, and 31.08.1991 and 02.09.1991, respectively (RETZLAFF 1992, RENNWALD 1992), which has been on and several days before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; from Oerlinghausen southeast of Bielefeld where very abundant individuals have flown and have sucked on flowers on 08.09.1969 (KINKLER & SCHMITZ 1970) which has been three days before the new moon on 11.09.1969, from Schloß Holte southsoutheast of Bielefeld where abt. 500 individuals have flown on 09.06.1987 (WOLF 1989) which has been two days before the full moon on 11.06.1987, from Hövelhof northnorthwest of Paderborn where abt. 300 individuals have flown and have sucked on flowers on 01.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been on the increasing half moon on 01.09.1968 between the new moon on 24.08.1968 and the full moon on 07.09.1968, from Bad Driburg east of Paderborn where abt. 1.000 individuals have flown on 01.09.1984 (WOLF 1987) which has been two days before the increasing half moon on 03.09.1984 between the new moon on 26.08.1984 and the full moon on 10.09.1984; from Bad Lippspringe northeast of Paderborn where more than 500 individuals, 80 individuals and abt. 10.000 individuals have flown and have sucked on flowers on 10.09.1989 (WOLF 1992a), 27.07.1991 (RETZLAFF 1992, RENNWALD 1992) and 30.08.1991 (RETZLAFF 1992, RENNWALD 1992), respectively, which has been five days before the full moon on 15.09.1989, one day after the full moon on 26.07.1991, and two days before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, respectively; from Lichtenau southsoutheast of Paderborn where abt. 15 individuals have flown on 09.07.1991 (RETZLAFF 1992) which has been two days before the new moon on 11.07.1991, from Warburg southsoutheast of Paderborn where 30 individuals have flown on 02.10.1971 (KINKLER & SCHMITZ 1972) which has

been two days before the full moon on 04.10.1971, from Westheim northeast of Marsberg south-southeast of Paderborn where masses of individuals have flown on 12.06.1987 (WOLF 1989) which has been one day after the full moon on 11.06.1987, from Bönen southsouthwest of Hamm where masses of individuals have flown and have sucked on flowers on 11.08.1969 (KINKLER & SCHMITZ 1970) which has been two days before the new moon on 13.08.1969, and from Beckum northeast of Hamm where abt. 1.000 individuals have flown on 09.08.1987 (WEIGT in WOLF 1989) which has been on the full moon on 09.08.1987.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the north-western part of Germany have also been notified from the region around and between Dortmund, Hagen, Wetter and Schwerte where masses of individuals each have flown on 09.09.1951, 16.07.1953 and 21.07.1953, 10.09.1954, 11.09.1955, 11.09.1960, 26.08.1962 – 15.09.1962 and 05.09.1963 (HARKORT 1965) which has been on the increasing half moon on 09.09.1951 between the new moon on 01.09.1951 and the full moon on 15.09.1951, four days before and one day after the increasing half moon on 20.07.1953 between the new moon on 11.07.1953 and the full moon on 26.07.1953, two days before the full moon on 12.09.1954, five days before the new moon on 16.09.1955, two days before the decreasing half moon on 13.09.1960 between the full moon on 05.09.1960 and the new moon on 20.09.1960, around and between the decreasing half moon on 23.08.1962 between the full moon on 15.08.1962 and the new moon on 30.08.1962 as well as the full moon on 14.09.1962, and two days after the full moon on 03.09.1963, respectively; from Göttingen in the Leine valley and other regions where more than 150 individuals each have flown daily in mid of September 1965 with a peak abundance on 20.09.1965 – 25.09.1965 (HARBICH 1967) which has been around and between the full moon on 11.09.1965 and the new moon on 25.09.1965, from Ottbergen southsouthwest of Höxter in the Weser valley where abt. 150 individuals have flown on 26.07.1969 (KINKLER & SCHMITZ 1970) which has been three days before the full moon on 29.07.1969; from Elten northwest of Emmerich in the Lower Rhine valley where abt. 350 individuals and more than 500 individuals have flown on 02.09.1968 – 10.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) and 15.08.1969 (KINKLER & SCHMITZ 1970), respectively, which has been around and between the increasing half moon on 01.09.1968 between the new moon on 24.08.1968 and the full moon on 07.09.1968 as well as the full moon on 07.09.1968, and two days after the new moon on 13.08.1969, respectively; from Bocholt east of Emmerich in the Lower Rhine valley where up to 50 individuals daily have flown and have sucked on flowers on 09.08.1969 – 15.08.1969 (KINKLER & SCHMITZ 1970) which has been several days before and after the new moon on 13.08.1969, from Burlo-Venn near Borken east of Bocholt where hundreds of individuals have flown and have sucked on flowers on 05.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been three days before the full moon on 08.08.1968, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where more than 10 individuals have flown on 13.08.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, from the Witte Venn near Alstätte westnorthwest of Ahaus where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Lembeck north of Gelsenkirchen where masses of individuals have flown and have sucked on flowers on 19.08.1974 (MÜLLER-KÖLLGES 1975) which has been two days after the new moon on 17.08.1974, from Hohenlimburg southeast of Hagen where abt. 500 individuals have flown on 25.08.1991 (RENNWALD 1992) which has been on the full moon on 25.08.1991, from Letmathe east of Hagen where abt. 500 individuals have flown on 30.08.1991 (RENNWALD 1992) which has been three days before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; from Dortmund where 50 individuals and 100 individuals each have flown on 29.07.1991, 30.07.1991 and 30.08.1991, respectively (RENNWALD 1992), which has been three and four days after the full moon on 26.07.1991 as well as three days before the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon

on 08.09.1991, respectively; from the vicinity of Dortmund where abundant individuals have flown on 23.08.1968 – 26.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around the new moon on 24.08.1968; from Leverkusen northeast of Cologne in the Middle Rhine valley where abt. 1.000 individuals and more than 400 individuals have flown in the period from the end of July 1969 to mid of August 1969 (KINKLER & SCHMITZ 1970) and in the period from the end of August 1971 to the beginning of September 1971 (KINKLER & SCHMITZ 1972), respectively, which has been around and between the full moon on 29.07.1969 and the new moon on 13.08.1969 as well as around and between the new moon on 21.08.1971 and the full moon on 05.09.1971, respectively; from Leverkusen northeast of Cologne in the Middle Rhine valley where abundant individuals, 110 individuals and 140 individuals have flown on 07.09.1963 (HARBICH & WITTSTADT 1964), 30.08.1977 and 06.09.1977 (LOBENSTEIN 1978, 1984), respectively, which has been four days after the full moon on 03.09.1963, three days after the full moon on 28.08.1977, and on the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; from Wermelskirchen northeast of Cologne in the Middle Rhine valley where abt. 1.000 individuals have flown in the period from the end of July 1969 to mid of August 1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 29.07.1969 and the new moon on 13.08.1969; from Cologne in the Middle Rhine valley where up to more than 200 individuals daily and up to 300 individuals daily have flown in the periods of 25.07.1969 – 28.07.1969 (KINKLER & SCHMITZ 1970) and 31.08.1991 – 08.09.1991 (RENNWALD 1992), respectively, which has been one to four days before the full moon on 29.07.1969, and around and between the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991 as well as the new moon on 08.09.1991, respectively; and from Schönenberg west of Ruppichteroth eastnortheast of Bonn where more than 75 individuals have flown on 17.09.1973 (MÜLLER-KÖLLGES 1974) which has been three days before the decreasing half moon on 20.09.1973 between the full moon on 12.09.1973 and the new moon on 26.09.1973.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have also been signaled from the districts Holweide and Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 19.07.1994, 26.07.1994, 02.08.1994, 09.08.1994, 16.08.1994, 23.08.1994, 30.08.1994 and 20.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before and four days after the full moon on 22.07.1994, five days before and two days after the new moon on 07.08.1994, five days before and two days after the full moon on 21.08.1994, on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, and one day after the full moon on 19.09.1994, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 29.07.1994, 05.08.1994, 12.08.1994, 19.08.1994, 26.08.1994, 02.09.1994 and 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, two days before and five days after the new moon on 07.08.1994, two days before and five days after the full moon on 21.08.1994, three days before the new moon on 05.09.1994 and three days before the full moon on 19.09.1994, respectively; from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 26.07.1994, 02.08.1994, 09.08.1994, 16.08.1994, 23.08.1994, 30.08.1994 and 13.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994, five days before and two days after the new moon on 07.08.1994, five days before and two days after the full moon on 21.08.1994, on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, and on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals have been captured on 30.07.1992 (WIPKING, FORST, KUHNA

& SCHMITZ 1996) which has been one day after the new moon on 29.07.1992.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the western part of Germany have been documented from Linz in the Middle Rhine valley northnorthwest of Neuwied where abundant individuals have flown from mid of July 1969 onwards (KINKLER & SCHMITZ 1970) which has been several days after the new moon on 14.07.1969, from Bad Hönningen in the Middle Rhine valley northnorthwest of Neuwied where abt. 100 individuals daily have flown in the period of 09.09.1991 – 19.09.1991 (RENNWALD 1992) which has been around and between the new moon on 08.09.1991 and the full moon on 23.09.1991, from Alendorf southsouthwest of Blankenheim northwest of Daun in the northwestern part of the Eifel where abundant individuals have flown on 21.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been one day before the new moon on 22.09.1968, from Trier in the Moselle valley where abundant individuals have flown from 10.07.1970 onwards (KINKLER & SCHMITZ 1971) which has been two days before the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970, from Pétange northwest of Esch-sur-Alzette in the southern part of Luxembourg where abundant individuals have flown from mid of September 1967 to the beginning of October 1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 18.09.1967 and the new moon on 03.10.1967, and from Kastellaun in the western part of the Hunsrück eastsoutheast of Cochem where up to 1.000 individuals daily have flown in mid of September 1958 (SCHMAUS in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; SCHMAUS in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been around the new moon on 13.09.1958.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the central part of Germany have been signaled from Tann in the Rhön eastnortheast of Fulda where 100 individuals have flown on 27.08.1991 (RENNWALD 1992) which has been two days after the full moon on 25.08.1991, from Schönstadt northeast of Cölbe northnortheast of Marburg in the Lahn valley where abt. 20 individuals have flown on 26.09.1992 (RENNWALD 1994) which has been on the new moon on 26.09.1992, from Bad Nauheim north of Frankfurt am Main where abt. 80 individuals have flown on 30.08.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been two days before the decreasing half moon on 01.09.1972 between the full moon on 24.08.1972 and the new moon on 07.09.1972; from Hünfelden in the Taunus northnorthwest of Idstein north of Wiesbaden where up to 200 individuals and 300 individuals each have flown and have sucked on flowers on 09.08.1977 (LOBENSTEIN 1978) and 11.09.1984 – 12.09.1984 (WOLF 1987), respectively, which has been two days after the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 15.08.1977 as well as one and two days after the full moon on 10.09.1984, respectively; from Frankfurt am Main where masses of individuals have flown at the end of June 1962 (RUDOLF KÜNNERT in HARZ & WITTSTADT 1964) which has been around and between the full moon on 18.06.1962 and the new moon on 02.07.1962, from Großheubach southsoutheast of Aschaffenburg in the Main valley where masses of individuals have flown and have sucked on flowers on 11.09.1977 (LOBENSTEIN 1978, 1984) which has been two days before the new moon on 13.09.1977; from Würzburg in the Main valley where up to 30 individuals daily have flown in the periods of 16.09.1968 – 24.09.1968 and 07.10.1968 – 20.10.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) as well as hundreds of individuals have flown on 21.09.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been around and between the decreasing half moon on 15.09.1968 between the full moon on 07.09.1968 and the new moon on 22.09.1968 as well as the new moon on 22.09.1968, around and between the full moon on 06.10.1968 and the new moon on 22.10.1968, and two days before the full moon on 23.09.1972, respectively; from Schweinfurt in the Main valley northnortheast of Würzburg where abundant individuals each have flown and have sucked on flowers in the period of 17.06.1969 – 22.06.1969 (KINKLER & SCHMITZ 1970) as well as on 29.08.1971 and 04.09.1971 (KINKLER & SCHMITZ 1972) which has been several days after the new

moon on 14.06.1969, one day before the increasing half moon on 30.08.1971 between the new moon on 21.08.1971 and the full moon on 05.09.1971, and one day before the full moon on 05.09.1971, respectively; and from Mainz at the transition of the Middle Rhine valley into the Upper Rhine valley where masses of individuals have flown on 23.09.1963 (HARBICH & WITTSTADT 1964), 02.09.1973 (MÜLLER-KÖLLGES 1974) and 02.09.1977 (LOBENSTEIN 1978, 1984) which has been four days before the increasing half moon on 27.09.1963 between the new moon on 17.09.1963 and the full moon on 03.10.1963, three days before the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, and five days after the full moon on 28.08.1977, respectively.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the southwestern part of Germany have been reported from Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach where masses of individuals have flown and have sucked on flowers at the end of August 1974 (MÜLLER-KÖLLGES 1975) which has been around the full moon on 01.09.1974, from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, from Pirmasens southsouthwest of Kaiserslautern in the Palatinate Forest where several thousands of individuals have flown on 21.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been three days before the new moon on 24.08.1968, from Albig north of Alzey southsouthwest of Mainz in the northern part of the Upper Rhine valley where several thousands of individuals have flown and have sucked on flowers on 07.09.1975 (ZUCCHI 1976) which has been two days after the new moon on 05.09.1975, from Dalheim southwest of Oppenheim south of Mainz in the northern part of the Upper Rhine valley where more than 1.000 individuals have flown on 24.08.1984 (WOLF 1987) which has been two days before the new moon on 26.08.1984, from Darmstadt in the northern part of the Upper Rhine valley where abt. 250 individuals in total have flown in the period of 02.08.1969 – 08.08.1969 (KINKLER & SCHMITZ 1970) which has been several days before and after the decreasing half moon on 06.08.1969 between the full moon on 29.07.1969 and the new moon on 13.08.1969, from Sinsheim southeast of Heidelberg where more than 1.000 individuals have flown and have sucked on flowers on 09.08.1994 (RENNWALD 1996) which has been two days after the new moon on 07.08.1994, from Dudenhofen west of Speyer westsouthwest of Heidelberg in the middle part of the Upper Rhine valley where hundreds or thousands of individuals have flown on 13.10.1966 (BETTAG 1966) which has been one day before the new moon on 14.10.1966, from Neustadt an der Weinstraße at the western margin of the middle part of the Upper Rhine valley where masses of individuals have flown from the beginning of June 1958 onwards (ROESLER 1960) which has been several days after the full moon on 01.06.1958, from the district Daxlanden at the southwestern margin of the city of Karlsruhe in the middle part of the Upper Rhine valley where abundant individuals have flown and have sucked on flowers on 13.09.1975 (ZUCCHI 1976) which has been on the increasing half moon on 13.09.1975 between the new moon on 05.09.1975 and the full moon on 20.09.1975, from Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley where abundant individuals have flown on 20.06.1970 (KINKLER & SCHMITZ 1971) which has been one day after the full moon on 19.06.1970, from Baden-Baden in the middle part of the Upper Rhine valley where abundant individuals have flown on 10.06.1962 – 11.06.1962 (W. FANK in HARZ & WITTSTADT 1964) which has been one day before and on the increasing half moon on 11.06.1962 between the new moon on 02.06.1962 and the full moon on 18.06.1962; from Rheinmünster-Stollhofen southeast of Rastatt in the middle part of the Upper Rhine valley where abt. 25 individuals, abt. 70 individuals and abt. 20 individuals have flown and have sucked on flowers on 17.08.1992, 26.08.1992 and 07.09.1992, respectively (RENNWALD 1994), which has been four days after the full moon on 13.08.1992, two days before the new moon on 28.08.1992, and five days before the full moon on 12.09.1992, respectively; from Sundheim southsoutheast of Kehl northwest of Offenburg in the southern part of the Upper Rhine

valley where abt. 20 individuals have flown and have sucked on flowers on 18.08.1992 (RENNWALD 1994) which has been five days after the full moon on 13.08.1992, from Willstätt-Eckartsweiler southeast of Kehl northwest of Offenburg in the southern part of the Upper Rhine valley where abt. 20 individuals have flown on 03.09.1992 (RENNWALD 1994) which has been one day before the increasing half moon on 04.09.1992 between the new moon on 28.08.1992 and the full moon on 12.09.1992, from Vogtsburg-Oberrotweil northwest of Freiburg in the southern part of the Upper Rhine valley where abt. 200 individuals in total have flown in the period of 19.06.1967 – 02.07.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 22.06.1967 and the new moon on 07.07.1967, from Stuttgart in the Neckar valley where masses of individuals have flown in September 1987 (WOLF 1989) which has been around and between the full moon on 07.09.1987 and the new moon on 23.09.1987, from Aselfingen west of Blumberg northnortheast of Waldshut-Tiengen where abt. 200 individuals have flown on 23.08.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been one day before the full moon on 24.08.1972; from Villingen-Schwenningen where abundant individuals have flown in the period of 28.07.1969 – 10.08.1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 29.07.1969 and the new moon on 13.08.1969, from Friedrichshafen at Lake Constance where abundant individuals have flown on 02.09.1977 (K.H. FIALA in LOBENSTEIN 1978, 1984) which has been five days after the full moon on 28.08.1977, from Lindenberg im Allgäu westsouthwest of Kempten where masses of individuals have flown on 24.10.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been two days after the new moon on 22.10.1968, from Beiningen near Blaubeuren west of Ulm where abundant individuals have flown and have sucked on flowers on 31.08.1969 (KINKLER & SCHMITZ 1970) which has been four days after the full moon on 27.08.1969; from Illertissen in the Iller valley southsoutheast of Ulm where abt. 20 individuals and abt. 100 individuals have flown on 23.05.1969 – 25.05.1969 and 02.08.1969, respectively (KINKLER & SCHMITZ 1970), which has been on and two days before the increasing half moon on 25.05.1969 between the new moon on 16.05.1969 and the full moon on 31.05.1969 as well as four days after the full moon on 29.07.1969, respectively; and from an unspecified locality in the southwestern part of Germany where more than 40 individuals in total have flown on 09.09.1999 and 12.10.1999 (HASSELBACH 2001) which has been one day before the new moon on 10.09.1999 and three days after the new moon on 09.10.1999, respectively.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the southeastern part of Germany have been registered from Regensburg in the Danube valley where several thousands of individuals have flown on 25.07.1965 – 26.07.1965 (HARBICH 1967) which has been three and two days before the new moon on 28.07.1965, from Fuchsmühl northwest of Wiesau north of Weiden in der Oberpfalz where more than 50 individuals have flown daily in the period of 02.06.1977 – 13.06.1977 (LOBENSTEIN 1978) which has been around and between the full moon on 01.06.1977 and the new moon on 16.06.1977, from Penzing eastnortheast of Landsberg am Lech where abundant individuals have flown and have sucked on flowers on 14.09.1970 (KINKLER & SCHMITZ 1971) which has been one day before the full moon on 15.09.1970, from Kaufering north of Landsberg am Lech where abt. 100 individuals have flown on 10.06.1971 (KINKLER & SCHMITZ 1972) which has been two days after the full moon on 08.06.1971; from Schwaigermoos east of Attaching southeast of Freising where abundant individuals, very abundant individuals and 60 individuals in total have flown on 10.06.1969 and in the period of 29.07.1969 – 15.08.1969 (KINKLER & SCHMITZ 1970) as well as in the period of 15.05.1971 – 26.05.1971 (KINKLER & SCHMITZ 1972), respectively, which has been four days before the new moon on 14.06.1969, around and between the full moon on 29.07.1969 and the new moon on 13.08.1969, and around and between the full moon on 10.05.1971 and the new moon on 24.05.1971, respectively; from Wartenberg northnortheast of Erding and Moosinning southsouthwest of Erding northeast of München where 150 individuals have flown and have sucked on flowers on 06.09.1969 (KINKLER & SCHMITZ 1970) which has been two days after the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and

the new moon on 11.09.1969, from München where hundreds of individuals have flown in the Olympic park on 06.09.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been one day after the new moon on 07.09.1972, from Oberstdorf south of Sonthofen where more than 100 individuals in total have flown in the period of 02.10.1969 – 10.10.1969 (KINKLER & SCHMITZ 1970) which has been around and between the decreasing half moon on 04.10.1969 between the full moon on 25.09.1969 and the new moon on 11.10.1969 as well as several days before the new moon on 11.10.1969; from Mittenwald eastsoutheast of Garmisch-Partenkirchen where up to 200 individuals daily have flown and have sucked on flowers in the period of 09.09.1975 – 01.10.1975 (ZUCCHI 1976) which has been around and between the new moon on 05.09.1975, the full moon on 20.09.1975 and the new moon on 05.10.1975; from Haiming northnortheast of Burghausen in the Salzach valley where several thousands of individuals have flown and have sucked on flowers on 11.08.1991 (RENNWALD 1992) which has been one day after the new moon on 10.08.1991; from Coburg where up to 50 individuals and up to 40 individuals have flown daily from 04.06.1969 onwards (KINKLER & SCHMITZ 1970) and from 11.07.1970 onwards (KINKLER & SCHMITZ 1971), respectively, which has been four days after the full moon on 31.05.1969 as well as one day before the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970, respectively; and from Hof where numerous individuals have flown on 08.06.1956 (VON DAMERAU in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1958) which has been one day before the new moon on 09.06.1956.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* at the coast of the Baltic Sea in the northeastern part of Germany have been confirmed from Rostock and Warnemünde north of Rostock where thousands of individuals each have flown on 24.07.1994 (RUDNICK 1996a, 1996c) and 08.08.1996 – 10.08.1996 (RUDNICK 1998) which has been two days after the full moon on 22.07.1994 as well as one to three days after the decreasing half moon on 07.08.1996 between the full moon on 30.07.1996 and the new moon on 14.08.1996, respectively; from Warnemünde north of Rostock where hundreds of individuals have flown on 06.08.1994 – 07.08.1994 (RUDNICK 1996c) which has been one day before and on the new moon on 07.08.1994, from Prerow in the northern part of the Darß northnortheast of Ribnitz-Damgarten where abundant individuals have flown from mid to end of August 1958 (DRECHSLER & DRECHSLER in KOCH 1959) which has been around and between the full moon on 30.07.1958 and the new moon on 15.08.1958; and from Boltenhagen northnortheast of Klütz westnorthwest of Wismar where abundant individuals have flown on 06.08.1991 – 09.08.1991 and the following days, abt. 140 individuals have flown on 27.08.1991, and abt. 50 individuals each have flown on 19.09.1991 and 30.09.1991, respectively (RENNWALD 1992), which has been one to three days before the new moon on 10.08.1991, two days after the full moon on 25.08.1991, four days before the full moon on 23.09.1991, and two days before the decreasing half moon on 02.10.1991 between the full moon on 23.09.1991 and the new moon on 08.10.1991, respectively.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the northeastern part of Germany have also been quoted from Boizenburg in the Elbe valley eastnortheast of Lüneburg where abt. 200 individuals have flown on 16.08.1991 (RENNWALD 1992) which has been two days before the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991, from Arendsee eastnortheast of Salzwedel where abundant individuals have flown at the end of July 1958 (DRECHSLER & DRECHSLER in KOCH 1959) which has been around the full moon on 30.07.1958, from Zehdenick northnorthwest of Berlin where numerous individuals have flown in mid of July 1958 (ERNST URBAHN in KOCH 1959) which has been around the new moon on 16.07.1958, from Kreuzbruch northeast of Oranienburg north of Berlin where 600 individuals have flown on 21.08.1958 (HAEGER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; HAEGER in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been one day before the increasing half moon on 22.08.1958 between the new moon on 15.08.1958 and the full moon on 29.08.1958, from

Berlin where abt. 300 individuals have flown in the period of 20.07.1969 – 03.08.1969 (KINKLER & SCHMITZ 1970) which has been around and between the increasing half moon on 23.07.1969 between the new moon on 14.07.1969 and the full moon on 31.07.1969 as well as the decreasing half moon on 06.08.1969 between the full moon on 31.07.1969 and the new moon on 13.08.1969, from the Kyffhäuser north of Bad Frankenhausen east of Sondershausen where very abundant individuals have flown on 05.07.1969 (KINKLER & SCHMITZ 1970) which has been two days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969, from Halle in the Saale valley (KAMES in KOCH 1959) and Gera in the Weiße Elster valley (RITTER in KOCH 1959) where very abundant individuals have flown from the end of July 1958 onwards which has been around the full moon on 30.07.1958, from Löberschütz northeast of Jena in the Saale valley where abt. 25 individuals daily have flown and have sucked in flowers at the beginning of September 1971 (KINKLER & SCHMITZ 1972) which has been around the full moon on 05.09.1971; from Bad Blankenburg in the Schwarza valley northwest of Saalfeld where abt. 600 individuals and abt. 700 individuals have flown on 24.07.1958 and 28.07.1958, respectively (STEUER in KOCH 1959), which has been on the increasing half moon on 24.07.1958 between the new moon on 16.07.1958 and the full moon on 30.07.1958 as well as two days before the full moon on 30.07.1958, respectively; from Königsbrück northnortheast of Dresden in the Elbe valley where abundant individuals have flown on 10.09.1958 – 11.09.1958 (TECHRITZ in KOCH 1959) which has been two and three days before the new moon on 13.09.1958, from Wehlen in the Elbe valley east of Pirna eastsoutheast of Dresden in the northeastern part of Germany where masses of individuals have flown in the first half of September 1879 (THWAITES 1879) which has been around and between the full moon on 31.08.1879 and the new moon on 16.09.1879, from Sohland south of Bautzen where abt. 1.000 individuals have flown on 20.07.1958 (EBERT in KOCH 1959) which has been four days after the new moon on 16.07.1958, from Niederoderwitz northwest of Zittau where abt. 5.000 individuals have flown on 20.07.1958 – 21.07.1958 (GÜNTHER in KOCH 1959; GÜNTHER in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; GÜNTHER in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been four and five days after the new moon on 16.07.1958; from Rosenhain northeast of Löbau westsouthwest of Görlitz where abt. 30 individuals daily have flown from the end of July 1968 to 20.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969), up to 100 individuals daily have flown in the period of 30.07.1969 – 18.08.1969 (KINKLER & SCHMITZ 1970), up to 50 individuals daily have flown in the period of 31.07.1970 – 21.08.1970 (KINKLER & SCHMITZ 1971) and abt. 225 individuals in total have flown in the period of 23.08.1972 – 29.08.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been around and between the new moon on 25.07.1968, the full moon on 08.08.1968 and the new moon on 24.08.1968; around and between the full moon on 29.07.1969 and the new moon on 13.08.1969, around and between the new moon on 02.08.1970 and the full moon on 17.08.1970, and several days before and after the full moon on 24.08.1972, respectively; and from Rosenhain northeast of Löbau westsouthwest of Görlitz where masses of individuals each have flown in the periods of 10.09.1960 – 14.09.1960 and 28.09.1961 – 30.09.1961 as well as from 06.08.1962 onwards and from 23.08.1963 onwards (G. SCHOLZ in HARKORT 1965) which has been around the decreasing half moon on 13.09.1960 between the full moon on 05.09.1960 and the new moon on 20.09.1960, several days after the full moon on 24.09.1961, around the increasing half moon on 09.08.1962 between the new moon on 31.07.1962 and the full moon on 15.08.1962, and around the increasing half moon on 28.08.1963 between the new moon on 19.08.1963 and the full moon on 03.09.1963, respectively.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the western part of Austria have been contributed from the Plansee near Reutte and the Heiterwangsee near Heiterwang southsoutheast of Reutte in the Lech valley southsoutheast of Füssen where masses of individuals have flown on 04.09.1975 – 06.09.1975 (BURMANN & TARMANN 1978) which has been around the new moon on 05.09.1975, from Salzburg in the Salzach valley where tens or even hundreds of thousands of individuals and masses of individuals have flown on 27.07.1962 (FRITZ MAIR-

HUBER in HARZ & WITTSTADT 1964) and 19.09.1974 (MAZZUCCO 1975), respectively, which has been four days before the new moon on 31.07.1962 and three days after the new moon on 16.09.1974, respectively; from Fließ eastsoutheast of Landeck where 15 individuals and 10 individuals have flown on 07.07.1975 and 17.09.1975, respectively (BURMANN & TARMANN 1978), which has been two days before the new moon on 09.07.1975 and three days before the full moon on 20.09.1975, respectively; from Fließ eastsoutheast of Landeck where abundant individuals have flown on 26.06.1973 (MÜLLER-KÖLLGES 1974) which has been four days before the new moon on 30.06.1973, from Hochfinstermünz north of Nauders south of Landeck where abt. 40 individuals have flown on 29.08.1976 (BURMANN & TARMANN 1979) which has been four days after the new moon on 25.08.1976, from Linz in the Danube valley where abt. 30 individuals have flown on 28.08.1975 (BURMANN & TARMANN 1978) which has been three days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975, from Königswiesen eastnortheast of Linz where numerous individuals have flown on 23.08.1975 (BURMANN & TARMANN 1978) which has been two days after the full moon on 21.08.1975, from Amstetten eastnortheast of Steyr where abundant individuals have flown on 17.08.1975 (BURMANN & TARMANN 1978) which has been four days before the full moon on 21.08.1975; from Waidhofen in the Ybbs valley southsouthwest of Amstetten where abundant individuals each have flown on 05.08.1975, 11.08.1975 and 15.08.1975 (BURMANN & TARMANN 1978) which has been two days before and four days after the new moon on 07.08.1975, and five days before the full moon on 20.08.1975, respectively; from Gaissulz north of Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 20 individuals daily have flown on 17.08.1977 and 20.08.1977 (BURMANN & TARMANN 1979) which has been three days before the new moon on 14.08.1977 as well as three days before the increasing half moon on 23.08.1977 between the new moon on 14.08.1977 and the full moon on 28.08.1977, respectively; from Küpfern in the Enns valley west of Weyer southeast of Steyr where masses of individuals have flown on 30.08.1975 (BURMANN & TARMANN 1978) which has been one day before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975; within and around Innsbruck in the Inn valley where masses of individuals have flown and have sucked on flowers on 01.07.1975 – 07.07.1975, 11.08.1975 – 12.08.1975 and 17.08.1975 (BURMANN & TARMANN 1978) and 27.07.1977, 16.08.1977, 03.09.1977, 08.09.1977, 09.10.1977 – 10.10.1977 and 27.10.1977 (BURMANN & TARMANN 1979) which has been around and between the decreasing half moon on 02.07.1975 between the full moon on 23.06.1975 and the new moon on 09.07.1975 as well as the new moon on 09.07.1975, four and five days after the new moon on 07.08.1975, four days before the full moon on 21.08.1975, three days before the full moon on 30.07.1977, two days after the new moon on 14.08.1977, three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, five days before the new moon on 13.09.1977, two and three days before the new moon on 12.10.1977, and one day after the full moon on 26.10.1977, respectively; from Kranebitten and Völs west of Innsbruck in the Inn valley where abt. 50 individuals and abundant individuals, respectively, have flown and have sucked on flowers on 27.07.1977 (BURMANN & TARMANN 1979) which has been three days before the full moon on 30.07.1977; from Kühtai in the Sellrain valley westsouthwest of Innsbruck where masses of individuals have flown on 14.08.1975 (BURMANN & TARMANN 1978) which has been one day before the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975, from the Ötz valley between Sautens and Sölden southwest of Innsbruck where 200 individuals have flown on 08.08.1963 (HARBICH & WITTSTADT 1964) which has been three days after the full moon on 05.08.1963; from the Großglocknerstraße south of Bruck southsoutheast of Zell am See where several thousands of individuals each have flown on 04.08.1994 and 09.08.1994 (GERNOT EMBACHER in RENNWALD 1996) which has been three days before and two days after the new moon on 07.08.1994, respectively; from Achenkirch north of the Achensee northnorthwest of Jenbach in the Inn valley eastnortheast of Innsbruck where masses of individuals have flown in the period of 21.08.1975 – 03.09.1975 (BURMANN & TARMANN 1978) which has been around and between the full moon on 21.08.1975 and the new moon on 05.09.1975,

from the Sonnwendjoch in the Rofangebirge north of Jenbach in the Inn valley eastnortheast of Innsbruck where masses of individuals have flown and have sucked in flowers on 17.09.1975 (BURMANN & TARMANN 1978) which has been three days before the full moon on 20.09.1975; from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 1.000 individuals, abt. 12.000 individuals and abt. 40.000 individuals per night have flown on 29.08.1965 (HARBICH 1967), 28.07.1967 – 02.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a), and at the end of August 1974 (MAZZUCCO 1975), respectively, which has been three days after the new moon on 26.08.1965, around the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, and around the full moon on 01.09.1974, respectively; from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 20.000 individuals each, abt. 50.000 individuals, abt. 2.000 individuals, abt. 60 individuals, abt. 5.000 individuals and abt. 400 individuals have flown on 30.07.1969, 02.08.1969, 19.08.1969 – 20.08.1969 and in September 1970 as well as on 16.08.1971 and 09.08.1973 (MAZZUCCO 1974) and 30.08.1976, 09.07.1977 and 03.09.1977 (GERNOT EMBACHER in BURMANN & TARMANN 1979), respectively, which has been one and four days after the full moon on 29.07.1969, one and two days before the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969; around and between the new moon on 01.09.1970, the full moon on 15.09.1970 and the new moon on 30.09.1970; four days before the new moon on 20.08.1971, five days before the full moon on 14.08.1973, five days after the new moon on 25.08.1976, on the decreasing half moon on 09.07.1977 between the full moon on 01.07.1977 and the new moon on 16.07.1977, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; from Sankt Ulrich am Pillersee northeast of Kitzbühel where masses of individuals have flown, have sucked on flowers and have sit on rocks on 10.09.1973 – 11.09.1973 (GERHARD TARMANN in MÜLLER-KÖLLGES 1974) and 09.08.1975 – 10.08.1975 (BURMANN & TARMANN 1978) which has been one and two days before the full moon on 12.09.1973, and two and three days after the new moon on 07.08.1975, respectively; and from Vandans southeast of Bludenz where abt. 30 individuals have flown on 04.08.1970 and 06.08.1970 (KINKLER & SCHMITZ 1971) which has been two and four days after the new moon on 02.08.1970, respectively.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the eastern part of Austria have been signaled from Rassach south of Stainz northnortheast of Deutschlandsberg where up to 50 individuals have flown daily in the period of 04.08.1969 – 10.09.1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 29.07.1969, the new moon on 13.08.1969, the full moon on 27.08.1969 and the new moon on 11.09.1969; from Hollenegg south of Deutschlandsberg where up to 30 individuals have flown daily in the period of 19.08.1969 – 01.09.1969 (KINKLER & SCHMITZ 1970) which has been around and between the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969 as well as the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and the new moon on 11.09.1969, from Kitzeck im Sausal eastsoutheast of Deutschlandsberg where abt. 50 individuals have flown at the end of July 1969 (KINKLER & SCHMITZ 1970) which has been around the full moon on 29.07.1969, from the Triebener Tauern south of Trieben westnorthwest of Leoben where masses of individuals have flown on 09.08.1975 (BURMANN & TARMANN 1978) which has been two days after the new moon on 07.08.1975, from Graz where abt. 20 individuals have flown on 29.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been one day before the increasing half moon on 30.09.1968 between the new moon on 22.09.1968 and the full moon on 06.10.1968, from Weiz northnortheast of Graz where abt. 25 individuals have flown on 16.06.1969 (KINKLER & SCHMITZ 1970) which has been two days after the new moon on 14.06.1969, from Obergurgl northwest of Merano where masses of individuals have flown on 20.08.1975 (BURMANN & TARMANN 1978) which has been one day before the full moon on 21.08.1975, from Pottschach southwest of Ternitz southsouthwest of Wiener Neustadt where masses of individuals have flown on 09.06.1962 (PREISSECKER in HARZ & WITTSTADT 1964) which has

been two days before the increasing half moon on 11.06.1962 between the new moon on 02.06.1962 and the full moon on 18.06.1962, from Dürnstein westsouthwest of Krems in the Danube valley where abt. 20 individuals have flown on 18.08.1977 (BURMANN & TARMANN 1979) which has been four days after the new moon on 14.08.1977, from Lake Neusiedl southeast of Vienna where abt. 40 individuals have flown on 06.08.1967 – 08.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been on and two days after the new moon on 06.08.1967, from Podersdorf at Lake Neusiedl south of Neusiedl am See southeast of Vienna where abt. 80 individuals have flown in the first half of September 1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around and between the increasing half moon on 01.09.1968 between the new moon on 24.08.1968 and the full moon on 07.09.1968 as well as the decreasing half moon on 15.09.1968 between the full moon on 07.09.1968 and the new moon on 22.09.1968, from Apetlon at Lake Neusiedl south of Neusiedl am See southeast of Vienna where abt. 20 individuals have flown on 20.05.1977 (BURMANN & TARMANN 1979) which has been two days after the new moon on 18.05.1977, from Seewinkel west of Sankt Andrä am Zicksee southsoutheast of Neusiedl am See southeast of Vienna where 15 individuals have flown on 25.05.1977 (BURMANN & TARMANN 1979) which has been two days before the increasing half moon on 27.05.1977 between the new moon on 18.05.1977 and the full moon on 01.06.1977, from Matrei northnorthwest of Lienz in the central part of Austria where abt. 70 individuals have flown on 10.06.1970 (KINKLER & SCHMITZ 1971) which has been three days before the increasing half moon on 13.06.1970 between the new moon on 04.06.1970 and the full moon on 19.06.1970, and from Lavant in the Drau valley eastsoutheast of Lienz in the southern part of Austria where masses of individuals have flown on 02.09.1977 (BURMANN & TARMANN 1979) which has been four days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in Southern Tyrol in the northeastern part of Italy have been notified from Martell in the Martell valley westsouthwest of Merano where more than 10 individuals have flown on 27.08.1975 (BURMANN & TARMANN 1978) which has been four days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975; from Naturno eastsoutheast of Merano where 15 individuals and 25 individuals have flown on 28.08.1975 and 29.08.1975, respectively (BURMANN & TARMANN 1978), which has been two and three days before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975; from Naturno eastsoutheast of Merano where abt. 100 – 200 individuals have flown daily in the period of 02.08.1969 – 14.08.1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 29.07.1969 and the full moon on 13.08.1969, from Taufers in the Münstertal west of Merano where hundreds of individuals have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, from the Stilfserjoch north of Bórmio west of Bolzano where abt. 15 individuals have flown on 03.08.1975 (BURMANN & TARMANN 1978) which has been four days before the new moon on 07.08.1975, from Klausen northeast of Bolzano where masses of individuals have flown on 04.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been four days before the full moon on 08.08.1968, from the Tauferertal north of Bruneck eastnortheast of Brixen where abt. 200 individuals have flown on 19.06.1973 (HELMUT KINKLER in MÜLLER-KÖLLGES 1974) which has been four days after the full moon on 15.06.1973, and from the Grödner Joch east of Wolkenstein southeast of Brixen where abundant individuals have flown on 23.07.1973 (MÜLLER-KÖLLGES 1974) which has been one day before the decreasing half moon on 24.07.1973 between the full moon on 15.07.1973 and the new moon on 29.07.1973.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in Switzerland have been reported from Uster eastsoutheast of Zürich in the northeastern part of Switzerland where very abundant individuals, up to 20 individuals, up to 40 individuals and up to 60 individuals

have flown daily on 27.08.1967 – 31.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a), from 12.08.1970 onwards (KINKLER & SCHMITZ 1971), from 10.07.1971 onwards (KINKLER & SCHMITZ 1972) and in the period of 24.08.1972 – 10.09.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), respectively, which has been around the decreasing half moon on 29.08.1967 between the full moon on 20.08.1967 and the new moon on 04.09.1967, one day after the increasing half moon between the new moon on 02.08.1970 and the full moon on 17.08.1970, several days after the full moon on 08.07.1971, and around and between the full moon on 24.08.1972 and the new moon on 07.09.1972, respectively; from Rigi Kulm east of Luzern in the northeastern part of Switzerland where masses of individuals have flown on 02.09.1977 (LADISLAUS REZBANYAI in LOBENSTEIN 1984) which has been five days after the full moon on 28.08.1977, from the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where abt. 2.000 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987, from Zermatt in the Matter valley southsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where more than 20 individuals daily have flown in the period of 06.08.1968 – 15.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around and between the full moon on 08.08.1968 as well as the decreasing half moon on 17.08.1968 between the full moon on 08.08.1968 and the new moon on 24.08.1968, and from Orselina westnorthwest of Locarno at the Lago Maggiore in the southeastern part of Switzerland where more than 100 individuals in total have flown in the period of 12.06.1972 – 20.06.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been around and between the new moon on 11.06.1972 and the full moon on 26.06.1972.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in the southeastern part of France and in the southern part of Luxembourg have been reported from Sète southwest of Montpellier where more than 20 individuals have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978; from Digne-les-Bains and Les Mées westsouthwest of Digne-les-Bains northwest of Cannes where abt. 200 individuals in total and abt. 20 individuals daily each have flown in the periods of 29.05.1972 – 09.06.1972, 25.06.1972 – 10.07.1972 and 16.09.1972 – 23.09.1972, respectively (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), which has been around and between the full moon on 28.05.1972 and the new moon on 11.06.1972, around and between the full moon on 26.06.1972 and the new moon on 10.07.1972, and around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the full moon on 23.09.1972, respectively; between Hyères east of Toulon and Antibes east of Cannes where masses of individuals have flown on 05.05.1907 – 08.05.1907 (HARZ 1975) which has been on and several days after the decreasing half moon on 05.05.1907 between the full moon on 28.04.1907 and the new moon on 12.05.1907, from Trouville-sur-Mer southsouthwest of Le Havre northwest of Paris in the northwestern part of France where masses of individuals have flown on 12.08.1879 (HAWKSHAW 1879) which has been one day after the decreasing half moon on 11.08.1879 between the full moon on 02.08.1879 and the new moon on 17.08.1879, from Rennes in the northwestern part of France where masses of individuals have flown on 10.07.1879 (OBERTHÜR & OBERTHÜR 1879) which has been two days before the decreasing half moon on 12.06.1879 between the full moon on 04.06.1879 and the new moon on 19.06.1879, and from Steinsel north of Luxembourg in the southern part of Luxembourg where very abundant individuals have flown and have sucked on flowers on 01.09.1973 (MAZZUCCO 1974) which has been four days after the new moon on 28.08.1973.

Mass occurrences of large quantities of individuals of the Silver Y *Autographa gamma* in Great Britain and other areas have been documented from London and its vicinity in the southeastern part of England where masses of individuals have flown from 24.05.1892 onwards (ADKIN 1892) which has been around the new moon on 26.05.1892, from Brentwood east of London in the southeastern

part of England where thousands of individuals have flown on 29.05.1892 (ADKIN 1892) which has been three days after the new moon on 26.05.1892, from Enfield and its vicinity in the northern part of the city of London where masses of individuals have flown at the end of May 1892 and at the beginning of June 1892 (SYKES 1892) which has been around and between the new moon on 26.05.1892 and the full moon on 10.06.1892, from Sheerness eastsoutheast of London in the southeastern part of England where abundant individuals have flown on 17.06.1894 (WALKER 1894) which has been one day before the full moon on 18.06.1894, from Bexley east of London in the southeastern part of England where masses of individuals have flown on 24.09.1903 (NEWMAN 1903) which has been three days after the new moon on 21.08.1903, from Ipswich eastnortheast of London in the southeastern part of England where masses of individuals have flown on 24.09.1903 (SPARKE 1903) which has been three days after the new moon on 21.09.1903, from Eastbourne southsoutheast of London in the southeastern part of England where masses of individuals have flown on 03.06.1906 (ADKIN 1906) which has been three days before the full moon on 06.06.1906, from Hallsands near Kingsbridge eastsoutheast of Plymouth in the southwestern part of England where masses of individuals have flown on 12.09.1934 (A.W. GODFREY in FISHER 1938) which has been four days after the new moon on 08.09.1934, from the Outer Dowsing Lightship in the North Sea east of the southeastern part of England where many thousands of individuals have flown on 20.08.1936 (FISHER 1938) which has been three days after the new moon on 17.08.1936, from Dovercourt southwest of Harwich eastnortheast of London in the southeastern part of England where hundreds of individuals have flown on 22.09.1903 (MATHEW 1903) which has been one day after the new moon on 21.09.1903; from Abergavenny north of Newport southwest of Birmingham in the southwestern part of England where abundant individuals and masses of individuals have flown in the periods of 18.06.1936 – 27.06.1936 and 17.08.1936 – 25.08.1936, respectively (TULLOCH 1936), which has been around and between the new moon on 19.06.1936 as well as the increasing half moon on 27.06.1936 between the new moon on 19.06.1936 and the full moon on 04.07.1936, and around and between the new moon on 17.08.1936 as well as the increasing half moon on 26.08.1936 between the new moon on 17.08.1936 and the full moon on 01.09.1936, respectively; from Gloucestershire and the Welsh Borders as well as from Devon to the eastern part of Kent in the southwestern part of England where hundreds of individuals and numerous individuals have flown in the period of 25.06.1934 – 30.06.1934 and at the end of June 1934, respectively (FISHER 1938), which has been around the full moon on 27.06.1934; from Rotherham eastsoutheast of Manchester in the northwestern part of England where masses of individuals each have flown on 28.05.1892, 02.06.1892 and 07.06.1892 (ADKIN 1892) which has been two days after the new moon on 26.05.1892, one day before the increasing half moon on 03.06.1892 between the new moon on 26.05.1892 and the full moon on 10.06.1892, and three days before the full moon on 10.06.1892, respectively; from Hartlepool southsoutheast of Newcastle-upon-Tyne in the northeastern part of England where masses of individuals have flown from 21.05.1883 onwards (ROBSON 1883) which has been around the full moon on 22.05.1883, from the St. Bride´s Bay north of Martin´s Haven northnorthwest of Pembroke westnorthwest of Swansea in the southwestern part of England where abundant individuals have flown on 11.09.1959 (SAGE 1960) which has been one day after the increasing half moon on 10.09.1959 between the new moon on 03.09.1959 and the full moon on 17.09.1959, and from Albena northnortheast of Varna at the coast of the Black Sea in the eastern part of Bulgaria where abt. 50 individuals have flown on 28.05.2002 (HANS RETZLAFF in RENNWALD 2004) which has been two days after the full moon on 26.05.2002. Various examples of mass flights of the Silver Y *Autographa gamma* from the older literature are compiled and quoted in WILLIAMS (1930).

6.10 The Gold Spangle *Autographa bractea*

Mass occurrences of large quantities of individuals of the Gold Spangle *Autographa bractea* SCHIF-

FERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recognized in Nonnenbach southwest of Blankenheim in the northwestern part of the Eifel in the western part of Germany where 30 individuals have flown on 10.07.1981 (LOBENSTEIN 1983) which has been on the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981, in Siegen in the Sieg valley in the northwestern part of Germany where abt. 20 individuals have flown on 14.07.1982 (LOBENSTEIN 1984) which has been one day before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, in the Röspe valley between Erndtebrück and Röspe north of Erndtebrück southeast of Siegen in the northwestern part of Germany where 10 individuals have flown on 13.07.1969 (H.G. KAMP in HARKORT 1971) which has been one day before the new moon on 14.07.1969, in Bad Blankenburg in the Schwarza valley northwest of Saalfeld in the northeastern part of Germany where 6 individuals have flown on 19.07.1961 (STEUER in KOCH, ALBERTI & HANNEMANN 1962) which has been three days before the increasing half moon on 22.07.1961 between the new moon on 12.07.1961 and the full moon on 27.07.1961, and in Bärenstein south of Annaberg-Buchholz in the northeastern part of Germany where 5 individuals have flown at the beginning of July 1961 (KOCH in KOCH, ALBERTI & HANNEMANN 1962) which has been around and between the full moon on 28.06.1961 and the new moon on 12.07.1961.

6.11 The Blood Droplet Moth *Zygaena carniolica*, the Variable Burnet *Zygaena ephialtes,* the Transalpine Burnet *Zygaena transalpina* and the Five-Spot Burnet *Zygaena trifolii*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Six-Spot Burnet *Zygaena filipendulae*, whereas I have not particularly looked for members of other species of the Burnet *Zygaena*. Therefore it is possible that I have overlooked members of other species of the Burnet *Zygaena* among the assemblages of the Six-Spot Burnet *Zygaena filipendulae.* Some examples of mass occurrences of members of other species of the Burnet *Zygaena* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Blood Droplet Moth *Zygaena carniolica* SCOPOLI 1763 (Lepidoptera: Zygaenidae) have been mentioned from Canstein near Marsberg southsoutheast of Paderborn in the northwestern part of Germany where 10 individuals have flown on 06.07.2003 (ARMIN RADTKE in SCHUMACHER 2004a) which has been one day before the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, from Schönecken southsoutheast of Prüm in the northwestern part of the Eifel in the western part of Germany where 15 individuals have flown on 03.08.1995 (HEINZ SCHUMACHER in KINKLER 1996) which has been two days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 200 individuals have flown on 13.07.1997 (SCHUMACHER 2001) which has been on the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997; from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 16.07.1992 and 02.07.1994 (BROSZKUS 1996a) which has been two days after the full moon on 14.07.1992, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; from an unspecified locality in Rheinhessen within and around the triangle between Bad Kreuznach, Mainz and Alzey in the southwestern part of Germany where abt. 50 individuals and abt. 30 individuals

have flown on 12.07.2002 (HASSELBACH 2003) and 09.07.2003 (HASSELBACH 2004), respectively, which has been two days after the new moon on 10.07.2002 as well as two days after the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, respectively; and from an unspecified locality in the southwestern part of Germany where 25 individuals have flown on 19.07.1992 (HASSELBACH 1993) which has been five days after the full moon on 14.07.1992.

Mass occurrences of large quantities of individuals of the Variable Burnet *Zygaena ephialtes* LINNAEUS 1767 (Lepidoptera: Zygaenidae) have been reported from Sechtem north of Bornheim south of Cologne in the Middle Rhine valley in the northwestern part of Germany where 20 individuals have flown on 08.07.1994 (HEINZ SCHUMACHER in KINKLER 1994) which has been on the new moon on 08.07.1994, and from the district Sürth at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 15 – 20 individuals have flown on 08.07.1995 (M. DERRA in SCHUMACHER 2001) which has been four days before the full moon on 12.07.1995.

Mass occurrences of large quantities of individuals of the Transalpine Burnet *Zygaena transalpina* (ESPER 1781) (Lepidoptera: Zygaenidae) have been encountered in the Urft valley near Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 25.07.1984 (KINKLER & HÜRTER 1992) which has been three days before the new moon on 28.07.1984, and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981.

Mass occurrences of large quantities of individuals of the Five-Spot Burnet *Zygaena trifolii* ESPER 1783 (Lepidoptera: Zygaenidae) have been confirmed from the Lüsekamp region near Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where more than 25 individuals have been observed on 08.06.2003 (ARMIN HEMMERSBACH in SCHUMACHER 2004a) which has been one day after the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, and from the Oberthaler Bruch near Oberthal north-northwest of Sankt Wendel in the southern part of the Saar area in the western part of Germany where hundreds of individuals have flown on 19.06.1968 (SCHMIDT-KOEHL 1977) which has been one day after the decreasing half moon on 18.06.1968 between the full moon on 10.06.1968 and the new moon on 25.06.1968.

6.12 The Narrow-Bordered Five-Spot Burnet *Zygaena lonicerae*, the Slender Scotch Burnet *Zygaena loti,* the New Forest Burnet *Zygaena viciae* and the Transparent Burnet *Zygaena purpuralis*

Mass occurrences of large quantities of individuals of the Narrow-Bordered Five-Spot Burnet *Zygaena lonicerae* (SCHEVEN 1777) (Lepidoptera: Zygaenidae) have been registered in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 10.07.1992 (BROSZKUS 1996a) which has been four days before the full moon on 14.07.1992; and around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 15.07.1876, 08.07.1880 – 12.07.1880 and 14.07.1903 (REICHENAU 1904) which has been on the decreasing half moon on 15.07.1876 between the full moon on 06.07.1876 and the new moon on 21.07.1876, one to five days after the new moon on 07.07.1880 and five days after the full moon on 09.07.1903, respectively.

Mass occurrences of large quantities of individuals of the Slender Scotch Burnet *Zygaena loti* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Zygaenidae) have been recorded at the Hammelsberg near Perl in the Moselle valley southsouthwest of Trier in the western part of Germany where hundreds of individuals have flown on 06.07.1967 (SCHMIDT-KOEHL 1977) which has been five days before the full moon on 11.07.1967; around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 15.07.1876, 19.06.1880 and 09.07.1901(REICHENAU 1904) which has been on the decreasing half moon on 15.07.1876 between the full moon on 06.07.1876 and the new moon on 21.07.1876, three days before the full moon on 22.06.1880, and one day before the decreasing half moon on 10.07.1901 between the full moon on 01.07.1901 and the new moon on 16.07.1901, respectively; in Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals each and 10 individuals have flown on 16.06.1992, 02.07.1993 and 02.07.1994, respectively (BROSZKUS 1996a), which has been one day after the full moon on 15.06.1992, two days before the full moon on 04.07.1993, and one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; and at an unspecified locality in the southwestern part of Germany where 5 individuals have flown on 01.07.1992 (HASSELBACH 1993) which has been one day after the new moon on 30.06.1992.

Mass occurrences of large quantities of individuals of the New Forest Burnet *Zygaena viciae* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Zygaenidae) have been observed at the Birnberg southwest of Fechingen southeast of Saarbrücken in the southern part of the Saar area in the western part of Germany where hundreds of individuals have flown in July 1966 (SCHMIDT-KOEHL 1977) which has been around and between the full moon on 02.07.1966, the new moon on 18.07.1966 and the full moon on 01.08.1966; around Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 29.06.1880 and 02.07.1880 (REICHENAU 1904) which has been one day before and two days after the decreasing half moon on 30.06.1880 between the full moon on 22.06.1880 and the new moon on 07.07.1880, respectively; and in Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 02.07.1994 (BROSZKUS 1996a) which has been one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994.

Mass occurrences of large quantities of individuals of the Transparent Burnet *Zygaena purpuralis* (BRÜNNICH 1763) (Lepidoptera: Zygaenidae) have been encountered in Breinigerberg northeast of Breinig southeast of Aachen in the western part of Germany where 7 individuals have flown on 28.06.2007 – 29.06.2007 (LUDGER WIROOKS in SCHUMACHER 2008a) which has been one and two days before the full moon on 30.06.2007; around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 17.07.1876 and 29.06.1903 (REICHENAU 1904) which has been four days before the new moon on 21.07.1876 and four days after the new moon on 25.06.1903, respectively; and around Kefermarkt in the Mühlkreis northeast of Linz in the western part of Austria where 7 individuals have been captured on 04.08.1957 (E.R. REICHL in SCHMIDT-KOEHL 1977) which has been one day after the increasing half moon on 03.08.1957 between the new moon on 27.07.1957 and the full moon on 10.08.1957.

6.13 The Cistus Forester *Adscita geryon* and the Forester *Adscita statices*

Mass occurrences of large quantities of individuals of the Cistus Forester *Adscita geryon* (HÜBNER

1813) (Lepidoptera: Zygaenidae) have been recognized in the Urft valley near Nettersheim south-southwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 40 individuals have flown on 15.06.1992 (KINKLER & HÜRTER 1992) which has been on the full moon on 15.06.1992, and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 29.07.1981 (KINKLER 1987) which has been two days before the new moon on 31.07.1981.

Mass occurrences of large quantities of individuals of the Forester *Adscita statices* (LINNAEUS 1758) (Lepidoptera: Zygaenidae) have been observed at the Köterberg near Niese near Lügde southsouthwest of Hameln in the northwestern part of Germany where 45 individuals have flown on 23.05.2007 (HANS RETZLAFF in SCHUMACHER 2008a) which has been on the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, near Welschneudorf southsouthwest of Montabaur eastnortheast of Koblenz in the northwestern part of Germany where more than 500 individuals have been noticed on 29.05.2008 – 30.05.2008 (S. KINKLER & REIFENBERG in SCHUMACHER 2009) which has been one and two days after the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008, near Steimel near Kausen south of Betzdorf southwest of Siegen in the northwestern part of Germany where 50 individuals have flown on 03.06.2007 (VIKTOR FIEBER in SCHUMACHER 2008a) which has been two days after the full moon on 01.06.2007, and near Krefeld northwest of Düsseldorf in the northwestern part of Germany where abt. 30 individuals in total have flown on 06.07.2002 – 10.07.2002 (BÄUMLER 2002, JELINEK 2006) which has been several days before and on the new moon on 10.07.2002.

6.14 The Large Yellow Underwing *Noctua pronuba*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have repeatedly noticed a few single or several scattered individuals of the Large Yellow Underwing *Noctua pronuba* LINNAEUS 1758 (Lepidoptera: Noctuidae) at the localities Nußloch, Rot, Sankt Leon, Walldorf and Tairnbach in 2007, 2008 and 2009. Apart from these single or scattered individuals, I have also seen occasionally a few single or several scattered individuals of the Large Yellow Underwing *Noctua pronuba* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Large Yellow Underwing *Noctua pronuba* has only occurred as a few single or several scattered individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Large Yellow Underwing *Noctua pronuba* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in the northwestern part of Germany have been reported from the island Helgoland in the North Sea northnorthwest of Bremerhaven where abt. 120 individuals in total have flown in the period of 23.07.1974 – 02.08.1974 and abt. 100 individuals have been registered on 17.08.1974 (THOMAS MEINEKE in ZUCCHI 1974b) which has been around and between the new moon on 19.07.1974 and the full moon on 03.08.1974 as well as on the new moon on 17.08.1974, respectively; from Boizenburg in the Elbe valley eastnortheast of Lüneburg where abt. 300 individuals have flown on 16.08.1991 (RENNWALD 1992) which has been two days before the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991, from Göhrde

west of Hitzacker in the Elbe valley where more than 100 individuals have flown on 31.07.1991 (RENNWALD 1992) which has been five days after the full moon on 26.07.1991, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where more than 10 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, from Essen-Rellinghausen in the Ruhr valley where abundant individuals have flown on 14.06.1937 (FUST in ZIELASKOWSKI 1951) which has been two days before the increasing half moon on 16.06.1937 between the new moon on 08.06.1937 and the full moon on 23.06.1937, from the Nutscheid forest near Ruppichteroth westnorthwest of Bonn where abt. 300 individuals have flown on 28.07.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been one day before the new moon on 29.07.1973, and from the Witte Venn near Alstätte westnorthwest of Ahaus where 30 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 12.07.1994, 26.07.1994, 02.08.1994, 09.08.1994, 23.08.1994, 30.08.1994 and 20.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days after the new moon on 09.07.1994, four days after the full moon on 22.07.1994, five days before and two days after the new moon on 07.08.1994, two days after the full moon on 21.08.1994, on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, and one day after the full moon on 19.09.1994, respectively; from the district Merkenich at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 10.06.1993, 24.06.1993, 01.07.1993, 05.08.1993, 12.08.1993 and 19.08.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, four days after the new moon on 20.06.1993, three days before the full moon on 04.07.1993, three days after the full moon on 02.08.1993, and five days before and two days after the new moon on 17.08.1993, respectively; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.08.1993, 02.09.1993, 09.09.1993, 16.09.1993 and 22.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before and one day after the full moon on 01.09.1993, one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, on the new moon on 16.09.1993, and one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals have been captured on 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 01.07.1994, 08.07.1994, 15.07.1994, 22.07.1994, 05.08.1994, 19.08.1994, 26.08.1994, 02.09.1994 and 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, one day before the new moon on 09.07.1994, two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, on the full moon on 22.07.1994, two days before the new moon on 07.08.1994, two days before and five days after the full moon on 21.08.1994, three days before the new moon on 05.09.1994 and three days before the full moon on 19.09.1994, respectively; from the district Weiler at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 24.06.1993, 01.07.1993, 08.07.1993, 12.08.1993, 19.08.1993, 26.08.1993, 03.09.1993, 10.09.1993 and 16.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the new moon on 20.06.1993, three days before and four days after the full moon on 04.07.1993, five days before and two days after the

new moon on 17.08.1993, five days before and two days after the full moon on 01.09.1993, on the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, and on the new moon on 16.09.1993, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 16.07.1992 and 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 14.07.1992 and four days before the full moon on 12.09.1992, respectively.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in the western part of Germany have been mentioned from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 20 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, from Kaub northnorthwest of Bingen in the Middle Rhine valley where abt. 60 individuals have flown on 11.07.1981 (LOBENSTEIN 1983) which has been one day after the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981, and from Perl in the Moselle valley southsouthwest of Trier where abt. 200 individuals have flown on 03.08.1991 (RENNWALD 1992) which has been one day before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in the southwestern part of Germany have been contributed from Marlen south of Kehl northwest of Offenburg in the southern part of the Upper Rhine valley where 10 individuals have flown on 01.10.1991 (RENNWALD 1992) which has been one day before the decreasing half moon on 02.10.1991 between the full moon on 23.09.1991 and the new moon on 08.10.1991, from Oberrotweil northwest of Freiburg and Schönaich southsouthwest of Stuttgart where masses of individuals each have flown at the beginning of August 1977 (LOBENSTEIN 1978) which has been around and between the full moon on 30.07.1977 and the new moon on 15.08.1977; from Herrenberg-Mönchberg and Rottenburg-Wendelsheim in the Neckar valley southwest of Stuttgart where abt. 10 individuals and abt. 20 individuals have flown on 07.10.1991 and 08.10.1991, respectively (RENNWALD 1992), which has been one day before and on the new moon on 08.10.1991, respectively; from Solnhofen in the Altmühl valley west of Eichstätt where up to more than 50 individuals daily have flown on 29.07.1976 – 30.07.1976 (LOBENSTEIN 1977) which has been on and one day before the full moon on 30.07.1976, and from Tröstau westsouthwest of Wunsiedel in the southeastern part of Germany where abt. 100 individuals have flown at the beginning of August 1977 (LOBENSTEIN 1978) which has been around and between the full moon on 30.07.1977 and the new moon on 15.08.1977.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in the western part of Austria have been registered from Scharnstein south of Wels where up to abt. 30 individuals daily have flown in the period of 15.08.1991 – 25.08.1991 and up to abt. 15 individuals daily have flown on 13.09.1991 – 14.09.1991 (RENNWALD 1992) which has been around and between the new moon on 10.08.1991 and the full moon on 25.08.1991, and two and three days before the decreasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991, respectively; from Waidhofen in the Ybbs valley southsouthwest of Amstetten where abundant individuals have flown on 05.08.1975 (BURMANN & TARMANN 1978) which has been two days before the new moon on 07.08.1975; from Gaissulz north of Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 25 individuals and abt. 20 individuals have flown on 17.08.1977 and 20.08.1977, respectively (BURMANN & TARMANN 1979), which has been three days after the new moon on 14.08.1977, and three days before the increasing half moon on 23.08.1977 between the new moon on 14.08.1977 and the full moon on 28.08.1977, respectively; from Franzen south of Pölla east of Zwettl where abt. 20 individuals have flown on 11.07.1977 (BURMANN & TARMANN 1979) which has been two days after the decreasing half moon on 09.07.1977 between the full moon on 01.07.1977 and the new moon on 16.07.1977; from Fließ eastsoutheast of Landeck where

very abundant individuals, abt. 100 individuals and abt. 50 individuals have flown on 24.08.1976, 22.09.1976 and 24.09.1976, respectively (BURMANN & TARMANN 1979), which has been one day before the new moon on 25.08.1976, and one day before and one day after the new moon on 23.09.1976, respectively; from Hochfinstermünz north of Nauders south of Landeck where very abundant individuals have flown on 29.08.1976 (BURMANN & TARMANN 1979) which has been four days after the new moon on 25.08.1976, from the Silvretta southeast of Landeck in the western part of Austria and eastnortheast of Davos in the northeastern part of Switzerland where masses of individuals have flown on 05.08.1977 (BURMANN & TARMANN 1979) which has been two days before the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 14.08.1977; from Innsbruck in the Inn valley where numerous individuals, masses of individuals and very abundant individuals have flown on 28.08.1976, 06.08.1977 and 16.08.1977, respectively (BURMANN & TARMANN 1979), which has been three days after the new moon on 25.08.1976, one day before the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 14.08.1977, and two days after the new moon on 14.08.1977, respectively; from Völs west of Innsbruck in the Inn valley where masses of individuals have flown on 06.08.1977 (BURMANN & TARMANN 1979) which has been one day before the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 14.08.1977, from Kühtai in the Sellrain valley westsouthwest of Innsbruck where more than 30 individuals have flown on 05.08.1975 (BURMANN & TARMANN 1978) which has been two days before the new moon on 07.08.1975, from Sankt Ulrich am Pillersee northeast of Kitzbühel where abt. 10 individuals daily have flown on 09.08.1975 – 10.08.1975 (BURMANN & TARMANN 1978) which has been two and three days after the new moon on 07.08.1975, from Wörgl in the Inn valley southsouthwest of Kufstein where abt. 60 individuals have flown and have sucked on flowers on 28.07.1975 (BURMANN & TARMANN 1978) which has been five days after the full moon on 23.07.1975; and from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 150 individuals in total, abundant individuals, abt. 800 individuals, abt. 100 individuals daily, abt. 10 individuals, abt. 800 individuals and abt. 3.000 individuals have flown in the period of 28.07.1967 – 02.08.1967 (KARL CLEVE in KINKLER & SCHMITZ in HARZ 1968a) as well as on 22.07.1969 – 24.07.1969, 20.08.1969 and from the beginning of August 1970 onwards (MAZZUCCO 1974) and on 30.08.1976, 12.07.1977 and 09.08.1977 (GERNOT EMBACHER in BURMANN & TARMANN 1979), respectively, which has been around the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, around the increasing half moon on 23.07.1969 between the new moon on 14.07.1969 and the full moon on 29.07.1969, one day before the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969, around the new moon on 02.08.1970, five days after the new moon on 25.08.1976, four days before the new moon on 16.07.1977, and five days before the new moon on 14.08.1977, respectively.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in the eastern part of Austria have been recorded from the pass of the Triebener Tauern south of Trieben westnorthwest of Leoben where numerous individuals have flown on 09.08.1975 (BURMANN & TARMANN 1978) which has been two days after the new moon on 07.08.1975, from Obergurgl northwest of Merano where more than 35 individuals and more than 20 individuals have flown on 14.07.1975 and 15.07.1975, respectively (BURMANN & TARMANN 1978), which has been one and two days before the increasing half moon on 16.07.1975 between the new moon on 09.07.1975 and the full moon on 23.07.1975; from Sölden and Hochgurgl southsoutheast of Sölden in the Ötz valley in the southern part of Austria where numerous individuals each have flown on 28.07.1975 and 01.08.1975, respectively (BURMANN & TARMANN 1978), which has been five days after the full moon on 23.07.1975, and on the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, respectively; and from Dürnstein westsouthwest of Krems in the Danube valley where abundant individuals, 12 individuals and 18 individuals have flown on 11.07.1975 (BURMANN & TARMANN 1978) as well as on 10.06.1977 and 18.08.1977 (BUR-

MANN & TARMANN 1979), respectively, which has been two days after the new moon on 09.07.1975, one day after the decreasing half moon on 09.06.1977 between the full moon on 01.06.1977 and the new moon on 16.06.1977, and four days after the new moon on 14.08.1977, respectively.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in Southern Tyrol in the northeastern part of Italy have been confirmed from the Stilfserjoch north of Bórmio west of Bolzano where 40 individuals, 20 individuals, abt. 70 individuals and 20 individuals have flown on 19.07.1975, 29.07.1975, 02.08.1975 and 03.08.1975, respectively (BURMANN & TARMANN 1978), which has been four days before the full moon on 23.07.1975, and around the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, respectively; from Latsch in the Etsch valley west of Merano where abt. 10 individuals and masses of individuals have flown on 29.07.1975 (BURMANN & TARMANN 1978) and 03.09.1977 (BURMANN & TARMANN 1979), respectively, which has been three days before the decreasing half moon on 01.08.1975 between the full moon on 23.07.1975 and the new moon on 07.08.1975, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; and from Taufers im Münstertal west of Merano where 6 individuals and masses of individuals have flown on 22.09.1976 and 03.09.1977, respectively (BURMANN & TARMANN 1979), which has been one day before the new moon on 23.09.1976, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively.

Mass occurrences of large quantities of individuals of the Large Yellow Underwing *Noctua pronuba* in Switzerland have been notified from the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where more than 600 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987, from the Col du Bretolet south of Montreux in the southwestern part of Switzerland where more than 200 individuals have flown on 07.10.1981 – 08.10.1981 (KÖHLER 1983) which has been several days before the full moon on 13.10.1981, and from the Saas valley southsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where more than 1.000 individuals have been caught in light traps in the night of 19.07.2007 (KÖHLER & SCHMIDT 2008) which has been three days before the increasing half moon on 22.07.2007 between the new moon on 14.07.2007 and the full moon on 30.07.2007.

6.15 The Broad-Bordered Yellow Underwing *Noctua fimbriata*

Mass occurrences of large quantities of individuals of the Broad-Bordered Yellow Underwing *Noctua fimbriata* SCHREBER 1759 (Lepidoptera: Noctuidae) in Germany have been encountered in the Nutscheid forest near Ruppichteroth westnorthwest of Bonn in the northwestern part of Germany where abt. 150 individuals have flown on 28.07.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been one day before the new moon on 29.07.1973, in Perl in the Moselle valley southsouthwest of Trier in the western part of Germany where abt. 400 individuals have flown on 03.08.1991 (RENNWALD 1992) which has been one day before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991; in Sitzerath near Nonnweiler northnorthwest of Sankt Wendel in the western part of Germany where abt. 30 individuals daily have flown on 22.07.1991 – 23.07.1991 and up to abt. 25 individuals daily have flown on 03.08.1991 – 05.08.1991 (RENNWALD 1992) which has been three and four days before the full moon on 26.07.1991, and around the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, respectively; in Hausen in the Fils valley near Göppingen in the southwestern part of Germany where abundant individuals have flown on 29.07.1992 (RENNWALD 1994) which has been on the new moon on 29.07.1992, in Fuchsmühl northwest of

Wiesau north of Weiden in der Oberpfalz in the southeastern part of Germany where more than 60 individuals and more than 30 individuals have flown on 06.08.1977 and 10.08.1977, respectively (LOBENSTEIN 1978), which has been one day before and three days after the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 15.08.1977, respectively; in Brelingen westnorthwest of Wedemark north of Hannover in the northwestern part of Germany where abt. 10 individuals have flown on 05.08.1991 (RENNWALD 1992) which has been one day after the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991; in Jena in the Saale valley in the northeastern part of Germany where up to 12 individuals daily have flown on 06.08.1991 and 08.08.1991 (RENNWALD 1992) which has been two and four days before the new moon on 10.08.1991, respectively; and in Wildenfels southeast of Zwickau in the northeastern part of Germany where up to 30 individuals daily have flown in the period of 28.07.1991 – 04.08.1991 (RENNWALD 1992) which has been around and between the full moon on 26.07.1991 as well as the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Broad-Bordered Yellow Underwing *Noctua fimbriata* in the western part of Austria have been recorded in Franzen south of Pölla east of Zwettl where more than 20 individuals have flown on 11.07.1977 (BURMANN & TARMANN 1979) which has been two days after the decreasing half moon on 09.07.1977 between the full moon on 01.07.1977 and the new moon on 16.07.1977; in Gaissulz north of Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 15 individuals each have flown on 17.08.1977 and 20.08.1977 (BURMANN & TARMANN 1979) which has been one and four days after the new moon on 16.08.1977, respectively; in Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 230 individuals in total have flown in the period of 28.07.1967 – 02.08.1967 (KARL CLEVE in KINKLER & SCHMITZ in HARZ 1968a) which has been around the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, in Fließ eastsoutheast of Landeck where abt. 50 individuals have flown on 24.08.1976 (BURMANN & TARMANN 1979) which has been one day before the new moon on 25.08.1976, in Hochfinstermünz north of Nauders south of Landeck where more than 20 individuals have flown on 29.08.1976 (BURMANN & TARMANN 1979) which has been four days after the new moon on 25.08.1976, and in Dürnstein westsouthwest of Krems in the Danube valley in the eastern part of Austria where more than 20 individuals have flown on 16.07.1977 (BURMANN & TARMANN 1979) which has been on the new moon on 16.07.1977.

Mass occurrences of large quantities of individuals of the Broad-Bordered Yellow Underwing *Noctua fimbriata* in Switzerland and Italy have been identified on the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where 12 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987, and in Latsch in the Etsch valley and Taufers im Münstertal west of Merano in Southern Tyrol in the northeastern part of Italy where masses of individuals each have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977.

6.16 The Lesser Yellow Underwing *Noctua comes,* the Lesser Broad-Bordered Yellow Underwing *Noctua janthina,* the Guernsey Underwing *Polyphaenis sericata* and the Straw Underwing *Thalpophila matura*

Mass occurrences of large quantities of individuals of the Lesser Yellow Underwing *Noctua comes*

(Hübner 1813) (Lepidoptera: Noctuidae) have been observed in Fischbach in the Nahe valley east-northeast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 15.07.1994 (Broszkus 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; and in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals, 10 individuals and 5 individuals have flown on 18.07.1992, 17.09.1993 and 11.07.1994, respectively (Broszkus 1996b), which has been four days after the full moon on 14.07.1992, one day after the new moon on 16.09.1993 and two days after the new moon on 09.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Lesser Yellow Underwing *Noctua comes* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been reported from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 16.07.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 02.09.1993, 09.09.1993 and 22.09.1993 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day after the full moon on 01.09.1993, one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, and one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, respectively; and from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 16.09.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been three days before the full moon on 19.09.1994.

Mass occurrences of large quantities of individuals of the Lesser Broad-Bordered Yellow Underwing *Noctua janthina* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Noctuidae) have been noticed in the district Hombruch at the southern margin of the city of Dortmund in the northwestern part of Germany where abt. 100 individuals have flown on 20.07.1968 (Harkort & Weigt 1969, Heinrich Linke in Harkort & Weigt 1969) which has been five days before the new moon on 25.07.1968; in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 21.08.1992, 02.08.1994 and 03.09.1994 (Broszkus 1996b), which has been one day before the decreasing half moon on 22.08.1992 between the full moon on 13.08.1992 and the new moon on 28.08.1992, five days before the new moon on 07.08.1994 and two days before the new moon on 05.09.1994, respectively; and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 31.07.1981 (Kinkler 1987) which has been on the new moon on 31.07.1981.

Mass occurrences of large quantities of individuals of the Lesser Broad-Bordered Yellow Underwing *Noctua janthina* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 12.07.1994, 19.07.1994, 26.07.1994, 09.08.1994, 16.08.1994, 23.08.1994 and 30.08.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been three days after the new moon on 09.07.1994, three days before and four days after the full moon on 22.07.1994, five days before after the new moon on 07.08.1994, five days before and two days after the full moon on 21.08.1994, and on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals have been captured on 27.08.1992 (Wipking, Forst, Kuhna & Schmitz 1996)

which has been one day before the new moon on 28.08.1992; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 22.07.1994, 26.08.1994, 02.09.1994 and 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the full moon on 22.07.1994, five days after the full moon on 21.08.1994, three days before the new moon on 05.09.1994 and three days before the full moon on 19.09.1994, respectively; from the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 26.07.1994, 02.08.1994, 09.08.1994, 23.08.1994, 30.08.1994 and 13.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994, five days before and two days after the new moon on 07.08.1994, two days after the full moon on 21.08.1994, on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, and on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 16.07.1992, 30.07.1992, 05.08.1992, 27.08.1992 and 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 14.07.1992, one day after the new moon on 29.07.1992, one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, one day before the new moon on 28.08.1992 and four days before the full moon on 12.09.1994, respectively.

Mass occurrences of large quantities of individuals of the Guernsey Underwing *Polyphaenis sericata* ESPER 1787 (Lepidoptera: Noctuidae) have been encountered in Filderstadt-Plattenhardt south of Stuttgart in the southwestern part of Germany where more than 10 individuals have flown on 16.07.1994 (RENNWALD 1996) which has been one day before the increasing half moon on 17.07.1994 between the new moon on 08.07.1994 and the full moon on 22.07.1994, and in Altenbamberg in the Alsenz valley south of Bad Münster am Stein southsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 11.07.1998 (HEINZ SCHUMACHER in KINKLER 2000) which has been two days after the full moon on 09.07.1998.

Mass occurrences of large quantities of individuals of the Straw Underwing *Thalpophila matura* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 09.08.1994, 16.08.1994 and 23.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 07.08.1994, and five days before and two days after the full moon on 21.08.1994, respectively.

6.17 The Gipsy Moth *Lymantria dispar* and the Black Arches *Lymantria monacha*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have only occasionally noticed a few single individuals of the Gipsy Moth *Lymantria dispar* LINNAEUS 1758 (Lepidoptera: Lymantriidae) and the Black Arches *Lymantria monacha* LINNAEUS 1758 (Lepidoptera: Lymantriidae) at the locality Walldorf between 1972 and 1979, whereas I have not discovered any individuals during my survey in Walldorf and other localities in 2007, 2008 and 2009. Apart from these single individuals, I have also seen occasionally a few single individuals of the Gipsy Moth *Lymantria dispar* and the Black Arches *Lymantria monacha* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley as well as within and around Neuwied between 1964 and 1972. Some examples of mass occurrences of the Gipsy Moth *Lymantria dispar* and the Black Arches *Lymantria monacha* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Gipsy Moth *Lymantria dispar* have been reported from the vicinity of Ergersheim west of Bad Windsheim southeast of Würzburg in the southeastern part of Germany where abundant individuals have been encountered in mid of July 1993 (for example on 18.07.1993; KRAUS & DUNK 1993) which has been around the new moon on 19.07.1993, from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 60 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals, 50 individuals and 200 individuals have flown on 18.07.1992, 10.07.1993 and 17.07.1993, respectively (BROSZKUS 1996a), which has been four days after the full moon on 14.07.1992, two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, and two days before the new moon on 19.07.1993, respectively; from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 24.07.1992 (BROSZKUS 1996a) which has been one day after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals have flown on 11.07.1994 (BROSZKUS 1996a) which has been two days after the new moon on 09.07.1994, from Windeck-Au westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where abt. 15 individuals have been observed on 23.07.2002 (W. BECKERT in SCHUMACHER 2003) which has been one day before the full moon on 24.07.2002, and from the train station of Taben-Rodt in the Saar valley north of Mettlach in the northern part of the Saar area in the western part of Germany where 5 individuals have been captured on 17.08.1972 (ROLF BLÄSIUS & MATTHIAS WEITZEL in SCHMIDT-KOEHL 1977) which has been one day before the increasing half moon on 18.08.1972 between the new moon on 09.08.1972 and the full moon on 24.08.1972.

Mass occurrences of large quantities of individuals of the Black Arches *Lymantria monacha* have been mentioned from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 06.07.1994 (BROSZKUS 1996a) which has been three days before the new moon on 09.07.1994, and from Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown on 22.07.1876 (REICHENAU 1904) which has been one day after the new moon on 21.07.1876.

6.18 The Ruby Tiger *Phragmatobia fuliginosa*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have repeatedly noticed a few single or several scattered individuals of the Ruby Tiger *Phragmatobia fuliginosa* LINNAEUS 1758 (Lepidoptera: Arctiidae) at the localities Nußloch, Rot, Sankt Leon, Walldorf and Tairnbach in 2007, 2008 and 2009. Apart from these single or scattered individuals, I have also seen occasionally a few single or several scattered individuals of the Ruby Tiger *Phragmatobia fuliginosa* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Ruby Tiger *Phragmatobia fuliginosa* has only occurred as a few single or several scattered individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007, 2008 and 2009, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Ruby Tiger *Phragmatobia fuliginosa* are compiled from the

results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Ruby Tiger *Phragmatobia fuliginosa* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 26.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994; from the district Merkenich at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 22.07.1993 and 29.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days after the new moon on 19.07.1993 and four days before the full moon on 02.08.1993, respectively; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 08.07.1993, 15.07.1993, 22.07.1993, 29.07.1993, 05.08.1993 and 20.05.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 04.07.1993, four days before and three days after the new moon on 19.07.1993, four days before and three days after the full moon on 02.08.1993, and five days before the full moon on 25.05.1994, respectively; and from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 29.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994.

Mass occurrences of large quantities of individuals of the Ruby Tiger *Phragmatobia fuliginosa* have also been recorded from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 100 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 – 15 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each have flown on 27.07.1994 and 04.08.1994 (BROSZKUS 1996a) which has been five days after the full moon on 22.07.1994 and three days before the new moon on 07.08.1994, respectively; from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; and from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 15 individuals and 20 individuals have flown on 15.07.1994 and 25.07.1994, respectively (BROSZKUS 1996a), which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; and three days after the full moon on 22.07.1994, respectively.

6.19 The Cream-Spot Tiger *Arctia villica,* the Garden Tiger *Arctia caja,* the Scarlet Tiger *Callimorpha dominula,* the Emperor Moth *Saturnia pavonia* and the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have only occasionally noticed a few single individuals of the Cream-Spot Tiger *Arctia villica* (LINNAEUS 1758) (Lepidoptera: Arctiidae), the Garden Tiger *Arctia caja* LINNAEUS 1758 (Lepidoptera: Arctiidae) and the Scarlet Tiger *Callimorpha dominula* LINNAEUS 1758 (Lepidoptera: Arctiidae) at the locality Walldorf between 1972 and 1979, whereas I have not discovered any individuals

during my survey in Walldorf and other localities in 2007, 2008 and 2009. Apart from these single individuals, I have also seen occasionally a few single individuals of the Cream-Spot Tiger *Arctia villica*, the Garden Tiger *Arctia caja* and the Scarlet Tiger *Callimorpha dominula* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972. On the other hand, I have only sometimes found a few single individuals of the Emperor Moth *Saturnia pavonia* LINNAEUS 1758 (Lepidoptera: Saturniidae) in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, whereas I have never encountered any individual of the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* SCHIFFERMÜLLER (DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Saturniidae) at any place in Germany and Europe. Some examples of mass occurrences of the Cream-Spot Tiger *Arctia villica*, the Garden Tiger *Arctia caja,* the Scarlet Tiger *Callimorpha dominula,* the Emperor Moth *Saturnia pavonia* and the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

A mass occurrence of large quantities of individuals of the Cream-Spot Tiger *Arctia villica* has been found near Valwig east of Cochem in the Moselle valley in the western part of Germany where abt. 25 individuals have been monitored on 27.05.2005 (HANS DUDLER & RUDOLF PÄHLER in SCHUMACHER 2006) which has been three days before the decreasing half moon on 30.05.2005 between the full moon on 23.05.2005 and the new moon on 06.06.2005. Significant quantities of individuals of the Cream-Spot Tiger *Arctia villica* have also been noticed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 19.05.1992 (BROSZKUS 1996a) which has been three days after the full moon on 16.05.1992, and in Klotten in the Moselle valley in the western part of Germany where 5 individuals have flown on 19.05.2007 (M. DERRA in SCHUMACHER 2008a) which has been three days after the new moon on 16.05.2007.

Significant quantities of individuals of the Garden Tiger *Arctia caja* have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 07.08.1981 (KINKLER 1987) which has been one day before the increasing half moon on 08.08.1981 between the new moon on 31.07.1981 and the full moon on 15.08.1981.

Significant quantities of individuals of the Scarlet Tiger *Callimorpha dominula* have been recognized in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 26.06.1993 (BROSZKUS 1996a) which has been one day before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993.

Mass occurrences of large quantities of individuals of the Emperor Moth *Saturnia pavonia* have been encountered near Bielefeld in the northwestern part of Germany where numerous individuals have flown on 04.05.1909 (JUNKERMANN 1909) which has been one day before the full moon on 05.05.1909.

Mass occurrences of large quantities of individuals of the Giant Peacock Moth or Large Emperor Moth *Saturnia pyri* have been mentioned from Dieuze between Saint-Avold and Sarrebourg northnorthwest and westnorthwest of Strasbourg in the northeastern part of France where abt. 50 individuals have been captured at the light of streetlamps in the period of 05.05.1906 – 28.05.1906 (WARNECKE 1927) which has been around and between the full moon on 08.05.1906 and the new moon on 23.05.1906.

6.20 The Brown Tiger *Hyporaia aulica* and the Wood Tiger *Parasemia plantaginis*

A mass occurrence of large quantities of individuals of the Brown Tiger *Hyporaia aulica* (LINNAEUS 1758) (Lepidoptera: Arctiidae) has been recognized near Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 100 individuals have flown on 07.05.2000 (SCHUMACHER 2001) which has been three days after the new moon on 04.05.2000.

Mass occurrences of large quantities of individuals of the Wood Tiger *Parasemia plantaginis* LINNAEUS 1758 (Lepidoptera: Arctiidae) have been confirmed from Windeck-Leuscheid west of Wissen westsouthwest of Siegen in the northwestern part of Germany where abt. 20 individuals in total have flown in the period of 26.05.2003 – 02.06.2003 (W. BECKERT in SCHUMACHER 2004a) which has been several days before and after the new moon on 31.05.2003; from Windeck-Roßbach in the Sieg valley northnorthwest of Hamm westsouthwest of Siegen in the northwestern part of Germany where 5 individuals and more than 20 individuals in total have flown in the period of 26.05.1999 – 01.06.1999 (W. BECKERT in KINKLER 2000) and on 09.06.2001 (W. BECKERT in SCHUMACHER 2002), respectively, which has been around the full moon on 30.05.1999 and three days after the full moon on 06.06.2001, respectively; and from Rigi Kulm and Rigi Staffel east of Luzern in the northeastern part of Switzerland where abt. 60 individuals have flown on 17.08.1846 (BREMI in HERING 1847) or 17.08.1847 (KEFERSTEIN 1863, LINSTOW 1913) which has been four days before the new moon on 21.08.1846, or three days before the increasing half moon on 20.08.1847 between the new moon on 11.08.1847 and the full moon on 26.08.1847, respectively.

6.21 The Scarce Footman *Eilema complana* and the Dingy Footman *Eilema griseola*

Mass occurrences of large quantities of individuals of the Scarce Footman *Eilema complana* LINNAEUS 1758 (Lepidoptera: Arctiidae) have been reported from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals and abt. 5 individuals have flown on 25.06.1993 and 30.06.1994, respectively (BROSZKUS 1996a), which has been two days before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993, and one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively, from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 26.06.1993 (BROSZKUS 1996a) which has been one day before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals each have flown on 16.07.1993 and 04.08.1994 (BROSZKUS 1996a) which has been three days before the new moon on 19.07.1993 and three days before the new moon on 07.08.1994, respectively; from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, and from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Dingy Footman *Eilema griseola* (HÜBNER

1803) (Lepidoptera: Arctiidae) have been recorded in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 20 individuals have flown on 18.07.2004 (M. DERRA in SCHUMACHER 2005a) which has been one day after the new moon on 17.07.2004, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

6.22 The Orange Footman *Eilema sororcula* and the Buff Footman *Eilema depressa*

Mass occurrences of large quantities of individuals of the Orange Footman *Eilema sororcula* (HUFNAGEL 1766) (Lepidoptera: Arctiidae) have been registered in Wuppertal eastnortheast of Düsseldorf where 10 individuals have flown on 16.05.1994 (RADTKE & WIEMERT 1995) which has been five days after the new moon on 10.05.1994; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each have flown on 21.05.1992, 11.05.1993, 24.05.1993 and 12.05.1994 (BROSZKUS 1996a) which has been five days after the full moon on 16.05.1992, five days after the full moon on 06.05.1993, three days after the new moon on 21.05.1993 and two days after the new moon on 10.05.1994, respectively.

Mass occurrences of large quantities of individuals of the Buff Footman *Eilema depressa* (ESPER 1787) (Lepidoptera: Arctiidae) have been recognized in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 10 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals each have flown on 30.06.1993 and 04.08.1994 (BROSZKUS 1996a) which has been four days before the full moon on 04.07.1993 and three days before the new moon on 07.08.1994, respectively.

6.23 The Hoary Footman *Eilema caniola,* the Common Footman *Eilema lurideola,* the Ivory Footman *Eilema palliatella* and the Pigmy Footman *Eilema pygmaeola*

Mass occurrences of large quantities of individuals of the Hoary Footman *Eilema caniola* (HÜBNER 1808) (Lepidoptera: Arctiidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals each and 10 individuals each have flown on 07.08.1992, 21.08.1992, 26.08.1992, 07.09.1993 and 02.08.1994 (BROSZKUS 1996a) which has been one day after the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, one day before the decreasing half moon on 22.08.1992 between the full moon on 13.08.1992 and the new moon on 28.08.1992, two days before the new moon on 28.08.1992, three days before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, and five days before the new moon on 07.08.1994, respectively; and in Kobern-Gondorf in the Moselle valley southwest of Koblenz in the western part of Germany where 20 individuals have flown on 22.08.1991 (KINKLER 1993) which has been three days before the full moon on 25.08.1991.

Mass occurrences of large quantities of individuals of the Common Footman *Eilema lurideola* (ZINCKEN 1817) (Lepidoptera: Arctiidae) have been recorded in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each, 20 individuals, 15 individuals each and abt. 10 individuals have flown on 18.06.1993, 30.06.1993,

16.07.1993, 06.07.1994, 11.07.1994 and 04.08.1994, respectively (BROSZKUS 1996a), which has been two days before the new moon on 20.06.1993, four days before the full moon on 04.07.1993, three days before the new moon on 19.07.1993, three days before and two days after the new moon on 09.07.1994, and three days before the new moon on 07.08.1994, respectively; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 15.07.1994 (BROSZKUS 1996a) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals each have flown on 16.07.1992, 25.06.1993 and 30.06.1994 (BROSZKUS 1996a) which has been two days after the full moon on 14.07.1992, five days after the new moon on 20.06.1993 and four days before the full moon on 04.07.1994, respectively; and in Leverkusen in the northwestern part of Germany where abt. 5 individuals have flown on 24.06.1964 (KARL PETRASCH in KINKLER, SCHMITZ, NIPPEL & SWOBODA 1974) which has been on the full moon on 24.06.1964.

Mass occurrences of large quantities of individuals of the Ivory Footman *Eilema palliatella* (SCOPOLI 1763) (Lepidoptera: Arctiidae) have been found in Kattenes in the Moselle valley southsouthwest of Kobern-Gondorf southwest of Koblenz in the western part of Germany where more than 10 individuals have flown on 06.08.2004 (HANS DUDLER & RUDOLF PÄHLER in SCHUMACHER 2005a) which has been one day before the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004.

Significant quantities of individuals of the Pigmy Footman *Eilema pygmaeola* (DOUBLEDAY 1847) (Lepidoptera: Arctiidae) have been encountered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 08.08.2004 (ROLF MÖRTTER in SCHUMACHER 2006) which has been one day after the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004.

6.24 The Rosy Footman *Miltochrista miniata* and the Dotted Footman *Pelosia muscerda*

Mass occurrences of large quantities of individuals of the Rosy Footman *Miltochrista miniata* FORSTER 1771 (Lepidoptera: Arctiidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 20 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, and from the Venner Moor northeast of Venne northeast of Osnabrück in the northwestern part of Germany where more than 5 individuals have flown on 04.07.1969 (HARKORT 1971, HANS-JOACHIM WEIGT in HARKORT 1971) which has been three days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969.

Mass occurrences of large quantities of individuals of the Dotted Footman *Pelosia muscerda* HUFNAGEL 1766 (Lepidoptera: Arctiidae) have been described from the vicinity of Bielefeld in the northwestern part of Germany where hundreds of individuals have flown on 17.06.1935 and the following days (SCHREIER 1936) which has been one and several days after the new moon on 16.06.1935; from the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 50 individuals and 40 individuals have flown on 31.07.1990 and 30.07.1991, respectively (WOLFGANG WITTLAND in KINKLER 1992), which has been one day after the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on

06.08.1990 as well as four days after the full moon on 26.07.1991, respectively; from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, and from the Venner Moor northeast of Venne northeast of Osnabrück in the northwestern part of Germany where abt. 5 individuals have flown on 04.07.1969 (HARKORT 1971, HANS-JOACHIM WEIGT in HARKORT 1971) which has been three days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969. .

6.25 The Feathered Footman *Spiris striata* and the Clouded Buff *Diachrysia sannio*

Mass occurrences of large quantities of individuals of the Feathered Footman *Spiris striata* (LINNAEUS 1758) (Lepidoptera: Arctiidae) have been described from Leibnitz southsoutheast of Graz in the southern part of Austria where abundant individuals have flown in the period of 08.08.1942 – 23.08.1942 (HOFFMANN 1944) which has been around and between the new moon on 12.08.1942 and the full moon on 26.08.1942, from Kaub in the Middle Rhine valley northnorthwest of Bingen in the western part of Germany where 15 individuals have flown on 07.07.1995 (HANS-ARNOLD HÜRTER, HELMUT KINKLER & A. SCHMIDT in KINKLER 1996) which has been five days before the full moon on 12.07.1995, from Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 15 individuals have flown on 21.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003; from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 12 individuals, 5 individuals and 15 individuals have flown on 30.05.1992, 16.06.1992 (WALTER BROSZKUS in KINKLER 1993, BROSZKUS 1996a) and 22.06.2005 (ERNST ZEBE in SCHUMACHER 2006), respectively, which has been two days before the new moon on 01.06.1992, one day after the full moon on 15.06.1992 and on the full moon on 22.06.2005, respectively; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 – 15 individuals have flown on 16.06.1999 (SCHUMACHER 2001) which has been three days after the new moon on 13.06.1999.

Mass occurrences of large quantities of individuals of the Clouded Buff *Diachrysia sannio* LINNAEUS 1758 (Lepidoptera: Arctiidae) have been found in Erbach north of Rheinböllen westnorthwest of Bingen in the western part of Germany where 20 individuals have flown on 23.06.2001 (SCHUMACHER 2002) which has been two days after the new moon on 21.06.2001, in the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where 5 individuals have flown on 10.08.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been five days after the new moon on 05.08.2005, and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 03.07.1980 (KINKLER 1987) which has been five days after the full moon on 28.06.1980.

6.26 The Striped Hawk-Moth *Hyles livornica* and the Bedstraw Hawk-Moth *Hyles gallii*

Mass occurrences of the Striped Hawk-Moth *Hyles livornica* (ESPER 1779) (Lepidoptera: Sphingidae) have been registered in the Rappenlochschlucht near Dornbirn in the Alpine Rhine valley south of Bregenz in the western part of Austria where thousands of individuals have flown and have sit on the ground on 20.05.1958 (RANSCH in KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; RANSCH

in WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been two days after the new moon on 18.05.1958, in the Stubach valley south of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where masses of individuals have flown on 28.03.1946 (HARZ 1975) which has been five days before the new moon on 02.04.1946, around Samoarhütte and Niederjochferner southwest of Obergurgl northwest of Merano in the western part of Austria where abt. 150 individuals have flown on 30.07.1962 (HAYEK in HARZ & WITTSTADT 1964) which has been one day before the new moon on 31.07.1962, in La Grande Motte southeast of Montpellier at the coast of the Mediterranean Sea in the southeastern part of France where several hundreds of individuals have flown on 25.06.2003 – 27.06.2003 (HARBICH 2004) which has been two to four days before the new moon on 29.06.2003, in the Salin de Giraud in the Camargue westnorthwest of Marseille at the coast of the Mediterranean Sea in the southeastern part of France where 18 individuals have flown on 18.05.1975 (HARBICH 1976) which has been one day before the increasing half moon on 19.05.1975 between the new moon on 11.05.1975 and the new moon on 25.05.1975, and at four localities in the Rhône valley north of Avignon northnorthwest of Marseille in the southeastern part of France where 21 individuals have flown in the night from 20.05.1975 to 21.05.1975 (HARBICH 1976) which has been one or two days after the increasing half moon on 19.05.1975 between the new moon on 11.05.1975 and the new moon on 25.05.1975.

Mass occurrences of the Bedstraw Hawk-Moth *Hyles gallii* (ROTTEMBURG 1775) (Lepidoptera: Sphingidae) have been recognized near Kaprun southsouthwest of Zell am See in the western part of Austria where abundant individuals have flown at the beginning of July 1966 (HEINZ GLEFFE in HARZ 1967a) which has been around the full moon on 02.07.1966; and near Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where 15 individuals and abt. 10 individuals have flown on 23.08.1976 (LINDEN in BURMANN & TARMANN 1979) and 30.08.1976 (GERNOT EMBACHER in BURMANN & TARMANN 1979), respectively, which has been two days before and five days after the new moon on 25.08.1976, respectively.

Significant quantities of individuals of the Bedstraw Hawk-Moth *Hyles gallii* have also been recorded in Nierow northwest of Schollene northnorthwest of Brandenburg in the northeastern part of Germany where 5 individuals have flown on 08.07.1991 (HARBICH 1992) which has been three days after the new moon on 11.07.1991, in Vienenburg southeast of Salzgitter in the northwestern part of Germany where 5 individuals have flown on 22.06.1974 (HARBICH 1975) which has been two days after the new moon on 20.06.1974, and in Fahrenhorst southsouthwest of Bremen in the northwestern part of Germany where 6 individuals have flown and have sucked on flowers in the crepuscular period in the evening on 17.06.1979 (HARBICH 1986) which has been one day before the decreasing half moon on 18.06.1979 between the full moon on 10.06.1979 and the new moon on 24.06.1979.

6.27 The Spurge Hawk-Moth *Hyles euphorbiae* and the Privet Hawk-Moth *Sphinx ligustri*

Mass occurrences of the Spurge Hawk-Moth *Hyles euphorbiae* (LINNAEUS 1758) (Lepidoptera: Sphingidae) have been confirmed around Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown at the beginning of July 1904 (REICHENAU 1904) which has been around and between the full moon on 27.06.1904 and the new moon on 13.07.1904, in the Kyffhäuser north of Bad Frankenhausen east of Sondershausen in the northeastern part of Germany where very abundant individuals have flown on 05.07.1969 (HARBICH 1970) which has been two days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969, at the Stöllborner Berg near Sprötau southeast of Sömmerda northnorthwest of Weimar in the northeastern part of Germany where numerous individuals have been found on 24.07.1993 (HARBICH 1995) which has been five days after the new

moon on 19.07.1993, near Jena in the Saale valley in the northeastern part of Germany where 14 individuals have flown in the period of end of July 1999 and beginning of August 1999 (HARBICH 2000) which has been around and between the full moon on 28.07.1999 and the new moon on 11.08.1999, in Lutherstadt Wittenberg in the Elbe valley in the northeastern part of Germany where numerous individuals have flown from the end of July 1959 to the beginning of August 1959 (EICHLER in KOCH 1960) which has been around and between the full moon on 20.07.1959 and the new moon on 04.08.1959; in Fließ eastsoutheast of Landeck in the western part of Austria where abt. 40 individuals in total have flown in the period of 01.06.1973 – 04.07.1973 (HARBICH 1974) which has been around and between the new moon on 01.06.1973, the full moon on 15.06.1973 and the new moon on 30.06.1973, and 100 individuals in total have flown in the periods of 10.05.1974 – 19.05.1974 and 21.06.1974 – 27.07.1974 (HARBICH 1975) which has been around and between the full moon on 06.05.1974 and the new moon on 21.05.1974 as well as around and between the new moon on 20.06.1974, the full moon on 04.07.1974, the new moon on 19.07.1974 and the full moon on 03.08.1974, respectively; and in Illmitz at Lake Neusiedl southeast of Vienna in the eastern part of Austria where 20 individuals have flown on 25.05.1971 (HARBICH 1972) which has been one day after the new moon on 24.05.1971.

Significant quantities of individuals of the Spurge Hawk-Moth *Hyles euphorbiae* have also been noticed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 10.07.1993 (BROSZKUS 1996a), 7 individuals have flown on 16.07.1993 (BROSZKUS 1996a), 5 individuals each have flown on 18.07.1992 and 02.08.1994 (BROSZKUS 1996a), and 4 individuals each have flown on 01.06.1992, 19.05.1993, 27.05.1993 (BROSZKUS 1996a) and 08.08.2004 (HARBICH 2005) which has been two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, three days before the new moon on 19.07.1993, four days after the full moon on 14.07.1992, five days before the new moon on 07.08.1994, on the new moon on 01.06.1992, two days before the new moon on 21.05.1993, two days before the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, and one day after the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on 16.08.2004, respectively; in Oberhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 26.05.1979 (HARBICH 1981) which has been on the new moon on 26.05.1979, in Unsleben southsouthwest of Mellrichstadt in the central part of Germany where several individuals have sucked on flowers on 23.07.1994 (HARBICH 1996) which has been one day after the full moon on 22.07.1994, near Ohrdruf southwest of Erfurt in the northeastern part of Germany where abt. 5 individuals have flown on 02.07.1994 (HARBICH 1996) which has been one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 08.07.1994; near Mechterstädt north of Waltershausen eastsoutheast of Eisenach in the northeastern part of Germany where up to 10 individuals have flown daily in the period from mid of May 1992 to mid of June 1992 (HARBICH 1994) which has been around and between the full moon on 16.05.1992, the new moon on 01.06.1992 and the full moon on 15.06.1992; near Bad Frankenhausen east of Sondershausen in the northeastern part of Germany where abt. 5 individuals have flown on 26.07.1994 – 27.04.1994 (HARBICH 1996) which has been four to five days after the full moon on 22.07.1994, and at Lake Neusiedl southeast of Vienna in the eastern part of Austria where abt. 5 individuals have flown on 20.08.1971 – 23.08.1971 (HARBICH 1972) which has been on and several days after the new moon on 20.08.1971.

Significant quantities of individuals of the Privet Hawk-Moth *Sphinx ligustri* LINNAEUS 1758 (Lepidoptera: Sphingidae) have been signaled from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 30.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 29.07.1992.

6.28 The Pale Tussock *Calliteara pudibunda,* the Yellow-Tail *Euproctis similis,* the Dew Moth *Setina roscida* and the Pebble Hook-Tip *Drepana falcataria*

Mass occurrences of large quantities of individuals of the Pale Tussock *Calliteara pudibunda* LINNAEUS 1758 (Lepidoptera: Lymantriidae) have been documented from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 15 – 20 individuals each have flown on 23.05.1982 and 29.05.1982 (WALFORT 1983) which has been on the new moon on 23.05.1982 as well as one day before the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each and 15 individuals have flown on 12.05.1992, 21.05.1992, 09.06.1992, 11.05.1993 and 24.05.1993, respectively (BROSZKUS 1996a), which has been four days before and five days after the full moon on 16.05.1992, one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, three days before the decreasing half moon on 14.05.1993 between the full moon on 06.05.1993 and the new moon on 21.05.1993, and three days after the new moon on 21.05.1993, respectively; from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 23.05.1992 (BROSZKUS 1996a) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals each have flown on 30.04.1993 and 19.05.1994 (BROSZKUS 1996a) which has been on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993 as well as on the decreasing half moon on 19.05.1994 between the new moon on 10.05.1994 and the full moon on 25.05.1994, respectively.

Mass occurrences of large quantities of individuals of the Yellow-Tail *Euproctis similis* FUESSLY 1775 (Lepidoptera: Lymantriidae) have been reported from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 40 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 15.07.1994 (BROSZKUS 1996a) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals each and 15 individuals have flown on 16.07.1993, 01.07.1994 and 11.07.1994, respectively (BROSZKUS 1996a), which has been three days before the new moon on 19.07.1993, on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and two days after the new moon on 09.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Dew Moth *Setina roscida* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Arctiidae) have been encountered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 50 individuals in total and 25 individuals in total have flown on 29.05.1999 and 02.06.1999 (VOLKER PELZ & HEINZ SCHUMACHER in SCHUMACHER 2001) as well as in the period of 26.05.2000 – 10.06.2000 (M. DERRA in SCHUMACHER 2001), respectively, which has been one day before and three days after the full moon on 31.05.1999, and around and between the decreasing half moon on

27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000 as well as the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 16.06.2000, respectively.

Mass occurrences of large quantities of individuals of the Pebble Hook-Tip *Drepana falcataria* LINNAEUS 1758 (Lepidoptera: Drepanidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 20 individuals and 12 individuals have flown on 20.05.1982 and 23.05.1982, respectively (WALFORT 1983), which has been three days before and on the new moon on 23.05.1982, respectively.

6.29 The Oak Hook-Tip *Drepana binaria,* the Dusky Hook-Tip *Drepana curvatula,* the Scarce Hook-Tip *Drepana harpagula* and the Barred Hook-Tip *Watsonalla cultraria*

A mass occurrence of large quantities of individuals of the Oak Hook-Tip *Drepana binaria* (HUFNAGEL 1767) (Lepidoptera: Drepanidae) has been reported from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 20 individuals have flown on 08.09.1981 (WALFORT 1983) which has been one day after the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981.

Mass occurrences of large quantities of individuals of the Dusky Hook-Tip *Drepana curvatula* (BORKHAUSEN 1790) (Lepidoptera: Drepanidae) have been mentioned from the Mühlenbach valley near Gartrop northeast of Hünxe north of Duisburg in the northwestern part of Germany where 22 individuals have been counted on 22.08.1996 (LUDESCHER in KINKLER 1997) which has been one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, and from the Schwarzbach valley near Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where abt. 20 individuals have been observed on 17.06.2002 (SCHUMACHER 2003) which has been one day before the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002.

Significant quantities of individuals of the Scarce Hook-Tip *Drepana harpagula* ESPER 1786 (Lepidoptera: Drepanidae) have been documented from the Katzenlochbachtal near Bonn in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals have flown on 16.08.1988 (FRIEDHELM NIPPEL in KINKLER 1989b) which has been four days after the new moon on 12.08.1988, and from Friesheim southsouthwest of Erftstadt southsouthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 5 individuals have flown on 18.05.2001 (ARMIN DUCHATSCH in SCHUMACHER 2003) which has been five days before the new moon on 23.05.2001.

Significant quantities of individuals of the Barred Hook-Tip *Watsonalla cultraria* (FABRICIUS 1775) (Lepidoptera: Drepanidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 5 individuals have flown on 20.05.1982 (WALFORT 1983) which has been three days before the new moon on 23.05.1982.

6.30 The Oak Processionary *Thaumetopoea processionea,* the Lappet *Gastropacha quercifolia,* the Satin Lutestring *Tetheella fluctuosa* and the Yellow Horned *Achlya flavicornis*

Mass occurrences of large quantities of individuals of the Oak Processionary *Thaumetopoea pro-*

cessionea LINNAEUS 1758 (Lepidoptera: Thaumetopoeidae) have been mentioned from Maria Veen east of Reken southsouthwest of Coesfeld in the northwestern part of Germany where abt. 5 individuals and abt. 15 individuals have been encountered on 31.07.2006 (B. NIEMEYER & LILIENTHAL in SCHUMACHER 2007a) and 06.08.2008 (B. NIEMEYER & LILIENTHAL in SCHUMACHER 2009), respectively, which has been two days before the increasing half moon on 02.08.2006 between the new moon on 24.07.2006 and the full moon on 09.08.2006, and two days before the increasing half moon on 08.08.2008 between the new moon on 01.08.2008 and the full moon on 16.08.2008, respectively; from Bracht north of Brüggen westnorthwest of Mönchengladbach in the northwestern part of Germany where 80 individuals and 30 individuals have been monitored on 31.07.2003 (ARMIN HEMMERSBACH in SCHUMACHER 2004a) and 04.08.2003 (SCHUMACHER 2004a, KLAUS MEYER & ARMIN HEMMERSBACH in SCHUMACHER 2004a), respectively, which has been two days after the new moon on 29.07.2003 as well as one day before the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, respectively; from Nettetal-Hinsbeck northnorthwest of Mönchengladbach in the northwestern part of Germany where 20 individuals have been noticed on 06.08.2003 (ARMIN HEMMERSBACH in SCHUMACHER 2004a) which has been one day after the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, from Nettetal-Kaldenkirchen northwest of Mönchengladbach in the northwestern part of Germany where 5 individuals have flown on 17.08.2007 (RUDI SELIGER in SCHUMACHER 2008a) which has been four days after the new moon on 13.08.2007, from Rheindahlen west of Mönchengladbach in the northwestern part of Germany where 8 individuals have flown on 18.08.2007 (BOMBELKA in SCHUMACHER 2008a) which has been five days after the new moon on 13.08.2007, from the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 5 individuals have flown on 07.08.2007 (RUDI SELIGER in SCHUMACHER 2008a) which has been two days after the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007, from the Kranenburger Bruch near Kranenburg west of Kleve in the northwestern part of Germany where 50 individuals have been confirmed on 02.08.2003 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2004a) which has been four days after the new moon on 29.07.2003, and from Rees northwest of Wesel in the Lower Rhine valley in the northwestern part of Germany where more than 50 individuals have been observed on 01.08.2003 (ARMIN HEMMERSBACH in SCHUMACHER 2004a) which has been three days after the new moon on 29.07.2003.

Mass occurrences of large quantities of individuals of the Lappet *Gastropacha quercifolia* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been found in Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 15 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been five days after the full moon on 14.06.2003.

Mass occurrences of large quantities of individuals of the Satin Lutestring *Tetheella fluctuosa* (HÜBNER 1813) (Lepidoptera: Thyatiridae) have been encountered in the Balver Wald eastsoutheast of Iserlohn southeast of Dortmund in the northwestern part of Germany where abt. 40 individuals have flown on 13.07.1963 (HARKORT & WEIGT 1967) which has been two days before the decreasing half moon on 15.07.1963 between the full moon on 07.07.1963 and the new moon on 20.07.1963, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 09.06.1982, 25.06.1982 and 11.07.1982 (WALFORT 1983) which has been three days after the full moon on 06.06.1982, four days after the new moon on 21.06.1982 and five days after the full moon on 06.07.1982, respectively.

Mass occurrences of large quantities of individuals of the Yellow Horned *Achlya flavicornis* (LINNAEUS 1758) (Lepidoptera: Thyatiridae) have been met in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 90 individuals and 30 indivi-

duals have flown on 22.03.1982 and 28.03.1982, respectively (WALFORT 1983), which has been three days before and three days after the new moon on 25.03.1982, respectively.

6.31 The Scarce Black Arches *Nola aerugula,* the Dark Arches *Apamea monoglypha,* the Small Clouded Brindle *Apamea unanimis,* the Reddish Light Arches *Apamea sublustris* and the Kent Black Arches *Meganola albula*

Mass occurrences of large quantities of individuals of the Scarce Black Arches *Nola aerugula* (HÜBNER 1793) (Lepidoptera: Nolidae) have been mentioned from the Boschbeek valley near Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where abt. 250 individuals in total have been counted in the period of 11.07.1997 – 18.07.1997 (ARMIN HEMMERSBACH & STEFAN STEEGERS in KINKLER 1998) which has been around and between the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997 as well as the full moon on 20.07.1997; from Bracht north of Brüggen westnorthwest of Mönchengladbach in the northwestern part of Germany where 5 individuals and more than 20 individuals have flown on 09.07.1997 (ARMIN HEMMERSBACH in KINKLER 1998) and 30.07.2004 (RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2005a), respectively, which has been five days after the new moon on 04.07.1997 and one day before the full moon on 31.07.2004, respectively; from the Elmpter Bruch west of Elmpt west of Niederkrüchten where 15 individuals on 09.07.1990 (WOLFGANG WITTLAND in KINKLER 1992), 60 individuals on 20.06.1997 – 12.07.1997 (ARMIN HEMMERSBACH in KINKLER 1998) and more than 30 individuals on 21.07.2004 (ARMIN HEMMERSBACH, PETRO RANDAZZO & RUDI SELIGER in SCHUMACHER 2005a) have flown which has been one day after the full moon on 08.07.1990, around and between the full moon on 20.06.1997 as well as the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997, and four days after the new moon on 17.07.2004, respectively; from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from the Venner Moor northeast of Venne northeast of Osnabrück in the northwestern part of Germany where more than 5 individuals have flown on 04.07.1969 (HARKORT 1971, HANS-JOACHIM WEIGT in HARKORT 1971) which has been three days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969, from the Hildener Heide near Hilden southsoutheast of Düsseldorf in the northwestern part of Germany where abt. 10 individuals have flown on 04.07.1947 (KARL STAMM in KINKLER, SCHMITZ, NIPPEL & SWOBODA 1974) which has been one day after the full moon on 03.07.1947, from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 25 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; and from the Rotenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 30 individuals and more than 5 individuals have flown on 21.04.2000 (SCHUMACHER 2001, KLAUS MEYER in SCHUMACHER 2001) and 05.05.2006 (B. NIEMEYER in SCHUMACHER 2007a), respectively, which has been three days after the full moon on 18.04.2000, and on the increasing half moon on 05.05.2006 between the new moon on 27.04.2006 and the full moon on 13.05.2006, respectively.

Mass occurrences of large quantities of individuals of the Dark Arches *Apamea monoglypha* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been mentioned from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after

the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 25.06.1993 (BROSZKUS 1996b) which has been five days after the new moon on 20.06.1993; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 25.06.1982 and 13.07.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982 as well as two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, respectively; from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where more than 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, from the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 17.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the new moon on 20.06.1993; from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 02.07.1992 and 16.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992 and two days after the full moon on 14.07.1992, respectively; and from the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where more than 30 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987.

Significant quantities of individuals of the Small Clouded Brindle *Apamea unanimis* (HÜBNER 1813) (Lepidoptera: Noctuidae) have been encountered in the Schwarzbach valley near Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where 7 individuals in total have been observed on 18.06.2003 and 27.06.2003 (SCHUMACHER 2004a) which has been four days after the full moon on 14.06.2003 and two days before the new moon on 29.06.2003, respectively.

Mass occurrences of large quantities of individuals of the Reddish Light Arches *Apamea sublustris* (ESPER 1788) (Lepidoptera: Noctuidae) have been found in Seelbach northnortheast of Herborn in the northwestern part of Germany where 12 individuals have flown on 08.06.2007 (KLAUS MEYER in SCHUMACHER 2008a) which has been on the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, near Letmathe in the Lenne valley southsoutheast of Dortmund in the northwestern part of Germany where abt. 50 individuals have flown on 30.06.1965 (HARKORT & WEIGT 1968) which has been one day after the new moon on 29.06.1965, and in the Dellbrücker Heide near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals have flown on 25.06.1965 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1975) which has been four days before the new moon on 29.06.1965.

Significant quantities of individuals of the Kent Black Arches *Meganola albula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Nolidae) have been recognized in the Hildener Heide near Hilden southsoutheast of Düsseldorf in the northwestern part of Germany where abt. 10 individuals and more than 5 individuals have flown on 04.07.1948 (KARL STAMM in KINKLER, SCHMITZ, NIPPEL & SWOBODA 1974) and 19.07.1969 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1974), respectively, which has been two days before the new moon on 06.07.1948 and five days after the new moon on 14.07.1969, respectively.

6.32 The Plumed Prominent *Ptilophora plumigera*, the Iron Prominent *Notodonta dromedarius*, the Pebble Prominent *Notodonta ziczac* and the Three-Humped Prominent *Notodonta tritophus*

Mass occurrences of large quantities of individuals of the Plumed Prominent *Ptilophora plumigera* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been confirmed in the Eschweiler valley near Bad Münstereifel south of Euskirchen in the northwestern part of the Eifel in the northwestern part of Germany where more than 50 individuals have been monitored on 17.11.2004 (RUDI SELIGER in SCHUMACHER 2005a) which has been two days before the increasing half moon on 19.11.2004 between the new moon on 12.11.2004 and the full moon on 26.11.2004; near Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 100 individuals, 20 individuals and 12 individuals have been encountered on 09.11.1993 (BROSZKUS in KINKLER 1994, BROSZKUS 1996a), 06.12.1993 and 04.11.1994 (BROSZKUS 1996a), respectively, which has been four days before the new moon on 13.11.1993, one day before the decreasing half moon on 07.12.1993 between the full moon on 29.11.1993 and the new moon on 13.12.1993, and one day after the new moon on 03.11.1994, respectively; near Attendorn in the Bigge valley southeast of Lüdenscheid in the northwestern part of Germany where 15 individuals have been observed on 03.11.1993 (BERND SCHMITZ in KINKLER 1997) which has been four days after the full moon on 30.10.1993, and in the Schwarzbach valley near Kirchhundem northnortheast of Siegen in the northwestern part of Germany where 15 individuals have been noticed on 15.11.2006 (KLAUS MEYER in SCHUMACHER 2007a) which has been three days after the decreasing half moon on 12.11.2006 between the full moon on 05.11.2006 and the new moon on 20.11.2006.

A mass occurrence of large quantities of individuals of the Iron Prominent *Notodonta dromedarius* LINNAEUS 1767 (Lepidoptera: Notodontidae) and the Pebble Prominent *Notodonta ziczac* LINNAEUS 1758 (Lepidoptera: Notodontidae) has been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals each have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975. Mass occurrences of large quantities of individuals of the Iron Prominent *Notodonta dromedarius* have also been reported from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals, abt. 10 individuals and 5 individuals have flown on 02.08.1992, 04.08.1994 and 27.08.1994, respectively (BROSZKUS 1996a), which has been four days after the new moon on 29.07.1992, three days before the new moon on 07.08.1994, and three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively.

Significant quantities of individuals of the Pebble Prominent *Notodonta ziczac* have also been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 20.05.1982 and 31.05.1982 (WALFORT 1983) which has been three days before the new moon on 23.05.1982 as well as one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively. Significant quantities of individuals of the Large Dark Prominent *Notodonta torva* have been mentioned from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 17.07.1994 (BROSZKUS 1996a) which has been two days after the new moon on 09.07.1994.

Significant quantities of individuals of the Three-Humped Prominent *Notodonta tritophus* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been encountered near Niederwalluf westsouthwest of Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown in May 1886 (REICHENAU 1904)

which has been around and between the new moon on 04.05.1886, the full moon on 18.05.1886 and the new moon on 02.06.1886.

6.33 The Square-Spot Rustic *Xestia xanthographa,* the Common Rustic *Mesapamea secalis,* the Large Wainscot *Rhizedra lutosa* and the Fisher´s Estuarine Moth *Gortyna borelii*

A mass occurrence of large quantities of individuals of the Square-Spot Rustic *Xestia xanthographa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) has been documented from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 100 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980. Significant quantities of individuals of the Square-Spot Rustic *Xestia xanthographa* have also been notified from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 17.09.1993 and 03.09.1994 (BROSZKUS 1996b) which has been one day after the new moon on 16.09.1993 and two days before the new moon on 05.09.1994, respectively. Significant quantities of individuals of the Rustic *Xestia collina* have been encountered in Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where more than 5 individuals in total have flown on 26.06.2004 – 01.07.2004 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2005a) which has been around and between the increasing half moon on 25.06.2004 between the new moon on 17.06.2004 and the full moon on 02.07.2004 as well as the full moon on 02.07.2004.

Mass occurrences of large quantities of individuals of the Square-Spot Rustic *Xestia xanthographa* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where abt. 40 individuals and more than 10 individuals have been captured on 23.08.1994 and 30.08.1994, respectively (WIPKING, FORST, KUHNA & SCHMITZ 1996), which has been two days after the full moon on 21.08.1994 as well as on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 25.08.1994 and 13.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 21.08.1994 as well as on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.08.1993, 02.09.1993, 09.09.1993, 16.09.1993, 22.09.1993 and 30.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the increasing half moon on 25.08.1993 between the new moon on 17.08.1993 and the full moon on 01.09.1993, one day after the full moon on 02.09.1993, one day before the decreasing half moon on 10.09.1993 between the full moon on 02.09.1993 and the new moon on 16.09.1993, on the new moon on 16.09.1993, one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, and on the full moon on 30.09.1993, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 02.09.1994 and 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the new moon on 05.09.1994 and three days before the full moon on 19.09.1994, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 27.08.1992, 08.09.1992 and 22.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992, four days before the full moon on 12.09.1992 and four days before the new moon on 26.09.1992, respectively.

Mass occurrences of large quantities of individuals of the Common Rustic *Mesapamea secalis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been reported from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, and from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981.

Significant quantities of individuals of the Common Rustic *Mesapamea secalis* have also been mentioned from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 07.08.1992 (BROSZKUS 1996b) which has been one day after the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals in total and 8 individuals in total have flown on 24.07.1994 and 27.07.1994, and on 04.08.1994 and 27.08.1994, respectively (BROSZKUS 1996b), which has been two and five days after the full moon on 22.07.1994, three days before the new moon on 07.08.1994, and three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, and from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Common Rustic *Mesapamea secalella* REMM 1983 (Lepidoptera: Noctuidae) have been signaled from the district Rheinkassel at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 30.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 29.07.1992.

Mass occurrences of large quantities of individuals of the Large Wainscot *Rhizedra lutosa* (HÜBNER 1803) (Lepidoptera: Noctuidae) have been found in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 12 individuals in total have flown on 19.10.2001 and 27.10.2001 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2002) which has been three days after the new moon on 16.10.2001 and five days before the full moon on 01.11.2001, respectively; in Laar north of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 5 individuals have flown on 09.10.2007 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2008a) which has been two days before the new moon on 11.10.2007, and in Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 10 individuals have flown on 10.09.1999 (ERNST ZEBE in SCHUMACHER 2001) which has been on the new moon on 10.09.1999.

Significant quantities of individuals of the Fisher´s Estuarine Moth *Gortyna borelii* (PIERRET 1837) (Lepidoptera: Noctuidae) have been identified in Schloßböckelheim westsouthwest of Bad Kreuznach in the Nahe valley in the southwestern part of Germany where 8 individuals in total, 5 individuals and more than 15 individuals have flown in the period of 09.09.2000 – 16.09.2000 (M. DERRA & KLAUS MEYER in SCHUMACHER 2001) as well as on 02.10.2001 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2002) and 07.09.2002 (KLAUS MEYER in SCHUMACHER 2003), respectively, which has been around the full moon on 13.09.2000, on the full moon on 02.10.2001 and on the new moon on 07.09.2002, respectively.

6.34 The Bordered Straw *Heliothis peltigera*, the Marbled Clover *Heliothis viriplaca*, the Scarce Chocolate-Tip *Clostera anachoreta* and the Hedge Rustic *Tholera cespitis*

Mass occurrences of the Bordered Straw *Heliothis peltigera* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been documented from the vicinity of Visp westsouthwest of Brig in the Rhône valley in the southeastern part of Switzerland where masses of individuals have flown on 09.08.1962 (STERZL in HARZ & WITTSTADT 1964) which has been on the increasing half moon on 09.08.1962 between the new moon on 31.07.1962 and the full moon on 15.08.1962, from Lanersbach in the Tuxer Tal southeast of Innsbruck in the western part of Austria where abt. 10 individuals in total have flown on 20.06.1964 – 22.06.1964 (HEINZ MÄNNEL in HARZ 1965c) which has been two to four days before the full moon on 24.06.1964, from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where 5 individuals have flown on 15.08.1971 (MAZZUCCO 1974) which has been five days before the new moon on 20.08.1971, from Lodève northwest of Montpellier in the southeastern part of France where 12 individuals in total have flown in the period of 26.08.1990 – 05.09.1990 (WOLF 1992b) which has been several days before and after the increasing half moon on 29.08.1990 between the new moon on 20.08.1990 and the full moon on 05.09.1990 as well as on and a few days before the full moon on 05.09.1990, from the Col de Vence northwest of Vence northwest of Nizza in the southeastern part of France where 10 individuals have flown on 05.08.1980 (LOBENSTEIN 1981b) which has been one day after the increasing half moon on 04.08.1980 between the full moon on 27.07.1980 and the new moon on 10.08.1980, from the Mont Ventoux north of Carpentras north of Marseille in the southeastern part of France where abt. 100 individuals have flown and have sucked on flowers on 28.06.1996 (A. BENNEWITZ in RENNWALD 2004) which has been three days before the full moon on 01.07.1996, and from Klausen northeast of Bolzano in Southern Tyrol in the northeastern part of Italy where 10 individuals have flown at the end of July 1968 and at the beginning of August 1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around and between the new moon on 25.07.1968 and the full moon on 08.08.1968.

Mass occurrences of large quantities of individuals of the Marbled Clover *Heliothis viriplaca* HUFNAGEL 1766 (Lepidoptera: Noctuidae) have been noticed near Leutesheim northnortheast of Kehl northnorthwest of Offenburg in the southern part of the Upper Rhine valley in the southwestern part of Germany where 80 individuals have flown and have sucked on flowers on 23.07.1993 (RENNWALD 1995) which has been four days after the new moon on 19.07.1993, near Schloßböckelheim westsouthwest of Bad Kreuznach in the Nahe valley in the southwestern part of Germany where abt. 25 individuals have flown on 24.07.2004 (SCHUMACHER 2005a) which has been one day before the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004, near Seibersbach southeast of Rheinböllen west of Bingen in the western part of Germany where abt. 15 individuals have flown on 24.07.2006 – 30.07.2006 (ERNST ZEBE in SCHUMACHER 2007a) which has been on and several days after the new moon on 24.07.2006, near Porz at the southeastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have flown on 30.07.1950 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1979) which has been one day after the full moon on 29.07.1950, in the district Pankow in the northern part of the city of Berlin in the northeastern part of Germany where 10 individuals have flown on 03.07.1992 (RENNWALD 1994) which has been three days after the new moon on 30.06.1992, in Apetlon at Lake Neusiedl south of Neusiedl am See southeast of Vienna in the eastern part of Austria where abt. 5 individuals have flown on 07.08.1976 (BURMANN & TARMANN 1979) which has been three days before the full moon on 10.08.1976, and in Les Mées westsouthwest of Digne-les-Bains northwest of Cannes in the southeastern part of France where 5 individuals have flown on 28.07.1975 (ZUCCHI 1976) which has been five days after the full moon on 23.07.1975.

Significant quantities of individuals of the Scarce Chocolate-Tip *Clostera anachoreta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been found near Lippolthausen west of Lünen north of Dortmund in the northwestern part of Germany where abt. 5 individuals have flown on 14.06.1928 (H. HEDDERGOTT in HARKORT & WEIGT 1969) which has been three days before the new moon on 17.06.1928.

Mass occurrences of large quantities of individuals of the Hedge Rustic *Tholera cespitis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been signaled from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 13.08.1994 and 13.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, and on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively.

6.35 The Shoulder-Striped Clover *Heliothis maritima,* the Scarce Bordered Straw *Helicoverpa armigera,* the Round-Winged Muslin *Thumatha senex* and the Oak Eggar *Lasiocampa quercus*

Mass occurrences of large quantities of individuals of the Shoulder-Striped Clover *Heliothis maritima* GRASLIN 1855 (Lepidoptera: Noctuidae) have been registered in Regis-Breitingen north of Altenburg south of Leipzig in the northeastern part of Germany where several thousands of individuals have flown on 14.07.1993 – 18.07.1993 (EGON JUNGMANN in RENNWALD 1995) which has been one to five days before the new moon on 19.07.1993, in the Kranenburger Bruch near Kranenburg west of Kleve in the northwestern part of Germany where 10 individuals have been confirmed on 31.05.2003 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2004a) which has been on the new moon on 31.05.2003, and near Kreuzkapelle and Herrenteich in the vicinity of Much northeast of Siegburg northeast of Bonn in the northwestern part of Germany where 12 individuals have flown on 19.07.1999 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2001) which has been two days before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999.

Mass occurrences of large quantities of individuals of the Scarce Bordered Straw *Helicoverpa armigera* (HÜBNER 1808) (Lepidoptera: Noctuidae) have been recognized near Sauve eastnortheast of Montpellier in the southeastern part of France where abt. 15 individuals have flown on 14.10.1992 (FINKE, SCHNELL & MERTENS in RENNWALD 1994) which has been three days after the full moon on 11.10.1992.

Mass occurrences of large quantities of individuals of the Round-Winged Muslin *Thumatha senex* (HÜBNER 1808) (Lepidoptera: Arctiidae) have been signaled from the Venner Moor northeast of Venne northeast of Osnabrück in the northwestern part of Germany where abt. 20 individuals in total have flown on 04.07.1970 and 07.07.1970 (HARKORT 1971, HANS-JOACHIM WEIGT in HARKORT 1971) which has been one and four days after the new moon on 03.07.1970, respectively.

Significant quantities of individuals of the Oak Eggar *Lasiocampa quercus* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been encountered in the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where more than 5 individuals have flown on 28.07.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been on the decreasing half moon on 28.07.2005 between the full moon on 21.08.2005 and the new moon on 05.08.2005.

6.36 The Heart and Dart *Agrotis exclamationis*

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* (Linnaeus 1758) (Lepidoptera: Noctuidae) in the northwestern part of Germany have been confirmed on the island Helgoland in the North Sea northnorthwest of Bremerhaven where 10 individuals in total have flown in the period of 23.07.1974 – 01.08.1974 (Thomas Meineke in Zucchi 1975b) which has been around and between the new moon on 19.07.1974 and the full moon on 03.08.1974, in Marsberg southsoutheast of Paderborn where more than 500 individuals have flown on 23.07.1977 (Lobenstein 1978) which has been one day before the increasing half moon on 24.07.1977 between the new moon on 16.07.1977 and the full moon on 30.07.1977, in the Witte Venn near Alstätte westnorthwest of Ahaus where 50 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975, and in Dortmund where 15 individuals have flown on 02.08.1991 (Rennwald 1992) which has been two days before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been found in the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 07.06.1994, 19.07.1994 and 23.08.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been two days before the new moon on 09.06.1994, three days before the full moon on 22.07.1994 and two days after the full moon on 21.08.1994, respectively; near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 28.06.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been five days after the full moon on 23.06.1994; in the districts Merkenich and Niehl at the northern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 03.06.1993 and 01.07.1993 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day before the full moon on 04.06.1993 and three days before the full moon on 04.07.1993, respectively; in the district Weiler at the northern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993 and 08.07.1993 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and four days after the full moon on 04.07.1993, respectively; in the district Rheinkassel at the northern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 16.06.1992, 25.06.1992, 02.07.1992, 09.07.1992 and 16.07.1992 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day after the full moon on 15.06.1992, one day after the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, two days after the new moon on 30.06.1992, and five days before and two days after the full moon on 14.07.1992, respectively; in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 10.06.1994, 17.06.1994, 24.06.1994, 01.07.1994, 08.07.1994 and 15.07.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day after the new moon on 09.06.1994, on the decreasing half moon on 17.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, one day after the full moon on 23.06.1994, on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and one day before and six days after the new moon on 09.07.1994, respectively; in the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 21.06.1994, 28.06.1994, 05.07.1994 and 12.07.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been two days

before and five days after the full moon on 23.06.1994, and four days before and three days after the new moon on 09.07.1994, respectively; and in the Worringer Bruch south of Dormagen north-northwest of Cologne where more than 10 individuals each have been captured on 02.07.1992 and 16.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992 and two days after the full moon on 14.07.1992, respectively.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* in the western part of Germany have been registered in Kobern-Gondorf in the Moselle valley south-southwest of Koblenz where more than 60 individuals have flown on 26.06.1994 (RENNWALD 1996) which has been three days after the full moon on 23.06.1994; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 5 individuals each have flown on 09.06.1992, 08.06.1993, 01.07.1994 and 06.07.1994 (BROSZKUS 1996b) which has been one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, four days after the full moon on 04.06.1993, on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and three days before the new moon on 09.06.1994, respectively.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* in the southwestern part of Germany have been recorded in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals each, 25 individuals and 5 individuals each have flown on 19.05.1993, 27.05.1993, 25.06.1993, 18.06.1994 and 30.06.1994, respectively (BROSZKUS 1996b), which has been two days before the new moon on 21.05.1993, two days before the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, five days after the new moon on 20.06.1993, one day after the increasing half moon on 17.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, and one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück where 5 individuals have flown on 23.05.1992 (BROSZKUS 1996b) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, in Bad Rappenau northnorthwest of Heilbronn in the Neckar valley where several hundreds of individuals in total have flown in the period of 20.05.1981 – 15.06.1981 (LOBENSTEIN 1983) which has been around and between the full moon on 19.05.1981, the new moon on 02.06.1981 and the full moon on 17.06.1981, in Hausen and Deggingen in the Fils valley southeast of Göppingen where masses of individuals have flown on 09.07.1992 (RENNWALD 1994) which has been one day after the increasing half moon on 08.07.1992 between the new moon on 30.06.1992 and the full moon on 14.07.1992, near Ammerbuch-Reusten westnorthwest of Tübingen southwest of Stuttgart where 130 individuals have flown on 02.06.1991 (RENNWALD 1992) which has been five days after the full moon on 28.05.1991, near Blaubeuren west of Ulm where more than 300 individuals each have flown on 07.07.1977 and 09.07.1977 (LOBENSTEIN 1978) which has been on and two days before the decreasing half moon on 09.07.1977 between the full moon on 01.07.1977 and the new moon on 16.07.1977, and in Mariabrunn northeast of Eriskirch southeast of Friedrichshafen at Lake Constance where abt. 20 individuals have flown from 20.05.1979 onwards (LOBENSTEIN 1981a) which has been on the decreasing half moon on 20.05.1979 between the full moon on 12.05.1979 and the new moon on 26.05.1979.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* in the southeastern part of Germany have been recognized in Niedergottsau south of Stammham in the Inn valley north of Burghausen where abt. 50 individuals have flown on 21.06.1994 (RENNWALD 1996) which has been two days before the full moon on 23.06.1994, in Weidach westnorthwest of Coburg where abundant individuals have flown on 06.08.1977 (LOBENSTEIN 1978) which has been one day before the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and

the new moon on 15.08.1977; and in Fuchsmühl northwest of Wiesau north of Weiden in der Oberpfalz where up to abt. 400 individuals have flown daily in June and July 1977 (LOBENSTEIN 1978) which has been around and between the full moon on 01.06.1977, the new moon on 16.06.1977, the full moon on 01.07.1977, the new moon on 16.07.1977 and the full moon on 30.07.1977.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* in the northeastern part of Germany have been confirmed in Dresden in the Elbe valley where more than 1.000 individuals in total have flown in the period of 24.05.1977 – 25.06.1977 (LOBENSTEIN 1978) which has been around and between the new moon on 18.05.1977, the full moon on 01.06.1977, the new moon on 16.06.1977 and the full moon on 01.07.1977; and in Wilkau-Haßlau south of Zwickau where masses of individuals have flown on 11.06.1983 (WOLF 1985) which has been on the new moon on 11.06.1983.

Mass occurrences of large quantities of individuals of the Heart and Dart *Agrotis exclamationis* in the southeastern part of France have been noticed in Les Mées westsouthwest of Digne-les-Bains northwest of Cannes where 20 individuals have flown on 15.06.1978 (LOBENSTEIN 1979) which has been one day after the increasing half moon on 14.06.1978 between the new moon on 05.06.1978 and the full moon on 20.06.1978, in Sète southwest of Montpellier where abt. 10 individuals have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978, and in Arles northwest of Marseille where 12 individuals in total have flown on 15.07.1979 – 18.07.1979 (LOBENSTEIN 1981a) which has been a few days before and after the decreasing half moon on 17.07.1979 between the full moon on 09.07.1979 and the new moon on 24.07.1979.

6.37 The Dark Sword-Grass *Agrotis ipsilon*

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) in the northwestern part of Germany have been recognized in Schloß Holte southsoutheast of Bielefeld where 480 individuals in total have flown in the period of 28.08.1967 – 29.09.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 20.08.1967, the new moon on 04.09.1967, the full moon on 18.09.1967 and the new moon on 03.10.1967; in Lichtenau southsoutheast and Willebadessen southeast of Paderborn where abt. 400 individuals and abt. 70 individuals, respectively, have flown on 19.09.1970 (KINKLER & SCHMITZ 1971) which has been on the full moon on 19.09.1970; in Elten northwest of Emmerich in the Lower Rhine valley where more than 300 individuals have flown in mid of September 1970 (KINKLER & SCHMITZ 1971) which has been several days before the full moon on 19.06.1970; in Nettetal-Hinsbeck northnorthwest of Mönchengladbach in the northwestern part of Germany and in Wippra eastnortheast of Lutherstadt Eisleben in the northeastern part of Germany where abt. 60 individuals and abt. 120 individuals, respectively, have flown on 26.09.1970 (KINKLER & SCHMITZ 1971) which has been four days before the new moon on 30.09.1970; in Göttingen in the Leine valley where more than 20 individuals have flown on 17.06.1969 (KINKLER & SCHMITZ 1970) which has been three days after the new moon on 14.06.1969; and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where abt. 150 individuals and abt. 90 individuals have flown on 15.09.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) and 28.08.1976 (HELMUT KINKLER in LOBENSTEIN 1977), respectively, which has been three days before the full moon on 18.09.1967 as well on the full moon on 28.08.1976, respectively.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the western part of Germany have been recorded in Godendorf northwest of Ralingen in the Sauer val-

ley northwest of Trier in the southwestern part of the Eifel where abt. 160 individuals in total have flown in the period of 06.09.1970 – 12.09.1970 (KINKLER & SCHMITZ 1971) which has been several days after the new moon on 01.09.1970 as well as several days before the full moon on 15.09.1970, in Kastellaun in the Hunsrück eastsoutheast of Cochem where abt. 30 – 60 individuals have flown daily from the end of August 1970 onwards (KINKLER & SCHMITZ 1971) which has been around the new moon on 01.09.1970, in Sommerau in the western part of the Hunsrück southeast of Trier where 7 individuals have flown on 02.09.1973 – 04.09.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been one to three days before the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, in Woppenroth south of Kirchberg in the eastern part of the Hunsrück where abt. 15 individuals in total have flown in the period of 01.07.1994 – 11.07.1994 (BROSZKUS 1996b) which has been around and between the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994 as well as the new moon on 09.07.1994, and near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 04.11.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 03.11.1994.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the southwestern part of Germany have been recognized in the Steiner Wald westnorthwest of Biblis northeast of Worms in the middle part of the Upper Rhine valley where abt. 1.000 individuals have flown on 12.08.1983 (WOLF 1985) which has been four days after the new moon on 08.08.1983, near Dudenhofen west of Speyer westsouthwest of Heidelberg in the middle part of the Upper Rhine valley where abundant individuals have flown on 13.10.1966 (BETTAG 1966) which has been one day before the new moon on 14.10.1966, at the Hornisgrinde eastnortheast of Kappelrodeck in the northern part of the Black Forest northeast of Offenburg where more than 15 individuals have flown on 24.08.1994 (RENNWALD 1996) which has been three days after the full moon on 21.08.1994, in Vogtsburg-Oberrotweil northwest of Freiburg in the southern part of the Upper Rhine valley where abt. 50 individuals in total have flown in the period of 19.06.1967 – 02.07.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 22.06.1967 and the new moon on 07.07.1967, in Todtnauberg north of Todtnau in the southern part of the Black Forest southeast of Freiburg where up to 20 individuals have flown on 09.10.1982 (TWARDELLA 1983) which has been two days before the decreasing half moon on 11.10.1982 between the full moon on 03.10.1982 and the new moon on 17.10.1982, in the Ried near Leipheim in the Danube valley eastnortheast of Ulm where more than 5 individuals have flown on 22.08.2002 (MARTIN STEHLE in RENNWALD 2004) which has been one day after the full moon on 21.08.2002; and in Überlingen north of Konstanz at Lake Constance where masses of individuals have flown on 22.08.1967 – 30.08.1967 and abundant individuals have flown on 13.09.1967 – 17.09.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 20.08.1967 as well as the decreasing half moon on 29.08.1967 between the full moon on 20.08.1967 and the new moon on 04.09.1967, and around and between the increasing half moon on 12.09.1967 between the new moon on 04.09.1967 and the full moon on 18.09.1967 as well as the full moon on 18.09.1967, respectively.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the southeastern part of Germany have been confirmed in Coburg where up to 50 individuals, more than 30 individuals and up to 50 individuals have flown daily at the beginning of September 1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a), from 18.08.1969 onwards (KINKLER & SCHMITZ 1970) and from 11.07.1970 onwards (KINKLER & SCHMITZ 1971), respectively, which has been around the new moon on 04.09.1967, three days before the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969, and one day before the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full

moon on 18.07.1970, respectively; in Schwaigermoos east of Attaching southeast of Freising where abt. 30 – 50 individuals have flown daily from 26.06.1970 onwards (KINKLER & SCHMITZ 1971) which has been one day before the decreasing half moon on 27.06.1970 between the full moon on 19.06.1970 and the new moon on 03.07.1970, in Hallbergmoos in the Isar valley northnortheast of München where 12 individuals in total have flown on 03.09.1973 and 05.09.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been on and two days before the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973, in Dießen am Ammersee southwest of München where abt. 150 individuals each have flown on 01.09.1967 – 02.09.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been two to three days before the new moon on 04.09.1967, and in Hirndobl near Tann southsoutheast of Eggenfelden where abt. 60 individuals in total have flown on 24.08.1987 – 26.08.1987 (WOLF 1989) which has been on and a few days after the new moon on 24.08.1987.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the northeastern part of Germany have been observed in Zehdenick northnorthwest of Berlin where 5 individuals and 7 individuals have flown on 20.06.1966 and 08.10.1966, respectively (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1967a), which has been two days after the new moon on 18.06.1966 as well as on the decreasing half moon on 08.10.1966 between the full moon on 29.09.1966 and the new moon on 14.10.1966, respectively; on the island Hiddensee north of Stralsund at the coast of the Baltic Sea where abt. 10 individuals in total have flown on 24.08.1966 – 28.08.1966 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1967a) which has been on and several days after the increasing half moon on 24.08.1966 between the new moon on 16.08.1966 and the full moon on 31.08.1966 as well as a few days before the full moon on 31.08.1966, in Sohland south of Bautzen where abundant individuals have flown from mid of May 1958 onwards (EBERT in KOCH 1959) which has been around the new moon on 18.05.1958, in the Leeskower Heide near Leeskow southwest of Eisenhüttenstadt where 10 individuals have flown on 24.08.2002 (L. LEHMANN in RENNWALD 2004) which has been three days after the full moon on 21.08.2004, and in Hainewalde west of Zittau where very abundant individuals have flown from the end of September 1958 to the beginning of October 1958 (SÜNDER in KOCH 1959) which has been around the full moon on 28.09.1958.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the western part of Austria have been noticed at the Großglocknerstraße south of Bruck southsoutheast of Zell am See where more than 50 individuals have flown on 09.08.1994 (GERNOT EMBACHER in RENNWALD 1996) which has been two days after the new moon on 07.08.1994; in Waidhofen in the Ybbs valley southsouthwest of Amstetten where numerous individuals each have flown on 11.08.1975 and 04.09.1975 (BURMANN & TARMANN 1978) which has been four days after the new moon on 07.08.1975 and one day before the new moon on 05.09.1975, respectively; in Küpfern in the Enns valley west of Weyer southeast of Steyr where more than 50 individuals have flown on 30.08.1975 (BURMANN & TARMANN 1978) which has been one day before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975; within and around Innsbruck in the Inn valley where masses of individuals each have flown on 24.09.1975 and 29.10.1975 (BURMANN & TARMANN 1978) as well as on 26.09.1976 (BURMANN & TARMANN 1979) which has been four days after the full moon on 20.09.1975, one day after the decreasing half moon on 28.10.1975 between the full moon on 20.10.1975 and the new moon on 03.11.1975, and three days after the new moon on 23.09.1976, respectively; in Völs in the Inn valley west of Innsbruck where 12 individuals, 17 individuals and abundant individuals each have flown on 12.08.1975, 25.08.1975, 18.09.1975 – 21.09.1975 and 24.09.1975, respectively (BURMANN & TARMANN 1978), which has been five days after the new moon on 07.08.1975, four days after the full moon on 21.08.1975 and around the full moon on 20.09.1975, respectively; in Völs in the Inn valley west of Innsbruck where 15 individuals and abt. 10 individuals have flown on 26.09.1976 and 29.10.1976,

respectively (BURMANN & TARMANN 1978), which has been three days after the new moon on 23.09.1976, and one day before the increasing half moon on 30.10.1976 between the new moon on 23.10.1976 and the full moon on 06.11.1976, respectively; in Sankt Ulrich am Pillersee northeast of Kitzbühel where abundant individuals have flown on 09.08.1975 – 10.08.1975 (BURMANN & TARMANN 1978) which has been two to three days after the new moon on 07.08.1975; in Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where 130 individuals in total, abt. 2.700 individuals, abt. 2.000 – 5.000 individuals daily, abt. 40 individuals, more than 250 individuals and more than 200 individuals have flown on 28.07.1967 – 02.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a), 20.08.1969, 25.08.1970 – 26.08.1970 (MAZZUCCO 1974), 30.08.1976, 09.08.1977 and 03.09.1977 (GERNOT EMBACHER in BURMANN & TARMANN 1979), respectively, which has been several days before and after the decreasing half moon on 30.07.1967 between the full moon on 21.07.1967 and the new moon on 06.08.1967, one day before the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969, one and two days after the decreasing half moon on 24.08.1970 between the full moon on 17.08.1970 and the new moon on 01.09.1970, five days after the new moon on 25.08.1976, five days before the new moon on 14.08.1977, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; in Fließ eastsoutheast of Landeck where 100 individuals and 50 individuals have flown on 07.09.1994 and 12.09.1994, respectively (F. PÜHRINGER in RENNWALD 1996), which has been two days after the new moon on 05.09.1994 as well as one day before the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively; in Fließ eastsoutheast of Landeck where masses of individuals have flown on 26.06.1975, 06.09.1975, 17.09.1975, 24.10.1975 and 27.10.1975 (BURMANN & TARMANN 1978) as well as on 22.09.1976 – 24.09.1976 (BURMANN & TARMANN 1979) which has been three days after the full moon on 23.06.1975, one day after the new moon on 05.09.1975, three days before the full moon on 20.09.1975, four days after the full moon on 20.10.1975, one day before the decreasing half moon on 28.10.1975 between the full moon on 20.10.1975 and the new moon on 03.11.1975, and one day before and one day after the new moon on 23.09.1976, respectively; in Hochfinstermünz north of Nauders south of Landeck where 5 individuals, 7 individuals each and very abundant individuals have flown on 24.06.1976, 28.06.1976, 29.08.1976 and 06.07.1977, respectively (BURMANN & TARMANN 1979), which has been three days before and one day after the new moon on 27.06.1976, four days after the new moon on 25.08.1976, and five days after the full moon on 01.07.1977, respectively; at the Zeinisjoch west of Galtür southwest of Landeck where masses of individuals have flown on 13.08.1977 (HUEMER in BURMANN & TARMANN 1979) which has been one day before the new moon on 14.08.1977, and in Wörgl in the Inn valley southsouthwest of Kufstein where abt. 15 individuals in total have flown on 20.09.1975 – 22.09.1975 (BURMANN & TARMANN 1978) which has been on and a few days after the full moon on 20.09.1975.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the eastern part of Austria have been identified in Oberretzbach northeast of Retz northnorthwest of Hollabrunn northnorthwest of Vienna where 15 individuals have flown on 07.08.1993 (RENNWALD 1995) which has been five days after the full moon on 02.08.1993, in Loretto north of Eisenstadt southsoutheast of Vienna where abundant individuals have flown on 29.06.1975 (BURMANN & TARMANN 1978) which has been three days before the decreasing half moon on 02.07.1975 between the full moon on 23.06.1975 and the new moon on 09.07.1975, in Matrei northnorthwest of Lienz in the southern part of Austria where abt. 60 – 70 individuals have flown on 10.06.1970 (KINKLER & SCHMITZ 1971) which has been three days before the increasing half moon on 13.06.1960 between the new moon on 04.06.1970 and the full moon on 19.06.1970, and in Lavant in the Drau valley eastsoutheast of Lienz in the southern part of Austria where abt. 10 individuals have flown on 18.09.1975 (BURMANN & TARMANN 1978) which has been two days before the full moon on 20.09.1975.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in Switzerland have been encountered in Martigny in the Rhône valley in the southeastern part of Switzerland where masses of individuals have flown on 22.06.1967 – 24.06.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been on and several days after the full moon on 22.06.1967; at the Corvatsch south of Sankt Moritz and the Julier west of Sankt Moritz south of Davos in the southeastern part of Switzerland where abt. 150 – 200 individuals each have flown on 19.09.1975 as well as on 23.09.1975 and 29.09.1975, respectively (ZUCCHI 1976), which has been one day before and three days after the full moon on 20.09.1975 as well as on the decreasing half moon on 29.09.1975 between the full moon on 20.09.1975 and the new moon on 05.10.1975, respectively; on the Fronalpstock southeast of Morschach southsouthwest of Schwyz in the northeastern part of Switzerland where 10 individuals have flown on 25.07.1987 – 26.07.1987 (REZBANYAI-RESER & SCHAEFER 1989) which has been on and one day after the new moon on 25.07.1987; and at the Col du Bretolet south of Montreux in the southwestern part of Switzerland where more than 80 individuals and more than 1.000 individuals have been observed probably on 20.08.1976 – 21.08.1976 (LOBENSTEIN 1977) and 07.10.1981 – 08.10.1981 (KÖHLER 1983), respectively, which has been five and four days before the new moon on 25.08.1976, and several days before the full moon on 13.10.1981, respectively.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in the southeastern part of France have been registered in Grasse northnorthwest of Cannes where abundant individuals have flown in early September 1978 (LOBENSTEIN 1979) which has been around the new moon on 02.09.1978, at the Col de Vence northwest of Vence northwest of Nizza where 6 individuals have flown on 10.07.1978 (LOBENSTEIN 1979) which has been five days after the new moon on 05.07.1978, and in Sète southwest of Montpellier where 8 individuals have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978.

Mass occurrences of large quantities of individuals of the Dark Sword-Grass *Agrotis ipsilon* in Southern Tyrol in the northeastern part of Italy have been recorded in Taufers im Münstertal west of Merano where 7 individuals and abundant individuals have flown on 22.09.1976, 06.08.1977 and 03.09.1977, respectively (BURMANN & TARMANN 1979), which has been one day before the new moon on 23.09.1976, one day before the decreasing half moon on 07.08.1977 between the full moon on 30.07.1977 and the new moon on 14.08.1977, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; in Naturno eastsoutheast of Merano where abt. 300 individuals each have flown on 23.06.1970 and 24.06.1970 (KINKLER & SCHMITZ 1971) which has been four and five days after the full moon on 19.06.1970, in Leifers south of Bolzano where 20 individuals have flown on 05.07.1975 – 06.07.1975 (BURMANN & TARMANN 1978) which has been four to five days before the new moon on 09.07.1975, in the Tauferertal north of Bruneck eastnortheast of Brixen where abt. 100 individuals have flown on 19.06.1973 (HELMUT KINKLER in MÜLLER-KÖLLGES 1974) which has been four days after the full moon on 15.06.1973, and at Lake Garda eastnortheast of Milano where abt. 70 individuals in total have flown in the period of 19.09.1967 – 03.10.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 18.07.1967 and the new moon on 03.10.1967. Various examples of mass flights of the Dark Sword-Grass *Agrotis ipsilon* from the older literature are compiled and quoted in WILLIAMS (1930).

6.38 The Turnip Moth *Agrotis segetum*, the Shuttle-Shaped Dart *Agrotis puta*, the Archer´s Dart *Agrotis vestigialis* and the Heart and Club *Agrotis clavis*

Mass occurrences of large quantities of individuals of the Turnip Moth *Agrotis segetum* SCHIFFER-

MÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) in Germany have been recognized in Kalenberg southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 23.09.1994 (W. SPEIDEL & OLIVER SCHMITZ in RENNWALD 1996) which has been four days after the full moon on 19.09.1994, in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 17.09.1993 (BROSZKUS 1996b) which has been one day after the new moon on 16.09.1993; in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 12.08.1992, 27.08.1992 and 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 13.08.1992, one day before the new moon on 28.08.1992 and four days before the full moon on 12.09.1992, respectively; in Brelingen westnorthwest of Wedemark north of Hannover in the northwestern part of Germany where 30 individuals in total have flown on 03.06.1993 – 06.06.1993 (RENNWALD 1995) which has been a few days before and after the full moon on 04.06.1993, in Loga northeast of Leer southeast of Emden in the northwestern part of Germany where 6 individuals have flown on 05.06.1993 (RENNWALD 1995) which has been one day after the full moon on 04.06.1993, in Bad Lippspringe northeast of Paderborn in the northwestern part of Germany where abt. 5 individuals have flown on 30.06.1991 (RETZLAFF 1992, BIERMANN in RETZLAFF 1992) which has been three days after the full moon on 27.06.1991, and in the vicinity of Stendal westnorthwest of Brandenburg in the northeastern part of Germany where 10 individuals have flown on 10.10.1991 (RENNWALD 1992) which has been two days after the new moon on 08.10.1991.

Mass occurrences of large quantities of individuals of the Turnip Moth *Agrotis segetum* in Austria have been recorded in Muhr west of Sankt Michael im Lungau in the central part of Austria where 7 individuals have flown on 04.11.1994 (GERNOT EMBACHER in RENNWALD 1996) which has been one day after the new moon on 03.11.1994, in Apetlon at Lake Neusiedl south of Neusiedl am See southeast of Vienna in the eastern part of Austria where abt. 15 individuals have flown on 19.05.1977 (BURMANN & TARMANN 1979) which has been one day after the new moon on 18.05.1977; in Hackelsberg north of Illmitz at Lake Neusiedl south of Neusiedl am See southeast of Vienna in the eastern part of Austria where 7 individuals and 6 individuals have flown on 22.05.1977 and 27.05.1977, respectively (BURMANN & TARMANN 1979), which has been four days after the new moon on 18.05.1977, and four days before the full moon on 01.06.1977, respectively; in Seewinkel west of Sankt Andrä am Zicksee southsoutheast of Neusiedl am See southeast of Vienna in the eastern part of Austria where 8 individuals have flown on 25.05.1977 (BURMANN & TARMANN 1979) which has been two days before the increasing half moon on 27.05.1977 between the new moon on 18.05.1977 and the full moon on 01.06.1977; and at Schloß Bruck westnorthwest of Lienz in the Drau valley in the southern part of Austria where 8 individuals and 12 individuals have flown on 27.09.1977 and 09.10.1977, respectively (BURMANN & TARMANN 1979), which has been on the full moon on 27.09.1977 and three days before the new moon on 12.10.1977, respectively.

Mass occurrences of large quantities of individuals of the Turnip Moth *Agrotis segetum* in Switzerland, France and Italy have been recognized at the Col du Bretolet south of Montreux in the southwestern part of Switzerland where more than 20 individuals have flown on 07.10.1981 – 08.10.1981 (KÖHLER 1983) which has been several days before the full moon on 13.10.1981, in Sète southwest of Montpellier in the southeastern part of France where 6 individuals in total have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978; and in Leifers south of Bolzano in Southern Tyrol in the northeastern part of Italy where numerous individuals daily have flown on 28.05.1975 – 29.05.1975 and 14.08.1975 (BURMANN & TARMANN 1978) which has been three to four days after the full moon on 25.05.1975 as well

as one day before the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975, respectively.

Mass occurrences of large quantities of individuals of the Shuttle-Shaped Dart *Agrotis puta* (HÜBNER 1803) (Lepidoptera: Noctuidae) have been met in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 10 individuals have flown on 31.07.1990 (WOLFGANG WITTLAND in KINKLER 1992) that has been one day after the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on 06.08.1990; in Marl-Korthausen northnortheast of Gelsenkirchen in the northwestern part of Germany where 12 individuals in total have flown on 02.08.2001 and 23.08.2001 (WERNER STELLMACH in SCHUMACHER 2002) that has been two days before the full moon on 04.08.2001 and four days after the new moon on 19.08.2001, respectively; in Wülfrath eastnortheast of Düsseldorf in the northwestern part of Germany where 5 individuals have flown on 16.08.1995 (WILLIBALD SCHMITZ in KINKLER 1997) that has been three days before the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, and near Rheinmünster-Söllingen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where 5 individuals have flown on 29.08.2002 (RENNWALD 2004) that has been on the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.09.2002.

Mass occurrences of large quantities of individuals of the Archer´s Dart *Agrotis vestigialis* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been found near Haltern north of Recklinghausen in the northwestern part of Germany where 10 individuals have been captured on 06.08.1964 (HARKORT & WEIGT 1968) which has been one day before the new moon on 07.08.1964, and near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 04.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the new moon on 07.08.1994.

Mass occurrences of large quantities of individuals of the Heart and Club *Agrotis clavis* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been encountered in the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 05.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before the new moon on 09.07.1994; in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 17.06.1993, 24.06.1993 and 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before and four days after the new moon on 20.06.1993, and three days before the full moon on 04.07.1993, respectively; in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 08.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 09.07.1994; and in the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 28.06.1994, 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994, and four days before and three days after the new moon on 09.07.1994, respectively.

6.39 The Copper Underwing *Amphipyra pyramidea*, the Svensson´s Copper Underwing *Amphipyra berbera* and the Willowherb Yellow Underwing *Epilecta linogrisea*

Mass occurrences of large quantities of individuals of the Copper Underwing *Amphipyra pyrami-*

dea LINNAEUS 1758 (Lepidoptera: Noctuidae) have been mentioned from Sankt Goarshausen in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where at least 50 individuals and masses of individuals have been observed on 20.07.1993 and 25.07.1993, respectively (RENNWALD 1995), which has been one day after the new moon on 19.07.1993 as well as two days before the increasing half moon on 27.07.1993 between the new moon on 19.07.1993 and the full moon on 02.08.1993, respectively; from the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 23.08.1994 and 30.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 21.08.1994 as well as on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the districts Hochkirchen and Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 13.09.1994 and 16.09.1994, respectively (WIPKING, FORST, KUHNA & SCHMITZ 1996), which has been on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, and three days before the full moon on 19.09.1994, respectively; from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before the full moon on 12.09.1992, and from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 12 individuals have flown on 08.09.1981 (WALFORT 1983) which has been one day after the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981.

Significant quantities of individuals of the Copper Underwing *Amphipyra pyramidea* have also been recorded in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 25.07.1994 (BROSZKUS 1996b) which has been three days after the full moon on 22.07.1994, in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 04.08.1994 (BROSZKUS 1996b) which has been three days before the new moon on 07.08.1994, and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980.

Significant quantities of individuals of the Svensson´s Copper Underwing *Amphipyra berbera* RUNGS 1949 (Lepidoptera: Noctuidae) have been found in Monheim-Laacherhof north of Cologne in the Middle Rhine valley in the northwestern part of Germany where 10 individuals in total have flown in the period of 09.08.1985 – 19.08.1985 (KOLBE & BRUNS in KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992) which has been around the new moon on 16.08.1985.

Mass occurrences of large quantities of individuals of the Willowherb Yellow Underwing *Epilecta linogrisea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been registered in Kobern-Gondorf in the Moselle valley southsouthwest of Koblenz in the western part of Germany where 20 individuals have flown on 07.08.1992 (GOERGENS & WILLIBALD SCHMITZ in KINKLER 1994, RENNWALD 1994) which has been one day after the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992.

6.40 The Dewick´s Plusia *Macdunnoughia confusa*

Mass occurrences of large quantities of individuals of the Dewick´s Plusia *Macdunnoughia confusa* STEPHENS 1850 (Lepidoptera: Noctuidae) in the southwestern part of Germany have been noticed in

the vicinity of Ettlingen south of Karlsruhe in the middle part of the Upper Rhine valley where hundreds of individuals have flown on 24.08.1953 (PEKARSKY 1955a) which has been on the full moon on 24.08.1953, in Rheinstetten southwest of Karlsruhe in the middle part of the Upper Rhine valley where 90 individuals have flown on 23.08.1994 (RENNWALD 1996) which has been two days after the full moon on 21.08.1994; in Rheinmünster-Stollhofen southeast of Rastatt in the middle part of the Upper Rhine valley where at least 120 individuals and at least 150 individuals have flown and have sucked on flowers on 17.08.1992 and 26.08.1992, respectively (RENNWALD 1994), which has been four days after the full moon on 13.08.1992 and two days before the new moon on 28.08.1992, respectively; in Sundheim southsoutheast of Kehl northwest of Offenburg in the southern part of the Upper Rhine valley where abt. 100 individuals have flown and have sucked on flowers on 18.08.1992 (RENNWALD 1994) which has been five days after the full moon on 13.08.1992, near Meißenheim southwest of Offenburg in the southern part of the Upper Rhine valley where abt. 50 individuals have flown and have sucked on flowers on 03.09.1991 (RENNWALD 1992) which has been one day after the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991, in Kippenheim south of Lahr in the southern part of the Upper Rhine valley where abt. 65 individuals have flown and have sucked on flowers on 12.08.1992 (RENNWALD 1994) which has been one day before the full moon on 13.08.1992, and in Vogtsburg-Oberbergen northwest of Freiburg in the southern part of the Upper Rhine valley where 150 individuals have flown and have sit in the grass on 06.09.1975 (ZUCCHI 1976) which has been one day after the new moon on 05.09.1975.

Mass occurrences of large quantities of individuals of the Dewick´s Plusia *Macdunnoughia confusa* in the northwestern and northeastern parts of Germany have been recorded in Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 40 individuals and more than 10 individuals have flown on 25.07.1969 – 28.07.1969 (KINKLER & SCHMITZ 1970) and 18.07.1979 (LOBENSTEIN 1981a), respectively, which has been one to four days before the full moon on 29.07.1969 as well as one day after the decreasing half moon on 17.07.1979 between the full moon on 09.07.1979 and the new moon on 24.07.1979, respectively; in Bad Neuenahr in the Ahr valley south of Bonn in the northwestern part of Germany where more than 10 individuals have flown on 20.09.1979 (LOBENSTEIN 1981a) which has been one day before the new moon on 21.09.1979, in Glienicke westnorthwest of Beeskow eastsoutheast of Berlin in the northeastern part of Germany where abt. 30 individuals in total have flown in the period of 23.09.1975 – 02.10.1975 (ZUCCHI 1976) which has been around and between the full moon on 20.09.1975 and the new moon on 05.10.1975; and in Zehdenick northnorthwest of Berlin and Waren-Müritzhof westnorthwest of Neustrelitz in the northeastern part of Germany where abt. 25 individuals in total each have flown in the period of 26.08.1975 – 19.09.1975 (ZUCCHI 1976) which has been around and between the full moon on 21.08.1975, the new moon on 05.09.1975 and the full moon on 20.09.1975.

Mass occurrences of large quantities of individuals of the Dewick´s Plusia *Macdunnoughia confusa* in Austria and Italy have been recognized in Fließ eastsoutheast of Landeck in the western part of Austria where abundant individuals have flown in the period of 17.09.1975 – 24.09.1975 (BURMANN & TARMANN 1978) which has been around the full moon on 20.09.1975, in Schluderns in the Etsch valley west of Merano in Southern Tyrol in the northeastern part of Italy where up to 8 individuals daily have flown in the period of 15.06.1967 – 02.07.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the increasing half moon on 16.06.1967 between the new moon on 08.06.1967 and the full moon on 22.06.1967 as well as the decreasing half moon on 30.06.1967 between the full moon on 22.06.1967 and the new moon on 07.07.1967; in Naturno eastsoutheast of Merano in Southern Tyrol in the northeastern part of Italy where abt. 10 individuals daily have flown on three evenings in the period of 08.07.1968 – 16.07.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) and abt. 20 individuals have flown at the beginning of August 1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 10.07.1968 as

well as the decreasing half moon on 18.07.1968 between the full moon on 10.07.1968 and the new moon on 25.07.1968, and around and between the full moon on 29.07.1969 and the new moon on 13.08.1969, respectively; and in Unserfrau in Schnals in the Schnals valley westnorthwest of Merano in Southern Tyrol in the northeastern part of Italy where abt. 10 individuals have flown on 20.08.1975 (BURMANN & TARMANN 1978) which has been one day before the full moon on 21.08.1975.

6.41 The Cabbage Moth *Mamestra brassicae*, the Dot Moth *Melanchra persicariae*, the Burnet Companion *Euclidia glyphica* and the Blackneck *Lygephila pastinum*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have always registered various individuals of the Burnet Companion *Euclidia glyphica* (LINNAEUS 1758) (Lepidoptera: Noctuidae) among the community of the background brown small butterflies. I have, however, never observed the almost sudden appearance of significant quantities of individuals of the Burnet Companion *Euclidia glyphica* which would permit a selenocyclical evaluation of its population dynamics, and therefore my own observations of its distribution are not incorporated into the interpretation of the relationships to the turning points of the lunar cycle. Some examples of mass occurrences of the Burnet Companion *Euclidia glyphica* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Cabbage Moth *Mamestra brassicae* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been documented from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 20 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980, from the district Rheinkassel at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992; from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 12.08.1992 and 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 13.08.1992 and one day before the new moon on 28.08.1992, respectively; from the Lower Rhine valley north and northwest of Cologne in the northwestern part of Germany where up to abt. 20 individuals daily have flown on 12.08.1993 – 16.08.1993 (RENNWALD 1995) which has been a few days after the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals have flown on 13.08.1982 (WALFORT 1983) which has been on the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, from Delbrück westnorthwest of Paderborn in the northwestern part of Germany where abt. 25 individuals have flown on 09.08.1991 (RUDOLF PÄHLER in RETZLAFF 1992) which has been one day before the new moon on 10.08.1991, from Innsbruck in the Inn valley in the western part of Austria where numerous individuals have flown on 26.08.1976 (BURMANN & TARMANN 1979) which has been one day after the new moon on 25.08.1976; from Fließ eastsoutheast of Landeck in the western part of Austria where masses of individuals and very abundant individuals have flown on 24.08.1976 and 24.09.1976 – 28.09.1976, respectively (BURMANN & TARMANN 1979), which has been one day before the new moon on 25.08.1976, and one to four days after the new moon on 23.09.1976, respectively; and from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where abt. 3.000 individuals and abt. 10 individuals have flown on 30.08.1976 and 03.09.1977, respectively (BURMANN & TARMANN 1979), which has been five days after the new moon

on 25.08.1976, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively.

Significant quantities of individuals of the Dot Moth *Melanchra persicariae* (LINNAEUS 1761) (Lepidoptera: Noctuidae) have been encountered in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Burnet Companion *Euclidia glyphica* have been encountered in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 04.08.1981 (KINKLER 1987) which has been four days after the new moon on 31.07.1981, and in the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where 7 individuals have flown on 22.07.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been one day after the full moon on 21.07.2005.

Significant quantities of individuals of the Blackneck *Lygephila pastinum* (TREITSCHKE 1826) (Lepidoptera: Noctuidae) have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 7 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981.

6.42 The Almond-Tree Leaf Skeletonizer Moth *Aglaope infausta*, the Dark Forester *Rhagades pruni*, the Scarce Dagger *Acronicta auricoma* and the Bordered Sallow *Pyrrhia umbra*

Mass occurrences of large quantities of individuals of the Almond-Tree Leaf Skeletonizer Moth *Aglaope infausta* LINNAEUS 1767 (Lepidoptera: Zygaenidae) have been reported from Kaub northnorthwest of Bingen in the Middle Rhine valley in the western part of Germany where abt. 100 individuals have flown on 07.07.1995 (KINKLER 1996, HANS-ARNOLD HÜRTER & A. SCHMIDT in KINKLER 1996) which has been five days before the full moon on 12.07.1995, from Klotten northwest of Cochem in the Moselle valley in the western part of Germany where 20 individuals have flown on 02.07.1993 (ROLF MÖRTTER in KINKLER 1994) which has been two days before the full moon on 04.07.1993, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the western part of Germany where abt. 20 individuals have flown on 10.06.2007 (ANDREAS WERNO in SCHUMACHER 2008a) which has been two days after the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, and from Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 02.07.1993 (BROSZKUS 1996a) which has been two days before the full moon on 04.07.1993.

Significant quantities of individuals of the Dark Forester *Rhagades pruni* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Zygaenidae) have been recorded in Bad Sobernheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals each have flown on 02.07.1993 and 02.07.1994 (BROSZKUS 1996a) which has been two days before the full moon on 04.07.1993 as well as one day after the decreasing half moon on

01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively.

Significant quantities of individuals of the Scarce Dagger *Acronicta auricoma* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 02.08.1980 (KINKLER 1987) which has been two days before the decreasing half moon on 04.08.1980 between the full moon on 27.07.1980 and the new moon on 10.08.1980.

Significant quantities of individuals of the Bordered Sallow *Pyrrhia umbra* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 7 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981.

6.43 The White-Point *Mythimna albipuncta*

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) in the western part of Germany have been noticed in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 20 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980, in Kattenes in the Moselle valley southsouthwest of Kobern-Gondorf southsouthwest of Koblenz where 70 individuals have flown on 24.08.1974 (ZUCCHI 1975b) which has been one day before the increasing half moon on 25.08.1974 between the new moon on 17.08.1974 and the full moon on 01.09.1974, at Burg Liebenstein near Kamp-Bornhofen in the Middle Rhine valley southsoutheast of Koblenz where more than 300 individuals in total have flown in the period of 22.09.1962 – 26.09.1962 (KARL CLEVE in HARZ & WITTSTADT 1964) which has been around and between the decreasing half moon on 21.09.1962 between the full moon on 14.09.1962 and the new moon on 28.09.1962 as well as the new moon on 28.09.1962; in Cologne in the Middle Rhine valley in the northwestern part of Germany where up to 20 individuals daily have flown from 07.06.1969 onwards and from 11.07.1969 onwards (KINKLER & SCHMITZ 1970) which has been one day before the decreasing half moon on 08.06.1969 between the full moon on 31.05.1969 and the new moon on 14.06.1969 as well as three days before the new moon on 14.07.1969, respectively; in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 26.08.1993 and 02.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before and one day after the full moon on 01.09.1993, respectively; in the district Rheinkassel at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992; and in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 12.08.1992 and 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 13.08.1992 and four days before the full moon on 12.09.1992, respectively.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the southwestern part of Germany have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where more than 5 individuals, abt. 10 individuals each and 20 individuals in total have flown on 01.06.1992, 21.07.1992 – 27.07.1992, 19.05.1993, and 02.08.1994 and

07.08.1994, respectively (Broszkus 1996b), which has been on the new moon on 01.06.1992, around the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, two days before the new moon on 21.05.1993, and five days before and on the new moon on 07.08.1994, respectively; and in the vicinity of Darmstadt in the northern part of the Upper Rhine valley where abt. 10 individuals have flown on 09.09.1972 (Kinkler, Nippel, Schmitz & Swoboda 1973) which has been two days after the new moon on 07.09.1972.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the northeastern part of Germany have been recorded in Kuhlhausen eastsoutheast of Havelberg in the Elbe valley eastsoutheast of Wittenberge where 15 individuals have flown on 16.09.1991 (Rennwald 1992) which has been on the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991; in Zehdenick northnorthwest of Berlin where abt. 10 individuals each have flown on 14.08.1972 and 07.09.1972 (Kinkler, Nippel, Schmitz & Swoboda 1973) which has been five days after the new moon on 09.08.1972 and on the new moon on 07.09.1972, respectively; in Glienicke westnorthwest of Beeskow eastsoutheast of Berlin where abt. 20 individuals in total have flown in the period of 16.08.1975 – 25.08.1975 (Zucchi 1976) which has been around and between the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975 as well as the full moon on 21.08.1975, in Bindfelde southeast of Stendal where abt. 20 individuals have flown on 10.08.1991 (Rennwald 1992) which has been on the new moon on 10.08.1991, in the Kyffhäuser north of Bad Frankenhausen east of Sondershausen where abundant individuals have flown on 05.07.1969 (Kinkler & Schmitz 1970) which has been two days before the decreasing half moon on 07.07.1969 between the full moon on 29.06.1969 and the new moon on 14.07.1969, in Bad Frankenhausen east of Sondershausen where abt. 2.000 individuals have flown on 04.08.1990 (Wolf 1992b) which has been two days before the full moon on 06.08.1990, and in Guttau northeast of Bautzen where more than 100 individuals each have flown on 12.08.1990 – 13.08.1990 (Wolf 1992b) which has been one and two days before the decreasing half moon on 14.08.1990 between the full moon on 06.08.1990 and the new moon on 20.08.1990.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the western part of Austria have been confirmed in Ludesch northwest of Bludenz where abt. 10 individuals have flown on 20.09.1973 (Sven Plattner in Kinkler, Nippel & Swoboda 1974) which has been on the decreasing half moon on 20.09.1973 between the full moon on 12.09.1973 and the new moon on 26.09.1973; in Waidhofen in the Ybbs valley southsouthwest of Amstetten where numerous individuals have flown in the period of 11.08.1975 – 17.08.1975 (Burmann & Tarmann 1978) which has been around and between the new moon on 07.08.1975 as well as the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975; in Gaissulz north of Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 20 individuals daily have flown on 17.08.1977, 20.08.1977 and 30.08.1977 (Burmann & Tarmann 1979) which has been three days after the new moon on 14.08.1977, three days before the increasing half moon on 23.08.1977 between the new moon on 14.08.1977 and the full moon on 28.08.1977, and two days after the full moon on 28.08.1977, respectively; in Innsbruck in the Inn valley where numerous individuals and very abundant individuals have flown on 24.08.1976 – 28.08.1976 and 19.09.1976, respectively (Burmann & Tarmann 1979), which has been around the new moon on 25.08.1976, and two days after the decreasing half moon on 17.09.1976 between the full moon on 08.09.1976 and the new moon on 23.09.1976, respectively; in Kühtai in the Sellrain valley westsouthwest of Innsbruck where abt. 30 individuals in total and more than 10 individuals have flown in the period of 18.08.1973 – 25.08.1973 (Kinkler, Nippel & Swoboda 1974) and on 14.08.1975 (Burmann & Tarmann 1978), respectively, which has been around and between the full moon on 14.08.1973 and the new moon on 28.08.1973, and one day before the increasing half moon on 15.08.1975 between the new moon on 07.08.1975 and the full moon on 21.08.1975, respectively; in

Fließ eastsoutheast of Landeck where abt. 50 individuals and masses of individuals have flown around 20.05.1975 (BURMANN & TARMANN 1978) and 03.09.1977 (BURMANN & TARMANN 1979), respectively, which has been one day after the increasing half moon on 19.05.1975 between the new moon on 11.05.1975 and the full moon on 25.05.1975, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; and at the Zeinisjoch west of Galtür southwest of Landeck where abundant individuals have flown on 03.09.1977 (HUEMER in BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the eastern part of Austria and in the northeastern part of Switzerland have been noticed in Dürnstein westsouthwest of Krems in the Danube valley in the eastern part of Austria where more than 15 individuals have flown on 28.08.1977 (BURMANN & TARMANN 1979) which has been on the full moon on 28.08.1977, in Illmitz at Lake Neusiedl eastsoutheast of Eisenstadt southeast of Vienna in the eastern part of Austria where 10 individuals have flown on 31.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been three days after the new moon on 28.08.1973, in Apetlon at Lake Neusiedl south of Neusiedl am See southeast of Vienna in the eastern part of Austria where more than 10 individuals have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, in Reichenburg southeast of Zürich in the northeastern part of Switzerland where more than 40 individuals in total have flown in the period of 10.08.1972 – 31.08.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) which has been around and between the new moon on 09.08.1972 and the full moon on 24.08.1972; and in Kreuzlingen south of Konstanz at Lake Constance in the northeastern part of Switzerland where more than 100 individuals in total have flown in the period of 03.08.1973 – 31.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been around and between the new moon on 29.07.1973, the full moon on 14.08.1973 and the new moon on 28.08.1973.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the southeastern part of France have been encountered in Digne-les-Bains and Les Mées westsouthwest of Digne-les-Bains northwest of Cannes where 50 individuals in total and 40 individuals in total have flown in the periods of 29.05.1972 – 09.06.1972 and 16.09.1972 – 23.09.1972, respectively (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), as well as abt. 100 individuals in total have flown in the period of 28.07.1973 – 04.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been around and between the full moon on 28.05.1972 and the new moon on 11.06.1972, around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the full moon on 23.09.1972, and around and between the new moon on 29.07.1973 as well as the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, respectively.

Mass occurrences of large quantities of individuals of the White-Point *Mythimna albipuncta* in the northeastern part of Italy have been observed in Latsch in the Etsch valley west of Merano where 12 individuals have flown on 01.09.1973 – 02.09.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been four and five days after the new moon on 28.08.1973, in Auer in the Etsch valley south of Bolzano where 9 individuals have flown on 22.09.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been four days before the new moon on 26.09.1973, in Riva del Garda at Lake Garda eastnortheast of Milano where abt. 20 individuals have flown on 04.05.1973 – 05.05.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been two to three days after the new moon on 02.05.1973, and at Lake Garda eastnortheast of Milano where abt. 50 individuals in total have flown in the period of 19.09.1967 – 03.10.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 18.07.1967 and the new moon on 03.10.1967.

6.44 The L-Album Wainscot *Mythimna l-album*

Mass occurrences of large quantities of individuals of the L-Album Wainscot *Mythimna l-album* (Linnaeus 1767) (Lepidoptera: Noctuidae) in the western part of Germany have been recognized in Godendorf northwest of Ralingen in the Sauer valley northwest of Trier in the southwestern part of the Eifel where more than 40 individuals in total have flown on 09.09.1970 – 12.09.1970 (Kinkler & Schmitz 1971) which has been on and several days after the increasing half moon on 09.09.1970 between the new moon on 01.09.1970 and the full moon on 15.09.1970, at Burg Liebenstein near Kamp-Bornhofen in the Middle Rhine valley southsoutheast of Koblenz where 7 individuals in total have flown in the period of 22.09.1962 – 26.09.1962 (Karl Cleve in Harz & Wittstadt 1964) which has been around and between the decreasing half moon on 21.09.1962 between the full moon on 14.09.1962 and the new moon on 28.09.1962 as well as the new moon on 28.09.1962, and in Höxter in the Weser valley in the northwestern part of Germany where abt. 40 individuals have flown on 20.09.1969 (Kinkler & Schmitz 1970) which has been on the increasing half moon on 20.09.1969 between the new moon on 11.09.1969 and the full moon on 25.09.1969.

Mass occurrences of large quantities of individuals of the L-Album Wainscot *Mythimna l-album* in the southwestern part of Germany have been recorded in Bürstadt northnorthwest of Heidelberg in the middle part of the Upper Rhine valley where abt. 80 individuals have flown on 10.09.1974 (Zucchi 1975b) which has been on the decreasing half moon on 10.09.1974 between the full moon on 01.09.1974 and the new moon on 16.09.1974, in Hörden southeast of Gaggenau in the Murg valley in the northern part of the Black Forest southeast of Rastatt where 6 individuals have flown and have sucked on flowers on 17.09.1993 (Rennwald 1995) which has been one day after the new moon on 16.09.1993; in Vogtsburg-Oberbergen northwest of Freiburg in the southern part of the Upper Rhine valley where 50 individuals have flown on 30.08.1974 (Zucchi 1975b) and 5 individuals have flown on 04.09.1980 (Lobenstein 1981b) which has been two days before the full moon on 01.09.1974 as well as two days after the decreasing half moon on 02.09.1980 between the full moon on 26.08.1980 and the new moon on 09.09.1980, respectively; and in Vogtsburg-Schelingen northwest of Freiburg in the southern part of the Upper Rhine valley where 10 individuals in total have flown in the period of 19.06.1967 – 02.07.1967 (Helmut Kinkler & Willibald Schmitz in Harz 1968a) which has been around and between the full moon on 22.06.1967 as well as the decreasing half moon on 30.06.1967 between the full moon on 22.06.1967 and the new moon on 07.07.1967.

Mass occurrences of large quantities of individuals of the L-Album Wainscot *Mythimna l-album* in the northeastern part of Germany have been recognized in Jena in the Saale valley where 30 individuals in total, abt. 15 individuals in total and abt. 5 individuals daily have flown in the periods of 26.08.1977 – 14.09.1977 (Lobenstein 1978), 12.09.1987 – 27.09.1987 (Wolf 1989) and 13.09.1991 – 18.09.1991 (Rennwald 1992), respectively, which has been around and between the full moon on 28.08.1977 and the new moon on 13.09.1977, around and between the decreasing half moon on 16.09.1987 between the full moon on 07.09.1987 and the new moon on 23.09.1987 as well as several days before and after the new moon on 23.09.1987, and several days before and after the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991, respectively; and in Briesen west of Frankfurt an der Oder where 12 individuals have flown on 15.09.1977 (Lobenstein 1978) which has been two days after the new moon on 13.09.1977.

Mass occurrences of large quantities of individuals of the L-Album Wainscot *Mythimna l-album* in Austria, France and Italy have been monitored in Innsbruck in the Inn valley in the western part of Austria where abundant individuals each have flown and have sucked on flowers on 19.09.1976, 24.09.1976, 30.09.1976 and 04.10.1976 (Burmann & Tarmann 1979) as well as on 07.09.1977 and 14.09.1977 (Burmann & Stengg in Burmann & Tarmann 1979) which has been four days before and

one day after the new moon on 23.09.1976, one day before and three days after the increasing half moon on 01.10.1976 between the new moon on 23.09.1976 and the full moon on 08.10.1976, one day after the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, and one day after the new moon on 13.09.1977, respectively; in Digne-les-Bains and Les Mées westsouthwest of Digne-les-Bains northwest of Cannes in the southeastern part of France where 15 individuals in total and abt. 30 individuals in total have flown in the periods of 25.06.1972 – 10.07.1972 and 16.09.1972 – 23.09.1972, respectively (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), as well as abt. 80 individuals in total have flown in the period of 28.07.1973 – 04.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been around and between the full moon on 26.06.1972 and the new moon on 10.07.1972, around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the full moon on 23.09.1972, and around and between the new moon on 29.07.1973 as well as the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, respectively; in Auer in the Etsch valley south of Bolzano in Southern Tyrol in the northeastern part of Italy where 17 individuals have flown on 22.09.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been four days before the new moon on 26.09.1973, in Riva del Garda eastnortheast of Milano in the northeastern part of Italy where 10 individuals have flown on 04.05.1973 – 05.05.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been two to three days after the new moon on 02.05.1973, and at Lake Garda eastnortheast of Milano in the northeastern part of Italy where abt. 50 individuals in total have flown in the period of 19.09.1967 – 03.10.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 18.07.1967 and the new moon on 03.10.1967.

6.45 The Cosmopolitan *Mythimna loreyi,* the Striped Wainscot *Mythimna pudorina,* the Smoky Wainscot *Mythimna impura* and the Double Line *Mythimna turca*

A mass occurrence of large quantities of individuals of the Cosmopolitan *Mythimna loreyi* (DUPONCHEL 1827) (Lepidoptera: Noctuidae) has been encountered in Sète southwest of Montpellier in the southeastern part of France where 8 individuals each have flown on 07.09.1978 and 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978.

A mass occurrence of large quantities of individuals of the Striped Wainscot *Mythimna pudorina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) and the Smoky Wainscot *Mythimna impura* HÜBNER 1808 (Lepidoptera: Noctuidae) has been mentioned from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 30 individuals and 50 individuals, respectively, have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975. Significant quantities of individuals of the Striped Wainscot *Mythimna pudorina* have also been met in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 5 individuals and abt. 10 individuals have flown on 11.07.1982 and 13.07.1982, respectively (WALFORT 1983), which has been five days after the full moon on 06.07.1982, and two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982, respectively; and in the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 21.06.1994, 28.06.1994 and 05.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before and five days after the full moon on 23.06.1994, and four days before the new moon on 09.07.1994, respectively. Significant quantities of individuals of the Smoky Wainscot *Mythimna impura* have also been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals

and 5 individuals have flown on 09.06.1982 and 25.06.1982, respectively (WALFORT 1983), which has been three days after the full moon on 06.06.1982 and four days after the new moon on 21.06.1982, respectively; in the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 09.07.1994, respectively; and in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981.

Significant quantities of individuals of the Double Line *Mythimna turca* LINNAEUS 1761 (Lepidoptera: Noctuidae) have been found in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 5 individuals have flown on 31.07.1991 (WOLFGANG WITTLAND in KINKLER 1992) which has been five days after the full moon on 26.07.1991; and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 12 individuals in total and abt. 5 individuals have flown in the period of 18.06.1998 – 06.07.1998 (SCHUMACHER 2001) and on 28.06.2004 (SCHUMACHER 2005a), respectively, which has been around and between the decreasing half moon on 18.06.1998 between the full moon on 10.06.1998 and the new moon on 24.06.1998 as well as the full moon on 09.07.1998, and four days before the full moon on 02.07.2004, respectively.

6.46 The White-Speck *Mythimna unipuncta,* the Brown-Line Bright-Eye *Mythimna conigera,* the Clay *Mythimna ferrago* and the Rustic *Hoplodrina blanda*

Mass occurrences of large quantities of individuals of the White-Speck *Mythimna unipuncta* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been recognized in Rosenheim in the southeastern part of Germany where 9 individuals have flown on 12.10.1979 (SCHEURINGER in LOBENSTEIN 1981a) which has been one day before the decreasing half moon on 13.10.1979 between the full moon on 05.10.1979 and the new moon on 21.10.1979, in Le Grau-du-Roi in the Camargue southsouthwest of Nîmes in the southeastern part of France where 8 individuals have flown on 10.09.1975 – 16.09.1975 (ZUCCHI 1976) which has been several days before and after the increasing half moon on 13.09.1975 between the new moon on 05.09.1975 and the full moon on 20.09.1975, and in Arles northwest of Marseille in the southeastern part of France where 18 individuals in total have flown on 15.07.1979 – 18.07.1979 (LOBENSTEIN 1981a) which has been a few days before and after the decreasing half moon on 17.07.1979 between the full moon on 09.07.1979 and the new moon on 24.07.1979.

Significant quantities of individuals of the Brown-Line Bright-Eye *Mythimna conigera* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been noticed in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 15.07.1994 (BROSZKUS 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; and in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 17.06.1993 and 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the new moon on 20.06.1993 and three days before the full moon on 04.07.1993, respectively.

Mass occurrences of large quantities of individuals of the Clay *Mythimna ferrago* FABRICIUS 1787 (Lepidoptera: Noctuidae) have been encountered in the vicinity of Bürvenich and Berg northwest of

Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Rustic *Hoplodrina blanda* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981, and in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the full moon on 04.07.1993.

6.47 The Delicate *Mythimna vitellina*

Mass occurrences of large quantities of individuals of the Delicate *Mythimna vitellina* (HÜBNER 1808) (Lepidoptera: Noctuidae) in Austria and Switzerland have been encountered in Kühtai in the Sellrain valley westsouthwest of Innsbruck in the western part of Austria where 4 individuals have flown on 25.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been three days before the new moon on 28.08.1973; in Veysonnaz southsouthwest of Sion in the Rhône valley in the southeastern part of Switzerland where 6 individuals in total have flown on 13.09.1995 and 18.09.1995 (G. BADTKE in RENNWALD 2004) which has been four days after the full moon on 09.06.1995 as well as one day after the decreasing half moon on 17.09.1995 between the full moon on 09.09.1995 and the new moon on 24.09.1995, respectively;

Mass occurrences of large quantities of individuals of the Delicate *Mythimna vitellina* in the southeastern part of France have been identified in the Salin de Giraud in the Camargue westsouthwest of Port-Saint-Louis-du-Rhône westnorthwest of Marseille where 10 individuals have flown on 18.05.1975 (ZUCCHI 1976) which has been one day before the increasing half moon on 19.05.1975 between the new moon on 11.05.1975 and the full moon on 25.05.1975, near Château-Arnoux-Saint-Auban in the Durance valley northnortheast of Manosque northwest of Cannes where 10 individuals have flown on 13.09.1975 (ZUCCHI 1976) which has been on the increasing half moon on 13.09.1975 between the new moon on 05.09.1975 and the full moon on 20.09.1975, in Sète southwest of Montpellier where 15 individuals in total have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978, in Les Mées westsouthwest of Digne-les-Bains northwest of Cannes where 15 individuals have flown on 02.06.1974 – 14.06.1974 (ZUCCHI 1975b) which has been around and between the full moon on 05.06.1974 as well as the decreasing half moon on 14.06.1974 between the full moon on 05.06.1974 and the new moon on 20.06.1974; and in Digne-les-Bains and Les Mées westsouthwest of Digne-les-Bains northwest of Cannes where abt. 300 individuals, abt. 30 individuals and abt. 20 individuals in total each have flown in the periods of 29.05.1972 – 09.06.1972, 25.06.1972 – 10.07.1972 and 16.09.1972 – 23.09.1972, respectively (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), as well as abt. 20 individuals in total have flown in the period of 28.07.1973 – 04.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been around and between the full moon on 28.05.1972 and the new moon on 11.06.1972, around and between the full moon on 26.06.1972 and the new moon on 10.07.1972, around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the full moon on 23.09.1972, and around and between the new

moon on 29.07.1973 as well as the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973, respectively.

6.48 The Lunar Underwing *Omphaloscelis lunosa*

Mass occurrences of large quantities of individuals of the Lunar Underwing *Omphaloscelis lunosa* (HAWORTH 1809) (Lepidoptera: Noctuidae) in the northwestern part of Germany have been recognized in Bergheim in the Sieg valley westsouthwest of Siegburg north of Bonn where abt. 20 individuals have flown on 18.09.1975 (ZUCCHI 1976) which has been two days before the full moon on 20.09.1975, in Holzlar east of Bonn in the Middle Rhine valley where more than 10 individuals have flown on 16.09.1975 – 18.09.1975 (LADDA in KINKLER 1990b) which has been two to four days before the full moon on 20.09.1975; in the district Steinbüchel at the northern margin of the city of Leverkusen where more than 50 individuals in total and abt. 20 individuals in total have flown in the periods of 12.09.1976 – 30.09.1976 (LOBENSTEIN 1977) and 10.09.1979 – 20.09.1979 (LOBENSTEIN 1981a), respectively, which has been around and between the new moon on 13.09.1976 and the full moon on 27.09.1976 as well as around and between the full moon on 06.09.1979 and the new moon on 21.09.1979, respectively; in the district Opladen at the northern margin of the city of Leverkusen where abt. 80 individuals in total have flown on 15.09.1991 – 06.10.1991 (RENNWALD 1992) which has been around and between the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991 as well as the new moon on 08.10.1991, in the district Hüls at the northern margin of the city of Krefeld where abt. 10 individuals in total each have flown in the periods of 17.09.1976 – 23.09.1976 (LOBENSTEIN 1977) and 18.09.1978 – 23.09.1978 (LOBENSTEIN 1979) which has been several days before and after the increasing half moon on 21.09.1976 between the new moon on 13.09.1976 and the full moon on 27.09.1976, and around and between the full moon on 16.09.1978 as well as the decreasing half moon on 25.09.1978 between the full moon on 16.09.1978 and the new moon on 02.10.1978, respectively; and in Walbeck westsouthwest of Geldern west of Duisburg in the northwestern part of Germany where 7 individuals have flown on 08.09.1979 – 28.09.1979 (LOBENSTEIN 1981a) which has been around and between the full moon on 06.09.1979 and the new moon on 21.09.1979.

Mass occurrences of large quantities of individuals of the Lunar Underwing *Omphaloscelis lunosa* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Flittard at the northern margin of the city of Cologne where abt. 15 individuals in total and 8 individuals have flown in the period of 15.09.1976 – 23.09.1976 (LOBENSTEIN 1977) and on 17.09.1979 (LOBENSTEIN 1981a), respectively, which has been around and between the new moon on 13.09.1976 as well as the increasing half moon on 21.09.1976 between the new moon on 13.09.1976 and the full moon on 27.09.1976, and four days before the new moon on 21.09.1979, respectively; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 16.09.1993, 22.09.1993, 30.09.1993 and 07.10.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the new moon on 16.09.1993, one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, on the full moon on 30.09.1993, and two days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, respectively; from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 20.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the full moon on 19.09.1994, from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 24.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 19.09.1994; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have

been captured on 23.09.1994, 30.09.1994 and 07.10.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 19.09.1994, and five days before and two days after the new moon on 05.10.1994, respectively; and from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 20.09.1994 and 27.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the full moon on 19.09.1994 as well as two days before the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994, respectively.

Mass occurrences of large quantities of individuals of the Lunar Underwing *Omphaloscelis lunosa* in the western part of Germany have been found in Wiltingen in the Saar valley south of Konz southsouthwest of Trier where abt. 10 individuals have flown on 19.09.1990 – 20.09.1990 (NIPPEL 1991, RENNWALD 1992, WOLF 1992b) which has been on and one day after the new moon on 19.09.1990, in Bad Münstereifel southsouthwest of Euskirchen in the northeastern part of the Eifel where 5 individuals have flown on 21.09.1989 (FÖRSTER in KINKLER 1990b) which has been two days before the decreasing half moon on 23.09.1989 between the full moon on 15.09.1989 and the new moon on 30.09.1989, and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück where abt. 5 individuals have flown on 12.09.1993 (WALTER BROSZKUS in KINKLER 1994, BROSZKUS 1996b) which has been four days before the new moon on 16.09.1993.

Mass occurrences of large quantities of individuals of the Lunar Underwing *Omphaloscelis lunosa* in the southwestern part of Germany have been observed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where abt. 10 individuals have flown on 17.09.1993 (WALTER BROSZKUS in KINKLER 1994, BROSZKUS 1996b) which has been one day after the new moon on 16.09.1993, and near Rheinmünster-Söllingen southwest of Rastatt in the middle part of the Upper Rhine valley where 7 individuals have flown on 24.09.2001 (RENNWALD 2004) which has been one day before the increasing half moon on 25.09.2001 between the new moon on 17.09.2001 and the full moon on 02.10.2001.

6.49 The Angle Shades *Phlogophora meticulosa*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim, I have so far only discovered a few single individuals of the Angle Shades *Phlogophora meticulosa* LINNAEUS 1758 (Lepidoptera: Noctuidae) at several localities in 2007 and 2008. Apart from these single individuals, I have up to now only seen occasionally a few single individuals of the Angle Shades *Phlogophora meticulosa* in Mülheim-Kärlich northwest of Koblenz and in Neuwied northnorthwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, in Wildbad southsouthwest of Pforzheim in the Enz valley in the northern part of the Black Forest between 1968 and 1972, and in Walldorf between 1972 and 1979. Because the Angle Shades *Phlogophora meticulosa* has only occurred as single individuals at the investigated localities in the vicinity of Heidelberg during my regular entomological observations in 2007 and 2008, its frequency of appearance is insufficient for a sound analysis of its correlation with the turning points of the lunar cycle. Some examples of mass occurrences of the Angle Shades *Phlogophora meticulosa* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in the northwestern part of Germany have been documented from the island Helgoland in the North Sea northnorthwest of Bremerhaven where 8 individuals have flown on 04.09.1973 – 13.09.1973 (ZUCCHI 1975b) which has been around and between the increasing half moon on 05.09.1973 between the new moon on 28.08.1973 and the full moon on 12.09.1973 as well as the full moon on

12.09.1973, from Brelingen westnorthwest of Wedemark north of Hannover where abundant individuals have flown in the period of 27.08.1991 – 11.09.1991 (RENNWALD 1992) which has been around and between the full moon on 25.08.1991 and the new moon on 08.09.1991, from Herzberg am Harz southsoutheast of Osterode where more than 110 individuals have flown on 10.10.1974 (ZUCCHI 1975b) which has been one day after the decreasing half moon on 09.10.1974 between the full moon on 01.10.1974 and the new moon on 15.10.1974, from Augustdorf southeast of Bielefeld and Lage-Lopshorn northwest of Detmold in the Teutoburger Wald where abt. 250 individuals in total have flown in the period of 14.09.1991 – 03.10.1991 (RETZLAFF 1992) which has been around and between the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 24.09.1991 as well as the decreasing half moon on 02.10.1991 between the full moon on 24.09.1991 and the new moon on 08.10.1991; from Detmold southeast of Bielefeld and Schlangen northnortheast of Paderborn where abt. 180 individuals and abt. 25 individuals, respectively, have flown on 14.09.1991 (RENNWALD 1992) which has been two days before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991; from Büren southsouthwest of Paderborn where 8 individuals have flown on 01.08.1991 (RENNWALD 1992) which has been three days before the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991; from Elten northwest of Emmerich in the Lower Rhine valley where 45 individuals and abt. 75 individuals have flown on 13.09.1968 and 14.09.1968, respectively (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been one and two days before the decreasing half moon on 15.09.1968 between the full moon on 07.09.1968 and the new moon on 22.09.1968; from Dortmund in the northwestern part of Germany where 12 individuals have flown on 24.10.1962 (HARKORT & WEIGT 1968) which has been four days before the new moon on 28.10.1962; from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley where more than 10 individuals each have been captured on 02.07.1992 and 22.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992 and four days before the new moon on 26.09.1992, respectively; from the district Vogelsang of the city of Cologne in the Middle Rhine valley where abt. 10 individuals daily have flown from the beginning of June 1969 onwards (KINKLER & SCHMITZ 1970) which has been several days after the full moon on 31.05.1969, and from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 30 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in the southwestern part of Germany have been reported from Viernheim northnorthwest of Heidelberg in the middle part of the Upper Rhine valley where abt. 120 individuals have flown on 10.09.1974 (ZUCCHI 1975b) which has been on the decreasing half moon on 10.09.1974 between the full moon on 01.09.1974 and the new moon on 16.09.1974, from Freiburg in the southern part of the Upper Rhine valley where 20 individuals have flown on 20.04.1975 – 23.04.1975 (ZUCCHI 1976) which has been on and several days after the increasing half moon on 20.04.1975 between the new moon on 11.04.1975 and the full moon on 25.04.1975, and from Coburg in the southeastern part of Germany where up to 20 individuals daily have flown from 05.09.1969 onwards (KINKLER & SCHMITZ 1970) which has been one day after the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and the new moon on 11.09.1969.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in the northeastern part of Germany have been mentioned from Boltenhagen northnortheast of Klütz westnorthwest of Wismar at the coast of the Baltic Sea where up to 100 individuals daily have flown in the period of 17.09.1991 – 24.09.1991 (RENNWALD 1992) which has been around and between the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991 as well as the full moon on 23.09.1991, from Klütz westnorthwest of Wismar

at the coast of the Baltic Sea where abt. 25 individuals have flown and have sit on the wall of a house on 15.10.1991 (RENNWALD 1992) which has been one day before the increasing half moon on 16.10.1991 between the new moon on 08.10.1991 and the full moon on 23.10.1991; from Eisenach west of Erfurt and Ohrdruf southwest of Erfurt where 30 individuals and 20 individuals have flown on 02.10.1991 and 03.10.1991, respectively (RENNWALD 1992), which has been on and one day after the decreasing half moon on 02.10.1991 between the full moon on 23.09.1991 and the new moon on 08.10.1991; from Jena in the Saale valley where up to more than 20 individuals daily have flown in the period of 13.09.1991 – 29.09.1991 (RENNWALD 1992) which has been around and between the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991 as well as the decreasing half moon on 02.10.1991 between the full moon on 23.09.1991 and the new moon on 08.10.1991, from Ebertswiese near Ebertshausen northeast of Meiningen in the Werra valley where abt. 10 individuals have flown on 21.09.1991 (RENNWALD 1992) which has been two days before the full moon on 23.09.1991, and from Wildenfels southeast of Zwickau where up to more than 15 individuals daily have flown in the period of 04.09.1991 – 15.09.1991 (RENNWALD 1992) which has been around and between the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991 as well as the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in Switzerland have been signaled from Kreuzlingen south of Konstanz at Lake Constance in the northeastern part of Switzerland where abt. 20 individuals have flown on 01.10.1973 – 08.10.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been several days before and after the increasing half moon on 05.10.1973 between the new moon on 26.09.1973 and the full moon on 12.10.1973, and from the Col du Bretolet south of Montreux in the southwestern part of Switzerland where abt. 800 individuals have flown on 07.10.1981 – 08.10.1981 (KÖHLER 1983) which has been several days before the full moon on 13.10.1981.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in Austria have been contributed from Fließ eastsoutheast of Landeck in the western part of Austria where abt. 15 – 20 individuals daily have flown on 24.10.1975 and 27.10.1975 (BURMANN & TARMANN 1978) which has been four days after the full moon on 20.10.1975 as well as one day before the decreasing half moon on 28.10.1975 between the full moon on 20.10.1975 and the new moon on 03.11.1975; within and around Innsbruck in the Inn valley in the western part of Austria where masses of individuals each have flown on 25.08.1975 and 29.10.1975 (BURMANN & TARMANN 1978) as well as around 20.09.1976 (BURMANN & TARMANN 1979) which has been four days after the full moon on 21.08.1975, one day after the decreasing half moon on 28.10.1975 between the full moon on 20.10.1975 and the new moon on 03.11.1975, and three days before the new moon on 23.09.1976, respectively; from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where 60 individuals, abt. 270 individuals and 30 individuals have been confirmed on 07.09.1962 (HARZ & WITTSTADT 1964), 20.08.1969 and 29.08.1972 (MAZZUCCO 1974), respectively, which has been one day before the increasing half moon on 08.09.1962 between the new moon on 30.08.1962 and the full moon on 14.09.1962, one day before the increasing half moon on 21.08.1969 between the new moon on 13.08.1969 and the full moon on 27.08.1969, and five days after the full moon on 24.08.1972, respectively; from Muhr west of Sankt Michael im Lungau in the central part of Austria where 45 individuals have flown on 04.11.1994 (GERNOT EMBACHER in RENNWALD 1996) which has been one day after the new moon on 03.11.1994, and from Seewinkel west of Sankt Andrä am Zicksee southsoutheast of Neusiedl am See southeast of Vienna in the eastern part of Austria where 10 individuals have flown on 25.05.1977 (BURMANN & TARMANN 1979) which has been two days before the increasing half moon on 27.05.1977 between the new moon on 18.05.1977 and the full moon on 01.06.1977.

Mass occurrences of large quantities of individuals of the Angle Shades *Phlogophora meticulosa* in the northeastern part of Italy and the southeastern part of France have been notified from Latsch in the Etsch valley and from Taufers im Münstertal west of Merano in Southern Tyrol in the northeastern part of Italy where masses of individuals have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977; and from Digne-les-Bains and Les Mées westsouthwest of Digne-les-Bains northwest of Cannes in the southeastern part of France where abt. 20 individuals and abt. 50 individuals in total each have flown in the periods of 16.09.1972 – 23.09.1972 (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973) and 28.07.1973 – 04.08.1973 (KINKLER, NIPPEL & SWOBODA 1974), respectively, which has been around and between the increasing half moon on 16.09.1972 between the new moon on 07.09.1972 and the full moon on 23.09.1972 as well as the full moon on 23.09.1972, and around and between the new moon on 29.07.1973 as well as the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon onn 14.08.1973, respectively.

6.50 The Setaceous Hebrew Character *Xestia c-nigrum*

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* (LINNAEUS 1758) (Lepidoptera: Noctuidae) in the northwestern part of Germany have been mentioned from Boizenburg in the Elbe valley eastnortheast of Lüneburg where 100 individuals have flown on 16.08.1991 (RENNWALD 1992) which has been two days before the increasing half moon on 18.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991, from Radbruch northwest of Lüneburg where abt. 100 individuals have flown on 22.09.1993 (RENNWALD 1995) which has been one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993; from Stade west of Hamburg at the coast of the North Sea where 12 individuals and 21 individuals have flown on 13.05.1993 and 19.05.1993, respectively (RENNWALD 1995), which has been one day before the decreasing half moon on 14.05.1993 between the full moon on 06.05.1993 and the new moon on 21.05.1993 as well as two days before the new moon on 21.05.1993, respectively, from Hövelhof northnorthwest of Paderborn where 20 individuals have flown on 07.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been on the full moon on 07.09.1968, from Letmathe between Hagen and Iserlohn where 40 individuals have flown on 31.08.1970 (KINKLER & SCHMITZ 1971) which has been one day before the new moon on 01.09.1970, from Elten northwest of Emmerich in the Lower Rhine valley where abt. 150 individuals have flown on 18.08.1969 (KINKLER & SCHMITZ 1970) which has been five days after the new moon on 13.08.1969, from the Weerter Heide around Weert westnorthwest of Roermond in the Maas valley in the southeastern part of the Netherlands where abundant individuals have flown on 15.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been two days after the increasing half moon on 13.08.1967 between the new moon on 06.08.1967 and the full moon on 20.08.1967; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where abt. 10 individuals each have flown on 08.09.1981 and 13.08.1982 (WALFORT 1983) which has been one day after the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981, and on the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, respectively; from Wermelskirchen northeast of Cologne in the Middle Rhine valley where 30 individuals have flown on 12.09.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been three days before the decreasing half moon on 15.09.1968 between the full moon on 07.09.1968 and the new moon on 22.09.1968; from the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley where 15 individuals each have been observed on 05.06.1965, 19.06.1965 and 27.08.1965 (HARBICH 1967) which has been two days before the increasing half moon on 07.06.1965 between the new moon on 30.05.1965 and the full moon on 14.06.1965, four days before the de-

creasing half moon on 23.06.1965 between the full moon on 14.06.1965 and the new moon on 29.06.1965, and one day after the new moon on 26.08.1965, respectively; from Burscheid-Höfchen northeast of Cologne where abt. 300 individuals in total, 40 individuals and abt. 140 individuals have flown in the period of 10.09.1970 – 13.10.1970 (KINKLER & SCHMITZ 1971) as well as on 05.09.1972 and 06.09.1972, respectively (KINKLER, NIPPEL, SCHMITZ & SWOBODA 1973), which has been around and between the full moon on 15.09.1970, the new moon on 30.09.1970 and the full moon on 14.10.1970 as well as one and two days before the new moon on 07.09.1972, respectively; and from Burscheid-Höfchen northeast of Cologne where abt. 450 individuals and abt. 150 individuals have flown on 23.08.1971 – 24.08.1971 and 24.08.1971 – 25.08.1971, respectively (KINKLER & SCHMITZ 1972), which has been two and three days after the new moon on 21.08.1971.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 02.08.1994, 09.08.1994, 16.08.1994, 23.08.1994 and 30.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before and two days after the new moon on 07.08.1994, five days before and two days after the full moon on 21.08.1994, and on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 25.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 21.08.1994; from the districts Merkenich, Niehl and Weiler at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993, 17.06.1993, 12.08.1993, 19.08.1993, 26.08.1993, 02.09.1993, 09.09.1993, 16.09.1993 and 22.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, three days before the new moon on 20.06.1993, five days before and two days after the new moon on 17.08.1993, one day after the increasing half moon on 25.08.1993 between the new moon on 17.08.1993 and the full moon on 01.09.1993, one day after the full moon on 01.09.1993, one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, on the new moon on 16.09.1993, and one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.05.1992, 16.06.1992, 25.06.1992, 27.08.1992 and 15.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, one day after the full moon on 15.06.1992, five days before the new moon on 30.06.1992, one day before the new moon on 28.08.1992 and three days after the full moon on 12.09.1992, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 12.08.1994, 19.08.1994, 26.08.1994 and 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the new moon on 07.08.1994, two days before and five days after the full moon on 21.08.1994, and three days before the full moon on 19.09.1994, respectively; from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 02.08.1994, 09.08.1994, 16.08.1994, 23.08.1994, 30.08.1994, 06.09.1994 and 13.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before and two days after the new moon on 07.08.1994, five days before and two days after the full moon on 21.08.1994, on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, one day after the new moon on 05.09.1994, and on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, respectively; and from the Worringer Bruch south of Dormagen northnorth-

west of Cologne where more than 10 individuals each have been captured on 02.07.1992, 05.08.1992, 12.08.1992, 27.08.1992, 08.09.1992 and 22.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992, one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, one day before the full moon on 13.08.1992, one day before the new moon on 28.08.1992, four days before the full moon on 12.09.1992 and four days before the new moon on 26.09.1992, respectively.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the western part of Germany have been reported from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 5 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980, from Godendorf northwest of Ralingen in the Sauer valley northwest of Trier in the southwestern part of the Eifel where abt. 120 individuals in total have flown on 08.09.1970 – 12.09.1970 (KINKLER & SCHMITZ 1971) which has been one day before and a few days after the increasing half moon on 09.09.1970 between the new moon on 01.09.1970 and the full moon on 15.09.1970, from Ediger-Eller in the Moselle valley south of Cochem where 300 individuals have flown on 03.09.1991 (RENNWALD 1992) which has been one day after the decreasing half moon on 02.09.1991 between the full moon on 25.08.1991 and the new moon on 08.09.1991; from Kattenes in the Moselle valley southsouthwest of Kobern-Gondorf southsouthwest of Koblenz where 200 individuals and 100 individuals have flown on 24.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) and 24.08.1974 (ZUCCHI 1975b), respectively, which has been on the new moon on 24.08.1968 as well as one day before the increasing half moon on 25.08.1974 between the new moon on 17.08.1974 and the full moon on 01.09.1974, respectively; and from Burg Liebenstein near Kamp-Bornhofen in the Middle Rhine valley southsoutheast of Koblenz where 30 individuals and more than 250 individuals in total each have flown in the periods of 23.05.1962 – 05.06.1962 and 22.09.1962 – 26.09.1962, respectively (KARL CLEVE in HARZ & WITTSTADT 1964), which has been around and between the full moon on 19.05.1962 and the new moon on 02.06.1962, and around and between the decreasing half moon on 21.09.1962 between the full moon on 14.09.1962 and the new moon on 28.09.1962 as well as the new moon on 28.09.1962, respectively.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the southwestern part of Germany have been documented from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 15 individuals have flown on 15.06.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been five days after the full moon on 10.06.1968, from the Steiner Wald westnorthwest of Biblis northeast of Worms in the middle part of the Upper Rhine valley where abt. 1.000 individuals have flown on 12.08.1983 (WOLF 1985) which has been four days after the new moon on 08.08.1983, from Überlingen north of Konstanz at Lake Constance where masses of individuals have flown on 21.08.1967 – 30.08.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been around and between the full moon on 20.08.1967 as well as the decreasing half moon on 29.08.1967 between the full moon on 20.08.1967 and the new moon on 04.09.1967, and from Mariabrunn northeast of Eriskirch southeast of Friedrichshafen at Lake Constance where more than 50 individuals have flown daily in June 1979 (LOBENSTEIN 1981a) which has been around and between the full moon on 10.06.1979 and the new moon on 24.06.1979.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the southeastern part of Germany have been notified from Winkel south of Lenggries in the Isar valley south of Bad Tölz where masses of individuals have flown on 10.10.1969 (KINKLER & SCHMITZ 1970) which has been one day before the new moon on 11.10.1969; from Neufinsing westnorthwest of Finsing eastnortheast of München where abt. 300 individuals and abt. 170 individuals

have flown on 27.08.1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) and 03.09.1969 (KINKLER & SCHMITZ 1970), respectively, which has been three days after the new moon on 24.08.1968 as well as one day before the decreasing half moon on 04.09.1969 between the full moon on 27.08.1969 and the new moon on 11.09.1969, respectively; from Bruckberg in the Isar valley westsouthwest of Landshut where 12 individuals and masses of individuals have flown on 18.06.1968 and 18.09.1968, respectively (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969), which has been on the decreasing half moon on 18.06.1968 between the full moon on 10.06.1968 and the new moon on 26.06.1968 as well as four days before the new moon on 22.09.1968, respectively; and from Dießen am Ammersee southwest of München where abt. 250 individuals in total have flown on 01.09.1967 – 03.09.1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a) which has been one to three days before the new moon on 04.09.1967.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the northeastern part of Germany have been contributed from Boltenhagen northnortheast of Klütz westnorthwest of Wismar at the coast of the Baltic Sea where up to more than 80 individuals daily have flown in the period of 17.09.1991 – 24.09.1991 (RENNWALD 1992) which has been around and between the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991 as well as the full moon on 23.09.1991, from Kreuzbruch northeast of Oranienburg north of Berlin where abt. 650 individuals have flown on 07.09.1958 (HAEGER in KOCH 1959) which has been on the decreasing half moon on 07.09.1958 between the full moon on 29.08.1958 and the new moon on 13.09.1958, and from Bergen an der Dumme westnorthwest of Salzwedel where 120 individuals have flown on 15.09.1991 (RENNWALD 1992) which has been one day before the increasing half moon on 16.09.1991 between the new moon on 08.09.1991 and the full moon on 23.09.1991.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the western part of Austria have been recorded from Küpfern in the Enns valley west of Weyer southeast of Steyr where at least 200 individuals have flown on 30.08.1975 (BURMANN & TARMANN 1978) which has been one day before the decreasing half moon on 31.08.1975 between the full moon on 21.08.1975 and the new moon on 05.09.1975, from Atschreith southsoutheast of Waidhofen in the Ybbs valley southsouthwest of Amstetten where numerous individuals have flown on 13.06.1975 (BURMANN & TARMANN 1978) which has been four days after the new moon on 09.06.1975; from the Schlüsselberg near Grieskirchen westnorthwest of Wels where 12 individuals daily have flown on 12.08.1977 – 13.08.1977 and 18.08.1977 (BURMANN & TARMANN 1979) which has been one and two days before as well as four days after the new moon on 14.08.1977, respectively; from Innsbruck in the Inn valley where abundant individuals have flown on 26.08.1976 (BURMANN & TARMANN 1979) which has been one day after the new moon on 25.08.1976; from Völs in the Inn valley west of Innsbruck where 10 individuals and abundant individuals have flown on 25.08.1975 and 11.09.1975, respectively (BURMANN & TARMANN 1978), which has been four days after the full moon on 21.08.1975, and two days before the increasing half moon on 13.09.1975 between the new moon on 05.09.1975 and the full moon on 20.09.1975, respectively; from Kühtai in the Sellrain valley westsouthwest of Innsbruck where masses of individuals have flown on 20.08.1973 (KINKLER, NIPPEL & SWOBODA 1974) which has been two days before the decreasing half moon on 22.08.1973 between the full moon on 14.08.1973 and the new moon on 28.08.1973; from Fließ eastsoutheast of Landeck where very abundant individuals and masses of individuals have flown on 24.08.1976 and 24.09.1976 – 25.09.1976, respectively (BURMANN & TARMANN 1979), which has been one day before the new moon on 25.08.1976, and one and two days after the new moon on 23.09.1976, respectively; from Hochfinstermünz north of Nauders south of Landeck where masses of individuals have flown on 29.08.1976 (BURMANN & TARMANN 1979) which has been four days after the new moon on 25.08.1976; from Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel where abt. 300 individuals and masses of individuals have flown on 30.08.1976 and

03.09.1977, respectively (GERNOT EMBACHER in BURMANN & TARMANN 1979), which has been five days after the new moon on 25.08.1976, and three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, respectively; and from Gaissulz north of Opponitz in the Ybbs valley southsoutheast of Waidhofen where abt. 15 individuals each have flown on 30.09.1976 and 17.08.1977 (BURMANN & TARMANN 1979) which has been one day before the increasing half moon on 01.10.1976 between the new moon on 23.09.1976 and the full moon on 08.10.1976, and three days after the new moon on 14.08.1977, respectively.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the eastern part of Austria have been registered from the Packer-Stausee westsouthwest of Graz where abt. 30 individuals in total have flown on 16.06.1969 – 22.06.1969 (KINKLER & SCHMITZ 1970) and abt. 450 individuals in total have flown on 19.08.1970 – 21.08.1970 (KINKLER & SCHMITZ 1971) which has been several days after the new moon on 14.06.1969 and two to four days after the full moon on 17.08.1970, respectively; from Dürnstein westsouthwest of Krems in the Danube valley where 10 individuals each have flown on 10.06.1977 and 18.08.1977 (BURMANN & TARMANN 1979) which has been one day after the decreasing half moon on 09.07.1977 between the full moon on 01.07.1977 and the new moon on 16.07.1977, and four days after the new moon on 14.08.1977, respectively; from Michelhausen in the Danube valley westnorthwest of Vienna where very abundant individuals have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, from Illmitz at Lake Neusiedl south of Neusiedl am See southeast of Vienna where 10 individuals have flown on 21.06.1976 – 25.06.1976 (BURMANN & TARMANN 1979) which has been around and between the decreasing half moon on 20.06.1976 between the full moon on 12.06.1976 and the new moon on 27.06.1976 as well as the new moon on 27.06.1976, from Apetlon at Lake Neusiedl south of Neusiedl am See southeast of Vienna where more than 20 individuals have flown on 20.05.1977 (BURMANN & TARMANN 1979) which has been two days after the new moon on 18.05.1977, from Hackelsberg north of Illmitz at Lake Neusiedl south of Neusiedl am See southeast of Vienna where 10 individuals have flown on 27.05.1977 (BURMANN & TARMANN 1979) which has been four days before the full moon on 01.06.1977, and from Seewinkel west of Sankt Andrä am Zicksee southsoutheast of Neusiedl am See southeast of Vienna where 25 individuals have flown on 25.05.1977 (BURMANN & TARMANN 1979) which has been two days before the increasing half moon on 27.05.1977 between the new moon on 18.05.1977 and the full moon on 01.06.1977.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in Switzerland and France have been recognized from the Col du Bretolet south of Montreux in the southwestern part of Switzerland where abt. 200 individuals have been observed probably on 20.08.1976 – 21.08.1976 (LOBENSTEIN 1977, CHÉRIX in BURMANN & TARMANN 1979) which has been five and four days before the new moon on 25.08.1976, and from Sète southwest of Montpellier in the southeastern part of France where 50 individuals in total have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in the southern part of Luxembourg have been mentioned from Pétange northwest of Esch-sur-Alzette where up to 100 individuals daily and up to abt. 15 individuals daily have flown from the end of August 1966 to the beginning of September 1966 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1967a) as well as in mid of August 1967 and from the end of September 1967 to the beginning of October 1967 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1968a), respectively, which has been around the full moon on 31.08.1966, around the increasing half moon on 13.08.1967 between the new moon on 06.08.1967 and the full moon on 20.08.1967, and around and between the

full moon on 18.09.1967 and the new moon on 03.10.1967, respectively; and from Pétange northwest of Esch-sur-Alzette where up to 20 individuals daily have flown at the end of September 1968 and the beginning of October 1968 (HELMUT KINKLER & WILLIBALD SCHMITZ in HARZ 1969) which has been around and between the new moon on 22.09.1968 and the full moon on 06.10.1968.

Mass occurrences of large quantities of individuals of the Setaceous Hebrew Character *Xestia c-nigrum* in Southern Tyrol in the northeastern part of Italy have been reported from Naturno eastsoutheast of Merano where large quantities of individuals have flown daily in the period of 02.08.1969 – 14.08.1969 (KINKLER & SCHMITZ 1970) which has been around and between the full moon on 29.07.1969 and the new moon on 13.08.1969; from Naturno eastsoutheast of Merano where more than 250 individuals daily and abt. 10 individuals have flown on 27.08.1975 – 28.08.1975 (BURMANN & TARMANN 1978) and 23.06.1976 (BURMANN & TARMANN 1979), respectively, which has been three and four days before the decreasing half moon on 31.08.1975 between the full moon on 31.08.1975 and the new moon on 05.09.1975, and four days before the new moon on 27.06.1976, respectively; from Latsch in the Etsch valley west of Merano where more than 15 individuals have flown on 15.06.1975 (BURMANN & TARMANN 1978) which has been two days before the increasing half moon on 17.06.1975 between the new moon on 09.06.1975 and the full moon on 23.06.1975, from Martell in the Martell valley westsouthwest of Merano where abt. 20 individuals have flown on 26.08.1975 (BURMANN & TARMANN 1978) which has been five days after the full moon on 21.08.1975, from Taufers im Münstertal west of Merano where masses of individuals have flown on 03.09.1977 (BURMANN & TARMANN 1979) which has been three days before the decreasing half moon on 06.09.1977 between the full moon on 28.08.1977 and the new moon on 13.09.1977, from Leifers south of Bolzano where abt. 15 – 20 individuals daily have flown on 28.05.1975 – 01.06.1975 and 09.06.1975 – 15.06.1975 (BURMANN & TARMANN 1978) which has been around and between the full moon on 25.05.1975 as well as the decreasing half moon on 03.06.1975 between the full moon on 25.05.1975 and the new moon on 09.06.1975, and around and between the new moon on 09.06.1975 as well as the increasing half moon on 17.06.1975 between the new moon on 09.06.1975 and the full moon on 23.06.1975, respectively; and from Auer and Neumarkt in the Etsch valley south of Bolzano where abt. 200 individuals each have flown on 12.08.1974 (ZUCCHI 1975b) which has been on the decreasing half moon on 12.08.1974 between the full moon on 03.08.1974 and the new moon on 17.08.1974.

6.51 The Marbled Gray *Cryphia raptricula*, the Tree-Lichen Beauty *Cryphia algae*, the Dun-Bar *Cosmia trapezina* and the Shining Marbled *Pseudeustrotia candidula*

Mass occurrences of large quantities of individuals of the Marbled Gray *Cryphia raptricula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been confirmed in Rotterdam at the coast of the North Sea in the southwestern part of the Netherlands where abt. 15 individuals in total have flown on 02.08.1991 and 06.08.1991 (RENNWALD 1992) which has been two days before and two days after the decreasing half moon on 04.08.1991 between the full moon on 26.07.1991 and the new moon on 10.08.1991, respectively; and in the vicinity of Dortmund in the northwestern part of Germany where abt. 10 individuals have flown on 01.08.1957 (HARKORT & WEIGT 1968) which has been two days before the increasing half moon on 03.08.1957 between the new moon on 27.07.1957 and the full moon on 10.08.1957.

Significant quantities of individuals of the Tree-Lichen Beauty *Cryphia algae* (FABRICIUS 1775) (Lepidoptera: Noctuidae) have been found in Marl-Brassert northnortheast of Gelsenkirchen in the northwestern part of Germany where 5 individuals in total have flown in the period of 03.08.2004 – 23.08.2004 (LOTHAR PODSADLOWSKI in SCHUMACHER 2005a) which has been around and between the decreasing half moon on 07.08.2004 between the full moon on 31.07.2004 and the new moon on

16.08.2004 as well as the increasing half moon on 23.08.2004 between the new moon on 16.08.2004 and the full moon on 30.08.2004, in the districts Holweide and Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 26.07.1994 – 27.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four to five days after the full moon on 22.07.1994; and in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 30.07.1992 and 05.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 29.07.1992 as well as one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, respectively.

Mass occurrences of large quantities of individuals of the Dun-Bar *Cosmia trapezina* LINNAEUS 1758 (Lepidoptera: Noctuidae) in the southwestern part of Germany have been mentioned from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach where 50 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach where 10 individuals and abt. 10 individuals in total have flown on 25.06.1993 as well as on 10.07.1993 and 17.07.1993, respectively (BROSZKUS 1996b), which has been five days after the new moon on 20.06.1993, two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, and two days before the new moon on 19.07.1993, respectively; from Mackenrodt westnorthwest of Idar-Oberstein in the Nahe valley in the eastern part of the Hunsrück where abt. 20 individuals have flown on 08.08.1993 (BROSZKUS 1996b) which has been three days before the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993; and from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück where 35 individuals in total have flown on 15.07.1994 and 25.07.1994 (BROSZKUS 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, and three days after the full moon on 22.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Dun-Bar *Cosmia trapezina* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 26.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994; from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 16.07.1994 and 27.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, and five days after the full moon on 22.07.1994, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 15.07.1994, 22.07.1994 and 05.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, on the full moon on 22.07.1994 and two days before the new moon on 07.08.1994, respectively; and from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 05.07.1994, 12.07.1994, 19.07.1994, 26.07.1994, 02.08.1994 and 09.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 09.07.1994, three days before and four days after the full moon on 22.07.1994, and five days before and two days after the new moon on 07.08.1994, respectively.

Mass occurrences of large quantities of individuals of the Dun-Bar *Cosmia trapezina* in the western

part of Germany have been notified from Woppenroth south of Kirchberg in the eastern part of the Hunsrück where 10 individuals in total, 60 individuals in total and 20 individuals in total have flown on 16.07.1993 and 29.07.1993, 11.07.1994 and 24.07.1994, and 04.08.1994 and 27.08.1994, respectively (BROSZKUS 1996b), which has been three days before the new moon on 19.07.1993, four days before the full moon on 02.08.1993, two days after the new moon on 09.07.1994, two days after the full moon on 22.07.1994, three days before the new moon on 07.08.1994, and three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; and from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel where 5 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980.

Significant quantities of individuals of the Shining Marbled *Pseudeustrotia candidula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered at the Felsenberg near Schloßböckelheim and at the Rotenfels near Traisen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals (ROLF MÖRTTER in SCHUMACHER 2007a) and abt. 5 individuals (B. NIEMEYER in SCHUMACHER 2007a), respectively, have flown on 25.07.2006 which has been one day after the new moon on 24.07.2006.

6.52 The Elephant Hawk-Moth *Deilephila elpenor,* the Small Elephant Hawk-Moth *Deilephila porcellus,* the Ingrailed Clay *Diarsia mendica* and the Reed Dagger *Simyra albovenosa*

Mass occurrences of large quantities of individuals of the Elephant Hawk-Moth *Deilephila elpenor* LINNAEUS 1758 (Lepidoptera: Sphingidae) have been noticed in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 15 individuals have flown on 18.06.1993 (BROSZKUS 1996a) which has been two days before the new moon on 20.06.1993, in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 02.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992, in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals have flown on 09.06.1982 (WALFORT 1983) which has been three days after the new moon on 06.06.1982, and in Abergavenny north of Newport southwest of Birmingham in the southwestern part of England where numerous individuals have flown in the period of 18.06.1936 – 27.06.1936 (TULLOCH 1936) which has been around and between the new moon on 19.06.1936 as well as the increasing half moon on 27.06.1936 between the new moon on 19.06.1936 and the full moon on 04.07.1936.

Significant quantities of individuals of the Elephant Hawk-Moth *Deilephila elpenor* have been recognized in the district Neckargartach at the northwestern margin of the city of Heilbronn in the Neckar valley in the southwestern part of Germany where abt. 5 individuals have flown on 10.07.1967 (HEIMO HARBICH in HARZ 1968a) which has been three days after the new moon on 07.07.1967, in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 25.06.1993 (BROSZKUS 1996a) which has been five days after the new moon on 20.06.1993; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals each have flown on 09.06.1992, 01.07.1992, 08.06.1993, 16.07.1993 and 06.07.1994 (BROSZKUS 1996a) which has been one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, one day after the new moon on 30.06.1992, four days after the full moon on 04.06.1993, three days before the new moon on 19.07.1993 and three days before the new moon on 09.07.1994, respectively.

Significant quantities of individuals of the Small Elephant Hawk-Moth *Deilephila porcellus* LINNAEUS 1758 (Lepidoptera: Sphingidae) have been recorded in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 19.05.1993 and 25.06.1993 (BROSZKUS 1996a) which has been two days before the new moon on 21.05.1993 and five days after the new moon on 20.06.1993, respectively; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals each have flown on 23.05.1992 and 26.06.1993 (BROSZKUS 1996a) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, and one day before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993, respectively; in Warmsroth west of Bingen in the western part of Germany where more than 10 individuals have flown on 29.06.1992 (J. BEGER in BROSZKUS 1996a) which has been one day before the new moon on 30.06.1992; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals each have flown on 27.06.1994, 01.07.1994 and 06.07.1994 as well as 5 individuals have flown on 30.06.1993 (BROSZKUS 1996a) which has been four days after the full moon on 23.06.1994, on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and four days before the full moon on 04.07.1993, respectively; and in Abergavenny north of Newport southwest of Birmingham in the southwestern part of England where numerous individuals have flown in the period of 18.06.1936 – 27.06.1936 (TULLOCH 1936) which has been around and between the new moon on 19.06.1936 as well as the increasing half moon on 27.06.1936 between the new moon on 19.06.1936 and the full moon on 04.07.1936.

Mass occurrences of large quantities of individuals of the Ingrailed Clay *Diarsia mendica* FABRICIUS 1775 (Lepidoptera: Noctuidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 25 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982; from the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 08.05.1994 and 20.05.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the new moon on 10.05.1994 and five days before the full moon on 25.05.1994, respectively; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 30.04.1993 (BROSZKUS 1996a) which has been on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993.

Significant quantities of individuals of the Reed Dagger *Simyra albovenosa* (GOEZE 1781) (Lepidoptera: Noctuidae) have been encountered in Schlüsselburg northwest of Rehburg-Loccum westnorthwest of Hannover in the northwestern part of Germany where 8 individuals have flown on 07.07.2003 (HANS RETZLAFF in SCHUMACHER 2006) which has been on the increasing half moon on 07.06.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, in the Kranenburger Bruch near Kranenburg west of Kleve in the northwestern part of Germany where 5 individuals have been confirmed on 02.08.2003 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2004a) which has been four days after the new moon on 29.07.2003, near Heisingen at the southern margin of the city of Essen in the Ruhr valley in the northwestern part of Germany where more than 20 individuals have flown on 23.07.1947 (ZIELASKOWSKI 1951, FUST in ZIELASKOWSKI 1951) which has been five days after the new moon on 18.07.1947, and in Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach in the southwestern part of Germany where 7 individuals have flown on 18.07.1999 (ERNST ZEBE in SCHUMACHER 2001) which has been five days

after the new moon on 13.07.1999.

6.53 The Autumnal Rustic *Eugnorisma glareosa*, the Rosy Marsh Moth *Eugraphe subrosea*, the Twin-Spotted Wainscot *Archanara geminipuncta* and the Brown-Veined Wainscot *Archanara dissoluta*

Mass occurrences of large quantities of individuals of the Autumnal Rustic *Eugnorisma glareosa* (ESPER 1788) (Lepidoptera: Noctuidae) have been recognized in Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 25 individuals have flown on 15.09.1993 (RENNWALD 1995) which has been one day before the new moon on 16.09.1993, in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 12 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980, at the Goldberg near Pommern eastnortheast of Cochem in the Moselle valley in the western part of Germany where abt. 10 individuals have flown on 10.09.1988 (FÖRSTER in KINKLER 1990b) which has been one day before the new moon on 11.09.1988, in Kobern-Gondorf in the Moselle valley southwest of Koblenz in the western part of Germany where more than 5 individuals have flown on 11.10.1991 (KINKLER 1992) which has been three days after the new moon on 08.10.1991, in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals have flown on 02.09.1994 (BROSZKUS 1996b) which has been three days before the new moon on 05.09.1994; and in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals and 10 individuals each have flown on 27.09.1992, 17.09.1993 and 27.09.1994, respectively (BROSZKUS 1996b), which has been one day after the new moon on 26.09.1992, one day after the new moon on 16.09.1993, and two days before the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994.

Mass occurrences of large quantities of individuals of the Rosy Marsh Moth *Eugraphe subrosea* (STEPHENS 1829) (Lepidoptera: Noctuidae) have been confirmed from the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 120 individuals and 180 individuals have been counted on 24.08.1997 – 31.08.1997 (ARMIN HEMMERSBACH & STEFAN STEEGERS in KINKLER 1998) and 19.08.2003 – 21.08.2003 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2004a), respectively, which has been around and between the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 02.09.1997 as well as the new moon on 02.09.1997, and around the decreasing half moon on 20.08.2003 between the full moon on 12.08.2003 and the new moon on 27.08.2003, respectively.

Significant quantities of individuals of the Twin-Spotted Wainscot *Archanara geminipuncta* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in the Kranenburger Bruch near Kranenburg west of Kleve in the northwestern part of Germany where 7 individuals have been confirmed on 02.08.2003 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2004a) which has been four days after the new moon on 29.07.2003.

Mass occurrences of large quantities of individuals of the Brown-Veined Wainscot *Archanara dissoluta* (TREITSCHKE 1825) (Lepidoptera: Noctuidae) have been found in the Kranenburger Bruch near Kranenburg west of Kleve in the northwestern part of Germany where 10 individuals have been confirmed on 02.08.2003 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2004a) which has been four days after the new moon on 29.07.2003, and near Kreuzkapelle and Herrenteich in the vicinity of Much northeast of Siegburg northeast of Bonn in the northwestern part of Germany where 40 individuals have flown on 08.08.1997 (SCHUMACHER 2001) which has been five days after the new moon on 03.08.1997.

6.54 The Drinker *Euthrix potatoria,* the Garden Dart *Euxoa aquilina,* the White-Line Dart *Euxoa tritici*, the White Colon *Sideridis albicolon* and the Fen Square-Spot *Diarsia florida*

Mass occurrences of large quantities of individuals of the Drinker *Euthrix potatoria* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been documented from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 20 individuals have flown on 13.07.1982 (WALFORT 1983) which has been two days before the decreasing half moon on 15.07.1982 between the full moon on 06.07.1982 and the new moon on 20.07.1982.

Mass occurrences of large quantities of individuals of the Garden Dart *Euxoa aquilina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been mentioned from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 30 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978, and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 10 individuals have flown on 06.07.2002 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2003) which has been four days before the new moon on 10.07.2002.

Mass occurrences of large quantities of individuals of the White-Line Dart *Euxoa tritici* (LINNAEUS 1761) (Lepidoptera: Noctuidae) have been found in the Senne south of Augustdorf southeast of Bielefeld in the northwestern part of Germany where 25 individuals have flown on 15.09.2003 (HANS RETZLAFF in SCHUMACHER 2006) which has been five days after the full moon on 10.09.2003, and in Kalenberg southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals in total have flown on 02.09.2005 – 09.09.2005 (SCHMITZ, HEINZ SCHUMACHER & RUDI SELIGER in SCHUMACHER 2006) which has been around the new moon on 03.09.2005.

Significant quantities of individuals of the Square-Spot Dart *Euxoa obelisca* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been notified from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals and 15 individuals have flown on 03.09.1994 (BROSZKUS 1996b) and 30.08.2002 (B. NIEMEYER in SCHUMACHER 2003), respectively, which has been two days before the new moon on 05.09.1994, and one day after the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.09.2002, respectively.

Significant quantities of individuals of the White Colon *Sideridis albicolon* (HÜBNER 1813) (Lepidoptera: Noctuidae) have been encountered in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have been monitored on 02.06.2003 (SCHUMACHER 2004a) which has been two days after the new moon on 31.05.2003, and in Haltern north of Recklinghausen in the northwestern part of Germany where more than 5 individuals have flown on 06.06.1970 (HEINRICH LINKE in HARKORT 1971) which has been two days after the new moon on 04.06.1970.

Significant quantities of individuals of the Fen Square-Spot *Diarsia florida* (F. SCHMIDT 1859) (Lepidoptera: Noctuidae) have been found in Willingen eastnortheast of Bad Marienberg in the Westerwald in the northwestern part of Germany where 8 individuals have flown on 20.06.2000 (HEINZ SCHUMACHER & KLAUS MEYER in SCHUMACHER 2004a) which has been three days after the full moon on 17.06.2000.

6.55 The Common Swift *Hepialus lupulinus,* the Uncertain *Hoplodrina alsines,* the Heath Rustic *Xestia agathina,* the Neglected Rustic *Xestia castanea* and the Square-Spotted Clay *Xestia rhomboidea*

Mass occurrences of large quantities of individuals of the Common Swift *Hepialus lupulinus* LINNAEUS 1758 (Lepidoptera: Hepialidae) have been mentioned from the vicinity of Letmathe in the Lenne valley southsoutheast of Dortmund in the northwestern part of Germany where more than 50 individuals have flown on 07.06.1968 (HARKORT & WEIGT 1969) which has been three days before the full moon on 10.06.1968, from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 25 individuals have flown on 30.05.1981 (KINKLER 1987) which has been three days before the new moon on 02.06.1981, and from the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where more than 350 individuals in total have flown in the period of 06.05.2005 – 13.05.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been around and between the new moon on 08.05.2005 as well as the increasing half moon on 16.05.2005 between the new moon on 08.05.2005 and the full moon on 23.05.2005.

Mass occurrences of large quantities of individuals of the Uncertain *Hoplodrina alsines* BRAHM 1791 (Lepidoptera: Noctuidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, and from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982.

Mass occurrences of large quantities of individuals of the Uncertain *Hoplodrina alsines* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 05.07.1994, 12.07.1994 and 19.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 09.07.1994, and three days before the full moon on 22.07.1994, respectively; from the district Merkenich at the northern margin of the city of Cologne where more than 10 individuals have been captured on 24.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the new moon on 20.06.1993; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 10.06.1993 and 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and three days before the full moon on 04.07.1993, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 25.06.1992, 02.07.1992, 09.07.1992 and 16.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before and two days after the new moon on 30.06.1992, and five days before and two days after the full moon on 14.07.1992, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 01.07.1994, 08.07.1994 and 15.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, one day before the new moon on 09.07.1994, and two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, respectively; and from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 28.06.1994, 05.07.1994, 12.07.1994 and 19.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after

the full moon on 23.06.1994, four days before and two days after the new moon on 09.07.1994, and three days before the full moon on 22.07.1994, respectively.

Significant quantities of individuals of the Heath Rustic *Xestia agathina* (DUPONCHEL 1827) (Lepidoptera: Noctuidae) have been found in Kalenberg southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals in total have flown in the period of 02.09.2005 – 09.09.2005 (SCHMITZ, HEINZ SCHUMACHER & RUDI SELIGER in SCHUMACHER 2006) which has been around the new moon on 03.09.2005, in Windeck-Nutscheid northwest of Hamm in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where 5 individuals have flown on 03.09.1999 (SCHUMACHER 2001) which has been on the decreasing half moon on 03.09.1999 between the full moon on 26.08.1999 and the new moon on 10.09.1999; and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 12 individuals in total and abt. 20 individuals have flown on 31.08.1999 – 03.09.1999 (SCHUMACHER 2001) and 10.09.1999 (VOLKER PELZ & HEINZ SCHUMACHER in SCHUMACHER 2001), respectively, which has been several days before and on the decreasing half moon on 03.09.1999 between the full moon on 26.08.1999 and the new moon on 10.09.1999, and on the new moon on 10.09.1999, respectively.

Significant quantities of individuals of the Neglected Rustic *Xestia castanea* (ESPER 1798) (Lepidoptera: Noctuidae) have been encountered in Brüggen westnorthwest of Mönchengladbach in the northwestern part of Germany where abt. 5 individuals have flown on 07.09.2005 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2006) which has been four days after the new moon on 03.09.2005.

Significant quantities of individuals of the Square-Spotted Clay *Xestia rhomboidea* (ESPER 1790) (Lepidoptera: Noctuidae) have been recognized in Schladern in the Sieg valley northnorthwest of Hamm westsouthwest of Siegen in the northwestern part of Germany where abt. 10 individuals have flown on 04.08.1973 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1975) which has been two days before the increasing half moon on 06.08.1973 between the new moon on 29.07.1973 and the full moon on 14.08.1973.

6.56 The Beautiful Hook-Tip *Laspeyria flexula,* the White Satin Moth *Leucoma salicis,* the Silver Hook *Lithacodia uncula* and the Marsh Oblique-Barred *Hypenodes humidalis*

Mass occurrences of large quantities of individuals of the Beautiful Hook-Tip *Laspeyria flexula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 01.06.2002 (SCHUMACHER 2003) which has been two days before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and from Valwig in the Moselle valley east of Cochem in the western part of Germany where abt. 15 individuals have flown on 02.09.2005 (HANS DUDLER & RUDOLF PÄHLER in SCHUMACHER 2006) which has been one day before the new moon on 03.09.2005.

Mass occurrences of large quantities of individuals of the White Satin Moth *Leucoma salicis* LINNAEUS 1758 (Lepidoptera: Lymantriidae) have been recognized in the district Gonsenheim at the western margin of the city of Mainz at the northern margin of the Upper Rhine valley in the western

part of Germany where masses of individuals have flown on 04.07.1904 (Reichenau 1904) which has been two days before the decreasing half moon on 06.07.1904 between the full moon on 27.06.1904 and the new moon on 13.07.1904, in Bergisch Gladbach eastnortheast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 7 individuals and 14 individuals have been counted on 28.07.1966 and 29.07.1966, respectively (Bruno P. Kremer in Harz 1967a), which has been three and four days before the full moon on 01.08.1966; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 09.06.1982 and 25.06.1982 (Walfort 1983) which has been three days after the full moon on 06.06.1982 and four days after the new moon on 21.06.1982, respectively; and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Silver Hook *Lithacodia uncula* (Clerck 1759) (Lepidoptera: Noctuidae) have been found in Strohn southsoutheast of Daun in the southwestern part of the Eifel in the western part of Germany where 12 individuals have flown on 14.06.2003 (Schumacher 2004a) which has been on the full moon on 14.06.2003, in Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where abt. 10 individuals in total have flown in the period of 04.06.2002 – 17.06.2002 (Klaus Meyer & Heinz Schumacher in Schumacher 2003) which has been around and between the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002 as well as the increasing half moon on 18.06.2002 between the new moon on 03.06.2002 and the full moon on 24.06.2002, and in the Elberndorfer Bachtal near Erndtebrück northeast of Siegen in the northwestern part of Germany where abt. 5 individuals have flown on 28.05.2005 (Schumacher 2006) which has been five days after the full moon on 23.05.2005.

Mass occurrences of large quantities of individuals of the Marsh Oblique-Barred *Hypenodes humidalis* (Doubleday 1850) (Lepidoptera: Noctuidae) have been encountered in Detmold eastsoutheast of Bielefeld in the northwestern part of Germany where 12 individuals have flown on 12.06.2007 (Hans Retzlaff in Schumacher 2008a) which has been three days before the new moon on 15.06.2007, and in the Hildener Heide near Hilden southsoutheast of Düsseldorf in the northwestern part of Germany where 10 individuals have flown on 19.07.1969 (Kinkler, Schmitz, Nippel & Swoboda 1979) which has been five days after the new moon on 14.07.1969.

6.57 The True Lover´s Knot *Lycophotia porphyrea*, the Lackey *Malacosoma neustria*, the White Tiger *Spilosoma menthastri* and the Buff Ermine *Spilarctia luteum*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim in 2007 – 2009, I have not discovered a single individual of the White Tiger *Spilosoma menthastri* (Esper 1786) (Lepidoptera: Arctiidae). I have up to now only seen occasionally a few single individuals of the White Tiger *Spilosoma menthastri* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the White Tiger *Spilosoma menthastri* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the True Lover´s Knot *Lycophotia porphyrea* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Noctuidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany

where 50 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; and from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 16.07.1994, 27.07.1994 and 30.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, five days after the full moon on 22.07.1994, and one day before the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, respectively.

Mass occurrences of large quantities of individuals of the Lackey *Malacosoma neustria* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been reported from Niederhausen in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals have been confirmed on 12.08.1978 – 13.08.1978 (SWOBODA 1983) which has been on and one day after the increasing half moon on 12.08.1978 between the new moon on 04.08.1978 and the full moon on 18.08.1978; from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals and 5 individuals have flown on 25.06.1993 and 30.06.1994, respectively (BROSZKUS 1996a) which has been five days after the new moon on 20.06.1993 as well as one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 8 individuals and 10 individuals have flown on 24.07.1992 and 15.07.1994, respectively (BROSZKUS 1996a), which has been one day after the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, and two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, respectively; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 10 individuals, 5 individuals each and 30 individuals have flown on 10.07.1992, 30.06.1993, 16.07.1993 and 01.07.1994, respectively (BROSZKUS 1996a), which has been four days before the full moon on 14.07.1992, four days before the full moon on 04.07.1993, three days before the new moon on 19.07.1993, and on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 5 individuals have flown on 02.08.1980 (KINKLER 1987) which has been two days before the decreasing half moon on 04.08.1980 between the full moon on 27.07.1980 and the new moon on 10.08.1980, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, and from Vienna and its surroundings in the Danube valley in the eastern part of Austria where masses of individuals have flown on 13.07.1907 (LINSTOW 1913) which has been three days after the new moon on 10.07.1907.

Significant quantities of individuals of the White Tiger *Spilosoma menthastri* have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 5 individuals have flown on 30.05.1981 (KINKLER 1987) which has been three days before the new moon on 02.06.1981; in the district Holweide at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 07.06.1994, 14.06.1994, 21.06.1994 and 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days

before and five days after the new moon on 09.06.1994, and two days before and five days after the full moon on 23.06.1994, respectively; in the districts Merkenich and Niehl at the northern margin as well as in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993 and 17.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and three days before the new moon on 20.06.1993, respectively; and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Buff Ermine *Spilarctia luteum* (HUFNAGEL 1766) (Lepidoptera: Arctiidae) have been signaled from the district Merkenich at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993 and 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and three days before the full moon on 04.07.1993, respectively.

6.58 The Flame Shoulder *Ochropleura plecta*, the Middle-Barred Minor *Oligia fasciuncula*, the Tawny Marbled Minor *Oligia latruncula* and the Haworth´s Minor *Celaena haworthii*

Mass occurrences of large quantities of individuals of the Flame Shoulder *Ochropleura plecta* LINNAEUS 1761 (Lepidoptera: Noctuidae) have been documented from the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 40 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals and 20 individuals have flown on 29.07.1992 and 27.07.1994, respectively (BROSZKUS 1996b), which has been on the new moon on 29.07.1992 and five days after the full moon on 22.07.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals each have flown on 08.09.1981, 14.05.1982, 20.05.1982 and 31.05.1982; 15 individuals each have flown on 23.05.1982 and 29.05.1982, and 20 individuals have flown on 13.08.1982 (WALFORT 1983) which has been one day after the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981, three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new moon on 23.05.1982, three days before the new moon on 23.05.1982, one day before and one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, and on the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, respectively; and from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Flame Shoulder *Ochropleura plecta* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 07.06.1994, 19.07.1994, 26.07.1994, 02.08.1994, 09.08.1994, 16.08.1994 and 23.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996)

which has been two days before the new moon on 09.06.1994, three days before and four days after the full moon on 22.07.1994, five days before and two days after the new moon on 07.08.1994, and five days before and two days after the new moon on 21.08.1994, respectively; from the districts Merkenich, Niehl and Weiler at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 03.06.1993, 12.08.1993 and 20.05.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, five days before the new moon on 17.08.1993 and five days before the full moon on 25.05.1994, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.05.1992, 30.07.1992, 05.08.1992 and 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, one day after the new moon on 29.07.1992, one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, and one day before the new moon on 28.08.1992, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 05.08.1994 and 12.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before and five days after the new moon on 07.08.1994; from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals each have been captured on 26.07.1994, 02.08.1994 and 09.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994, and five days before and two days after the new moon on 07.08.1994, respectively; from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 05.08.1992 and 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, and one day before the new moon on 28.08.1992, respectively.

Mass occurrences of large quantities of individuals of the Middle-Barred Minor *Oligia fasciuncula* HAWORTH 1809 (Lepidoptera: Noctuidae) have been noticed near Rheinmünster-Stollhofen southwest of Rastatt in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 10 individuals have flown on 15.06.1991 (RENNWALD 1995) which has been three days after the new moon on 12.06.1991, at the Hohloh northwest of Enzklösterle southsouthwest of Bad Wildbad in the northern part of the Black Forest in the southwestern part of Germany where abundant individuals have flown on 26.07.1939 – 29.07.1939 (STROBEL 1968) which has been two to five days before the full moon on 31.07.1939; in the districts Merkenich and Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 03.06.1993 and 10.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993 as well as three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, respectively; in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 03.06.1994, 10.06.1994, 17.06.1994 and 24.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the decreasing half moon on 02.06.1994 between the full moon on 25.05.1994 and the new moon on 09.06.1994, one day after the new moon on 09.06.1994, on the increasing half moon on 17.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, and one day after the full moon on 23.06.1994, respectively; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 31.05.1982 (WALFORT 1983) which has been one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, in Paffenbroich near Aachen in the northwestern part of Germany where abt. 50 individuals have flown on 08.06.1921 (RUDOLF PÜNGELER in ZIELASKOWSKI 1951) which has been two days after the new moon on 06.06.1921, and in Lintorf north of Ratingen

northnortheast of Düsseldorf in the northwestern part of Germany where 12 individuals have flown on 16.06.1927 (ZIELASKOWSKI 1951) which has been one day after the full moon on 15.06.1927.

Significant quantities of individuals of the Tawny Marbled Minor *Oligia latruncula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been met in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals each have flown on 18.05.1993 and 27.05.1993 as well as on 20.06.1994 (BROSZKUS 1996a) which has been three days before the new moon on 21.05.1993, two days before the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, and three days before the full moon on 23.06.1994, respectively; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 5 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982.

Mass occurrences of large quantities of individuals of the Tawny Marbled Minor *Oligia latruncula* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 21.06.1994, 28.06.1994 and 05.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before and five days after the full moon on 23.06.1994, and four days before the new moon on 09.09.1994, respectively; from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993 and 17.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, and three days before the new moon on 20.06.1993, respectively; from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 01.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and from the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 21.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the full moon on 23.06.1994.

Mass occurrences of large quantities of individuals of the Haworth´s Minor *Celaena haworthii* (CURTIS 1829) (Lepidoptera: Noctuidae) have been encountered near Strohn southsoutheast of Daun in the southwestern part of the Eifel in the western part of Germany where more than 15 individuals have flown on 16.08.2002 (HERMANN JOSEF HEIMBACH, SCHMIDT & HEINZ SCHUMACHER in SCHUMACHER 2003) which has been one day after the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, and at the Wildseemoor northeast of Kaltenbronn southwest of Bad Wildbad in the northern part of the Black Forest in the southwestern part of Germany where abt. 10 individuals have flown on 06.09.1924 – 07.09.1924 (GUTH 1924) which has been one day before and on the increasing half moon on 07.09.1924 between the new moon on 30.08.1924 and the full moon on 13.09.1924.

6.59 The Glaucous Muslin *Paidia rica,* the Pearly Underwing *Peridroma saucia,* the Lempke´s Gold Spot *Plusia putnami,* the Rosy Minor *Mesoligia literosa* and the Beautiful Yellow Underwing *Anarta myrtilli*

Mass occurrences of large quantities of individuals of the Glaucous Muslin *Paidia rica* FREYER 1858

(Lepidoptera: Arctiidae) have been mentioned from Schloßböckelheim westsouthwest of Bad Kreuznach in the Nahe valley in the southwestern part of Germany where abt. 5 individuals and abt. 15 individuals have flown on 02.08.2002 (M. DERRA in SCHUMACHER 2003) and 25.07.2006 (ROLF MÖRTTER in SCHUMACHER 2007a), respectively, which has been one day after the decreasing half moon on 01.08.2002 between the full moon on 24.07.2002 and the new moon on 08.08.2002, and one day after the new moon on 24.07.2006, respectively.

Mass occurrences of large quantities of individuals of the Pearly Underwing *Peridroma saucia* (HÜBNER 1808) (Lepidoptera: Noctuidae) have been recognized in Oberretzbach northeast of Retz northnorthwest of Hollabrunn northnorthwest of Vienna in the eastern part of Austria where abt. 15 individuals in total have flown on 07.08.1993 – 12.08.1993 (RENNWALD 1995) which has been several days before and after the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, at Weißsee southsoutheast of Uttendorf southsoutheast of Kitzbühel in the western part of Austria where abt. 30 individuals have flown on 07.09.1962 (HARZ & WITTSTADT 1964) which has been one day before the increasing half moon on 08.09.1962 between the new moon on 30.08.1962 and the full moon on 14.09.1962, and at the Col du Bretolet south of Montreux in the southwestern part of Switzerland where 20 individuals have flown on 07.10.1981 – 08.10.1981 (KÖHLER 1983) which has been several days before the full moon on 13.10.1981.

Significant quantities of individuals of the Lempke´s Gold Spot *Plusia putnami* (GROTE 1873) (Lepidoptera: Noctuidae) have been found in the Elberndorfer Bachtal near Erndtebrück northeast of Siegen in the northwestern part of Germany where more than 5 individuals have flown on 03.07.2005 (SCHUMACHER 2006) which has been three days before the new moon on 06.07.2005, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where more than 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Rosy Minor *Mesoligia literosa* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in Schalkenmehren southsoutheast of Daun in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals have flown on 19.07.2003 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2004a) which has been two days before the decreasing half moon on 21.07.2003 between the full moon on 13.07.2003 and the new moon on 29.07.2003, and in Wollseifen near Dreiborn westnorthwest of Schleiden westsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 7 individuals have been observed on 11.08.2007 (SCHUMACHER 2008a) which has been two days before the new moon on 13.08.2007.

Mass occurrences of large quantities of individuals of the Beautiful Yellow Underwing *Anarta myrtilli* (LINNAEUS 1761) (Lepidoptera: Noctuidae) have been signaled from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 27.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 22.07.1994.

6.60 The Map-Winged Swift *Pharmacis fusconebulosa,* the Marbled White Spot *Protodeltote pygarga,* the Pretty Marbled *Deltote deceptoria,* the Silver Barred *Deltote bankiana* and the Water Ermine *Spilosoma urticae*

Mass occurrences of large quantities of individuals of the Map-Winged Swift *Pharmacis fuscone-*

bulosa DE GEER 1778 (Lepidoptera: Hepialidae) have been observed near Horn-Bad Meinberg in the Eggegebirge northeast of Paderborn in the northeastern part of Germany where more than 30 individuals have been observed on 29.06.2001 (HANS RETZLAFF in SCHUMACHER 2006) which has been on the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, near Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where abt. 5 individuals have flown on 06.07.2001 (SCHUMACHER 2002) which has been one day after the full moon on 05.07.2001, and at the Nordhelle in the Ebbegebirge south of Herscheid southeast of Lüdenscheid in the northwestern part of Germany where abt. 10 individuals have flown on 05.07.2001 (KLAUS MEYER in SCHUMACHER 2002) which has been on the full moon on 05.07.2001.

Mass occurrences of large quantities of individuals of the Marbled White Spot *Protodeltote pygarga* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals each have flown on 25.06.1982 and 11.07.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982 and five days after the full moon on 06.07.1982, respectively, from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994, from the district Weiler at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 10.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 20 individuals in total, 5 individuals, 7 individuals and 6 individuals in total have flown on 08.06.1993 and 18.06.1993, 16.07.1993, 20.06.1994 and 01.07.1994 – 11.07.1994, respectively (BROSZKUS 1996b), which has been four days after the full moon on 04.06.1993, two days before the new moon on 20.06.1993, three days before the new moon on 19.07.1993, three days before the full moon on 23.06.1994, and around and between the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994 as well as the new moon on 09.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Pretty Marbled *Deltote deceptoria* (SCOPOLI 1763) (Lepidoptera: Noctuidae) have been identified in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 15 individuals in total and 10 individuals have flown on 08.06.1993 and 18.06.1993 as well as on 20.06.1994, respectively (BROSZKUS 1996b), which has been four days after the full moon on 04.06.1993, two days before the new moon on 20.06.1993 and three days before the full moon on 23.06.1994, respectively.

Mass occurrences of large quantities of individuals of the Silver Barred *Deltote bankiana* (FABRICIUS 1775) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 21.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the full moon on 23.06.1994; and from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 10.06.1993 and 24.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1994 between the full moon on 04.06.1993 and the new moon on 20.06.1993, respectively.

Mass occurrences of large quantities of individuals of the Water Ermine *Spilosoma urticae* (Esper 1789) (Lepidoptera: Arctiidae) have been encountered in the Lüsekamp region near Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 12 individuals have flown on 06.06.2003 – 07.06.2003 (Armin Hemmersbach in Schumacher 2004a) which has been one day before and on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003; and in Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals each have flown on 05.06.1880 and 05.06.1889 (Reichenau 1904) which has been two days before the new moon on 07.06.1880, and two days before the increasing half moon on 07.06.1889 between the new moon on 29.05.1889 and the full moon on 13.06.1889, respectively.

6.61 The Spotted Clover Moth *Schinia nuchalis,* the Pinion-Streaked Snout *Schrankia costaestrigalis,* the Glaucous Shears *Papestra biren* and the Merveille du Jour *Dichonia aprilina*

Mass occurrences of the Spotted Clover Moth *Schinia nuchalis* (Grote 1878) (Lepidoptera: Noctuidae) have been recognized in Illmitz at Lake Neusiedl eastsoutheast of Eisenstadt southeast of Vienna in the eastern part of Austria where abt. 30 individuals have flown on 31.07.1973 (Kinkler, Nippel & Swoboda 1974) which has been two days after the new moon on 29.07.1973.

Mass occurrences of large quantities of individuals of the Pinion-Streaked Snout *Schrankia costaestrigalis* Stephens 1834 (Lepidoptera: Noctuidae) have been noticed in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 40 individuals have been encountered on 19.08.2003 – 25.08.2003 (Armin Hemmersbach & Rudi Seliger in Schumacher 2004a) which has been around and between the decreasing half moon on 20.08.2003 between the full moon on 12.08.2003 and the new moon on 27.08.2003 as well as the new moon on 27.08.2003; in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 10 individuals have been monitored on 31.07.2003 (Schumacher 2004a) which has been two days after the new moon on 29.07.2003, in the Hildener Heide near Hilden southsoutheast of Düsseldorf in the northwestern part of Germany where more than 5 individuals have flown on 20.09.1938 (Kinkler, Schmitz, Nippel & Swoboda 1979) which has been five days after the new moon on 15.09.1936, in Nettetal-Hinsbeck west of Krefeld in the northwestern part of Germany where 15 individuals have flown on 06.08.2003 (Armin Hemmersbach in Schumacher 2004a) which has been one day after the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003, and in Maria Veen east of Reken southsouthwest of Coesfeld in the northwestern part of Germany where more than 5 individuals have flown on 23.05.2007 (B. Niemeyer & Lilienthal in Schumacher 2008a) which has been on the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007.

Significant quantities of individuals of the Glaucous Shears *Papestra biren* (Goeze 1781) (Lepidoptera: Noctuidae) have been found in Heinsberg southeast of Kirchhundem south of Lennestadt north of Siegen in the northwestern part of Germany where abt. 5 individuals and more than 10 individuals have been observed on 26.06.2001 – 27.06.2001 (Klaus Meyer & Heinz Schumacher in Schumacher 2002) and 17.05.2002 (Schumacher 2003), respectively, which has been two to three days before the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, and five days after the new moon on 12.05.2002, respectively; at the Kahler Asten west of Winterberg south of Brilon in the northwestern part of Germany where 7 individuals have flown on 26.05.2005 – 27.05.2005 (Hans Retzlaff & Rudi Seliger in Schumacher 2006) which has been three to four days after the full moon on 23.05.2005, and in Niedersfeld north

of Winterberg south of Brilon in the northwestern part of Germany where 12 individuals have flown on 27.05.2005 (RUDI SELIGER in SCHUMACHER 2006) which has been four days after the full moon on 23.05.2005.

Significant quantities of individuals of the Merveille du Jour *Dichonia aprilina* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been identified near Gemünd in the Urft valley northnorthwest of Kall westsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 11.10.2008 (HANS RETZLAFF & RUDI SELIGER in SCHUMACHER 2009) which has been three days before the full moon on 14.10.2008, at the Roßstein near Dörscheid southeast of Oberwesel in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where abt. 5 individuals have flown on 13.10.2001 (M. DERRA in SCHUMACHER 2002) which has been three days before the new moon on 16.10.2001; near Windeck-Au and Windeck-Gierzhagen westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where more than 10 individuals and more than 5 individuals, respectively, have been observed on 28.09.2002 – 03.10.2002 (W. BECKERT in SCHUMACHER 2003) which has been around and between the decreasing half moon on 29.09.2002 between the full moon on 21.09.2002 and the new moon on 06.10.2002 as well as the new moon on 06.10.2002; and near Heggen in the Bigge valley southsouthwest of Finnentrop southsoutheast of Plettenberg in the northwestern part of Germany where abt. 5 individuals in total have flown in the period of 15.10.2006 – 24.10.2006 (M. DIRR in SCHUMACHER 2007a) which has been around and between the decreasing half moon on 14.10.2006 between the full moon on 07.10.2006 and the new moon on 22.09.2006 as well as the new moon on 22.09.2006. Significant quantities of individuals of the Merveille du Jour *Dichonia convergens* have been encountered at the Roßstein near Dörscheid southeast of Oberwesel in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 15 individuals have flown on 03.10.2002 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2003) which has been three days before the new moon on 06.10.2002, and at the Drachenfels south of Königswinter in the Middle Rhine valley south of Bonn in the northwestern part of Germany where 12 individuals have flown on 14.10.2008 (SCHUMACHER 2009) which has been on the full moon on 14.10.2008.

6.62 The Stout Dart *Spaelotis ravida*, the Deep-Brown Dart *Aporophyla lutulenta*, the Black Rustic *Aporophyla nigra* and the White Ermine *Spilosoma lubricipeda*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim in 2007 – 2009, I have not discovered a single individual of the White Ermine *Spilosoma lubricipeda* LINNAEUS 1758 (Lepidoptera: Arctiidae). I have up to now only seen occasionally a few single individuals of the White Ermine *Spilosoma lubricipeda* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the White Ermine *Spilosoma lubricipeda* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Significant quantities of individuals of the Stout Dart *Spaelotis ravida* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recognized in Herbsleben eastnortheast of Bad Langensalza northwest of Erfurt in the northeastern part of Germany where 6 individuals have been found on 21.07.1990 (RENNWALD 1994) which has been one day before the new moon on 22.07.1990.

Mass occurrences of large quantities of individuals of the Deep-Brown Dart *Aporophyla lutulenta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in

Rheinbrohl in the Middle Rhine valley northwest of Neuwied in the western part of Germany where 10 individuals in total each have flown in the periods of 17.09.1995 – 23.09.1995 (HERMANN JOSEF HEIMBACH in KINKLER 1996) and 09.09.1996 – 14.09.1996 (HERMANN JOSEF HEIMBACH in KINKLER 1998) which has been around and between the decreasing half moon on 17.09.1995 between the full moon on 09.09.1995 and the new moon on 24.09.1995 as well as the new moon on 24.09.1995, and around the new moon on 12.09.1996, respectively; and in Dahlem southwest of Blankenheim north-northwest of Daun in the northwestern part of the Eifel in the western part of Germany where 15 individuals have flown on 06.09.2004 – 10.09.2004 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2005a) which has been around and between the decreasing half moon on 06.09.2004 between the full moon on 30.08.2004 and the new moon on 14.09.2004 as well as the new moon on 14.09.2004.

Significant quantities of individuals of the Black Rustic *Aporophyla nigra* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in the Elmpter Wald west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where abt. 5 individuals have flown on 28.09.2002 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2003) which has been one day before the decreasing half moon on 29.09.2002 between the full moon on 21.09.2002 and the new moon on 06.10.2002.

Mass occurrences of large quantities of individuals of the White Ermine *Spilosoma lubricipeda* have been documented from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 15 individuals each have flown on 29.05.1982 and 09.06.1982 (WALFORT 1983) which has been one day before the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982 as well as three days after the full moon on 06.06.1982, respectively; from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 28.05.1992 (BROSZKUS 1996a) which has been four days before the new moon on 01.06.1992; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 5 individuals and 10 individuals have flown on 25.05.1992 and 24.05.1993, respectively (BROSZKUS 1996a), which has been on the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, and three days after the new moon on 21.05.1993, respectively.

6.63 The Nine-Spotted Moth *Syntomis phegea,* the Scarce Silver Y *Syngrapha interrogationis,* the Pale Eggar *Trichiura crataegi* and the Alder Kitten *Furcula biscuspis*

Mass occurrences of large quantities of individuals of the Nine-Spotted Moth *Syntomis phegea* LINNAEUS 1758 (Lepidoptera: Arctiidae) have been noticed near Kaldenkirchen northwest of Mönchengladbach in the northwestern part of Germany where more than 500 individuals have been observed on 25.06.2003 (ARMIN HEMMERSBACH in SCHUMACHER 2004a) which has been four days before the new moon on 29.06.2003; and in Bad Münster am Stein in the Nahe valley southsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 30 individuals each and abt. 15 individuals each have flown on 16.06.1990, 25.06.1990, 02.07.1990 (WALTER BROSZKUS & PETER FÖHST in KINKLER 1990b) and 22.06.1992 (BROSZKUS 1996a), respectively, which has been one day before the decreasing half moon on 17.06.1990 between the full moon on 08.06.1990 and the new moon on 22.06.1990, three days after the new moon on 22.06.1990, two days after the increasing half moon on 30.06.1990 between the new moon on 22.06.1990 and the full moon on 08.07.1990, and two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, respectively.

Mass occurrences of large quantities of individuals of the Scarce Silver Y *Syngrapha interrogationis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been recognized near Kniebis west of Freudenstadt in the northern part of the Black Forest in the southwestern part of Germany where 10 individuals have flown on 02.08.1980 (LOBENSTEIN 1981b) which has been two days before the decreasing half moon on 04.08.1980 between the full moon on 27.07.1980 and the new moon on 10.08.1980, near Altastenberg west of Winterberg south of Brilon in the northwestern part of Germany where 7 individuals have flown on 15.07.1983 (WOLF 1985) which has been three days before the increasing half moon on 18.07.1983 between the new moon on 10.07.1983 and the full moon on 25.07.1983, and at the Kahler Asten west of Winterberg south of Brilon in the northwestern part of Germany where abt. 15 individuals have flown on 13.07.2005 (HANS RETZLAFF in SCHUMACHER 2006) which has been one day before the increasing half moon on 14.07.2005 between the new moon on 06.07.2005 and the full moon on 21.07.2005.

Significant quantities of individuals of the Pale Eggar *Trichiura crataegi* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been encountered in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 5 individuals have flown on 12.09.1981 (WALFORT 1983) which has been two days before the full moon on 14.09.1981; and in Kirchhellen north of Bottrop in the northwestern part of Germany where 12 individuals in total have flown on 22.08.1947 and 29.08.1947 (ZIELASKOWSKI 1951, FUST in ZIELASKOWSKI 1951) which has been two days before the increasing half moon on 24.08.1947 between the new moon on 16.08.1947 and the full moon on 31.08.1947 as well as two days before the full moon on 31.08.1947, respectively.

Mass occurrences of large quantities of individuals of the Alder Kitten *Furcula bicuspis* (BORKHAUSEN 1790) (Lepidoptera: Notodontidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982.

6.64 The Figure of Eighty *Tethea ocularis,* the Four-Spotted Moth *Tyta luctuosa,* the Purple Clay *Diarsia brunnea* and the Small Square-Spot *Diarsia rubi*

Mass occurrences of large quantities of individuals of the Figure of Eighty *Tethea ocularis* LINNAEUS 1767 (Lepidoptera: Thyatiridae) have been documented from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 20 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Four-Spotted Moth *Tyta luctuosa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recognized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 10 individuals in total and 5 individuals each have flown on 21.04.1993 and 30.04.1993 as well as on 10.07.1993 and 02.08.1994, respectively (BROSZKUS 1996b), which has been on the new moon on 21.04.1993, on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, and on the full moon on 02.08.1993, respectively; in Gerolzhofen eastnortheast of Würzburg in the central part of Germany where 6 individuals have flown on 17.06.1977 (LOBENSTEIN 1978) which has been one day after the new moon on 16.06.1977, near Jena in the Saale valley in the northeastern part of Germany where 15 individuals have flown and have sucked on flowers on 02.07.1991 (RENNWALD 1992) which has been four days before the decreasing half moon on 06.07.1991 between the full moon on 27.06.1991 and the new moon on 11.07.1991; in Dürnstein westsouthwest of Krems in the Danube

valley in the eastern part of Austria where 6 individuals each and more than 20 individuals have flown on 09.06.1977, 11.06.1977 and 18.08.1977, respectively (BURMANN & TARMANN 1979), which has been on and two days after the decreasing half moon on 09.06.1977 between the full moon on 01.06.1977 and the new moon on 16.06.1977, and four days after the new moon on 14.08.1977, respectively; in Sète southwest of Montpellier in the southeastern part of France where 8 individuals in total have flown on 07.09.1978 – 08.09.1978 (LOBENSTEIN 1979) which has been three and four days before the increasing half moon on 11.09.1978 between the new moon on 02.09.1978 and the full moon on 16.09.1978, and in Arles northwest of Marseille in the southeastern part of France where 7 individuals have flown on 15.07.1979 – 18.07.1979 (LOBENSTEIN 1981a) which has been a few days before and after the decreasing half moon on 17.07.1979 between the full moon on 09.07.1979 and the new moon on 24.07.1979.

Significant quantities of individuals of the Purple Clay *Diarsia brunnea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 5 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982.

Mass occurrences of large quantities of individuals of the Small Square-Spot *Diarsia rubi* (VIEWEG 1790) (Lepidoptera: Noctuidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 12 individuals have flown on 31.05.1982 (WALFORT 1983) which has been one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 02.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the new moon on 05.09.1994, and in the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where abt. 5 individuals have flown on 13.05.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been five days after the new moon on 08.05.2005.

6.65 The Small Mottled Willow *Spodoptera exigua* and the Polygone Moth *Opigena polygona*

Mass occurrences of large quantities of individuals of the Small Mottled Willow *Spodoptera exigua* (HÜBNER 1808) (Lepidoptera: Noctuidae) have been registered in Pforzheim eastsoutheast of Karlsruhe in the southwestern part of Germany where 10 individuals have flown on 24.05.1958 – 25.05.1958 (KOCH, WARNECKE, WITTSTADT & MAZZUCCO 1959; WARNECKE, WITTSTADT, KOCH & MAZZUCCO 1959) which has been two to three days before the increasing half moon on 27.05.1958 between the new moon on 18.05.1958 and the full moon on 01.06.1958.

Mass occurrences of large quantities of individuals of the Polygone Moth *Opigena polygona* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recorded in the Ziegelroda forest southeast of Querfurt westsouthwest of Halle in the Saale valley in the northeastern part of Germany where abt. 150 individuals have flown on 05.08.1958 – 06.08.1958 (LAUTENSCHLÄGER 1959) which has been two to three days before the decreasing half moon on 08.08.1958 between the full moon on 30.07.1958 and the new moon on 15.08.1958; and in Altenahr in the Ahr valley westsouthwest of Bad Neuenahr-Ahrweiler in the northeastern part of the Eifel in the western part of Germany where abt. 10 individuals in total have flown on 23.08.1987 and 01.09.1987 (FÖRSTER, SCHAUB & BERND SCHMITZ in KINKLER 1989a) which has been one day before the new moon on 24.08.1987 as well as one day before the increasing half moon on 02.09.1987 between the new

moon on 24.08.1987 and the full moon on 07.09.1987, respectively.

6.66 The Pale Shoulder *Acontia lucida,* the Red-Headed Chestnut *Conistra erythrocephala,* the Black-Spot Chestnut *Conistra rubiginosa,* the Mottled Rustic *Caradrina morpheus* and the Pale-Mottled Willow *Paradrina clavipalpis*

Significant quantities of individuals of the Pale Shoulder *Acontia lucida* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been noticed in Illmitz at Lake Neusiedl southeast of Vienna in the eastern part of Austria where 6 individuals have flown on 22.07.1976 (BURMANN & TARMANN 1979) which has been five days before the new moon on 27.07.1976.

Mass occurrences of large quantities of individuals of the Red-Headed Chestnut *Conistra erythrocephala* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been observed in Bülgenauel east of Hennef in the Sieg valley eastnortheast of Bonn in the northwestern part of Germany where abt. 200 individuals have flown on 09.11.1995 (HEINZ SCHUMACHER in KINKLER 1997) which has been two days after the full moon on 07.11.1995, at the Galgenberg in the vicinity of Nutscheid southwest of Waldbröl west of Siegen in the northwestern part of Germany where abt. 5 individuals have flown on 10.10.1996 (HEINZ SCHUMACHER in KINKLER 1997) which has been two days before the new moon on 12.10.1996, in the Loopebachtal near Engelskirchen east of Bergisch Gladbach in the northwestern part of Germany where 20 individuals have flown on 03.11.1996 (KLAUS MEYER in KINKLER 1997) which has been one day before the decreasing half moon on 04.11.1996 between the full moon on 26.10.1996 and the new moon on 11.11.1996, in Wuppertal eastnortheast of Düsseldorf in the northwestern part of Germany where 6 individuals have flown on 05.11.1994 (RADTKE & WIEMERT 1995) which has been two days after the new moon on 03.11.1994, and in the Auer Wald near Windeck-Au westnorthwest of Wissen in the Sieg valley westsouthwest of Siegen in the northwestern part of Germany where more than 15 individuals have been observed on 03.10.1995 (HEINZ SCHUMACHER in KINKLER 1996) which has been one day after the increasing half moon on 02.10.1995 between the new moon on 24.09.1995 and the full moon on 08.10.1995.

Mass occurrences of large quantities of individuals of the Black-Spot Chestnut *Conistra rubiginosa* (SCOPOLI 1763) (Lepidoptera: Noctuidae) have been signaled from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 04.11.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 03.11.1994.

Mass occurrences of large quantities of individuals of the Mottled Rustic *Caradrina morpheus* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 21.06.1994, 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the full moon on 23.06.1994, and four days before and three days after the new moon on 09.07.1994, respectively; from the district Merkenich at the northern margin of the city of Cologne where more than 10 individuals have been captured on 24.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the new moon on 20.06.1993; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 03.06.1993, 10.06.1993, 17.06.1993, 24.06.1993 and 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the full moon on 04.06.1993, three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993, three days before and four days after the new moon on 20.06.1993, and three

days before the full moon on 04.07.1993, respectively; and from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 25.06.1992, 09.07.1992 and 16.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days before the new moon on 30.06.1992, and five days before and two days after the full moon on 14.07.1992, respectively.

Mass occurrences of large quantities of individuals of the Pale-Mottled Willow *Paradrina clavipalpis* (SCOPOLI 1763) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been contributed from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 23.08.1994 and 30.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 21.08.1994 as well as on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the district Merkenich at the northern margin of the city of Cologne where more than 10 individuals have been captured on 02.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the full moon on 01.09.1993; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.05.1992 and 25.06.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, and five days before the new moon on 30.06.1992, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals have been captured on 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before the full moon on 12.09.1992.

6.67 The Vapourer *Orgyia antiqua*, the Scarce Vapourer *Orgyia recens*, the Black V Moth *Arctornis l-nigrum*, the Rustic Shoulder-Knot *Apamea sordens* and the Light Arches *Apamea lithoxylea*

Mass occurrences of large quantities of individuals of the Vapourer *Orgyia antiqua* LINNAEUS 1758 (Lepidoptera: Lymantriidae) have been found in Sankt Georg in the city of Hamburg in the northwestern part of Germany where masses of individuals have flown on 10.09.1899 – 16.09.1899 (REH 1899) which has been around and between the new moon on 05.09.1899 as well as the increasing half moon on 13.09.1899 between the new moon on 05.09.1899 and the full moon on 19.09.1899.

Mass occurrences of large quantities of individuals of the Scarce Vapourer *Orgyia recens* (HÜBNER 1819) (Lepidoptera: Lymantriidae) have been reported from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals have flown on 04.08.1993 (BROSZKUS 1996a) which has been two days after the full moon on 02.08.1993.

Significant quantities of individuals of the Black V Moth *Arctornis l-nigrum* (MÜLLER 1764) (Lepidoptera: Lymantriidae) have been mentioned from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals each have flown on 01.07.1992 and 01.07.1994 (BROSZKUS 1996a) which has been one day after the new moon on 30.06.1992, and on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; and from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 15 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982.

Significant quantities of individuals of the Rustic Shoulder-Knot *Apamea sordens* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been encountered in the vicinity of Bürvenich and Berg northwest of

Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 30.05.1980 (KINKLER 1987) which has been one day after the full moon on 29.05.1980.

Significant quantities of individuals of the Light Arches *Apamea lithoxylea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 5 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981.

6.68 The Handmaid *Dysauxes ancilla,* the Lobster Moth *Stauropus fagi,* the Lesser Sallow Prominent *Pheosia gnoma* and the Dusky Marbled Brown *Gluphisia crenata*

Mass occurrences of large quantities of individuals of the Handmaid *Dysauxes ancilla* (LINNAEUS 1767) (Lepidoptera: Arctiidae) have been noticed in Valwig in the Moselle valley east of Cochem in the western part of Germany where abt. 10 individuals have flown on 23.07.1995 – 24.07.1995 (LINKE in KINKLER 1996) which has been three to four days before the new moon on 27.07.1995; in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 40 individuals, abt. 20 individuals and abt. 15 individuals have flown on 22.06.1992, 25.06.1993, 17.07.1993 (BROSZKUS 1996a) and 28.06.2005 (ROLF MÖRTTER in SCHUMACHER 2006), respectively, which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, five days after the new moon on 20.06.1993, two days before the new moon on 19.07.1993, and on the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005, respectively; and from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 26.06.1993 (BROSZKUS 1996a) which has been one day before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993.

Mass occurrences of large quantities of individuals of the Lobster Moth *Stauropus fagi* LINNAEUS 1758 (Lepidoptera: Notodontidae) have been confirmed in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals have flown on 25.04.1993 (BROSZKUS 1996a) which has been four days after the new moon on 21.04.1993.

Mass occurrences of large quantities of individuals of the Lesser Sallow Prominent *Pheosia gnoma* (FABRICIUS 1777) (Lepidoptera: Notodontidae) have been encountered in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals each have flown on 31.05.1982 and 13.08.1982 (WALFORT 1983) which has been one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, and on the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, respectively; and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where more than 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Dusky Marbled Brown *Gluphisia crenata* (BRAY 1929) (Lepidoptera: Notodontidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 15 individuals have

flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982, and in the Venner Moor northeast of Venne northeast of Osnabrück in the northwestern part of Germany where more than 10 individuals have flown on 07.07.1970 (HARKORT 1971, HANS-JOACHIM WEIGT in HARKORT 1971) which has been four days after the new moon on 03.07.1970.

6.69 The Lunar Marbled Brown *Drymonia ruficornis,* the Undotted Marbled Brown *Drymonia trimacula,* the Oak Marbled Brown *Drymonia querna,* the Marbled Brown *Drymonia dodonaea* and the Rosy Marbled *Elaphria venustula*

Mass occurrences of large quantities of individuals of the Lunar Marbled Brown *Drymonia ruficornis* (HUFNAGEL 1766) (Lepidoptera: Notodontidae) have been recognized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals each have flown on 06.05.1992, 23.04.1993, 28.04.1993 and 11.05.1993, and 20 individuals each have flown on 16.04.1993, 25.04.1993 and 30.04.1994, respectively (BROSZKUS 1996a), which has been four days after the new moon on 02.05.1992, two days after the new moon on 21.04.1993, two days before the increasing half moon on 30.04.1993 between the new moon on 21.05.1993 and the full moon on 06.05.1993, five days after the full moon on 06.05.1993, two days after the decreasing half moon on 14.04.1993 between the full moon on 06.04.1993 and the new moon on 21.04.1993, four days after the new moon on 21.04.1993 and five days after the full moon on 25.04.1994, respectively; in Warmsroth west of Bingen in the western part of Germany where more than 10 individuals have flown on 22.04.1994 (J. BEGER in BROSZKUS 1996a) which has been three days before the full moon on 25.04.1994, in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 21.04.1993 (BROSZKUS 1996a) which has been on the new moon on 21.04.1993, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 5 individuals have flown on 14.05.1982 (WALFORT 1983) which has been three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new moon on 23.05.1982.

Mass occurrences of large quantities of individuals of the Undotted Marbled Brown *Drymonia trimacula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been realized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 19.05.1993 (BROSZKUS 1996a) which has been two days before the new moon on 21.05.1993; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 01.06.1994 (BROSZKUS 1996a) which has been one day before the decreasing half moon on 02.06.1994 between the full moon on 25.05.1994 and the new moon on 09.06.1994; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 5 individuals each, 15 individuals and more than 5 individuals have flown on 25.05.1992, 11.05.1993, 24.05.1993 and 12.05.1994, respectively (BROSZKUS 1996a), which has been on the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, five days after the full moon on 06.05.1993, three days after the new moon on 21.05.1993 and two days after the new moon on 10.05.1994, respectively.

Significant quantities of individuals of the Oak Marbled Brown *Drymonia querna* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been encountered in Schlüsselburg northwest of Rehburg-Loccum westnorthwest of Hannover in the northwestern part of Germany where 7 individuals have flown on 22.06.2003 (HANS RETZLAFF in SCHUMACHER 2006) which has been one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003.

Significant quantities of individuals of the Marbled Brown *Drymonia dodonaea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 20.05.1982 and 31.05.1982 (WALFORT 1983) which has been three days before the new moon on 23.05.1982 as well as one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively.

Mass occurrences of large quantities of individuals of the Rosy Marbled *Elaphria venustula* (HÜBNER 1790) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 21.06.1994 and 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before and five days after the full moon on 23.06.1994, respectively; and from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals have been captured on 10.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993.

6.70 The Great Prominent *Peridea anceps,* the Coxcomb Prominent *Ptilodon capucina,* the Scarce Prominent *Odontosia carmelita* and the Pale Prominent *Pterostoma palpina*

Mass occurrences of large quantities of individuals of the Great Prominent *Peridea anceps* (GOEZE 1781) (Lepidoptera: Notodontidae) have been reported from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals and more than 5 individuals have flown on 30.04.1992 and 28.04.1994, respectively (BROSZKUS 1996a), which has been two days before the new moon on 02.05.1992 and three days after the full moon on 25.04.1994, respectively; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 5 individuals, 10 individuals and more than 5 individuals have flown on 12.05.1992, 25.04.1993 and 30.04.1994, respectively (BROSZKUS 1996a), which has been four days before the full moon on 16.05.1992, four days after the new moon on 21.04.1993 and five days after the full moon on 25.04.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals each have flown on 14.05.1982, 23.05.1982 and 31.05.1982 (WALFORT 1983) which has been three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new moon on 23.05.1982, on the new moon on 23.05.1982, and one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively; and from Flaesheim southeast of Haltern north of Recklinghausen in the northwestern part of Germany where 25 individuals in total have flown in the period of 09.05.1970 – 08.06.1970 (HEINRICH LINKE in HARKORT 1971) which has been around and between the new moon on 05.05.1970, the full moon on 21.05.1970 and the new moon on 04.06.1970.

Significant quantities of individuals of the Coxcomb Prominent *Ptilodon capucina* LINNAEUS 1758 (Lepidoptera: Notodontidae) have been mentioned from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 30.04.1994 (S. JOUAUX in BROSZKUS 1996a) which has been five days after the full moon on 25.04.1994; and from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 – 10 individuals each have flown on 14.05.1982, 20.05.1982, 23.05.1982, 29.05.1982, 13.08.1982 and 20.08.1982 (WALFORT 1983) which has been three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new

moon on 23.05.1982, three days before and on the new moon on 23.05.1982, one day before the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, on the decreasing half moon on 13.08.1982 between the full moon on 04.08.1982 and the new moon on 19.08.1982, and one day after the new moon on 19.08.1982, respectively.

Mass occurrences of large quantities of individuals of the Scarce Prominent *Odontosia carmelita* (ESPER 1798) (Lepidoptera: Notodontidae) have been notified from Lippolthausen west of Lünen north of Dortmund in the northwestern part of Germany where abt. 30 individuals have flown and have sit on stems of trees on 01.05.1933 (H. HEDDERGOTT in HARKORT & WEIGT 1969) which has been two days before the increasing half moon on 03.05.1933 between the new moon on 24.04.1933 and the full moon on 10.05.1933, and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 28.04.1993 (BROSZKUS 1996a) which has been two days before the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993.

Significant quantities of individuals of the Pale Prominent *Pterostoma palpina* (CLERCK 1759) (Lepidoptera: Notodontidae) have been encountered in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 – 10 individuals each have flown on 14.05.1982, 23.05.1982 and 29.05.1982 (WALFORT 1983) which has been three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new moon on 23.05.1982, on the new moon on 23.05.1982, and one day before the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively.

6.71 The Buff-Tip *Phalera bucephala*, the Festoon *Apoda limacodes*, the Argentine *Spatalia argentina* and the White Prominent *Leucodonta bicoloria*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim in 2007 – 2009, I have not discovered a single individual of the Buff-Tip *Phalera bucephala* LINNAEUS 1758 (Lepidoptera: Notodontidae). I have up to now only seen occasionally a few single individuals of the Buff-Tip *Phalera bucephala* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Buff-Tip *Phalera bucephala* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Significant quantities of individuals of the Buff-Tip *Phalera bucephala* have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 10.07.1993 (BROSZKUS 1996a) which has been two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993.

Mass occurrences of large quantities of individuals of the Festoon *Apoda limacodes* (HUFNAGEL 1766) (Lepidoptera: Limacodidae) have been observed at an unspecified locality where abt. 20 individuals have flown on 19.06.1911 (SCHEPP 1911) which has been one day before the decreasing half moon on 20.06.1911 between the full moon on 11.06.1911 and the new moon on 26.06.1911, and in the district Weiler at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days after the new moon on 09.07.1994. Significant quantities of individuals of the Festoon *Apoda limacodes* have also been found in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of

Germany where abt. 5 individuals each have flown on 09.06.1992, 24.06.1992, 08.06.1993 and 01.07.1994, respectively (BROSZKUS 1996a), which has been one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, on the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, four days after the full moon on 04.06.1993, and on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 25.06.1993 (BROSZKUS 1996a) which has been five days after the new moon on 20.06.1993.

Significant quantities of individuals of the Argentine *Spatalia argentina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) have been noticed at the Rotenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 29.07.1997 (ROLF MÖRTER in KINKLER 1998) and 20.05.1998 (SCHUMACHER 2001) which has been two days before the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997, and five days before the new moon on 25.05.1998, respectively.

Mass occurrences of large quantities of individuals of the White Prominent *Leucodonta bicoloria* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Notodontidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 26.07.1994, 02.08.1994 and 23.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 22.07.1994, five days before the new moon on 07.08.1994 and two days after the full moon on 21.08.1994, respectively; from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 27.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 22.07.1994; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 15.07.1993, 22.07.1993, 29.07.1993, 26.08.1993, 02.09.1993 and 09.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 19.07.1993, four days before the full moon on 02.08.1993, five days before and one day after the full moon on 01.09.1993, and one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, respectively; from the district Weiler at the northern margin of the city of Cologne where more than 10 individuals have been captured on 19.08.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 17.08.1993, and from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where abt. 10 individuals have flown on 31.05.1982 (WALFORT 1983) which has been one day before the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982.

6.72 The Pine Hawk-Moth *Hyloicus pinastri,* the Poplar Hawk-Moth *Laothoe populi,* the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* and the Buff Arches *Habrosyne pyritoides*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim in 2007 – 2009, I have not discovered a single individual of the Pine Hawk-Moth *Hyloicus pinastri* LINNAEUS 1758 (Lepidoptera: Sphingidae), the Poplar Hawk-Moth *Laothoe populi* (LINNAEUS 1758) (Lepidoptera: Sphingidae), the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* LINNAEUS 1758 (Lepidoptera: Sphingidae) and the Buff Arches *Habrosyne pyritoides* (HUFNAGEL 1766)

(Lepidoptera: Thyatiridae). I have up to now only seen occasionally a few single individuals of the Pine Hawk-Moth *Hyloicus pinastri,* the Poplar Hawk-Moth *Laothoe populi,* the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* and the Buff Arches *Habrosyne pyritoides* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Pine Hawk-Moth *Hyloicus pinastri,* the Poplar Hawk-Moth *Laothoe populi,* the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* and the Buff Arches *Habrosyne pyritoides* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Significant quantities of individuals of the Buff Arches *Habrosyne pyritoides* have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals and 10 individuals each have flown on 25.06.1993, 17.07.1993 and 30.06.1994, respectively (Broszkus 1996a), which has been five days after the new moon on 20.06.1993, two days before the new moon on 19.07.1993, and one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, respectively; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where more than 5 individuals have flown on 15.07.1994 (Broszkus 1996a) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals each, 10 individuals each and 15 individuals have flown on 01.07.1992, 10.07.1992, 16.07.1993, 06.07.1994 and 11.07.1994, respectively (Broszkus 1996a), which has been one day after the new moon on 30.06.1992, four days before the full moon on 14.07.1992, three days before the new moon on 19.07.1993, and three days before and two days after the new moon on 09.07.1994, respectively; in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 31.07.1981 (Kinkler 1987) which has been on the new moon on 31.07.1981, in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals have flown on 11.07.1982 (Walfort 1983) which has been five days after the full moon on 06.07.1982, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Pine Hawk-Moth *Hyloicus pinastri* have been noticed around Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where abundant individuals each have flown on 20.05.1894, 01.07.1894 and 16.07.1899 (Reichenau 1904) which has been one day after the full moon on 19.05.1894, two days before the new moon on 03.07.1894, and one day before the increasing half moon on 17.07.1899 between the new moon on 07.07.1899 and the full moon on 22.07.1899, respectively; in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 19.05.1993 (Broszkus 1996a) which has been two days before the new moon on 21.05.1993, in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 08.06.1993 (Broszkus 1996a) which has been four days after the full moon on 04.06.1993; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 – 10 individuals each have flown on 09.06.1982, 25.06.1982 and 11.07.1982 (Walfort 1983) which has been three days after the full moon on 06.06.1982, four days after the new moon on 21.06.1982 and five days after the full moon on 06.07.1982, respectively.

Significant quantities of individuals of the Poplar Hawk-Moth *Laothoe populi* have been encounte-

red around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where abt. 5 individuals have flown on 12.05.1892 (REICHENAU 1904) which has been on the full moon on 12.05.1892.

Significant quantities of individuals of the Broad-Bordered Bee Hawk-Moth *Hemaris fuciformis* have been identified around Mainz and Wiesbaden at the northern margin of the Upper Rhine valley in the western part of Germany where numerous individuals have flown on 23.05.1902 (REICHENAU 1904) which has been one day after the full moon on 22.05.1902.

6.73 The Poplar Lutestring *Tethea or,* the Oak Lutestring *Cymatophorima diluta,* the Common Lutestring *Ochropacha duplaris* and the Miller *Acronicta leporina*

Mass occurrences of large quantities of individuals of the Poplar Lutestring *Tethea or* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Thyatiridae) have been reported from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals and 10 individuals have flown on 18.06.1993 and 11.07.1994, respectively (BROSZKUS 1996a), which has been two days before the new moon on 20.06.1993 and two days after the new moon on 09.07.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals have flown on 31.05.1982 (WALFORT 1983) which has been one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, and from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Oak Lutestring *Cymatophorima diluta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Drepanidae) have been mentioned from the Lösseler Heide near Letmathe in the Lenne valley southsoutheast of Dortmund in the northwestern part of Germany where more than 15 individuals have flown on 12.09.1966 (HARKORT & WEIGT 1967) which has been two days before the new moon on 14.09.1966, from Schwelm eastnortheast of Wuppertal in the northwestern part of Germany where more than 100 individuals have flown on 13.09.1969 (HANS-GÜNTHER KAMP & MICHAEL TREIMER in HARKORT 1971) which has been two days after the new moon on 11.09.1969; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals, 25 individuals each and 12 individuals have flown on 20.09.1992, 27.09.1993, 08.10.1993 and 22.09.1994, respectively (BROSZKUS 1996a), which has been on the decreasing half moon on 20.09.1992 between the full moon on 12.09.1992 and the new moon on 26.09.1992, three days before the full moon on 30.09.1993, one day before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and three days after the full moon on 19.09.1994, respectively; and from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals and 40 individuals have flown on 06.10.1993 and 29.09.1994, respectively (BROSZKUS 1996a), which has been three days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and on the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994, respectively.

Mass occurrences of large quantities of individuals of the Common Lutestring *Ochropacha duplaris* (LINNAEUS 1761) (Lepidoptera: Thyatiridae) have been encountered in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days

after the new moon on 09.07.1975, and on the campus of the university in Saarbrücken in the Saar valley in the southern part of the Saar area in the western part of Germany where abt. 30 individuals in total have flown in the period of 14.08.1962 – 29.08.1962 (GEORG MOSBACHER in SCHMIDT-KOEHL 1977) which has been around and between the full moon on 15.08.1962 and the new moon on 30.08.1962.

Mass occurrences of large quantities of individuals of the Miller *Acronicta leporina* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been found in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

6.74 The Frosted Green *Polyploca ridens*, the Ground Lackey *Malacosoma castrensis*, the Dusky Brocade *Apamea remissa*, the Rufous Minor *Oligia versicolor* and the Marbled Minor *Oligia strigilis*

Significant quantities of individuals of the Frosted Green *Polyploca ridens* (FABRICIUS 1787) (Lepidoptera: Thyatiridae) have been recognized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals each and abt. 10 individuals have flown on 21.04.1993, 25.04.1993, 28.04.1993 and 30.04.1994, respectively (BROSZKUS 1996a), which has been on and four days after the new moon on 21.04.1993, two days before the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, and five days after the full moon on 25.04.1994, respectively; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 5 individuals have flown on 12.05.1982 (WALFORT 1983) which has been five days after the full moon on 07.05.1982, and in Flaesheim southeast of Haltern north of Recklinghausen in the northwestern part of Germany where 5 individuals have flown on 09.05.1970 (HEINRICH LINKE in HARKORT 1971) which has been four days after the new moon on 05.05.1970.

Significant quantities of individuals of the Ground Lackey *Malacosoma castrensis* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been identified in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 10.07.1993 and 30.06.1994 (BROSZKUS 1996a) as well as 7 individuals have flown on 28.06.2005 (ROLF MÖRTTER in SCHUMACHER 2006) which has been two days before the decreasing half moon on 12.07.1993 between the full moon on 04.07.1993 and the new moon on 19.07.1993, one day before the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and on the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005, respectively; and in Oberwesel in the Middle Rhine valley southsoutheast of Koblenz in the western part of Germany where 10 individuals have flown on 17.07.1994 (HELMUT KINKLER & HEINZ SCHUMACHER in KINKLER 1994) which has been on the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994.

Significant quantities of individuals of the Dusky Brocade *Apamea remissa* HÜBNER 1809 (Lepidoptera: Noctuidae) have been met in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, and in the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 10.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993.

Significant quantities of individuals of the Rufous Minor *Oligia versicolor* (BORKHAUSEN 1792) (Lepidoptera: Noctuidae) have been found in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Marbled Minor *Oligia strigilis* LINNAEUS 1758 (Lepidoptera: Noctuidae) in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 21.06.1994 and 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before and five days after the full moon on 23.06.1994, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 11.06.1992, 16.06.1992 and 25.06.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and one day after the full moon on 15.06.1992, and five days before the new moon on 30.06.1992, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals have been captured on 02.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992.

6.75 The December Moth *Poecilocampa populi,* the Peach Blossom *Thyatira batis,* the Double Square-Spot *Xestia triangulum* and the Bright-Line Brown-Eye *Lacanobia oleracea*

During my entomological observations at localities in the surroundings of Heidelberg and Mannheim in 2007 – 2009, I have not discovered a single individual of the Peach Blossom *Thyatira batis* LINNAEUS 1758 (Lepidoptera: Thyatiridae). I have up to now only seen occasionally a few single individuals of the Peach Blossom *Thyatira batis* in Mülheim-Kärlich northwest of Koblenz in the Neuwied Basin in the Middle Rhine valley between 1964 and 1972, and in Walldorf between 1972 and 1979. Some examples of mass occurrences of the Peach Blossom *Thyatira batis* are compiled from the results of my evaluation of the literature and are analyzed in the framework of their correlation with the new moon and the full moon as follows.

Mass occurrences of large quantities of individuals of the December Moth *Poecilocampa populi* LINNAEUS 1758 (Lepidoptera: Lasiocampidae) have been registered in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 10 individuals, 15 individuals, 70 individuals, 100 individuals and 15 individuals have flown on 30.10.1992, 04.11.1992, 04.11.1993, 09.11.1993 and 04.11.1994, respectively (BROSZKUS 1996a), which has been five days after the new moon on 25.10.1992, one day after the increasing half moon on 03.11.1992 between the new moon on 25.10.1992 and the full moon on 10.11.1992, five days after the full moon on 30.10.1993, one day after the decreasing half moon on 08.11.1993 between the full moon on 30.10.1993 and the new moon on 13.11.1993, and one day after the new moon on 03.11.1994, respectively; and in the Alster valley around Hamburg in the northwestern part of Germany where abundant individuals have been observed on 23.11.1919 (HANS LOIBL in WARNECKE 1929) which has been one day after the new moon on 22.11.1919.

Significant quantities of individuals of the Peach Blossom *Thyatira batis* have been recognized in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 23.05.1992 (BROSZKUS 1996a) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 indivi-

duals have flown on 19.05.1993 (BROSZKUS 1996a) which has been two days before the new moon on 21.05.1993; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals each have flown on 20.05.1982 and 31.05.1982 (WALFORT 1983) which has been three days before the new moon on 23.05.1982 as well as one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982, respectively; and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where more than 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Double Square-Spot *Xestia triangulum* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been found in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975, and near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994.

Mass occurrences of large quantities of individuals of the Bright-Line Brown-Eye *Lacanobia oleracea* (LINNAEUS 1758) (Lepidoptera: Noctuidae) have been encountered in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 15 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; and in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 16.07.1992 and 30.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 14.07.1992 and one day after the new moon on 29.07.1992, respectively.

6.76 The Chinese Character *Cilix glaucata,* the Raspberry Clearwing *Pennisetia hylaeiformis,* the Reed Leopard *Phragmataecia castaneae* and the Six-Belted Clearwing *Bembecia ichneumoniformis*

Significant quantities of individuals of the Chinese Character *Cilix glaucata* (SCOPOLI 1763) (Lepidoptera: Drepanidae) have been identified in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 28.04.1994 (BROSZKUS 1996a) which has been three days after the full moon on 25.04.1994.

Mass occurrences of large quantities of individuals of the Raspberry Clearwing *Pennisetia hylaeiformis* (LASPEYRES 1801) (Lepidoptera: Sesiidae) have been noticed in Börfink northnorthwest of Birkenfeld in the central part of the Hunsrück in the western part of Germany where 10 individuals have flown and in Kempfeld eastsoutheast of Morbach in the central part of the Hunsrück in the western part of Germany where 15 individuals have flown on 08.08.1993 (BROSZKUS 1996a) which has been three days before the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, and in Heiligenhaus northeast of Düsseldorf in the northwestern part of Germany where more than 15 individuals in total have flown on 09.08.1991 – 13.08.1991 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1992) which has been around the new moon on 10.08.1991.

Mass occurrences of large quantities of individuals of the Reed Leopard *Phragmataecia castaneae*

(Hübner 1790) (Lepidoptera: Cossidae) have been found in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 80 individuals in total have flown in the period of 05.06.1997 – 12.07.1997 (Armin Hemmersbach & Stefan Steegers in Kinkler 1998) and abt. 5 individuals have flown on 24.05.2007 (Rudi Seliger & Stefan Steegers in Schumacher 2008a), respectively, which has been around and between the new moon on 05.06.1997, the full moon on 20.06.1997, the new moon on 04.07.1997, and the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997, as well as one day after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, respectively; in Nettetal-Leuth northnorthwest of Mönchengladbach in the northwestern part of Germany where abt. 5 individuals have flown on 01.06.2007 (Rudi Seliger in Schumacher 2008a) which has been on the full moon on 01.06.2007; and in the district Unterbach at the eastern margin of the city of Düsseldorf where 30 individuals have flown in the period of 04.06.1932 – 12.07.1932 (Horst-Dieter Heider & Karl Oertel in Kinkler, Schmitz, Nippel & Swoboda 1974) which has been around and between the new moon on 04.06.1932, the full moon on 18.06.1932, the new moon on 03.07.1932 and the full moon on 17.07.1932.

Mass occurrences of large quantities of individuals of the Six-Belted Clearwing *Bembecia ichneumoniformis* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Sesiidae) have been encountered in Schwalmtal-Raderberg west of Waldniel westnorthwest of Mönchengladbach in the northwestern part of Germany where 30 individuals in total have flown in the period of 07.08.2005 – 16.08.2005 (Armin Hemmersbach & Rudi Seliger in Schumacher 2006) which has been around and between the new moon on 05.08.2005 as well as the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005, respectively; in Hardt west of Mönchengladbach in the northwestern part of Germany where 15 individuals have flown on 13.08.2005 (Armin Hemmersbach in Schumacher 2006) which has been on the increasing half moon on 13.08.2005 between the new moon on 05.08.2005 and the full moon on 19.08.2005, and in Bedburg-Broich westnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have flown on 05.08.2007 (Armin Duchatsch & Wolfgang Göttlinger in Schumacher 2008a) which has been on the decreasing half moon on 05.08.2007 between the full moon on 30.07.2007 and the new moon on 13.08.2007.

6.77 The Yellow-Legged Clearwing *Synanthedon vespiformis,* the Red-Belted Clearwing *Synanthedon myopaeformis,* the Orange-Tailed Clearwing *Synanthedon andrenaeformis,* the Dale´s Oak Clearwing *Synanthedon conopiformis* and the Cypress Spurge *Chamaephecia empiformis*

Mass occurrences of large quantities of individuals of the Yellow-Legged Clearwing *Synanthedon vespiformis* (Linnaeus 1761) (Lepidoptera: Sesiidae) have been registered in Kempfeld eastsoutheast of Morbach in the central part of the Hunsrück in the western part of Germany where 10 individuals have flown on 08.08.1993 (Broszkus 1996a) which has been three days before the decreasing half moon on 11.08.1993 between the full moon on 02.08.1993 and the new moon on 17.08.1993, and at the Galgenberg near Nutscheid southwest of Waldbröl west of Siegen where more than 5 individuals have flown on 30.07.1991 (Kinkler, Schmitz, Nippel & Swoboda 1992) which has been four days after the full moon on 26.07.1991.

Significant quantities of individuals of the Red-Belted Clearwing *Synanthedon myopaeformis* (Borkhausen 1789) (Lepidoptera: Sesiidae) have been recorded in Idar-Oberstein in the Nahe valley in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 12.06.1992 (Broszkus 1996a) which has been three days before the full moon on 15.06.1992.

Mass occurrences of large quantities of individuals of the Orange-Tailed Clearwing *Synanthedon andrenaeformis* (Laspeyres 1801) (Lepidoptera: Sesiidae) have been identified in Nettersheim southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 50 individuals have flown on 03.07.1994 (Volker Pelz & Heinz Schumacher in Kinkler 1994) which has been two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994.

Significant quantities of individuals of the Dale´s Oak Clearwing *Synanthedon conopiformis* (Esper 1782) (Lepidoptera: Sesiidae) have been found in Treis-Karden eastnortheast of Cochem in the Moselle valley in the western part of Germany where 5 individuals have flown on 03.07.1994 (Volker Pelz & Heinz Schumacher in Kinkler 1994) which has been two days after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994.

Significant quantities of individuals of the Clearwing *Chamaesphecia tenthrediniformis* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Sesiidae) have been met at the mouth of the river Sieg into the river Rhine northwest of Bonn in the northwestern part of Germany where 20 individuals have flown on 22.05.1994 (Volker Pelz in Kinkler 1994) which has been three days before the full moon on 25.05.1994, in the district Beuel in the southeastern part of the city of Bonn in the Middle Rhine valley in the northwestern part of Germany where 12 individuals have flown on 19.05.1997 (Heinz Schumacher in Kinkler 2000) which has been three days before the full moon on 22.05.1997, and in Düsseldorf in the northwestern part of Germany where 5 individuals have flown on 28.05.1997 (M. Derra in Schumacher 2001) which has been two days before the decreasing half moon on 30.05.1997 between the full moon on 22.05.1997 and the new moon on 05.06.1997.

Mass occurrences of large quantities of individuals of the Cypress Spurge *Chamaephecia empiformis* Esper 1783 (Lepidoptera: Sesiidae) have been encountered in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where very abundant individuals have flown on 12.07.1970 (Hans Brochhaus & Willibald Schmitz in Kinkler, Schmitz, Nippel & Swoboda 1974) which has been on the increasing half moon on 12.07.1970 between the new moon on 03.07.1970 and the full moon on 18.07.1970.

6.78 The Dog´s Tooth *Lacanobia suasa*, the Light Brocade *Lacanobia w-latinum*, the Double Dart *Graphiphora augur*, the Triple-Spotted Clay *Xestia ditrapezium* and the Mere Wainscot *Chortodes fluxa*

Significant quantities of individuals of the Dog´s Tooth *Lacanobia suasa* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Noctuidae) have been observed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 17.07.1993 (Broszkus 1996b) which has been two days before the new moon on 19.07.1993.

Significant quantities of individuals of the Light Brocade *Lacanobia w-latinum* (Hufnagel 1766) (Lepidoptera: Noctuidae) have been noticed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 30.04.1993 and 19.05.1993 (Broszkus 1996b) which has been on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, and two days before the new moon on 21.05.1993, respectively.

Significant quantities of individuals of the Double Dart *Graphiphora augur* (Fabricius 1775) (Lepidoptera: Noctuidae) have been encountered in the vicinity of Bürvenich and Berg northwest of

Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981.

Significant quantities of individuals of the Triple-Spotted Clay *Xestia ditrapezium* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been found in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 31.07.1981 (KINKLER 1987) which has been on the new moon on 31.07.1981.

Mass occurrences of large quantities of individuals of the Mere Wainscot *Chortodes fluxa* (HÜBNER 1809) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 12.07.1994 and 19.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days after the new moon on 09.07.1994 and three days before the full moon on 22.07.1994, respectively; from the district Niehl at the northern margin of the city of Cologne where more than 10 individuals have been captured on 01.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the full moon on 04.07.1993, and from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 15.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994.

6.79 The Feathered Ear *Pachetra sagittigera,* the Silver Cloud *Egira conspicillaris,* the Pale-Shouldered Cloud *Actinotia hyperici* and the Marbled Coronet *Hadena confusa*

Significant quantities of individuals of the Feathered Ear *Pachetra sagittigera* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been identified in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 24.05.1993 (BROSZKUS 1996b) which has been three days after the new moon on 21.05.1993.

Mass occurrences of large quantities of individuals of the Silver Cloud *Egira conspicillaris* (LINNAEUS 1758) (Lepidoptera: Noctuidae) have been recognized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, more than 5 individuals and 15 individuals have flown on 11.04.1993, 30.04.1993 and 28.04.1994, respectively (BROSZKUS 1996b), which has been five days after the full moon on 06.04.1993, on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, and three days after the full moon on 25.04.1994, respectively.

Mass occurrences of large quantities of individuals of the Pale-Shouldered Cloud *Actinotia hyperici* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been realized in Finnentrop in the Lenne valley northnortheast of Attendorn in the northwestern part of Germany where abt. 25 individuals in total have flown in the period of 24.07.1995 – 21.08.1995 (BERND SCHMITZ in KINKLER 1996) which has been around and between the new moon on 27.07.1995, the full moon on 10.08.1995 and the new moon on 26.08.1995.

Significant quantities of individuals of the Marbled Coronet *Hadena confusa* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been encountered in Kalenberg southsouthwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where abt. 5 individuals have flown

on 09.07.2006 (SCHUMACHER 2007a) which has been two days before the full moon on 11.07.2006.

6.80 The Barrett´s Marbled Coronet *Hadena luteago*, the Varied Coronet *Hadena compta,* the Shears *Hada plebeja* and the Tawny Shears *Hadena perplexa*

Mass occurrences of large quantities of individuals of the Barrett´s Marbled Coronet *Hadena luteago* (DOUBLEDAY 1864) (Lepidoptera: Noctuidae) have been identified at the Calmont near Bremm in the Moselle valley southsouthwest of Cochem in the western part of Germany where 40 individuals and 10 individuals have flown on 23.05.1990 and 17.06.1990, respectively (WILLIBALD SCHMITZ in KINKLER 1990b), which has been one day before the new moon on 24.05.1990 as well as on the decreasing half moon on 17.06.1990 between the full moon on 08.06.1990 and the new moon on 22.06.1990, respectively.

Significant quantities of individuals of the Barrett´s Marbled Coronet *Hadena luteago* and the Varied Coronet *Hadena compta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals each have flown on 19.05.1993 (BROSZKUS 1996b, J. BEGER in BROSZKUS 1996b) which has been two days before the new moon on 21.05.1993.

Significant quantities of individuals of the Shears *Hada plebeja* LINNAEUS 1761 (Lepidoptera: Noctuidae) have been realized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals each have flown on 21.05.1992 and 08.06.1993 (BROSZKUS 1996b, J. BEGER in BROSZKUS 1996b) which has been five days after the full moon on 16.05.1992 and four days after the full moon on 04.06.1993, respectively.

Mass occurrences of large quantities of individuals of the Tawny Shears *Hadena perplexa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in Bremm in the Moselle valley southsouthwest of Cochem in the western part of Germany where abt. 25 individuals in total have flown in the period of 08.06.2002 – 08.07.2002 (B. NIEMEYER in SCHUMACHER 2003) which has been around and between the new moon on 11.06.2002, the full moon on 24.06.2002 and the new moon on 10.07.2002, and at the Binsfeldhammer southsouthwest of Stolberg east of Aachen in the northwestern part of Germany where 5 individuals have flown on 01.07.2005 – 02.07.2005 (AXEL BLUMBERG, HÖRNIG & LUDGER WIROOKS in SCHUMACHER 2006) which has been four to five days before the new moon on 06.07.2005.

6.81 The Small Quaker *Orthosia cruda,* the Common Quaker *Orthosia stabilis,* the Orange Sallow *Xanthia citrago* and the Centre-Barred Sallow *Atethmia centrago*

Mass occurrences of large quantities of individuals of the Small Quaker *Orthosia cruda* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been observed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 35 individuals, 40 individuals and 10 individuals each have flown on 12.04.1992, 21.04.1993, 08.03.1994, 16.04.1994 and 28.04.1994, respectively (BROSZKUS 1996b), which has been five days before the full moon on 17.04.1992, on the full moon on 08.03.1993, five days after the new moon on 16.04.1994, and three days after the full moon on 25.04.1994, respectively; in Warmsroth west of Bingen in the western part of Germany where 15 individuals have flown on 22.04.1994 (J. BEGER in BROSZKUS 1996b) which has been three days before the full moon on 25.04.1994; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western

part of Germany where 5 individuals, 60 individuals, 45 individuals, abt. 35 individuals, abt. 25 individuals and 100 individuals have flown on 06.05.1992, 31.03.1993, 16.04.1993, 23.04.1993 – 28.04.1993, 10.03.1994 and 30.03.1994, respectively (BROSZKUS 1996b), which has been four days after the new moon on 02.05.1992, one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, five days before the new moon on 21.04.1993, around and between the new moon on 21.04.1993 as well as the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, two days before the new moon on 12.03.1994 and three days after the full moon on 27.03.1994, respectively; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 60 individuals, 70 individuals and 25 individuals have flown on 28.03.1982, 05.04.1982 and 17.04.1982, respectively (WALFORT 1983), which has been three days after the new moon on 25.03.1982, three days before the full moon on 08.04.1982, and on the decreasing half moon on 17.04.1982 between the full moon on 08.04.1982 and the new moon on 23.04.1982, respectively.

Mass occurrences of large quantities of individuals of the Common Quaker *Orthosia stabilis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been noticed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 40 individuals, abt. 20 individuals and more than 10 individuals in total have flown on 21.04.1993, 30.04.1993, and 16.04.1994 and 28.04.1994, respectively (BROSZKUS 1996b), which has been on the new moon on 21.04.1993, on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, five days after the new moon on 11.04.1994 and three days after the full moon on 25.04.1994, respectively; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 15 individuals in total, more than 80 individuals in total and abt. 100 individuals each have flown on 12.05.1992 and 28.05.1992, 23.03.1993 and 31.03.1993, 16.04.1993 – 28.04.1993, and 30.03.1994, respectively (BROSZKUS 1996b), which has been four days before the full moon on 16.05.1992, four days before the new moon on 01.06.1992, on the new moon on 23.03.1993, one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, around and between the decreasing half moon on 14.04.1993 between the full moon on 06.04.1993 and the new moon on 21.04.1993 as well as the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, and three days after the full moon on 27.03.1994, respectively; in the districts Merkenich and Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 13.04.1994 and 24.04.1994 – 25.04.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 11.04.1994 as well as one day before and on the full moon on 25.04.1994, respectively; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 20 individuals and 25 individuals have flown on 22.03.1982 and 28.03.1982, respectively (WALFORT 1983), which has been three days before and three days after the new moon on 25.03.1982, respectively.

Mass occurrences of large quantities of individuals of the Orange Sallow *Xanthia citrago* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been found at the Drachenfels south of Königswinter in the Middle Rhine valley south of Bonn in the northwestern part of Germany where 20 individuals have flown on 19.09.2008 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2009) which has been four days after the full moon on 15.09.2008.

Mass occurrences of large quantities of individuals of the Centre-Barred Sallow *Atethmia centrago* (HAWORTH 1809) (Lepidoptera: Noctuidae) in the Middle Rhine valley in the northwestern part of Germany have been encountered at the Drachenfels south of Königswinter south of Bonn where 15 individuals in total have flown in the period of 09.09.2008 – 19.09.2008 (KLAUS MEYER & HEINZ

SCHUMACHER in SCHUMACHER 2009) which has been around and between the increasing half moon on 07.09.2008 between the new moon on 30.08.2008 and the full moon on 15.09.2008 as well as the decreasing half moon on 22.09.2008 between the full moon on 15.09.2008 and the new moon on 29.09.2008, in Oberkassel southsoutheast of Bonn where 5 individuals have flown on 10.09.2000 (KLAUS MEYER in SCHUMACHER 2001) which has been three days before the full moon on 13.09.2000, in the district Hochkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 30.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, and in the district Weiler at the northern margin of the city of Cologne where more than 10 individuals have been captured on 22.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993.

6.82 The Twin-Spotted Quaker *Orthosia munda,* the Clouded Drab *Orthosia incerta,* the Blossom Underwing *Orthosia miniosa* and the Pale-Lemon Sallow *Xanthia ocellaris*

Mass occurrences of large quantities of individuals of the Twin-Spotted Quaker *Orthosia munda* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 20 individuals have flown on 09.03.1994 (BROSZKUS 1996b) which has been three days before the new moon on 12.03.1994. Mass occurrences of large quantities of individuals of the Quaker *Orthosia caecimacula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been met in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 10 individuals have flown on 05.09.1980 (KINKLER 1987) which has been four days before the new moon on 09.09.1980.

Mass occurrences of large quantities of individuals of the Northern Drab *Orthosia opima* (HÜBNER 1809) (Lepidoptera: Noctuidae) have been found in Niedersfeld north of Winterberg south of Brilon in the northwestern part of Germany where 20 individuals in total have flown on 14.04.2005 and 30.04.2005 (HANS RETZLAFF & RUDI SELIGER in SCHUMACHER 2006) which has been two days before the increasing half moon on 16.04.2005 between the new moon on 08.04.2005 and the full moon on 24.04.2005, and one day before the decreasing half moon on 01.05.2005 between the full moon on 24.04.2005 and the new moon on 08.05.2005, respectively; in Burbach southsoutheast of Siegen in the northwestern part of Germany where 10 individuals have flown on 16.04.2007 (SCHUMACHER 2008a) which has been one day before the new moon on 17.04.2007, in Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 5 individuals have flown on 01.05.1996 (M. DERRA in SCHUMACHER 2001) which has been two days before the full moon on 03.05.1996, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals have flown on 28.03.1982 (WALFORT 1983) which has been three days after the new moon on 25.03.1982.

Mass occurrences of large quantities of individuals of the Clouded Drab *Orthosia incerta* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been recorded in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals each and 30 individuals have flown on 12.04.1992, 30.04.1993 and 09.03.1994, respectively (BROSZKUS 1996b), which has been five days before the full moon on 17.04.1992, on the increasing half moon on 30.04.1993 between the new moon on 21.04.1993 and the full moon on 06.05.1993, and three days before the new moon on 12.03.1994, respectively; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 30 individuals, 15 individuals and 5

individuals have flown on 31.03.1993, 16.04.1993 and 10.03.1994, respectively (BROSZKUS 1996b), which has been one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, five days before the new moon on 21.04.1993 and two days before the new moon on 12.03.1994, respectively; in the district Merkenich at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 13.04.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 11.04.1994; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 40 individuals and 45 individuals have flown on 22.03.1982 and 28.03.1982, respectively (WALFORT 1983), which has been three days before and three days after the new moon on 25.03.1982, respectively.

Mass occurrences of large quantities of individuals of the Blossom Underwing *Orthosia miniosa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in Klotten in the Moselle valley northeast of Cochem in the western part of Germany where more than 15 individuals have flown on 17.03.2002 (KLAUS MEYER in SCHUMACHER 2003) which has been three days after the new moon on 14.03.2002; and in Lasserg northwest of Burgen in the Moselle valley southsoutheast of Münstermaifeld in the western part of Germany where abt. 20 individuals in total have flown on 12.03.2002 and 17.03.2002 (B. NIEMEYER in SCHUMACHER 2003) which has been two days before and three days after the new moon on 14.03.2002, respectively.

Significant quantities of individuals of the Pale-Lemon Sallow *Xanthia ocellaris* (BORKHAUSEN 1792) (Lepidoptera: Noctuidae) have been found in the vicinity of Viersen north of Mönchengladbach in the northwestern part of Germany where abt. 5 individuals have flown on 13.09.2006 – 22.09.2006 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2007a) which has been around and between the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006 as well as the new moon on 22.09.2006, and in Tecklenburg westsouthwest of Osnabrück in the northwestern part of Germany where 10 individuals have been captured on 01.09.1929 (ZIELASKOWSKI 1951) which has been two days before the new moon on 03.09.1929.

6.83 The Hebrew Character *Orthosia gothica,* the Small Angle Shades *Euplexia lonigera,* the Yellow-Line Quaker *Agrochola macilenta* and the Dusky Sallow *Eremobia ochroleuca*

Mass occurrences of large quantities of individuals of the Hebrew Character *Orthosia gothica* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been recognized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 20 individuals in total, 10 individuals, more than 10 individuals in total and 10 individuals have flown on 23.03.1993 and 31.03.1993, 16.04.1993, 23.04.1993 – 25.04.1993, and 30.03.1994, respectively (BROSZKUS 1996b), which has been on the new moon on 23.03.1993, one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, five days before and two to four days after the new moon on 21.04.1993, and three days after the full moon on 27.03.1994, respectively; in the districts Merkenich and Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 13.04.1994 and 24.04.1994 – 25.04.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 11.04.1994 as well as one day before and on the full moon on 25.04.1994, respectively; and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 15 individuals each have flown on 05.04.1982 and 17.04.1982 (WALFORT 1983) which has been three days before the full moon on 08.04.1982, and on the decreasing half moon on 17.04.1982 between the full moon on

08.04.1982 and the new moon on 23.04.1982, respectively.

Significant quantities of individuals of the Small Angle Shades *Euplexia lonigera* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been realized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 08.06.1993 (BROSZKUS 1996b) which has been four days after the full moon on 04.06.1993.

Significant quantities of individuals of the Yellow-Line Quaker *Agrochola macilenta* (HÜBNER 1809) (Lepidoptera: Noctuidae) have been identified in Schloßböckelheim in the Nahe valley west-southwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 06.10.1993 (BROSZKUS 1996b) which has been three days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals have flown on 08.10.1993 (BROSZKUS 1996b) which has been one day before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and in the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 08.12.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the new moon on 03.12.1994.

Mass occurrences of large quantities of individuals of the Dusky Sallow *Eremobia ochroleuca* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 30 individuals have flown on 06.07.2002 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2003) which has been four days before the new moon on 10.07.2002, and at the Korretsberg near Kruft in the southeastern part of the Eifel westnorthwest of Koblenz in the western part of Germany where 10 individuals have flown on 30.06.2003 (KLAUS MEYER in SCHUMACHER 2004a) which has been one day after the new moon on 29.06.2003.

6.84 The Olive *Ipimorpha subtusa,* the Lunar-Spotted Pinion *Cosmia pyralina,* the Lesser-Spotted Pinion *Cosmia affinis,* the Pale Pinion *Lithophane hepatica* and the Green Silver-Lines *Pseudoips prasinana*

Significant quantities of individuals of the Olive *Ipimorpha subtusa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been noticed in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 04.08.1994 (BROSZKUS 1996b) which has been three days before the new moon on 07.08.1994, in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 30.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 29.07.1992, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Lunar-Spotted Pinion *Cosmia pyralina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been documented in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 15.07.1994 (BROSZKUS 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; in Woppenroth south of Kirchberg in the

eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each have flown on 10.07.1992, 16.07.1993, 06.07.1994 and 11.07.1994, and 27.07.1994 (BROSZKUS 1996b) which has been four days before the full moon on 14.07.1992, three days before the new moon on 19.07.1993, three days before and two days after the new moon on 09.07.1994, and five days after the full moon on 22.07.1994, respectively; in the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before and three days after the new moon on 09.07.1994, respectively; and in the district Weiler at the northern margin of the city of Cologne where more than 10 individuals have been captured on 08.07.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days after the full moon on 04.07.1993.

Significant quantities of individuals of the Lesser-Spotted Pinion *Cosmia affinis* LINNAEUS 1767 (Lepidoptera: Noctuidae) have been found at the Rotenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 16.07.2004 (ROLF MÖRTTER in SCHUMACHER 2005a) which has been one day before the new moon on 17.07.2004.

Significant quantities of individuals of the Pale Pinion *Lithophane hepatica* (CLERCK 1759) (Lepidoptera: Noctuidae) have been encountered in the Schwarzbach valley near Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where 7 individuals have flown on 26.06.2006 (SCHUMACHER 2007a) which has been one day after the new moon on 25.06.2006, and near Haltern north of Recklinghausen in the northwestern part of Germany where abt. 5 individuals have flown on 29.06.1963 (HARKORT & WEIGT 1968) which has been on the increasing half moon on 29.06.1963 between the new moon on 21.06.1963 and the full moon on 07.07.1963.

Mass occurrences of large quantities of individuals of the Green Silver-Lines *Pseudoips prasinana* (WARREN 1913) (Lepidoptera: Noctuidae) have been signaled from Dortmund in the northwestern part of Germany where abt. 40 individuals have flown on 05.06.1963 (HARKORT & WEIGT 1968) which has been two days before the full moon on 07.06.1963.

6.85 The Slender Brindle *Apamea scolopacina,* the Clouded Brindle *Apamea epomidion,* the Confused *Apamea furva,* the Clouded-Bordered Brindle *Apamea crenata* and the Treble Lines *Charanyca trigrammica*

Mass occurrences of large quantities of individuals of the Slender Brindle *Apamea scolopacina* (ESPER 1788) (Lepidoptera: Noctuidae) have been registered in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 30 individuals in total have flown in the period of 06.07.1994 – 25.07.1994 (BROSZKUS 1996b) which has been around and between the new moon on 09.07.1994 and the full moon on 22.07.1994, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 5 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982. Mass occurrences of large quantities of individuals of the Brindle *Apamea aquila* have been encountered in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 300 individuals in total have flown in the period of 05.07.2003 – 25.07.2003 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2004a) which has been around and between the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003 as well as the decreasing half moon on 21.07.2003 between the full moon on 13.07.2003 and the new moon on 29.07.2003, and

near Bracht north of Brüggen westnorthwest of Mönchengladbach in the northwestern part of Germany where 30 individuals have flown on 04.08.2003 (ARMIN HEMMERSBACH, KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2004a) which has been one day before the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on 12.08.2003.

Significant quantities of individuals of the Clouded Brindle *Apamea epomidion* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been found in Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 5 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been five days after the full moon on 14.06.2003, and in Oberkassel southsoutheast of Bonn in the Middle Rhine valley in the northwestern part of Germany where 5 individuals have flown on 19.06.1997 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2001) which has been one day before the full moon on 20.06.1997.

Significant quantities of individuals of the Clouded-Bordered Brindle *Apamea crenata* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been signaled from the Balver Wald eastsoutheast of Iserlohn southeast of Dortmund in the northwestern part of Germany where abt. 5 individuals have flown on 07.06.1966 (HARKORT & WEIGT 1968, HEINRICH LINKE in HARKORT & WEIGT 1968) which has been four days after the full moon on 03.06.1966.

Mass occurrences of large quantities of individuals of the Treble Lines *Charanyca trigrammica* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been recorded in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where more than 20 individuals have flown on 23.05.1992 (BROSZKUS 1996b) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992.

Mass occurrences of large quantities of individuals of the Confused *Apamea furva* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been identified in Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where more than 10 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been five days after the full moon on 14.06.2003.

6.86 The Sandhill Rustic *Luperina nickerlii,* the Flounced Rustic *Luperina testacea,* the Vine´s Rustic *Hoplodrina ambigua,* the Powdered Rustic *Hoplodrina superstes* and the Nonconformist *Lithophane lamda*

Mass occurrences of large quantities of individuals of the Sandhill Rustic *Luperina nickerlii* (FREYER 1845) (Lepidoptera: Noctuidae) have been observed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals, 5 individuals each, 12 individuals and abt. 10 individuals have flown on 26.08.1992 (WALTER BROSZKUS in KINKLER 1993, BROSZKUS 1996b), 07.09.1993, 17.09.1993, 03.09.1994 (BROSZKUS 1996b) and 11.09.2004 (ROLF MÖRTTER in SCHUMACHER 2006), respectively, which has been two days before the new moon on 28.08.1992, three days before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, one day after the new moon on 16.09.1993, two days before the new moon on 05.09.1994 and three days before the new moon on 14.09.2004, respectively.

Mass occurrences of large quantities of individuals of the Flounced Rustic *Luperina testacea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been signaled from the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the north-

western part of Germany where more than 10 individuals each have been captured on 02.09.1993, 09.09.1993 and 16.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the full moon on 01.09.1993, one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, and on the new moon on 16.09.1993, respectively.

Mass occurrences of large quantities of individuals of the Vine´s Rustic *Hoplodrina ambigua* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recognized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 30 individuals in total have flown on 21.08.1992 and 26.08.1992 (BROSZKUS 1996b) which has been one day before and four days after the decreasing half moon on 22.08.1992 between the full moon on 13.08.1992 and the new moon on 28.08.1992, respectively; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals in total have flown on 04.08.1994 and 27.08.1994 (BROSZKUS 1996b) which has been three days before the new moon on 07.08.1994, and three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively.

Mass occurrences of large quantities of individuals of the Vine´s Rustic *Hoplodrina ambigua* around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 23.08.1994 and 30.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the full moon on 21.08.1994 as well as on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 15.07.1993, 26.08.1993 and 02.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before the new moon on 19.07.1993, and five days before and one day after the full moon on 01.09.1993, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals have been captured on 27.08.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992, from the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 16.09.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the full moon on 19.09.1994; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 27.08.1992 and 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the new moon on 28.08.1992 and five days before the full moon on 13.08.1992, respectively.

Significant quantities of individuals of the Powdered Rustic *Hoplodrina superstes* (OCHSENHEIMER 1816) (Lepidoptera: Noctuidae) have been found in Rheinbrohl in the Middle Rhine valley northwest of Neuwied in the western part of Germany where 5 individuals and 7 individuals in total have flown on 11.07.1996 and in the period of 23.07.1997 – 04.08.1997, respectively (HERMANN JOSEF HEIMBACH in KINKLER 1998), which has been four days before the new moon on 15.07.1996, and around and between the full moon on 20.07.1997 and the new moon on 03.08.1997, respectively.

Mass occurrences of large quantities of individuals of the Nonconformist *Lithophane lamda* (FABRICIUS 1787) (Lepidoptera: Noctuidae) have been encountered in the Boschbeek valley near Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 25 individuals in total have flown in the period of 22.03.2005 – 12.04.2005 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2006) which has been around and between the full moon on 25.03.2005 and the new moon on 08.04.2005.

6.87 The Mullein Moth *Cucullia dracunculi,* the Sprawler *Asteroscopus sphinx,* the Marbled Beauty *Cryphia domestica,* the Saxon *Hyppa rectilinea* and the Shaded Fan-Foot *Herminia tarsicrinalis*

Mass occurrences of large quantities of individuals of the Mullein Moth *Cucullia dracunculi* (HÜBNER 1813) (Lepidoptera: Noctuidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals and 30 individuals in total have flown on 25.06.1993 (BROSZKUS 1996b) as well as on 14.06.1997 and 12.07.1997 (HEINZ SCHUMACHER in KINKLER 2000), respectively, which has been two days before the increasing half moon on 27.06.1993 between the new moon on 20.06.1993 and the full moon on 04.07.1993, on the increasing half moon on 14.06.1997 between the new moon on 05.06.1997 and the full moon on 20.06.1997, and one day before the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997, respectively; and in Pommern in the Moselle valley eastnortheast of Cochem in the western part of Germany where abt. 5 individuals have flown on 23.07.1988 (FÖRSTER in KINKLER 1990b) which has been on the increasing half moon on 23.07.1988 between the new moon on 14.07.1988 and the full moon on 29.07.1988.

Mass occurrences of large quantities of individuals of the Sprawler *Asteroscopus sphinx* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been recorded in Dierdorf northnorthwest of Montabaur northnortheast of Koblenz in the western part of Germany where abt. 15 individuals have flown on 04.11.2006 (M. DERRA in SCHUMACHER 2007a) which has been one day before the full moon on 05.11.2006, and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals have flown on 11.10.1993 (BROSZKUS 1996b) which has been four days before the new moon on 15.10.1993.

Mass occurrences of large quantities of individuals of the Marbled Beauty *Cryphia domestica* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been found in Wülfrath eastnortheast of Düsseldorf in the northwestern part of Germany where 40 individuals have flown on 19.07.1995 (WILLIBALD SCHMITZ in KINKLER 1997) which has been one day before the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995.

Mass occurrences of large quantities of individuals of the Saxon *Hyppa rectilinea* (ESPER 1788) (Lepidoptera: Noctuidae) have been encountered in the Rohrvenn near Roth north of Prüm in the northwestern part of the Eifel in the western part of Germany where abt. 10 individuals have flown on 14.06.2002 (M. DERRA in SCHUMACHER 2003) which has been three days after the new moon on 11.06.2002.

Mass occurrences of large quantities of individuals of the Shaded Fan-Foot *Herminia tarsicrinalis* (KNOCH 1782) (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the vicinity of the district Dellbrück at the eastern margin of the city of Cologne where more than 10 individuals have been captured on 28.06.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994; and from the Wahner Heide north of Troisdorf southeast of Cologne where more than 10 individuals each have been captured on 23.06.1967, 28.06.1969, 12.07.1969 and 28.06.1986 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the full moon on 22.06.1967, one day before the full moon on 29.06.1969, two days before the new moon on 14.07.1969, and two days before the decreasing half moon on 30.06.1986 between the full moon on 22.06.1986 and the new moon on 07.07.1986, respectively.

Mass occurrences of large quantities of individuals of the noctuid *Phragmatiphila nexa* (HÜBNER 1808) (Lepidoptera: Noctuidae) have been identified in the vicinity of Viersen north of Mönchen-

gladbach in the northwestern part of Germany where 30 individuals in total have flown in the period of 13.09.2006 – 22.09.2006 (ARMIN HEMMERSBACH, RUDI SELIGER & STEFAN STEEGERS in SCHUMACHER 2007a) which has been around and between the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006 as well as the new moon on 22.09.2006, and near Grefrath west of Krefeld in the northwestern part of Germany where more than 5 individuals have flown on 07.09.2007 (M. DERRA in SCHUMACHER 2008a) which has been four days before the new moon on 11.09.2007.

6.88 The Grey Shoulder-Knot *Lithophane ornitopus*, the Minor Shoulder-Knot *Brachylomia viminalis*, the Black-Banded *Polymixis xanthomista* and the Cameo *Polymixis gemmea*

Significant quantities of individuals of the Grey Shoulder-Knot *Lithophane ornitopus* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been reported from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 22.04.1993 (BROSZKUS 1996b) which has been one day after the new moon on 21.04.1993.

Mass occurrences of large quantities of individuals of the Minor Shoulder-Knot *Brachylomia viminalis* (FABRICIUS 1777) (Lepidoptera: Noctuidae) have been documented from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 10 individuals have flown on 15.07.1994 (BROSZKUS 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals in total have flown on 01.07.1994 and 06.07.1994 (BROSZKUS 1996b) which has been on the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and three days before the new moon on 09.07.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 20 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, from the Balver Wald eastsoutheast of Iserlohn southeast of Dortmund in the northwestern part of Germany where abt. 5 individuals have flown on 24.07.1964 (HARKORT & WEIGT 1968) which has been on the full moon on 24.07.1964, and from Letmathe in the Lenne valley southsoutheast of Dortmund where more than 5 individuals have flown on 16.07.1964 (HARKORT & WEIGT 1968) which has been one day before the increasing half moon on 17.07.1964 between the new moon on 09.07.1964 and the full moon on 24.07.1964.

Significant quantities of individuals of the Black-Banded *Polymixis xanthomista* (HÜBNER 1819) (Lepidoptera: Noctuidae) have been mentioned from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals each have flown on 17.09.1993 and 25.09.1994 (BROSZKUS 1996b) which has been one day after the new moon on 16.09.1993, and four days before the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994, respectively; and from Attendorn in the Bigge valley in the northwestern part of Germany where abt. 10 individuals have flown on 15.09.1996 – 21.09.1996 (DIRR in KINKLER 1997) which has been around and between the new moon on 12.09.1996 as well as the increasing half moon on 21.09.1996 between the new moon on 12.09.1996 and the full moon on 27.09.1996.

Significant quantities of individuals of the Cameo *Polymixis gemmea* (TREITSCHKE 1825) (Lepidoptera: Noctuidae) have been found in Eckenhagen westsouthwest of Olpe in the northwestern part of Germany where abt. 5 individuals each have flown on 03.08.1997 (KLAUS MEYER in KINKLER 2000)

and 24.08.1999 (KLAUS MEYER in SCHUMACHER 2001) which has been on the new moon on 03.08.1997 and two days before the full moon on 26.08.1999, respectively; in Wissinghausen east-northeast of Winterberg in the northwestern part of Germany where 5 individuals have flown on 09.08.1997 (ARMIN RADTKE in SCHUMACHER 2002) which has been three days before the increasing half moon on 12.08.1997 between the new moon on 03.08.1997 and the full moon on 18.08.1997, in Reichshof-Wildberg westnorthwest of Siegen in the northwestern part of Germany where 5 individuals have flown on 18.08.2000 (KLAUS MEYER in SCHUMACHER 2001) which has been three days after the full moon on 15.08.2000; in Emmerzhausen eastsoutheast of Daaden and in Gambach near Burbach south of Siegen in the northwestern part of Germany where abt. 12 individuals each have flown on 25.08.2001 and 26.08.2001, respectively (SCHUMACHER 2002), which has been one day before and on the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; and in Perlenbachtal and Fuhrtsbachtal near Monschau in the northwestern part of the Eifel in the northwestern part of Germany where 5 individuals have flown on 12.08.1998 (BERNHARD THEISSEN in SCHUMACHER 2001) which has been four days after the full moon on 08.08.1998.

6.89 The Green-Brindled Descent *Allophyes oxyacanthae,* the Brindled Green *Dryobotodes eremita,* the Beautiful Arches *Blepharita satura* and the Butterbur *Hydraecia petasitis*

Mass occurrences of large quantities of individuals of the Green-Brindled Descent *Allophyes oxyacanthae* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been observed in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 12 individuals in total have flown on 06.10.1993 and 17.10.1993 (BROSZKUS 1996b) which has been three days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and two days after the new moon on 17.10.1993, respectively; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 15 individuals and more than 5 individuals in total have flown on 08.10.1993 as well as on 22.09.1994 and 25.09.1994, respectively (BROSZKUS 1996b), which has been one day before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, three days after the full moon on 19.09.1994, and four days before the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994, respectively; and in the district Rodenkirchen at the southern margin of the city of Cologne where more than 10 individuals have been captured on 04.11.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 03.11.1994.

Mass occurrences of large quantities of individuals of the Brindled Green *Dryobotodes eremita* (FABRICIUS 1775) (Lepidoptera: Noctuidae) have been found in the Lüsekamp region near Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where more than 70 individuals in total have flown in the period of 18.09.2004 – 23.10.2004 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2005a) which has been around and between the new moon on 14.09.2004, the full moon on 28.09.2004, the new moon on 14.10.2004 and the full moon on 28.10.2004.

Significant quantities of individuals of the Beautiful Arches *Blepharita satura* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recognized in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 27.08.1994 (BROSZKUS 1996b) which has been three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994.

Mass occurrences of large quantities of individuals of the Butterbur *Hydraecia petasitis* (Doubleday 1847) (Lepidoptera: Noctuidae) have been identified near Marmagen westsouthwest of Nettersheim south of Mechernich in the northwestern part of the Eifel in the western part of Germany where more than 30 individuals in total have flown in the period of 23.08.2004 – 10.09.2004 (Armin Hemmersbach, Klaus Meyer, Heinz Schumacher & Rudi Seliger in Schumacher 2005a) which has been around and between the increasing half moon on 23.08.2004 between the new moon on 16.08.2004 and the full moon on 30.08.2004 as well as the decreasing half moon on 06.09.2004 between the full moon on 30.08.2004 and the new moon on 14.09.2004.

6.90 The Satellite *Eupsilia transversa,* the Chestnut *Conistra vaccinii,* the Marsh Moth *Athetis gluteosa,* the Bordered Gothic *Heliophobus reticulata* and the White-Marked *Cerastis leucographa*

Mass occurrences of large quantities of individuals of the Satellite *Eupsilia transversa* (Hufnagel 1766) (Lepidoptera: Noctuidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 27.09.1992 (Broszkus 1996b) which has been one day after the new moon on 26.09.1992; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 30 individuals and more than 15 individuals in total have flown on 31.03.1993 as well as on 16.04.1993 and 21.04.1993, respectively (Broszkus 1996b), which has been one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, and five days before and on the new moon on 21.04.1993, respectively; in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 25 individuals have flown on 13.03.1981 (Kinkler 1987) which has been one day before the increasing half moon on 14.03.1981 between the new moon on 06.03.1981 and the full moon on 20.03.1981; and near Wetter in the Ruhr valley southsouthwest of Dortmund in the northwestern part of Germany where more than 100 individuals daily have flown on most of the evenings in the period of 18.10.1954 – 10.11.1954 (Harkort & Weigt 1968) which has been around and between the full moon on 12.10.1954, the new moon on 26.10.1954 and the full moon on 10.11.1954.

Mass occurrences of large quantities of individuals of the Chestnut *Conistra vaccinii* Linnaeus 1761 (Lepidoptera: Noctuidae) have been recorded near Wetter in the Ruhr valley southsouthwest of Dortmund in the northwestern part of Germany where abt. 400 individuals have flown on 17.10.1954 (Harkort & Weigt 1968) which has been five days after the full moon on 12.10.1954, in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 21.04.1993 (Broszkus 1996b) which has been on the new moon on 21.04.1993; and in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals, more than 60 individuals in total, more than 20 individuals in total and more than 50 individuals in total have flown on 27.09.1992, 23.03.1993 and 31.03.1993, 16.04.1993 and 28.04.1993, and 08.10.1993 and 11.10.1993, respectively (Broszkus 1996b), which has been one day after the new moon on 26.09.1992, on the new moon on 23.03.1993, one day before the increasing half moon on 01.04.1993 between the new moon on 23.03.1993 and the full moon on 06.04.1993, five days before the new moon on 21.04.1993, two days before the increasing half moon on 30.04.1993 between the new moon on 21.03.1993 and the full moon on 06.05.1993, one day before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and four days before the new moon on 15.10.1993, respectively.

Significant quantities of individuals of the Marsh Moth *Athetis gluteosa* (Treitschke 1835) (Lepido-

ptera: Noctuidae) have been found in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 12.07.1997 (HEINZ SCHUMACHER in KINKLER 2000) which has been one day before the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997.

Mass occurrences of large quantities of individuals of the Bordered Gothic *Heliophobus reticulata* (GOEZE 1781) (Lepidoptera: Noctuidae) have been encountered in Dahlem southwest of Blankenheim northnorthwest of Daun in the northwestern part of the Eifel in the western part of Germany where 30 individuals each have flown on 07.06.2004 and 11.06.2004 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2005a) which has been four days after the full moon on 03.06.2004 as well as two days after the decreasing half moon on 09.06.2004 between the full moon on 03.06.2004 and the new moon on 17.06.2004, respectively; and near Haltern north of Recklinghausen in the northwestern part of Germany where abt. 5 individuals have flown on 29.06.1963 (HARKORT & WEIGT 1968) which has been on the increasing half moon on 29.06.1963 between the new moon on 21.06.1963 and the full moon on 07.07.1963.

Mass occurrences of large quantities of individuals of the White-Marked *Cerastis leucographa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been signaled from the Hünxener Chaussee near Kirchhellen north of Bottrop in the northwestern part of Germany where more than 20 individuals in total have flown on 03.08.1936 – 08.08.1936 (FUST in ZIELASKOWSKI 1951) which has been on and several days after the full moon on 03.08.1936, and from the vicinity of Dortmund in the northwestern part of Germany where abt. 5 individuals have flown on 05.05.1967 (HARKORT & WEIGT 1968) which has been four days before the new moon on 09.05.1967.

6.91 The Flame *Axylia putris,* the Nut-Tree Tussock *Colocasia coryli,* the Nun or Monk Moth *Panthea coenobita,* the Dark Brocade *Blepharita adusta* and the Angle-Striped Sallow *Enargia paleacea*

Mass occurrences of large quantities of individuals of the Flame *Axylia putris* LINNAEUS 1761 (Lepidoptera: Noctuidae) around and within the city of Cologne in the Middle Rhine valley in the northwestern part of Germany have been signaled from the district Holweide at the eastern margin of the city of Cologne where more than 10 individuals each have been captured on 28.06.1994, 05.07.1994 and 12.07.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been five days after the full moon on 23.06.1994, and four days before and three days after the new moon on 09.07.1994, respectively; from the districts Merkenich and Niehl at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 10.06.1993 and 17.06.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been three days before the decreasing half moon on 13.06.1993 between the full moon on 04.06.1993 and the new moon on 20.06.1993 as well as three days before the new moon on 20.06.1993, respectively; from the district Rheinkassel at the northern margin of the city of Cologne where more than 10 individuals each have been captured on 26.05.1992, 16.06.1992, 25.06.1992, 02.07.1992 and 09.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, one day after the full moon on 15.06.1992, one day after the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, and two days after the new moon on 30.06.1992, respectively; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne where more than 10 individuals each have been captured on 02.07.1992, 16.07.1992 and 30.07.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been two days after the new moon on 30.06.1992, two days after the full moon on 14.07.1992 and one day after the new moon on 29.07.1992, respec-

tively.

Mass occurrences of large quantities of individuals of the Flame *Axylia putris* have also been recognized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals have flown on 25.06.1993 (Broszkus 1996b) which has been five days after the new moon on 20.06.1993; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 5 individuals and more than 15 individuals in total have flown on 09.06.1992 as well as on 08.06.1993 and 18.06.1993, respectively (Broszkus 1996b), which has been one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, four days after the full moon on 04.06.1993 and two days before the new moon on 20.06.1993, respectively; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 25.06.1982 (Walfort 1983) which has been four days after the new moon on 21.06.1982, and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where 10 individuals have flown on 12.07.1975 – 13.07.1975 (Kinkler & Swoboda 1982) which has been three and four days after the new moon on 09.07.1975.

Mass occurrences of large quantities of individuals of the Nut-Tree Tussock *Colocasia coryli* Linnaeus 1758 (Lepidoptera: Noctuidae) have been identified in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where more than 15 individuals in total have flown on 11.05.1993 and 24.05.1993 (Broszkus 1996b) which has been five days after the full moon on 06.05.1993 and three days after the new moon on 21.05.1993, respectively; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where more than 25 individuals have flown on 14.05.1982 (Walfort 1983) which has been three days before the decreasing half moon on 17.05.1982 between the full moon on 07.05.1982 and the new moon on 23.05.1982, and near Bottrop northeast of Duisburg in the northwestern part of Germany where numerous individuals have flown on 17.04.1948 (Zielaskowski 1951, Fust & Meise in Zielaskowski 1951) which has been on the increasing half moon on 17.04.1948 between the new moon on 09.04.1948 and the full moon on 23.04.1948.

Significant quantities of individuals of the Nun or Monk Moth *Panthea coenobita* (Esper 1785) (Lepidoptera: Noctuidae) have been found in Valwig in the Moselle valley east of Cochem in the western part of Germany where 7 individuals have flown on 20.07.1995 (Linke in Kinkler 1996) which has been on the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995; and in the Balver Wald eastsoutheast of Iserlohn southeast of Dortmund in the northwestern part of Germany where abt. 5 individuals and more than 10 individuals in total have flown on 13.07.1963 and in the period of 05.06.1966 – 12.06.1966, respectively (Harkort & Weigt 1968), which has been two days before the decreasing half moon on 15.07.1963 between the full moon on 07.07.1963 and the new moon on 20.07.1963, and around and between the full moon on 03.06.1966 as well as the decreasing half moon on 12.06.1966 between the full moon on 03.06.1966 and the new moon on 18.06.1966, respectively.

Significant quantities of individuals of the Dark Brocade *Blepharita adusta* (Esper 1790) (Lepidoptera: Noctuidae) have been encountered in the Schwarzbach valley near Heinsberg southeast of Kirchhundem south of Lennestadt in the northwestern part of Germany where 5 individuals have been observed in the period of 17.05.2002 – 17.06.2002 (Klaus Meyer in Schumacher 2003) which has been around and between the new moon on 12.05.2002, the full moon on 26.05.2002 and the new moon on 11.06.2002.

Significant quantities of individuals of the Angle-Striped Sallow *Enargia paleacea* (Esper 1788) (Lepidoptera: Noctuidae) have been signaled from Haltern north of Recklinghausen in the north-

western part of Germany where abt. 5 individuals have flown on 06.08.1964 (HARKORT & WEIGT 1968) which has been one day before the new moon on 07.08.1964.

6.92 The Figure of Eight *Diloba caeruleocephala,* the Oak Nycteoline *Nycteola revayana*, the Frosted Orange *Gortyna flavago,* the Suspected *Parastichtis suspecta* and the Feathered Gothic *Tholera decimalis*

Mass occurrences of large quantities of individuals of the Figure of Eight *Diloba caeruleocephala* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been reported from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals and abt. 10 individuals in total have flown on 08.10.1992 as well as on 06.10.1993 and 17.10.1993, respectively (BROSZKUS 1996b), which has been three days before the full moon on 11.10.1992, three days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and two days after the new moon on 15.10.1993, respectively; from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 20 individuals, 10 individuals and 15 individuals have flown on 08.10.1993, 11.10.1993 and 13.10.1994, respectively (BROSZKUS 1996b), which has been one day before and two days after the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and one day after the increasing half moon on 12.10.1994 between the new moon on 05.10.1994 and the full moon on 19.10.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 7 individuals have flown on 16.10.1982 (WALFORT 1983) which has been one day before the new moon on 17.10.1982, and from Ennepetal eastnortheast of Wuppertal in the northwestern part of Germany where 8 individuals have flown on 10.10.1970 (HANS-GÜNTHER KAMP & MICHAEL TREIMER in HARKORT 1971) which has been four days before the full moon on 14.10.1970.

Mass occurrences of large quantities of individuals of the Oak Nycteoline *Nycteola revayana* (SCOPOLI 1772) (Lepidoptera: Noctuidae) have been mentioned from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 5 individuals and 10 individuals have flown on 22.06.1992 and 25.06.1993, respectively (BROSZKUS 1996b), which has been two days before the decreasing half moon on 24.06.1992 between the full moon on 15.06.1992 and the new moon on 30.06.1992, and five days after the new moon on 20.06.1993, respectively.

Mass occurrences of large quantities of individuals of the Frosted Orange *Gortyna flavago* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 10 individuals have flown on 30.09.1981 (WALFORT 1983) which has been two days after the new moon on 28.09.1981.

Significant quantities of individuals of the Suspected *Parastichtis suspecta* (HÜBNER 1817) (Lepidoptera: Noctuidae) have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 11.07.1982 (WALFORT 1983) which has been five days after the full moon on 06.07.1982, and near Wetter in the Ruhr valley southsouthwest of Dortmund where more than 10 individuals in total have been captured in the period of 28.07.1954 – 06.08.1954 (HARKORT & WEIGT 1968) which has been around and between the new moon on 30.07.1954 as well as the increasing half moon on 07.08.1954 between the new moon on 30.07.1954 and the full moon on 14.08.1954.

Mass occurrences of large quantities of individuals of the Feathered Gothic *Tholera decimalis*

(Poda 1761) (Lepidoptera: Noctuidae) have been signaled from the district Niehl at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 09.09.1993 and 16.09.1993 (Wipking, Forst, Kuhna & Schmitz 1996) which has been one day before the decreasing half moon on 10.09.1993 between the full moon on 01.09.1993 and the new moon on 16.09.1993, and on the new moon on 16.09.1993, respectively; and from the district Hochkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 13.09.1994 (Wipking, Forst, Kuhna & Schmitz 1996) which has been on the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994.

6.93 The Poplar Grey *Acronicta megacephala,* the Sycamore *Acronicta aceris,* the Light Knot Grass *Acronicta menyanthidis,* the Marsh Dagger *Acronicta strigosa* and the Knot Grass *Acronicta rumicis*

Mass occurrences of large quantities of individuals of the Poplar Grey *Acronicta megacephala* Schiffermüller (in Denis & Schiffermüller 1775) (Lepidoptera: Noctuidae) have been documented from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 10 individuals have flown on 18.05.1993 (Broszkus 1996b) which has been three days before the new moon on 21.05.1993, from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 29.07.1992 (Broszkus 1996b) which has been on the new moon on 29.07.1992; and from the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 16.07.1992, 30.07.1992, 05.08.1992 and 12.08.1992 (Wipking, Forst, Kuhna & Schmitz 1996) which has been two days after the full moon on 14.07.1992, one day after the new moon on 29.07.1992, one day before the increasing half moon on 06.08.1992 between the new moon on 29.07.1992 and the full moon on 13.08.1992, and one day before the full moon on 13.08.1992, respectively.

Mass occurrences of large quantities of individuals of the Sycamore *Acronicta aceris* Linnaeus 1758 (Lepidoptera: Noctuidae) have been confirmed from Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 12 individuals in total have flown on 19.05.1993 and 27.05.1993 (Broszkus 1996b) which has been two days before the new moon on 21.05.1993, and two days before the increasing half moon on 29.05.1993 between the new moon on 21.05.1993 and the full moon on 04.06.1993, respectively.

Mass occurrences of large quantities of individuals of the Light Knot Grass *Acronicta menyanthidis* (Esper 1879) (Lepidoptera: Noctuidae) have been found in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 50 individuals in total and abt. 5 individuals each have flown in the period of 17.05.1997 – 12.07.1997 (Armin Hemmersbach & Stefan Steegers in Kinkler 1998) as well as on 27.05.2002 (Armin Hemmersbach, Klaus Meyer & Heinz Schumacher in Schumacher 2003) and 23.04.2007 and 24.05.2007 (Hans Retzlaff, Rudi Seliger & Stefan Steegers in Schumacher 2008a), respectively, which has been from five days before the full moon on 22.05.1997 until one day before the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997, one day after the full moon on 26.05.2002, one day before the increasing half moon on 24.04.2007 between the new moon on 17.04.2007 and the full moon on 02.05.2007, and one day after the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, respectively.

Mass occurrences of large quantities of individuals of the Marsh Dagger *Acronicta strigosa* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered near Schalkenmehren and near Strohn southsoutheast of Daun in the northwestern part of the Eifel in the western part of Germany where 10 individuals each have flown on 07.06.2003 (HERMANN JOSEF HEIMBACH, SCHMIDT & HEINZ SCHUMACHER in SCHUMACHER 2004a) which has been on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, and near Willebadessen southeast of Paderborn in the northwestern part of Germany where more than 5 individuals have flown on 15.06.2002 (RUDOLF PÄHLER in SCHUMACHER 2004a) which has been four days after the new moon on 11.06.2002.

Mass occurrences of large quantities of individuals of the Knot Grass *Acronicta rumicis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been signaled from Witten in the Ruhr valley southwest of Dortmund in the northwestern part of Germany where abt. 25 individuals have flown and have sit on stems of trees on 08.05.1945 (HARKORT & WEIGT 1968) which has been three days before the new moon on 11.05.1945.

6.94 The Gold Spot *Plusia festucae*, the Beautiful Golden Y *Autographa pulchrina*, the Concolourous *Chortodes extrema* and the Small Wainscot *Chortodes pygmina*

Mass occurrences of large quantities of individuals of the Gold Spot *Plusia festucae* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been registered in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where 15 individuals have flown on 04.08.1994 (BROSZKUS 1996b) which has been three days before the new moon on 07.08.1994.

Significant quantities of individuals of the Beautiful Golden Y *Autographa pulchrina* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been recorded in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 15 individuals in total have flown in the period of 08.06.1993 – 30.06.1993 (BROSZKUS 1996b) which has been around and between the full moon on 04.06.1993, the new moon on 20.06.1993 and the full moon on 04.07.1993.

Mass occurrences of large quantities of individuals of the Concolourous *Chortodes extrema* (HÜBNER 1809) (Lepidoptera: Noctuidae) have been found in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 20 individuals in total have flown on 05.06.1998 and 18.06.1998 (KLAUS MEYER & HEINZ SCHUMACHER in KINKLER 2000) which has been two days after the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, and on the decreasing half moon on 18.06.1998 between the full moon on 10.06.1998 and the new moon on 24.06.1998, respectively; and in Rheidt southsoutheast of Niederkassel northnorthwest of Bonn in the Middle Rhine valley in the northwestern part of Germany where 12 individuals have flown on 14.06.2004 (SCHUMACHER 2005a) which has been three days before the new moon on 17.06.2004.

Mass occurrences of large quantities of individuals of the Small Wainscot *Chortodes pygmina* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in Lavesum northnorthwest of Haltern north of Recklinghausen in the northwestern part of Germany where more than 10 individuals have flown on 30.08.2002 (LOTHAR PODSADLOWSKI & WERNER STELLMACH in SCHUMACHER 2003) which has been one day after the decreasing half moon on 29.08.2002 between the full moon on 21.08.2002 and the new moon on 07.09.2002, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 10 individuals have flown on 12.09.1981 (WALFORT 1983) which has been two days before the full moon on 14.09.1981.

6.95 The Flounced Chestnut *Agrochola helvola*, the Brown-Spot Pinion *Agrochola litura,* the Red-Line Quaker *Agrochola lota* and the Tawny Pinion *Lithophane semibrunnea*

Significant quantities of individuals of the Flounced Chestnut *Agrochola helvola* LINNAEUS 1758 (Lepidoptera: Noctuidae) and the Brown-Spot Pinion *Agrochola litura* LINNAEUS 1761 (Lepidoptera: Noctuidae) have been recognized in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 06.10.1993 (BROSZKUS 1996b) which has been three days before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993. Significant quantities of individuals of the Brown-Spot Pinion *Agrochola litura* have also been found near Letmathe-Lössel in the Lenne valley southsoutheast of Dortmund in the northwestern part of Germany where more than 5 individuals have flown on 12.09.1966 (HARKORT & WEIGT 1968) which has been two days before the new moon on 14.09.1966.

Significant quantities of individuals of the Red-Line Quaker *Agrochola lota* (CLERCK 1759) (Lepidoptera: Noctuidae) have been confirmed in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 08.10.1993 (BROSZKUS 1996b) which has been one day before the decreasing half moon on 09.10.1993 between the full moon on 30.09.1993 and the new moon on 15.10.1993, and near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 04.11.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 03.11.1994.

Mass occurrences of large quantities of individuals of the Quaker *Agrochola laevis* (HÜBNER 1803) (Lepidoptera: Noctuidae) have been found at the Rotenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where 80 individuals and 5 individuals have flown on 26.09.1997 (VOLKER PELZ in KINKLER 1998) and 13.09.2006 (B. NIEMEYER in SCHUMACHER 2007a), respectively, which has been five days before the new moon on 01.10.1997, and one day before the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006, respectively; and in Altenbamberg in the Alsenz valley south of Bad Münster am Stein southsouthwest of Bad Kreuznach in the southwestern part of Germany where 100 individuals each have flown on 18.09.1997 (VOLKER PELZ in KINKLER 1998) and 20.09.1997 (SCHUMACHER 2001) which has been two and four days after the full moon on 16.09.1997, respectively.

Mass occurrences of large quantities of individuals of the Tawny Pinion *Lithophane semibrunnea* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in Grevenbroich northwest of Cologne in the northwestern part of Germany where 10 individuals have flown on 20.09.1997 (M. DERRA in SCHUMACHER 2001) which has been four days after the full moon on 16.09.1997.

6.96 The Burnished Brass *Diachrysia chrysitis,* the Dark Spectacle *Abrostola triplasia,* the Burren Green *Calamia tridens,* the Small Rufous *Coenobia rufa* and the Antler Moth *Cerapteryx graminis*

Mass occurrences of large quantities of individuals of the Burnished Brass *Diachrysia chrysitis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been reported from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals, 10 individuals in total, abt. 15 individuals in total, abt. 10 individuals and abt. 20 individuals in total have

flown on 20.06.1992, in the period of 01.07.1992 – 29.07.1992, in the period of 08.06.1993 – 30.06.1993, on 20.06.1994 and in the period of 01.07.1994 – 27.07.1994, respectively (BROSZKUS 1996b), which has been five days after the full moon on 15.06.1992; around and between the new moon on 30.06.1992, the full moon on 14.07.1992 and the new moon on 29.07.1992; around and between the full moon on 04.06.1993, the new moon on 20.06.1993 and the full moon on 04.07.1993; three days before the full moon on 23.06.1994; and around and between the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994 as well as the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, respectively; from Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where abt. 5 individuals have flown on 25.06.1982 (WALFORT 1983) which has been four days after the new moon on 21.06.1982, from the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where more than 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975; and from the vicinity of Satrup southeast of Flensburg in the northwestern part of Germany where numerous individuals each have flown around plants on 11.09.1926 – 13.09.1926 and 18.09.1927 (LICHTWERK in WARNECKE 1932) which has been several days after the new moon on 07.09.1926, and one day before the decreasing half moon on 19.09.1927 between the full moon on 11.09.1927 and the new moon on 25.09.1927, respectively.

Significant quantities of individuals of the Dark Spectacle *Abrostola triplasia* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been mentioned from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 5 individuals have flown on 01.07.1994 – 11.07.1994 (BROSZKUS 1996b) which has been around and between the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994 as well as the new moon on 09.07.1994, and from the vicinity of Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where abt. 5 individuals have flown on 04.08.2002 – 06.08.2002 (ERWIN SEFRIN in HASSELBACH 2003) which has been two to four days before the new moon on 08.08.2002. Significant quantities of individuals of the Spectacle *Abrostola asclepiades* have been notified from Rheinbrohl in the Middle Rhine valley northwest of Neuwied in the western part of Germany where 7 individuals in total have flown on 19.06.1995 – 24.06.1995 (HERMANN JOSEF HEIMBACH in KINKLER 1996) which has been around and between the decreasing half moon on 20.06.1995 between the full moon on 13.06.1995 and the new moon on 27.06.1995 as well as the new moon on 27.06.1995.

Mass occurrences of large quantities of individuals of the Burren Green *Calamia tridens* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) have been recognized in Rheinbrohl in the Middle Rhine valley northwest of Neuwied in the western part of Germany where abt. 100 individuals in total have flown in the period of 29.07.1995 – 19.08.1995 (HERMANN JOSEF HEIMBACH in KINKLER 1996) which has been around and between the new moon on 27.07.1995, the full moon on 10.08.1995 and the new moon on 26.08.1995; and in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where 15 individuals have flown on 18.07.2003 (SCHUMACHER 2004a) which has been five days after the full moon on 13.07.2003.

Mass occurrences of large quantities of individuals of the Small Rufous *Coenobia rufa* (HAWORTH 1809) (Lepidoptera: Noctuidae) have been encountered in Reken southsouthwest of Coesfeld in the northwestern part of Germany where abt. 15 individuals have flown on 21.07.2006 (B. NIEMEYER & LILIENTHAL in SCHUMACHER 2007a) which has been three days before the new moon on 24.07.2006, and in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where abt. 5 individuals have flown on 10.08.2007 (HANS RETZLAFF & RUDI SELIGER in SCHUMACHER 2008a) which has been three days before the new moon on 13.08.2007.

Mass occurrences of large quantities of individuals of the Antler Moth *Cerapteryx graminis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been signaled from Haltern north of Recklinghausen in the northwestern part of Germany where more than 30 individuals have flown on 06.08.1964 (HARKORT & WEIGT 1968) which has been one day before the new moon on 07.08.1964.

6.97 The Common Fan-Foot *Pechipogo strigilata*, the Small Fan-Foot *Herminia nemoralis*, the Large Ranunculus *Polymixis flavicincta* and the Brick *Agrochola circellaris*

Mass occurrences of large quantities of individuals of the Common Fan-Foot *Pechipogo strigilata* (CLERCK 1759) (Lepidoptera: Noctuidae) have been documented from Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 10 individuals have flown on 23.05.1992 (BROSZKUS 1996b) which has been two days before the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, from Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 19.06.2003 (ANDREAS WERNO in SCHUMACHER 2005a) which has been five days after the full moon on 14.06.2003; and from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals each and abt. 30 individuals in total have flown on 25.05.1992, 09.06.1992 and 24.05.1993 as well as in the period of 08.06.1993 – 30.06.1993, respectively (BROSZKUS 1996b), which has been on the decreasing half moon on 25.05.1992 between the full moon on 16.05.1992 and the new moon on 01.06.1992, one day after the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992, three days after the new moon on 21.05.1993; and around and between the full moon on 04.06.1993, the new moon on 20.06.1993 and the full moon on 04.07.1993.

Significant quantities of individuals of the Small Fan-Foot *Herminia nemoralis* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been verified from Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals in total have flown on 08.06.1993 and 30.06.1993 (BROSZKUS 1996b) which has been four days after the full moon on 04.06.1993 and four days before the full moon on 04.07.1993, respectively.

Significant quantities of individuals of the Large Ranunculus *Polymixis flavicincta* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been encountered at the Götzenfels near Traisen northwest of Bad Münster am Stein in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals have flown on 09.10.2007 (B. NIEMEYER in SCHUMACHER 2008a) which has been two days before the new moon on 11.10.2007, and in Valwig in the Moselle valley east of Cochem in the western part of Germany where 7 individuals have flown on 12.10.2007 (KLAUS MEYER in SCHUMACHER 2008a) which has been one day after the new moon on 11.10.2007.

Significant quantities of individuals of the Brick *Agrochola circellaris* (HUFNAGEL 1766) (Lepidoptera: Noctuidae) in the northwestern part of Germany have been found in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel where abt. 5 individuals have flown on 30.09.1981 (WALFORT 1983) which has been two days after the new moon on 28.09.1981, near the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on 04.11.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 03.11.1994, and in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley where more than 10 individuals have been captured on

09.12.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been six days after the new moon on 03.12.1994.

6.98 The Snout *Hypena proboscidalis,* the Green-Brindled Dot *Valeria oleagina,* the Spotted Sulphur *Emmelia trabealis,* the Straw Dot *Rivula sericealis* and the Mother Shipton *Callistege mi*

Significant quantities of individuals of the Snout *Hypena proboscidalis* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been registered in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where abt. 5 individuals each have flown on 26.08.1992 (BROSZKUS 1996b) which has been two days before the new moon on 28.08.1992; in Fischbach in the Nahe valley eastnortheast of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where abt. 10 individuals in total have flown on 15.07.1994 and 27.07.1994 (BROSZKUS 1996b) which has been two days before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994, and five days after the full moon on 22.07.1994, respectively; in Woppenroth south of Kirchberg in the eastern part of the Hunsrück in the western part of Germany where abt. 10 individuals in total each have flown on 01.07.1992 and 29.07.1992, 02.08.1992 and 29.08.1992, 08.06.1993 and 18.06.1993, 16.07.1993 and 29.07.1993, and 27.08.1994, respectively (BROSZKUS 1996b), which has been one day after the new moon on 30.06.1992, on and four days after the new moon on 29.07.1992, one day after the new moon on 28.08.1992, four days after the full moon on 04.06.1993, two days before the new moon on 20.06.1993, three days before the new moon on 19.07.1993, four days before the full moon on 02.08.1993, and three days before the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994, respectively; in the vicinity of Bürvenich and Berg northwest of Mechernich in the northwestern part of the Eifel in the western part of Germany where 15 individuals have flown on 07.07.1981 (KINKLER 1987) which has been three days before the increasing half moon on 10.07.1981 between the new moon on 01.07.1981 and the full moon on 17.07.1981; in the district Weiler at the northern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 22.09.1993 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day before the increasing half moon on 23.09.1993 between the new moon on 16.09.1993 and the full moon on 30.09.1993, in the Worringer Bruch south of Dormagen northnorthwest of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have been captured on 08.09.1992 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been four days before the full moon on 12.09.1992, and in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 20 individuals and abt. 15 individuals have flown on 08.09.1981 and 12.09.1981, respectively (WALFORT 1983), which has been one day after the increasing half moon on 07.09.1981 between the new moon on 29.08.1981 and the full moon on 14.09.1981 as well as two days before the full moon on 14.09.1981, respectively.

Significant quantities of individuals of the Green-Brindled Dot *Valeria oleagina* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been recorded in Lasserg northwest of Burgen in the Moselle valley southsoutheast of Münstermaifeld in the western part of Germany where 10 individuals have flown on 13.03.1990 (BERND SCHMITZ in KINKLER 1990b) which has been two days after the full moon on 11.03.1990; in Klotten in the Moselle valley northeast of Cochem in the western part of Germany where more than 10 individuals and 7 individuals have flown on 17.03.2002 (KLAUS MEYER in SCHUMACHER 2003) and 28.03.2007 (B. NIEMEYER in SCHUMACHER 2008a), respectively, which has been three days after the new moon on 14.03.2002, and three days after the increasing half moon on 25.03.2007 between the new moon on 19.03.2007 and the full

moon on 02.04.2007, respectively; and in Kamp-Bornhofen eastsoutheast of Boppard in the Middle Rhine valley south of Koblenz in the western part of Germany where more than 5 individuals each have flown on 03.04.1987 and 14.04.1987 (GOERGENS in KINKLER 1989c) which has been five days after the new moon on 29.03.1987 and on the full moon on 14.04.1987, respectively. Significant quantities of individuals of the Jaspis-Brindled Dot *Valeria jaspidea* have been found in Schloßböckelheim in the Nahe valley westsouthwest of Bad Kreuznach in the southwestern part of Germany where more than 5 individuals have flown on 09.03.1997 (HEINZ SCHUMACHER in KINKLER 2000) which has been on the new moon on 09.03.1997, and in Baumholder south of Idar-Oberstein in the eastern part of the Hunsrück in the southwestern part of Germany where 5 individuals have flown on 08.04.2007 (ANDREAS WERNO in SCHUMACHER 2008a) which has been two days before the decreasing half moon on 10.04.2007 between the full moon on 02.04.2007 and the new moon on 17.04.2007.

Significant quantities of individuals of the Spotted Sulphur *Emmelia trabealis* (SCOPOLI 1763) (Lepidoptera: Noctuidae) have been identified at the Korretsberg near Kruft in the southeastern part of the Eifel westnorthwest of Koblenz where abt. 5 individuals and abt. 10 individuals have flown on 02.07.1994 (KUHNA in KINKLER 1994) and 13.07.1994 (HEINZ SCHUMACHER in KINKLER 1994), respectively, which has been one day after the decreasing half moon on 01.07.1994 between the full moon on 23.06.1994 and the new moon on 09.07.1994, and four days after the new moon on 09.07.1994, respectively.

Mass occurrences of large quantities of individuals of the Straw Dot *Rivula sericealis* (SCOPOLI 1763) (Lepidoptera: Noctuidae) have been found in the district Rodenkirchen at the southern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals each have been captured on 10.06.1994, 05.08.1994 and 12.08.1994 (WIPKING, FORST, KUHNA & SCHMITZ 1996) which has been one day after the new moon on 09.06.1994, and two days before and five days after the new moon on 07.08.1994, respectively; in Lichtenhagen northwest of Schermbeck eastnortheast of Wesel in the northwestern part of Germany where 12 individuals and abt. 10 individuals have flown on 31.05.1982 and 11.07.1982, respectively (WALFORT 1983), which has been one day after the increasing half moon on 30.05.1982 between the new moon on 23.05.1982 and the full moon on 06.06.1982 as well as five days after the full moon on 06.07.1982, respectively; and in the Witte Venn near Alstätte westnorthwest of Ahaus in the northwestern part of Germany where abt. 5 individuals have flown on 12.07.1975 – 13.07.1975 (KINKLER & SWOBODA 1982) which has been three and four days after the new moon on 09.07.1975.

Significant quantities of individuals of the Mother Shipton *Callistege mi* (CLERCK 1759) (Lepidoptera: Noctuidae) have been identified in the vicinity of Gundersweiler southsouthwest of Rockenhausen north of Kaiserslautern in the southwestern part of Germany where 7 individuals have flown on 19.05.2005 (GERHARD SCHWAB in HASSELBACH 2006) which has been four days before the full moon on 23.05.2005.

6.99 The Fen Wainscot *Arenostola phragmitidis,* the Flame Wainscot *Senta flammea,* the Pine Beauty *Panolis flammea*, the Blair´s Wainscot *Sedina buettneri* and the Great Brocade *Eurois occulta*

Significant quantities of individuals of the Fen Wainscot *Arenostola phragmitidis* (HÜBNER 1803) (Lepidoptera: Noctuidae) have been recognized in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 5 individuals have flown on 31.07.1990 (WOLFGANG WITTLAND in KINKLER 1992) which has been one day after the increasing half moon on 30.07.1990 between the new moon on 22.07.1990 and the full moon on

06.08.1990, in the Wahner Heide north of Troisdorf southeast of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 5 individuals have flown on 27.07.2001 (KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2002) which has been one day before the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, and in Maria Veen east of Reken southsouthwest of Coesfeld in the northwestern part of Germany where abt. 35 individuals have flown on 16.06.2007 (B. NIEMEYER & LILIENTHAL in SCHUMACHER 2008a) which has been one day after the new moon on 15.06.2007.

Mass occurrences of large quantities of individuals of the Flame Wainscot *Senta flammea* (CURTIS 1828) (Lepidoptera: Noctuidae) have been discovered in the Elmpter Bruch west of Elmpt west of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where 120 individuals in total, more than 20 individuals and 60 individuals have flown in the period of 17.05.1997 – 20.06.1997 (ARMIN HEMMERSBACH & STEFAN STEEGERS in KINKLER 1998) as well as on 19.05.2002 (M. DERRA in SCHUMACHER 2003) and 27.05.2002 (ARMIN HEMMERSBACH, KLAUS MEYER & HEINZ SCHUMACHER in SCHUMACHER 2003), respectively, which has been around and between the full moon on 22.05.1997, the new moon on 05.06.1997 and the full moon on 20.06.1997; on the increasing half moon on 19.05.2002 between the new moon on 12.05.2002 and the full moon on 26.05.2002, and one day after the full moon on 26.05.2002, respectively; and in the Ohligser Heide near Ohligs west of Solingen eastsoutheast of Düsseldorf in the northwestern part of Germany where abt. 10 individuals have flown on 04.06.1966 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1975) which has been one day after the full moon on 03.06.1966.

Mass occurrences of large quantities of individuals of the Pine Beauty *Panolis flammea* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) have been identified in the district Dellbrück at the eastern margin of the city of Cologne in the Middle Rhine valley in the northwestern part of Germany where abt. 500 individuals have flown on 20.04.1965 (KINKLER, SCHMITZ, NIPPEL & SWOBODA 1975) which has been four days after the full moon on 16.04.1965.

Mass occurrences of large quantities of individuals of the Blair´s Wainscot *Sedina buettneri* (E. HERING 1858) (Lepidoptera: Noctuidae) have been found in Windeck-Helpenstell in the Sieg valley northnorthwest of Hamm westsouthwest of Siegen in the northwestern part of Germany where more than 15 individuals have flown on 03.10.2002 (M. DERRA in SCHUMACHER 2003) which has been three days before the new moon on 06.10.2002, in Königswinter-Oelinghoven in the Middle Rhine valley south of Bonn in the northwestern part of Germany where abt. 10 individuals have flown on 26.09.2004 (SCHUMACHER 2004) which has been two days before the full moon on 28.09.2004, and in Laar north of Niederkrüchten west of Mönchengladbach in the northwestern part of Germany where more than 40 individuals have flown on 04.10.2005 – 07.10.2005 (ARMIN HEMMERSBACH & RUDI SELIGER in SCHUMACHER 2006) which has been one to four days after the new moon on 03.10.2005.

Significant quantities of individuals of the Great Brocade *Eurois occulta* LINNAEUS 1758 (Lepidoptera: Noctuidae) have been realized in Paustenbach near Simmerath northnortheast of Monschau in the northwestern part of the Eifel in the northwestern part of Germany where more than 5 individuals have flown on 22.07.1992 (RASKIN in KINKLER 1993) which has been one day before the decreasing half moon on 23.07.1992 between the full moon on 14.07.1992 and the new moon on 29.07.1992, and in the Balver Wald eastsoutheast of Iserlohn southeast of Dortmund in the northwestern part of Germany where abt. 5 individuals have flown on 13.07.1963 (HARKORT & WEIGT 1968) which has been two days before the decreasing half moon on 15.07.1963 between the full moon on 07.07.1963 and the new moon on 20.07.1963.

Mass occurrences of large quantities of individuals of the noctuids *Dichagyris forcipula* SCHIFFERMÜLLER (in DENIS & SCHIFFERMÜLLER 1775) (Lepidoptera: Noctuidae) and *Chersotis multangula* (HÜB-

NER 1803) (Lepidoptera: Noctuidae) have been reported from Cochem in the Moselle valley in the western part of Germany where abt. 40 individuals and abt. 20 individuals, respectively, have flown on 25.06.1994 (KUHNA in KINKLER 1994) which has been two days after the full moon on 23.06.1994. Mass occurrences of large quantities of individuals of the noctuid *Chersotis multangula* have also been mentioned from Kobern-Gondorf in the Moselle valley southwest of Koblenz in the western part of Germany where 60 individuals have flown on 27.06.1994 (KINKLER 1994) which has been four days after the full moon on 23.06.1994, and from Oberwesel southsoutheast of Koblenz in the Middle Rhine valley in the western part of Germany where more than 15 individuals have flown on 17.07.1994 (HELMUT KINKLER & HEINZ SCHMACHER in KINKLER 1994) which has been on the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994.

Mass occurrences of large quantities of individuals of the noctuid *Chersotis margaritacea* (VILLERS 1789) (Lepidoptera: Noctuidae) have been reported from Valwig in the Moselle valley east of Cochem in the western part of Germany where abt. 15 individuals and 35 individuals have flown on 02.09.2005 (HANS DUDLER & RUDOLF PÄHLER in SCHUMACHER 2006) and 02.09.2007 (KLAUS MEYER in SCHUMACHER 2008a), respectively, which has been one day before the new moon on 03.09.2005, and two days before the decreasing half moon on 04.09.2007 between the full moon on 28.08.2007 and the new moon on 11.09.2007, respectively.

Mass occurrences of large quantities of individuals of the noctuid *Dichagyris forcipula* have also been documented from Valwig in the Moselle valley east of Cochem in the western part of Germany where abt. 25 individuals and abt. 20 individuals have flown on 20.07.1995 – 24.07.1995 (LINKE in KINKLER 1996) and 27.06.2005 (B. NIEMEYER in SCHUMACHER 2006), respectively, which has been around and between the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995 as well as the new moon on 27.07.1995, and one day before the decreasing half moon on 28.06.2005 between the full moon on 22.06.2005 and the new moon on 06.07.2005, respectively; from Bremm in the Moselle valley southsouthwest of Cochem in the western part of Germany where 150 individuals have flown on 26.06.2004 (B. NIEMEYER in SCHUMACHER 2005a) which has been one day after the increasing half moon on 25.06.2004 between the new moon on 17.06.2004 and the full moon on 02.07.2004; and from Klotten in the Moselle valley northeast of Cochem in the western part of Germany where 20 individuals each have flown on 01.07.1995 (HEINZ SCHUMACHER in KINKLER 1996) as well as on 13.07.1995 and 20.07.1995 (ROLF MÖRTTER in KINKLER 1996), abt. 5 individuals have flown on 28.06.1996 (ROLF MÖRTTER in KINKLER 1997) and 30 individuals have flown on 19.06.2000 (KLAUS MEYER in SCHUMACHER 2001) which has been four days after the new moon on 27.06.1995, one day after the full moon on 12.07.1995, on the decreasing half moon on 20.07.1995 between the full moon on 12.07.1995 and the new moon on 27.07.1995, three days before the full moon on 01.07.1996, and three days after the full moon on 16.06.2000, respectively.

7 Relationships of swarm phases, mass flights and peak occurrences of dragonflies, damselflies and other insects with the new moon and full moon phases of the lunar cycle

In addition to the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* with the new moon and full moon phases as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies and nocturnal butterflies with the turning points of the lunar cycle, also some examples of relationships of swarm phases and peak activity of dragonflies, damselflies and other insects with the new moon and full moon phases are outlined as follows.

The observations and analysis of the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species with the new moon and full moon phases of the lunar cycle are the base for the selenocyclical evaluation of the short-term population dynamics of the treated diurnal and crepuscular insects. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

7.1 The Beautiful Demoiselle *Calopteryx virgo* based on own observations

In 2008, some single individuals of the Beautiful Demoiselle *Calopteryx virgo* LINNAEUS 1758 (Odonata: Calopterygidae) have already been present at the locality Tairnbach since mid of May 2008, whereas around the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008, almost suddenly numerous individuals have flown along and around the creek crossing the meadows near the margin of the forest south of the village. The appearance of the peak numbers of the Beautiful Demoiselle *Calopteryx virgo* in Tairnbach around the decreasing half moon on 28.05.2008 has taken place within the second period of summerly warm and sunny weather from 19.05.2008 to 12.06.2008 which has started before the full moon on 20.05.2008 and has ended before the full moon on 18.06.2008, and the occurrence of many individuals has continued into the third period of summerly warm and sunny weather from 18.06.2008 to 05.07.2008 that has begun on the full moon on 18.06.2008 and has been terminated after the new moon on 03.07.2008.

In 2009, some single individuals of the Beautiful Demoiselle *Calopteryx virgo* have already been present at the locality Tairnbach since mid of May 2009, whereas around the new moon on 24.05.2009, almost suddenly numerous individuals have flown along and around the creek crossing the meadows near the margin of the forest. The occurrence of many individuals of the Beautiful Demoiselle *Calopteryx virgo* in Tairnbach has again persisted for quite some time. The individuals of the Beautiful Demoiselle *Calopteryx virgo* have frequently danced as singles or in pairs above the creek, have flown to and fro along the creek, have flown across the meadows adjacent to the creek, and have sit on leaves of plants close to the creek.

7.2 The Beautiful Demoiselle *Calopteryx virgo* based on literature evaluation

Mass flights of the Beautiful Demoiselle *Calopteryx virgo* in the middle part of the Upper Rhine valley in the southwestern part of Germany have been noticed at the Eisbach westsouthwest of Worms where more than 10 individuals have flown on 07.08.1998 (RICHARD WITT in VIESSMANN 1999) which has been one day before the full moon on 08.08.1998; in the Pfrimm valley near Breunigweiler west of Grünstadt where more than 50 individuals each, more than 10 individuals and more than 50 individuals each have flown on 10.07.1997 (VIESSMANN 1998), 31.05.1998 (VIESSMANN 1999), 03.06.1999 (VIESSMANN 2000a), 10.06.2000 (VIESSMANN 2001), 13.06.2001, 30.06.2001, 08.07.2001 (VIESSMANN 2002), 23.06.2002, 05.07.2002 and 10.07.2002 (VIESSMANN 2003), respectively, which has been three days before the increasing half moon on 13.07.1997 between the new moon on 04.07.1997 and the full moon on 20.07.1997, three days before the decreasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, three days after the full moon on 31.05.1999, on the increasing half moon on 10.06.2000 between the new

moon on 02.06.2000 and the full moon on 17.06.2000, two days before the decreasing half moon on 15.06.2001 between the full moon on 06.06.2001 and the new moon on 21.06.2001, one day after the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, three days after the full moon on 05.07.2001, one day before the full moon on 24.06.2002, and five days before and on the new moon on 10.07.2002, respectively; in the Pfrimm valley near Breunigweiler west of Grünstadt where more than 10 individuals, more than 50 individuals, more than 10 individuals and more than 50 individuals have flown on 20.06.2003, 03.07.2003, 07.07.2003 and 11.07.2003, respectively (VIESSMANN 2004), which has been one day before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, four days after the new moon on 29.06.2003, on the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, and two days before the full moon on 13.07.2003, respectively; near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 01.08.1999 (VIESSMANN 2000a) which has been four days after the full moon on 28.07.1999; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 07.07.1997 (VIESSMANN 1998), and 14.07.1998 (VIESSMANN 1999) which has been three days after the new moon on 04.07.1997 and five days after the full moon on 09.07.1998, respectively; and near Erpolzheim southsoutheast of Freinsheim westsouthwest of Frankenthal where more than 10 individuals have flown on 06.07.2003 (HERMANN DEICHFUSS in VIESSMANN 2004) which has been one day before the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003.

Significant quantities of individuals of the Beautiful Demoiselle *Calopteryx virgo* in the southwestern part of Germany have also been observed in the Pfrimm valley near Breunigweiler west of Grünstadt where up to 10 individuals have flown on 24.07.1996 (VIESSMANN 1997) which has been four days before the full moon on 28.07.1996, near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 09.08.1998 (VIESSMANN 1999) which has been one day after the full moon on 08.08.1998, and near Bayerfeld-Steckweiler in the Alsenz valley southsouthwest of Bad Kreuznach where 5 individuals have flown on 20.05.1993 (ADOLF STAUFFER in BOSSELMANN 1994) which has been one day before the new moon on 21.05.1993.

Mass flights of the Beautiful Demoiselle *Calopteryx virgo* in the southwestern part of Germany have also been recognized near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 10 individuals have flown on 22.06.2003 (HERMANN DEICHFUSS in VIESSMANN 2004) which has been one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, and near Hahnenbach in the Hahnenbach valley northwest of Kirn in the eastern part of the Hunsrück where more than 10 individuals have flown on 23.06.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days after the new moon on 21.06.2001.

Mass flights of the Beautiful Demoiselle *Calopteryx virgo* in the western part of Germany have been verified near Hentern in the Ruwer valley westsouthwest of Hermeskeil in the western part of the Hunsrück where more than 10 individuals have flown on 27.06.1998 (FRIEDHELM ROBECK in VIESSMANN 1999) which has been three days after the new moon on 24.06.1998, near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 10 individuals have flown on 04.07.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been three days after the new moon on 01.07.2000, near Dhronecken northnortheast of Hermeskeil in the western part of the Hunsrück where more than 10 individuals have flown on 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days after the new moon on 02.06.2000, at the Heilbachsee near Gunderath

westsouthwest of Mayen in the southeastern part of the Eifel where more than 15 individuals have flown on 23.07.1991 (Bosselmann 1992) which has been three days before the full moon on 26.07.1991, in the Elz valley southwest of Kehrig southsouthwest of Mayen in the southeastern part of the Eifel where more than 50 individuals have flown on 28.07.1991 (Bosselmann 1992) which has been two days after the full moon on 26.07.1991, in the Elz valley southwest of Münstermaifeld westsouthwest of Koblenz where abt. 20 individuals have flown on 08.06.2008 (Andreas Freitag in Bosselmann 2009) which has been five days after the new moon on 03.06.2008, in the Ahr valley between Mayschoß and Dernau westsouthwest of Bad Neuenahr-Ahrweiler where abt. 30 individuals have flown on 28.05.2008 (Nora Wuttke in Bosselmann 2009) which has been on the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008, and near Serrières westsouthwest of Neuchâtel (Neuenburg) at the northeastern margin of the Lac de Neuchâtel (Neuenburg) in the northwestern part of Switzerland where masses of individuals have flown on 17.09.1879 (Göldlin 1880) which has been one day after the new moon on 16.09.1879.

Significant quantities of individuals of the Beautiful Demoiselle *Calopteryx virgo* in the western part of Germany have also been observed near Hahnenbach in the Hahnenbach valley northwest of Kirn in the eastern part of the Hunsrück where up to 10 individuals each have flown on 31.07.1999 (Monika Robeck in Viessmann 2000a) and 31.07.2000 (Monika Robeck in Viessmann 2001) which has been three days after the full moon on 28.07.1999 and on the new moon on 31.07.2000, respectively; in the Wadrilltal near Wadrill north of Wadern south of Hermeskeil in the western part of the Hunsrück where up to 10 individuals each have flown on 20.06.1998 (Monika Robeck in Viessmann 1999) and 28.07.2001 (Monika Robeck in Viessmann 2002) which has been four days before the new moon on 24.06.1998, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; near Ollmuth in the Ruwer valley south of Trier in the western part of the Hunsrück where up to 10 individuals have flown on 19.07.1999 (Monika Robeck in Viessmann 2000a) which has been two days before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999, near the Irreler Mühle in the Nims valley in the vicinity of Irrel northwest of Trier in the southwestern part of the Eifel where up to 10 individuals have flown on 02.07.2000 (Monika Robeck in Viessmann 2001) which has been one day after the new moon on 01.07.2000, near Bad Bertrich in the Ueßbach valley southwest of Cochem in the southwestern part of the Eifel where up to 10 individuals have flown on 25.06.1995 (Klaus Bittner in Viessmann 1996) which has been two days before the new moon on 27.06.1995, and near Thür southsouthwest of Mendig northeast of Mayen in the southeastern part of the Eifel where up to 10 individuals have flown on 01.08.2001 (Klaus Bittner in Viessmann 2002) which has been three days before the full moon on 04.08.2001.

Significant quantities of individuals of the Beautiful Demoiselle *Calopteryx virgo* in the northwestern part of Germany have been met near Obererbach northwest of Limburg an der Lahn where up to 10 individuals have flown on 22.07.2000 (Leander Hoffmann in Viessmann 2001) which has been three days before the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000; near Steinefrenz northwest of Limburg an der Lahn where up to 10 individuals each have flown on 15.07.1997 (Leander Hoffmann in Viessmann 1998) and 16.06.2000 (Leander Hoffmann in Viessmann 2001) which has been five days before the full moon on 20.07.1997 and one day before the full moon on 17.06.2000, respectively; near Zehnhausen northeast of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 16.06.2000 (Leander Hoffmann in Viessmann 2001) which has been one day before the full moon on 17.06.2000, and near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn and Molsberg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.07.1996 (Leander Hoffmann in Viessmann 1997) which has been five days after the new moon on 15.07.1996.

7.3 The Banded Demoiselle *Calopteryx splendens* based on own observations

In 2007, I have noticed during my regular entomological observations at the locality Walldorf that in the period from mid to end of June to early to mid of July 2007, almost suddenly and nearly from one day to the next, abundant individuals of the Banded Demoiselle *Calopteryx splendens* (HARRIS 1782) (Odonata: Calopterygidae) have appeared at the Hardtbach west of the railway line northeast of the airfield at the eastern margin of Walldorf, whereas in the days before, I have recorded only single individuals. The swarming of the abundant individuals of the Banded Demoiselle *Calopteryx splendens* has been so pronounced that they have been flying to and fro along the creek, flying across the meadows adjacent to the creek, dancing in groups above the creek, and sitting on leaves of plants close to the creek almost everywhere in the investigated interval of the Hardtbach which extends over abt. 1 km length. The clouds of flying and dancing individuals of the Banded Demoiselle *Calopteryx splendens* above the creek could even be observed from the adjacent paved way crossing the fields and have been so striking that it has not been possible to overlook the almost instantaneous breakout of enormous quantities of individuals during my daily power walking tour which leads also along the corresponding section of the creek. The breakout of the swarming of the abundant individuals of the Banded Demoiselle *Calopteryx splendens* at the Hardtbach west of the railway line northeast of the airfield at the eastern margin of Walldorf has probably been related to the full moon on 30.06.2007.

7.4 The Banded Demoiselle *Calopteryx splendens* based on literature evaluation

Mass flights of the Banded Demoiselle *Calopteryx splendens* in the middle part of the Upper Rhine valley in the southwestern part of Germany have been recorded near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each have flown on 30.05.1991, 25.06.1991 (KLAUS WEISS in BOSSELMANN 1992), 27.05.1994, 07.06.1994, 18.06.1994, 27.06.1994, 24.07.1994 (KLAUS WEISS in VIESSMANN 1995), 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999, 24.07.1999 – 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 23.06.2001, 22.07.2001 and 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days after the full moon on 28.05.1991, two days before the full moon on 27.06.1991, two days after the full moon on 25.05.1994, two days before the new moon on 09.06.1994, five days before and four days after the full moon on 23.06.1994, two days after the full moon on 22.07.1994, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, three to four days before the full moon on 28.07.1999, two days after the new moon on 21.06.2001, two days after the new moon on 20.07.2001 and five days before the full moon on 04.08.2001, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals and more than 100 each individuals have flown on 15.06.2002, 10.08.2002 (KLAUS WEISS in VIESSMANN 2003), 10.06.2006 and 14.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been four days after the new moon on 11.06.2002, two days after the new moon on 08.08.2002, one day before the full moon on 11.06.2006 and three days after the full moon on 11.07.2006, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 300 individuals, more than 200 individuals each, more than 150 individuals, more than 50 individuals, more than 100 individuals, more than 200 individuals, more than 150 individuals, more than 1.000 individuals and more than 100 individuals have flown on 06.06.1993 (WEISS & SCHWAB 1994), 01.07.1995 – 02.07.1995, 02.08.1995 (KLAUS WEISS in VIESSMANN 1996), 18.06.2000, 21.07.2000 (KLAUS WEISS in VIESSMANN 2001), 07.06.2003, 09.06.2003, 22.06.2003 (KLAUS WEISS in VIESSMANN 2004), 01.06.2008 and 15.07.2008 (WEISS 2009), respectively, which has been two days after the full moon on 04.06.1993, several days after the new moon on 27.06.1995, five days after the new moon on 27.07.1995, one day after the full moon on 17.06.2000, five days after the full moon on 16.07.2000, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, five days before the full moon on 14.06.2003, one day

after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, two days before the new moon on 03.06.2008 and three days before the full moon on 18.07.2008, respectively; near Offenbach an der Queich east of Landau in der Pfalz where more than 200 individuals, more than 50 individuals each and more than 10 individuals have flown on 06.06.1993 (WEISS & SCHWAB 1994), 25.07.1995, 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 01.06.2000 (KLAUS WEISS in VIESSMANN 2001), respectively, which has been two days after the full moon on 04.06.1993, two days before and five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999 and one day before the new moon on 02.06.2000, respectively; near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each and more than 100 individuals each have flown on 18.06.1994, 27.06.1994, 24.07.1994 (KLAUS WEISS in VIESSMANN 1995), 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 16.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been five days before and four days after the full moon on 23.06.1994, two days after the full moon on 22.07.1994, on the full moon on 10.08.1995 and five days after the full moon on 11.07.2006, respectively; near Bellheim east of Landau in der Pfalz where more than 50 individuals each, more than 10 individuals and more than 100 individuals have flown on 18.06.1994, 10.07.1994, 24.07.1994, 23.08.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 30.07.2001 (KLAUS WEISS in VIESSMANN 2002), 16.08.2003 (KLAUS WEISS in VIESSMANN 2004) and 08.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been five days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, two days after the full moon on 22.07.1994, two days after the full moon on 21.08.1994, two days before the new moon on 27.07.1995, five days before the full moon on 04.08.2001, four days after the full moon on 12.08.2003 and three days before the full moon on 11.07.2006, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 50 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, at the Klingbach north of Hördt eastsoutheast of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 26.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the full moon on 28.07.1999, near Lustadt northwest of Germersheim where more than 20 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008, and near Erpolzheim southsoutheast of Freinsheim westsouthwest of Frankenthal where more than 10 individuals have flown on 06.07.2003 (HERMANN DEICHFUSS in VIESSMANN 2004) which has been one day before the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003.

Significant quantities of individuals of the Banded Demoiselle *Calopteryx splendens* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 07.05.2000, 26.05.2000 (KLAUS WEISS in VIESSMANN 2001), 12.08.2001 (KLAUS WEISS in VIESSMANN 2002), 03.08.2002 (KLAUS WEISS in VIESSMANN 2003) and 18.05.2008 (WEISS 2009) which has been two days before the new moon on 27.07.1995, two days after the full moon on 10.08.1995, three days after the new moon on 04.05.2000, one day before the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, five days before the new moon on 08.08.2002 and two days before the full moon on 20.05.2008, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 26.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days before

the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, at the Klingbach north of Hördt eastsoutheast of Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 29.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been on the new moon on 29.06.2003, and near Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where up to 10 individuals have flown on 11.06.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been one day after the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 17.06.2000.

Mass flights of the Banded Demoiselle *Calopteryx splendens* in the southwestern part of Germany have also been identified in the Lauter valley north of Kaiserslautern in the Palatinate Forest where more than 50 individuals have flown on 21.07.2002 (ALFRED KLEIN in VIESSMANN 2003) which has been three days before the full moon on 24.07.2002, and in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals have flown on 06.07.2003 (VIESSMANN 2004) which has been one day before the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003.

Significant quantities of individuals of the Banded Demoiselle *Calopteryx splendens* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 24.07.1997 (VIESSMANN 1998) and 28.07.1998 (VIESSMANN 1999) which has been four days after the full moon on 20.07.1997 and five days after the new moon on 23.07.1998, respectively; and near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 29.07.2001 (VIESSMANN 2002) and 25.07.2002 (VIESSMANN 2003) which has been one day after the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, and one day after the full moon on 24.07.2002, respectively.

Mass flights of the Banded Demoiselle *Calopteryx splendens* in the western part of Germany have been encountered in the Lothary Aue near Mainz at the northern margin of the Upper Rhine valley where abt. 10 individuals have flown on 28.05.2006 (CINDY VONDERLIND in WILLIGALLA 2007) which has been one day after the new moon on 27.05.2006, near Laubenheim in the Nahe valley south of Bingen where more than 10 individuals have flown on 30.05.1996 (MARTIN KROHNE in VIESSMANN 1997) which has been two days before the full moon on 01.06.1996, in the Elz valley southwest of Münstermaifeld westsouthwest of Koblenz where abt. 10 individuals have flown on 08.06.2008 (ANDREAS FREITAG in BOSSELMANN 2009) which has been five days after the new moon on 03.06.2008, and at the Wiedbach near Wied southwest of Hachenburg where abt. 10 individuals have flown on 10.07.1991 (HERBERT GILGENBACH in BOSSELMANN 1992) which has been one day before the new moon on 11.07.1991.

Significant quantities of individuals of the Banded Demoiselle *Calopteryx splendens* in the western part of Germany have also been observed near Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days after the new moon on 02.06.2000.

7.5 The Four-Spotted Chaser *Libellula quadrimaculata*

Mass flights of the Four-Spotted Chaser *Libellula quadrimaculata* LINNAEUS 1758 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been mentioned from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in

der Pfalz where more than 10 individuals each and more than 50 individuals each have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) as well as on 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively.

Significant quantities of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been notified from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 03.06.1995, 08.07.1995, 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 24.06.2001 (KLAUS WEISS in VIESSMANN 2002), 15.06.2002 (KLAUS WEISS in VIESSMANN 2003) and 21.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994, five days after the new moon on 29.05.1995, four days before the full moon on 12.07.1995, two days before the new moon on 27.07.1995, three days after the new moon on 21.06.2001, four days after the new moon on 11.06.2002, and on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 23.06.1994 and four days after the full moon on 21.08.1994, respectively; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999, from Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, and from Lustadt northwest of Germersheim where more than 5 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008.

Significant quantities of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* in the southwestern part of Germany have also been signaled from the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.06.1997 (VIESSMANN 1998), 01.06.1998 (VIESSMANN 1999), 30.05.2000, 09.07.2000 (VIESSMANN 2001), 30.06.2001 (VIESSMANN 2002), 15.06.2002 (VIESSMANN 2003) and 15.07.2003 (VIESSMANN 2004) which has been five days after the full moon on 20.06.1997, two days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, three days before the new moon on 02.06.2000, on the increasing half moon on 09.07.2000 between the new moon on 01.07.2000 and the full moon on 16.07.2000, one day after the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, four days after the new moon on 11.06.2002 and two days after the full moon on 13.07.2003, respectively; from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 26.06.2001 (VIESSMANN 2002) which has been five days after the new moon on 21.06.2001, and from Mainz at the northern margin of the Upper Rhine valley where abt. 5 individuals have flown on 09.05.2006 (BRITTA DAWIEDEIT in WILLIGALLA 2007) which has been four days before the full moon on 13.05.2006.

Significant quantities of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* in the western part of Germany have also been observed near Thranenweier northnortheast of Börfink northnorthwest of Birkenfeld in the central part of the Hunsrück where up to 10 individuals have flown on 26.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been three days after the new

moon on 23.05.2001, near Kanzem in the Saar valley south of Konz southsouthwest of Trier where up to 10 individuals have flown on 24.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day after the new moon on 23.05.2002, near Wolken in the Moselle valley north of Kobern-Gondorf westsouthwest of Koblenz where more than 15 individuals have flown on 07.06.1992 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in BOSSELMANN 1993) which has been one day before the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992; and at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 02.07.2001 (KLAUS BITTNER in VIESSMANN 2002) and 02.06.2002 (KLAUS BITTNER in VIESSMANN 2003) which has been three days before the full moon on 05.07.2001, and one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

Mass flights of the Four-Spotted Chaser *Libellula quadrimaculata* in the northeastern and northwestern parts of Germany have been observed near Dresden in the Elbe valley in the northeastern part of Germany on 13.06.1816 (KEFERSTEIN 1817, FRAENKEL 1932) or 13.06.1817 (KEFERSTEIN 1863) as well as on 29.05.1881 (BLASIUS 1883, FRAENKEL 1932) which has been three days after the full moon on 10.06.1816, two days before the new moon on 15.06.1817 and one day after the new moon on 28.05.1881, respectively; near Gotha westsouthwest of Erfurt in the northeastern part of Germany on 29.06.1817 (KEFERSTEIN 1863) which has been on the full moon on 29.06.1817, near Halle in the Saale valley and Magdeburg in the Elbe valley in the northeastern part of Germany on 19.06.1825 (HAGEN 1861) which has been three days after the new moon on 16.06.1825, within and around Weißenfels south of Halle in the Saale valley in the northeastern part of Germany on 16.06.1914 (BEUTHAN 1914) which has been on the decreasing half moon on 16.06.1914 between the full moon on 08.06.1914 and the new moon on 23.06.1914, in Sanssouci near Potsdam in the northeastern part of Germany on 04.08.1908 (MEISSNER 1908) which has been two days before the increasing half moon on 06.08.1908 between the new moon on 28.07.1908 and the full moon on 12.08.1908, in the region south of Berlin in the northeastern part of Germany on 06.06.1926 (MEISE in E. HARTERT in WILLIAMS 1929) which has been four days before the new moon on 10.06.1926, near Hildesheim southsoutheast of Hannover in the northwestern part of Germany on 18.05.1673 (F. LACHMUND in HAGEN 1861) which has been on the new moon on 18.05.1673; near Braunschweig, Magdeburg, Halberstadt, Aschersleben, Gotha, Könnern northwest of Halle and other localities in the northwestern and northeastern parts of Germany at the end of June 1816 (KEFERSTEIN 1817, FRAENKEL 1932) or in the second half of June 1817 (KEFERSTEIN 1863) which has been around the new moon on 25.06.1816, or around and between the new moon on 15.06.1817 and the full moon on 29.06.1817, respectively; near Göttingen, Eisenach, Weimar and Halle in the northwestern and northeastern parts of Germany on 30.05.1839 – 02.06.1839 (WEISSENBORN 1839) which has been two to five days after the full moon on 28.05.1839; near Weimar in the northeastern part of Germany on 28.06.1816 (WEISSENBORN 1839) which has been three days after the new moon on 25.06.1916; near Dresden, Leipzig, Halle, Magdeburg, Braunschweig, Bad Gandersheim north of Göttingen and Bielefeld as well as in the Neiße valley around and between Zittau and Görlitz in the northeastern and northwestern parts of Germany on 28.05.1881 – 01.06.1881 (GAUCKLER 1881, LANDWEHR 1881, WEIDINGER 1881, BLASIUS 1883) which has been on and several days after the new moon on 28.05.1881; south of Berlin in the northeastern part of Germany on 06.06.1926 (WILLIAMS 1929) which has been four days before the new moon on 10.06.1926, near Klocksin southwest of the Malchiner See southwest of Malchin southeast of Rostock in the northeastern part of Germany on 15.05.1831 (GERICHAU in BOLL 1856, ERNST BOLL in KÖPPEN 1871, F.T. KÖPPEN in MEYER 1918) which has been three days after the new moon on 12.05.1831, near Mettmann eastnortheast of Düsseldorf in the northwestern part of Germany on 19.05.1861 (KEFERSTEIN 1863) or 19.05.1862 (CORNELIUS 1862, FRAENKEL 1932) which has been five days before the full moon on 24.05.1861, or two days before the decreasing half moon on 21.05.1862 between the full moon on 13.05.1862 and the new moon on 28.05.1862, respectively; near Münster in the northwestern part of Germany on

19.05.1862 (ALTUM 1862) which has been two days before the decreasing half moon on 21.05.1862 between the full moon on 13.05.1862 and the new moon on 28.05.1862, in the region around the mouths of the river Ems near Emden and the river Elbe near Cuxhaven into the North Sea (VIEWEG 1897) as well as within and around Hamburg (ANONYMUS 1897, WAGNER 1897) in the northwestern part of Germany on 01.06.1897 – 03.06.1897 (FRAENKEL 1932) which has been one to three days after the new moon on 31.05.1897, and on the island Helgoland in the North Sea northnorthwest of Bremerhaven in the northwestern part of Germany on 19.05.1964 (KARL NUSCH in HARZ 1965d) which has been on the increasing half moon on 19.05.1964 between the new moon on 11.05.1964 and the full moon on 26.05.1964.

Significant quantities of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* in the northwestern part of Germany have also been encountered near Nentershausen westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 01.06.1995 (LEANDER HOFFMANN in VIESSMANN 1996) which has been three days after the new moon on 29.05.1995, near Ruppach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 27.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been four days before the full moon on 01.07.1996, and near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996.

Mass flights of the Four-Spotted Chaser *Libellula quadrimaculata* in Austria, England, Poland and Russia have been recognized in the district Pötzleinsdorf at the northwestern margin of the city of Vienna in the eastern part of Austria on 22.05.1925 (GEISSLER 1925) which has been on the new moon on 22.05.1925, between Bruck an der Leitha and Neusiedl am See eastsoutheast of Vienna in the eastern part of Austria on 24.05.1925 (GALVAGNI 1925) which has been two days after the new moon on 22.05.1925, near Dover southeast of London in the southeastern part of England on 06.06.1889 – 07.06.1889 (HALL 1889) which has been one day before and on the increasing half moon on 07.06.1889 between the new moon on 29.05.1889 and the full moon on 13.06.1889, near Margate eastsoutheast of London in the southeastern part of England on 10.06.1900 (H. STOCKS in LUCAS 1900a) which has been three days before the full moon on 13.06.1900, near Shoeburyness at the mouth of the river Thames eastsoutheast of London in the southeastern part of England on 23.06.1888 (PENDER 1888) which has been on the full moon on 23.06.1888, near Berwick-upon-Tweed north of Newcastle-upon-Tyne in the northeastern part of England on 17.06.1900 (G. BOLAM in LUCAS 1900a) which has been four days after the full moon on 13.06.1900, near Zukowo (formerly Zuckau) southwest of Gdansk (formerly Danzig) in the northeastern part of Poland (formerly in the northeastern part of Germany) at the end of June 1926 (M.A. POPHAM in WILLIAMS 1929) which has been around the full moon on 25.06.1926, in Kaliningrad (formerly Königsberg) in the southwestern part of Russia (formerly in the northeastern part of Germany) in June 1852 (HAGEN 1861, HAGEN in KEFERSTEIN 1863) which has been around and between the full moon on 02.06.1852, the new moon on 17.06.1852 and the full moon on 01.07.1852; and on the Kurian Spit (Kurische Nehrung) between Zelenogradsk (formerly Cranz) and Klaipeda (formerly Memel) north of Kaliningrad (formerly Königsberg) in the southwestern parts of Russia and Lithuania (formerly in the northeastern part of Germany) in June 1926 (SZIDAT 1928, HARZ 1965d) which has been around and between the full moon on 27.05.1926, the new moon on 10.06.1926 and the full moon on 25.06.1926.

Mass flights of the Four-Spotted Chaser *Libellula quadrimaculata* in France, Belgium and Netherlands have been recognized near Cherbourg westnorthwest of Le Havre in the northwestern part of France on 12.06.1825 (DESCOURTILEZ 1827) which has been four days before the new moon on 16.06.1825, near Calais north of Paris in the northwestern part of France on 14.06.1839 (WEISSENBORN 1839) which has been four days after the full moon on 10.06.1839, near Huissignies northeast of Beloeil southsouthwest of Ath southwest of Bruxelles in the western part of Belgium on

16.06.1853 (MORREN 1853, KEFERSTEIN 1863) which has been five days before the full moon on 21.06.1853, near Lebbeke northeast of Aalst northnorthwest of Bruxelles (LANCASTER 1900) and near Gent westnorthwest of Bruxelles (MCLACHLAN 1900) in the western part of Belgium on 21.06.1860 which has been two days after the new moon on 19.06.1860; in the regions around Antwerpen north of Bruxelles and Mons southwest of Bruxelles in the western part of Belgium, in the regions around Namur southsoutheast of Bruxelles and Liège southeast of Bruxelles in the eastern part of Belgium, and at the coast of the North Sea in the western parts of Belgium and the Netherlands on 05.06.1900 and 10.06.1900 – 12.06.1900, respectively (LANCASTER 1900, KARSCH 1900, MCLACHLAN 1900, ACLOQUE 1901, FONTAINE 1902), which has been one day before the increasing half moon on 06.06.1900 between the new moon on 28.05.1900 and the full moon on 13.06.1900 as well as one to three days before the full moon on 13.06.1900, respectively; in different parts of the Netherlands from 31.05.1855 onwards (MULDER 1855, BEMMELEN 1857) which has been on and after the full moon on 31.05.1855, within and around Den Haag as well as between Leiden and Katwijk north to northnortheast of Den Haag southwest of Amsterdam in the western part of the Netherlands on 09.07.1884 – 10.07.1884 (HASSELT 1884, RITSEMA 1884) which has been one and two days after the full moon on 08.07.1884, within and around Veenendaal west of Ede southeast of Amsterdam in the eastern part of the Netherlands on 05.07.1884 (RITSEMA 1884) which has been three days before the full moon on 08.07.1884, and in Blokzijl westnorthwest of Meppel southeast of Amsterdam in the eastern part of the Netherlands on 12.06.1852 (BEMMELEN 1857) which has been five days before the new moon on 17.06.1852.

Mass flights of unspecified dragonflies which have probably also been the Four-Spotted Chaser *Libellula quadrimaculata* have also been reported from Weissenburg in Bayern northwest of Eichstätt in the southeastern part of Germany on 13.06.1832 (BURMEISTER 1847, H. BURMEISTER in KÖPPEN 1871, F.T. KÖPPEN in MEYER 1918) which has been on the full moon on 13.06.1832, from Zittau southsouthwest of Görlitz in the northeastern part of Germany on 13.05.1623 and 30.05.1695 (J.B. CARPZOV in KÖPPEN 1871, F.T. KÖPPEN in MEYER 1918) which has been three days before the full moon on 16.05.1623 and on the full moon on 30.05.1695, respectively; from Liepaja (formerly Libau) at the coast of the Baltic Sea westsouthwest of Riga in the southwestern part of Latvia (formerly in the northeastern part of Germany) at the end of May 1850 (KÖPPEN 1871, MEYER 1918) which has been around the full moon on 25.05.1850, and from Tallinn (formerly Reval) at the coast of the Baltic Sea in the northwestern part of Estonia on 25.05.1852 and 28.05.1852 (S. MOTSCHULSKY in KÖPPEN 1871, F.T. KÖPPEN in MEYER 1918) which has been around the increasing half moon on 27.05.1852 between the new moon on 19.05.1852 and the full moon on 02.06.1852.

7.6 The Broad-Bodied Chaser *Libellula depressa*

Mass flights of the Broad-Bodied Chaser *Libellula depressa* LINNAEUS 1758 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been reported from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals each have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been three days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals have flown on 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been one day before the full moon on 11.06.2006, and from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 01.06.2000 (KLAUS WEISS in VIESSMANN 2001) which has been one day before the new moon on 02.06.2000.

Significant quantities of individuals of the Broad-Bodied Chaser *Libellula depressa* in the middle

part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 30.05.1994, 18.06.1994, 27.06.1994, 09.07.1994, 31.07.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995) and 03.06.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the full moon on 25.05.1994, five days before and four days after the full moon on 23.06.1994, on the new moon on 09.07.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, four days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994 and five days after the new moon on 29.05.1995, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) and 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994 and two days before the new moon on 27.07.1995, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 28.05.1995 (KLAUS WEISS in VIESSMANN 1996) which has been one day before the new moon on 29.05.1995, near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 18.05.1994, 19.06.1994, 10.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been one day before the increasing half moon on 19.05.1994 between the new moon on 10.05.1994 and the full moon on 25.05.1994, five days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994 and four days after the full moon on 21.08.1994, respectively; and at the Silbersee near Roxheim north of Frankenthal northnorthwest of Ludwigshafen where up to 10 individuals have flown on 23.06.2002 (HERMANN DEICHFUSS in VIESSMANN 2003) which has been one day before the full moon on 24.06.2002.

Significant quantities of individuals of the Broad-Bodied Chaser *Libellula depressa* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.06.1997 (VIESSMANN 1998), 25.06.1998 – 27.06.1998 (VIESSMANN 1999), 30.05.2000, 30.06.2000 (VIESSMANN 2001), 30.06.2001 (VIESSMANN 2002), 01.07.2002 (VIESSMANN 2003) and 07.06.2003 (VIESSMANN 2004) which has been five days after the full moon on 20.06.1997, one to three days after the new moon on 24.06.1998, three days before the new moon on 02.06.2000, one day before the new moon on 01.07.2000, one day after the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, one day before the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002, and on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 10.06.1995 (VIESSMANN 1996), 15.06.1997 (VIESSMANN 1998), 18.06.1998, 27.06.1998 (VIESSMANN 1999), 10.06.2000, 30.06.2000 (VIESSMANN 2001), 11.06.2001, 29.06.2001 (VIESSMANN 2002) and 30.06.2002 (VIESSMANN 2003) which has been three days before the full moon on 13.06.1995, five days before the full moon on 20.06.1997, on the decreasing half moon on 18.06.1998 between the full moon on 10.06.1998 and the new moon on 24.06.1998, three days after the new moon on 24.06.1998, on the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 17.06.2000, two days before the new moon on 01.07.2000, five days after the full moon on 06.06.2001, on the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, and two days before the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002, respectively; and in the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where abt. 5 individuals have flown on 11.06.2006 (ELISABETH KASCHAK in WILLIGALLA 2007) which

has been on the full moon on 11.06.2006.

Mass flights of the Broad-Bodied Chaser *Libellula depressa* in the western part of Germany have been signaled from Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 04.07.2000 (Monika Robeck in Viessmann 2001) which has been three days after the new moon on 01.07.2000, from the Laacher See in the southeastern part of the Eifel north of Mendig westnorthwest of Koblenz where more than 5 individuals have flown on 04.07.1994 (Jürgen Bosselmann & Edith Bosselmann in Viessmann 1995) which has been five days before the new moon on 09.07.1994, from Adenau southsouthwest of Bad Neuenahr-Ahrweiler in the northeastern part of the Eifel where abt. 5 individuals have flown on 15.07.1992 (Bosselmann 1993) which has been one day after the full moon on 14.07.1992, from Könen in the Saar valley southsouthwest of Konz southsouthwest of Trier where up to 10 individuals have flown on 29.06.2000 (Monika Robeck in Viessmann 2001) which has been two days before the new moon on 01.07.2000, and from Kanzem in the Saar valley south of Konz southsouthwest of Trier where more than 10 individuals have flown on 24.05.2001 (Monika Robeck in Viessmann 2002) which has been one day after the new moon on 23.05.2002.

Significant quantities of individuals of the Broad-Bodied Chaser *Libellula depressa* in the western part of Germany have also been noticed at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 14.06.1995 (Klaus Bittner in Viessmann 1996), 25.06.1996 (Klaus Bittner in Viessmann 1997), 25.06.1997 (Klaus Bittner in Viessmann 1998), 24.05.1999 (Klaus Bittner in Viessmann 2000a), 02.07.2001 (Klaus Bittner in Viessmann 2002) and 02.06.2002 (Klaus Bittner in Viessmann 2003) which has been one day after the full moon on 13.06.1995, two days after the increasing half moon on 23.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, five days after the full moon on 20.06.1997, one day after the increasing half moon on 23.05.1999 between the new moon on 15.05.1999 and the full moon on 30.05.1999, three days before the full moon on 05.07.2001, and one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

Significant quantities of individuals of the Broad-Bodied Chaser *Libellula depressa* in the northwestern part of Germany have been encountered near Obererbach westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 27.06.1996 (Leander Hoffmann in Viessmann 1997) which has been four days before the full moon on 01.07.1996, and near Großholbach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.06.1996 (Leander Hoffmann in Viessmann 1997) which has been two days before the full moon on 01.07.1996.

Mass flights of the Broad-Bodied Chaser *Libellula depressa* have also been registered near Halle in the Saale valley and Oppin northnortheast of Halle in the northeastern part of Germany on 31.05.1839 (Germar 1840) which has been three days after the full moon on 28.05.1839, near Boulogne-sur-Mer north of Paris in the northwestern part of France on 01.06.1911 (Baxter 1911) which has been four days after the new moon on 28.05.1911, and near Saint Anne´s-on-the-Sea in Lytham Saint Anne´s south of Blackpool northnorthwest of Liverpool in the northwestern part of England on 03.06.1911 (Baxter 1911) which has been one day before the increasing half moon on 04.06.1911 between the new moon on 28.05.1911 and the full moon on 11.06.1911.

7.7 The Scarce Chaser *Libellula fulva*

Mass flights of the Scarce Chaser *Libellula fulva* O.F. Müller 1764 (Odonata: Libellulidae) in the

middle part of the Upper Rhine valley in the southwestern part of Germany have been mentioned from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals and more than 10 individuals each have flown on 06.06.1993 (Weiss & Schwab 1994), 18.06.1994, 24.07.1994 (Klaus Weiss in Viessmann 1995), 24.07.1999 (Klaus Weiss in Viessmann 2000a), 26.05.2000, 18.06.2000 (Klaus Weiss in Viessmann 2001) and 10.06.2006 (Klaus Weiss in Willigalla 2007), respectively, which has been two days after the full moon on 04.06.1993, five days before the full moon on 23.06.1994, two days after the full moon on 22.07.1994, four days before the full moon on 28.07.1999, one day before the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, one day after the full moon on 17.06.2000 and one day before the full moon on 11.06.2006, respectively.

Significant quantities of individuals of the Scarce Chaser *Libellula fulva* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been notified from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 27.06.1994 (Klaus Weiss in Viessmann 1995), 01.07.1995 – 02.07.1995 (Klaus Weiss in Viessmann 1996) and 12.07.1999 (Klaus Weiss in Viessmann 2000a) which has been four days after the full moon on 23.06.1994, four to five days after the new moon on 27.06.1995 and one day before the new moon on 13.07.1999, respectively.

7.8 The Migrant Hawker *Aeshna mixta*

Mass flights of the Migrant Hawker *Aeshna mixta* Latreille 1805 (Odonata: Aeshnidae) have been reported from Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where more than 10 individuals each have flown on 27.09.1997 (Erwin Sefrin in Viessmann 1998) and 15.09.2001 (Erwin Sefrin in Viessmann 2002) which has been four days before the new moon on 01.10.1997 and two days before the new moon on 17.09.2001, respectively; from the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel in the western part of Germany where more than 10 individuals each have flown on 12.09.1999 (Monika Robeck in Viessmann 2000a) and 25.08.2001 (Monika Robeck in Viessmann 2002) which has been two days after the new moon on 10.09.1999, and one day before the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; and from the river Gironde in the vicinity of Saint Estèphe westsouthwest of Limoges in the southwestern part of France on 23.09.1884 (Campbell 1885) which has been four days after the new moon on 19.09.1884.

Significant quantities of individuals of the Migrant Hawker *Aeshna mixta* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 23.08.1994 – 25.08.1994, 23.09.1994 – 25.09.1994 (Klaus Weiss in Viessmann 1995), 08.07.1995, 12.08.1995 and 19.08.1995 (Klaus Weiss in Viessmann 1996) which has been two to four days after the full moon on 21.08.1994, four to six days after the full moon on 19.09.1994, four days before the full moon on 12.07.1995, two days after the full moon on 10.08.1995, and on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 (Klaus Weiss in Viessmann 1995) and 24.07.1999 (Klaus Weiss in Viessmann 2000a) which has been four days after the full moon on 21.08.1994 and four days before the full moon on 28.07.1999, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1994, 25.08.1994 (Klaus Weiss in Viessmann 1995), 01.08.1995 and 12.08.1995 (Klaus Weiss in Viessmann 1996) which has been three days after the full moon on

22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 10.09.1995 (ERWIN SEFRIN in VIESSMANN 1996), 01.09.1997, 19.10.1997 (ERWIN SEFRIN in VIESSMANN 1998), 30.08.1999 (ERWIN SEFRIN in VIESSMANN 2000a), 01.09.2000, 20.09.2000 (ERWIN SEFRIN in VIESSMANN 2001) and 24.08.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been one day after the full moon on 09.09.1995, one day before the new moon on 02.09.1997, three days after the full moon on 16.10.1997, four days after the full moon on 26.08.1999, three days after the new moon on 29.08.2000, two days before the decreasing half moon on 22.09.2000 between the full moon on 13.09.2000 and the new moon on 27.09.2000, and three days after the full moon on 21.08.2002, respectively.

Significant quantities of individuals of the Migrant Hawker *Aeshna mixta* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 24.09.1996 (VIESSMANN 1997), 09.09.1997, 20.09.1997 (VIESSMANN 1998), 13.09.1998, 19.09.1998 (VIESSMANN 1999), 17.09.2000 (VIESSMANN 2001), 29.08.2001 (VIESSMANN 2002), 09.09.2002 (VIESSMANN 2003) and 15.09.2003 (VIESSMANN 2004) which has been three days before the full moon on 27.09.1996, two days before the increasing half moon on 11.09.1997 between the new moon on 02.09.1997 and the full moon on 16.09.1997, four days after the full moon on 16.09.1997, one day before the decreasing half moon on 14.09.1998 between the full moon on 06.09.1998 and the new moon on 20.09.1998, one day before the new moon on 20.09.1998, four days after the full moon on 13.09.2000, five days before the full moon on 03.09.2001, two days after the new moon on 07.09.2002 and five days after the full moon on 10.09.2003, respectively; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 14.08.1995 (VIESSMANN 1996) which has been four days after the full moon on 10.08.1995.

Significant quantities of individuals of the Migrant Hawker *Aeshna mixta* in the western and northwestern parts of Germany have also been encountered at the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel in the western part of Germany where up to 10 individuals have flown on 17.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999) which has been five days before the new moon on 22.08.1998, near Nentershausen westnorthwest of Limburg an der Lahn in the northwestern part of Germany where up to 10 individuals have flown on 10.09.2000 (LEANDER HOFFMANN in VIESSMANN 2001) which has been three days before the full moon on 13.09.2000, and near Berod northeast of Montabaur westnorthwest of Limburg an der Lahn in the northwestern part of Germany where up to 10 individuals have flown on 11.09.2000 (LEANDER HOFFMANN in VIESSMANN 2001) which has been two days before the full moon on 13.09.2000.

7.9 The Southern Migrant Hawker *Aeshna affinis*

Mass flights of the Southern Migrant Hawker *Aeshna affinis* LINDEN 1820 (Odonata: Aeshnidae) have been mentioned from In den Bohlen near Mainz at the northern margin of the Upper Rhine valley in the central part of Germany where more than 10 individuals have flown on 20.07.2006 (C. WENDELS in WILLIGALLA 2007) which has been four days before the new moon on 24.07.2006.

Significant quantities of individuals of the Southern Migrant Hawker *Aeshna affinis* in the middle part of the Upper Rhine valley in the southwestern part of Germany have been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 21.07.2000, 14.08.2000 (KLAUS WEISS in VIESSMANN 2001), 30.07.2001 (KLAUS WEISS in VIESSMANN 2002), 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) and 08.09.2003 (KLAUS WEISS in VIESSMANN 2004) which has been two days after the full moon on 10.08.1995, three days before the full moon on 28.07.1999, five days after the full moon on 16.07.2000, one day before the full moon on 15.08.2000, five days before the full moon on 04.08.2001, one day after the new moon on 07.09.2002 and two days before the full moon on 10.09.2003, respectively; and near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

Significant quantities of individuals of the Southern Migrant Hawker *Aeshna affinis* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 24.08.1997 (VIESSMANN 1998) and 18.08.1998 (VIESSMANN 1999) which has been two days before the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 02.09.^997, and four days before the new moon on 22.08.1998, respectively.

7.10 The Southern Hawker *Aeshna cyanea*

Mass flights of the Southern Hawker *Aeshna cyanea* RAMBUR 1842 (Odonata: Aeshnidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been signaled from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been three days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively.

Significant quantities of individuals of the Southern Hawker *Aeshna cyanea* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994, 09.07.1994, 31.07.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995, 27.07.1995, 02.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999, 26.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been four days after the full moon on 23.06.1994, on the new moon on 09.07.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, four days after the full moon on 19.09.1994, four days before the full moon on 12.07.1995, on the new moon on 27.07.1995, three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, two days before the full moon on 28.07.1999 and one day after the new moon on 07.09.2002, respectively; near Offenbach an der Queich and at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, and near

Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 13.08.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been two days before the full moon on 15.08.2000.

Significant quantities of individuals of the Southern Hawker *Aeshna cyanea* in the southwestern part of Germany have also been recognized near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, near Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999; in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 24.07.1997 (VIESSMANN 1998), 25.07.1998 (VIESSMANN 1999), 30.07.2000 (VIESSMANN 2001), 19.08.2001 (VIESSMANN 2002), 10.08.2002, 15.08.2002 (VIESSMANN 2003), 10.07.2003 and 15.08.2003 (VIESSMANN 2004) which has been four days before the full moon on 20.07.1997, two days after the new moon on 23.07.1998, one day before the new moon on 31.07.2000, on the new moon on 19.08.2001, two days after the new moon on 08.08.2002, on the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, three days before the full moon on 13.07.2003 and three days after the full moon on 12.08.2003, respectively; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 14.08.1995 (VIESSMANN 1996) which has been four days after the full moon on 10.08.1995.

Mass flights of the Southern Hawker *Aeshna cyanea* in the western part of Germany have been documented from the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where more than 10 individuals have flown on 29.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been one day after the full moon on 28.07.1999, from Mülheim-Kärlich westnorthwest of Koblenz in the Middle Rhine valley where 10 individuals have flown on 12.09.1994 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in VIESSMANN 1995) which has been one day before the increasing half moon on 13.09.1994 between the new moon on 05.09.1994 and the full moon on 19.09.1994, and from Wolken in the Moselle valley north of Kobern-Gondorf westsouthwest of Koblenz where more than 5 individuals have flown on 15.08.1994 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in VIESSMANN 1995) which has been on the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994.

Significant quantities of individuals of the Southern Hawker *Aeshna cyanea* in the western part of Germany have also been noticed near Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals each have flown on 04.07.2000 (MONIKA ROBECK in VIESSMANN 2001), 28.07.2001 and 11.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been three days after the new moon on 01.07.2000, on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, and two days before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, respectively; in the Wadrilltal near Wadrill north of Wadern south of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 13.08.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the full moon on 15.08.2000, near Thranenweier northnortheast of Börfink northnorthwest of Birkenfeld in the central part of the Hunsrück where up to 10 individuals have flown on 12.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001; at the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where up to 10 individuals each have flown on 12.08.2000 (MONIKA ROBECK in VIESSMANN 2001) and 25.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been three days before

the full moon on 15.08.2000, and one day before the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; near Binsfeld east of Bitburg in the southwestern part of the Eifel where up to 10 individuals have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the new moon on 19.08.2001; at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 07.08.1996, 21.09.1996 (KLAUS BITTNER in VIESSMANN 1997), 04.09.1999 (KLAUS BITTNER in VIESSMANN 2000a) and 03.08.2001 (KLAUS BITTNER in VIESSMANN 2002) which has been on the decreasing half moon on 07.08.1996 between the full moon on 30.07.1996 and the new moon on 14.08.1996, on the increasing half moon on 21.09.1996 between the new moon on 12.09.1996 and the full moon on 27.09.1996, one day after the decreasing half moon on 03.09.1999 between the full moon on 26.08.1999 and the new moon on 10.09.1999, and one day before the full moon on 04.08.2001, respectively; near Mertloch southeast of Mayen in the southeastern part of the Eifel where up to 10 individuals have flown on 26.08.1992 (BOSSELMANN 1993) which has been two days before the new moon on 28.08.1992, and near Rheinbrohl in the Middle Rhine valley northwest of Koblenz where more than 5 individuals have flown on 31.07.1991 (BOSSELMANN 1992) which has been five days after the full moon on 26.07.1991.

Significant quantities of individuals of the Southern Hawker *Aeshna cyanea* in the northwestern part of Germany have been encountered near Herschbach west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 20.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 15.07.1996, near Obererbach northwest of Limburg an der Lahn where up to 10 individuals have flown on 25.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days before the full moon on 30.07.1996, near Hundsangen northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 27.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 30.07.1996, and near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996.

7.11 The Green Hawker *Aeshna viridis*

In 2007, the abundant individuals of the Red Admiral *Vanessa atalanta* LINNAEUS 1758 (Lepidoptera: Nymphalidae) and the Comma Butterfly *Polygonia c-album* LINNAEUS 1758 (Lepidoptera: Nymphalidae) which have appeared almost suddenly at the locality Nußloch around the new moon on 11.09.2007 when numerous individuals have shown up almost from one day to the next and have particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards have been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* LINNAEUS 1758 (Lepidoptera: Satyridae) and the Green Hawker *Aeshna viridis* EVERSMANN 1836 (Odonata: Aeshnidae) especially in the vineyards, with many individuals having sucked juice of overmature grapes and plums. The peak of flight of the Green Hawker *Aeshna viridis* has therefore also been around the new moon on 11.09.2007. The vineyards and meadows near the forest in Nußloch are in several hundreds of m distance from a few small creeks running down from the hills into the plain and extending further within the plain, and in a few km distance from some ponds within the plain.

In 2008, the various individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* which have almost suddenly been present at the locality Nußloch a few days before the new moon on 29.09.2008 and have again particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the

vineyards have again been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* and the Green Hawker *Aeshna viridis* especially in the vineyards, with many individuals having sucked juice of overmature grapes and plums. The peak of flight of the Green Hawker *Aeshna viridis* has therefore also been around the new moon on 29.09.2008.

In 2009, the abundant individuals of the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* which have almost suddenly shown up at the locality Nußloch a few days before the full moon on 04.09.2009 and have again particularly flown in the vineyards with blue grapes as well as around plum trees and bee hives in the meadows close to the forest between the vineyards have again been accompanied by numerous individuals of the Speckled Wood *Pararge aegeria* and the Green Hawker *Aeshna viridis* especially in the vineyards, with many individuals having sucked juice of overmature grapes and plums. The peak of flight of the Green Hawker *Aeshna viridis* has therefore also been around the full moon on 04.09.2009.

7.12 The Common Darter *Sympetrum striolatum*

Mass flights of the Common Darter *Sympetrum striolatum* Charpentier 1840 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been reported from Zeiskam eastnortheast of Landau in der Pfalz where more than 20 individuals have flown on 12.08.1995 (Klaus Weiss in Viessmann 1996), more than 50 individuals have flown and have deposited eggs on 08.09.2002 (Klaus Weiss in Viessmann 2003), and more than 20 individuals have flown on 16.08.2003 (Klaus Weiss in Viessmann 2004) which has been two days after the full moon on 10.08.1995, one day after the new moon on 07.09.2002 and four days after the full moon on 12.08.2003, respectively; and from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals have flown on 01.08.1995 (Klaus Weiss in Viessmann 1996) which has been five days after the new moon on 27.07.1995.

Significant quantities of individuals of the Common Darter *Sympetrum striolatum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been signaled from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 23.08.1994 – 25.08.1994, 23.09.1994 – 25.09.1994 (Klaus Weiss in Viessmann 1995), 08.07.1995 and 25.07.1995 (Klaus Weiss in Viessmann 1996) which has been two to four days after the full moon on 21.08.1994, four to six days after the full moon on 19.09.1994, four days before the full moon on 12.07.1995 and two days before the new moon on 27.07.1995, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 25.08.1994 (Klaus Weiss in Viessmann 1995) which has been four days after the full moon on 21.08.1994; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1994 and 25.08.1994 (Klaus Weiss in Viessmann 1995) which has been three days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively; from Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 19.08.1995 (Klaus Weiss in Viessmann 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995; from Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 04.09.1994 (Klaus Weiss in Viessmann 1995) which has been four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively; and from Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 01.09.1997 (Erwin Sefrin in Viessmann 1998), 24.09.2000 (Erwin Sefrin in Viessmann 2001) and 08.09.2002 (Erwin Sefrin in Viessmann 2003) which has been one day before the new moon on 02.09.1997, three days before the new moon on 27.09.2000 and one day after the new moon on 07.09.2002, respectively.

Mass flights of the Common Darter *Sympetrum striolatum* in the southwestern part of Germany have also been notified from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 14.08.1995 (VIESSMANN 1996), 22.08.1996 (VIESSMANN 1997), 27.09.2000 (VIESSMANN 2001) and 07.09.2001 (VIESSMANN 2002) which has been four days after the full moon on 10.08.1995, one day before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, on the new moon on 27.09.2000 and four days after the full moon on 03.09.2001, respectively; from Rothenkirchen in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals each and more than 10 individuals each have flown on 10.06.2000 (VIESSMANN 2001), 15.06.2001 (VIESSMANN 2002), 15.08.2002 (VIESSMANN 2003) and 15.08.2003 (VIESSMANN 2004), respectively, which has been on the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 17.06.2000, on the decreasing half moon on 15.06.2001 between the full moon on 06.06.2001 and the new moon on 21.06.2001, on the increasing half moon on 15.08.2002 between the new moon on 08.08.2002 and the full moon on 21.08.2002, and three days after the full moon on 12.08.2003, respectively; from Laubenheim in the Nahe valley south of Bingen where abt. 5 individuals and up to 10 individuals have flown on 12.09.1992 (MARTIN KROHNE in BOSSELMANN 1993) and 21.08.1995 (MARTIN KROHNE in VIESSMANN 1996), respectively, which has been on the full moon on 12.09.1992 and five days before the new moon on 26.08.1995, respectively; and from In den Bohlen near Mainz and the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where abt. 20 individuals each have flown on 12.09.2006 and 13.09.2006, respectively (C. WENDELS in WILLIGALLA 2007), which has been one and two days before the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006, respectively.

Significant quantities of individuals of the Common Darter *Sympetrum striolatum* in the southwestern part of Germany have also been recognized in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 07.09.2002 (VIESSMANN 2003) and 06.09.2003 (VIESSMANN 2004) which has been on the new moon on 07.09.2002 and four days before the full moon on 10.09.2003, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 14.09.1997, 20.09.1997 (VIESSMANN 1998), 10.09.1998 (VIESSMANN 1999) and 09.09.2002 (VIESSMANN 2003) which has been two days before and four days after the full moon on 16.09.1997, four days after the full moon on 06.09.1998 and two days after the new moon on 07.09.2002, respectively; near Laubenheim in the Nahe valley south of Bingen where up to 10 individuals have flown on 23.07.1997 (MARTIN KROHNE in VIESSMANN 1998) which has been three days after the full moon on 20.07.1997, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley in the northwestern part of Germany where up to 10 individuals have flown on 16.08.1998 (MONIKA ROBECK in VIESSMANN 1999) which has been one day after the decreasing half moon on 15.08.1998 between the full moon on 08.08.1998 and the new moon on 22.08.1998.

Mass flights of the Common Darter *Sympetrum striolatum* have also been mentioned from Chur in the Alpine Rhine valley in the northeastern part of Switzerland on 02.10.1920 (TARNUZZER 1922) which has been four days after the full moon on 28.09.1920, from the Prättigau west to northwest of Klosters and northeast to southeast of Igis northeast to north of Chur in the Alpine Rhine valley in the northeastern part of Switzerland on 30.07.1921 (TARNUZZER 1922) which has been one day after the decreasing half moon on 29.07.1921 between the full moon on 20.07.1921 and the new moon on 03.08.1921, and from the Oberengadiner Tal between Sankt Moritz and Maloja southwest of Sankt Moritz in the southeastern part of Switzerland on 12.07.1921 (TARNUZZER 1922) which has been one day before the increasing half moon on 13.07.1921 between the new moon on 05.07.1921 and the full moon on 20.07.1921.

7.13 The Ruddy Darter *Sympetrum sanguineum*

Mass flights of the Ruddy Darter *Sympetrum sanguineum* (O.F. MÜLLER 1764) (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been registered from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each, more than 50 individuals each and more than 10 individuals each have flown on 27.07.1994, 23.08.1994 – 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 18.06.2000, 21.07.2000 and 29.07.2000 (KLAUS WEISS in VIESSMANN 2001), respectively, which has been five days after the full moon on 22.07.1994, two to four days after the full moon on 21.08.1994, four days before the full moon on 12.07.1995, two days after the full moon on 10.08.1995, four days before the full moon on 28.07.1999, one day after the full moon on 17.06.2000, five days after the full moon on 16.07.2000 and two days before the new moon on 31.07.2000, respectively; from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each, more than 10 individuals, more than 50 individuals and more than 20 individuals have flown on 24.06.2001, 22.07.2001, 30.07.2001 (KLAUS WEISS in VIESSMANN 2002), 09.06.2002 (KLAUS WEISS in VIESSMANN 2003), 21.06.2003 and 16.08.2003 (KLAUS WEISS in VIESSMANN 2004), respectively, which has been three days after the new moon on 21.06.2001, two days after the new moon on 20.07.2001, five days before the full moon on 04.08.2001, two days before the new moon on 11.06.2002, on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, and four days after the full moon on 12.08.2003, respectively; from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals have flown and have deposited eggs on 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the new moon on 07.09.2002, from Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals have flown on 16.07.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been five days after the full moon on 11.07.2006; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each, more than 20 individuals each and more than 50 individuals have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995, one day before the new moon on 13.07.1999, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; from Bellheim east of Landau in der Pfalz where more than 10 individuals, more than 50 individuals and abt. 20 individuals have flown on 19.08.1995 (KLAUS WEISS in VIESSMANN 1996), 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) and 08.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, five days before the full moon on 04.08.2001 and three days before the full moon on 11.07.2006, respectively; from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, from Lustadt northwest of Germersheim where more than 10 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008, and from the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel in the western part of Germany where more than 10 individuals have flown on 12.08.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been three days before the full moon on 15.08.2000.

Significant quantities of individuals of the Ruddy Darter *Sympetrum sanguineum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been notified from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 03.09.1994, 23.09.1994 – 25.09.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 – 27.07.1995

(KLAUS WEISS in VIESSMANN 1996), 24.07.1999 – 25.07.1999, 28.09.1999 (KLAUS WEISS in VIESSMANN 2000a), 08.10.2000 (KLAUS WEISS in VIESSMANN 2001) and 12.08.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days before the new moon on 05.09.1994, four to six days after the full moon on 19.09.1994, on and a few days before the new moon on 27.07.1995, three to four days before the full moon on 28.07.1999, three days after the full moon on 25.09.1999, five days before the full moon on 13.10.2000, and one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, respectively; from Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 and 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 27.07.1995, one day before the new moon on 13.07.1999 and four days before the full moon on 28.07.1999, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) and 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days after the full moon on 21.08.1994, two days before the new moon on 27.07.1995 and four days before the full moon on 28.07.1999, respectively; from Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 23.08.1994, 25.09.1994 (KLAUS WEISS in VIESSMANN 1995) and 04.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days after the full moon on 21.08.1994, four days before the decreasing half moon on 29.09.1994 between the full moon on 19.09.1994 and the new moon on 05.10.1994, and one day before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, respectively; from Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 19.06.1994, 10.07.1994, 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively; and from Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 27.08.1996 (ERWIN SEFRIN in VIESSMANN 1997), 12.09.1999 (ERWIN SEFRIN in VIESSMANN 2000a), 20.09.2000, 24.09.2000 (ERWIN SEFRIN in VIESSMANN 2001) and 04.08.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been one day before the full moon on 28.08.1996, two days after the new moon on 10.09.1999, two days before the decreasing half moon on 22.09.2000 between the full moon on 13.09.2000 and the new moon on 27.09.2000, three days before the new moon on 27.09.2000 and four days before the new moon on 08.08.2002, respectively.

Significant quantities of individuals of the Ruddy Darter *Sympetrum sanguineum* in the southwestern part of Germany have also been observed in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.09.1997 (VIESSMANN 1998), 28.09.1998 – 29.09.1998 (VIESSMANN 1999), 24.09.2000 (VIESSMANN 2001), 17.09.2001 (VIESSMANN 2002), 07.09.2002 (VIESSMANN 2003) and 24.06.2003 (VIESSMANN 2004) which has been one day after the decreasing half moon on 24.09.1997 between the full moon on 16.09.1997 and the new moon on 01.10.1997, on and one day before the increasing half moon on 29.09.1998 between the new moon on 20.09.1998 and the full moon on 05.10.1998, three days before the new moon on 27.09.2000, on the new moon on 17.09.2001, on the new moon on 07.09.2002 and five days before the new moon on 29.06.2003, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 10.07.1995 (VIESSMANN 1996) and 21.09.2000 (VIESSMANN 2001) which has been two days before the full moon on 12.07.1995, and one day before the decreasing half moon on 22.09.2000 between the full moon on 13.09.2000 and the new moon on 27.09.2000, respectively; in the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where abt. 5 individuals have flown on 09.08.2006 (ELISABETH KASCHAK in WILLIGALLA 2007) which has been on the full moon on 09.08.2006, and in Mainz at the northern margin of the Upper Rhine val-

ley where abt. 10 individuals have flown on 03.09.2006 (KARSTEN GEES, SABINE VON DER GÖNNA & KATHARINA LÄNEGGERS in WILLIGALLA 2007) which has been four days before the full moon on 07.09.2006.

Significant quantities of individuals of the Ruddy Darter *Sympetrum sanguineum* in the western part of Germany have also been recognized at the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where up to 10 individuals each have flown on 17.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999), 29.07.1999 (MONIKA ROBECK in VIESSMANN 2000a), 25.08.2001 (MONIKA ROBECK in VIESSMANN 2002) and 25.08.2002 (MONIKA ROBECK in VIESSMANN 2003) which has been five days before the new moon on 22.08.1998, one day after the full moon on 28.07.1999, one day before the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, and four days after the full moon on 21.08.2002, respectively; near Binsfeld east of Bitburg in the southwestern part of the Eifel where up to 10 individuals each have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) and 18.08.2002 (MONIKA ROBECK in VIESSMANN 2003) which has been one day before the new moon on 19.08.2001 and three days before the full moon on 21.08.2002, respectively; near Kanzem in the Saar valley south of Konz southsouthwest of Trier where more than 10 individuals have flown on 01.08.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been one day after the new moon on 31.07.2000, and at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals have flown on 19.10.1997 (KLAUS BITTNER in VIESSMANN 1998) which has been three days after the full moon on 16.10.1997.

Significant quantities of individuals of the Ruddy Darter *Sympetrum sanguineum* in the northwestern part of Germany have been encountered near Hundsangen northnorthwest of Limburg an der Lahn and Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 27.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 30.07.1996, near Großholbach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn as well as Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996, and near Herschbach west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 20.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996.

7.14 The Vagrant Darter *Sympetrum vulgatum*

Mass flights of the Vagrant Darter *Sympetrum vulgatum* LINNAEUS 1758 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been recorded from Zeiskam eastnortheast of Landau in der Pfalz where more than 20 individuals and more than 50 individuals each have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 24.07.1999 – 25.07.1999, 28.09.1999 (KLAUS WEISS in VIESSMANN 2000a) and 08.09.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been two days after the full moon on 10.08.1995, three to four days before the full moon on 28.07.1999, three days after the full moon on 25.09.1999 and one day after the new moon on 07.09.2002, respectively; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each and more than 20 individuals have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) as well as on 01.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994 and five days after the new moon on 27.07.1995, respectively; and from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 indi-

viduals each have flown on 14.08.1995 (VIESSMANN 1996) and 28.08.1996 (VIESSMANN 1997) which has been four days after the full moon on 10.08.1995 and on the full moon on 28.08.1996, respectively.

Significant quantities of individuals of the Vagrant Darter *Sympetrum vulgatum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been notified from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 31.07.1994, 23.09.1994 – 25.09.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995, 02.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 25.09.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, four to six days after the full moon on 19.09.1994, two days before the new moon on 27.07.1995, three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, and on the full moon on 25.09.1999, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) and 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been four days after the full moon on 21.08.1994 and two days before the new moon on 27.07.1995, respectively; from Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995; from Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively; from Römerberg-Heiligenstein southsouthwest of Speyer where up to 10 individuals have flown on 09.09.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been four days before the full moon on 13.09.2000, and from Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 08.09.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been one day after the new moon on 07.09.2002.

Significant quantities of individuals of the Vagrant Darter *Sympetrum vulgatum* in the southwestern part of Germany have also been encountered in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.09.1997 (VIESSMANN 1998), 08.09.1998 – 09.09.1998 (VIESSMANN 1999), 08.09.2000 (VIESSMANN 2001), 08.09.2001 (VIESSMANN 2002), 03.09.2002 (VIESSMANN 2003) and 05.09.2003 (VIESSMANN 2004) which has been one day after the decreasing half moon on 24.09.1997 between the full moon on 16.09.1997 and the new moon on 01.10.1997, two to three days after the full moon on 06.09.1998, five days before the full moon on 13.09.2000, five days after the full moon on 03.09.2001, four days before the new moon on 07.09.2002 and five days before the full moon on 10.09.2003, respectively; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 14.09.1997 (VIESSMANN 1998), 10.09.1998 (VIESSMANN 1999), 16.09.2000 (VIESSMANN 2001), 06.09.2001, 16.09.2001 (VIESSMANN 2002), 22.09.2002 (VIESSMANN 2003) and 18.09.2003 (VIESSMANN 2004) which has been two days before the full moon on 16.09.1997, four days after the full moon on 06.09.1998, three days after the full moon on 13.09.2000, three days after the full moon on 03.09.2001, one day before the new moon on 17.09.2001, one day after the full moon on 21.09.2002, and on the decreasing half moon on 18.09.2003 between the full moon on 10.09.2003 and the new moon on 26.09.2003, respectively.

Mass flights of the Vagrant Darter *Sympetrum vulgatum* in the western part of Germany have been documented from the Ulmener Maar near Ulmen east of Daun in the southwestern part of the Eifel where more than 50 individuals have flown on 15.08.1994 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in VIESSMANN 1995) which has been on the increasing half moon on 15.08.1994 between the new

moon on 07.08.1994 and the full moon on 21.08.1994, from the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where abt. 30 individuals have flown on 30.08.1994 (EDITH BOSSELMANN & JÜRGEN BOSSELMANN in VIESSMANN 1995) which has been on the decreasing half moon on 30.08.1994 between the full moon on 21.08.1994 and the new moon on 05.09.1994; from Wolken in the Moselle valley north of Kobern-Gondorf westsouthwest of Koblenz where abt. 50 individuals and abt. 10 individuals have flown on 10.08.1994 and 24.09.1994, respectively (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in VIESSMANN 1995), which has been three days after the new moon on 07.08.1994 and five days after the full moon on 19.09.1994, respectively; and from Obererbach northwest of Limburg an der Lahn in the northwestern part of Germany where more than 10 individuals have flown on 25.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day after the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 01.07.1996.

Significant quantities of individuals of the Vagrant Darter *Sympetrum vulgatum* in the western part of Germany have been signaled from Mertloch southeast of Mayen in the southeastern part of the Eifel where abt. 5 individuals have flown on 26.08.1992 (BOSSELMANN 1993) which has been two days before the new moon on 28.08.1992.

Significant quantities of individuals of the Vagrant Darter *Sympetrum vulgatum* in the northwestern part of Germany have also been recognized near Hundsangen northnorthwest of Limburg an der Lahn and Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 27.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 30.07.1996, near Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996, near Nentershausen westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 19.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 14.08.1996, near Herschbach west of Dornburg northnorthwest of Limburg an der Lahn and Molsberg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the increasing half moon on 23.08.1996 between the new moon on 14.08.1996 and the full moon on 28.08.1996, near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 29.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day after the full moon on 28.08.1996, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley in the northwestern part of Germany where up to 10 individuals have flown on 16.08.1998 (MONIKA ROBECK in VIESSMANN 1999) which has been one day after the decreasing half moon on 15.08.1998 between the full moon on 08.08.1998 and the new moon on 22.08.1998.

7.15 The Black Darter *Sympetrum danae*

Mass flights of the Black Darter *Sympetrum danae* (SULZER 1776) (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been noticed near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 14.08.2000 (KLAUS WEISS in VIESSMANN 2001) and 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days after the full moon on 10.08.1995, one day before the full moon on 15.08.2000 and five days before the full moon on 04.08.2001, respectively; and near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals have flown and have deposited eggs on 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the new moon on 07.09.2002.

Significant quantities of individuals of the Black Darter *Sympetrum danae* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 25.08.1994, 23.09.1994 – 25.09.1994 (KLAUS WEISS in VIESSMANN 1995) and 25.09.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days after the full moon on 21.08.1994, four to six days after the full moon on 19.09.1994 and on the full moon on 25.09.1999, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 14.08.1995 (VIESSMANN 1996) which has been four days after the full moon on 10.08.1995.

Significant quantities of individuals of the Black Darter *Sympetrum danae* in the western part of Germany have been noticed at the Laacher See in the southeastern part of the Eifel north of Mendig westnorthwest of Koblenz where abt. 5 individuals have flown on 04.09.1991 (BOSSELMANN 1992) which has been four days before the new moon on 08.09.1991.

7.16 The Red-Veined Darter *Sympetrum fonscolombii*

Mass flights of the Red-Veined Darter *Sympetrum fonscolombii* (SÉLYS 1840) (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been observed near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals, more than 10 individuals and more than 20 individuals have flown on 15.06.2002 (KLAUS WEISS in VIESSMANN 2003), 21.06.2003 (KLAUS WEISS in VIESSMANN 2004) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been four days after the new moon on 11.06.2002, on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, and one day before the full moon on 11.06.2006, respectively.

Significant quantities of individuals of the Red-Veined Darter *Sympetrum fonscolombii* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 23.08.1994 – 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been two to four days after the full moon on 21.08.1994.

7.17 The Yellow-Winged Darter *Sympetrum flaveolum*

Mass flights of the Yellow-Winged Darter *Sympetrum flaveolum* LINNAEUS 1758 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been encountered near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals, more than 20 individuals and more than 10 individuals have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 29.07.2000 (KLAUS WEISS in VIESSMANN 2001) and 16.08.2003 (KLAUS WEISS in VIESSMANN 2004), respectively, which has been two days after the full moon on 10.08.1995, two days before the new moon on 31.07.2000 and four days after the full moon on 12.08.2003, respectively.

Significant quantities of individuals of the Yellow-Winged Darter *Sympetrum flaveolum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on

25.08.1994 and 23.09.1994 – 25.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and four to six days after the full moon on 19.09.1994, respectively; and near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively.

Significant quantities of individuals of the Yellow-Winged Darter *Sympetrum flaveolum* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 24.08.1997 (VIESSMANN 1998) which has been two days before the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 02.09.1997.

Significant quantities of individuals of the Yellow-Winged Darter *Sympetrum flaveolum* in the western part of Germany have been found at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 21.09.1996 (KLAUS BITTNER in VIESSMANN 1997) and 19.10.1997 (KLAUS BITTNER in VIESSMANN 1998) which has been on the increasing half moon on 21.09.1996 between the new moon on 12.09.1996 and the full moon on 27.09.1996, and three days after the full moon on 16.10.1997, respectively.

7.18 The Southern Damselfly *Coenagrion mercuriale*

Mass flights of the Southern Damselfly *Coenagrion mercuriale* CHARPENTIER 1825 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been identified near Zeiskam eastnortheast of Landau in der Pfalz where abt. 20 individuals, more than 100 individuals, more than 50 individuals each, more than 150 individuals, more than 50 individuals and more than 10 individuals each have flown on 25.06.1991 (KLAUS WEISS in BOSSELMANN 1992), 06.06.1993 (WEISS & SCHWAB 1994), 27.05.1994, 18.06.1994, 27.06.1994, 24.07.1994 (KLAUS WEISS in VIESSMANN 1995), 27.06.1995, 01.07.1995, 02.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999, 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 26.05.2000, 18.06.2000 (KLAUS WEISS in VIESSMANN 2001), 23.06.2001 (KLAUS WEISS in VIESSMANN 2002), 31.05.2002, 04.06.2002, 15.06.2002 (KLAUS WEISS in VIESSMANN 2003) and 29.05.2003 (KLAUS WEISS in VIESSMANN 2004), respectively, which has been two days before the full moon on 27.06.1991, two days after the full moon on 04.06.1993, two days after the full moon on 25.05.1994, five days before and four days after the full moon on 23.06.1994, two days after the full moon on 22.07.1994, on and four days after the new moon on 27.06.1995, three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, four days before the full moon on 28.07.1999, one day before the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, one day after the full moon on 17.06.2000, two days after the new moon on 21.06.2001, five days after the full moon on 26.05.2002, one day after the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, four days after the new moon on 11.06.2002 and two days before the new moon on 31.05.2003, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 500 individuals, more than 150 individuals, more than 100 individuals, 20 individuals and more than 300 individuals have flown on 07.06.2003, 09.06.2003, 22.06.2003 (KLAUS WEISS in VIESSMANN 2004), 16.05.2006 and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, five days before the full moon on 14.06.2003, one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on

29.06.2003, three days after the full moon on 13.05.2006 and one day before the full moon on 11.06.2006, respectively; and near Offenbach an der Queich east of Landau in der Pfalz where abt. 20 individuals have flown on 06.06.1993 (WEISS & SCHWAB 1994) which has been two days after the full moon on 04.06.1993.

Significant quantities of individuals of the Southern Damselfly *Coenagrion mercuriale* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where abt. 5 individuals and up to 10 individuals have flown on 30.05.1992 (KLAUS WEISS in BOSSELMANN 1993) and 28.05.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been two days before the new moon on 01.06.1992 and five days after the new moon on 23.05.2001, respectively; and near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

7.19 The Azure Damselfly *Coenagrion puella*

Mass flights of the Azure Damselfly *Coenagrion puella* LINNAEUS 1758 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been verified near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each have flown on 18.06.1994, 27.06.1994, 09.07.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 24.07.1999 – 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 18.06.2000 (KLAUS WEISS in VIESSMANN 2001), 23.06.2001 – 24.06.2001 (KLAUS WEISS in VIESSMANN 2002), 30.05.2002, 09.06.2002, 15.06.2002 (KLAUS WEISS in VIESSMANN 2003), 07.06.2003 and 21.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been five days before and four days after the full moon on 23.06.1994, on the new moon on 09.07.1994, four days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994, three to four days before the full moon on 28.07.1999, one day after the full moon on 17.06.2000, two and three days after the new moon on 21.06.2001, four days after the full moon on 26.05.2002, two days before and four days after the new moon on 11.06.2002, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, and on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 150 individuals and more than 100 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been one day before the new moon on 13.07.1999 and one day before the full moon on 11.06.2006, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 03.06.1995, 01.07.1995, 08.07.1995, 02.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 13.05.2000 and 12.07.2000 (KLAUS WEISS in VIESSMANN 2001) which has been five days after the new moon on 29.05.1995, four days after the new moon on 27.06.1995, four days before the full moon on 12.07.1995, three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, two days after the full moon on 10.08.1995, five days before the full moon on 18.05.2000 and four days before the full moon on 16.07.2000, respectively; near Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each and more than 100 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 28.07.2001 (KLAUS WEISS in VIESSMANN 2002), 20.05.2002 and 16.06.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been one day before the new moon on 13.07.1999, on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, one day after the increasing half moon on 19.05.2002 between the new moon on 12.05.2002 and the full moon on 26.05.2002, and five days after the new moon on 11.06.2002, respectively; near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each and more

than 10 individuals have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) and 20.05.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, and one day after the increasing half moon on 19.05.2002 between the new moon on 12.05.2002 and the full moon on 26.05.2002, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 100 individuals each and more than 50 individuals each have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each, more than 50 individuals each and more than 20 individuals have flown on 27.06.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 23.06.2001 (KLAUS WEISS in VIESSMANN 2002), 30.05.2002 (KLAUS WEISS in VIESSMANN 2003), 07.06.2003 (KLAUS WEISS in VIESSMANN 2004) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994, two days before the new moon on 27.07.1995, two days after the new moon on 21.06.2001, four days after the full moon on 26.05.2002, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, and one day before the full moon on 11.06.2006, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 50 individuals each and more than 10 individuals each have flown on 19.06.1994, 10.07.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 01.06.2000 (KLAUS WEISS in VIESSMANN 2001) and 23.06.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been four days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, two days before the new moon on 27.07.1995, one day before the new moon on 02.06.2000 and one day before the full moon on 24.06.2002, respectively; near Herxheimweyher east of Herxheim eastsoutheast of Landau in der Pfalz where more than 50 individuals have flown on 02.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002; near Lustadt northwest of Germersheim where more than 200 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008; and near Römerberg-Mechtersheim southsouthwest of Speyer where more than 10 individuals each and more than 50 individuals each have flown on 08.06.1996 (ERWIN SEFRIN in VIESSMANN 1997), 19.05.1997 (ERWIN SEFRIN in VIESSMANN 1998), 24.05.1999 (ERWIN SEFRIN in VIESSMANN 2000a) and 14.05.2000 (ERWIN SEFRIN in VIESSMANN 2001), respectively, which has been one day before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, three days before the full moon on 22.05.1997, one day after the increasing half moon on 23.05.1999 between the new moon on 15.05.1999 and the full moon on 30.05.1999, and four days before the full moon on 18.05.2000, respectively.

Significant quantities of individuals of the Azure Damselfly *Coenagrion puella* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 30.05.1994, 31.07.1994 (KLAUS WEISS in VIESSMANN 1995), 27.06.1995 (KLAUS WEISS in VIESSMANN 1996) and 03.06.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been five days after the full moon on 25.05.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, on the new moon on 27.06.1995, and one day before the increasing half moon on 04.06.2006 between the new moon on 27.05.2006 and the full moon on 11.06.2006, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals have

flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 18.05.1994, 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been one day before the decreasing half moon on 19.05.1994 between the full moon on 10.05.1994 and the new moon on 25.05.1994, four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 28.05.1995 (ERWIN SEFRIN in VIESSMANN 1996) and 02.06.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been one day before the new moon on 29.05.1995, and one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

Mass flights of the Azure Damselfly *Coenagrion puella* in the southwestern part of Germany have also been registered in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each and more than 50 individuals each have flown on 25.06.1997 (VIESSMANN 1998), 01.06.1998, 10.06.1998 (VIESSMANN 1999), 20.05.1999, 09.06.1999 (VIESSMANN 2000a), 20.06.2000, 29.06.2000 (VIESSMANN 2001), 29.07.2001 (VIESSMANN 2002), 15.05.2002, 09.07.2002 and 27.07.2002 (VIESSMANN 2003) as well as on 15.05.2003, 10.07.2003 and 26.07.2003 (VIESSMANN 2004), respectively, which has been five days after the full moon on 20.06.1997, two days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, on the full moon on 10.06.1998, five days after the new moon on 15.05.1999, one day after the decreasing half moon on 08.06.1999 between the full moon on 30.05.1999 and the new moon on 13.06.1999, three days after the full moon on 17.06.2000, two days before the new moon on 01.07.2000, one day after the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, three days after the new moon on 12.05.2002, one day before the new moon on 10.07.2002, three days after the full moon on 27.07.2002, one day before the full moon on 16.05.2003, three days before the full moon on 13.07.2003 and three days before the new moon on 29.07.2003, respectively; near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals and more than 50 individuals each have flown on 09.08.1998 (VIESSMANN 1999), 01.08.1999 (VIESSMANN 2000a) and 03.08.2000 (VIESSMANN 2001), respectively, which has been one day after the full moon on 08.08.1998, four days after the full moon on 28.07.1999 and three days after the new moon on 31.07.2000, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each and more than 50 individuals each have flown on 10.06.1995, 17.07.1995 (VIESSMANN 1996), 15.06.1997, 20.06.1997 (VIESSMANN 1998), 12.06.1996, 27.06.1996 (VIESSMANN 1997), 31.05.1998, 18.06.1998, 24.06.1998, 30.06.1998 (VIESSMANN 1999), 26.05.1999, 21.06.1999 (VIESSMANN 2000a), 20.06.2000 (VIESSMANN 2001), 24.07.2001 (VIESSMANN 2002), 12.06.2002 and 29.07.2002 (VIESSMANN 2003) as well as on 17.06.2003 and 30.07.2003 (VIESSMANN 2004), respectively, which has been three days before the full moon on 13.06.1995, five days after the full moon on 12.07.1995, four days before the new moon on 16.06.1996, four days before the full moon on 01.07.1996, five days before and on the full moon on 20.06.1997, four days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, on the decreasing half moon on 18.06.1998 between the full moon on 10.06.1998 and the new moon on 24.06.1998, on the new moon on 24.06.1998, two days before the increasing half moon on 02.07.1998 between the new moon on 24.06.1998 and the full moon on 09.07.1998, four days before the full moon on 30.05.1999, on the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 28.06.1999, three days after the full moon on 17.06.2000, four days after the new moon on 20.07.2001, one day after the new moon on 11.06.2002, five days after the full moon on 24.07.2002, three days after the full moon on 14.06.2003 and one day after the new moon on 29.07.2003, respectively; near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 50 individuals have flown on

18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, and near Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 10 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999.

Mass flights of the Azure Damselfly *Coenagrion puella* in the western part of Germany have been encountered near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 10 individuals each have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999) and 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the full moon on 08.08.1998 and two days after the new moon on 02.06.2000, respectively; near Thranenweier northnortheast of Börfink northnorthwest of Birkenfeld in the central part of the Hunsrück where more than 10 individuals have flown on 12.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, near Wolken in the Moselle valley north of Kobern-Gondorf westsouthwest of Koblenz where more than 20 individuals have flown on 07.06.1992 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in BOSSELMANN 1993) which has been one day before the increasing half moon on 08.06.1992 between the new moon on 01.06.1992 and the full moon on 15.06.1992; and at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where more than 10 individuals each have flown on 28.05.1997 (KLAUS BITTNER in VIESSMANN 1998) and 13.07.2001 (KLAUS BITTNER in VIESSMANN 2002) which has been two days before the decreasing half moon on 30.05.1997 between the full moon on 22.05.1997 and the new moon on 05.06.1997, and one day before the decreasing half moon on 14.07.2001 between the full moon on 05.07.2001 and the new moon on 20.07.2001, respectively.

Significant quantities of individuals of the Azure Damselfly *Coenagrion puella* in the western part of Germany have also been encountered at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 01.06.1996 (KLAUS BITTNER in VIESSMANN 1997) and 04.09.1999 (KLAUS BITTNER in VIESSMANN 2000a) which has been on the full moon on 01.06.1996, and one day after the decreasing half moon on 03.09.1999 between the full moon on 26.08.1999 and the new moon on 10.09.1999, respectively.

Mass flights of the Azure Damselfly *Coenagrion puella* in the northwestern part of Germany have been found near Hundsangen northwest of Limburg an der Lahn where more than 10 individuals have flown on 25.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days after the increasing half moon on 23.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, near Obererbach northwest of Limburg an der Lahn where more than 10 individuals have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996, near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996, near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where more than 10 individuals have flown on 22.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been four days before the decreasing half moon on 26.06.2000 between the full moon on 17.06.2000 and the new moon on 01.07.2000.

Significant quantities of individuals of the Azure Damselfly *Coenagrion puella* in the northwestern part of Germany have also been observed near Nentershausen westnorthwest of Limburg an der Lahn, Hundsangen and Molsberg northwest to northnorthwest of Limburg an der Lahn, and Girod and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 indivi-

duals each have flown on 29.06.1996 (Leander Hoffmann in Viessmann 1997) which has been two days before the full moon on 01.07.1996; near Herschbach and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.07.1996 (Leander Hoffmann in Viessmann 1997) which has been five days after the new moon on 15.07.1996, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where up to 10 individuals have flown on 10.06.1999 (Monika Robeck in Viessmann 2000a) which has been three days before the new moon on 13.06.1999.

7.20 The Variable Damselfly *Coenagrion pulchellum*

Mass flights of the Variable Damselfly *Coenagrion pulchellum* Linden 1825 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been experienced near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 03.06.1995, 08.07.1995 (Klaus Weiss in Viessmann 1996), 09.06.2002 and 15.06.2002 (Klaus Weiss in Viessmann 2003) which has been five days after the new moon on 29.05.1996, four days before the full moon on 12.07.1995, and two days before and four days after the new moon on 11.06.2002, respectively; and in the Erdekaut region near Eisenberg west of Grünstadt where more than 10 individuals each have flown on 02.07.1997 (Viessmann 1998) and 08.07.1998 (Viessmann 1999) which has been two days before the new moon on 04.07.1997 and one day before the full moon on 09.07.1998, respectively.

Significant quantities of individuals of the Variable Damselfly *Coenagrion pulchellum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been recognized near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 02.08.1995 (Klaus Weiss in Viessmann 1996) and 24.07.1999 (Klaus Weiss in Viessmann 2000a) which has been six days after the new moon on 27.07.1995 and four days before the full moon on 28.07.1999, respectively; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 11.06.1995 (Erwin Sefrin in Viessmann 1996) and 02.06.2002 (Erwin Sefrin in Viessmann 2003) which has been two days before the full moon on 13.06.1995, and one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

7.21 The Southern Emerald Damselfly *Lestes barbarus*

Mass flights of the Southern Emerald Damselfly *Lestes barbarus* (Fabricius 1798) (Odonata: Lestidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been reported from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each have flown on 12.08.1995 (Klaus Weiss in Viessmann 1996), 18.06.2000, 29.07.2000, 14.08.2000 (Klaus Weiss in Viessmann 2001), 24.06.2001, 22.07.2001, 30.07.2001 (Klaus Weiss in Viessmann 2002), 09.06.2002, 15.06.2002 and 07.07.2002 (Klaus Weiss in Viessmann 2003) as well as more than 20 individuals have flown on 09.06.2003 (Klaus Weiss in Viessmann 2004) and 10.06.2006 (Klaus Weiss in Willigalla 2007) which has been two days after the full moon on 10.08.1995, one day after the full moon on 17.06.2000, two days before the new moon on 31.07.2000, one day before the full moon on 15.08.2000, three days after the new moon on 21.06.2001, two days after the new moon on 20.07.2001, five days before the full moon on 04.08.2001, two days before and four days after the new moon on 11.06.2002, three days before the new moon on 10.07.2002, five days before the full moon on 14.06.2003 and one day before the full moon on 11.06.2006, respectively; from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals have flown and have deposited eggs on 08.09.2002 (Klaus Weiss in Viessmann 2003) which has been one

day after the new moon on 07.09.2002, from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, and from Lustadt northwest of Germersheim where more than 100 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008.

Significant quantities of individuals of the Southern Emerald Damselfly *Lestes barbarus* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and one day before the new moon on 05.09.1994, respectively.

Mass flights of the Southern Emerald Damselfly *Lestes barbarus* have also been signaled from the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey in the southwestern part of Germany where more than 10 individuals each have flown on 10.07.2003 and 30.07.2003 (VIESSMANN 2004) which has been three days before the full moon on 13.07.2003 and one day after the new moon on 29.07.2003, respectively; and from Nentershausen westnorthwest of Limburg an der Lahn in the northwestern part of Germany where more than 10 individuals have flown on 09.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days before the new moon on 14.08.1996.

Significant quantities of individuals of the Southern Emerald Damselfly *Lestes barbarus* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 09.06.1998, 13.06.1998 (VIESSMANN 1999), 15.06.2000, 30.07.2000 (VIESSMANN 2001), 22.06.2001, 25.06.2001, 29.07.2001 (VIESSMANN 2002), 03.07.2002 and 24.07.2002 (VIESSMANN 2003) which has been one day before and three days after the full moon on 10.06.1998, two days before the full moon on 17.06.2000, one day before the new moon on 31.07.2000, one and four days after the new moon on 21.06.2001, one day after the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, one day after the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002, and on the full moon on 24.07.2002, respectively.

7.22 The Emerald Spreadwing Damselfly *Lestes dryas*

Mass flights of the Emerald Spreadwing Damselfly *Lestes dryas* (W.F. KIRBY 1890) (Odonata: Lestidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been registered from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals have flown on 15.06.2002 (KLAUS WEISS in VIESSMANN 2003) as well as more than 10 individuals have flown and have deposited eggs on 09.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been four days after the new moon on 11.06.2002 and two days before the new moon on 11.06.2002, respectively; and from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 23.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the full moon on 24.06.2002.

Significant quantities of individuals of the Emerald Spreadwing Damselfly *Lestes dryas* in the northwestern part of Germany have been found near Girod east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 29.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day after the full moon on 28.08.1996.

7.23 The Emerald Damselfly *Lestes sponsa*

Mass flights of the Emerald Damselfly *Lestes sponsa* (HANSEMANN 1823) (Odonata: Lestidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been recorded from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals have flown on 22.07.2001 (KLAUS WEISS in VIESSMANN 2002) as well as more than 10 individuals have flown and have deposited eggs on 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been two days after the full moon on 20.07.2001 and one day after the new moon on 07.09.2002, respectively.

Significant quantities of individuals of the Emerald Damselfly *Lestes sponsa* in the southwestern part of Germany have also been noticed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days after the full moon on 10.08.1995; and in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 24.08.1997 (VIESSMANN 1998), 10.08.1998 (VIESSMANN 1999), 10.08.2000 (VIESSMANN 2001), 13.08.2001 (VIESSMANN 2002) and 15.08.2003 (VIESSMANN 2004) which has been two days before the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 02.09.1997, two days after the full moon on 08.08.1998, five days before the full moon on 15.08.2000, on the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, and three days after the new moon on 12.08.2003, respectively.

Mass flights of the Emerald Damselfly *Lestes sponsa* in the western part of Germany have been signaled from Binsfeld east of Bitburg in the southwestern part of the Eifel where more than 10 individuals have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the new moon on 19.08.2001, from the Ulmener Maar near Ulmen east of Daun in the southwestern part of the Eifel where abt. 15 individuals have flown on 15.08.1994 (IRENE KWIATKOWSKI & HANS KWIATKOWSKI in VIESSMANN 1995) which has been on the increasing half moon on 15.08.1994 between the new moon on 07.08.1994 and the full moon on 21.08.1994, from Mertloch southeast of Mayen in the southeastern part of the Eifel where abt. 5 individuals have flown on 26.08.1992 (BOSSELMANN 1993) which has been two days before the new moon on 28.08.1992, and from Röderbach near the Erbeskopf northnorthwest of Birkenfeld in the central part of the Hunsrück where more than 10 individuals have flown on 12.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001.

7.24 The Small Emerald Damselfly *Lestes virens*

Mass flights of the Small Emerald Damselfly *Lestes virens* (CHARPENTIER 1828) (Odonata: Lestidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been mentioned from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 18.06.2000, 21.07.2000, 14.08.2000 and 08.10.2000 (KLAUS WEISS in VIESSMANN 2001) which has been one day after the full moon on 17.06.2000, five days after the full moon on 16.07.2000, one day before the full moon on 15.08.2000 and five days before the full moon on 13.10.2000, respectively; from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each, more than 100 individuals and more than 20 individuals have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 22.07.2001, 30.07.2001 (KLAUS WEISS in VIESSMANN 2002), 07.07.2002 (KLAUS WEISS in VIESSMANN 2003), 21.06.2003 and 16.08.2003 (KLAUS WEISS in VIESSMANN 2004), respectively, which has been two days after the full moon on 10.08.1995, two days after the new moon on 20.07.2001, five days before the full moon on 04.08.2001, three days before the new moon on 10.07.2002, on the decreasing half moon on 21.06.2003 between the full

moon on 14.06.2003 and the new moon on 29.06.2003, and four days after the full moon on 12.08.2003, respectively; and from Zeiskam eastnortheast of Landau in der Pfalz where more than 100 individuals have flown and have deposited eggs on 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the new moon on 07.09.2002.

Significant quantities of individuals of the Small Emerald Damselfly *Lestes virens* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 25.08.1994 and 23.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 21.08.1994 and four days after the full moon on 19.09.1994, respectively.

7.25 The Willow Emerald Damselfly *Chalcolestes viridis*

Mass flights of the Willow Emerald Damselfly *Chalcolestes viridis* (LINDEN 1828) (Odonata: Lestidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been signaled from Zeiskam eastnortheast of Landau in der Pfalz where more than 30 individuals, more than 50 individuals each and more than 10 individuals have flown on 19.09.1993 (WEISS & SCHWAB 1994), 09.07.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been three days after the new moon on 16.09.1993, on the new moon on 09.07.1994, four days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994, four days before the full moon on 12.07.1995 and two days after the full moon on 10.08.1995, respectively; from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals have flown and have deposited eggs on 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the new moon on 07.09.2002; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each have flown on 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; from Bellheim east of Landau in der Pfalz where more than 10 individuals have flown 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, and from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

Significant quantities of individuals of the Willow Emerald Damselfly *Chalcolestes viridis* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the full moon on 10.08.1995; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 12.09.1999 (ERWIN SEFRIN in VIESSMANN 2000a) and 12.08.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been two days after the new moon on 10.09.1999 and three days before the full moon on 15.08.2000, respectively.

Mass flights of the Willow Emerald Damselfly *Chalcolestes viridis* in the southwestern part of Germany have also been documented from the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 24.08.1997 (VIESSMANN 1998), 04.08.1998 (VIESSMANN 1999), 13.08.1999 (VIESSMANN 2000a), 13.08.2000 (VIESSMANN 2001), 10.08.2001 (VIESSMANN 2002), 20.08.2002 (VIESSMANN 2003) and 29.08.2003 (VIESSMANN 2004) which has been two days before the decreasing half moon on 26.08.1997 between the full moon on 18.08.1997 and the new moon on 01.09.1997, four days before the full moon on 08.08.1998, two

days after the new moon on 11.08.1999, two days before the full moon on 15.08.2000, three days before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, one day before the full moon on 21.08.2002 and two days after the new moon on 27.08.2003, respectively; from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 17.07.1995 (VIESSMANN 1996), 20.08.1997 (VIESSMANN 1998), 02.08.1998, 10.08.1998 (VIESSMANN 1999) and 12.08.1999 (VIESSMANN 2000a) which has been five days after the full moon on 12.07.1995, two days after the full moon on 18.08.1997, one day after the increasing half moon on 01.08.1998 between the new moon on 23.07.1998 and the full moon on 08.08.1998, two days after the full moon on 08.08.1998 and one day after the new moon on 11.08.1999, respectively; from the vicinity of Mainz at the northern margin of the Upper Rhine valley where more than 10 individuals have flown on 26.07.2006 (KATHRIN JÄCKEL in WILLIGALLA 2007) which has been two days after the new moon on 24.07.2006, and from Nentershausen westnorthwest of Limburg an der Lahn in the northwestern part of Germany where more than 10 individuals have flown on 09.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days before the new moon on 14.08.1996.

Significant quantities of individuals of the Willow Emerald Damselfly *Chalcolestes viridis* in the southwestern part of Germany have also been confirmed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 24.08.1996 (VIESSMANN 1997) which has been four days before the full moon on 28.08.1996; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 02.08.2000 (VIESSMANN 2001), 10.07.2001 (VIESSMANN 2002) and 19.07.2002 (VIESSMANN 2003) which has been two days after the new moon on 31.07.2000, five days after the full moon on 05.07.2001 and five days before the full moon on 24.07.2002, respectively; and in Mainz at the northern margin of the Upper Rhine valley in the western part of Germany where abt. 10 individuals have flown on 03.09.2006 (KARSTEN GEES, SABINE VON DER GÖNNA & KATHARINA LÄNEGGERS in WILLIGALLA 2007) which has been four days before the full moon on 07.09.2006.

Mass flights of the Willow Emerald Damselfly *Chalcolestes viridis* in the western part of Germany have been signaled from Rheinbrohl in the Middle Rhine valley northwest of Koblenz where abt. 15 individuals have flown on 31.07.1991 (BOSSELMANN 1992) which has been five days after the full moon on 26.07.1991.

Significant quantities of individuals of the Willow Emerald Damselfly *Chalcolestes viridis* in the northwestern part of Germany have been encountered near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn and Molsberg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 15.07.1996, near Kleinholbach and Großholbach east of Montabaur westnorthwest of Limburg an der Lahn as well as Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996, and near Girod and Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day after the full moon on 28.08.1996.

7.26 The Common Winter Damselfly *Sympecma fusca*

Mass flights of the Common Winter Damselfly *Sympecma fusca* (LINDEN 1820) (Odonata: Lestidae)

in the middle part of the Upper Rhine valley in the southwestern part of Germany have been documented from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 24.04.1995, 07.05.1995, 28.05.1995 (KLAUS WEISS in VIESSMANN 1996) and 08.09.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the decreasing half moon on 23.04.1995 between the full moon on 15.04.1995 and the new moon on 29.04.1995, one day before the increasing half moon on 08.05.1995 between the new moon on 29.04.1995 and the full moon on 14.05.1995, one day before the new moon on 29.05.1995 and one day after the new moon on 07.09.2002, respectively.

Significant quantities of individuals of the Common Winter Damselfly *Sympecma fusca* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 23.03.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day after the increasing half moon on 22.03.2002 between the new moon on 14.03.2002 and the full moon on 28.03.2002; and near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been three days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively.

Mass flights of the Common Winter Damselfly *Sympecma fusca* in the southwestern part of Germany have also been mentioned from the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals each and more than 10 individuals each have flown on 13.07.1999 (VIESSMANN 2000a), 18.07.2000 (VIESSMANN 2001), 22.07.2001 and 29.07.2001 (VIESSMANN 2002) as well as on 11.08.2002 (VIESSMANN 2003) and 15.08.2003 (VIESSMANN 2004), respectively, which has been on the new moon on 13.07.1999, two days after the full moon on 16.07.2000, two days after the new moon on 20.07.2001, one day after the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, three days after the new moon on 08.08.2002 and three days after the full moon on 12.08.2003, respectively.

Significant quantities of individuals of the Common Winter Damselfly *Sympecma fusca* in the southwestern part of Germany have also been notified from the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 01.04.2002 (VIESSMANN 2003) and 05.04.2003 (VIESSMANN 2004) which has been four days after the full moon on 28.03.2002 and four days after the new moon on 01.04.2003, respectively.

7.27 The Common Blue Damselfly *Enallagma cyathigerum*

Mass flights of the Common Blue Damselfly *Enallagma cyathigerum* CHARPENTIER 1840 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been encountered near Römerberg-Mechtersheim southsouthwest of Speyer where more than 10 individuals each have flown on 24.05.1999 (ERWIN SEFRIN in VIESSMANN 2000a), 13.08.2000 (ERWIN SEFRIN in VIESSMANN 2001) and 30.06.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been one day after the increasing half moon on 23.05.1999 between the new moon on 15.05.1999 and the full moon on 30.05.1999, two days before the full moon on 15.08.2000, and two days before the decreasing half moon on 02.07.2002 between the full moon on 24.06.2002 and the new moon on 10.07.2002, respectively.

Significant quantities of individuals of the Common Blue Damselfly *Enallagma cyathigerum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been found near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on

03.06.1995 and 08.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the new moon on 29.05.1995 and four days before the full moon on 12.07.1995, respectively; and at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively.

Mass flights of the Common Blue Damselfly *Enallagma cyathigerum* in the southwestern part of Germany have also been observed near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each, more than 50 individuals each and more than 10 individuals have flown on 25.06.1997 (VIESSMANN 1998), 09.08.1998 (VIESSMANN 1999), 10.07.1999 (VIESSMANN 2000a), 11.07.2000 (VIESSMANN 2001), 10.07.2001 (VIESSMANN 2002), 15.06.2002 (VIESSMANN 2003) and 20.06.2003 (VIESSMANN 2004), respectively, which has been five days after the full moon on 20.06.1997, one day after the full moon on 08.08.1998, three days before the new moon on 13.07.1999, two days after the increasing half moon on 09.07.2000 between the new moon on 01.07.2000 and the full moon on 16.07.2000, five days after the full moon on 05.07.2001, four days after the new moon on 11.06.2002, and one day before the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals, more than 10 individuals, more than 30 individuals, more than 20 individuals, more than 30 individuals, more than 10 individuals, more than 20 individuals, more than 30 individuals, more than 50 individuals and more than 10 individuals each have flown on 17.07.1995 (VIESSMANN 1996), 19.07.1996, 27.07.1996 (VIESSMANN 1997), 15.06.1997, 20.06.1997 (VIESSMANN 1998), 31.05.1998, 18.06.1998, 27.06.1998, 30.06.1998 (VIESSMANN 1999), 30.05.1999, 25.06.1999 (VIESSMANN 2000a), 25.06.2000, 30.06.2000 (VIESSMANN 2001), 25.06.2001, 30.06.2001 (VIESSMANN 2002), 05.07.2002 (VIESSMANN 2003), 10.07.2003, 15.07.2003 and 20.07.2003 (VIESSMANN 2004), respectively, which has been five days after the full moon on 12.07.1995, four days after the new moon on 15.07.1996, three days before the full moon on 30.07.1996, five days before and on the full moon on 20.06.1997, four days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, on the decreasing half moon on 18.06.1998 between the full moon on 10.06.1998 and the new moon on 24.06.1998, three days after the new moon on 24.06.1998, two days before the increasing half moon on 02.07.1998 between the new moon on 24.06.1998 and the full moon on 09.07.1998, on the full moon on 30.05.1999, three days before the full moon on 28.06.1999, one day before the decreasing half moon on 26.06.2000 between the full moon on 17.06.2000 and the new moon on 01.07.2000, one day before the new moon on 01.07.2000, four days after the new moon on 21.06.2001, one day after the increasing half moon on 30.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, five days before the new moon on 10.07.2002, three days before and two days after the full moon on 13.07.2003, and one day before the decreasing half moon on 21.07.2003 between the full moon on 13.07.2003 and the new moon on 29.07.2003, respectively.

Mass flights of the Common Blue Damselfly *Enallagma cyathigerum* in the western part of Germany have been encountered near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 10 individuals have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999) which has been two days before the full moon on 08.08.1998, near Binsfeld east of Bitburg in the southwestern part of the Eifel where more than 10 individuals have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the new moon on 19.08.2001, at the Silbersee in Mayen in the southeastern part of the Eifel where abt. 20 individuals have flown on 05.08.1991 (BOSSELMANN 1992) which has been five days before the new moon on 10.08.1991; at the Laacher See in the southeastern part of the Eifel north of Mendig westnorthwest of Koblenz where

abt. 300 individuals and more than 1.000 individuals have flown on 21.08.1991 (Bosselmann 1992) and 04.07.1994 (Jürgen Bosselmann & Edith Bosselmann in Viessmann 1995), respectively, which has been four days before the full moon on 25.08.1991 and five days before the new moon on 09.07.1994, respectively; and near Rheinbrohl in the Middle Rhine valley northwest of Koblenz where abt. 10 individuals have flown on 31.07.1991 (Bosselmann 1992) which has been five days after the full moon on 26.07.1991.

Mass flights of the Common Blue Damselfly *Enallagma cyathigerum* in the northwestern part of Germany have been found near Obererbach northwest of Limburg an der Lahn where more than 10 individuals have flown on 25.06.1996 (Leander Hoffmann in Viessmann 1997) which has been two days after the increasing half moon on 23.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 29.06.1996 (Leander Hoffmann in Viessmann 1997) which has been two days before the full moon on 01.07.1996, near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 29.07.1996 (Leander Hoffmann in Viessmann 1997) which has been one day before the full moon on 30.07.1996, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where more than 10 individuals have flown on 10.06.1999 (Monika Robeck in Viessmann 2000a) which has been three days before the new moon on 13.06.1999.

Significant quantities of individuals of the Common Blue Damselfly *Enallagma cyathigerum* in the northwestern part of Germany have also been encountered near Girod east of Montabaur westnorthwest of Limburg an der Lahn and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.06.1996 (Leander Hoffmann in Viessmann 1997) which has been two days before the full moon on 01.07.1996, near Herschbach west of Dornburg northnorthwest of Limburg an der Lahn as well as Hundsangen and Molsberg northwest to northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.07.1996 (Leander Hoffmann in Viessmann 1997) which has been five days after the new moon on 15.07.1996, and near Nentershausen westnorthwest of Limburg an der Lahn and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (Leander Hoffmann in Viessmann 1997) which has been one day before the full moon on 30.07.1996.

7.28 The Large Red Damselfly *Pyrrhosoma nymphula*

Mass flights of the Large Red Damselfly *Pyrrhosoma nymphula* (Sulzer 1776) (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been verified near Zeiskam eastnortheast of Landau in der Pfalz where abt. 10 individuals, more than 50 individuals each, more than 10 individuals each, more than 50 individuals and more than 10 individuals each have flown on 06.06.1993 (Weiss & Schwab 1994), 18.06.1994, 10.07.1994, 24.07.1994 (Klaus Weiss in Viessmann 1995), 03.06.1995 (Klaus Weiss in Viessmann 1996), 12.07.1999, 24.07.1999 (Klaus Weiss in Viessmann 2000a), 12.05.2001 (Klaus Weiss in Viessmann 2002), 07.06.2003, 09.06.2003 (Klaus Weiss in Viessmann 2004) and 10.06.2006 (Klaus Weiss in Willigalla 2007), respectively, which has been two days after the full moon on 04.06.1993, five days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, three days after the full moon on 21.08.1994, five days after the new moon on 29.05.1995, one day before the new moon on 13.07.1999, four days before the full moon on 28.07.1999, five days after the full moon on 07.05.2001, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, five days before the full moon on 14.06.2003 and one day before the full moon on 11.06.2006, respectively; near Offenbach an der Queich east of Landau

in der Pfalz where more than 10 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999, near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals have flown on 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the full moon on 10.08.1995; and near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals each have flown on 19.06.1994 and 10.07.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days before the full moon on 23.06.1994 and one day after the new moon on 09.07.1994, respectively.

Significant quantities of individuals of the Large Red Damselfly *Pyrrhosoma nymphula* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where abt. 5 individuals and up to 10 individuals each have flown on 25.06.1991 (KLAUS WEISS in BOSSELMANN 1992), 27.05.1994, 30.05.1994, 07.06.1994, 31.07.1994 (KLAUS WEISS in VIESSMANN 1995), 07.05.1995, 28.05.1995, 27.06.1995 (KLAUS WEISS in VIESSMANN 1996), 26.05.2000 (KLAUS WEISS in VIESSMANN 2001) and 20.05.2002 (KLAUS WEISS in VIESSMANN 2003) which has been two days before the full moon on 27.06.1991, two and five days after the full moon on 25.05.1994, two days before the new moon on 09.06.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, one day before the increasing half moon on 08.05.1995 between the new moon on 29.04.1995 and the full moon on 14.05.1995, one day before the new moon on 29.05.1995, on the new moon on 27.06.1995, one day before the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, and one day after the increasing half moon on 19.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994 (KLAUS WEISS in VIESSMANN 1995), 25.05.1995 (KLAUS WEISS in VIESSMANN 1996) and 09.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been four days after the full moon on 23.06.1994, four days before the new moon on 29.05.1995 and five days before the full moon on 14.06.2003, respectively; near Ottersheim east of Offenbach an der Queich and near Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 18.06.1994, 27.06.1994 and 24.07.1994 (KLAUS WEISS in VIESSMANN 1995) which has been five days before and four days after the full moon on 23.06.1994, and two days after the full moon on 22.07.1994, respectively; near Herxheimweyher east of Herxheim eastsoutheast of Landau in der Pfalz where up to 10 individuals have flown on 02.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 25.05.1995 (ERWIN SEFRIN in VIESSMANN 1996), 19.05.1997 (ERWIN SEFRIN in VIESSMANN 1998) and 07.05.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been four days before the new moon on 29.05.1995, three days before the full moon on 22.05.1997 and three days after the new moon on 04.05.2000, respectively.

Mass flights of the Large Red Damselfly *Pyrrhosoma nymphula* in the southwestern part of Germany have also been recognized in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 07.06.1997 (VIESSMANN 1998), 25.06.1998 (VIESSMANN 1999), 20.05.1999 (VIESSMANN 2000a), 22.05.2000 (VIESSMANN 2001) and 23.05.2001 (VIESSMANN 2002) which has been two days after the new moon on 05.06.1997, one day after the new moon on 24.06.1998, five days after the new moon on 15.05.1999, four days after the full moon on 18.05.2000 and on the new moon on 23.05.2001, respectively; near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals, more than 50 individuals and more than 10 individuals each have flown on 15.06.2002 and 23.06.2002 (VIESSMANN 2003) as well as on 15.06.2003 and 23.06.2003 (VIESSMANN 2004), respectively, which has been four days after the new moon on 11.06.2002, one day before the full moon

on 24.06.2002, one day after the full moon on 14.06.2003, and two days after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; near Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals have flown on 10.07.2003 (VIESSMANN 2004) which has been three days before the full moon on 13.07.2003; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 10.05.1995 (VIESSMANN 1996), 22.05.1997 (VIESSMANN 1998), 28.05.1998, 31.05.1998, 30.06.1998 (VIESSMANN 1999), 28.05.1999, 01.06.1999 (VIESSMANN 2000a) and 30.05.2000 (VIESSMANN 2001) which has been four days before the full moon on 14.05.1995, on the full moon on 22.05.1997, three days after the new moon on 25.05.1998, two days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, two days before the increasing half moon on 02.07.1998 between the new moon on 24.06.1998 and the full moon on 09.07.1998, two days before and one day after the full moon on 31.05.1999, and three days before the new moon on 02.06.2000, respectively.

Significant quantities of individuals of the Large Red Damselfly *Pyrrhosoma nymphula* in the southwestern part of Germany have also been observed near Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.05.1998 (VIESSMANN 1999), 28.05.2000 (VIESSMANN 2001), 08.07.2001 (VIESSMANN 2002) and 10.07.2002 (VIESSMANN 2003) which has been on the new moon on 25.05.1998, one day after the decreasing half moon on 27.05.2000 between the full moon on 18.05.2000 and the new moon on 02.06.2000, three days after the full moon on 05.07.2001 and on the new moon on 10.07.2002, respectively; and in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 23.05.1996 (VIESSMANN 1997) which has been three days before the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996.

Mass flights of the Large Red Damselfly *Pyrrhosoma nymphula* in the western part of Germany have been encountered in the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where more than 20 individuals have flown on 28.05.2006 (C. WENDELS in WILLIGALLA 2007) which has been one day after the new moon on 27.05.2006; near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 50 individuals each have flown on 13.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) and 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been on the new moon on 13.06.1999 and two days after the new moon on 02.06.2000, respectively; near Kell am See westsouthwest of Hermeskeil in the western part of the Hunsrück where more than 50 individuals have flown on 10.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been three days before the new moon on 13.07.1999; in the Wadrilltal near Wadrill north of Wadern south of Hermeskeil in the western part of the Hunsrück where more than 10 individuals each have flown on 20.06.1998 (MONIKA ROBECK in VIESSMANN 1999) and 31.05.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been four days before the new moon on 24.06.1998 and one day after the full moon on 30.05.1999, respectively; at the Hangbrücher near Morbach in the central part of the Hunsrück where more than 10 individuals have flown on 01.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been one day before the new moon on 02.06.2000, near Thranenweier northnortheast of Börfink northnorthwest of Birkenfeld in the central part of the Hunsrück where more than 10 individuals have flown on 26.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been three days after the new moon on 23.05.2001; and at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where more than 10 individuals each have flown on 24.05.1999 (KLAUS BITTNER in VIESSMANN 2000a) and 02.07.2001 (KLAUS BITTNER in VIESSMANN 2002) which has been one day after the increasing half moon on 23.05.1999 between the new moon on 15.05.1999 and the full moon on 30.05.1999, and three days before the full moon on 05.07.2001, respectively.

Significant quantities of individuals of the Large Red Damselfly *Pyrrhosoma nymphula* in the western part of Germany have also been observed near Laubenheim in the Nahe valley south of Bingen where up to 10 individuals each have flown on 04.05.1995 (MARTIN KROHNE in VIESSMANN 1996) and 16.05.1998 (MARTIN KROHNE in VIESSMANN 1999) which has been five days after the new moon on 29.04.1995 and five days after the full moon on 11.05.1998, respectively; in Mainz at the northern margin of the Upper Rhine valley where abt. 5 individuals have flown on 09.06.2006 (CHRISTIAN TRITSCH in WILLIGALLA 2007) which has been two days before the full moon on 11.06.2006, in the Wadrilltal near Wadrill north of Wadern south of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 27.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been four days after the new moon on 23.05.2001, near Hahnenbach in the Hahnenbach valley northwest of Kirn in the eastern part of the Hunsrück where up to 10 individuals have flown on 23.06.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days after the new moon on 21.06.2001, in the Ueßbach valley northwest of Alf southwest of Cochem where up to 10 individuals have flown on 19.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been two days before the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 28.06.1999; at the Heckenberg at the northwestern margin of the city of Mayen in the southeastern part of the Eifel where up to 10 individuals each have flown on 01.05.1996 (KLAUS BITTNER in VIESSMANN 1997) and 28.05.1997 (KLAUS BITTNER in VIESSMANN 1998) which has been two days before the full moon on 03.05.1996, and two days before the decreasing half moon on 30.05.1997 between the full moon on 22.05.1997 and the new moon on 05.06.1997, respectively; in the Elz valley southwest of Kehrig southsouthwest of Mayen in the southeastern part of the Eifel where abt. 5 individuals have flown on 30.07.1991 (BOSSELMANN 1992) which has been four days after the full moon on 26.07.1991, and near Adenau southsouthwest of Bad Neuenahr-Ahrweiler in the northeastern part of the Eifel where 7 individuals have flown on 30.05.1992 (BOSSELMANN 1993) which has been two days before the new moon on 01.06.1992.

Significant quantities of individuals of the Large Red Damselfly *Pyrrhosoma nymphula* in the northwestern part of Germany have been encountered near Obererbach and Hundsangen northwest to northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.05.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days after the new moon on 17.05.1996, near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 25.05.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the increasing half moon on 26.05.1996 between the new moon on 17.05.1996 and the full moon on 01.06.1996, near Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.05.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 01.06.1996, and near Nentershausen westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 09.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the new moon on 12.06.1996.

7.29 The Blue-Tailed Damselfly *Ischnura elegans*

Mass flights of the Blue-Tailed Damselfly *Ischnura elegans* LINDEN 1820 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been identified near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals each have flown on 18.06.1994, 24.07.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 27.06.1995, 02.07.1995, 02.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999, 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 23.06.2001, 24.06.2001 and 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been five days before the full moon on 23.06.1994, two days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, four days after the

full moon on 19.09.1994, on and five days after the new moon on 27.06.1995, three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, four days before the full moon on 28.07.1999, two and three days after the new moon on 21.06.2001, and five days before the full moon on 04.07.2001, respectively; near Zeiskam east-northeast of Landau in der Pfalz where more than 10 individuals each and more than 50 individuals have flown on 30.05.2002 – 31.05.2002 and 15.06.2002, respectively (KLAUS WEISS in VIESSMANN 2003), which has been four and five days after the full moon on 26.05.2002, and four days after the new moon on 11.06.2002, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 30 individuals, more than 100 individuals, more than 30 individuals and more than 20 individuals have flown on 08.05.2003, 09.06.2003, 16.08.2003 (KLAUS WEISS in VIESSMANN 2004) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been one day before the increasing half moon on 09.05.2003 between the new moon on 01.05.2003 and the full moon on 16.05.2003, five days before the full moon on 14.06.2003, four days after the full moon on 12.08.2003 and one day before the full moon on 11.06.2006, respectively; near Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals each, more than 100 individuals, more than 50 individuals each, more than 100 individuals and more than 10 individuals have flown on 25.07.1995, 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 20.05.2002, 16.06.2002 (KLAUS WEISS in VIESSMANN 2003) and 06.06.2008 (WEISS 2009), respectively, which has been two days before and five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, one day after the increasing half moon on 19.05.2002 between the new moon on 12.05.2002 and the full moon on 26.05.2002, five days after the new moon on 11.06.2002 and three days after the new moon on 03.06.2008, respectively; near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals and more than 10 individuals each have flown on 10.08.1995 (KLAUS WEISS in VIESSMANN 1996), 20.05.2002 (KLAUS WEISS in VIESSMANN 2003) and 16.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been on the full moon on 10.08.1995, one day after the increasing half moon on 19.05.2002 between the new moon on 12.05.2002 and the full moon on 26.05.2002, and five days after the full moon on 11.07.2006, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals and more than 20 individuals have flown on 30.05.2002 (KLAUS WEISS in VIESSMANN 2003) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been four days after the full moon on 26.05.2002 and one day before the full moon on 11.06.2006, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals each and more than 50 individuals have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; near Bellheim east of Landau in der Pfalz where more than 10 individuals each and more than 20 individuals have flown on 10.07.1994, 23.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 08.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been one day after the new moon on 09.07.1994, two days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994, on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, and three days before the full moon on 11.07.2006, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals each, more than 50 individuals and more than 10 individuals have flown on 19.06.1994, 10.07.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 26.07.2001 (KLAUS WEISS in VIESSMANN 2002) and 23.06.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been four

days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, two days before the new moon on 27.07.1995, two days before the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, and one day before the full moon on 24.06.2002, respectively; at the Klingbach north of Hördt eastsoutheast of Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 26.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the full moon on 28.07.1999, near Herxheimweyher east of Herxheim eastsoutheast of Landau in der Pfalz where more than 50 individuals have flown on 02.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and near Römerberg-Mechtersheim southsouthwest of Speyer where more than 10 individuals have flown on 08.06.1996 (ERWIN SEFRIN in VIESSMANN 1997) which has been one day before the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996.

Significant quantities of individuals of the Blue-Tailed Damselfly *Ischnura elegans* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where 5 individuals and up to 10 individuals each have flown on 06.06.1993, 19.09.1993 (WEISS & SCHWAB 1994), 27.05.1994, 30.05.1994, 31.07.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995, 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 10.08.2002 (KLAUS WEISS in VIESSMANN 2003) and 23.08.2003 (KLAUS WEISS in VIESSMANN 2004), respectively, which has been two days after the full moon on 04.06.1993, three days after the new moon on 19.09.1993, two and five days after the full moon on 25.05.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, four days before the full moon on 12.07.1995, two days before the new moon on 27.07.1995, two days after the new moon on 08.08.2002 and four days before the new moon on 27.08.2003, respectively; near Offenbach an der Queich east of Landau in der Pfalz where abt. 5 individuals have flown on 06.06.1993 (WEISS & SCHWAB 1994) which has been two days after the full moon on 04.06.1993; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 23.06.2001 (KLAUS WEISS in VIESSMANN 2002) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994, two days before the new moon on 27.07.1995, four days before the full moon on 28.07.1999 and two days after the new moon on 21.06.2001, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) and 23.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been two days before the new moon on 27.07.1995 and one day before the full moon on 24.06.2002, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 18.05.1994, 25.08.1994, 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) and 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been one day before the decreasing half moon on 19.05.1994 between the full moon on 10.05.1994 and the new moon on 25.05.1994, four days after the full moon on 21.08.1994, one day before the new moon on 05.09.1994 and two days before the new moon on 27.07.1995, respectively; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 28.05.1995 (ERWIN SEFRIN in VIESSMANN 1996), 19.05.1997 (ERWIN SEFRIN in VIESSMANN 1998), 16.05.1999 (ERWIN SEFRIN in VIESSMANN 2000a) and 04.08.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been one day before the full moon on 29.05.1995, three days before the full moon on 22.05.1997, one day after the new moon on 15.05.1999 and four days after the new moon on 31.07.2000, respectively.

Mass flights of the Blue-Tailed Damselfly *Ischnura elegans* in the southwestern part of Germany have also been noticed in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals each have flown on 25.06.1997 (VIESSMANN 1998),

30.06.1998 (VIESSMANN 1999) and 20.07.1999 (VIESSMANN 2000a) which has been five days after the full moon on 20.06.1997, two days before the increasing half moon on 02.07.1998 between the new moon on 24.06.1998 and the full moon on 09.07.1998, and one day before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999, respectively; near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals and more than 50 individuals each have flown on 09.08.1998 (VIESSMANN 1999), 09.07.1999 (VIESSMANN 2000a), 10.07.2000, 29.07.2000 (VIESSMANN 2001), 03.06.2002 (VIESSMANN 2003) and 09.06.2003 (VIESSMANN 2004), respectively, which has been one day after the full moon on 08.08.1998, four days before the new moon on 13.07.1999, one day after the increasing half moon on 09.07.2000 between the new moon on 01.07.2000 and the full moon on 16.07.2000, two days before the new moon on 31.07.2000, on the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and five days before the full moon on 14.06.2003, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals and more than 10 individuals each have flown on 17.07.1995 (VIESSMANN 1996), 23.07.1996 (VIESSMANN 1997), 15.06.1997, 20.06.1997 (VIESSMANN 1998), 31.05.1998, 20.06.1998, 01.07.1998 (VIESSMANN 1999), 20.05.1999, 17.07.1999 (VIESSMANN 2000a), 20.07.2000, 30.07.2000 (VIESSMANN 2001) and 27.07.2001 (VIESSMANN 2002), respectively, which has been five days after the full moon on 12.07.1995, one day before the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 30.07.1996, five days before and on the full moon on 20.06.1997, three days before the increasing half moon on 03.06.1998 between the new moon on 25.05.1998 and the full moon on 10.06.1998, four days before the new moon on 24.06.1998, one day before the increasing half moon on 02.07.1998 between the new moon on 24.06.1998 and the full moon on 09.07.1998, five days after the new moon on 15.05.1999, four days after the new moon on 13.07.1999, four days after the full moon on 16.07.2000, one day before the new moon on 31.07.2000, and one day before the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, near Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 10 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999, and in the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where 5 individuals have flown on 28.05.2006 (ELISABETH KASCHAK in WILLIGALLA 2007) which has been one day after the new moon on 27.05.2006.

Mass flights of the Blue-Tailed Damselfly *Ischnura elegans* in the western part of Germany have been verified near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 10 individuals each have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999), 13.06.1999 (MONIKA ROBECK in VIESSMANN 2000a), 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) and 28.07.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days before the full moon on 08.08.1998, on the new moon on 13.06.1999, two days after the new moon on 02.06.2000, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; near Kell am See westsouthwest of Hermeskeil in the western part of the Hunsrück where more than 50 individuals each have flown on 10.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) and 27.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been three days before the new moon on 13.07.1999 and four days before the new moon on 01.07.2000, respectively; at the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where more than 10 individuals have flown on 17.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999) which has been five days before the new moon on 22.08.1998, near Binsfeld east of Bitburg in the southwestern part of the Eifel where more than 10 individuals have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the new moon on 19.08.2001, near Kenn in the

Moselle valley northeast of Trier in the western part of the Hunsrück where more than 10 individuals have flown on 30.05.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been three days before the new moon on 02.06.2000, near Könen in the Saar valley southsouthwest of Konz southsouthwest of Trier where up to 10 individuals have flown on 29.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the new moon on 01.07.2000; near Kanzem in the Saar valley south of Konz southsouthwest of Trier where more than 10 individuals each have flown on 01.07.2000 (MONIKA ROBECK in VIESSMANN 2001) and 24.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been on the new moon on 01.07.2000 and one day after the new moon on 23.05.2002, respectively; at the Silbersee in Mayen in the southeastern part of the Eifel where abt. 10 individuals have flown on 05.08.1991 (BOSSELMANN 1992) which has been five days before the new moon on 10.08.1991, and at the Heilbachsee near Gunderath westsouthwest of Mayen in the southeastern part of the Eifel where abt. 10 individuals have flown on 16.07.1991 (BOSSELMANN 1992) which has been five days after the new moon on 11.07.1991.

Mass flights of the Blue-Tailed Damselfly *Ischnura elegans* in the northwestern part of Germany have been confirmed near Hundsangen northwest of Limburg an der Lahn where more than 10 individuals have flown on 25.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days after the increasing half moon on 23.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, near Obererbach northwest of Limburg an der Lahn where more than 10 individuals have flown on 25.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days after the increasing half moon on 23.06.1996 between the new moon on 16.06.1996 and the full moon on 01.07.1996, near Molsberg northnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 20.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 15.07.1996, and near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where more than 10 individuals have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996.

Significant quantities of individuals of the Blue-Tailed Damselfly *Ischnura elegans* in the northwestern part of Germany have also been observed near Nentershausen westnorthwest of Limburg an der Lahn and Girod east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996, near Herschbach west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 20.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 15.07.1996, near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 25.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days before the full moon on 30.07.1996, near Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996, and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where up to 10 individuals have flown on 10.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been three days before the new moon on 13.06.1999.

7.30 The Scarce Blue-Tailed Damselfly *Ischnura pumilio*

Mass flights of the Scarce Blue-Tailed Damselfly *Ischnura pumilio* CHARPENTIER 1840 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been verified near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each have flown on 29.07.2000 (KLAUS WEISS in VIESSMANN 2001), 22.07.2001 and 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days before the new moon on 31.07.2000,

two days after the new moon on 20.07.2001 and five days before the full moon on 04.08.2001, respectively; near Bellheim east of Landau in der Pfalz where more than 10 individuals have flown on 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995; and in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each have flown on 28.06.1999 (VIESSMANN 2000a) and 21.06.2000 (VIESSMANN 2001) which has been on the full moon on 28.06.1999 and four days after the full moon on 17.06.2000, respectively.

Significant quantities of individuals of the Scarce Blue-Tailed Damselfly *Ischnura pumilio* in the southwestern part of Germany have also been observed near Frankenthal northwest of Ludwigshafen in the middle part of the Upper Rhine valley where up to 10 individuals have flown on 10.08.2003 (HERMANN DEICHFUSS in VIESSMANN 2004) which has been two days before the full moon on 12.08.2003; near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 20.07.1999 (VIESSMANN 2000a), 22.07.2000 (VIESSMANN 2001), 20.06.2001 (VIESSMANN 2002) and 22.06.2002 (VIESSMANN 2003) which has been one day before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999, three days before the decreasing half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000, one day before the new moon on 21.06.2001 and two days before the full moon on 24.06.2002, respectively.

Significant quantities of individuals of the Scarce Blue-Tailed Damselfly *Ischnura pumilio* in the northwestern part of Germany have been found near Nentershausen westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 19.08.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on 14.08.1996.

7.31 The White-Legged Damselfly *Platycnemis pennipes*

Mass flights of the White-Legged Damselfly *Platycnemis pennipes* (PALLAS 1771) (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been experienced near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals, more than 100 individuals each and more than 20 individuals have flown on 07.06.2003, 09.06.2003, 22.06.2003 (KLAUS WEISS in VIESSMANN 2004), 01.06.2008 and 15.07.2008 (WEISS 2009), respectively, which has been on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, five days before the full moon on 14.06.2003, one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, two days before the new moon on 03.06.2008 and three days before the full moon on 18.06.2008, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where more than 150 individuals, more than 50 individuals, more than 100 individuals and more than 50 individuals each have flown on 12.07.1999, 24.07.1999 – 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 18.06.2000, 21.07.2000 (KLAUS WEISS in VIESSMANN 2001), 22.07.2001 and 30.07.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been one day before the new moon on 13.07.1999, three and four days before the full moon on 28.07.1999, one day after the full moon on 17.06.2000, five days after the full moon on 16.07.2000, two days after the new moon on 20.07.2001 and five days before the full moon on 04.08.2001, respectively; near Zeiskam eastnortheast of Landau in der Pfalz where abt. 30 individuals, more than 50 individuals each and more than 100 individuals each have flown on 30.05.1992 (KLAUS WEISS in BOSSELMANN 1993), 18.06.1994, 24.07.1994 (KLAUS WEISS in VIESSMANN 1995), 27.06.1995, 02.07.1995 and 02.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been two days before the new moon on 01.06.1992, five days before the full moon on 23.06.1994, two days after the full moon on

22.07.1994, on and five days after the new moon on 27.06.1995, and three days before the increasing half moon on 05.08.1995 between the new moon on 27.07.1995 and the full moon on 10.08.1995, respectively; near Offenbach an der Queich east of Landau in der Pfalz where abt. 25 individuals, more than 10 individuals each, more than 50 individuals and more than 100 individuals have flown on 21.08.1993 (WEISS & SCHWAB 1994), 25.07.1995, 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 16.06.2002 (KLAUS WEISS in VIESSMANN 2003), respectively, which has been four days after the new moon on 17.03.1993, two days before and five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, one day before the new moon on 13.07.1999, and two days before the increasing half moon on 18.06.2002 between the new moon on 11.06.2002 and the full moon on 24.06.2002, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each and more than 50 individuals each have flown on 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 30.05.2002 (KLAUS WEISS in VIESSMANN 2003) as well as on 07.06.2003, 22.06.2003 (KLAUS WEISS in VIESSMANN 2004) and 10.06.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been four days before the full moon on 28.07.1999, four days after the full moon on 26.05.2002, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, and one day before the full moon on 11.06.2006, respectively; near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals each have flown on 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 16.07.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been on the full moon on 10.08.1995 and five days after the full moon on 11.07.2006, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals and more than 50 individuals each have flown on 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a), respectively, which has been five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995 and one day before the new moon on 13.07.1999, respectively; near Bellheim east of Landau in der Pfalz where more than 10 individuals each and more than 20 individuals have flown on 10.07.1994, 23.08.1994 and 23.09.1994 (KLAUS WEISS in VIESSMANN 1995) as well as on 08.07.2006 (KLAUS WEISS in WILLIGALLA 2007), respectively, which has been one day after the new moon on 09.07.1994, two days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994 and three days before the full moon on 11.07.2006, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 10 individuals each have flown on 19.06.1994, 10.07.1994 (KLAUS WEISS in VIESSMANN 1995) and 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been four days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994 and two days before the new moon on 27.07.1995, respectively; and near Herxheimweyher east of Herxheim eastsoutheast of Landau in der Pfalz where more than 10 individuals have flown on 02.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002.

Significant quantities of individuals of the White-Legged Damselfly *Platycnemis pennipes* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz and at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 5 individuals and up to 10 individuals each have flown on 25.06.1991 (KLAUS WEISS in BOSSELMANN 1992), 23.06.2001 (KLAUS WEISS in VIESSMANN 2002) and 04.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been two days before the full moon on 27.06.1991, two days after the new moon on 21.06.2001, and one day after the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been five days before the

full moon on 04.08.2001; near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 27.08.1996 (ERWIN SEFRIN in VIESSMANN 1997), 12.09.1999 (ERWIN SEFRIN in VIESSMANN 2000a) and 04.08.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been one day before the full moon on 28.08.1996, two days after the new moon on 10.09.1999 and four days after the new moon on 31.07.2000, respectively; and near Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 10.07.2002 (VIESSMANN 2003) and 12.07.2003 (VIESSMANN 2004) which has been on the new moon on 10.07.2002 and one day before the full moon on 13.07.2003, respectively.

Mass flights of the White-Legged Damselfly *Platycnemis pennipes* in the southwestern part of Germany have also been identified in the Pfrimm valley in the vicinity of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals and more than 50 individuals each have flown on 25.06.1997 (VIESSMANN 1998), 24.06.1998 (VIESSMANN 1999), 15.07.1999 (VIESSMANN 2000a) and 10.07.2000 (VIESSMANN 2001), respectively, which has been five days after the full moon on 20.06.1997, on the new moon on 24.06.1998, two days after the new moon on 13.07.1999, and one day after the increasing half moon on 09.07.2000 between the new moon on 01.07.2000 and the full moon on 16.07.2000, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals each, more than 40 individuals, more than 20 individuals and more than 10 individuals each have flown on 10.06.1995 (VIESSMANN 1996), 12.06.1996 (VIESSMANN 1997), 15.06.1997, 20.06.1997 (VIESSMANN 1998), 19.06.1998, 29.06.1998 (VIESSMANN 1999), 20.06.1999 (VIESSMANN 2000a), 25.06.2000 (VIESSMANN 2001), 29.06.2001, 08.07.2001 (VIESSMANN 2002), 29.06.2002 (VIESSMANN 2003), 09.06.2003 and 25.06.2003 (VIESSMANN 2004), respectively, which has been three days before the full moon on 13.06.1995, four days before the new moon on 16.06.1996, five days before and on the full moon on 20.06.1997, five days before and four days after the new moon on 24.06.1998, one day before the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 28.06.1999, two days before the decreasing half moon on 27.06.2000 between the full moon on 17.06.2000 and the new moon on 01.07.2000, on the increasing half moon on 29.06.2001 between the new moon on 21.06.2001 and the full moon on 05.07.2001, three days after the full moon on 05.07.2001, five days after the full moon on 24.06.2002, five days before the full moon on 14.06.2003 and four days before the new moon on 29.06.2003, respectively; near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 50 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, and near Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 50 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999.

Mass flights of the White-Legged Damselfly *Platycnemis pennipes* in the western part of Germany have been encountered near Beuren north of Hermeskeil in the western part of the Hunsrück where more than 10 individuals, more than 50 individuals and more than 10 individuals have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999), 04.06.2000 (MONIKA ROBECK in VIESSMANN 2001) and 28.07.2001 (MONIKA ROBECK in VIESSMANN 2002), respectively, which has been two days before the full moon on 08.08.1998, two days after the new moon on 02.06.2000, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; near Kell am See westsouthwest of Hermeskeil in the western part of the Hunsrück where more than 10 individuals have flown on 10.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been three days before the new moon on 13.07.1999, near Könen in the Saar valley southsouthwest of Konz southsouthwest of Trier where more than 10 individuals have flown on 29.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the new moon on 01.07.2000, near Kanzem in the Saar valley south of Konz southsouthwest of Trier where more

than 50 individuals have flown on 01.07.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been on the new moon on 01.07.2000, and at the Heilbachsee near Gunderath westsouthwest of Mayen in the southeastern part of the Eifel where abt. 5 individuals have flown on 16.07.1991 (BOSSELMANN 1992) which has been five days after the new moon on 11.07.1991.

Significant quantities of individuals of the White-Legged Damselfly *Platycnemis pennipes* in the western part of Germany have also been recognized near Hahnenbach in the Hahnenbach valley northwest of Kirn in the eastern part of the Hunsrück where up to 10 individuals have flown on 23.06.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days after the new moon on 21.06.2001.

Significant quantities of individuals of the White-Legged Damselfly *Platycnemis pennipes* in the northwestern part of Germany have been encountered near Nentershausen and Eppenrod westnorthwest of Limburg an der Lahn, Obererbach northwest of Limburg an der Lahn; Ruppach, Goldhausen, Großholbach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn; Herschbach and Salz west of Dornburg northnorthwest of Limburg an der Lahn, and Berod northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.06.1995 (LEANDER HOFFMANN in VIESSMANN 1996) which has been two days after the new moon on 27.06.1995; and near Nentershausen westnorthwest of Limburg an der Lahn; Obererbach, Hundsangen and Molsberg northwest to northnorthwest of Limburg an der Lahn; Ruppach, Girod and Großholbach east of Montabaur westnorthwest of Limburg an der Lahn; and Herschbach and Salz west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996.

7.32 The Red-Eyed Damselfly *Erythromma najas*

Mass flights of the Red-Eyed Damselfly *Erythromma najas* HANSEMANN 1823 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been signaled from Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals have flown on 22.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been two days after the new moon on 20.07.2001, from Offenbach an der Queich and the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each and more than 10 individuals each have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; and from Römerberg-Mechtersheim southsouthwest of Speyer where more than 10 individuals have flown on 22.08.1999 (ERWIN SEFRIN in VIESSMANN 2000a) which has been four days before the full moon on 26.08.1999.

Significant quantities of individuals of the Red-Eyed Damselfly *Erythromma najas* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 02.06.2002 (ERWIN SEFRIN in VIESSMANN 2003) and 02.06.2003 (ERWIN SEFRIN in VIESSMANN 2004) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and two days after the new moon on 31.07.2003, re-

spectively.

Significant quantities of individuals of the Red-Eyed Damselfly *Erythromma najas* in the northwestern part of Germany have been identified near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996.

7.33 The Small Red-Eyed Damselfly *Erythromma viridulum*

Mass flights of the Small Red-Eyed Damselfly *Erythromma viridulum* CHARPENTIER 1840 (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been mentioned from Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals and more than 10 individuals each have flown on 24.07.1993 (WEISS & SCHWAB 1994), 27.06.1994, 25.08.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 03.06.1995, 08.07.1995 (KLAUS WEISS in VIESSMANN 1996) and 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), respectively, which has been five days after the new moon on 19.07.1993, four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994, four days after the full moon on 19.09.1994, five days after the new moon on 29.05.1995, four days before the full moon on 12.07.1995 and three days before the full moon on 28.07.1999, respectively; from Offenbach an der Queich and the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been one day before the new moon on 13.07.1999, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each and more than 20 individuals each have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals have flown on 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days before the full moon on 28.07.1999; and from Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 50 individuals and more than 10 individuals each have flown on 20.06.1993 (WEISS & SCHWAB 1994), 19.06.1994 and 10.07.1994 (KLAUS WEISS in VIESSMANN 1995), respectively, which has been on the new moon on 20.06.1993, four days before the full moon on 23.06.1994 and one day after the new moon on 09.07.1994, respectively.

Significant quantities of individuals of the Small Red-Eyed Damselfly *Erythromma viridulum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 30.05.1994, 31.07.1994 (KLAUS WEISS in VIESSMANN 1995), 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 16.08.2003 and 23.08.2003 (KLAUS WEISS in VIESSMANN 2004) which has been five days after the full moon on 25.05.1994, on the decreasing half moon on 31.07.1994 between the full moon on 22.07.1994 and the new moon on 07.08.1994, two days after the full moon on 10.08.1995, four days after the full moon on 12.08.2003 and four days before the new moon on 27.08.2003, respectively; near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 23.07.1995 (ERWIN SEFRIN in VIESSMANN 1996) which has been four days before the new moon on 27.07.1995, and near Lingenfeld northnorthwest of Germersheim where up to 10 individuals have flown on 04.08.2003 (KLAUS WEISS in VIESSMANN 2004) which has been one day before the increasing half moon on 05.08.2003 between the new moon on 29.07.2003 and the full moon on

12.08.2003.

Mass flights of the Small Red-Eyed Damselfly *Erythromma viridulum* in the southwestern part of Germany have also been signaled from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where more than 10 individuals have flown on 23.07.1996 (VIESSMANN 1997) and 28.07.1997 (VIESSMANN 1998) which has been one day before the increasing half moon on 24.07.1996 between the new moon on 15.07.1996 and the full moon on 30.07.1996, and one day after the decreasing half moon on 27.07.1997 between the full moon on 20.07.1997 and the new moon on 03.08.1997, respectively; from Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where more than 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, and from the Laubenheimer Ried near Laubenheim in the Nahe valley south of Bingen where 10 individuals have flown on 13.09.2006 (C. WENDELS in WILLIGALLA 2007) which has been one day before the decreasing half moon on 14.09.2006 between the full moon on 07.09.2006 and the new moon on 22.09.2006.

7.34 The Goblet-Marked Damselfly *Erythromma lindenii*

Mass flights of the Goblet-Marked Damselfly *Erythromma lindenii* (SÉLYS 1840) (Odonata: Coenagrionidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been documented from the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001.

Significant quantities of individuals of the Goblet-Marked Damselfly *Erythromma lindenii* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been encountered at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; and near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

7.35 The Green Snaketail *Ophiogomphus cecilia*

Mass flights of the Green Snaketail *Ophiogomphus cecilia* (FOURCROY 1785) (Odonata: Gomphidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been observed near Zeiskam eastnortheast of Landau in der Pfalz where more than 10 individuals each and more than 20 individuals have flown on 24.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 18.06.2000, 21.07.2000 (KLAUS WEISS in VIESSMANN 2001), 22.07.2001, 30.07.2001 (KLAUS WEISS in VIESSMANN 2002) and 15.07.2008 (WEISS 2009), respectively, which has been two days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, one day after the full moon on 17.06.2000, five days after the full moon on 16.07.2000, two days after the new moon on 20.07.2001, five days before the full moon on 04.08.2001 and three days after the full moon on 18.06.2008, respectively; near Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals each have flown on 25.07.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 27.07.1995, two days after the full moon on 10.08.1995 and four days before the full moon on

28.07.1999, respectively; and near Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals have flown on 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been on the full moon on 10.08.1995.

Significant quantities of individuals of the Green Snaketail *Ophiogomphus cecilia* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been found near Zeiskam eastnortheast of Landau in der Pfalz where abt. 5 individuals have flown on 22.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003; near Ottersheim east of Offenbach an der Queich and near Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 24.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been two days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively; and near Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999.

7.36 The Common Clubtail *Gomphus vulgatissimus*

Mass flights of the Common Clubtail *Gomphus vulgatissimus* LINNAEUS 1758 (Odonata: Gomphidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been encountered near Zeiskam eastnortheast of Landau in der Pfalz where more than 50 individuals have flown on 01.06.2008 (WEISS 2009) which has been two days before the new moon on 03.06.2008.

7.37 The Western Clubtail *Gomphus pulchellus*

Significant quantities of individuals of the Western Clubtail *Gomphus pulchellus* SÉLYS 1840 (Odonata: Gomphidae) in the southwestern part of Germany have been observed in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 10.06.1995 (VIESSMANN 1996) and 05.06.1997 (VIESSMANN 1998) which has been three days before the full moon on 13.06.1995 and on the new moon on 05.06.1997, respectively.

Significant quantities of individuals of the Western Clubtail *Gomphus pulchellus* in the northwestern part of Germany have been encountered near Hundsangen northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 27.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been four days before the full moon on 01.07.1996, and near Molsberg northnorthwest of Limburg an der Lahn and Herschbach west of Dornburg northnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 20.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been five days after the new moon on15.07.1996.

7.38 The Black-Tailed Skimmer *Orthetrum cancellatum*

Mass flights of the Black-Tailed Skimmer *Orthetrum cancellatum* LINNAEUS 1758 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been noticed near Offenbach an der Queich east of Landau in der Pfalz where more than 50 individuals and more than 10 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002), respectively, which has been one day before the

new moon on 13.07.1999, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 20 individuals each and more than 50 individuals have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and one day before the new moon on 13.07.1999, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where more than 5 individuals have flown on 20.06.1993 (WEISS & SCHWAB 1994) which has been on the new moon on 20.06.1993, near Lustadt northwest of Germersheim where more than 10 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008, and near Römerberg-Mechtersheim southsouthwest of Speyer where more than 10 individuals have flown on 29.06.1997 (ERWIN SEFRIN in VIESSMANN 1998) which has been one day after the decreasing half moon on 28.06.1997 between the full moon on 20.06.1997 and the new moon on 04.07.1997.

Significant quantities of individuals of the Black-Tailed Skimmer *Orthetrum cancellatum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 18.06.1994, 09.07.1994, 23.09.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995, 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) and 21.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been five days before the full moon on 23.06.1994, on the new moon on 09.07.1994, four days after the full moon on 19.09.1994, four days before the full moon on 12.07.1995, two days before the new moon on 27.07.1995, and on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; near Zeiskam eastnortheast of Landau in der Pfalz and at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) and 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994 and four days before the full moon on 28.07.1999, respectively; near Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 16.06.2002 (KLAUS WEISS in VIESSMANN 2003) and 06.06.2008 (WEISS 2009) which has been two days before the new moon on 27.07.1995, five days after the new moon on 11.06.2002 and three days after the new moon on 03.06.2008, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996), 07.06.2003 and 22.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been two days before the new moon on 27.07.1995, on the increasing half moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, and one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 1995) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001; near Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 10.07.1994, 23.08.1994 (KLAUS WEISS in VIESSMANN 1995), 25.07.1995 and 19.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been one day after the new moon on 09.07.1994, two days after the full moon on 21.08.1994, two days before the new moon on 27.07.1995, and on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, respectively; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 19.06.1994, 10.07.1994, 25.08.1994 and 04.09.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days before the full moon on 23.06.1994, one day after the new moon on 09.07.1994, four days after the full moon on 21.08.1994

and one day before the new moon on 05.09.1994, respectively; near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 12.06.2000 (ERWIN SEFRIN in VIESSMANN 2001) which has been five days before the full moon on 17.06.2000, and in the Bienwald west of Karlsruhe where abt. 10 individuals have flown on 15.06.1991 (KLAUS WEISS in BOSSELMANN 1992) which has been three days after the new moon on 12.06.1991.

Significant quantities of individuals of the Black-Tailed Skimmer *Orthetrum cancellatum* in the southwestern part of Germany have also been recognized in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 25.06.1997 (VIESSMANN 1998), 20.06.1998 – 21.06.1998 (VIESSMANN 1999), 20.06.2000 (VIESSMANN 2001), 10.07.2002 (VIESSMANN 2003) and 06.07.2003 (VIESSMANN 2004) which has been five days after the full moon on 20.06.1997, three to four days before the new moon on 24.06.1998, three days after the full moon on 17.06.2000, on the new moon on 10.07.2002, and one day before the increasing half moon on 07.07.2003 between the new moon on 29.06.2003 and the full moon on 13.07.2003, respectively; in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 17.07.1995 (VIESSMANN 1996), 15.06.1997 (VIESSMANN 1998), 19.06.1998 (VIESSMANN 1999) and 19.08.2000 (VIESSMANN 2001) which has been five days after the full moon on 12.07.1995, five days before the full moon on 20.06.1997, five days before the new moon on 24.06.1998 and four days after the full moon on 19.08.2000, respectively; and near Rothenkirchen in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 15.06.2001 (VIESSMANN 2002), 23.06.2002 (VIESSMANN 2003) and 22.06.2003 (VIESSMANN 2004) which has been on the decreasing half moon on 15.06.2001 between the full moon on 06.06.2001 and the new moon on 21.06.2001, one day before the full moon on 24.06.2002, and one day after the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively.

Mass flights of the Black-Tailed Skimmer *Orthetrum cancellatum* in the western part of Germany have been encountered near Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 28.07.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001; at the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where more than 10 individuals each have flown on 17.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999), 29.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) and 12.08.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been five days before the full moon on 22.08.1998, one day after the full moon on 28.07.1999 and three days before the full moon on 15.08.2000, respectively; near Könen in the Saar valley southsouthwest of Konz southsouthwest of Trier where up to 10 individuals have flown on 29.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the new moon on 01.07.2000, and near Kanzem in the Saar valley south of Konz southsouthwest of Trier where more than 10 individuals have flown on 01.07.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been on the new moon on 01.07.2000.

Mass flights of the Black-Tailed Skimmer *Orthetrum cancellatum* in the northwestern part of Germany have been verified near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley in the northwestern part of Germany where more than 10 individuals have flown on 26.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been two days before the full moon on 28.06.1999.

Significant quantities of individuals of the Black-Tailed Skimmer *Orthetrum cancellatum* in the northwestern part of Germany have also been identified near Großholbach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on

29.06.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been two days before the full moon on 01.07.1996; and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where up to 10 individuals each have flown on 16.08.1998 (MONIKA ROBECK in VIESSMANN 1999) and 30.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been one day after the decreasing half moon on 15.08.1998 between the full moon on 08.08.1998 and the new moon on 22.08.1998, and one day before the new moon on 01.07.2000, respectively.

7.39 The Southern Skimmer *Orthetrum brunneum*

Mass flights of the Southern Skimmer *Orthetrum brunneum* FONSCOLOMBE 1837 (Odonata: Libellulidae) in the southwestern part of Germany have been recognized near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where more than 50 individuals each have flown on 26.05.1999 (VIESSMANN 2000a, 2000b) and 20.05.2000 (VIESSMANN 2001) which has been four days before the full moon on 30.05.1999 and two days after the full moon on 18.05.2000, respectively.

Significant quantities of individuals of the Southern Skimmer *Orthetrum brunneum* in the middle part of the Upper Rhine valley in the southwestern part of Germany have been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 02.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been six days after the new moon on 27.07.1995, and near Bellheim east of Landau in der Pfalz in the middle part of the Upper Rhine valley where abt. 10 individuals have flown on 08.07.2006 (KLAUS WEISS in WILLIGALLA 2007) which has been three days before the full moon on 11.07.2006.

Significant quantities of individuals of the Southern Skimmer *Orthetrum brunneum* in the southwestern part of Germany have also been noticed near Albisheim in the Pfrimm valley eastsoutheast of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 29.06.1997 (VIESSMANN 1998), 20.05.1998, 07.06.1998 and 08.08.1998 – 09.08.1998 (VIESSMANN 1999) which has been one day after the decreasing half moon on 28.06.1997 between the full moon on 20.06.1997 and the new moon on 04.07.1997, on the decreasing half moon on 20.05.1998 between the full moon on 11.05.1998 and the new moon on 25.05.1998, three days before the full moon on 10.06.1998, and on and one day after the full moon on 08.08.1998, respectively; and near Rothenkirchen in the vicinity of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals each have flown on 10.06.2000 (VIESSMANN 2001), 15.06.2001 (VIESSMANN 2002), 15.06.2002 (VIESSMANN 2003) and 20.06.2003 (VIESSMANN 2004) which has been on the increasing half moon on 10.06.2000 between the new moon on 02.06.2000 and the full moon on 17.06.2000, on the decreasing half moon on 15.06.2001 between the full moon on 06.06.2001 and the new moon on 21.06.2001, four days after the new moon on 11.06.2002, and one day before the decreasing half moon on 20.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively.

Mass flights of the Southern Skimmer *Orthetrum brunneum* in the northwestern part of Germany have been identified near Nentershausen westnorthwest of Limburg an der Lahn in the northwestern part of Germany where more than 10 individuals have flown on 27.07.1995 (LEANDER HOFFMANN in VIESSMANN 1996) which has been on the new moon on 27.07.1995.

Significant quantities of individuals of the Southern Skimmer *Orthetrum brunneum* in the northwestern part of Germany have also been confirmed near Nentershausen westnorthwest of Limburg an der Lahn in the northwestern part of Germany where up to 10 individuals have flown on 22.07.2000 (LEANDER HOFFMANN in VIESSMANN 2001) which has been three days before the decreasing

half moon on 25.07.2000 between the full moon on 16.07.2000 and the new moon on 31.07.2000.

7.40 The Keeled Skimmer *Orthetrum coerulescens*

Significant quantities of individuals of the Keeled Skimmer *Orthetrum coerulescens* (FABRICIUS 1798) (Odonata: Libellulidae) in the southwestern part of Germany have been found near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, and in the vicinity of Fischbach southwest of Dahn southeast of Pirmasens in the Palatinate Forest where more than 5 individuals have flown on 15.07.2006 (WILLIGALLA 2007) which has been four days after the full moon on 11.07.2006.

7.41 The Scarlet Dragonfly *Crocothemis erythraea*

Mass flights of the Scarlet Dragonfly *Crocothemis erythraea* BRULLÉ 1832 (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been recorded near Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each, more than 50 individuals each and more than 10 individuals have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a), respectively, which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995 and one day before the new moon on 13.07.1999, respectively; and near Kanzem in the Saar valley south of Konz southsouthwest of Trier in the western part of Germany where more than 10 individuals have flown on 01.07.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been on the new moon on 01.07.2000.

Significant quantities of individuals of the Scarlet Dragonfly *Crocothemis erythraea* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been four days after the full moon on 23.06.1994 and four days after the full moon on 21.08.1994, respectively; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995, near Lustadt northwest of Germersheim where 5 individuals have flown on 21.06.2008 (WEISS 2009) which has been three days after the full moon on 18.06.2008; and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals each have flown on 02.07.1995 (ERWIN SEFRIN in VIESSMANN 1996), 12.09.1999 (ERWIN SEFRIN in VIESSMANN 2000a) and 23.06.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been five days after the new moon on 27.06.1995, two days after the new moon on 10.09.1999 and one day before the full moon on 24.06.2002, respectively.

Significant quantities of individuals of the Scarlet Dragonfly *Crocothemis erythraea* in the southwestern part of Germany have also been verified in the Pfrimm valley in the vicinity of Kirchheim-

Bolanden southwest of Alzey where up to 10 individuals each have flown on 09.07.2000 (VIESSMANN 2001), 11.07.2001 (VIESSMANN 2002) and 03.07.2003 (VIESSMANN 2004) which has been on the increasing half moon on 09.07.2000 between the new moon on 01.07.2000 and the full moon on 16.07.2000, three days before the decreasing half moon on 14.07.2001 between the full moon on 05.07.2001 and the new moon on 20.07.2001, and four days after the new moon on 29.06.2003, respectively.

7.42 The Emperor Dragonfly *Anax imperator*

Mass flights of the Emperor Dragonfly *Anax imperator* LEACH 1815 (Odonata: Aeshnidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been encountered at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where more than 10 individuals each have flown on 25.07.1994 and 25.08.1994 (KLAUS WEISS in VIESSMANN 1995) which has been three days after the full moon on 22.07.1994 and four days after the full moon on 21.08.1994, respectively; and near Niedermohr westnorthwest of Landstuhl where 10 individuals have flown on 16.07.1994 (ALFRED KLEIN in VIESSMANN 1995) which has been one day before the increasing half moon on 17.07.1994 between the new moon on 09.07.1994 and the full moon on 22.07.1994.

Significant quantities of individuals of the Emperor Dragonfly *Anax imperator* in the middle part of the Upper Rhine valley in the southwestern part of Germany have also been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 27.06.1994 (KLAUS WEISS in VIESSMANN 1995), 08.07.1995, 25.07.2995, 12.08.1995, 19.08.1995 (KLAUS WEISS in VIESSMANN 1996), 12.07.1999, 24.07.1999 – 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 23.06.2001, 24.07.2001 (KLAUS WEISS in VIESSMANN 2002) and 07.07.2002 (KLAUS WEISS in VIESSMANN 2003) which has been four days after the full moon on 23.06.1994, four days before the full moon on 12.07.1995, two days before the new moon on 27.07.1995, two days after the full moon on 10.08.1995, on the decreasing half moon on 19.08.1995 between the full moon on 10.08.1995 and the new moon on 26.08.1995, one day before the new moon on 13.07.1999, three to four days before the full moon on 28.07.1999, two days after the new moon on 21.06.2001, four days after the new moon on 20.07.2001 and three days before the new moon on 10.07.2002, respectively; near Offenbach an der Queich and at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999; at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 01.08.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which has been five days after the new moon on 27.07.1995, two days after the full moon on 10.08.1995, and on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001, respectively; at the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown 27.06.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 10.08.1995 (KLAUS WEISS in VIESSMANN 1996) and 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days after the full moon on 23.06.1994, four days after the full moon on 21.08.1994, on the full moon on 10.08.1995 and four days before the full moon on 28.07.1999, respectively; near Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995; near Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals each have flown on 19.06.1994 and 10.07.1994 (KLAUS WEISS in VIESSMANN 1995) which has been five days before the full moon on 23.06.1994 and one day after the new moon on 09.07.1994, respectively; near Herxheimweyher east of Herxheim eastsoutheast of Landau in der Pfalz where up to 10 individuals have flown on

02.06.2002 (KLAUS WEISS in VIESSMANN 2003) which has been one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 09.07.1995 (ERWIN SEFRIN in VIESSMANN 1996) which has been three days before the full moon on 12.07.1995.

Significant quantities of individuals of the Emperor Dragonfly *Anax imperator* in the southwestern part of Germany have also been found in the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 17.07.1995 (VIESSMANN 1996) which has been five days after the full moon on 12.07.1995, near Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, and near Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999.

Significant quantities of individuals of the Emperor Dragonfly *Anax imperator* in the western part of Germany have been noticed near Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999) which has been two days before the full moon on 08.08.1998, near Könen in the Saar valley southsouthwest of Konz southsouthwest of Trier where up to 10 individuals have flown on 29.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the new moon on 01.07.2000; near Kanzem in the Saar valley south of Konz southsouthwest of Trier where more than 10 individuals each have flown on 01.07.2000 (MONIKA ROBECK in VIESSMANN 2001) and 24.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been on the new moon on 01.07.2000 and one day after the new moon on 23.05.2002, respectively; and in the Ueßbach valley northwest of Alf southwest of Cochem where up to 10 individuals have flown on 19.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) which has been two days before the increasing half moon on 21.06.1999 between the new moon on 13.06.1999 and the full moon on 28.06.1999.

Significant quantities of individuals of the Emperor Dragonfly *Anax imperator* in the northwestern part of Germany have been encountered near Hundsangen northnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 27.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 30.07.1996, near Großholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996; and near Benrath at the southeastern margin of the city of Düsseldorf in the Middle Rhine valley where up to 10 individuals each have flown on 26.06.1999 (MONIKA ROBECK in VIESSMANN 2000a) and 30.06.2000 (MONIKA ROBECK in VIESSMANN 2001) which has been two days before the full moon on 28.06.1999 and one day before the new moon on 01.07.2000, respectively.

7.43 The Lesser Emperor Dragonfly *Anax parthenope*

Significant quantities of individuals of the Lesser Emperor Dragonfly *Anax parthenope* SÉLYS 1839 (Odonata: Aeshnidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been reported from Offenbach an der Queich and the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 12.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been one day before the new moon on 13.07.1999, at the Bärensee in Ottersheim east of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 28.07.2001 (KLAUS WEISS in VIESSMANN 2002) which

has been on the increasing half moon on 28.07.2001 between the new moon on 20.07.2001 and the full moon on 04.08.2001; and from Römerberg-Mechtersheim southsouthwest of Speyer in the middle part of the Upper Rhine valley in the southwestern part of Germany where up to 10 individuals each have flown on 23.07.1995 (ERWIN SEFRIN in VIESSMANN 1996), 27.08.1996 (ERWIN SEFRIN in VIESSMANN 1997), 12.07.1999, 31.07.1999 (ERWIN SEFRIN in VIESSMANN 2000a), 12.06.2000 (ERWIN SEFRIN in VIESSMANN 2001) and 02.06.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been four days before the new moon on 27.07.1995, one day before the full moon on 28.08.1996, one day before the new moon on 13.07.1999, three days after the full moon on 28.07.1999, five days before the full moon on 17.06.2000, and one day before the decreasing half moon on 03.06.2002 between the full moon on 26.05.2002 and the new moon on 11.06.2002, respectively.

7.44 The Small Pincertail *Onychogomphus forcipatus*

Significant quantities of individuals of the Small Pincertail *Onychogomphus forcipatus* LINNAEUS 1758 (Odonata: Gomphidae) in the western part of Germany have been mentioned from Hahnenbach in the Hahnenbach valley northwest of Kirn in the eastern part of the Hunsrück where up to 10 individuals each have flown on 19.07.1999 (MONIKA ROBECK in VIESSMANN 2000a) and 23.06.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days before the increasing half moon on 21.07.1999 between the new moon on 13.07.1999 and the full moon on 28.07.1999, and two days after the new moon on 21.06.2001, respectively.

7.45 The Golden-Ringed Dragonfly *Cordulegaster boltonii*

Significant quantities of individuals of the Golden-Ringed Dragonfly *Cordulegaster boltonii* (DONOVAN 1807) (Odonata: Cordulegasteridae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been documented from Hilst westnorthwest of Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 11.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been two days before the new moon on 13.07.1999, from Beuren north of Hermeskeil in the western part of the Hunsrück where up to 10 individuals have flown on 11.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been two days before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, and from near Kanzem in the Saar valley south of Konz southsouthwest of Trier where up to 10 individuals have flown on 24.05.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day after the new moon on 23.05.2002.

7.46 The Downy Emerald *Cordulia aenea*

Significant quantities of individuals of the Downy Emerald *Cordulia aenea* LINNAEUS 1758 (Odonata: Corduliidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been signaled from Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals each have flown on 08.07.1995, 25.07.1995, 12.08.1995 (KLAUS WEISS in VIESSMANN 1996), 25.07.1999 (KLAUS WEISS in VIESSMANN 2000a), 18.06.2000 (KLAUS WEISS in VIESSMANN 2001), 09.06.2002, 15.06.2002 (KLAUS WEISS in VIESSMANN 2003) and 21.06.2003 (KLAUS WEISS in VIESSMANN 2004) which has been four days before the full moon on 12.07.1995, two days before the new moon on 27.07.1995, two days after the full moon on 10.08.1995, three days before the full moon on 28.07.1999, one day after the full moon on 17.06.2000, two days before and four days after the new moon on 11.06.2002, and on the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, respectively; from the Bärensee in Ottersheim east

of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals each have flown on 25.07.1994, 25.08.1994 (KLAUS WEISS in VIESSMANN 1995), 01.08.1995 and 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been three days after the full moon on 22.07.1994, four days after the full moon on 21.08.1994, five days after the new moon on 27.07.1995 and two days after the full moon on 10.08.1995, respectively; and from the Bienwald west of Karlsruhe where abt. 10 individuals have flown on 15.06.1991 (KLAUS WEISS in BOSSELMANN 1992) which has been three days after the new moon on 12.06.1991.

Significant quantities of individuals of the Downy Emerald *Cordulia aenea* in the southwestern part of Germany have also been mentioned from the Steinbühl region in the vicinity of Steinbach am Donnersberg southsouthwest of Kirchheim-Bolanden southwest of Alzey where up to 10 individuals have flown on 17.07.1995 (VIESSMANN 1996) which has been five days after the full moon on 12.07.1995.

Significant quantities of individuals of the Downy Emerald *Cordulia aenea* in the northwestern part of Germany have been encountered near Ruppach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals have flown on 27.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been three days before the full moon on 30.07.1996, and near Großholbach and Kleinholbach east of Montabaur westnorthwest of Limburg an der Lahn where up to 10 individuals each have flown on 29.07.1996 (LEANDER HOFFMANN in VIESSMANN 1997) which has been one day before the full moon on 30.07.1996.

7.47 The Brilliant Emerald *Somatochlora metallica*

Significant quantities of individuals of the Brilliant Emerald *Somatochlora metallica* (LINDEN 1825) (Odonata: Corduliidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been verified from the Bärenbusch in the vicinity of Offenbach an der Queich east of Landau in der Pfalz where up to 10 individuals have flown on 24.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been four days before the full moon on 28.07.1999, and from Knittelsheim west of Bellheim east of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

Significant quantities of individuals of the Brilliant Emerald *Somatochlora metallica* in the southwestern part of Germany have also been reported from Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999, and from Beuren north of Hermeskeil in the western part of the Hunsrück in the western part of Germany where up to 10 individuals have flown on 06.08.1998 (MONIKA ROBECK in VIESSMANN 1999) which has been two days before the full moon on 08.08.1998.

7.48 The Brown Hawker *Aeschna grandis*

Significant quantities of individuals of the Brown Hawker *Aeschna grandis* LINNAEUS 1758 (Odonata: Aeshnidae) in the southwestern part of Germany have been confirmed from Eppenbrunn southsouthwest of Pirmasens in the Palatinate Forest where up to 10 individuals have flown on 18.07.1999 (KLAUS WEISS in VIESSMANN 2000a) which has been five days after the new moon on 13.07.1999.

Significant quantities of individuals of the Brown Hawker *Aeschna grandis* in the western part of

Germany have been notified from Röderbach near the Erbeskopf northnorthwest of Birkenfeld in the central part of the Hunsrück where up to 10 individuals have flown on 12.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the decreasing half moon on 13.08.2001 between the full moon on 04.08.2001 and the new moon on 19.08.2001, from the Keßbach south of Daun in the southwestern part of the Eifel where up to 10 individuals have flown on 15.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999) which has been on the decreasing half moon on 15.08.1998 between the full moon on 08.08.1998 and the new moon on 22.08.1998; from the Jungfernweiher near Ulmen east of Daun in the southwestern part of the Eifel where up to 10 individuals each have flown on 17.08.1998 (FRIEDHELM ROBECK in VIESSMANN 1999), 12.08.2000 (MONIKA ROBECK in VIESSMANN 2001) and 25.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been five days before the new moon on 22.08.1998, three days before the full moon on 15.08.2000, and one day before the increasing half moon on 26.08.2001 between the new moon on 19.08.2001 and the full moon on 03.09.2001, respectively; and near Binsfeld east of Bitburg in the southwestern part of the Eifel where up to 10 individuals have flown on 18.08.2001 (MONIKA ROBECK in VIESSMANN 2002) which has been one day before the new moon on 19.08.2001.

7.49 The Norfolk Hawker *Aeshna isosceles*

Significant quantities of individuals of the Norfolk Hawker *Aeshna isosceles* O.F. MÜLLER 1767 (Odonata: Aeshnidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been encountered near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 11.05.2003 (ERWIN SEFRIN in VIESSMANN 2004) which has been five days before the full moon on 16.05.2003.

7.50 The Hairy Dragonfly *Brachytron pratense*

Significant quantities of individuals of the Hairy Dragonfly *Brachytron pratense* O.F. MÜLLER 1764 (Odonata: Aeshnidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been observed near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 12.08.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days after the full moon on 10.08.1995, and near Römerberg-Mechtersheim southsouthwest of Speyer where up to 10 individuals have flown on 17.05.2002 (ERWIN SEFRIN in VIESSMANN 2003) which has been five days after the new moon on 12.05.2002.

7.51 The Lilypad Whiteface *Leucorrhinia caudalis*

Significant quantities of individuals of the Lilypad Whiteface *Leucorrhinia caudalis* (CHARPENTIER 1840) (Odonata: Libellulidae) in the middle part of the Upper Rhine valley in the southwestern part of Germany have been found near Zeiskam eastnortheast of Landau in der Pfalz where up to 10 individuals have flown on 25.07.1995 (KLAUS WEISS in VIESSMANN 1996) which has been two days before the new moon on 27.07.1995.

7.52 The Burrowing Mayfly *Ephoron virgo*

A spectacular mass occurrence of the Burrowing Mayfly *Ephoron virgo* (OLIVIER 1791) (Ephemeroptera: Polymitarcyidae) has been reported from the river Naab in Schwandorf north of Regensburg

in the Oberpfalz in the southeastern part of Germany by articles in several overregional newspapers which have appeared one day after the full moon on 06.08.2009 (DETSCH 2009, SCHMIDT 2009, SÜDDEUTSCHE ZEITUNG 2009). According to the documentation of DETSCH (2009), the breakout of the abundance of the Burrowing Mayfly *Ephoron virgo* at the river Naab in Schwandorf has happened on the day before the full moon on 06.08.2009, and the phenomenon of its mass flying has taken place there in almost every year. Mass occurrences of the Burrowing Mayfly *Ephoron virgo* are common phenomena in the summer of many years at numerous rivers such as Rhine, Moselle, Neckar, Main, Tauber, Lahn, Danube, Naab, Leine, Fulda, Weser, Elbe, Oder and various others in Germany and other countries in Europe (examples and references are contained among others in SCHÄFFER 1757, KEFERSTEIN 1863, KLAPÁLEK 1909; SCHOENEMUND 1924, 1930; SCHLENKER 1924; STADLER 1924a, 1924b, 1935; ULMER 1927; DENIS, PARIS & PILLON 1937; WEISS 1947, WEIDNER 1963; WITTENBERGER 1981, 1983; BATHON 1982, 1983a, 1983b; BURMEISTER 1985, 1987, 1989a, 1989b; MARTEN 1986, GRIMM 1988; SCHLEUTER, SCHLEUTER & TITTIZER 1989; MEYER-ARNDT & BERGER 1990; KURECK 1992, 1993, 1996; BUTZ & SCHUWERK 1993, KURECK & FONTES 1996, TOBIAS 1996, JAGUSCH 2000; HAYBACH, MÜLLER & SCHLEUTER 2004; TOBIAS & BERNERTH 2004).

I have had the occasion to observe a mass flying of the Burrowing Mayfly *Ephoron virgo* during the crepuscular period in the evening and after the beginning of the night upon establishment of full darkness at the river Neckar in the district Wieblingen at the northwestern margin of the city of Heidelberg a few days after 15.08.1991 when I have received the information on its occurrence by an article and photographs in a regional newspaper (RHEIN-NECKAR-ZEITUNG 1991). During my visit of the margin of the river Neckar in Wieblingen, clouds of individuals of the Burrowing Mayfly *Ephoron virgo* have been dancing around several burning lights at the margin of the street Neckarhamm close to the river Neckar, and deposits of dead individuals from the flight activity during the days before have been lying on the street. In the following years, mass flights of the Burrowing Mayfly *Ephoron virgo* have repeatedly been reported from Wieblingen and other localities at the river Neckar within and around Heidelberg by several articles and photographs in a regional newspaper (RHEIN-NECKAR-ZEITUNG 1994, 1999, 2003, 2006). The notes on the mass flights of the Burrowing Mayfly *Ephoron virgo* at the river Neckar within and around Heidelberg have been published in the regional newpaper two days before the increasing half moon on 17.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991 (RHEIN-NECKAR-ZEITUNG 1991), one day after the new moon on 07.08.1994 (RHEIN-NECKAR-ZEITUNG 1994), one day after the increasing half moon on 19.08.1999 between the new moon on 11.08.1999 and the full moon on 27.08.1999 (RHEIN-NECKAR-ZEITUNG 1999), two days after the new moon on 27.08.2003 (RHEIN-NECKAR-ZEITUNG 2003), and two days before the increasing half moon on 31.08.2006 between the new moon on 23.08.2006 and the full moon on 07.09.2006 (RHEIN-NECKAR-ZEITUNG 2006). Mass flights of the Burrowing Mayfly *Ephoron virgo* at the river Rhine in Mannheim west of Heidelberg have been observed on 08.08.1924 (SCHOENEMUND 1930) which has been one day before the decreasing half moon on 09.08.1924 between the full moon on 14.08.1924 and the new moon on 30.08.1924.

Mass flights of the Burrowing Mayfly *Ephoron virgo* in Germany have also been documented at the river Main in Frankfurt am Main in the central part of Germany where they have happened on and around 14.08.1995 (TOBIAS 1996) which has been four days after the full moon on 10.08.1995; at the river Main in Hanau east of Frankfurt am Main in the central part of Germany where they have occurred on 15.08.1981 – 20.08.1981 (WITTENBERGER 1981; BATHON 1982, 1983a, 1983b) and 19.08.1983 – 21.08.1983 (BATHON 1983a, 1983b; WITTENBERGER 1983) which has been on and several days after the full moon on 15.08.1981 as well as a few days before the full moon on 23.08.1983, respectively; at the river Main in Würzburg in the central part of Germany where they have been manifested in August 1898 (LEYDIG 1902, WEIDNER 1963) which has been around and between the full moon on 02.08.1898, the new moon on 17.08.1898 and the full moon on 31.08.1898; at the river Moselle in Trier in the western part of Germany where they have been developed on

10.08.1886 (Leydig 1902) which has been four days before the full moon on 14.08.1886, at the river Rhine within and around Bonn in the Middle Rhine valley in the western part of Germany where they have been reported by an article in a regional newspaper which has been printed four days before the full moon on 06.08.1990 (Rhein-Zeitung 1990; Kureck 1992, 1993) and where they have occurred also in Cologne in August 1991 (Kureck 1992, 1996) which has probably been around and between the new moon on 10.08.1991 and the full moon on 25.08.1991; at the creek Wallufbach, a tributary to the river Rhine, in abt. 7.5 km distance from the river Rhine in Schlangenbad west-northwest of Wiesbaden in the Middle Rhine valley in the western part of Germany where they have taken place on 11.08.1990 – 12.08.1990 (Meyer-Arndt & Berger 1990) which has been several days after the full moon on 06.08.1990; at the river Danube in Regensburg in the southeastern part of Germany where they have been expressed on 11.08.1757 (Schäffer 1757) as well as in Passau and Deggendorf northwest of Passau in the southeastern part of Germany where they have happened on 31.07.1992 – 01.08.1992 (Butz & Schuwerk 1993) and 15.08.2001 (Tobias & Bernerth 2004) which has been four days before the new moon on 15.08.1757, a few days after the new moon on 29.07.1992 and four days before the new moon on 19.08.2001, respectively; at the river Naab in Kallmünz northnorthwest of Regensburg in the southeastern part of Germany where they have been established on 17.08.1987 (Burmeister 1989b) which has been on the decreasing half moon on 17.08.1987 between the full moon on 09.08.1987 and the new moon on 24.08.1987, and at the river Weser in Bremen in the northwestern part of Germany where they have taken place on 09.08.1910 (Alfken in Weiss 1947) which has been four days after the new moon on 05.08.1910.

Mass flights of the Burrowing Mayfly *Ephoron virgo* in Switzerland and France have been recognized at the river Rhône in Geneva in the southwestern part of Switzerland where they have been manifested in August 1906 (Schlenker 1924) which has been around and between the full moon on 04.08.1906 and the new moon on 20.08.1906, at the river Gard near Nîmes northwest of Marseille in the southeastern part of France where they have been developed on 25.08.1985 – 27.08.1985 (Burmeister 1987) which has been several days before the full moon on 30.08.1985; at the river Allier east of Issoire south of Clermont-Ferrand west of Lyon in the southeastern part of France where they have been expressed on 29.07.1943 – 30.07.1943 (Verrier 1943) which has been two and three days before the new moon on 01.08.1943, and east of Clermont-Ferrand on 05.07.1945 – 06.07.1945 (R. Hovasse & L. Olivier in Verrier 1954) which has been three and four days before the new moon on 09.07.1945; at the river Saône in Saint-Jean-de-Losne southeast of Dijon in the eastern part of France where they have happened on 15.08.1936 – 18.08.1936 (Denis, Paris & Pillon 1937) which has been around the new moon on 17.08.1936, and at the river Dordogne near Roche-Gageac east of Bordeaux in the southwestern part of France where they have been manifested on 30.08.1951 (R. Poisson in Verrier 1954) which has been two days before the new moon on 01.09.1951.

Mass flights of unspecified Ephemeroptera which have probably also been either the larger Burrowing Mayfly *Ephoron virgo* or the smaller Burrowing Mayfly *Oligoneuriella rhenana* have also been reported from the river Fulda in Kassel in the northwestern part of Germany where they have been established on 21.08.1856 – 22.08.1856 (Keferstein 1863) which has been one to two days before the decreasing half moon on 23.08.1856 between the full moon on 16.08.1856 and the new moon on 30.08.1856, from the river Seine in Paris in the northwestern part of France where they have been developed on 02.07.1852 (Lucas 1861, H. Lucas in Keferstein 1863) which has been one day after the full moon on 01.07.1852, from the river Sarthe near Le Mans southwest of Paris in the northwestern part of France where they have taken place on 02.08.1861 – 03.08.1861 (Reiche 1861, Keferstein 1863) which has been three to four days before the new moon on 06.08.1861, and from the river Vistula in Cracow in the southern part of Poland where they have been expressed on 29.06.1859 – 30.06.1859 (Keferstein 1863) which has been one day before and on the new moon on 30.06.1859.

7.53 The Burrowing Mayfly *Oligoneuriella rhenana*

In addition to the larger Burrowing Mayfly *Ephoron virgo* (Olivier 1791) (Ephemeroptera: Polymitarcyidae), also the smaller Burrowing Mayfly *Oligoneuriella rhenana* (Imhoff 1852) (Ephemeroptera: Oligoneuriidae) has repeatedly appeared with mass flights predominantly at the river Rhine and subordinately also at other rivers (examples and references are contained among others in Imhoff 1852, Meyer-Dür 1874, Klapálek 1909, Neeracher 1910, Zschokke & Steinmann 1911; Lauterborn 1917, 1928, 1938; Steinmann 1919, Zschokke 1928, Schoenemund 1930, Sowa 1975, Burmeister 1985, Marten 1986, Grimm 1988; Jansen, Kappus & Böhmer 1997; Schöll 1998, Jansen 2000).

Mass flights of the Burrowing Mayfly *Oligoneuriella rhenana* in Switzerland have been documented at the river Rhine in Basel in the northwestern part of Switzerland where they have been manifested at the beginning of August 1834 and at the beginning of September 1851 (Imhoff 1852) which have been around the new moon on 05.08.1834 and several days after the new moon on 26.08.1851, respectively; at the river Rhine in Basel and at the river Aare in Aarau southeast of Basel in the northwestern part of Switzerland that have particularly been investigated by Steinmann (1919) who has indicated the peaks of its mass occurrences at the end of August 1913 which has been around and between the full moon on 16.08.1913 and the new moon on 31.08.1913, at the end of August 1914 which has been around and between the new moon on 21.08.1914 and the full moon on 04.09.1914, at the beginning of September 1916 which has been around and between the new moon on 28.08.1916 and the full moon on 11.09.1916, at the beginning of September 1917 which has been around and between the full moon on 01.09.1917 and the new moon on 16.09.1917, and at the end of August 1918 which has been around and between the full moon on 22.08.1918 and the new moon on 05.09.1918; and that have also been studied by Neeracher (1910) who has mentioned the beginning of its mass occurrence in the middle of August 1906 which has been around the new moon on 20.08.1906, and in the middle of August 1907 which has been around the full moon on 23.08.1907; and at the river Aare near Wildegg eastnortheast of Aarau where they have taken place on 26.08.1871 (Meyer-Dür 1874) which has been four days before the full moon on 30.08.1871.

Mass flights of the Burrowing Mayfly *Oligoneuriella rhenana* in Germany, Poland and France have been registered at the river Rot, a southern tributary of the river Danube, around Niedernzell south of Ulm in the southwestern part of Germany where they have happened on 11.08.1987, 17.08.1987 and 25.08.1987 (Grimm 1988) which has been around and between the full moon on 09.08.1987 and the new moon on 24.08.1987; at the river Raba in the Beskid Mountains southsouthwest of Cracow in the southwestern part of Poland where they have taken place on 26.07.1969 (Sowa 1975) which has been three days before the full moon on 29.07.1969; and at the river Couze Pavin, a tributary of the river Allier, between Perrier and Issoire south of Clermont-Ferrand west of Lyon in the southeastern part of France where they have been established on end of August 1941 (Verrier 1941), 18.07.1943 (Verrier 1954), 27.07.1943 (Verrier 1943, 1954) and 22.07.1952 (Verrier 1954) which has been around and between the new moon on 22.08.1941 and the full moon on 05.09.1941, one day after the full moon on 17.07.1943, five days before the new moon on 01.08.1943 and on the new moon on 22.07.1952, respectively.

7.54 The Carpenter Bee *Xylocopa violacea*

The wood-nesting Carpenter Bee *Xylocopa violacea* Linnaeus 1758 (Hymenoptera: Anthophoridae) is one of the largest bees in Middle Europe and is a spectacular insect because of its noisy flight with distinct humming and buzzing. It is a typical indicator of the entomological beginning of the

spring when various individuals of the Carpenter Bee *Xylocopa violacea* begin to fly around roofs, balconies and walls of houses in full sunlight. The Carpenter Bee *Xylocopa violacea* has the size and the shape of a large bumble-bee and is highlighted by its bluish black body and its dark bluish brown wings, with the females carrying yellow pollen loads on the ventral side of the body.

I have had the occasion to observe the swarming of the Carpenter Bee *Xylocopa violacea* in blazing sunshine in a wild garden that contains an assemblage of piles of pieces of old wood which are oriented towards east and south and are thus exposed to the open sunlight during most parts of the day within the city of Oftersheim (abt. 9 km westsouthwest of Heidelberg) in the middle part of the Upper Rhine valley in the southwestern part of Germany from 28.04.2007 onwards. The wild garden with an abundance of piles of pieces of old wood that contain a rich suite of holes, an almost unlimited illumination by the sun from the morning to the evening, and the availability of cultivated gardens and meadows with a broad spectrum of flowers for the collection of pollen in the nearer and farther surroundings represents a typical environment for nesting of the Carpenter Bee *Xylocopa violacea*. The numerous individuals of the Carpenter Bee *Xylocopa violacea* have flown around the various piles of pieces of old wood from stems of trees which had been felled, cut and deposited in the wild garden already many years ago, and have entered the abundant holes in the pieces of wood for the purpose of provisioning cells with yellow pollen. The swarming of the Carpenter Bee *Xylocopa violacea* has been a continuous flying of numerous individuals into and through the wild garden to the piles of wood where the yellow pollen has been deposited within the various holes in the wood, and through and out of the wild garden in order to collect new pollen in cultivated gardens and meadows within the vicinity of the wild garden and to bring it also to the piles of wood for the installation and completion of cells within the holes in the wood before their closure. The regular cyclicity of arrival, deposition of pollen, departure and return of the individuals of the Carpenter Bee *Xylocopa violacea* has persisted for many hours on each day of observation.

I have witnessed the swarming of the Carpenter Bee *Xylocopa violacea* in the wild garden within the city of Oftersheim on 28.04.2007 as well as on four to six days during the following two weeks, with abt. 10 – 20 individuals having flown on each day of my visits that have been predominantly to exclusively females which could be easily recognized according to their typical yellow pollen load on the ventral side of the body. The swarming of the Carpenter Bee *Xylocopa violacea* in the wild garden within the city of Oftersheim from 28.04.2007 onwards has happened four days before the full moon on 02.05.2007, and has continued around and between the full moon on 02.05.2007 and the new moon on 16.05.2007.

7.55 The Mason Bee *Megachile parietina*

The Mason Bee *Megachile parietina* (Geoffroy in Fourcroy 1785) (Hymenoptera: Megachilidae) belongs together with the Mason Bee *Osmia anthocopoides* Schenck 1853 (Hymenoptera: Megachilidae), the Delta Mud Wasp *Delta unguiculatum* (Villers 1789) (Hymenoptera: Eumenidae) and the Mud Dauber *Sceliphron destillatorium* (Illiger 1807) (Hymenoptera: Sphecidae) to the outstanding assemblage of mortaring bees and wasps which build free-standing mason nests on the surface of stones of natural rock monuments, artificial outcrops and anthropogenic buildings (Mader 2000, 2001a, 2001b, 2001c, 2002). In contrast to the widespread distribution of the Mason Bee *Osmia anthocopoides* which builds its nests predominantly on stones of natural rock monuments and artificial outcrops (Mader 2000, 2001a) as well as the Delta Mud Wasp *Delta unguiculatum* and in some regions also the Mud Dauber *Sceliphron destillatorium* that construct their nests mainly on stones of anthropogenic buildings (Mader 2000, 2001c), the Mason Bee *Megachile parietina* which accepts all three types of occurrences of stones as substrates for the establishment of its nests occurs nowadays in Germany only still at a few isolated localities (Mader 2001b, Westrich 2007) in con-

trast to its widespread former distribution (MADER 2002). The Mason Bee *Megachile parietina* looks like a small version of the Carpenter Bee *Xylocopa violacea*, has the size and the shape of a small bumble-bee and is also highlighted by its bluish black body and its dark bluish brown wings, with the females carrying yellow pollen loads on the ventral side of the body.

One of the last existing populations of the Mason Bee *Megachile parietina* in the southwestern part of Germany occurs at the Goldberg northnorthwest of Pflaumloch west of Nördlingen in the Nördlinger Ries where it nests on the extensive walls of an old abandoned quarry (MADER 2001a, 2001b) which are oriented towards the south and are thus exposed to the open sunlight during most parts of the day. I have had the occasion to observe the swarming of the Mason Bee *Megachile parietina* in blazing sunshine in the quarry at the Goldberg west of Nördlingen on 26.06.2001 and 02.07.2001, whereas no more individuals have flown on 19.07.2001. The abandoned quarry with a broad chain of walls of rocks that contain a rich suite of horizontal and vertical surfaces, an almost unlimited illumination by the sun from the morning to the evening, and the availability of meadows with a broad spectrum of flowers for the collection of pollen in the nearer and farther surroundings of the walls of rocks represents a typical environment for nesting of the Mason Bee *Megachile parietina*. The numerous individuals of the Mason Bee *Megachile parietina* have flown along and around the walls of the quarry where they have built nests at various places and have provisioned the cells with yellow pollen.

The swarming of the Mason Bee *Megachile parietina* has been a continuous flying of numerous individuals towards the wall of the quarry where the yellow pollen has been deposited within various cells in the suite of nests having been mortared on the surface of the rocks, and away from the wall of the quarry in order to collect new pollen in the meadows within the vicinity of the quarry and to bring it also to the nests on the surface of the rocks for the installation and completion of the cells within the mortared nests before their closure. The regular cyclicity of arrival, deposition of pollen, departure and return of the individuals of the Mason Bee *Megachile parietina* has persisted for many hours on each day of observation.

In the middle part of the abandoned quarry at the Goldberg west of Nördlingen, also a wild colony of the Honey Bee *Apis mellifera* LINNAEUS 1758 (Hymenoptera: Apidae) has aggregated at one spot on the vertical surface of the wall, with abundant individuals having swarmed by continuous flying around the centre of the concentration on both days of observation.

I have witnessed the swarming of the Mason Bee *Megachile parietina* in the abandoned quarry at the Goldberg west of Nördlingen on 26.06.2001 and 02.07.2001, with abt. 5 – 10 individuals having flown on both days of my observations that have been exclusively females which could be easily recognized according to their typical yellow pollen load on the ventral side of the body. The swarming of the Mason Bee *Megachile parietina* in the abandoned quarry at the Goldberg west of Nördlingen on 26.06.2001 and 02.07.2001 has taken place five days after the new moon on 21.06.2001 and three days before the full moon on 05.07.2001. The whole extension of the swarming of the Mason Bee *Megachile parietina* at the Goldberg west of Nördlingen has therefore encompassed the period around and between the new moon on 21.06.2001 and the full moon on 05.07.2001, whereas the activity has been completely terminated with not a single individual flying any more before the new moon on 20.07.2001.

The second population of the Mason Bee *Megachile parietina* in the Nördlinger Ries which has been located at the Ofnethöhlen southwest of Holheim southwest of Nördlingen and that has still been active abt. 20 years ago is now already extinct (MADER 2001a). BELLMANN (1995, 1999) has published some photographs of females of the Mason Bee *Megachile parietina* provisioning cells in several nests on the rocks at the Ofnethöhlen which have been taken in June 1978. In comparison

with my observations of the activity of the females of the Mason Bee *Megachile parietina* provisioning cells in several nests on the rocks at the Goldberg on 26.06.2001 and 02.07.2001, the period of activity of the females of the Mason Bee *Megachile parietina* at the Ofnethöhlen in June 1978 that has been documented by BELLMANN (1995, 1999) has probably happened around and between the full moon on 20.06.1978 and the new moon on 05.07.1978.

7.56 The Lettuce-Root Aphid *Pemphigus bursarius*

Mass flights of large quantities of individuals of the Lettuce-Root Aphid *Pemphigus bursarius* (LINNAEUS 1758) (Hemiptera: Aphididae) have been reported from Sweden on 02.10.1846 (KEFERSTEIN 1863) which has been two days before the full moon on 04.10.1846.

7.57 The Peach-Potato Aphid *Myzus persicae*

Mass flights of large quantities of individuals of the Peach-Potato Aphid *Myzus persicae* (SULZER 1776) (Hemiptera: Aphididae) have been mentioned from Mariakerke between Brugge and Gent northwest of Bruxelles as well as within Gent in the western part of Belgium on 28.09.1834 and 29.09.1834, respectively (MORREN 1836, C. MORREN in KEFERSTEIN 1863), which has been three and four days before the new moon on 02.10.1834, respectively; from Tête-de-Flandre southeast of Calais in the northwestern part of France as well as the road between Antwerpen and Gent north and northwest of Bruxelles, respectively, in the western part of Belgium on 05.10.1834 (MORREN 1836, C. MORREN in KEFERSTEIN 1863) which has been three days after the new moon on 02.10.1834; and from the vicinity of Bruxelles, Mons southwest of Bruxelles and Aalst northwest of Bruxelles in the western part of Belgium on 12.10.1834 and 09.10.1834, respectively (MORREN 1836, C. MORREN in KEFERSTEIN 1863), which has been two days after and one day before the increasing half moon on 10.10.1834 between the new moon on 02.10.1834 and the full moon on 17.10.1834, respectively.

7.58 The Black Bean Aphid *Aphis fabae* and the Bean Aphid *Aphis rumicis*

Mass flights of large quantities of individuals of the Black Bean Aphid *Aphis fabae* SCOPOLI 1763 (Hemiptera: Aphididae) have been documented from several regions in the western part of England in the period of 14.06.1847 – 21.06.1847 (KEFERSTEIN 1863) which has been around and between the new moon on 13.06.1847 as well as the increasing half moon on 21.06.1847 between the new moon on 13.06.1847 and the full moon on 28.06.1847.

Mass flights of large quantities of individuals of the Bean Aphid *Aphis rumicis* LINNAEUS 1758 (Hemiptera: Aphididae) have been encountered around Stockton-on-Tees south of Newcastle-upon-Tyne in the northeastern part of England at the end of September 1853 (HOGG 1855) which has been around and between the full moon on 17.09.1853 and the new moon on 02.10.1853.

7.59 The Springtail *Sminthurus ater*

Mass occurrences of the Springtail *Sminthurus ater* LATREILLE (Collembola: Sminthuridae) have been found between Niesky and Quitzdorf southwest of Niesky northwest of Görlitz in the northeastern part of Germany on 13.09.1837 (FECHNER 1840) which has been one day before the full moon on 14.09.1837.

7.60 The Cosmopolitan Grain Psocid *Lachesilla pedicularia*

Mass flights of the Cosmopolitan Grain Psocid *Lachesilla pedicularia* Linnaeus 1758 (Psocoptera: Lachesillidae) have been observed near Saint Mary´s Bay westsouthwest of Folkestone southeast of London in the southeastern part of England on 25.09.1949 (Burton 1950) which has been three days after the new moon on 22.09.1949, and near Koksijde westsouthwest of Oostende in the western part of Belgium on 01.09.1935 (J.A. Lestage in Burton 1950) which has been four days after the new moon on 28.08.1935.

7.61 The Common Elbowed Red Ant *Myrmica scabrinodis*

Mass flights of the Common Elbowed Red Ant *Myrmica scabrinodis* Nylander 1846 (Hymenoptera: Formicidae) have been registered near Saint Mary´s Bay westsouthwest of Folkestone southeast of London in the southeastern part of England on 25.09.1949 (Burton 1950) which has been three days after the new moon on 22.09.1949.

7.62 The Hawthorn Fly *Bibio marci*

A mass flight of large quantities of individuals of the Hawthorn Fly *Bibio marci* Linnaeus 1758 (Diptera: Bibionidae) has been mentioned from the vicinity of Potsdam westsouthwest of Berlin in the northwestern part of Germany from 10.05.1907 onwards (Meissner 1907) which has been two days before the new moon on 12.05.1907.

A mass flight of large quantities of individuals of locusts (Orthoptera) has been reported from Obereggendorf northwest of Wiener Neustadt south of Vienna in the eastern part of Austria which has been entered by a big swarm of locusts on 26.06.1930 (Entomologische Zeitschrift 1930a) which has been on the new moon on 26.06.1930. The swarming of masses of individuals of locusts in 1930 has also been reported from the vicinity of Karsko (formerly Karzig) east of Myslibórz (formerly Soldin) southsoutheast of Szczecin (formerly Stettin) in Pomerania in the northwestern part of Poland (formerly in the northeastern part of Germany; Entomologische Zeitschrift 1930b). The swarming of masses of individuals of locusts in 1875 has been mentioned from the Upper Rhine valley in the southwestern part of Germany (Leydig 1881).

7.63 The Common Toad *Bufo bufo*

For the purpose of the broadening of the systematical scope of the selenocyclical evaluation of the population dynamics of the aforementioned beetles, butterflies and other insects, some comments are offered on the Common Toad *Bufo bufo* Laurenti 1768 (Amphibia: Bufonidae) as follows. The Common Toad *Bufo bufo* wanders in early spring in nights without frost from the forests to lakes, ponds and pools for spawning, and because often roads and paved ways have to be crossed between the forest and the standing waterbodies (compilation of articles in a regional newspaper on the migration of the Common Toad *Bufo bufo* and other amphibia to lakes, ponds and pools for spawning in spring in Heidelberg and vicinity in Mader 2009a), many individuals of the Common Toad *Bufo bufo* and other amphibia are frequently killed by the traffic. I have observed the wandering of the Common Toad *Bufo bufo* from the forest to a pond in the fields west of the railway line northeast of the airfield at the eastern margin of Walldorf south of Heidelberg in early spring 2009 and 2010, and I have been able to assess its population dynamics based on the number of road kills

which I have encountered on the paved way next to the pond during my daily power walking tour in the early morning. The fresh road kills of individuals of the Common Toad *Bufo bufo* are frequently removed until the next morning by predators and scavengers either partially or almost totally, and therefore the numbers of fresh road kills which are found in the early morning represent an excellent record of the population dynamics and the intensity of the wandering of the individuals of the Common Toad *Bufo bufo.*

In 2009, the first individuals of the Common Toad *Bufo bufo* have been found on the paved way next to the pond from two days after the full moon on 11.03.2009 to five days after the latter turning point of the lunar cycle, and then no more individuals have been observed until the end of March, because frost has occurred during most of the nights from 17.03.2009 to 30.03.2009. After the last night with frost on 30.03.2009, a significant change in temperature has happened, with the night or early morning temperature having risen from abt. 0 – 7 °C in the period from 15.03.2009 to 01.04.2009 to abt. 10 – 15 °C in the period from 02.04.2009 to 15.04.2009, and the first period of dry and warm weather with temperatures of up to 20 – 25 °C during the day has started on 02.04.2009 and has ended on 15.04.2009, with this period of dry and warm weather having finished and succeeded the winter. On the increasing half moon on 02.04.2009 between the new moon on 26.03.2009 and the full moon on 09.04.2009 when the temperature of 20 °C has been reached during the day for the first time in the current year as well as on the next day, abt. 2 – 5 individuals of the Common Toad *Bufo bufo* per day have been encountered on the paved way next to the pond, whereas on 04.04.2009, the exceptional number of abt. 20 – 25 individuals has been seen on the track, and from the next day onwards until 10.04.2009, only abt. 1 – 3 fresh individuals per day have been discovered in addition to various old road kills from the previous days. The last fresh individuals of the Common Toad *Bufo bufo* have been observed two days after the full moon on 09.04.2009, and on the fourth day after the latter turning point of the lunar cycle, the temperature of 25 °C has been reached during the day for the first time in the current year. The wandering of the Common Toad *Bufo bufo* has thus happened more or less from the full moon on 11.03.2009 to the full moon on 09.04.2009, with the peak of activity having been established around the increasing half moon on 02.04.2009.

In 2010, the wandering of the Common Toad *Bufo bufo* has started suddenly in the night of 17.03.2010 which has been two days after the new moon on 15.03.2010 and one day after the last night with frost on 16.03.2010 when the grass in the fields has been covered with hoar frost. The almost instantaneous onset of the wandering of the Common Toad *Bufo bufo* a few days after the new moon on 15.03.2010 has been reflected by the presence of abt. 10 individuals on the paved way next to the pond which I have observed in the morning of 18.03.2010, whereas not a single individual has been found in the days and weeks before. The sudden beginning of the wandering of the Common Toad *Bufo bufo* has also happened at the exactly identical length of day and night around the vernal equinox on 21.03.2010 which has been reached in Heidelberg already four days earlier on 17.03.2010, because on that day, sunrise has been at 6.35 hrs Middle European time and sunset has been at 18.35 hrs, and the length of the day has thus been exactly 12 hrs. On the next day in the morning of 19.03.2010, I have recorded only abt. 5 fresh individuals of the Common Toad *Bufo bufo* on the paved way next to the pond, whereas the abt. 10 individuals from the day before had been completely removed by predators and scavengers. Again on the next day in the morning of 20.03.2010, I have noticed abt. 10 fresh individuals of the Common Toad *Bufo bufo* on the paved way next to the pond that reflect another pronounced wandering in the night of 19.03.2010 which has been four days after the new moon on 15.03.2010, whereas the abt. 5 individuals from the day before had again totally disappeared as a result of predation and scavenging. Again on the next day in the morning of 21.03.2010, I have registered only abt. 5 fresh individuals of the Common Toad *Bufo bufo* on the paved way next to the pond, whereas the abt. 10 individuals from the day before had again been entirely cleared by predators and scavengers. Again on the next day in the morning

of 22.03.2010, I have not found a single fresh individual of the Common Toad *Bufo bufo* on the paved way next to the pond, whereas the abt. 5 individuals from the day before had again wholly vanished as a consequence of predation and scavenging. In contrast to the nights without frost from 17.03.2010 to 22.03.2010 when the morning temperature has been between 8°C and 12°C, frost has occurred once again in the night from 22.03.2010 to 23.03.2010, and in the morning of 23.03.2010 when the grass in the fields has again been covered by hoar frost, I have not discovered a single fresh individual of the Common Toad *Bufo bufo* on the paved way next to the pond, whereas the following nights have again been without frost, but again not a single fresh individual has been found in the mornings of 24.03.2010 and 25.03.2010.

In the morning of 26.03.2010 after another night without frost, again 2 fresh individuals of the Common Toad *Bufo bufo* have appeared on the paved way next to the pond after an interruption of four days when I have not registered a single fresh individual, thereby suggesting the possible beginning of the second peak of the wandering of the Common Toad *Bufo bufo* on the paved way next to the pond in the night from 25.03.2010 to 26.03.2010 which has been five days before the full moon on 30.03.2010. On the next day in the morning of 27.03.2010, however, I have found only one single fresh individual of the Common Toad *Bufo bufo* on the paved way next to the pond, whereas the 2 individuals from the day before had again wholly vanished as a consequence of predation and scavenging. On the following days in the mornings of 28.03.2010 and 29.03.2010, I have not detected a single fresh individual of the Common Toad *Bufo bufo* on the paved way next to the pond, and in the morning of 30.03.2010, I have observed only one single fresh individual on the paved way next to the pond which has been on the full moon on 30.03.2010. The few scattered individuals of the Common Toad *Bufo bufo* which have occurred on the paved way next to the pond in the mornings of 26.03.2010, 27.03.2010 and 30.03.2010 represent thus only stragglers of the mass wandering which has taken place in the period of 17.03.2010 – 21.03.2010 that has been several days after the new moon on 15.03.2010. No more individuals of the Common Toad *Bufo bufo* have been present on the paved way next to the pond in the mornings of 31.03.2010, 01.04.2010, 02.04.2010, 03.04.2010 and the following days. In the night from 01.04.2010 to 02.04.2010, frost has occurred once again for the first time since the night from 22.03.2010 to 23.03.2010 and the grass in the fields has again been covered by hoar frost in the morning of 02.04.2010, whereas all the other nights have been without frost and the morning temperature has been between 8°C and 12°C. After the morning of the full moon on 30.03.2010, I have only still seen one more single fresh individual of the Common Toad *Bufo bufo* on the paved way next to the pond in the morning of the new moon on 14.04.2010, whereas no individuals at all have shown up between the full moon on 30.03.2010 and the new moon on 14.04.2010. The beginning of the wandering of numerous individuals of the Common Toad *Bufo bufo* after the new moon on 15.03.2010 has also happened at other localities in the vicinity of Heidelberg and Mannheim (Frenzel 2010, Rhein-Neckar-Zeitung 2010d).

8 Relationships of mass growth of mushrooms with the new moon and full moon phases of the lunar cycle

During my entomological observations in fields, meadows and forests within and around Walldorf in 2009, I have also come across some remarkable correlations of phases of mass growth of mushrooms with the turning points of the lunar cycle. My observations have a daily coverage throughout the year, because I make a power walking tour through the fields and the forests Bandholz and Dannhecker Wald around Walldorf in every morning and thus get a good overview on the changes of the vegetation along the ways in the fields and the forest. Mushroom growth has been limited to a few distinct periods in the forests around Walldorf in 2009, and two phases of mass growth of

mushrooms have been particularly striking which include the sudden breakout of large quantities of individuals of the Edible Bolete *Boletus edulis* BULLIARD 1782 (Boletales: Boletaceae) on the new moon on 22.07.2009 as well as the Parasol Mushroom *Macrolepiota procera* (SCOPOLI 1772) (Agaricales: Lepiotaceae) on the full moon on 03.11.2009 and on the new moon on 16.11.2009. Other outstanding correlations are the restriction of the phase of growth of aggregates of numerous individuals of the Honey Fungus *Armillaria mellea* (VAHL 1792) (Agaricales: Marasmiaceae) mainly to the period around the full moon on 04.10.2009, the limitation of the phase of appearance of groups of the Saffron Milk Cap *Lactarius deliciosus* LINNAEUS 1753 (Russulales: Russulaceae) as well as white and brown individuals of the Field Mushroom *Agaricus campestris* LINNAEUS 1753 (Agaricales: Agaricaceae) in several gardens within the cities of Walldorf and Wiesloch predominantly to exclusively to the period around the new moon on 16.11.2009, the concentration of the growth of the Ink Cap *Coprinus comatus* (O.F. MÜLLER 1797) (Agaricales: Coprinaceae) in the meadows south of the shopping centre at the southern margin of the city of Walldorf and near the creek Daisbach between Maisbach and Ochsenbach to the period around the new moon on 16.11.2009, and the binding of the growth of patches and circles of the Saffron Milk Cap *Lactarius deliciosus* in parts of the forest around Walldorf mainly to the period around the full moon on 02.12.2009.

The correlations of phases of mass growth of mushrooms with the turning points of the lunar cycle complement the results of the analysis of the relationships of swarm phases, mass flights and peak occurrences of the Stag Beetle *Lucanus cervus*, other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the new moon and full moon phases of the lunar cycle. Together with the observations of the relationships of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as the correlations of mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species with the new moon and full moon phases of the lunar cycle, the correlations of phases of mass growth of mushrooms with the turning points of the lunar cycle are the base for the selenocyclical evaluation of the short-term population dynamics of the treated diurnal and crepuscular insects as well as mushrooms.

The different types of mushrooms are particularly suitable indicators of the relationships of their growth with the new moon and full moon phases of the lunar cycle because of their almost instantaneous appearance which happens frequently during one night that results in their sudden presence in parts of forests and meadows where nothing has been standing on the day before, and this constellation permits to delineate in detail the triggering of the growth of the different types of mushrooms by the turning phases of the lunar cycle in a similarly precise manner as is possible with the sudden appearance of large quantities of individuals of butterflies, beetles, dragonflies, damselflies and other insects when only a few single individuals or even none have flown on the days before.

8.1 The Edible Bolete *Boletus edulis*

During June and July 2009, I have not discovered a single mushroom along the ways through the forests around Walldorf until the new moon on 22.07.2009 when I have suddenly detected several fresh individuals of the Edible Bolete *Boletus edulis* BULLIARD 1782 (Boletales: Boletaceae). I have then checked immediately the clearing in the forest Bandholz east of the abandoned sand pit in the nature reserve north of the Luther bridge across the creek Hardtbach northnortheast of Walldorf where I have found various individuals of the Edible Bolete *Boletus edulis* during the last years and have encountered a large quantity of fresh individuals of different size which have been arranged in patchy groups and sometimes also in circles on the meadow around several isolated trees as well as in the adjacent forest around different trees, and I have also found numerous fresh individuals of the Edible Bolete *Boletus edulis* in patchy groups at the northern margin of the forest Sternwald south

of Tairnbach as well as along the road B 291 through the forest Schwetzinger Hardt between Walldorf and Oftersheim near the exit to the golf course southeast of Oftersheim on the new moon on 22.07.2009 and during the following days. The sudden mass growth of the Edible Bolete *Boletus edulis* on the new moon on 22.07.2009 and during the following days has been particularly striking due to the fact that not a single individual has shown up before, because I have been looking around for mushrooms according to my experience of growth of various individuals of members of the family Boletaceae from July onwards in earlier years.

The phase of mass growth of the Edible Boletus *Boletus edulis* which has started on the new moon on 22.07.2009 has lasted for abt. one week or ten days with slightly declining frequency and in some places also diminishing size of the individuals, and then again almost suddenly the growth has been terminated, with not a single individual having appeared in the period from August to November 2009. The mass growth of mushrooms on and after the new moon on 22.07.2009 has almost exclusively been restricted to the appearance of monospecific populations of the Edible Bolete *Boletus edulis* which have only occasionally been accompanied by a few single individuals or some limited groups of individuals of other mushrooms including mainly the Fly Agaric *Amanita muscaria* (Agaricales: Amanitaceae), the Chanterelle *Cantharellus cibarius* (Cantharellales: Cantharellaceae) and the Octopus Stinkhorn *Clathrus archeri* (Phallales: Phallaceae), whereas other representatives of the family Boletaceae comprising predominantly the Slippery Jack *Suillus luteus*, the Bay Bolete *Xerocomus badius*, the Red Cracking Bolete *Xerocomus chrysenteron*, the Inkstain Bolete *Boletus pulverulentus* and the Larch Bolete *Suillus grevillei* have been limited to a few single individuals or have even been almost completely missing.

8.2 The Parasol Mushroom *Macrolepiota procera*

After the end of the limited phase of mass growth of the Edible Bolete *Boletus edulis* which has been suddenly initiated on the new moon on 22.07.2009, almost no mushrooms at all have been present in the forests around Walldorf in August and September 2009. In October 2009, I have occasionally discovered a few isolated individuals of the Parasol Mushroom *Macrolepiota procera* (Scopoli 1772) (Agaricales: Lepiotaceae) along the ways through the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf, along the road B 291 through the forest Schwetzinger Hardt between Walldorf and Oftersheim, and along the road L 556 through the forest Untere Lusshardt between Reilingen and Waghäusel-Kirrlach. A few days before the full moon on 03.11.2009, I have observed several fresh individuals of the Parasol Mushroom *Macrolepiota procera* along the road L 556 through the forest Untere Lusshardt between Reilingen and Waghäusel-Kirrlach, whereas no individuals have been present along the ways through the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf as well as along the road B 291 through the forest Schwetzinger Hardt between Walldorf and Oftersheim. On the full moon on 03.11.2009, suddenly numerous fresh individuals of the Parasol Mushroom *Macrolepiota procera* have stood along the ways through the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf, and when I have then immediately checked also the other places, I have also found abundant fresh individuals which have been arranged in patchy groups and sometimes also in circles in the forest Bandholz south of Sandhausen close to the parking place along the road L 598 between Walldorf and Sandhausen as well as along the road L 556 through the forest Untere Lusshardt between Reilingen and Waghäusel-Kirrlach. The mass growth of the Parasol Mushroom *Macrolepiota procera* in the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf as well as along the road L 556 through the forest Untere Lusshardt between Reilingen and Waghäusel-Kirrlach has also continued during the following days after the full moon on 03.11.2009, and some days after the full moon on 03.11.2009, the mass growth has also happened along the road B 291 through the forest Schwetzinger Hardt between Walldorf and Oftersheim.

The phase of mass growth of the Parasol Mushroom *Macrolepiota procera* which has started on the full moon on 03.11.2009 has lasted for abt. one week or ten days with slightly declining frequency and in some places also diminishing size of the individuals, and then again almost suddenly the growth has been terminated, with only a few single or some scattered individuals having still appeared in the second half of November 2009 in most of the aforementioned parts of the forests around Walldorf. The mass growth of mushrooms on and after the full moon on 03.11.2009 has almost exclusively been restricted to the appearance of monospecific populations of the Parasol Mushroom *Macrolepiota procera* which have only occasionally been accompanied by some individuals of other mushrooms including also a few limited groups of individuals of the Ink Cap *Coprinus comatus* (Agaricales: Coprinaceae) that have grown in parts of some fields east of the forest Bandholz north of the creek Hardtbach northeast of Walldorf as well as some rows or patches of individuals of the Clouded Agaric *Lepista nebularis* (Agaricales: Tricholomataceae), the Umber-Brown Puffball *Lycoperdon umbrinum* (Agaricales: Agaricaceae) and the Fly Agaric *Amanita muscaria* which have grown in different places in the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf, whereas at least at the places which I have checked, I have not discovered a single individual of the Edible Bolete *Boletus edulis,* other representatives of the family Boletaceae and the Saffron Milk Cap *Lactarius deliciosus* (Russulales: Russulaceae).

Another phase of mass growth of the Parasol Mushroom *Macrolepiota procera* has happened on the new moon on 16.11.2009 and during the following days in a small young forest plantation south of the parking place in the forest Bandholz south of Sandhausen along the road L 598 between Walldorf and Sandhausen where abundant individuals have suddenly been present in contrast to the occurrence of only a few single or some scattered individuals which have shown up at this locality in the period from the full moon on 03.11.2009 to the new moon on 16.11.2009 when the mass growth has been developed in the aforementioned parts of the forests around Walldorf. On the other hand, only a few single or some scattered individuals of the Parasol Mushroom *Macrolepiota procera* have still appeared in the aforementioned parts of the forests around Walldorf on the new moon on 16.11.2009 and during the following days when the mass growth has been limited to the small young forest plantation south of the parking place in the forest Bandholz south of Sandhausen along the road L 598 between Walldorf and Sandhausen. The mass growth of mushrooms within and around the aforementioned small young forest plantation on and after the new moon on 16.11.2009 has almost exclusively been restricted to the appearance of monospecific populations of the Parasol Mushroom *Macrolepiota procera* which have only occasionally been accompanied by some individuals of other mushrooms including also a few limited rows or patches of individuals of the Clouded Agaric *Lepista nebularis* and the Fly Agaric *Amanita muscaria* which have grown in different places in the forest Bandholz around the small young forest plantation, whereas I have not discovered a single individual of the Edible Bolete *Boletus edulis,* other representatives of the family Boletaceae and the Saffron Milk Cap *Lactarius deliciosus* within and around the aforementioned small young forest plantation. The phase of mass growth of the Parasol Mushroom *Macrolepiota procera* in the aforementioned small young forest plantation which has started on the new moon on 16.11.2009 has lasted for abt. one week or ten days with slightly declining frequency and in some places also diminishing size of the individuals, and then again almost suddenly the growth has been terminated, with only a few single or some scattered individuals having still appeared in the last week of November 2009 and around the full moon on 02.12.2009.

8.3 The Ink Cap *Coprinus comatus*

On the new moon on 16.11.2009 and during the following days, also suddenly abundant individuals of the Ink Cap *Coprinus comatus* (O.F. MÜLLER 1797) (Agaricales: Coprinaceae) have grown in a meadow south of the shopping centre at the southern margin of the city of Walldorf where I have

not observed a single individual in the period from the full moon on 03.11.2009 to the new moon on 16.11.2009 when some groups of individuals have only appeared in a few parts of some fields east of the forest Bandholz north of the creek Hardtbach northeast of Walldorf which have also continued to grow after the new moon on 16.11.2009, but have always been restricted to a few patches of some scattered individuals and have never reached the stage of mass growth. Numerous individuals of the Ink Cap *Coprinus comatus* have also grown in a meadow near the creek Daisbach along the road K 4157 between Maisbach and Ochsenbach eastnortheast of Nußloch on the new moon on 16.11.2009 and during the following days. The mass growth of mushrooms in the meadows south of the shopping centre at the southern margin of the city of Walldorf and near the creek Daisbach between Maisbach and Ochsenbach on and after the new moon on 16.11.2009 has almost exclusively been restricted to the appearance of monospecific populations of the Ink Cap *Coprinus comatus* which have only occasionally been accompanied by some individuals of other mushrooms. The phase of mass growth of the Ink Cap *Coprinus comatus* in the meadow south of the shopping centre at the southern margin of the city of Walldorf which has started on the new moon on 16.11.2009 has lasted for abt. one week or ten days with slightly declining frequency and in some places also diminishing size of the individuals, and then again almost suddenly the growth has been terminated, with only a few single or some scattered individuals having still appeared in the last week of November 2009 and around the full moon on 02.12.2009.

8.4 The Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus*

In the clearing in the forest Bandholz east of the abandoned sand pit in the nature reserve north of the Luther bridge across the creek Hardtbach northnortheast of Walldorf where the mass growth of the Edible Bolete *Boletus edulis* on the new moon on 22.07.2009 and during the following days has taken place when abundant individuals of the Edible Bolete *Boletus edulis* have stood in various patchy groups and circles on the meadow around several isolated trees and have been accompanied by only a few single or some scattered individuals of the Fly Agaric *Amanita muscaria* LINNAEUS 1753 (Agaricales: Amanitaceae) and the Slippery Jack *Suillus luteus* (LINNAEUS 1753) (Boletales: Boletaceae), the constellation has been reversed on the new moon on 16.11.2009 and during the following days when a sudden mass growth of the Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus* has happened there, with abundant individuals of the Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus* having been arranged in numerous patchy groups and circles on the meadow between and around several isolated trees in separate distribution from each other, whereas individuals of the Edible Bolete *Boletus edulis* have now been completely lacking in Walldorf as well as in Tairnbach.

Before the sudden mass growth of the Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus* on the meadow in the clearing in the forest Bandholz east of the abandoned sand pit in the nature reserve north of the Luther bridge across the creek Hardtbach northnortheast of Walldorf on the new moon on 16.11.2009 and during the following days, not a single individual has been discovered there since the termination of the mass growth of the Edible Bolete *Boletus edulis* after the new moon on 22.07.2009. The mass growth of mushrooms on the meadow in the aforementioned clearing on and after the new moon on 16.11.2009 has almost exclusively been restricted to the appearance of separate monospecific populations of the Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus* which have only occasionally been accompanied by some individuals of other mushrooms. The mass growth of the Fly Agaric *Amanita muscaria* and the Slippery Jack *Suillus luteus* on the meadow in the aforementioned clearing on the new moon on 16.11.2009 and during the following days has lasted for abt. one week and has then faded out around the increasing half moon on 24.11.2009, with no more individuals of both types of mushrooms having been present several days before the full moon on 02.12.2009.

8.5 The Saffron Milk Cap *Lactarius deliciosus* and the Field Mushroom *Agaricus campestris*

The Clouded Agaric *Lepista nebularis* has also grown in numerous patchy groups of scattered individuals as well as in rows and circles in various parts of the forests Bandholz and Dannhecker Wald north and northnortheast of Walldorf on the new moon on 16.11.2009 and during the following days, and at the same time, patchy groups or circles of individuals of the Saffron Milk Cap *Lactarius deliciosus* LINNAEUS 1753 (Russulales: Russulaceae) have suddenly appeared on the lawn in a garden near the western margin of the city of Walldorf where they have also already shown up during the last years, whereas in a garden near the forest at the western margin of the city of Wiesloch where patchy groups, rows and circles of the Saffron Milk Cap *Lactarius deliciosus* have grown during the last years, now several patchy groups, rows and circles of brown individuals of the Field Mushroom *Agaricus campestris* LINNAEUS 1753 (Agaricales: Agaricaceae) have grown around and between isolated trees which have not been present there during the last years. The brown individuals of the Field Mushroom *Agaricus campestris* have grown in several assemblages on the new moon on 16.11.2009 and during the following days, whereas only a few single individuals have still appeared around the full moon on 02.12.2009.

In other gardens within the western and southern parts of the city of Walldorf, also patchy groups, rows and circles of white individuals of the Field Mushroom *Agaricus campestris* or the Toadstool *Agaricus xanthodermus* GENEVIER 1876 (Agaricales: Agaricaceae) have suddenly grown on the new moon on 16.11.2009 and during the following days, whereas neither white nor brown individuals of the Field Mushroom *Agaricus campestris* have shown up in the forest close to the fish pond west of Bruchwiese near the railway northeast of Walldorf where plenty of them have been present in earlier years. In addition to the Saffron Milk Cap *Lactarius deliciosus,* also patchy groups, rows and circles of other Milk Caps including mainly the Milk Cap *Lactarius fluens* BOUDIER 1899 (Russulales: Russulaceae) and the Woolly Milk Cap *Lactarius torminosus* (SCHÄFFER 1774) (Russulales: Russulaceae) have suddenly grown on the lawns in various gardens within the northern, western and southern parts of the city of Walldorf on the new moon on 16.11.2009 and during the following days, whereas I have not discovered any single individual of the Saffron Milk Cap *Lactarius deliciosus* and other Milk Caps at any place within and around Walldorf before the new moon on 16.11.2009.

Particularly within and around the meadow in the clearing in the forest Bandholz east of the abandoned sand pit in the nature reserve north of the Luther bridge across the creek Hardtbach northnortheast of Walldorf where various individuals of the Saffron Milk Cap *Lactarius deliciosus* have grown during the last years, not a single individual has shown up in autumn 2009 before the new moon on 16.11.2009 and even not on the new moon on 16.11.2009 and during the following days when patchy groups, rows and circles of individuals of the Saffron Milk Cap *Lactarius deliciosus* have suddenly appeared on the lawn in a garden near the western margin of the city of Walldorf, but a few single individuals have only grown in the aforementioned clearing and also in a garden near the forest at the western margin of the city of Wiesloch in the period from quite some days after the new moon on 16.11.2009 to around the full moon on 02.12.2009. Finally a whole circle of large fresh individuals of the Saffron Milk Cap *Lactarius deliciosus* has grown around an isolated tree on the meadow near the margin of the forest in the aforementioned clearing several days after the full moon on 02.12.2009, with such a nice assemblage of individuals not having appeared earlier at any place within and around Walldorf, and in the days after the emergence of the complete circle, only a few isolated individuals have still grown. The last single individuals of the Saffron Milk Cap *Lactarius deliciosus* have appeared on the meadow near the margin of the forest in the aforementioned clearing a few days before and on the decreasing half moon on 09.12.2009, whereas no more indivi-

duals have shown up several days before the new moon on 16.12.2009. The growth of mushrooms in the aforementioned clearing around the full moon on 02.12.2009 has almost exclusively been restricted to single individuals, patches and circles of the Saffron Milk Cap *Lactarius deliciosus* which have only occasionally been accompanied by some individuals of other mushrooms.

Similarly, the Gem-Studded Puffball *Lycoperdon perlatum* and the Umber-Brown Puffball *Lycoperdon umbrinum* which are also common mushrooms in the forests around Walldorf and have occurred in various patchy groups, rows and circles at different places during the last years have only appeared as a few scattered individuals at some places around the full moon on 03.11.2009 and have otherwise been almost totally lacking in 2009.

8.6 The Honey Fungus *Armillaria mellea*

Another common mushroom in the forests around Walldorf is the Honey Fungus *Armillaria mellea* (VAHL 1792) (Agaricales: Marasmiaceae) which grows in groups of dozens or hundreds of individuals on rotten tree stumps in the period from September to November. During my entomological observations in fields, meadows and forests within and around Walldorf in 2009, I have also paid attention to the appearance of the typical assemblages of numerous individuals of the Honey Fungus *Armillaria mellea* on rotten tree stumps which have indicated the beginning of the automnal mushroom season in many earlier years. The characteristical aggregates of abundant individuals of the Honey Fungus *Armillaria mellea* have suddenly appeared on various rotten tree stumps at the margins of the forests around Nußloch and Walldorf as well as along the road through the forest Schwetzinger Hardt between Walldorf and Oftersheim around the full moon on 04.10.2009, whereas I have not discovered clusters of individuals on rotten tree stumps before. The phase of mass growth of the Honey Fungus *Armillaria mellea* which has started around the full moon on 04.10.2009 has lasted for abt. one week or ten days, and then again almost suddenly the growth has been terminated, with no more groups of individuals having emerged from rotten tree stumps in the second half of October 2009 and in the first half of November 2009. After the end of the phase of mass growth of the Honey Fungus *Armillaria mellea* after the full moon on 04.10.2009, the aggregates of mushrooms on rotten tree stumps have almost exclusively consisted of numerous individuals of the Sulphur Tuft *Hypholoma fasciculare* (HUDSON 1778) (Agaricales: Strophariaceae), and on some rotten tree stumps, occasionally also colonies of the Cauliflower Mushroom *Sparassis crispa* (WULFEN in JACQUIN 1781) (Polyporales: Sparassidaceae) have been developed. Some aggregates of numerous individuals of the Honey Fungus *Armillaria mellea* have only again grown on a few rotten tree stumps on the new moon on 16.11.2009 and during the following days as well as on the full moon on 02.12.2009 and during the following days, whereas most of the rotten tree stumps have been occupied by assemblages of the Sulphur Tuft *Hypholoma fasciculare* in changing frequency and distribution from the full moon on 04.10.2009 via the new moon on 16.11.2009 to the full moon on 02.12.2009.

9 Selenocyclical interpretation of short-term population dynamics

The correlations of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* as well as mass flights and peak occurrences of other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the turning points of the lunar cycle are discussed as follows. The selenocyclical evaluation of the short-term population dynamics of the Stag Beetle *Lucanus cervus* as well as other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects constituting a broad spectrum of in total more than 500 species focusses particularly on the influence of the new moon and the full moon on the swarm behaviour and the peak

abundance of the observed diurnal and crepuscular insects. Some correlations of peak occurrences of toads and mass growth of mushrooms with the turning points of the lunar cycle are also evaluated. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

Influences of moonlight and lunar periodicity on the population dynamics of crepuscular and nocturnal insects have been investigated among others by HORA (1929), WILLIAMS (1936), VANDERPLANK (1941), RIBBANDS (1946), WILLIAMS & SINGH (1951), HARTLAND-ROWE (1955, 1958); WILLIAMS, SINGH & EL ZIADY (1956); EL-ZIADY (1957), FRYER (1959), PROVOST (1959), EL-ZIADY & OSMAN (1961), BIDLINGMAYER (1964), BOWDEN (1964, 1973a, 1973b, 1984), CLEVE (1967), HANNA & ATRIES (1969), NEMEC (1971); AGEE, WEBB & TAFT (1972); BOWDEN & CHURCH (1973), BOWDEN & MORRIS (1975), BROWN & TAYLOR (1971), HANNA & HAMAD (1975), VAISHAMPAYAN & SHRIVASTAVA (1978); NOWINSZKY, SZABÓ, TÓTH, EKK & KISS (1979); VAISHAMPAYAN & VERMA (1982) and NAG & NATH (1991). Effects of the new moon and full moon phases of the lunar cycle on the population dynamics of diurnal insects have so far not been discussed in the literature.

9.1 The Stag Beetle *Lucanus cervus*

The analysis of the short-term population dynamics of the Stag Beetle *Lucanus cervus* by the evaluation of the distribution of its peak activity during the period of appearance in the current year has revealed that the culmination of its occurrence takes place mainly on abt. 1 – 7 days when a pronounced swarming is established in the crepuscular period in the evening when predominantly abt. 10 – 20 or even abt. 20 – 30 individuals and subordinately abt. 5 – 10 individuals per day are flying and walking around, whereas before and after these swarm evenings, predominantly only abt. 1 – 2 or abt. 3 – 5 individuals and subordinately only abt. 5 – 10 individuals per day are walking and flying around during the period of appearance in the current year. The peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, thus suggesting that the breakout of the culmination of its activity and the development of extraordinary swarm evenings are frequently triggered by the turning points of the lunar cycle. Various examples of the correlation of swarm phases and peak activity of the Stag Beetle *Lucanus cervus* with the new moon and the full moon phases of the lunar cycle are compiled as follows.

The correlation of the peak activity of the Stag Beetle *Lucanus cervus* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed in Tairnbach southsoutheast of Heidelberg in the southwestern part of Germany around the new moon on 03.06.2008 (MADER 2009a) and 24.05.2009, in Schriesheim north of Heidelberg (ELISABETH LÖFFLER, person. commun. 2008; MARIANNE KRIEG and MANFRED GLASER, person. commun. 2008) around the new moon on 03.07.2008, in Bürstadt-Riedrode northnorthwest of Heidelberg (SCHADER 2004) around the new moon on 17.07.2004; in Colchester in Essex eastnortheast of London in the southeastern part of England around the new moon on 16.06.1996 (BOWDREY 1997), 06.06.2005 and 15.06.2007 (FREMLIN 2009, FREMLIN & FREMLIN 2010); in Münchenstein south of Basel in the northwestern part of Switzerland (SPRECHER-UEBERSAX & DURRER 1998, SPRECHER-UEBERSAX 2001) around the new moon on 20.06.1993, 16.06.1996, 05.06.1997, 24.06.1998 and 13.06.1999; in Heiligenhaus-Isenbügel northeast of Düsseldorf in the northwestern part of Germany (HILPÜSCH 2004) around the new moon on 17.07.2004, in Bonn in the northwestern part of Germany (FRINGS 1897) around the new moon on 24.06.1892, in Rückersbach northwest of Aschaffenburg in the central

part of Germany (SINGER 1955) around the new moon on 26.05.1922 and 10.06.1926, around the airport southwest of Frankfurt am Main in the western part of Germany (KARNER 1994) around the new moon on 21.05.1993, around Heilbronn in the southwestern part of Germany (WANNER 1954) around the new moon on 11.06.1953, in Holbeck southsoutheast of Berlin in the northeastern part of Germany (INGO RICHTER in FRANZKE 2003) around the new moon on 31.05.2003, in the vicinity of Minerve northnorthwest of Narbonne in the Languedoc in the southeastern part of France (CARRIÈRE 1989) around the new moon on 14.06.1988, in Cabanac-et-Villagrains southsouthwest of Talence in the southwestern part of France (GUYE 1996) around the new moon on 27.06.1995, in Geul east of Maastricht in the southeastern part of the Netherlands (WILMINK 1950) around the new moon on 26.06.1949, around Windsor Forest south of Slough west of London in the southeastern part of England (DONISTHORPE 1935) around the new moon on 30.06.1935, in Slough west of London in the southeastern part of England (SMITH 1959) around the new moon on 06.06.1959, in London in the southeastern part of England (JONES 2001) around the new moon on 13.06.1999, and near Meinier northeast of Geneva in the southwestern part of Switzerland (WÜEST 1993) around the new moon on 01.06.1992 or around the full moon on 04.07.1993.

The correlation of the peak activity of the Stag Beetle *Lucanus cervus* with the full moon at the middle or central point of the lunar cycle has been observed in Tairnbach southsoutheast of Heidelberg in the southwestern part of Germany around the full moon on 07.06.2009, in Schriesheim north of Heidelberg (PETER FINDEISEN, person. commun. 2008) around the full moon on 18.06.2008; in Colchester in Essex eastnortheast of London in the southeastern part of England (FREMLIN 2009, FREMLIN & FREMLIN 2010) around the full moon on 23.05.2005, 22.06.2005, 11.06.2006 and 01.06.2007; in Münchenstein south of Basel in the northwestern part of Switzerland (SPRECHER-UEBERSAX & DURRER 1998, SPRECHER-UEBERSAX 2001) around the full moon on 27.06.1991, 15.06.1992, 10.06.1998 and 17.06.2000; in Prague in the northwestern part of Czechia (HAABER in CORNELIUS 1868) around the full moon on 11.07.1862, in Sondershausen northnorthwest of Erfurt in the northeastern part of Germany (CHOP 1863) around the full moon on 01.07.1863, around Kassel in the northwestern part of Germany (OCHSE 1993) around the full moon on 15.06.1992, around the airport southwest of Frankfurt am Main in the central part of Germany (RIPPEGATHER 2004) around the full moon on 03.06.2004, in Karlsruhe-Rüppurr southsouthwest of Heidelberg in the southwestern part of Germany (SCHWERDTFEGER 1983, BRECHTEL & KOSTENBADER 2002) around the full moon on 25.06.1983, in Karlsruhe-Fasanerie southsouthwest of Heidelberg in the southwestern part of Germany (GAUSS 1963) around the full moon on 23.06.1956, near Metzingen southsoutheast of Stuttgart in the southwestern part of Germany (KAMP 1958) around the full moon on 05.08.1952, in the surroundings of Paris in the northwestern part of France (DUTREIX 1974) around the full moon on 15.06.1973, in Watermaal-Bosvoorde in the southeastern part of Bruxelles in the central part of Belgium (ARNO THOMAES, person. commun. 2009) around the full moon on 14.06.2003, in Leatherhead south of London in the southeastern part of England (BIZELY 1984) around the full moon on 28.06.1980 and 13.06.1984, in Maidenhead west of Slough west of London in the southeastern part of England (VERDCOURT 1990) around the full moon on 19.06.1989, in Worthing south of London in the southeastern part of England (LANGTON 1967) around the full moon on 18.06.1962, in Holbrook northeast of Birmingham in the southeastern part of England (HAWES 2000) around the full moon on 17.06.2000, near Ponto Valentino/Val Blenio north of Bellinzona in the southeastern part of Switzerland (ALLENSPACH 1970) around the full moon on 01.07.1958, and near Meinier northeast of Geneva in the southwestern part of Switzerland (WÜEST 1993) around the full moon on 04.07.1993 or around the new moon on 01.06.1992.

The distribution of the peak activity of the Stag Beetle *Lucanus cervus* between the new moon and the full moon or vice versa in the first half or in the second half of the lunar cycle has been observed in Colchester in Essex eastnortheast of London in the southeastern part of England (FREMLIN 2005, 2009; FREMLIN & FREMLIN 2010; MARIA FREMLIN, person. commun. 2009) around the increasing half

moon on 07.06.2003 between the new moon on 31.05.2003 and the full moon on 14.06.2003, around the increasing half moon on 15.06.2005 between the new moon on 06.06.2005 and the full moon on 22.06.2005, around the decreasing half moon on 18.06.2006 between the full moon on 11.06.2006 and the new moon on 25.06.2006, around the increasing half moon on 23.05.2007 between the new moon on 16.05.2007 and the full moon on 01.06.2007, around the decreasing half moon on 08.06.2007 between the full moon on 01.06.2007 and the new moon on 15.06.2007, around the increasing half moon on 10.06.2008 between the new moon on 03.06.2008 and the full moon on 18.06.2008; around the increasing half moon on 31.05.2009 between the new moon on 24.05.2009 and the full moon on 07.06.2009, and around the decreasing half moon on 15.06.2009 between the full moon on 07.06.2009 and the new moon on 22.06.2009; in Münchenstein south of Basel in the northwestern part of Switzerland (SPRECHER-UEBERSAX & DURRER 1998, SPRECHER-UEBERSAX 2001) around the increasing half moon on 16.06.1994 between the new moon on 09.06.1994 and the full moon on 23.06.1994, around the decreasing half moon on 20.06.1995 between the full moon on 13.06.1995 and the new moon on 28.06.1995, around the decreasing half moon on 09.06.1996 between the full moon on 01.06.1996 and the new moon on 16.06.1996, and around the increasing half moon on 13.06.1997 between the new moon on 05.06.1997 and the full moon on 20.06.1997; in Heiligenhaus-Isenbügel northeast of Düsseldorf in the northwestern part of Germany (HILPÜSCH 2004) around the increasing half moon on 25.06.2004 between the new moon on 17.06.2004 and the full moon on 02.07.2004, around the decreasing half moon on 09.07.2004 between the full moon on 02.07.2004 and the new moon on 17.07.2004, and around the increasing half moon on 25.07.2004 between the new moon on 17.07.2004 and the full moon on 31.07.2004; in Karlsruhe-Rüppurr southsouthwest of Heidelberg in the southwestern part of Germany (VOLKER KLOCK in NÜCKEL 1999, VOLKER KLOCK in BRECHTEL & KOSTENBADER 2002) around and between the full moon on 30.04.1999 and the new moon on 15.05.1999, in Karlsruhe-Fasanerie southsouthwest of Heidelberg in the southwestern part of Germany (GAUSS 1963) around the increasing half moon on 16.06.1956 between the new moon on 08.06.1956 and the full moon on 23.06.1956, in Bonn in the western part of Germany (FRINGS 1897) around the increasing half moon on 14.06.1891 between the new moon on 06.06.1891 and the full moon on 22.06.1891, in Wuppertal-Elberfeld in the northwestern part of Germany (CORNELIUS 1867) around and between the full moon on 17.06.1867 and the new moon on 01.07.1867, in Oberweimar south of Marburg in the central part of Germany (ZUCCHI & ZUCCHI 1982) around and between the full moon on 06.06.1982 and the new moon on 21.06.1982, at the airport southwest of Frankfurt am Main in the western part of Germany (FRANKFURTER ALLGEMEINE ZEITUNG 1959) around the decreasing half moon on 30.05.1959 between the full moon on 22.05.1959 and the new moon on 06.06.1959, in Berlin in the northeastern part of Germany (FRITZ PURDEL in SCHMITT 1928) around the decreasing half moon on 04.06.1926 between the full moon on 27.05.1926 and the new moon on 10.06.1926, in Kiev in the northwestern part of the Ukraina (MAMONOV 1991) around and between the new moon on 20.06.1974 and the full moon on 04.07.1974 as well as around and between the full moon on 12.06.1976 and the new moon on 27.06.1976, in the surroundings of Paris in the northwestern part of France (BEVIERRE 1984) around and between the full moon on 25.06.1983 and the new moon on 10.07.1983, in Watermaal-Bosvoorde in the southeastern part of Bruxelles in the central part of Belgium (ARNO THOMAES, person. commun. 2009) around the decreasing half moon on 21.06.2003 between the full moon on 14.06.2003 and the new moon on 29.06.2003, and in Bromsberrow southwest of Birmingham in the southwestern part of England (H. BRITTEN in HALL 1969) around and between the new moon on 25.07.1968 and the full moon on 08.08.1968. A suite of examples of the correlation of the peak activity of various beetles, butterflies and other insects with the new moon or the full moon is also compiled in MADER (2009a).

The triggering of the peak activity of the Stag Beetle *Lucanus cervus* with establishment of extraordinary swarm evenings by the new moon could be caused by the appearance of the thin crescent of the freshly increasing moon on the sky in the crepuscular period in the evening in the first days after

the new moon at the beginning of the new lunar cycle which terminates a period of abt. 8 – 10 days when the moon has no longer been present on the evening sky before the onset of the night after the full moon of the preceding lunar cycle. The stimulation of the peak activity of the Stag Beetle *Lucanus cervus* with happening of outstanding swarm evenings by the full moon could be caused by the illumination of the evening sky by the nearly complete disk of the almost full moon in the days before and after the full moon around the middle or central point of the lunar cycle when the moon is rising above the horizon just in the crepuscular period in the evening, whereas a few days after the full moon, it rises above the horizon not before the onset of the night and a few days earlier, it has already risen considerably above the horizon before the beginning of the crepuscular period in the evening.

The turning points of the lunar cycle are often also significant breaks in weather character with frequently rapid changes from dry and warm to wet and cool periods or vice versa, and therefore particularly the changes from wet and cool periods to dry and warm periods on the new moon or the full moon could be the reasons for the breakout of the peak activity of the Stag Beetle *Lucanus cervus* with development of pronounced swarm evenings. The aforementioned mechanisms apply probably in a similar manner as for the Stag Beetle *Lucanus cervus* also for other crepuscular beetles such as the Rhinoceros Beetle *Oryctes nasicornis* which has also been reported to occur at various localities in the region around Heidelberg and Mannheim, and from which also spectacular swarm evenings with the flight of numerous individuals have been registered by several observers (MADER 2009a).

In many cases, only one peak of activity of the Stag Beetle *Lucanus cervus* has been developed per flight season during the investigated periods of appearance in the studied years, whereas in other years, also two distinct peaks of activity of abt. 1 – 7 days duration per flight season have been established which have been separated by phases of reduced or normal activity of abt. 4 – 12 days duration. The generalization of the interpretation of the development of an unimodal or bimodal distribution of the frequency of individuals of the Stag Beetle *Lucanus cervus* during the flight season is only possible in a speculative manner on the basis of the existing data. It could be suspected that the establishment of unipolar or bipolar culminations of the activity of the Stag Beetle *Lucanus cervus* during the flight season is probably the consequence of continuous or staggered emergence of males and females depending on the extension of periods of dry and warm weather and their interruption and termination by phases of wet and cool weather.

9.2 The Cockchafer *Melolontha*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Cockchafer *Melolontha* is frequently related with the new moon or the full moon.

The correlation of the peak activity of the Cockchafer *Melolontha* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed for the Forest Cockchafer *Melolontha hippocastani* in Sankt Leon around the new moon on 05.05.2008, and the Field Cockchafer *Melolontha melolontha* in Tairnbach around the new moon on 25.04.2009. The swarming of the Forest Cockchafer *Melolontha hippocastani* in Sankt Leon around the new moon on 05.05.2008 has happened at the beginning of the first period of summerly warm and sunny weather from 02.05.2008 to 14.05.2008 which has started after the end of the transition phase from winter to spring before the new moon on 05.05.2008 and has ended before the full moon on 20.05.2008, and represents therefore a significant example of the stimulation of the breakout of the peak numbers of individuals of beetles by considerable changes in weather character

around the turning points of the lunar cycle.

The correlation of excessive swarm phases of the Field Cockchafer *Melolontha melolontha* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported among others from Mundraching, Stadel, Issing and Thaining south of Landsberg am Lech in the southeastern part of Germany (EITSCHBERGER 1970c) around the new moon on 29.05.1938; from Prittriching and Winkl north of Landsberg am Lech (EITSCHBERGER 1970c) around the new moon on 26.04.1960, from Burghausen in the Salzach valley in the southeastern part of Germany (R. KRATZER in MEISSNER 1938) around the new moon on 05.05.1932, from Halle in the Saale valley in the northeastern part of Germany (FRANZ BANDERMANN in MEISSNER 1938) around the new moon on 10.05.1937, and from Frankfurt am Main in the central part of Germany (A. HEPP in MEISSNER 1938) around the new moon on 10.05.1937. The correlation of excessive swarm phases of the Forest Cockchafer *Melolontha hippocastani* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported among others from Burghausen in the Salzach valley in the southeastern part of Germany (R. KRATZER in MEISSNER 1938) around the new moon on 05.05.1932.

The correlation of the peak activity of the Cockchafer *Melolontha* with the full moon at the middle or central point of the lunar cycle has been observed for the Field Cockchafer *Melolontha melolontha* in Tairnbach around the full moon on 02.05.2007 and 28.04.2010. A pronounced swarming of the Field Cockchafer *Melolontha melolontha* in Kruibeke southwest of Antwerpen in the northwestern part of Belgium (ARNO THOMAES, person. commun. 2009) has taken place around the full moon on 09.05.2009.

The correlation of excessive swarm phases of the Field Cockchafer *Melolontha melolontha* with the full moon at the middle or central point of the lunar cycle has been reported among others from Winkl, Pestenacker, Wabern, Walleshausen, Prittriching, Scheuring und Beuerbach north of Landsberg am Lech in the southeastern part of Germany (EITSCHBERGER 1970c) around the full moon on 06.05.1936; from Heilbronn in the Neckar valley in the southwestern part of Germany (LEYDIG 1902) around the full moon on 10.05.1884, from Talmontiers at the road between Gournay-en-Bray and Gisors northnorthwest of Paris in the northwestern part of France (LEFEBVRE 1832, LEFEBVRE in HAGEN 1861, KEFERSTEIN 1863) around the full moon on 14.05.1832, and from Le Havre northwest of Paris in the northwestern part of France (POORTMANN 1862, KEFERSTEIN 1863) around the full moon on 11.07.1862.

The distribution of excessive swarm phases of the Field Cockchafer *Melolontha melolontha* between the new moon and the full moon or vice versa in the first half or in the second half of the lunar cycle has been reported among others from Plattling southsouthwest of Deggendorf in the Danube valley in the southeastern part of Germany (MEISSNER 1938) around and between the new moon on 10.05.1937 and the full moon on 25.05.1937, from Bad Nauheim north of Frankfurt am Main in the central part of Germany (A. HEPP in MEISSNER 1938) around and between the full moon on 25.05.1937 and the new moon on 08.06.1937, and from Bergheim west of Cologne in the northwestern part of Germany (STOLLWERCK 1846) around the new moon on 06.05.1845. The distribution of excessive swarm phases of the Forest Cockchafer *Melolontha hippocastani* between the new moon and the full moon or vice versa in the first half or in the second half of the lunar cycle has been reported among others from Kaufering and Lagerlechfeld north of Landsberg am Lech (EITSCHBERGER 1970c) around and between the new moon on 27.04.1968 and the full moon on 12.05.1968.

The reasons for the triggering of the peak activity of the Cockchafer *Melolontha*, the Summer Chafer *Amphimallon solstitiale*, and the Tanner Sawyer Beetle *Prionus coriarius* which belong together

with the Stag Beetle *Lucanus cervus* to the group of crepuscular beetles that culminate in activity during the limited period between the sunset and the beginning of the night are probably the same as applying for the Stag Beetle *Lucanus cervus* which is stimulated by the appearance of the thin crescent of the freshly increasing moon in the first days after the new moon and the nearly complete disk of the almost full moon in the days before and after the full moon above the horizon on the evening sky just between the sunset and the beginning of the night. The triggering of the peak activity of all the mentioned other beetles is similarly as applying for the Stag Beetle *Lucanus cervus* also controlled by significant breaks in weather character which are frequently related to the turning points of the lunar cycle when in many cases dry and warm periods are replaced by wet and cool periods or vice versa, and similarly as applying for the Stag Beetle *Lucanus cervus*, especially the changes from wet and cool periods to dry and warm periods on the new moon or the full moon could be the factors provoking the onset of the peak activity of all the mentioned other beetles as well as of the various diurnal and nocturnal butterflies that are discussed as follows.

9.3 The Summer Chafer *Amphimallon solstitiale*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Summer Chafer *Amphimallon solstitiale* is repeatedly related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Summer Chafer *Amphimallon solstitiale* with the full moon at the middle or central point of the lunar cycle has been observed in Tairnbach around the full moon on 07.07.2009.

A spectacular swarming of the Summer Chafer *Amphimallon solstitiale* in Vivoin north of Le Mans westsouthwest of Paris in the northwestern part of France (ARNO THOMAES, person. commun. 2009) and an accentuated swarming of the dune chafer *Anomala dubia* in Fontainebleau south of Paris in the northwestern part of France (ARNO THOMAES, person. commun. 2009) have happened around the new moon on 25.06.2006.

9.4 The Golden Rose Chafer *Cetonia aurata*, the Forest Dung Beetle *Geotrupes stercorosus* and the Tanner Sawyer Beetle *Prionus coriarius*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of other beetles is frequently related with the new moon or the full moon.

Among other beetles, the correlation of the appearance of the peak numbers of individuals with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed for the Golden Rose Chafer *Cetonia aurata* in Nußloch around the new moon on 05.05.2008 and 25.04.2009, and the Forest Dung Beetle *Geotrupes stercorosus* in Walldorf around the new moon on 24.05.2009. The swarming of the Golden Rose Chafer *Cetonia aurata* in Nußloch around the new moon on 05.05.2008 has happened at the beginning of the first period of summerly warm and sunny weather from 02.05.2008 to 14.05.2008 which has started after the end of the transition phase from winter to spring before the new moon on 05.05.2008 and has ended before the full moon on 20.05.2008, and represents therefore a significant example of the stimulation of the breakout of the peak numbers of individuals of beetles by considerable changes in weather charac-

ter around the turning points of the lunar cycle.

Among other beetles, the correlation of the appearance of the peak numbers of individuals with the full moon at the middle or central point of the lunar cycle has been observed for the Tanner Sawyer Beetle *Prionus coriarius* in Tairnbach around the full moon on 18.07.2008, the Golden Rose Chafer *Cetonia aurata* in Walldorf around the full moon on 28.04.2010, and probably also the Rhinoceros Beetle *Oryctes nasicornis* in Adelsheim (HANSJÖRG GÖTZ, person. commun. 2008) around the full moon on 01.06.2007.

The reasons for the triggering of the peak activity of the Cockchafer *Melolontha*, the Summer Chafer *Amphimallon solstitiale*, and the Tanner Sawyer Beetle *Prionus coriarius* which belong together with the Stag Beetle *Lucanus cervus* to the group of crepuscular beetles that culminate in activity during the limited period between the sunset and the beginning of the night are probably the same as applying for the Stag Beetle *Lucanus cervus* which is stimulated by the appearance of the thin crescent of the freshly increasing moon in the first days after the new moon and the nearly complete disk of the almost full moon in the days before and after the full moon above the horizon on the evening sky just between the sunset and the beginning of the night. The triggering of the peak activity of all the mentioned other beetles is similarly as applying for the Stag Beetle *Lucanus cervus* also controlled by significant breaks in weather character which are frequently related to the turning points of the lunar cycle when in many cases dry and warm periods are replaced by wet and cool periods or vice versa, and similarly as applying for the Stag Beetle *Lucanus cervus*, especially the changes from wet and cool periods to dry and warm periods on the new moon or the full moon could be the factors provoking the onset of the peak activity of all the mentioned other beetles as well as of the various diurnal and nocturnal butterflies that are discussed as follows.

9.5 The Golden Ground Beetle *Carabus auratus*

The correlation of the appearance of the peak numbers of individuals of the Golden Ground Beetle *Carabus auratus* with the full moon at the middle or central point of the lunar cycle has been observed in Walldorf around the full moon on 28.04.2010.

A mass occurrence of large quantities of individuals of the Golden Ground Beetle *Carabus auratus* along the road between Falkenrehde and Grube northnorthwest of Potsdam in the northeastern part of Germany (AUEL 1930) has taken place around the new moon on 28.05.1930.

9.6 The Seven-Spot Ladybird *Coccinella septempunctata*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of other beetles is frequently related with the new moon or the full moon, as is outlined for the example of the Seven-Spot Ladybird *Coccinella septempunctata* as follows.

The correlation of the appearance of the peak numbers of individuals of the Seven-Spot Ladybird *Coccinella septempunctata* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the island Sylt at the coast of the North Sea westnorthwest of Flensburg in the northwestern part of Germany (MEINEKE 1976) around the new moon on 07.08.1975, from Sankt Peter-Ording southwest of Husum at the coast of the North Sea in the northwestern part of Germany (HARZ 1967b) around the new moon on 06.08.1967, from the island Pagensand in the Elbe river westnorthwest of Hamburg close to its mouth into the North

Sea in the northwestern part of Germany (ALLMER 2000) around the new moon on 03.08.1997, from Lubmin eastnortheast of Greifswald as well as from Greifswald at the coast of the Baltic Sea in the northeastern part of Germany (EITSCHBERGER 2005) around the new moon on 05.08.2005, and from Warnemünde north of Rostock at the coast of the Baltic Sea in the northeastern part of Germany (RATHKE 2009) around the new moon on 22.07.2009.

The correlation of the appearance of the peak numbers of individuals of the Seven-Spot Ladybird *Coccinella septempunctata* with the full moon at the middle or central point of the lunar cycle has been reported from Kiel at the coast of the Baltic Sea in the northwestern part of Germany and from Kalundborg west of Copenhagen in the eastern part of Denmark (PAUKSTADT 1989) around the full moon on 18.07.1989, from the Darß between Ahrenshoop and Darßer Ort north of Ribnitz-Damgarten at the coast of the Baltic Sea (SPITTLER 1963) and from the city of Schwerin (KLAUS GRASER in SPITTLER 1963) in the northeastern part of Germany around the full moon on 27.07.1961, from the Darß between Drei Eichen and the lighthouse north of Ribnitz-Damgarten at the coast of the Baltic Sea in the northeastern part of Germany (KLAUSNITZER 1992, KLAUSNITZER & KLAUSNITZER 1997) around the full moon on 14.07.1992, and from the Randecker Maar south of Weilheim an der Teck southeast of Stuttgart in the southwestern part of Germany (GATTER & GATTER 1973) around the new moon on 09.08.1972.

The correlation of the appearance of the peak numbers of individuals of the Seven-Spot Ladybird *Coccinella septempunctata* with the decreasing half moon in the fourth quarter of the lunar cycle has been reported from the island Borkum northnorthwest of Emden at the coast of the North Sea in the northwestern part of Germany (PAUKSTADT 1989) around the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, from Colwyn Bay west of Liverpool at the coast of the Irish Sea in the northern part of Wales (K. KÜRSCHNER in EITSCHBERGER & STEINIGER 1977b) around the decreasing half moon on 19.07.1976 between the full moon on 11.07.1976 and the new moon on 27.07.1976, from the Darß between Drei Eichen and the lighthouse north of Ribnitz-Damgarten at the coast of the Baltic Sea in the northeastern part of Germany (KLAUSNITZER 1989, KLAUSNITZER & KLAUSNITZER 1997) around the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989, and from the Fischland between Wustrow and Dierhagen northwest of Ribnitz-Damgarten (G. MORITZ in KLAUSNITZER 1989) and from Rerik west of Rostock (HÜSING 1990) at the coast of the Baltic Sea in the northeastern part of Germany around the decreasing half moon on 26.07.1989 between the full moon on 18.07.1989 and the new moon on 01.08.1989.

The correlation of the appearance of the peak numbers of individuals of the Seven-Spot Ladybird *Coccinella septempunctata* with the increasing half moon in the first quarter of the lunar cycle has been reported from the Darß between Drei Eichen and the lighthouse north of Ribnitz-Damgarten at the coast of the Baltic Sea in the northeastern part of Germany (KLAUSNITZER 1989, KLAUSNITZER & KLAUSNITZER 1997) around the increasing half moon on 12.07.1989 between the new moon on 03.07.1989 and the full moon on 18.07.1989, and from the Museum of Natural History in the city of Vienna in the eastern part of Austria (HARZ 1968b) around the increasing half moon on 04.07.1968 between the new moon on 26.06.1968 and the full moon on 10.07.1968.

9.7 Various diurnal and nocturnal butterflies

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of various diurnal and nocturnal butterflies is frequently related with the new moon or the full moon, with a suite of examples of own observations being compiled as fol-

lows.

Among the butterflies, the correlation of the appearance of the peak numbers of individuals with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed for the male of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the new moon on 17.04.2007, 05.05.2008, 25.04.2009 and 14.04.2010; the Brimstone *Gonepteryx rhamni,* the Silver-Washed Fritillary *Argynnis paphia* and the Comma Butterfly *Polygonia c-album* in Nußloch, Rot and Tairnbach around the new moon on 03.07.2008; the Brimstone *Gonepteryx rhamni* and the Silver-Washed Fritillary *Argynnis paphia* at several localities around Calmbach and Wildbad in the Enz valley southsouthwest of Pforzheim around the new moon on 13.08.2007 as well as around Abreschwiller in the Sarre valley south of Sarrebourg around the new moon on 14.07.2007 and 13.08.2007, the Wall Brown *Lasiommata megera* in Tairnbach around the new moon on 01.08.2008; the Swallowtail *Papilio machaon* in Sankt Leon, Walldorf and Tairnbach around the new moon on 30.08.2008; the Clouded Yellow *Colias croceus* in Sankt Leon and Walldorf around the new moon on 30.08.2008 and 22.07.2009; the Swallowtail *Papilio machaon* and the Clouded Yellow *Colias croceus* in Walldorf around the new moon on 20.08.2009, the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* in Nußloch around the new moon on 11.09.2007 and 29.09.2008; the Wood White *Leptidea sinapis* in Nußloch around the new moon on 25.04.2009, the Black-Veined White *Aporia crataegi* in Tairnbach and Walldorf around the new moon on 24.05.2009, the Comma Butterfly *Polygonia c-album* in Nußloch and Tairnbach around the new moon on 22.06.2009 and 20.08.2009, the Marbled White *Melanargia galathea* in Tairnbach and Walldorf around the new moon on 22.06.2009, the Common Blue *Polyommatus icarus* and the Six-Spot Burnet *Zygaena filipendulae* in Tairnbach and Walldorf around the new moon on 22.07.2009, the Red Admiral *Vanessa atalanta* in Nußloch around the new moon on 18.09.2009, and the Map Butterfly *Araschnia levana* in Nußloch and Tairnbach around the new moon on 20.08.2009. The correlation of the appearance of the peak numbers of individuals with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has also been reported for various diurnal and nocturnal butterflies in the literature, with examples being compiled in the corresponding sections.

The correlation of the appearance of the peak numbers of individuals with the full moon at the middle or central point of the lunar cycle has been observed for the male of the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the full moon on 09.04.2009; the Marbled White *Melanargia galathea* in Nußloch, Tairnbach and Walldorf around the full moon on 18.06.2008; the Wood White *Leptidea sinapis* in Tairnbach around the full moon on 16.08.2008; the Swallowtail *Papilio machaon* in Sankt Leon, Walldorf and Tairnbach around the full moon on 16.08.2008; the Painted Lady *Vanessa cardui* in Walldorf around the full moon on 09.05.2009 and 07.07.2009, the Ringlet *Aphantopus hyperantus* and the Six-Spot Burnet *Zygaena filipendulae* in Tairnbach around the full moon on 07.07.2009, the Swallowtail *Papilio machaon* and the Clouded Yellow *Colias croceus* in Walldorf around the full moon on 07.07.2009, the Jersey Tiger *Euplagia quadripunctaria* in Nußloch around the full moon on 06.08.2009, and the Red Admiral *Vanessa atalanta* and the Comma Butterfly *Polygonia c-album* in Nußloch around the full moon on 04.09.2009. The correlation of the appearance of the peak numbers of individuals with the full moon at the middle or central point of the lunar cycle has also been reported for various diurnal and nocturnal butterflies in the literature, with examples being compiled in the corresponding sections.

The correlation of the appearance of the peak numbers of individuals with the decreasing half moon in the fourth quarter of the lunar cycle has been observed for the Purple Emperor *Apatura iris* in Nußloch and Tairnbach around the decreasing half moon on 15.06.2009 between the full moon on 07.06.2009 and the new moon on 22.06.2009 as well as around the decreasing half moon on 13.08.2009 between the full moon on 06.08.2009 and the new moon on 20.08.2009; the Black-

Veined White *Aporia crataegi,* the Queen of Spain Fritillary *Issoria lathonia* and the Black Hairstreak *Strymonidia pruni* in Rot around the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008; the Peacock Butterfly *Inachis io* in Nußloch around the decreasing half moon on 26.06.2008 between the full moon on 18.06.2008 and the new moon on 03.07.2008, and the Tau Emperor *Aglia tau* in Nußloch around the decreasing half moon on 17.04.2009 between the full moon on 09.04.2009 and the new moon on 25.04.2009.

The correlation of the appearance of the peak numbers of individuals with the increasing half moon in the first quarter of the lunar cycle has been observed for the Silver-Washed Fritillary *Argynnis paphia* in Tairnbach around the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009, the Peacock Butterfly *Inachis io* in Nußloch and Tairnbach around the increasing half moon on 29.06.2009 between the new moon on 22.06.2009 and the full moon on 07.07.2009 as well as around the increasing half moon on 27.08.2009 between the new moon on 20.08.2009 and the full moon on 04.09.2009, and the Wood White *Leptidea sinapis* in Walldorf around the increasing half moon on 28.07.2009 between the new moon on 22.07.2009 and the full moon on 06.08.2009. The correlation of the appearance of the peak numbers of individuals with the decreasing half moon in the fourth quarter of the lunar cycle or the increasing half moon in the first quarter of the lunar cycle has also been reported for various diurnal and nocturnal butterflies in the literature, with examples being compiled in the corresponding sections.

The turning points of the lunar cycle are often also significant breaks in weather character with frequently rapid changes from dry and warm periods to wet and cool periods or vice versa, and therefore particularly the changes from wet and cool periods to dry and warm periods around the new moon or the full moon could be the reasons for the triggering of the culmination of the activity with establishment of the peak numbers of individuals and development of pronounced swarm events of the Stag Beetle *Lucanus cervus* as well as other beetles, butterflies and other insects. The changes from dry and warm periods to wet and cool periods or vice versa in relation to the turning points of the lunar cycle are illustrated in a summary of the distribution of the periods of sunny summerly weather in 2008 in MADER (2009a).

An excellent example of the decisive impact of the considerable changes in weather character around the turning points of the lunar cycle has been the quick replacement of wet and cool winterly weather by dry and warm summerly weather with temperatures of up to 20 – 25 °C at the beginning of April 2009 which has happened abt. one week before the full moon on 09.04.2009, and which has stimulated the rapid development of the Orange Tip *Anthocharis cardamines* that is one of the first true vernal butterflies, with only some single males having appeared up to the first day after the full moon on 09.04.2009 and then suddenly numerous males having flown around in Nußloch and Tairnbach from the second day after the full moon on 09.04.2009 onwards.

Significant examples of the stimulation of the breakout of the peak numbers of individuals of butterflies by considerable changes in weather character around the turning points of the lunar cycle are also the almost sudden appearance of numerous individuals of the Black-Veined White *Aporia crataegi*, the Queen of Spain Fritillary *Issoria lathonia* and the Black Hairstreak *Strymonidia pruni* in Rot around the decreasing half moon on 28.05.2008 which has happened shortly after the beginning of the second period of summerly warm and sunny weather before the full moon on 20.05.2008; the Marbled White *Melanargia galathea* in Walldorf, Nußloch and Tairnbach on the full moon on 18.06.2008 which has marked the beginning of the third period of summerly warm and sunny weather; the Peacock Butterfly *Inachis io* in Nußloch around the decreasing half moon on 26.06.2008 which has taken place shortly after the beginning of the third period of summerly warm and sunny weather on the full moon on 18.06.2008; the Brimstone *Gonepteryx rhamni*, the

Silver-Washed Fritillary *Argynnis paphia* and the Comma Butterfly *Polygonia c-album* in Nußloch, Rot and Tairnbach around the new moon on 03.07.2008 which has occurred before the end of the third period of summerly warm and sunny weather after the new moon on 03.07.2008; the Swallowtail *Papilio machaon* in Sankt Leon, Walldorf and Tairnbach as well as the Clouded Yellow *Colias croceus* in Sankt Leon and Walldorf around the new moon on 30.08.2008 which has happened shortly after the beginning of the fifth period of summerly warm and sunny weather on the decreasing half moon on 24.08.2008 between the full moon on 16.08.2008 and the new moon on 30.08.2008; and the Orange Tip *Anthocharis cardamines* in Nußloch and Tairnbach around the new moon on 14.04.2010 which has taken place at the beginning of first longer period of warm and sunny weather after the new moon on 14.04.2010.

9.8 The Beautiful Demoiselle *Calopteryx virgo*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Beautiful Demoiselle *Calopteryx virgo* (Odonata: Calopterygidae) is repeatedly related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Beautiful Demoiselle *Calopteryx virgo* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed in Tairnbach around the new moon on 24.05.2009.

The correlation of the appearance of the peak numbers of individuals of the Beautiful Demoiselle *Calopteryx virgo* with the decreasing half moon in the fourth quarter of the lunar cycle has been observed in Tairnbach around the decreasing half moon on 28.05.2008 between the full moon on 20.05.2008 and the new moon on 03.06.2008.

The correlation of the appearance of the peak numbers of individuals of the Beautiful Demoiselle *Calopteryx virgo* as well as other damselflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also frequently been reported in the literature, with various examples being compiled in the corresponding sections.

9.9 The Banded Demoiselle *Calopteryx splendens*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Banded Demoiselle *Calopteryx splendens* (Odonata: Calopterygidae) is sometimes related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Banded Demoiselle *Calopteryx splendens* with the full moon at the middle or central point of the lunar cycle has been observed in Walldorf around the full moon on 30.06.2007.

The correlation of the appearance of the peak numbers of individuals of the Banded Demoiselle *Calopteryx splendens* as well as other damselflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also frequently been reported in the literature, with various examples being compiled in the corresponding sections.

9.10 The Four-Spotted Chaser *Libellula quadrimaculata*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* (Odonata: Libellulidae) is repeatedly related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from Dresden in the Elbe valley in the northeastern part of Germany (KEFERSTEIN 1863, BLASIUS 1883, FRAENKEL 1932) around the new moon on 15.06.1817 and 28.05.1881; from Dresden, Leipzig, Halle, Magdeburg, Braunschweig, Bad Gandersheim north of Göttingen and Bielefeld as well as the Neiße valley around and between Zittau and Görlitz in the northeastern and northwestern parts of Germany (GAUCKLER 1881, LANDWEHR 1881, WEIDINGER 1881, BLASIUS 1883) around the new moon on 28.05.1881; from Weimar in the northeastern part of Germany (WEISSENBORN 1839) around the new moon on 25.06.1916, from Gotha westsouthwest of Erfurt in the northeastern part of Germany (KEFERSTEIN 1817, FRAENKEL 1932) around the new moon on 25.06.1816; from Halle in the Saale valley and Magdeburg in the Elbe valley in the northeastern part of Germany (HAGEN 1861) around the new moon on 16.06.1825, from the region south of Berlin in the northeastern part of Germany (MEISE in E. HARTERT in WILLIAMS 1929) around the new moon on 10.06.1926, from Klocksin southwest of the Malchiner See southwest of Malchin southeast of Rostock in the northeastern part of Germany on 15.05.1831 (GERICHAU in BOLL 1856, ERNST BOLL in KÖPPEN 1871, F.T. KÖPPEN in MEYER 1918) around the new moon on 12.05.1831, from the region south of Berlin in the northeastern part of Germany (WILLIAMS 1929) around the new moon on 10.06.1926, from Hildesheim southsoutheast of Hannover in the northwestern part of Germany (F. LACHMUND in HAGEN 1861) around the new moon on 18.05.1673, and from the region around the mouths of the river Ems near Emden and the river Elbe near Cuxhaven into the North Sea (VIEWEG 1897) as well as within and around Hamburg (ANONYMUS 1897, WAGNER 1897) in the northwestern part of Germany (FRAENKEL 1932) around the new moon on 31.05.1897.

The correlation of the appearance of the peak numbers of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has also been signaled from the district Pötzleinsdorf at the northwestern margin of the city of Vienna (GEISSLER 1925) and between Bruck an der Leitha and Neusiedl am See eastsoutheast of Vienna (GALVAGNI 1925) in the eastern part of Austria around the new moon on 22.05.1925, from Cherbourg westnorthwest of Le Havre in the northwestern part of France (DESCOURTILEZ 1827) around the new moon on 16.06.1825, from Lebbeke northeast of Aalst northnorthwest of Bruxelles (LANCASTER 1900) and near Gent westnorthwest of Bruxelles (MCLACHLAN 1900) in the western part of Belgium around the new moon on 19.06.1860, and from Blokzijl westnorthwest of Meppel southeast of Amsterdam in the eastern part of the Netherlands (BEMMELEN 1857) around the new moon on 17.06.1852.

The correlation of the appearance of the peak numbers of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* with the full moon at the middle or central point of the lunar cycle has been reported from Dresden in the Elbe valley in the northeastern part of Germany (KEFERSTEIN 1817, FRAENKEL 1932) around the full moon on 10.06.1816, from Gotha westsouthwest of Erfurt in the northeastern part of Germany (KEFERSTEIN 1863) around the full moon on 29.06.1817; from Göttingen, Eisenach, Weimar and Halle in the northwestern and northeastern parts of Germany (WEISSENBORN 1839) around the full moon on 28.05.1839; from Mettmann eastnortheast of Düsseldorf in the northwestern part of Germany (KEFERSTEIN 1863) around the full moon on 24.05.1861, from Margate eastsoutheast of London in the southeastern part of England (H. STOCKS in LUCAS

1900a) and from Berwick-upon-Tweed north of Newcastle-upon-Tyne in the northeastern part of England (G. BOLAM in LUCAS 1900a) around the full moon on 13.06.1900, from the vicinity of Shoeburyness at the mouth of the river Thames eastsoutheast of London in the southeastern part of England (PENDER 1888) around the full moon on 23.06.1888, from Calais north of Paris in the northwestern part of France (WEISSENBORN 1839) around the full moon on 10.06.1839, from Huissignies northeast of Beloeil southsouthwest of Ath southwest of Bruxelles in the western part of Belgium (MORREN 1853, KEFERSTEIN 1863) around the full moon on 21.06.1853, from the regions around Antwerpen north of Bruxelles and Mons southwest of Bruxelles in the western part of Belgium as well as Namur southsoutheast of Bruxelles and Liège southeast of Bruxelles in the eastern part of Belgium in the western part of Belgium and Liège in the eastern part of Belgium as well as from the coast of the North Sea in the western parts of Belgium and the Netherlands (LANCASTER 1900, KARSCH 1900, MCLACHLAN 1900, ACLOQUE 1901, FONTAINE 1902) around the full moon on 13.06.1900, from different parts of the Netherlands (MULDER 1855, BEMMELEN 1857) around the full moon on 31.05.1855; from Den Haag and its vicinity as well as between Leiden and Katwijk north to northnortheast of Den Haag southwest of Amsterdam in the western part of the Netherlands (HASSELT 1884, RITSEMA 1884) around the full moon on 08.07.1884, from Veenendaal west of Ede southeast of Amsterdam in the eastern part of the Netherlands (RITSEMA 1884) around the full moon on 08.07.1884, and from Zukowo (formerly Zuckau) southwest of Gdansk (formerly Danzig) in the northeastern part of Poland (formerly in the northeastern part of Germany) (M.A. POPHAM in WILLIAMS 1929) around the full moon on 25.06.1926.

The correlation of the appearance of the peak numbers of individuals of the Four-Spotted Chaser *Libellula quadrimaculata* as well as other dragonflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also frequently been reported in the literature in addition to the account that has been given above, with various examples being compiled in the corresponding sections.

9.11 The Broad-Bodied Chaser *Libellula depressa*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Broad-Bodied Chaser *Libellula depressa* (Odonata: Libellulidae) is repeatedly related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Broad-Bodied Chaser *Libellula depressa* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from Boulogne-sur-Mer north of Paris in the northwestern part of France (BAXTER 1911) around the new moon on 28.05.1911.

The correlation of the appearance of the peak numbers of individuals of the Broad-Bodied Chaser *Libellula depressa* with the full moon at the middle or central point of the lunar cycle has been reported from Halle in the Saale valley and Oppin northnortheast of Halle in the northeastern part of Germany (GERMAR 1840) around the full moon on 28.05.1839.

The correlation of the appearance of the peak numbers of individuals of the Broad-Bodied Chaser *Libellula depressa* as well as other dragonflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also often been noted in the literature in addition to the account that has been given above, with various examples being compiled in the corresponding sections.

9.12 The Migrant Hawker *Aeshna mixta*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Migrant Hawker *Aeshna mixta* (Odonata: Aeshnidae) is sometimes related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Migrant Hawker *Aeshna mixta* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the river Gironde in the vicinity of Saint Estèphe west-southwest of Limoges in the southwestern part of France (CAMPBELL 1885) around the new moon on 19.09.1884.

The correlation of the appearance of the peak numbers of individuals of the Migrant Hawker *Aeshna mixta* as well as other dragonflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also frequently been reported in the literature in addition to the account that has been given above, with various examples being compiled in the corresponding sections.

9.13 The Green Hawker *Aeshna viridis*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Green Hawker *Aeshna viridis* (Odonata: Aeshnidae) is sometimes related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Green Hawker *Aeshna viridis* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed at the locality Nußloch around the new moon on 11.09.2007 and 29.09.2008.

The correlation of the appearance of the peak numbers of individuals of the Green Hawker *Aeshna viridis* with the full moon at the middle or central point of the lunar cycle has been observed at the locality Nußloch around the full moon on 04.09.2009.

The correlation of the appearance of the peak numbers of individuals of the Green Hawker *Aeshna viridis* as well as other dragonflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has also frequently been reported in the literature, with various examples being compiled in the corresponding sections.

9.14 Various dragonflies and damselflies

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of various dragonflies (Odonata: Anisoptera) and damselflies (Odonata: Zygoptera) is frequently related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of various dragonflies and damselflies with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle has frequently been reported in the literature, with various examples being compiled in the corresponding sections.

9.15 The Burrowing Mayfly *Ephoron virgo*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Burrowing Mayfly *Ephoron virgo* (Ephemeroptera: Polymitarcyidae) is frequently related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Ephoron virgo* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the river Neckar around Heidelberg in the southwestern part of Germany around the new moon on 07.08.1994 (Rhein-Neckar-Zeitung 1994) and 27.08.2003 (Rhein-Neckar-Zeitung 2003), from the river Main in Würzburg in the central part of Germany probably around the new moon on 17.08.1898 (Leydig 1902, Weidner 1963), from the river Danube in Regensburg in the southeastern part of Germany around the new moon on 15.08.1757 (Schäffer 1757) as well as in Passau and Deggendorf northwest of Passau in the southeastern part of Germany around the new moon on 29.07.1992 (Butz & Schuwerk 1993) and 19.08.2001 (Tobias & Bernerth 2004), from the river Weser in Bremen in the northwestern part of Germany around the new moon on 05.08.1910 (Alfken in Weiss 1947), from the river Allier east of Issoire south of Clermont-Ferrand west of Lyon in the southeastern part of France around the new moon on 01.08.1943 (Verrier 1943) and east of Clermont-Ferrand around the new moon on 09.07.1945 (R. Hovasse & L. Olivier in Verrier 1954), from the river Saône in Saint-Jean-de-Losne southeast of Dijon in the eastern part of France around the new moon on 17.08.1936 (Denis, Paris & Pillon 1937), and from the river Dordogne near Roche-Gageac east of Bordeaux in the southwestern part of France around the new moon on 01.09.1951 (R. Poisson in Verrier 1954).

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Ephoron virgo* with the full moon at the middle or central point of the lunar cycle has been reported from the river Rhine around Bonn in the Middle Rhine valley in the western part of Germany around the full moon on 06.08.1990 (Rhein-Zeitung 1990; Kureck 1992, 1993), from the river Main in Frankfurt am Main in the central part of Germany around the full moon on 10.08.1995 (Tobias 1996), from the river Main in Hanau east of Frankfurt am Main in the central part of Germany around the full moon on 15.08.1981 (Wittenberger 1981; Bathon 1982, 1983a, 1983b) and 23.08.1983 (Bathon 1983a, 1983b; Wittenberger 1983), from the river Moselle in Trier in the western part of Germany around the full moon on 14.08.1886 (Leydig 1902); from the creek Wallufbach, a tributary to the river Rhine, in abt. 7.5 km distance from the river Rhine in Schlangenbad westnorthwest of Wiesbaden in the Middle Rhine valley in the western part of Germany around the full moon on 06.08.1990 (Meyer-Arndt & Berger 1990); from the river Naab in Schwandorf in the southeastern part of Germany around the full moon on 06.08.2009 (Detsch 2009, Schmidt 2009, Süddeutsche Zeitung 2009), and from the river Gard near Nîmes northwest of Marseille in the southeastern part of France around the full moon on 30.08.1985 (Burmeister 1987).

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Ephoron virgo* with the decreasing half moon in the fourth quarter of the lunar cycle has been reported from the river Rhine in Mannheim west of Heidelberg around the decreasing half moon on

09.08.1924 between the full moon on 14.08.1924 and the new moon on 30.08.1924 (SCHOENEMUND 1930), and from the river Naab in Kallmünz northnorthwest of Regensburg in the southeastern part of Germany around the decreasing half moon on 17.08.1987 between the full moon on 09.08.1987 and the new moon on 24.08.1987 (BURMEISTER 1989b).

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Ephoron virgo* with the increasing half moon in the first quarter of the lunar cycle has been reported from the river Neckar around Heidelberg around the increasing half moon on 17.08.1991 between the new moon on 10.08.1991 and the full moon on 25.08.1991 (RHEIN-NECKAR-ZEITUNG 1991), around the increasing half moon on 19.08.1999 between the new moon on 11.08.1999 and the full moon on 27.08.1999 (RHEIN-NECKAR-ZEITUNG 1999), and around the increasing half moon on 31.08.2006 between the new moon on 23.08.2006 and the full moon on 07.09.2006 (RHEIN-NECKAR-ZEITUNG 2006).

9.16 The Burrowing Mayfly *Oligoneuriella rhenana*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Burrowing Mayfly *Oligoneuriella rhenana* (Ephemeroptera: Oligoneuriidae) is frequently related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Oligoneuriella rhenana* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the river Rhine in Basel in the northwestern part of Switzerland around the new moon on 05.08.1834 and 26.08.1851 (IMHOFF 1852), from the river Rhine in Basel and the river Aare in Aarau southeast of Basel in the northwestern part of Switzerland around the new moon on 20.08.1906 (NEERACHER 1910); from the river Rot, a southern tributary of the river Danube, around Niedernzell south of Ulm in the southwestern part of Germany around the new moon on 24.08.1987 (GRIMM 1988); and from the river Couze Pavin, a tributary of the river Allier, between Perrier and Issoire south of Clermont-Ferrand west of Lyon in the southeastern part of France around the new moon on 22.08.1941 (VERRIER 1941), 01.08.1943 (VERRIER 1943, 1954) and 22.07.1952 (VERRIER 1954).

The correlation of the appearance of the peak numbers of individuals of the Burrowing Mayfly *Oligoneuriella rhenana* with the full moon at the middle or central point of the lunar cycle has been reported from the river Rhine in Basel and the river Aare in Aarau southeast of Basel in the northwestern part of Switzerland around the full moon on 23.08.1907 (NEERACHER 1910), from the river Aare near Wildegg eastnortheast of Aarau around the full moon on 30.08.1871 (MEYER-DÜR 1874); from the river Rot, a southern tributary of the river Danube, around Niedernzell south of Ulm in the southwestern part of Germany around the full moon on 09.08.1987 (GRIMM 1988); from the river Raba in the Beskid Mountains southsouthwest of Cracow in the southwestern part of Poland around the full moon on 29.07.1969 (SOWA 1975); and from the river Couze Pavin, a tributary of the river Allier, between Perrier and Issoire south of Clermont-Ferrand west of Lyon in the southeastern part of France around the full moon on 05.09.1941 (VERRIER 1941) and 17.07.1943 (VERRIER 1954).

9.17 The Carpenter Bee *Xylocopa violacea*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings

on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Carpenter Bee *Xylocopa violacea* (Hymenoptera: Anthophoridae) is sometimes related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Carpenter Bee *Xylocopa violacea* in the garden within the city of Oftersheim with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed around the new moon on 16.05.2007, and the correlation of the appearance of its peak numbers of individuals with the full moon at the middle or central point of the lunar cycle has been noticed around the full moon on 02.05.2007.

9.18 The Mason Bee *Megachile parietina*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Mason Bee *Megachile parietina* (Hymenoptera: Megachilidae) is sometimes related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Mason Bee *Megachile parietina* in the quarry at the Goldberg west of Nördlingen with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed around the new moon on 21.06.2001, and the correlation of the appearance of its peak numbers of individuals with the full moon at the middle or central point of the lunar cycle has been noticed around the full moon on 05.07.2001.

9.19 The Lettuce-Root Aphid *Pemphigus bursarius*, the Peach-Potato Aphid *Myzus persicae,* the Black Bean Aphid *Aphis fabae* and the Bean Aphid *Aphis rumicis*

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of the Lettuce-Root Aphid *Pemphigus bursarius*, the Peach-Potato Aphid *Myzus persicae* and the Black Bean Aphid *Aphis fabae* (Hemiptera: Aphididae) is repeatedly related with the new moon or the full moon.

The correlation of the appearance of the peak numbers of individuals of the Peach-Potato Aphid *Myzus persicae* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the road between Brugge and Gent northwest of Bruxelles, within Gent, and from the road between Antwerpen and Gent north and northwest of Bruxelles in the western part of Belgium (Keferstein 1863) around the new moon on 02.10.1834.

The correlation of the appearance of the peak numbers of individuals of the Black Bean Aphid *Aphis fabae* with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from several regions in the western part of England (Keferstein 1863) around the new moon on 13.06.1847.

The correlation of the appearance of the peak numbers of individuals of the Lettuce-Root Aphid *Pemphigus bursarius* with the full moon at the middle or central point of the lunar cycle has been reported from Sweden (Keferstein 1863) around the full moon on 04.10.1846.

9.20 The Springtail *Sminthurus ater*

The correlation of the appearance of the peak numbers of individuals of the Springtail *Sminthurus ater* (Collembola: Sminthuridae) with the full moon at the middle or central point of the lunar cycle has been reported from Niesky and Quitzdorf southwest of Niesky northwest of Görlitz in the northeastern part of Germany (FECHNER 1840) around the full moon on 14.09.1837.

9.21 The Cosmopolitan Grain Psocid *Lachesilla pedicularia*

The correlation of the appearance of the peak numbers of individuals of the Cosmopolitan Grain Psocid *Lachesilla pedicularia* (Psocoptera: Lachesillidae) with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from Saint Mary´s Bay westsouthwest of Folkestone southeast of London in the southeastern part of England (BURTON 1950) around the new moon on 22.09.1949, and from Koksijde westsouthwest of Oostende in the western part of Belgium (J.A. LESTAGE in BURTON 1950) around the new moon on 28.08.1935.

9.22 The Common Elbowed Red Ant *Myrmica scabrinodis*

The correlation of the appearance of the peak numbers of individuals of the Common Elbowed Red Ant *Myrmica scabrinodis* (Hymenoptera: Formicidae) with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from Saint Mary ´s Bay westsouthwest of Folkestone southeast of London in the southeastern part of England (BURTON 1950) around the new moon on 22.09.1949.

9.23 The Hawthorn Fly *Bibio marci*

The correlation of the appearance of the peak numbers of individuals of the Hawthorn Fly *Bibio marci* (Diptera: Bibionidae) with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been reported from the vicinity of Potsdam westsouthwest of Berlin in the northwestern part of Germany (MEISSNER 1907) around the new moon on 12.05.1907.

9.24 The Common Toad *Bufo bufo*

An example of a relationship between the wandering of individuals of the Common Toad *Bufo bufo* and the turning points of the lunar cycle has been observed in the vicinity of Walldorf in 2009 and 2010 and is presented here for the purpose of the broadening of the systematical scope of the selenocyclical evaluation of the population dynamics of the aforementioned beetles, butterflies and other insects.

The correlation of the onset of the appearance of individuals of the Common Toad *Bufo bufo* in the vicinity of Walldorf with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed around the new moon on 15.03.2010.

The correlation of the onset of the appearance of individuals of the Common Toad *Bufo bufo* in the vicinity of Walldorf with the full moon at the middle or central point of the lunar cycle has been observed around the full moon on 11.03.2009.

The correlation of the appearance of the peak numbers of individuals of the Common Toad *Bufo bufo* in the vicinity of Walldorf with the increasing half moon in the first quarter of the lunar cycle has been observed around the increasing half moon on 02.04.2009 between the new moon on 26.03.2009 and the full moon on 09.04.2009.

9.25 Various mushrooms

Similarly as the peak activity of the Stag Beetle *Lucanus cervus* with spectacular swarm evenings on abt. 1 – 7 days occurs often around the new moon or the full moon, also the culmination of the appearance of individuals of various mushrooms is repeatedly related with the new moon or the full moon.

The correlation of mass growth and peak abundance of individuals of mushrooms in the vicinity of Walldorf with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle has been observed for the Edible Bolete *Boletus edulis* (Boletales: Boletaceae) around the new moon on 22.07.2009; and for the Parasol Mushroom *Macrolepiota procera* (Agaricales: Lepiotaceae), the Saffron Milk Cap *Lactarius deliciosus* (Russulales: Russulaceae), the Field Mushroom *Agaricus campestris* (Agaricales: Agaricaceae), the Slippery Jack *Suillus luteus* (Boletales: Boletaceae), the Ink Cap *Coprinus comatus* (Agaricales: Coprinaceae) and the Fly Agaric *Amanita muscaria* (Agaricales: Amanitaceae) around the new moon on 16.11.2009.

The correlation of mass growth and peak abundance of individuals of mushrooms in the vicinity of Walldorf with the full moon at the middle or central point of the lunar cycle has been observed for the Parasol Mushroom *Macrolepiota procera* (Agaricales: Lepiotaceae) around the full moon on 03.11.2009, for the Honey Fungus *Armillaria mellea* (Agaricales: Marasmiaceae) around the full moon on 04.10.2009 and 02.12.2009, and for the Saffron Milk Cap *Lactarius deliciosus* (Russulales: Russulaceae) around the full moon on 02.12.2009.

9.26 Outlook and call for cooperation

Much more examples of the correlation of the peak activity of the Stag Beetle *Lucanus cervus,* other beetles, butterflies, dragonflies, damselflies, and other diurnal and crepuscular insects with the new moon or the full moon are required for the further generalization of the interpretation of the triggering of outstanding swarm days or evenings by the turning points of the lunar cycle. I would therefore like to encourage all the readers of my paper to pay attention to the possible correlation of swarm days or evenings of the Stag Beetle *Lucanus cervus,* other beetles, butterflies, dragonflies, damselflies, and other diurnal and crepuscular insects with the turning points of the lunar cycle, and to report examples to me for averaged selenocyclical evaluation of the short-term population dynamics.

Contact and exchange addresses and connections for the reporting of finds and observations of individuals of the Stag Beetle *Lucanus cervus* as well as overviews of current projects of data collection and research are compiled together with information on literature, conferences and meetings in the internet in the websites http://agnu-haan.de/hirschkaefer and http://maria.fremlin.de/stagbeetles. Observations of individuals of the Stag Beetle *Lucanus cervus* in the region around Heidelberg and Mannheim in the southwestern part of Germany should be reported to me preferably by e-mail: dr.detlef.mader@web.de.

Every friend of nature who is interested in more details of current research and conservation of the Stag Beetle *Lucanus cervus* and who wants to participate actively in the work on protection and monitoring of the Stag Beetle *Lucanus cervus* should also consider joining the European Stag Beetle Group which is an international working group of scientists and amateurs that are involved in the study of the Stag Beetle *Lucanus cervus* and related species (contact by e-mail to: european-stag-beetle-group@googlegroups.com).

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Moon-Related Population Dynamics and Ecology of the Stag Beetle *Lucanus cervus,*
Other Beetles, Butterflies, Dragonflies and Other Insects
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Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* in Garten, Streuobstwiese, Wald, Waldrand, Haus und Straße für alle Naturfreunde (Coleoptera: Lucanidae)

Conservation Measures for the Stag Beetle *Lucanus cervus* in Garden, Orchard, Forest, Forest Margin, House and Street for all Friends of Nature (Coleoptera: Lucanidae)

DETLEF MADER

Zusammenfassung

Der Hirschkäfer *Lucanus cervus* LINNAEUS 1758 steht schon seit langer Zeit in Deutschland und in anderen Ländern Europas unter strengem Naturschutz, welcher in den letzten Jahren in der Europäischen Union weiter verschärft wurde. Im Rahmen einer Studie der Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* im Raum um Heidelberg und Mannheim im südwestlichen Teil von Deutschland habe ich eine Reihe von einfachen Schutzmaßnahmen entwickelt, welche von jedem Naturfreund problemlos in Garten, Streuobstwiese, Wald, Waldrand, Haus und Straße durchgeführt werden können. Diese einfachen Schutzmaßnahmen, an deren konsequenter Anwendung sich möglichst viele Naturfreunde beteiligen sollten, können in der Summe eine wesentliche Verbesserung der Lebens- und Fortpflanzungsbedingungen des Hirschkäfers *Lucanus cervus* bewirken. Die vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* umfassen den Transitservice an Wegen und Straßen am Waldrand, die zeitweise Sperrung von Wegen und Straßen am Waldrand für den Verkehr, das Umdrehen auf dem Rücken liegender Männchen und Weibchen, die Anlage von Komposthaufen und Totholzdeponien mit ausreichend langer Lagerzeit in Gärten und Streuobstwiesen; das Stehenlassen von natürlichen Baumstümpfen und das Aufstellen von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern; die Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen, die Installation von Hirschkäferpflastern, die Ausweisung von Bannwaldflächen, das Angebot von Saftaustritten an Bäumen in Gärten und Streuobstwiesen, die Anpflanzung und Pflege von Kirschbäumen in Gärten und Streuobstwiesen, die Herstellung und Auslage von Mischungen von Säften und Früchten, die Abdeckung und Kontrolle von Wasserbehältern in Gärten und Parks, die Überprüfung von Rasenflächen vor dem Mähen, die Multiplikation durch Sensibilisierung von weiteren Naturfreunden, die regelmäßige Meldung von Beobachtungen zur zentralen Auswertung, und das Engagement gegen chemische Maikäferbekämpfungsaktionen. Die Bedeutung der konsequenten Durchführung der empfohlenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* wird besonders dadurch unterstrichen, daß jedes einzelne Weibchen, welches vor der vorzeitigen nichtnatürlichen Mortalität bewahrt wird und problemlos günstige Substrate für die Ablage seiner Eier findet, für sich allein in der Lage ist, den Fortbestand der jeweiligen Population in der nächsten Generation zu begründen und sicherzustellen. Jeder einzelne Natur-

freund, welcher an der Umsetzung der vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* teilnimmt, trägt mit seiner Mithilfe dazu bei, die Ziele der Fauna-Flora-Habitat-Richtlinie der Europäischen Union auf möglichst breiter Basis zu erreichen und die herausgehobene Stellung des Hirschkäfers *Lucanus cervus* in der mitteleuropäischen Entomofauna auf Dauer sicherzustellen.

Abstract

The Stag Beetle *Lucanus cervus* LINNAEUS 1758 is since long time in Germany and in other countries of Europe under rigorous nature protection which has been further restricted in the European Union in the last years. During the course of a study of population dynamics and ecology of the Stag Beetle *Lucanus cervus* in the region around Heidelberg and Mannheim in the southwestern part of Germany, I have developed a suite of simple conservation measures which could be executed by every friend of nature without problems in garden, orchard, forest, forest margin, house and street. These simple conservation measures could lead to a significant improvement of the conditions of life and reproduction of the Stag Beetle *Lucanus cervus*, and therefore as many friends of nature as possible should participate consequently in their application. The proposed conservation measures for the Stag Beetle *Lucanus cervus* include the transit service at streets and roads at the forest margin, the temporary closure of streets and roads at the forest margin for the traffic, the turnaround of males and females which are found lying on their back, the accumulation of compost heaps and dead wood piles with sufficient deposit time in gardens and orchards; the maintenance of natural tree stumps and the installation of artificial tree stumps in gardens, orchards and forests; the construction of stag beetle pyramids, piles and cradles; the installation of stag beetle pavements, the delineation of forest regions with restricted or prohibited cultivation, the supply of sap runs on trees in gardens and orchards, the planting and cultivation of cherry trees in gardens and orchards, the preparation and exposition of mixtures of juices and fruits, the cover and control of water containers in gardens and parks, the inspection of lawns before mowing, the multiplication by sensitization of other friends of nature, the regular reporting of observations for central evaluation, and the engagement against actions of chemical destruction of populations of the Cockchafer *Melolontha*. The significance of the consequent execution of the proposed conservation measures for the Stag Beetle *Lucanus cervus* is particularly underlined by the fact that every single female which can be protected from premature non-natural mortality and which can find suitable substrates for the deposition of its eggs without problems is able for itself alone to found and to secure the persistence of the corresponding population in the next generation. Every single friend of nature who participates in the application of the suggested conservation measures for the Stag Beetle *Lucanus cervus* contributes with his help to achieve the aims of the fauna-flora-habitat-directive of the European Union in an extent as wide as possible and to secure the pronounced position of the Stag Beetle *Lucanus cervus* in the entomofauna of Middle Europe permanently.

Résumé

Le Cerf Volant *Lucanus cervus* LINNAEUS 1758 est sous la protection de la nature rigoureuse depuis longtemps en Allemagne et en autres pays d´Europe qu´avait été aggravée dans les années dernières en l´Union Europeénne. Dans le cadre d´une étude de la dynamique des populations et de l´écologie du Cerf Volant *Lucanus cervus* dans la région autour de Heidelberg et Mannheim dans le sud-ouest de l´Allemagne, j´ai développé une collection de mesures simples de protection qui peuvent être appliquées par chaque ami de la nature dans le jardin, le verger, la forêt, la lisière de la forêt, la maison et la rue. Ces mesures simples de protection peuvent en somme amener à une amélioration considérable des conditions de vie et de reproduction du Cerf Volant *Lucanus cervus* s´ils sont exécu-

tées conséquemment par des amis de la nature nombreuses autant que possible. Les mesures de protection proposées pour le Cerf Volant *Lucanus cervus* comprennent le service de transit aux chemins et rues à la lisière de la forêt, la fermeture temporaire des chemins et rues à la lisière de la forêt pour la circulation, le tournement des mâles et femelles qui reposent sur le dos, l´aménagement des tas de compost et des dépôts de bois mort avec une durée de magasinage suffisante dans des jardins et des vergers; le laissement des souches d´arbres naturelles et l´érection des souches d´arbres artificielles dans des jardins, des vergers et des forêts; la construction des meules du cerf volant ou des berceaux du cerf volant, l´installation des pavés du cerf volant, la délimitation des forêts de protection, l´offre des sorties de jus aux arbres dans des jardins et des vergers, la plantation et la cultivation des cerisiers dans des jardins et des vergers, la préparation et l´étalage des mixtures de jus et de fruits, la couverture et le contrôle des réservoirs d´eau dans des jardins et des parques, la révision des pelouses avant la fauche, la multiplication par la sensibilisation des amis de la nature additionnels, le rapport régulier des observations pour l´évaluation centrale, et l´engagement contre des actions de lutte chimique du Hanneton *Melolontha*. La signification de l´application conséquente des mesures de protection recommandées pour le Cerf Volant *Lucanus cervus* est soulignée particulièrement par le fait que chaque femelle individuelle qui est préservée de la mortalité non-naturelle prématurée et qui trouve des substrats favorables pour la ponte sans problème, a la possibilité pour soi-même tout seule de fonder et d´assurer le maintien et la continuité de la population respective dans la génération prochaine. Chaque ami de la nature individuel qui participe en la réalisation des mesures de protection proposées pour le Cerf Volant *Lucanus cervus* apporte sa contribution avec son aide pour atteindre les buts de la directive de la faune, de la flore et du habitat de l´Union Européenne sur une base large autant que possible, et pour garantir en permanence la position accentuée du Cerf Volant *Lucanus cervus* en l´entomofaune de l´Europe centrale.

Key words

Lucanus cervus, Stag Beetle, conservation, protection, population stability, population dynamics, saproxylic, xylobiontic, crepuscular, Upper Rhine valley, Heidelberg, Mannheim, Germany, Palaearctic region.

1 Einleitung

Der Hirschkäfer *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae) ist der größte und berühmteste Käfer in der mitteleuropäischen Insektenfauna, und ist damit gleichzeitig auch das am besten bekannte und hervorstechendste Mitglied der Gruppe der saproxylischen oder xylobionten Käfer, deren Larven sich in zersetztem, vermorschtem, vermodertem und verfaulendem Holz entwickeln. Der Hirschkäfer *Lucanus cervus* ist aufgrund der auffälligen geweihartig verlängerten Mandibeln der Männchen im Gegensatz zu den kurzen zangenartigen Mandibeln der Weibchen auch ein morphologisch besonders spektakuläres und attraktives Insekt. Weltweit zählen die Hirschkäfer (Familie Lucanidae) wegen der stattlichen Größe der meisten Arten ebenfalls zu den bemerkenswertesten und schönsten Insekten. Der Hirschkäfer *Lucanus cervus* ist auch der prägnanteste und hervorragendste Vertreter der Gilde der dämmerungsaktiven oder krepuskulären Käfer, welche ihre Aktivität während des Tages überwiegend oder sogar fast ausschließlich in der kurzen Zeit zwischen dem Sonnenuntergang und dem Einbruch der Nacht entfalten. Ein Schwärmabend des Hirschkäfers *Lucanus cervus* mit zahlreichen am Waldrand vor dem romantischen Hintergrund des leuchtenden Abendrotes und manchmal auch des aufgehenden Mondes um die Bäume herum fliegenden und dabei laut brummenden Männchen und Weibchen ist besonders aufgrund des eleganten und majestätischen Fluges mit steilwinkliger Körperhaltung der außergewöhnlich großen und imposanten

Käfer ein unvergleichlich eindrucksvolles und unvergeßliches Naturschauspiel, welches jeder Naturfreund einmal erlebt haben sollte. Die einleitenden Bemerkungen unterstreichen die Sonderstellung des Hirschkäfers *Lucanus cervus* in der einheimischen Insektenfauna vor allem dadurch, daß nicht jeder ihn bisher in der Natur entdeckt hat, und geben einen Überblick über Gesetze, Verordnungen und Richtlinien des Naturschutzes.

1.1 Nicht jeder hat ihn bisher in der Natur entdeckt

Jeder Naturfreund kennt den Hirschkäfer *Lucanus cervus* aus Büchern, Zeitungen, Schule und Museum, aber bei weitem nicht alle Naturfreunde haben ihn bisher auch lebend in der Natur beobachten können. Die exklusiven Kreise der bevorzugten Naturfreunde, welche den Hirschkäfer *Lucanus cervus* bereits in seinem natürlichen Umfeld entdecken konnten, haben ihn meist laufend oder sitzend am Boden, an Bäumen und an Wänden gesehen, wohingegen nur eine sehr begrenzte Anzahl von Naturfreunden schon einmal die Gelegenheit hatte, ihn auch fliegend zu bewundern. Ich habe im Rahmen der Erstellung meiner Studie der Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* im Raum um Heidelberg und Mannheim im südwestlichen Teil von Deutschland (Mader 2009a) mehrere Aufrufe zur Mitteilung von Fundmeldungen in regionalen Tageszeitungen veröffentlicht (Rhein-Neckar-Zeitung 2008a, 2008b, 2008c, 2008d; Schwetzinger Zeitung 2008, Bruchsaler Rundschau 2008) und habe in Resonanz auf diese Appelle mehr als 600 Berichte über Beobachtungen des Hirschkäfers *Lucanus cervus* an über 225 Lokalitäten aus einem Gebiet mit einer Erstreckung von über 100 km sowohl in Nord-Süd-Richtung als auch in West-Ost-Richtung erhalten. Nach der Publikation meines Buches (Mader 2009a) habe ich zusätzliche Beiträge über Beobachtungen des Hirschkäfers *Lucanus cervus* als Reaktion auf den Abdruck von weiteren Notizen in regionalen Tageszeitungen (Mannheimer Morgen 2009a, 2009b; Rhein-Neckar-Zeitung 2009a, 2009b, 2009c; Weinheimer Nachrichten 2009) sowie auf die Ausstrahlung eines Interviews im Rundfunk (Kurpfalz Radio 2009) bekommen. Die meisten dieser Nachweise des Hirschkäfers *Lucanus cervus* waren zufällige Einzelfunde in disperser Verteilung in Raum und Zeit, welche in den überwiegenden Fällen in den auf die Beobachtungen folgenden Tagen, Wochen, Monaten und Jahren nicht reproduzierbar waren.

Auf der anderen Seite konnten über 150 Naturfreunde an ihren Wohnorten das regelmäßige jährliche Erscheinen des Hirschkäfers *Lucanus cervus* über Zeiträume von bis zu 50 – 75 Jahren an etwa 75 Lokalitäten dokumentieren und damit einzigartige und äußerst wertvolle Daten zur langfristigen Populationsdynamik des Hirschkäfers *Lucanus cervus* über Perioden von mehreren Jahrzehnten oder sogar mehr als einem halben Jahrhundert für meine zentrale Auswertung zur Verfügung stellen, welche in der entomologischen Literatur einmalig sind (Mader 2010a). Es hat sich dabei gezeigt, daß die Begegnungen mit dem Hirschkäfer *Lucanus cervus* für die meisten Naturfreunde derart eindrückliche und unvergeßliche Ereignisse waren, daß sie sich an die Einzelheiten der Funde und Beobachtungen auch nach sehr langer Zeit noch genau erinnern konnten und sogar dann noch die Details der Sichtungen exakt im Gedächtnis hatten, wenn sie seit den lange zurückliegenden Treffen nie wieder ein Exemplar des Hirschkäfers *Lucanus cervus* in der Natur entdeckt haben. Ich habe im Laufe der Zusammenstellung meiner Studie jeden der über 600 Naturfreunde telefonisch nach den Umständen und dem Umfeld seiner Funde und Beobachtungen des Hirschkäfers *Lucanus cervus* in 2008 und ebenso auch in früheren Jahren befragt, wobei die ältesten mir berichteten Nachweise bis 1935 zurückreichen. Der älteste Naturfreund, welcher mir seine Funde des Hirschkäfers *Lucanus cervus* mitgeteilt hat, ist fast 95 Jahre alt, wohingegen der jüngste Naturfreund, der mir seine Beobachtungen übermittelt hat, gerade 8 Jahre alt ist. In diesen Gesprächen habe ich auch erfahren, daß es immer noch sehr viele Naturfreunde in allen Altersgruppen gibt, welche bisher noch nie ein Exemplar des Hirschkäfers *Lucanus cervus* in der Natur entdeckt haben.

Die zahlreichen Meldungen von Funden und Beobachtungen des Hirschkäfers *Lucanus cervus* durch die über 600 Naturfreunde an über 225 Lokalitäten aus einem Gebiet mit einer Ausdehnung von über 100 km sowohl von Norden nach Süden als auch von Westen nach Osten haben mir auch sehr viele wertvolle Hinweise für die Konzeption der nachstehend erläuterten Schutzmaßnahmen gegeben. Die langfristige und kurzfristige Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* sind in den anderen Artikeln in diesem Band zusammengefaßt (MADER 2010a, 2010b).

1.2 Gesetze, Verordnungen und Richtlinien des Naturschutzes

Der imposante, majestätische und besonders auffällige Hirschkäfer *Lucanus cervus* LINNAEUS 1758 steht schon seit 1935 durch REICHSNATURSCHUTZGESETZ (1935), NATURSCHUTZVERORDNUNG (1936), BUNDESNATURSCHUTZGESETZ (1976, 1998) und BUNDESARTENSCHUTZVERORDNUNG (1980, 1986, 1999) in Deutschland und ebenso auch in anderen Ländern Europas (COUNCIL OF EUROPE 1982) unter strengem Naturschutz, welcher in den letzten Jahren in der Europäischen Union durch die FAUNA-FLORA-HABITAT-RICHTLINIE (1992, 1997) weiter verschärft wurde (Literaturübersicht in MADER 2009a). Der Hirschkäfer *Lucanus cervus* ist auch in der Roten Liste der gefährdeten Arten in Deutschland (BLAB, NOWAK, TRAUTMANN & SUKOPP 1984; BUNDESAMT FÜR NATURSCHUTZ 1998; BINOT-HAFKE, GRUTTKE, LUDWIG & RIECKEN 2000) enthalten. Der Hirschkäfer *Lucanus cervus* wurde auch als Indikatorinsekt für naturgemäßen Eichenwald im Naturschutzprogramm der Europäischen Gemeinschaft eingestuft (TOCHTERMANN 1992). Die nachstehend erläuterten Schutzmaßnahmen zeigen, daß jeder einzelne Naturfreund einen wichtigen Beitrag dazu leisten kann, daß die Ziele des internationalen Naturschutzes für den Hirschkäfer *Lucanus cervus* vor allem im Rahmen der Fauna-Flora-Habitat-Richtlinie der Europäischen Union auf einer möglichst breiten Basis erreicht werden. Bei der Umsetzung der empfohlenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* hat die engagierte Mithilfe jedes einzelnen Naturfreundes die erhebliche Bedeutung eines entscheidenden Mosaiksteines am rasterartigen Gesamtwerk der Unterstützung, Verbesserung und Erweiterung der Lebens- und Fortpflanzungsbedingungen des herausragenden und spektakulärsten Käfers in der mitteleuropäischen Insektenwelt.

2 Zielsetzung und Erfolg der Schutzmaßnahmen für Imagines und Larven

Zielsetzung und Erfolg der Schutzmaßnahmen für Imagines und Larven des Hirschkäfers *Lucanus cervus* werden anhand einer Darstellung der Bedeutung der vorgeschlagenen Schutzmaßnahmen qualitativ erläutert, durch eine Überschlagsrechnung des minimalen und maximalen Fortpflanzungserfolgs mit Risikoabschlägen auch quantitativ illustriert, durch ein Fazit der Überschlagsrechnung des Fortpflanzungserfolgs mit Risikoabschlägen bewertet, und durch einen Abschnitt Literaturübersicht und Kontaktadressen der Schutzmaßnahmen abgerundet.

2.1 Bedeutung der vorgeschlagenen Schutzmaßnahmen

Im Rahmen der Erstellung meiner Studie der Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* im Raum um Heidelberg und Mannheim (MADER 2009a) habe ich eine Reihe von einfachen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* konzipiert, welche von jedem Naturfreund in Garten, Streuobstwiese, Wald, Waldrand, Haus und Straße problemlos durchgeführt werden können. Diese Palette von einfachen Schutzmaßnahmen, welche von allen Naturfreunden ohne besondere Umstände umgesetzt werden können, stellt einen wertvollen Beitrag zum Natur-

schutz für den Hirschkäfer *Lucanus cervus* dar, welcher von jedem einzelnen Naturfreund geleistet werden kann. Die Effektivität des Spektrums der vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* ist umso größer, je mehr Naturfreunde sich engagiert an ihrer konsequenten Anwendung beteiligen und dabei möglichst viele Elemente aus der Palette der vorgestellten Hilfsdienste regelmäßig und systematisch durchführen. In der Summe der zahlreichen teilnehmenden Naturfreunde kann die komplette Bandbreite der verschiedenen erläuterten Schutzmaßnahmen zu einer signifikanten Unterstützung, Verbesserung und Erweiterung der Lebens- und Fortpflanzungsbedingungen des Hirschkäfers *Lucanus cervus* führen. Von der konsequenten Anwendung der genannten Schutzmaßnahmen profitieren nicht nur der Hirschkäfer *Lucanus cervus*, sondern auch andere Vertreter der saproxylischen oder xylobionten Käfer, unter denen vor allem der horntragende Nashornkäfer *Oryctes nasicornis* (LINNAEUS 1758) (Coleoptera: Scarabaeidae) hervorsticht, welcher ebenfalls an etlichen Lokalitäten im Raum um Heidelberg und Mannheim gefunden wurde.

Die Bedeutung der konsequenten Anwendung der empfohlenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* wird besonders dadurch unterstrichen, daß jedes einzelne Weibchen, welches vor der vorzeitigen nichtnatürlichen Mortalität bewahrt oder gerettet wird und problemlos günstige Substrate für die Ablage seiner Eier findet, für sich allein in der Lage ist, den Fortbestand der jeweiligen Population in der nächsten Generation zu begründen und sicherzustellen. Jedes getötete Weibchen des Hirschkäfers *Lucanus cervus* bedeutet den Verlust von etwa 20 – 30 abgelegten Eiern und damit auch von etwa 20 – 30 potentiellen Individuen in der nächsten Generation (HAWES 2006), und deshalb ist es das vorrangige Ziel der vorgeschlagenen Schutzmaßnahmen, möglichst viele Weibchen des Hirschkäfers *Lucanus cervus* durch Vermeidung der vorzeitigen nichtnatürlichen Letalität und Bereitstellung von geeigneten Substraten in dem erfolgreichen Abschluß ihres Lebenszyklus mit der Eiablage nach der vollendeten Paarung mit einem oder mehreren Männchen zu unterstützen. In analoger Weise leistet jedes einzelne Männchen des Hirschkäfers *Lucanus cervus*, welches vor der vorzeitigen nichtnatürlichen Mortalität bewahrt oder gerettet wird und sein Lebensziel mit der erfolgreichen Weitergabe seiner Spermien an ein oder mehrere Weibchen zur Befruchtung ihrer Eier bei der Kopulation erreicht, einen wertvollen Beitrag zur Erhaltung der Population auch in der nachfolgenden Generation. Jeder einzelne Naturfreund, welcher an der konsequenten Umsetzung der verschiedenen vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* teilnimmt, trägt mit seiner engagierten Mithilfe erheblich dazu bei, die Ziele der Fauna-Flora-Habitat-Richtlinie der Europäischen Union auf möglichst breiter Basis zu erreichen und die herausgehobene Stellung des Hirschkäfers *Lucanus cervus* in der mitteleuropäischen Entomofauna auf Dauer sicherzustellen.

2.2 Literaturübersicht und Kontaktadressen der Schutzmaßnahmen

Übersichten und Erläuterungen verschiedener Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* sind auch in KLAUSNITZER (1982, 1995), HAWES (1998), SPRECHER-UEBERSAX (2001), BRECHTEL & KOSTENBADER (2002), KLAUSNITZER & WURST (2003); HACHTEL, SCHMIDT, CHMELA & BÖHME (2007); RINK (2007, 2009), KLAUSNITZER & SPRECHER-UEBERSAX (2008) und THOMAES (2009) enthalten. Zusammenstellungen von laufenden Erfassungsaktionen und Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* in verschiedenen Regionen in Deutschland und in anderen Ländern Europas finden sich im Internet unter den Adressen http://www.agnu-haan.de/hirschkaefer und http://maria.fremlin.de/stagbeetles. Die meisten Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* zielen auf die Erhaltung und Bereitstellung von vermorschtem, vermodertem, zersetztem und verfaulendem Holz von alten, kranken und abgestorbenen Eichen und anderen Bäumen als Substrate für die Ablage der Eier und die Entwicklung der Larven sowie das Angebot von Saftleckstellen an Eichen und anderen Bäumen, an denen natürliche und künstliche Beschädigungen der Rinde das Austreten von Saft ermöglicht haben und den Imagines an den blutenden Wunden Nahrungsquellen und Treff-

punkte bieten, wobei im Rahmen des naturnahen Waldbaus in möglichst weiter Verbreitung besonders ältere Bestände von Eichen und anderen Bäumen bis zum Erreichen der Alters-, Vermorschungs- und Zerfallsphase erhalten und der natürlichen Dynamik bis hin zu Absterben, Vermoderung, Zersetzung und Verfaulung überlassen werden sollen.

2.3 Überschlagsrechnung des minimalen Fortpflanzungserfolgs mit Risikoabschlägen

Die erhebliche Signifikanz der nachhaltigen und fortgesetzten Durchführung möglichst vieler der vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* wird auch durch eine Überschlagsrechnung des minimalen und maximalen Fortpflanzungserfolgs unter Einkalkulation von Risikoabschlägen verdeutlicht. Für die Überschlagsrechnung des minimalen Fortpflanzungserfolgs des Hirschkäfers *Lucanus cervus* habe ich ein Verlustrisiko von 50 % angesetzt, wohingegen ich für die Überschlagsrechnung des maximalen Fortpflanzungserfolgs ein Verlustrisiko von 30 % angenommen habe.

Aus den etwa 20 – 30 abgelegten Eiern eines Weibchens des Hirschkäfers *Lucanus cervus* kann unter Berücksichtigung eines Verlustrisikos von 50 % für den Fall des minimalen Fortpflanzungserfolgs mit dem Schlüpfen von etwa 10 – 15 Käfern in der nächsten Generation gerechnet werden, wovon etwa 6 – 10 Männchen und etwa 3 – 5 Weibchen sind. Nimmt man nochmals einen Risikoabschlag von 50 % für die Erbeutung durch Räuber und das Überfahren durch den Verkehr an, so bleiben etwa 3 – 5 Männchen und etwa 2 – 3 Weibchen übrig, welche zur Paarung gelangen. Unter nochmaliger Einkalkulation eines Verlustrisikos von 50 % während und nach der Kopulation bleiben nach der Paarung etwa 2 – 3 Männchen übrig, welche ihre Spermien anschließend noch an weitere ortsnahe oder ortsferne Weibchen weitergeben können, und bleiben nach der Paarung etwa 1 – 2 befruchtete Weibchen übrig, welche anschließend nochmals mit weiteren ortsnahen oder ortsfernen Männchen kopulieren können, und wenn am Ende nur ein Weibchen seine etwa 20 – 30 Eier erfolgreich ablegen kann, ist der Fortbestand eines Teils der Population in der nächsten Generation gesichert und der Kreislauf der Fortpflanzung ist erfolgreich abgeschlossen (MADER 2009b). Über die Dynamik von Migration und Austausch zwischen unterschiedlichen getrennten Populationen des Hirschkäfers *Lucanus cervus* sowie die genetische Durchmischung mehrerer separater Populationen infolge der Paarung von ortsnahen und ortsfernen Individuen haben RINK (2007) und RINK & SINSCH (2008) berichtet.

2.4 Überschlagsrechnung des maximalen Fortpflanzungserfolgs mit Risikoabschlägen

Optimistischere Prognosen des Fortpflanzungserfolgs sind möglich im Falle des Ansatzes eines geringeren Risikoabschlages und der Annahme des zusätzlichen Austausches von überwiegend Männchen und untergeordnet auch Weibchen zwischen diskreten Populationen des Hirschkäfers *Lucanus cervus*, welche in derartigen Entfernungen voneinander liegen, daß sie im Rahmen der Migration von Männchen und Weibchen durch Flug überbrückt werden können, wobei realistische Zahlen für den maximalen Fortpflanzungserfolg unter Berücksichtigung von 30 % Verlustrisiko und 10 – 25 % Austauschrate zwischen getrennten Populationen erreicht werden. Die Austauschrate zwischen separaten Populationen des Hirschkäfers *Lucanus cervus* ist jedoch nur schwer zu kalkulieren und wird deshalb in der nachfolgenden Überschlagsrechnung des maximalen Fortpflanzungserfolgs weggelassen, wodurch unter Einbeziehung der Austauschrate zwischen disjunkten Populationen zusätzlicher Spielraum für eine Verbesserung der Resultate entsteht.

Aus den etwa 20 – 30 abgelegten Eiern eines Weibchens des Hirschkäfers *Lucanus cervus* kann unter Berücksichtigung eines Verlustrisikos von 30 % für den Fall des maximalen Fortpflanzungs-

erfolgs mit dem Schlüpfen von etwa 13 – 20 Käfern in der nächsten Generation gerechnet werden, wovon etwa 8 – 13 Männchen und etwa 4 – 7 Weibchen sind. Nimmt man nochmals einen Risikoabschlag von 30 % für die Erbeutung durch Räuber und das Überfahren durch den Verkehr an, so bleiben etwa 6 – 8 Männchen und etwa 3 – 5 Weibchen übrig, welche zur Paarung gelangen. Unter nochmaliger Einkalkulation eines Verlustrisikos von 30 % während und nach der Kopulation bleiben nach der Paarung etwa 4 – 6 Männchen übrig, welche ihre Spermien anschließend noch an weitere ortsnahe oder ortsferne Weibchen weitergeben können, und bleiben nach der Paarung etwa 2 – 4 befruchtete Weibchen übrig, welche anschließend nochmals mit weiteren ortsnahen oder ortsfernen Männchen kopulieren können, und wenn am Ende nur etwa 1 – 3 Weibchen ihre jeweils etwa 20 – 30 Eier erfolgreich ablegen können, ist die Kontinuität eines Teils der Population in der folgenden Generation gewährleistet und der Zyklus der Reproduktion ist erfüllt und vollendet.

2.5 Fazit der Überschlagsrechnung des Fortpflanzungserfolgs mit Risikoabschlägen

Die vorstehende Überschlagsrechnung mit Risikoabschlägen aufgrund der Gefahr des Verlustes von Individuen des Hirschkäfers *Lucanus cervus* durch Prädatoren und im Verkehr soll jeden Naturfreund dazu motivieren, alles ihm mögliche zu tun, um mit den vorgeschlagenen Schutzmaßnahmen dem unter dem besonders strengen Naturschutz der europäischen Fauna-Flora-Habitat-Richtlinie stehenden Hirschkäfer *Lucanus cervus* umfassend und effektiv zu helfen, seinen Fortpflanzungszyklus erfolgreich abzuschließen und letztlich das natürliche Ende seines Lebenslaufes nach der vollendeten Paarung und Eiablage zu erreichen. Jeder engagierte Naturfreund kann durch seine individuelle Hilfestellung aufgrund der möglichst umfangreichen Anwendung der empfohlenen Schutzmaßnahmen einen wertvollen Beitrag zur Umsetzung des Naturschutzkonzeptes der Europäischen Union für den Hirschkäfer *Lucanus cervus* leisten, welcher in der europäischen Fauna-Flora-Habitat-Richtlinie zu den Insekten mit der höchsten Priorität des Schutzbedarfes und der Schutzwürdigkeit zählt. Die vielen kleindimensionalen lokalen Beiträge der zahlreichen Naturfreunde, welche jeder für sich die vorgeschlagenen Schutzmaßnahmen konsequent, regelmäßig und systematisch durchführen, ergeben gemeinsam einen bedeutenden großdimensionalen internationalen Effekt der Unterstützung und Absicherung der Lebens- und Fortpflanzungsbedingungen des Hirschkäfers *Lucanus cervus*.

3 Begrenzung der Verluste von Imagines durch Verkehr und Räuber

Die Schutzmaßnahmen für die Imagines des Hirschkäfers *Lucanus cervus* zur Begrenzung der Verluste durch Verkehr und Räuber umfassen den Transitservice an Wegen und Straßen am Waldrand, die zeitweise Sperrung von Wegen und Straßen am Waldrand für den Verkehr, und das Umdrehen auf dem Rücken liegender Männchen und Weibchen.

3.1 Transitservice an Wegen und Straßen am Waldrand

Die Weibchen des Hirschkäfers *Lucanus cervus* bewegen sich überwiegend laufend und nur untergeordnet auch fliegend fort, wohingegen die Männchen hauptsächlich fliegend und nur untergeordnet auch laufend unterwegs sind (Literaturübersicht in Mader 2009a). An den Wegen und Straßen am Waldrand überqueren vor allem die Weibchen und zuweilen auch die Männchen des Hirschkäfers *Lucanus cervus* häufig abends in der Dämmerung die Fahrbahnen am Boden meist vom anrainenden Waldrand aus in Richtung der angrenzenden Wiesen und Gärten sowie manchmal bis öfters auch in der Gegenrichtung auf den danebenliegenden Waldrand zu. Bei ihrer Überquerung

von Wegen und Straßen am Waldrand sind die laufenden Weibchen und Männchen des Hirschkäfers *Lucanus cervus* der Gefahr des Überrollens durch Fahrzeuge und des Zertretens durch Fußgänger ausgesetzt. Eine sehr hilfreiche Unterstützung für das Überleben der Weibchen und Männchen des Hirschkäfers *Lucanus cervus* wäre daher ein Transitservice für die laufenden Individuen an Wegen und Straßen am Waldrand abends in der Dämmerung während der gesamten Flugzeit von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder sogar Anfang August. Die laufenden Weibchen und Männchen des Hirschkäfers *Lucanus cervus* sollten dabei von den Wegen und Straßen aufgesammelt werden und entsprechend ihrer Laufrichtung neben den Wegen und Straßen entweder am angrenzenden Waldrand oder an den gegenüberliegenden Wiesen und Gärten in ausreichender Entfernung von den Fahrbahnen wieder abgesetzt werden.

Jeder Naturfreund, der einen Standort mit dem Erscheinen von zahlreichen Individuen des Hirschkäfers *Lucanus cervus* am Waldrand kennt, sollte möglichst täglich einen etwa 500 m langen Abschnitt des Weges oder der Straße am Waldrand abends in der Dämmerung mindestens von 20.30 Uhr bis 22 Uhr Mitteleuropäischer Sommerzeit systematisch abgehen und die auf der Fahrbahn angetroffenen laufenden Individuen des Hirschkäfers *Lucanus cervus* gemäß ihrer Orientierung neben den Weg oder die Straße in ausreichender Entfernung von der Fahrbahn umsetzen. Dieser Transitservice für die laufenden Individuen des Hirschkäfers *Lucanus cervus* ist vergleichbar mit dem vielerorts alljährlich praktizierten Hilfsdienst für die zahlreichen Exemplare der Erdkröte (*Bufo bufo*), des Bergmolches (*Triturus alpestris*), des Feuersalamanders (*Salamandra salamandra*) und anderer Amphibien, welche in der Laichzeit ebenfalls häufig Straßen und Wege an der Grenze von Wäldern und Wiesen überqueren, um zu ihren Laichgewässern zu gelangen, wobei deren Passage über die Fahrbahn durch einen manuellen Transitservice unter Einsatz vieler Helfer unterstützt und gesichert wird (entsprechende Aufrufe zur Beteiligung an dem alljährlich durchgeführten Hilfsdienst für die wandernden Amphibien während der Laichzeit werden regelmäßig in den regionalen Tageszeitungen veröffentlicht; u.a. Frenzel 2010, Rhein-Neckar-Zeitung 2010d).

Die Umsetzung der laufenden Individuen des Hirschkäfers *Lucanus cervus*, welche Wege und Straßen transversal überqueren, sollte stets in Laufrichtung erfolgen, wohingegen bei longitudinal entlang von Straßen und Wegen laufenden Exemplaren die Umsetzung an den näher gelegenen Rand der Fahrbahn durchgeführt werden sollte. In analoger Weise wird bei dem vielerorts alljährlich praktizierten Hilfsdienst für die vorgenannten Amphibien vorgegangen.

3.2 Zeitweise Sperrung von Wegen und Straßen am Waldrand für den Verkehr

Eine wirksame Unterstützung des Transitservices für die laufenden Weibchen und Männchen des Hirschkäfers *Lucanus cervus* wäre eine zeitweise Sperrung von besonders frequentierten Wegen und Straßen am Waldrand für den Verkehr während der Flugzeit, sofern eine derartige Schutzmaßnahme für den Hirschkäfer *Lucanus cervus* bei den örtlichen Behörden durchsetzbar wäre. Eine derartige zeitweise Sperrung von Wegen und Straßen am Waldrand für den Verkehr sollte während der gesamten Flugzeit des Hirschkäfers *Lucanus cervus* von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder sogar Anfang August möglichst täglich in der Zeit der Abenddämmerung mindestens von 20.30 Uhr bis 22 Uhr Mitteleuropäischer Sommerzeit erfolgen, und wäre eine einfache, angemessene und wirkungsvolle Ergänzung des systematischen Auf- und Abgehens eines etwa 500 m langen Abschnittes des Weges oder der Straße am Waldrand im Rahmen des Transitservices insbesondere dadurch, daß damit auch Beobachtungslücken während der regelmäßigen Patrouille der überwachten Strecke abgedeckt werden könnten.

Ich konnte sogar während meines Transitservices im Rahmen des regelmäßigen Auf- und Abgehens

einer ca. 500 m langen Strecke des asphaltierten Weges am Waldrand an dem von mir in 2008 während der Flugzeit allabendlich systematisch untersuchten Standort Tairnbach in mehreren Fällen nicht verhindern, daß einzelne Weibchen des Hirschkäfers *Lucanus cervus* gerade dann in einem Abschnitt des Weges von Radfahrern und Rollerfahrern überfahren wurden, während ich bei meiner Patrouille in einem anderen Abschnitt des Weges gewesen bin, wodurch die Bedeutung einer zeitweisen Sperrung des Weges zur Verbesserung der Effektivität des Transitservices unterstrichen wird.

Im Rahmen des vielerorts alljährlich praktizierten Hilfsdienstes für die zahlreichen Individuen der vorgenannten Amphibien wird der manuelle Transitservice durch viele Helfer regelmäßig durch Sperrungen von etlichen Straßen und Wegen in der Zeit von 19.30 Uhr bis 6.30 Uhr unterstützt, und an denjenigen Straßen, welche nicht völlig gesperrt werden können, werden zumindest erhebliche Geschwindigkeitsbeschränkungen angeordnet (entsprechende Informationen über gesperrte oder nur eingeschränkt befahrbare Straßen und Wege während der Laichzeit der wandernden Amphibien werden regelmäßig in den regionalen Tageszeitungen veröffentlicht; u.a. FRENZEL 2010, RHEIN-NECKAR-ZEITUNG 2010d). In entsprechender Weise sollte es deshalb auch möglich sein, in ausgewählten Abschnitten von Straßen und Wegen am Waldrand während der begrenzten Dauer der Flugzeit eine derartige Schutzmaßnahme für den unter dem besonders strengen Naturschutz der europäischen Fauna-Flora-Habitat-Richtlinie stehenden Hirschkäfer *Lucanus cervus* anzuordnen und durchzuführen, und damit einen wesentlichen Beitrag zur Umsetzung des Naturschutzkonzeptes der Europäischen Union für den Hirschkäfer *Lucanus cervus* zu leisten, welcher in der europäischen Fauna-Flora-Habitat-Richtlinie zu den Insekten mit der höchsten Priorität des Schutzbedarfes und der Schutzwürdigkeit zählt.

3.3 Umdrehen auf dem Rücken liegender Männchen und Weibchen

Die Männchen und Weibchen des Hirschkäfers *Lucanus cervus* sind offenbar besonders dann das Ziel der Angriffe und die leichte Beute von räuberischen Vögeln und Säugetieren (Literaturübersicht in MADER 2009a, 2010a), wenn sie aufgrund von Sturz, Ausrutscher oder Bruchlandung auf dem Rücken liegen, denn in der Dorsallage sind sie relativ wehrlos den Attacken von räuberischen Vögeln durch Schnabelpicken ausgesetzt. In der normalen Ventrallage sind die Männchen und Weibchen des Hirschkäfers *Lucanus cervus* uneingeschränkt mobil durch jederzeit möglichen Beginn von Laufen oder Fliegen, wohingegen sie in der Dorsallage aufgrund des plumpen Körpers häufig erst mit erheblicher Verzögerung die Flügel entfalten können und mit den Beinen an den Seiten keinen ausreichenden Halt zum Aufrichten finden, weil sie auf der konvexen Abdomendecke nicht ruhig liegen können, sondern bei lateralen Bewegungen schaukeln und rutschen. In der normalen Ventrallage können die Männchen des Hirschkäfers *Lucanus cervus* auch wesentlich kontrollierter und effektiver ihre Mandibeln als Waffen gegen angreifende räuberische Vögel einsetzen, weil sie sicher auf ihren Beinen stehen, und können daher oftmals die Attacken abwehren oder zumindest die Angreifer derart verwirren, daß sie von ihnen ablassen, wohingegen sie in der Dorsallage relativ hilflos auf den gewölbten Elytren wackeln und kippen, und deshalb weniger wirkungsvoll von ihren Mandibeln als Waffen gegen angreifende räuberische Vögel Gebrauch machen können. Eine weitere Gefährdung der auf dem Rücken liegenden Männchen und Weibchen des Hirschkäfers *Lucanus cervus* ergibt sich dadurch, daß besonders die Dorsallage den Totstellreflex oder die Thanatose auslöst, womit die scheinbar toten Individuen erst recht die leichte Beute räuberischer Vögel werden.

Deshalb sollte jeder Naturfreund, der ein Männchen oder Weibchen des Hirschkäfers *Lucanus cervus* auf dem Rücken liegend am Boden findet, dieses umdrehen und damit wieder in die uneingeschränkt bewegungsfähige Ventrallage zurückversetzen, um es der Gefährdung durch räuberische

Vögel zu entziehen. In der Dorsallage sind besonders die großen und schwerfälligen Männchen des Hirschkäfers *Lucanus cervus* nur sehr eingeschränkt bewegungsfähig und zappeln häufig längere Zeit hilflos mit den Beinen, und auch die Weibchen sind oftmals nicht fähig, sich aus eigener Kraft rasch aus der gefährlichen Dorsallage zu befreien. Jeder Naturfreund kann daher mit seiner Hilfe durch Umdrehen auf dem Rücken liegender Individuen des Hirschkäfers *Lucanus cervus* das Gefährdungspotential infolge möglicher Angriffe räuberischer Vögel reduzieren und damit auch zur Stabilisierung der bestehenden Population sowie zur Begründung und Sicherstellung des Fortbestandes der Population in der nächsten Generation beitragen.

Die Bedeutung der einfachen Schutzmaßnahme des Umdrehens auf dem Rücken liegender Individuen des Hirschkäfers *Lucanus cervus* wurde in 2009 durch eine außergewöhnlich zahlreiche Erbeutung von Männchen durch räuberische Vögel unterstrichen. In den ersten drei Maiwochen wurde mir von etlichen Naturfreunden das vereinzelte oder gehäufte Auftreten der geweihtragenden Männchen des Hirschkäfers *Lucanus cervus* von zahlreichen Orten berichtet, wobei in diesem Jahr leider besonders hohe Verluste durch Prädatoren zu beklagen waren. Die meisten der gefundenen Männchen des Hirschkäfers *Lucanus cervus* waren nur noch Reste der Mahlzeiten räuberischer Vögel (Übersicht in MADER 2009a, 2010a), welche den imposanten Männchen die Hinterleiber abgebissen hatten und nur noch Kopf-Brust-Torsi mit dem beeindruckenden Geweih als unverdauliche Reste übriggelassen hatten. Diese Bruchstücke von Männchen des Hirschkäfers *Lucanus cervus* haben in vielen Fällen nach der Amputation der Abdomina durch die räuberischen Vögel noch gelebt und haben viele Beobachter mit ihren geweihartigen Mandibeln kräftig in den Finger gezwickt. Am Standort Tairnbach südsüdöstlich Heidelberg habe ich bei meiner täglichen Kontrolle während der Abenddämmerung nicht nur wiederholt diesbezügliche Relikte von Männchen entdeckt, sondern ich habe dort häufig auch entsprechende Fragmente von Weibchen des Hirschkäfers *Lucanus cervus* gefunden. Leider sind diese Reste von Opfern der Attacken räuberischer Vögel aufgrund des Verlustes des Hinterleibes mit den Geschlechtsorganen für die Fortpflanzung und Populationserhaltung des Hirschkäfers *Lucanus cervus* verloren, selbst wenn sie nach dem Angriff und der Verstümmelung noch mehrere Tage weiterleben können. Durch diese Konstellation wird besonders eindrucksvoll unterstrichen, daß sich das Risiko der Entfernung aus dem Fortpflanzungszyklus infolge Erbeutung durch räuberische Vögel für jedes einzelne Weibchen und Männchen des Hirschkäfers *Lucanus cervus*, welches durch Umdrehen aus der gefährlichen Dorsallage befreit werden kann, beträchtlich reduziert, und daß deshalb die einfache Schutzmaßnahme des Umdrehens auf dem Rücken liegender Individuen eine erhebliche Unterstützung für den erfolgreichen Abschluß des Fortpflanzungszyklus mit der Vollendung von Paarung und Eiablage der Weibchen des Hirschkäfers *Lucanus cervus* bieten kann.

4 Verbesserung des Substratangebotes für die Entwicklung der Larven

Die Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* zur Verbesserung des Substratangebotes für die Entwicklung der Larven umfassen die Anlage von Komposthaufen und Totholzdeponien in Gärten und Streuobstwiesen, die ausreichend lange Lagerzeit von Komposthaufen und Totholzdeponien; das Stehenlassen von natürlichen Baumstümpfen und das Aufstellen von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern; die Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen, die Installation von Hirschkäferpflastern, und die Ausweisung von Bannwaldflächen.

4.1 Anlage von Komposthaufen und Totholzdeponien in Gärten und Streuobstwiesen

Larven des Hirschkäfers *Lucanus cervus* wurden nicht nur in den primären Substraten der Wurzel-

bereiche von alten, kranken und abgestorbenen Eichen und anderen Bäumen (Übersicht der als Substrate nachgewiesenen Holzarten in MADER 2009a, 2010a) in Wäldern, Streuobstwiesen und Gärten gefunden, sondern wurden häufig auch in sekundären Substraten in Gärten und Streuobstwiesen in der Nähe der Siedlungen des Menschen angetroffen, welche anthropogene Komposthaufen, Grünschnitthaufen, Rindenmulchhaufen, Sägespanhaufen, Holzhäckselhaufen, Blumenerdebehälter und Totholzdeponien umfassen (Zusammenstellung und Literaturübersicht in MADER 2009a). In den meisten der berichteten Fälle belegen die Funde von sowohl Imagines als auch Larven des Hirschkäfers *Lucanus cervus* am gleichen Ort zu gleichen oder unterschiedlichen Zeiten sowie das Fehlen von Imagines des Nashornkäfers *Oryctes nasicornis*, daß die beobachteten Larven dem Hirschkäfer *Lucanus cervus* zuzuordnen sind. In anderen Fällen bestätigen die Funde von sowohl Imagines als auch Larven des Nashornkäfers *Oryctes nasicornis* am gleichen Ort zu gleichen oder unterschiedlichen Zeiten sowie das Fehlen von Imagines des Hirschkäfers *Lucanus cervus*, daß die beobachteten Larven zum Nashornkäfer *Oryctes nasicornis* gehören.

Deshalb kann jeder einzelne Naturfreund die Entwicklungsmöglichkeiten der Larven des Hirschkäfers *Lucanus cervus* und des Nashornkäfers *Oryctes nasicornis* wesentlich durch die Anlage von Komposthaufen, anderen Bioabfallhaufen und Totholzdeponien in Gärten und Streuobstwiesen vorwiegend in Waldnähe begünstigen, denn dadurch werden wertvolle zusätzliche Substrate für die Ablage der Eier und das Heranreifen der Imagines während der mehrstufigen Metamorphose über die Stadien der Larven und Puppen geschaffen. Die Komposthaufen, anderen Bioabfallhaufen und Totholzdeponien in kultiviertem Gelände im Randbereich der Siedlungen des Menschen vorwiegend in Waldnähe sollten wegen des mehrjährigen Entwicklungszyklus der Larven des Hirschkäfers *Lucanus cervus* möglichst wenig und wenn, dann möglichst schonend umgesetzt werden. Die Stämme von gefällten Bäumen sowie die abgeschnittenen Äste und Zweige von Bäumen, Sträuchern und Büschen sollten zu dichten Grünschnitthaufen aufgeschichtet und liegengelassen werden, und die nach der Fällung der Bäume noch vorhandenen restlichen Stammstutzen sollten nicht ausgegraben werden, sondern im Boden belassen werden und stehenbleiben. Die Stämme von gefällten Bäumen sollten in möglichst meterlange Intervalle geteilt werden, und die geschnittenen und gespaltenen Stammstücke der gefällten Bäume sollten liegend zu Totholzstapeln aufgeschichtet werden oder stehend zu Totholzgruppen aufgestellt werden, welche möglichst lange ungestört verrotten und vermodern sollten. Äste und Zweige können alternativ auch geschreddert oder gehäckselt werden, wobei das Material dann ebenfalls zu Deponien angehäuft werden sollte.

Die vorgenannten Prozeduren sollten bei allen Holzarten durchgeführt werden, wobei Priorität der Aufschichtung von geteilten Stämmen, Ästen und Zweigen gegeben werden sollte und die Zerkleinerung zu Häcksel nur untergeordnet bis akzessorisch erfolgen sollte. Mit diesen einfachen Verfahren der naturschutzgerechten und insektenfreundlichen Entsorgung der anfallenden Bioabfälle in Gärten und Streuobstwiesen vorwiegend in Waldnähe kann jeder Naturfreund einen wesentlichen Beitrag zur Erhaltung und Verbreitung des Hirschkäfers *Lucanus cervus* leisten und dabei gleichzeitig auch die Entwicklungsmöglichkeiten für andere saproxylische oder xylobionte Käfer unterstützen, von denen besonders der Nashornkäfer *Oryctes nasicornis* ebenfalls verbreitet die diversen sekundären Substrate der anthropogenen Bioabfallhaufen besiedelt (Zusammenstellung und Literaturübersicht in MADER 2009a).

4.2 Bandbreite der als Substrate akzeptierten Totholzformen

Die Anlage von Totholzdeponien aus geschnittenen und gespaltenen Stücken von Stämmen sowie aus abgeschnittenen Ästen und Zweigen von Bäumen, Sträuchern und Büschen unterstützt die Erhaltung und Verbreitung des Hirschkäfers *Lucanus cervus* sowohl in Gärten und Streuobstwiesen als auch in Wäldern. Das Totholzspektrum in Gärten, Streuobstwiesen und Wäldern umfaßt stehen-

de Baumruinen, liegende Baumleichen und Astwerk (NOLTE, GEGINAT & WEIHRAUCH 1995; BÜTLER, LACHAT & SCHLAEPPER 2006), welche alle eine erhebliche Bedeutung als potentielle Substrate für saproxylische oder xylobionte Käfer und besonders für den Hirschkäfer *Lucanus cervus* haben. In der Totholzpalette in Gärten, Streuobstwiesen und Wäldern haben alle Holzarten eine wesentliche Signifikanz als potentielle Substrate für das Brutgeschäft der saproxylischen oder xylobionten Käfer.

In Totholz von überwiegend Eichen und untergeordnet auch anderen Holzarten wurden Larven des Hirschkäfers *Lucanus cervus* nicht nur in Teilen von Stämmen, Ästen und Wurzeln verschiedener Größe in Wäldern, Gärten und Streuobstwiesen gefunden, sondern wurden auch in Fachwerk von Häusern, Hütten und Scheunen; Eisenbahnschwellen, Prellböcken, Grubenholz, Pfosten, Zaunpfählen, Zaunlatten, Brettern, Palisaden und Holzrahmen angetroffen (Literaturübersicht in MADER 2009a), wodurch die Bandbreite der vom Hirschkäfer *Lucanus cervus* als Substrate akzeptierten Totholzformen illustriert wird und das Potential für die Unterstützung des Brutgeschäfts durch das Angebot unterschiedlicher Totholzarten beleuchtet wird.

4.3 Ausreichend lange Lagerzeit von Komposthaufen und Totholzdeponien

Bei allen vorgenannten sekundären Substraten in anthropogenen Bioabfallhaufen ist darauf zu achten, daß die Deponien lange genug liegen bleiben und wenn, dann nur schonend umgesetzt werden, damit sie nicht zu Larvenfallen werden, weil die durchschnittliche Entwicklungsdauer der Larven des Hirschkäfers *Lucanus cervus* mit 5 Jahren meist länger ist als die durchschnittliche Ruhezeit und Umschlagperiode der Bioabfallhaufen und deshalb bei einem vorzeitigen Umsetzen und Ausbringen des Kompostes und anderer menschlicher organischer Abfälle die darin befindlichen Larven des Hirschkäfers *Lucanus cervus* vernichtet würden, und gleiches gilt auch für Totholzanhäufungen. Auf die Gefahr, daß Rindenmulchhaufen und Komposthaufen von Sägewerken und Gärten durch vorzeitige Ausbringung und Verbrennung des Bioabfalls zu Larvenfallen werden, indem die darin enthaltenen Larven des Hirschkäfers *Lucanus cervus* aufgrund gegenüber dem Entwicklungszyklus verfrühter Umsetzung und Beseitigung vernichtet würden, hat besonders TOCHTERMANN (1987, 1992) hingewiesen, und die Problematik der oftmals zu kurzen Lagerzeit von Totholzanhäufungen hat SPRECHER-UEBERSAX (2001) unterstrichen.

Jeder Naturfreund kann deshalb durch ausreichend langes ungestörtes und ununterbrochenes Liegenlassen und aufgrund der mit zunehmender Lagerzeit fortschreitenden Verrottung gleichzeitig auch Reifenlassen der aufgeschichteten Komposthaufen, Grünschnitthaufen, Rindenmulchhaufen, Sägespanhaufen, Holzhäckselhaufen, Blumenerdebehälter und Totholzstapel in Gärten und Streuobstwiesen die ungestörte Entwicklung der darin befindlichen Larven des Hirschkäfers *Lucanus cervus* bis zum Stadium der Imago sicherstellen. Dieses Vorgehen gilt in gleicher Weise auch für den Nashornkäfer *Oryctes nasicornis*, welcher ebenfalls häufig die anthropogenen Bioabfallhaufen als Substrate für die Entwicklung seiner Larven akzeptiert, und für weitere saproxylische oder xylobionte Käfer.

Die Qualität des Totholzangebotes in Gärten, Streuobstwiesen und Wäldern steigt mit zunehmender Lagerzeit, wodurch das möglichst lange ungestörte und ununterbrochene Liegenlassen und Reifenlassen der Totholzansammlungen ein entscheidender Einflußfaktor auf den erfolgreichen Abschluß der Metamorphose der darin enthaltenen Larven des Hirschkäfers *Lucanus cervus* über das Zwischenstadium der Puppe zum Endstadium der Imago ist, welche aus dem Substrat hervorkommt und mit der Paarung den alten Entwicklungszyklus abschließt und gleichzeitig den neuen Entwicklungszyklus beginnt, in dem auch wieder von den möglichst lange ruhenden anthropogenen Bioabfallhaufen und Totholzanhäufungen als geeignete Substrate für die Eiablage Gebrauch gemacht werden kann.

4.4 Stehenlassen von natürlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern

Der Hirschkäfer *Lucanus cervus* verwendet als primäres und bevorzugtes Substrat für die Ablage der Eier und das Heranwachsen der Larven über mehrere Wachstumsetappen hauptsächlich zersetztes, vermorschtes, vermodertes und verfaulendes Holz überwiegend von Eichen, aber auch von zahlreichen anderen Bäumen und Sträuchern (Übersicht der als Substrate nachgewiesenen Holzarten in MADER 2009a, 2010a), und akzeptiert darüber hinaus als sekundäre und untergeordnete Substrate auch die vorgenannten diversen anthropogenen Bioabfallhaufen. Für die Eignung als Substrat für die Entwicklung des Hirschkäfers *Lucanus cervus* vom Ei über Larve und Puppe zur Imago im Rahmen der mehrstufigen Metamorphose ist der Zersetzungsgrad und die Zersetzungsgeschwindigkeit des Holzes von alten, kranken und abgestorbenen Bäumen sowie von gelagertem Totholz unabhängig von der Art des Holzes entscheidend, und bei einem günstigen Zersetzungsstadium stellt jeder Holztyp ein potentielles Substrat für die erfolgreiche Entwicklung des Hirschkäfers *Lucanus cervus* dar (RINK 2007). Verschiedene Eichenrotfäulepilze und Eichenweißfäulepilze, zu denen vor allem der Eichenwirrling *Daedalea quercina*, der Baumschwamm *Fomitopsis pinicola*, der Eichenfeuerschwamm *Phellinus robustus* und der Leberpilz *Fistulina hepatica* zählen, haben eine entscheidende aufbereitende Wirkung auf Eichentotholz, welches vom Hirschkäfer *Lucanus cervus* bevorzugt als Substrat für Eiablage und Larvenentwicklung genutzt wird (TOCHTERMANN 1992).

Daher kann jeder Naturfreund und Förster das Substratangebot für die Ablage der Eier und das Heranreifen der Imagines des Hirschkäfers *Lucanus cervus* während der mehrstufigen Metamorphose über die Stadien der Larven und Puppen wesentlich dadurch bereichern, in dem Fällungen von kranken und abgestorbenen Bäumen in Gärten, Streuobstwiesen und Wäldern naturschutzgerecht und insektenfreundlich vorgenommen werden. Die Stämme der Bäume sollten nicht unmittelbar über dem Boden, sondern am besten in mindestens 1 m Höhe über dem Boden oder besser noch in etwa 2 – 3 m Höhe über dem Boden abgesägt werden. Von den abgesägten Teilen der Bäume sollten die Stämme, Äste und Zweige in Gärten, Streuobstwiesen und Wäldern zu dichten Haufen aufgeschichtet und liegengelassen werden, und die restlichen Stammstutzen sollten nicht ausgegraben werden, sondern im Boden belassen werden und stehenbleiben. Äste und Zweige können alternativ auch geschreddert oder gehäckselt werden, wobei das Material dann ebenfalls zu Deponien angehäuft werden sollte. Die im Boden verbliebenen reliktischen Stammstümpfe können mit einem Kranz oder Kegel aus Häcksel umgeben werden. Die vorgenannten Prozeduren sollten bei allen Holzarten angewendet werden. Mit diesen einfachen Verfahren der naturschutzgerechten und insektenfreundlichen Fällung von kranken und abgestorbenen Bäumen in Gärten, Streuobstwiesen und Wäldern kann jeder Naturfreund und Förster einen maßgeblichen Beitrag zur Erhaltung der Verbreitung des Hirschkäfers *Lucanus cervus* leisten und kann erheblich dabei mithelfen, das Vorkommen des größten und bekanntesten Käfers in der einheimischen Insektenfauna zu sichern.

Fällungen von kranken und abgestorbenen Bäumen in Gärten, Streuobstwiesen und Wäldern sollten darüber hinaus auf ein Mindestmaß begrenzt werden, denn stehende vollständige Baumruinen und liegende komplette Baumleichen nach deren natürlichem Umstürzen und teilweise Zerbrechen haben ein wesentlich vielfältigeres Substratangebot für den Hirschkäfer *Lucanus cervus* und andere saproxylische oder xylobionte Käfer als residuale Stammstutzen im Boden und aufgeschichtete Totholzstapel, Grünschnitthaufen und Holzhäckselhaufen auf dem Boden nach der Fällung (Literaturübersicht zur Bedeutung des Stehenlassens von natürlichen Baumstümpfen und alten Bäumen in MADER 2009a). Insbesondere sollte von jedem einzelnen kranken und abgestorbenen Baum, bei dem eine zumindest teilweise Entfernung unvermeidlich ist, ein möglich umfangreicher reliktischer Stammstumpf als aufrechtes Baumdenkmal stehenbleiben und der holzbewohnenden Insektengilde als autochthones Substrat angeboten werden. Die in situ verbleibenden rudimentären Stammstrünke

können zur Anreicherung der Substratdiversifizierung mit einem Wall aus abgeschnittenen und geteilten allochthonen Stammstücken, Ästen und Zweigen umgeben werden.

Im Gegensatz zu kranken und abgestorbenen Bäumen sollten gesunde ältere Bäume überhaupt nicht gefällt werden, sondern stehengelassen werden, damit sie bis zum Erreichen der Alters-, Vermorschungs- und Zerfallsphase erhalten bleiben und der natürlichen Dynamik bis hin zu Absterben, Vermoderung, Zersetzung und Verfaulung überlassen werden. Gesunde ältere Bäume in Gärten von Häusern, welche vor Jahrzehnten als junge Setzlinge gepflanzt wurden und inzwischen eine derartige Größe und Höhe erreicht haben, daß sie das Dach des Hauses überragen oder die Terrasse und die Fenster weitgehend oder sogar fast völlig verschatten, sollten nach Möglichkeit nicht gefällt und entfernt werden, sondern sollten nur teilweise gekappt und zurückgeschnitten werden, damit besonders der Stamm und die dicken Äste nahe dem Stamm als intakter lebender Baum an Ort und Stelle verbleiben. In analoger Weise sollte bei gesunden älteren Bäumen in Alleen, Straßen, Plätzen und Parks vorgegangen werden. Diese Strategie sollte bei allen Holzarten angewendet werden.

4.5 Aufstellen von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern

In Ergänzung oder als Alternative zu dem Stehenlassen von natürlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern kann jeder Naturfreund und Förster die Palette der Substrate für die Ablage der Eier und die Entwicklung der Imagines des Hirschkäfers *Lucanus cervus* während der mehrphasigen Metamorphose über die Etappen der Larven und Puppen erheblich dadurch erweitern, indem er künstliche Baumstümpfe aufstellt. Diese künstlichen Baumstümpfe werden am besten aus vermorschten, zersetzten und verfaulenden Teilen von Stämmen konstruiert, welche im Wald gesammelt werden und dann in Gärten, Streuobstwiesen und Wäldern zu dicken Bündeln zusammengebunden werden und in den Boden eingegraben und aufrecht aufgestellt werden, wobei die Zwischenräume zwischen den einzelnen Stämmen im Basisbereich der künstlichen Baumstümpfe mit Humus, vermoderter Rindenstreu, zersetzter Blattstreu und/oder Nadelstreu, Häckselmaterial, Sägemehl oder Mulch ausgefüllt werden.

Die künstlichen Baumstümpfe werden vorzugsweise aus vermorschten, zersetzten und verfaulenden Teilen von Stämmen von Eichen errichtet, welche das bevorzugte Substrat des Hirschkäfers *Lucanus cervus* für die Ablage der Eier und die Entwicklung der Larven darstellen. Es sind aber ebenso auch alle anderen Holzarten für die Konstruktion der künstlichen Baumstümpfe geeignet, denn die Substratpalette des Hirschkäfers *Lucanus cervus* ist sehr breit gefächert, und die bisherigen Nachweise der Akzeptanz als Substrat für die Ablage der Eier aufgrund von Funden von Larven umfassen eine Vielzahl von Holzarten (Übersicht der als Substrate verifizierten Holzarten in MADER 2009a, 2010a). Mit dieser einfachen Methode des naturschutzgerechten und insektenfreundlichen Aufstellens von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern kann jeder Naturfreund und Förster einen wichtigen Beitrag zur Stabilisierung der Verbreitung des Hirschkäfers *Lucanus cervus* liefern und kann eine beträchtliche Unterstützung dabei gewähren, das Vorkommen des spektakulärsten und berühmtesten Käfers in der einheimischen Insektenfauna zu sichern. Analog wie für den Hirschkäfer *Lucanus cervus* gelten die vorgenannten Verfahren auch für den Nashornkäfer *Oryctes nasicornis* sowie für andere saproxylische oder xylobionte Käfer.

4.6 Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen

Die Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen wurde ursprünglich als Schutzmaß-

nahme für den Hirschkäfer *Lucanus cervus* im Wald entwickelt (TOCHTERMANN 1987, 1992, in HAMBERGER 2006), kann aber auch in Gärten, Streuobstwiesen und Parks durchgeführt werden. Seit der Konzeption und Publikation durch TOCHTERMANN (1987, 1992, in HAMBERGER 2006) wurden die klassischen Hirschkäfermeiler oder Hirschkäferwiegen in vielen Gebieten in Deutschland und in anderen Ländern Europas immer wieder installiert und sind schon seit langem als Standardaktion für den Schutz des Hirschkäfers *Lucanus cervus* akzeptiert. Zur Anlage der Hirschkäfermeiler oder Hirschkäferwiegen werden etwa meterlange vermoderte, verrottete oder angefaulte Stammstücke von Eichen mit einem Durchmesser ab etwa 30 cm in Pyramiden in etwa 30 – 50 cm Tiefe in den Boden eingegraben oder in eine Grube eingesetzt, und die Zwischenräume zwischen den zersetzten oder vermorschten Stammstücken von Eichen werden mit Häcksel aus Eichenrinde und Eichenkronen oder mit Sägespänen oder Sägemehl aus Eichenholz aufgefüllt. Anstelle von Eichenholz können auch alle anderen Holzarten verwendet werden, weil die Weibchen des Hirschkäfers *Lucanus cervus* ihre Eier nicht nur an Eichenholz, sondern auch an zahlreichen anderen Holzarten ablegen (Übersicht der als Substrate nachgewiesenen Holzarten in MADER 2009a, 2010a).

Die Hirschkäfermeiler oder Hirschkäferwiegen sollten im Abstand von etwa 3 – 5 Jahren mit Häcksel aus Eichenrinde und Eichenkronen oder mit Sägespänen oder Sägemehl aus Eichenholz ergänzt werden. Alternativ können auch stehengebliebene natürliche oder eingesetzte künstliche Baumstümpfe von Eichen und anderen Holzarten mit einem Kranz aus eingegrabenen vermoderten, verrotteten oder angefaulten Stammstücken von Eichen umgeben werden und mit einer Anhäufung von Häcksel aus Eichenrinde und Eichenkronen oder von Sägespänen oder Sägemehl aus Eichenholz versehen werden. Zur Optimierung des Fortpflanzungserfolgs sollten die Hirschkäfermeiler oder Hirschkäferwiegen im Wald gegen Schwarzwild, Dachs und Spechte sowie auch neugierige Wanderer und Sammler geschützt werden. In analoger Weise wie für den Hirschkäfer *Lucanus cervus* können Hirschkäfermeiler oder Hirschkäferwiegen sowie ähnliche Totholzaggregate auch geeignete zusätzliche Brutsubstrate für den Nashornkäfer *Oryctes nasicornis* sowie andere saproxylische oder xylobionte Käfer bereitstellen.

4.7 Installation von Hirschkäferpflastern

Von den Hirschkäfermeilern oder Hirschkäferwiegen abgeleitet sind die Hirschkäferpflaster (TOCHTERMANN 1987, 1992), bei denen Rollen, Scheiben oder Blöcke aus vermodertem, verrottetem oder angefaultem Eichenholz in den Boden eingegraben werden, so daß die Oberseiten der Rollen, Scheiben oder Blöcke aus zersetztem oder vermorschtem Eichenholz ein pflasterartiges Feld oder einen pflasterartigen Streifen mit einer Gesamtfläche von etwa 10 m² oder mehr an der Oberfläche bilden. Die Zwischenräume zwischen den Rollen, Scheiben oder Blöcken aus vermodertem, verrottetem oder angefaultem Eichenholz werden beim Eingraben ebenfalls mit Häcksel aus Eichenrinde und Eichenkronen oder mit Sägespänen oder Sägemehl aus Eichenholz bis kurz unter die Oberfläche aufgefüllt und anschließend bis zur Oberfläche mit Erde bedeckt. Derartige Hirschkäferpflaster oder Hirschkäferpfade wurden wiederholt in Freilandmuseen, Naturparks und Waldlehrwegen angelegt.

Neben dem Eingraben in den Boden ist in vielen Fällen auch schon das Aufstellen von Rollen, Scheiben oder Blöcken aus zersetztem oder vermorschtem Eichenholz in Gruppen oder Stapeln auf dem Boden in Gärten, Streuobstwiesen und Wäldern eine ausreichende Maßnahme zur Bereitstellung von Brutsubstraten für den Hirschkäfer *Lucanus cervus* (Beispiele haben OWEN 1992 und BOWDREY 1997 mitgeteilt). Als Alternative zu Eichenholz können auch alle anderen Holzarten eingesetzt werden, weil die Weibchen des Hirschkäfers *Lucanus cervus* ihre Eier nicht nur an Eichenholz, sondern auch an zahlreichen anderen Holzarten deponieren (Übersicht der als Substrate belegten Holz-

arten in MADER 2009a, 2010a). In analoger Weise wie für den Hirschkäfer *Lucanus cervus* gelten die vorgenannten Verfahren auch für den Nashornkäfer *Oryctes nasicornis* sowie für andere saproxylische oder xylobionte Käfer.

4.8 Ausweisung von Bannwaldflächen

Eine weitere bedeutende Unterstützung für die Erhaltung der vorhandenen Populationen des Hirschkäfers *Lucanus cervus* kann die Ausweisung von Bannwaldflächen besonders in stark gepflegten Waldregionen bewirken, weil sich in den nicht mehr bewirtschafteten und für die forstliche Nutzung aufgegebenen Waldgebieten wieder vermehrt Totholz ansammeln kann. In einigen Gebieten besteht ein Zusammenhang zwischen der Häufigkeit von Totholz in den Wäldern und der Häufigkeit des Auftretens des Hirschkäfers *Lucanus cervus*. In meinen Gesprächen mit vielen Naturfreunden habe ich erfahren, daß etliche von ihnen besonders eindrucksvoll und unvergeßlich das imposante und einprägende Erscheinen von zahlreichen Exemplaren des Hirschkäfers *Lucanus cervus* aus naturbelassenen Wäldern mit teilweise uraltem Baumbestand sowie mit etlichen stehenden Baumruinen und liegenden Baumleichen in Erinnerung haben, selbst wenn diese Begegnungen mit Individuen des Hirschkäfers *Lucanus cervus* in ungestörten Wäldern mit einem breiten Totholzspektrum und vielen sehr alten Bäumen schon mehrere Jahrzehnte oder sogar über ein halbes Jahrhundert zurückliegen.

5 Verbesserung des Nahrungsangebotes für die Versorgung der Imagines

Die Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* zur Verbesserung des Nahrungsangebotes für die Versorgung der Imagines umfassen das Angebot von Saftaustritten an Bäumen in Gärten und Streuobstwiesen, die Anpflanzung und Pflege von Kirschbäumen in Gärten und Streuobstwiesen, und die Herstellung und Auslage von Mischungen von Säften und Früchten.

5.1 Angebot von Saftaustritten an Bäumen in Gärten und Streuobstwiesen

Der Hirschkäfer *Lucanus cervus* nimmt als Nahrung im Stadium der Imago lediglich austretenden Saft an verletzten Bäumen und überreifen Früchten auf (Literaturübersicht in MADER 2009a) und versorgt sich dadurch mit zusätzlicher Energie über die körpereigenen Depots hinaus, wodurch der Verbrauch der eingelagerten Reserven hinausgezögert wird und damit nicht nur Kondition und Fitness verbessert werden, sondern möglicherweise auch die Lebensdauer der Imago verlängert werden kann, womit mehr Zeit und Kraft für die Erledigung der Ziele des Fortpflanzungszyklus zur Verfügung steht, welche die Befruchtung eines oder mehrerer Weibchen durch das Männchen und die Eiablage nach erfolgreicher Kopulation durch das Weibchen umfassen. Als Saftquellen bevorzugt der Hirschkäfer *Lucanus cervus* blutende Eichen, akzeptiert aber auch andere beschädigte Bäume mit ausfließendem Saft. Jeder Naturfreund, der einen Garten mit reichem Baumbestand oder eine Streuobstwiese in Waldnähe besitzt, kann daher den Hirschkäfer *Lucanus cervus* und andere saftsaugende Insekten in ihrer Nahrungsaufnahme zur Energieversorgung dadurch unterstützen, in dem er ein Angebot von künstlichen Saftaustritten an mehreren Bäumen zur Verfügung stellt, sofern nicht bereits an einigen Bäumen natürliche Saftquellen vorhanden sind. Natürliche Saftausflüsse an blutenden Bäumen in Gärten, Streuobstwiesen und Wäldern entstehen durch Rindenverletzungen, Pilzinfektionen, Insektenlarvenbefall, Frostrisse, Windbruch, Wasserreiser, Blitzschlag, Fällschäden, Fauläste (MÖLLER 1990, TOCHTERMANN 1992) oder auch durch die Beißtätigkeit der Weibchen des Hirschkäfers *Lucanus cervus* mit ihren kurzen kneifzangenartigen Mandibeln sowie manchmal vielleicht auch durch den Gebrauch der langen geweihartigen Mandibeln der Männchen.

Es sollten in einem Garten mit reichem Baumbestand oder in einer Streuobstwiese in Waldnähe vielleicht zwei oder drei Bäume ausgewählt werden, an denen während der Flugzeit des Hirschkäfers *Lucanus cervus* von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder sogar Anfang August durch Einschnitte, Einkerbungen oder Bohrungen in den Stamm künstliche Saftaustritte geschaffen werden. Diese anthropogen eröffneten Saftquellen sollten regelmäßig aufgefrischt werden, denn infolge der natürlichen Wundheilung versiegen die künstlich angelegten Saftaustritte häufig relativ rasch wieder. Ebenso können ältere natürliche Saftausblutungen bei Bedarf künstlich reaktiviert und erweitert werden. Durch das Angebot von natürlichen und künstlichen Saftausflüssen an blutenden Bäumen werden nicht nur Kondition, Fitness und Lebensdauer der Individuen des Hirschkäfers *Lucanus cervus* gefördert, in dem Nahrungsquellen für die Energieversorgung bereitgestellt werden, sondern es wird auch die Effektivität der Fortpflanzung begünstigt, denn die Saftaustrittsstellen an beschädigten Bäumen sind bevorzugte Treffpunkte der Geschlechter, Orte von Rivalenkämpfen und Plätze der Paarung. Um ein möglichst breites Spektrum abzudecken, sollten am besten zwei oder drei Bäume verschiedener Holzarten für die Erzeugung von künstlichen Saftaustritten ausgewählt werden. Die kohlenhydratreichen Baumsäfte geraten durch die Wirkung von Pilzen in Gärung, enthalten dann Alkohol und setzen auch Duftstoffe frei, wodurch die Anziehungskraft auf die Männchen und Weibchen des Hirschkäfers *Lucanus cervus* gesteigert wird und damit auch die Bedeutung der Saftleckstellen an beschädigten Bäumen als bevorzugte Lokalitäten von Kopulation und Rivalenkämpfen als Begleiteffekte des Treffens zahlreicher Individuen an den Nahrungsquellen zwecks Energieversorgung aufgewertet wird.

Die ausreichende Aufnahme von Nährstoffen an den Tankstellen der Saftaustritte an beschädigten Bäumen gewährleistet, daß die Männchen und Weibchen des Hirschkäfers *Lucanus cervus* aufgrund länger anhaltender Kondition und Fitness sowie möglicherweise auch verlängerter Lebensdauer mit einer höheren Wahrscheinlichkeit mit dem erfolgreichen Abschluß von Kopulation und Eiablage die Ziele ihres Lebenszyklus erreichen können und dadurch den Fortbestand der Population in der nächsten Generation begründen und sicherstellen können. Jeder Naturfreund kann deshalb auch durch die Bereitstellung von künstlichen Saftquellen durch Einschnitte, Einkerbungen oder Bohrungen in den Stamm von mehreren ausgewählten Bäumen unterschiedlicher Holzarten in Gärten und Streuobstwiesen einen wesentlichen Beitrag zur erfolgreichen Beendigung des Lebenszyklus der Individuen der bestehenden Generation des Hirschkäfers *Lucanus cervus* leisten und damit eine erhebliche Unterstützung für die Erhaltung der Population in der nachfolgenden Generation liefern.

5.2 Anpflanzung und Pflege von Kirschbäumen in Gärten und Streuobstwiesen

Weil die Kirschen in der Flugzeit des Hirschkäfers *Lucanus cervus* reifen, lecken besonders die Männchen und gelegentlich auch die Weibchen des Hirschkäfers *Lucanus cervus* auch häufig Saft an abgefallenen, geplatzten und überreifen Kirschen, und außer an Kirschen wurden Exemplare des Hirschkäfers *Lucanus cervus* auch an Birnen, Zwetschgen, Pfirsichen, Aprikosen, Trauben und Himbeeren beobachtet (Literaturübersicht in MADER 2009a). In Laborversuchen wurde belegt, daß die Männchen des Hirschkäfers *Lucanus cervus* mit ihren Mundwerkzeugen Kirschen im Laufe einiger Stunden vollkommen zerkleinern können (KRENN, PERNSTICH, MESSNER, HANNAPPEL & PAULUS 2002), und dazu paßt, daß in einigen ländlichen Gebieten der Hirschkäfer *Lucanus cervus* als Kirschenesser bekannt ist (COOPER in PRATT 2003). Individuen des Hirschkäfers *Lucanus cervus* wurden auch am ausfließenden Saft von Kirschbäumen und Apfelbäumen gefunden. Die Vorliebe des Hirschkäfers *Lucanus cervus* für Säfte nicht nur von blutenden Eichen, Kastanien und anderen Bäumen, sondern auch von reifen und überreifen Früchten in Gärten und Streuobstwiesen ist einer der Auslöser für das zunehmende Vordringen des größten und spektakulärsten Käfers in der mitteleuropäischen Insektenwelt aus dem Wald in die angrenzenden Siedlungen und besonders die Obst-

baumplantagen, und trägt daher wesentlich zur Entwicklung einer synanthropen Tendenz aufgrund der durch das Angebot von verschiedenen Säften induzierten Kulturfolge des Hirschkäfers *Lucanus cervus* bei.

Deshalb kann jeder Naturfreund über das Angebot von Saftaustritten an Bäumen hinaus in Gärten und Streuobstwiesen zusätzliche Nahrungsquellen für den Hirschkäfer *Lucanus cervus* dadurch bereithalten und beschaffen, in dem er vorhandene Kirschbäume pflegt und bei Bedarf neue Kirschbäume anpflanzt. Die heruntergefallenen überreifen Kirschen sollten nicht vollständig entfernt, sondern teilweise liegengelassen werden, denn besonders der Saft der überreifen Kirschen lockt Individuen des Hirschkäfers *Lucanus cervus* an. Bei der Ernte sollten deshalb die reifen Kirschen nicht vollständig abgepflückt werden, sondern es sollte ein Teil der reifen Früchte so lange am Baum verbleiben, bis sie überreif werden und von alleine abfallen. In analoger Weise sollte bei allen anderen Obstbäumen verfahren werden. In den meisten Gärten und Streuobstwiesen sind bereits Kirschbäume verschiedener Sorten vorhanden, und damit ist dieses Segment des Nahrungsspektrums des Hirschkäfers *Lucanus cervus* bei entsprechender Pflege der Kirschbäume und insektenfreundlicher Ernte der reifen Früchte ausreichend abgedeckt.

In denjenigen Gärten und Streuobstwiesen, in denen bisher Kirschbäume fehlen, sollte jeder Naturfreund zwei oder drei Kirschbäume anpflanzen, wobei besonders weichfleischige, dickfruchtige und saftreiche Kirschen verschiedener Sorten ausgewählt werden sollten, denn hartfleischige, dünnfruchtige und saftarme Kirschen platzen erst sehr spät oder gar nicht beim Erreichen des Stadiums der Überreife und stellen wesentlich weniger Saft als Nahrungsangebot für den Hirschkäfer *Lucanus cervus* zur Verfügung als weichfleischige, dickfruchtige und saftreiche Kirschen, von denen etliche schon sehr früh platzen. Es sollten möglichst vorwiegend frühreife Kirschsorten für die zusätzliche Anpflanzung ausgewählt werden, welche bereits zur Hauptzeit der Aktivität des Hirschkäfers *Lucanus cervus* etwa Anfang bis Mitte Juni reif sind und damit von dem überwiegenden Teil der Exemplare der Population als Nahrungsquelle benutzt werden können, wohingegen spätreife Kirschsorten, welche erst Ende Juni oder Anfang bis Mitte Juli reif sind, ihren Saft erst nach dem Höhepunkt der Aktivität des Hirschkäfers *Lucanus cervus* bereitstellen können und deshalb nur noch von einem untergeordneten Teil der Individuen der Population als Nahrungsquelle verwendet werden können. In analoger Weise wie bei den Kirschbäumen sollte besonders bei den Zwetschgenbäumen, Mirabellenbäumen und Pfirsichbäumen sowie auch bei allen anderen Obstbäumen vorgegangen werden.

Bezüglich des Reifeverhaltens der Früchte sollten vorwiegend solche Kirschsorten für die zusätzliche Anpflanzung ausgewählt werden, bei denen die Kirschen ähnlich wie die Zwetschgen und Mirabellen beim Erreichen des Stadiums der Überreife sich vom Stiel lösen, vom Baum herabfallen und sich unter dem Baum zu Fruchtteppichen oder Obststreu ansammeln, wohingegen andere Kirschsorten, bei denen sich die Kirschen beim Erreichen des Stadiums der Überreife nicht vom Stiel lösen, sondern am Stiel verbleiben und dort verdorren, vertrocknen, verschrumpfen oder verfaulen, für die ergänzende Anpflanzung nicht berücksichtigt werden sollten.

5.3 Herstellung und Auslage von Mischungen von Säften und Früchten

Neben den natürlich reifen und überreifen Kirschen und anderen Früchten von Obstbäumen aller Art kann jeder Naturfreund das Nahrungsangebot für den Hirschkäfer *Lucanus cervus* in Gärten und Streuobstwiesen auch durch Herstellung und Auslage von künstlichen Mischungen von Säften, Früchten, Honig, Wein, Bier und Zuckerwasser erweitern. Ein vielfältiges Spektrum von natürlich reifen und überreifen Kirschen und anderen Früchten von Obstbäumen aller Art sowie von künstlich hergestellten und ausgelegten Mischungen von Säften, Früchten, Honig, Wein, Bier und

Zuckerwasser in Gärten und Streuobstwiesen kann eine bedeutende Unterstützung der erfolgreichen Fortpflanzung des Hirschkäfers *Lucanus cervus* dadurch bewirken, daß das in vielen Gebieten lediglich begrenzte Angebot an natürlichen und künstlichen Saftleckstellen an Bäumen unterschiedlicher Holzarten durch die diversifizierte Erweiterung der Palette der Nahrungsquellen wesentlich verbessert werden kann und damit zahlreichen Individuen des Hirschkäfers *Lucanus cervus* die unproblematische Versorgung mit Nährstoffen ermöglicht, mit denen sie aufgrund länger anhaltender Kondition und Fitness sowie möglicherweise auch verlängerter Lebensdauer mit einer höheren Wahrscheinlichkeit mit dem erfolgreichen Abschluß von Kopulation und Eiablage die Ziele ihres Lebenszyklus erreichen können und dadurch den Fortbestand der Population in der nächsten Generation begründen und sicherstellen können.

Jeder Naturfreund kann deshalb auch durch die Bereitstellung einer breiten Palette von natürlich reifen und überreifen Kirschen und anderen Früchten von Obstbäumen aller Art sowie von künstlich hergestellten Mischungen von Säften, Früchten, Honig, Wein, Bier und Zuckerwasser in Gärten und Streuobstwiesen einen wesentlichen Beitrag zur erfolgreichen Beendigung des Lebenszyklus der Individuen der bestehenden Generation des Hirschkäfers *Lucanus cervus* leisten und mit dieser Schutzmaßnahme eine erhebliche Unterstützung für die Erhaltung der Population in der nachfolgenden Generation liefern.

6 Begrenzung der Verluste von Imagines bei Gartengestaltung und Gartenpflege

Die Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* zur Begrenzung der Verluste von Imagines bei Gartengestaltung und Gartenpflege in privaten und öffentlichen Bereichen umfassen die Abdeckung und Kontrolle von Wasserbehältern in Gärten und Parks, und die Überprüfung von Rasenflächen vor dem Mähen.

6.1 Abdeckung und Kontrolle von Wasserbehältern in Gärten und Parks

Einzelne Individuen des Hirschkäfers *Lucanus cervus* wurden immer wieder in Regenwassertonnen, Zierteichen, Schwimmpools, Plantschbecken, Aquarien, Brunnen, Vasen, Töpfen, Gießkannen, Eimern, Schüsseln, Fässern, Zisternen, Schläuchen und anderen Wasserbehältern in Gärten, Streuobstwiesen und Parks sowie auch in Angelweihern, Fischzuchtbecken, Vogelteichen, Badeseen, Waldtümpeln, Wiesensümpfen, Grubenlöchern, großen Regenwasserpfützen und abgeschnittenen Altarmen von Flüssen und Bächen angetroffen, wo sie ins Wasser gefallen waren und sich nicht mehr selbst befreien konnten.

Jeder Naturfreund kann deshalb einen wichtigen Beitrag zur Begrenzung oder Vermeidung von Verlusten von Imagines durch Ertrinken leisten, in dem die Wasserbehälter in den Gärten und Parks während der Flugzeit des Hirschkäfers *Lucanus cervus* von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder sogar Anfang August mit Planen, engmaschigen Netzen, Brettern oder Deckeln verschlossen werden, und zusätzlich auch noch möglichst täglich kontrolliert werden.

Ins Wasser gefallene Individuen des Hirschkäfers *Lucanus cervus* sollten herausgenommen werden und an einen geschützten Ort gesetzt werden, auch wenn sie tot erscheinen, denn sie können manchmal tagelang im Wasser überleben und benötigen dann oft mehrere Stunden zur Erholung. In die regelmäßige Kontrolle von Wasserbehältern in Gärten sollten auch die Abflüsse an den unteren Enden der Außenkellertreppen der Häuser und die Pumpensümpfe in den Waschräumen in den Kellern der Häuser einbezogen werden, denn dort werden ebenfalls immer wieder Exemplare des Hirschkäfers *Lucanus cervus* entdeckt.

6.2 Überprüfung von Rasenflächen vor dem Mähen

In Gärten und Parks in London sowie auf Grünflächen in anderen Orten Englands wurden etliche Exemplare des Hirschkäfers *Lucanus cervus* beim Rasenmähen getötet (LANGTON 1967, NAPIER 1999, JONES 2001, SMITH 2003). Jeder Naturfreund sollte daher in Gärten und Streuobstwiesen vor dem Rasenmähen die Grasflächen auf eventuell dort sitzende und laufende Individuen des Hirschkäfers *Lucanus cervus* überprüfen, und sollte dort gefundene Exemplare in andere Teile der Gärten und Streuobstwiesen umsetzen, damit sie beim Rasenmähen nicht verletzt oder getötet werden. Die Kontrolle auf versteckte Exemplare des Hirschkäfers *Lucanus cervus* vor Beginn der Arbeiten ist besonders wichtig bei großflächigen Rasenanlagen, welche mit fahrbaren motorbetriebenen Mähgeräten geschnitten werden, ist aber genauso bedeutend bei kleineren Rasenstücken, welche mit geschobenen mechanischen oder motorbetriebenen Mähgeräten geschnitten werden.

Jeder Naturfreund kann deshalb durch die Überprüfung von Rasenflächen vor dem Mähen sowie die Abdeckung und Kontrolle von Wasserbehältern wichtige Beiträge zur Begrenzung oder Vermeidung von Verlusten von Imagines des Hirschkäfers *Lucanus cervus* durch Gartengestaltung und Gartenpflege leisten.

7 Teilnahme an der Information und Mobilisierung der Öffentlichkeit zur Mitarbeit an den Schutzmaßnahmen

Die Bedeutung der Unterstützung der Durchführung der Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* durch die Teilnahme an der Information und Mobilisierung der Öffentlichkeit zur Mitarbeit an den Schutzmaßnahmen wird anhand von Multiplikation durch Sensibilisierung von weiteren Naturfreunden, zeitnahe Veröffentlichung von Aufrufen zur Mitarbeit an den Schutzmaßnahmen in regionalen Tageszeitungen, regelmäßige Meldung von Beobachtungen zur zentralen Auswertung, Engagement gegen chemische Maikäferbekämpfungsaktionen, und rechtzeitige Publikation von Forschungsergebnissen erläutert.

7.1 Multiplikation durch Sensibilisierung von weiteren Naturfreunden

Jeder Naturfreund kann ohne zusätzlichen Aufwand einen ganz besonders wichtigen und herausragend empfehlenswerten Beitrag zum Schutz des Hirschkäfers *Lucanus cervus* und anderer vorwiegend holzbewohnender Insekten dadurch leisten, in dem er als Multiplikator auftritt und möglichst viele weitere Naturfreunde für die erhebliche Bedeutung der konsequenten Durchführung der vorgenannten Schutzmaßnahmen in ihrem Bereich sensibilisiert sowie auch dazu anregt, ihre Funde und Beobachtungen des Hirschkäfers *Lucanus cervus* an mich für den Raum um Heidelberg und Mannheim oder an andere Stellen in anderen Gebieten zur zentralen Auswertung zu melden. Jeder Naturfreund kann die Anwendung der vorgenannten Schutzmaßnahmen und die Registrierung der Vorkommen des Hirschkäfers *Lucanus cervus* wesentlich dadurch multiplizieren, in dem er kategorisch und insistierend in seinem näheren und weiteren Umfeld fortgesetzte und wiederholte Überzeugungsarbeit leistet und Familienmitglieder, Nachbarn, Verwandte, Freunde, Bekannte, Arbeitskollegen, Geschäftspartner, Amtsträger, Behördensachbearbeiter, Vereinskameraden, Studienkommilitonen, Urlaubsgäste und weitere Personen auf die Problematik hinweist und für die engagierte Teilnahme an der Umsetzung der vorgenannten Schutzmaßnahmen sowie an der Aufnahme und Meldung der Funde und Beobachtungen des Hirschkäfers *Lucanus cervus* gewinnt. Es wäre auch sehr wünschenswert, wenn jeder Naturfreund in seinem Umfeld alle an dem Hirschkäfer *Lucanus cervus* näher interessierten Personen aus vorgenannten Kreisen auf mein Buch (MADER

2009a) aufmerksam machen würde und ihnen die Unterstützung meiner Naturschutzarbeit für den Hirschkäfer *Lucanus cervus* durch die Bestellung eines Exemplares meines Buches bei mir empfehlen würde.

Die Sensibilisierung des Umfeldes für die Ziele der unterschiedlichen Schutzmaßnahmen beinhaltet auch die Überzeugung des vorgenannten Personenkreises von dem Schutzbedarf und der Schutzwürdigkeit des Hirschkäfers *Lucanus cervus* als dem bekanntesten und spektakulärsten Käfer in der einheimischen Insektenfauna vor allem dahingehend, daß jedes einzelne Weibchen, welches durch die diversen Schutzmaßnahmen vor der Gefahr der vorzeitigen nichtnatürlichen Mortalität gerettet wird und damit die Chance hat, nach erfolgreicher Kopulation und Oviposition das natürliche Ende seines Lebens zu erreichen, für sich allein die Fähigkeit hat, mit seiner Eiablage die Erhaltung der Population auch in der nächsten Generation zu sicherzustellen, und daß auch jedes einzelne Männchen, welches durch die vielfältigen Schutzmaßnahmen vor dem Risiko der prämaturen nichtnatürlichen Letalität bewahrt wird und damit die Gelegenheit hat, sein Lebensziel mit der erfolgreichen Weitergabe seiner Spermien an ein oder mehrere Weibchen bei der Paarung zur Befruchtung ihrer Eier zu erreichen, ebenfalls wertvolle Beiträge zur Erhaltung der Population auch in der nächsten Generation leistet. Jeder Naturfreund kann deshalb in signifikanter Weise die konsequente Anwendung der unterschiedlichen Schutzmaßnahmen auch dadurch fördern, in dem er bei möglichst vielen Personen in seinem Umfeld durch umfassende Information das Verständnis besonders dafür erreicht, daß jedes fahrlässig oder vorsätzlich getötete Weibchen des Hirschkäfers *Lucanus cervus* den Verlust von etwa 20 – 30 abgelegten Eiern und damit auch von etwa 20 – 30 potentiellen Individuen in der nächsten Generation bedeutet (HAWES 2006). Vorstehendes Argument sollte von jedem Naturfreund insbesondere dazu verwendet werden, damit durch ausreichendes Wissen und durch optimale Akzeptanz der Bedeutung der diversen Schutzmaßnahmen bei möglichst vielen Personen in seinem Umfeld weitgehend oder sogar fast vollständig vermieden wird, daß trotz der schon seit längerer Zeit deutlich zurückgegangenen Verbreitung des Hirschkäfers *Lucanus cervus* auch heute immer noch gelegentlich Individuen aus Faszination, Neugier, Leidenschaft, Sammeltrieb, Furcht, Experimentierlust, Unkenntnis und Unverständnis von Kindern, Jugendlichen und Erwachsenen gefangen und getötet werden (Übersicht der Rolle des Menschen als nichtnatürlicher Mortalitätsfaktor des Hirschkäfers *Lucanus cervus* in MADER 2009a*)*.

Zu dieser Sensibilisierung des Umfeldes zählt auch gegebenenfalls die Intervention bei erkennbar den Zielen der vorgenannten Schutzmaßnahmen entgegenlaufenden Aktionen in dem vorbezeichneten Personenkreis, um durch Überzeugung und Unterbreitung von Alternativvorschlägen möglicherweise für den Hirschkäfer *Lucanus cervus* und ebenso andere vorwiegend holzbewohnende Insekten schädliche Eingriffe teilweise abzuschwächen oder sogar völlig abzuwenden. Eine Intervention sollte vor allem dann erfolgen, wenn in dem Umfeld des Naturfreundes die Fällung und restlose Entfernung von alten, kranken und abgestorbenen Bäumen in Gärten, Streuobstwiesen, Parkanlagen, Alleen, Straßen und Plätzen erkennbar bevorsteht oder in Waldgebieten, Parkanlagen und Obstbaumplantagen übertriebene Pflegemaßnahmen durchgeführt werden. Einspruch sollte auch erhoben werden, falls in dem Wohnort des Naturfreundes und in dessen Umgebung neue Baugebiete oder Straßen geplant oder ausgewiesen werden, die auf Kosten von kleineren oder größeren Waldflächen gehen sollen, welche für die Erschließung des Baulandes und der Straßentrassen gerodet werden müßten, ohne daß gleichzeitig entsprechend angemessene Ausgleichsmaßnahmen durchgeführt werden und sowohl qualitativ als auch quantitativ ausreichende Ersatzstandorte als kompensatorische Substratangebote für den Hirschkäfer *Lucanus cervus* eingerichtet werden. Ein Beispiel einer zur Schadensbegrenzung sorgfältig geplanten und realisierten Substitutionsaktion mit der erfolgreichen Umsetzung zahlreicher Baumstümpfe mit Larven des Hirschkäfers *Lucanus cervus* an Ersatzstandorte vor dem Beginn der Rodung von Waldflächen nach dem Eintritt der Rechtskraft der finalen Entscheidung der abschließenden Gerichtsinstanz haben EBERT & MÜLLER-PFANNENSTIEL (2008) dokumentiert. Andererseits werden leider auch heute immer noch erhebliche Wald-

flächen für Baumaßnahmen gerodet, ohne daß parallel dazu entsprechend ausreichende Kompensationsaktionen für den Verlust des Lebensraumes des Hirschkäfers *Lucanus cervus* und anderer geschützter Arten erfolgen (über einen aktuellen Fall aus der Umgebung von Heidelberg hat RHEIN-NECKAR-ZEITUNG 2009d, 2010e berichtet). Schließlich sollte unbedingt durch massiven und wiederholten Protest bei den verantwortlichen Stellen und Information der Öffentlichkeit durch Meldungen und Beiträge in lokalen Mitteilungsblättern und regionalen Tageszeitungen eingegriffen werden, wenn erneut Insektenbekämpfungsaktionen unter Einsatz chemischer Mittel geplant sind (2010 wird in Südhessen und Mittelbaden ein Massenauftreten des Maikäfers *Melolontha* erwartet; RHEIN-NECKAR-ZEITUNG 2009e, 2010a, 2010b, 2010c, 2010f, 2010g).

7.2 Zeitnahe Veröffentlichung von Aufrufen zur Mitarbeit an den Schutzmaßnahmen in regionalen Tageszeitungen

Im Rahmen der Multiplikation durch Sensibilisierung von weiteren Naturfreunden für die Teilnahme und Empfehlung der Durchführung der vorgeschlagenen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* wäre es auch wünschenswert, wenn entsprechende Aufrufe zur Mitarbeit an der Umsetzung der konzipierten Schutzmaßnahmen sowie zur Mitteilung von Beobachtungen und Funden des Hirschkäfers *Lucanus cervus* für die zentrale Auswertung nach deren Einreichung und Vorlage bei den Redaktionen der regionalen Tageszeitungen auch zeitnah veröffentlicht werden würden. Ich habe im Raum um Heidelberg und Mannheim durch die Publikation einer Reihe von Notizen in mehreren regionalen Tageszeitungen (RHEIN-NECKAR-ZEITUNG 2008a, 2008b, 2008c, 2008d, 2009a, 2009b, 2009c; SCHWETZINGER ZEITUNG 2008, BRUCHSALER RUNDSCHAU 2008; MANNHEIMER MORGEN 2009a, 2009b; WEINHEIMER NACHRICHTEN 2009) einen breiten Personenkreis für die Aufmerksamkeit des Vorkommens und die Meldung von Beobachtungen und Funden des Hirschkäfers *Lucanus cervus* ansprechen und gewinnen können, und die erfolgreiche Erstellung und rasche Drucklegung meines Buches über den Hirschkäfer *Lucanus cervus* (MADER 2009a) beruht zu einem erheblichen Anteil auf dem zügigen Eingang zahlreicher Registrierungen von Nachweisen an einer Fülle von Standorten in dem genannten Gebiet durch viele Naturfreunde als Reaktion auf den Abdruck der Beiträge in den erwähnten regionalen Tageszeitungen.

Ich würde mich daher sehr freuen, wenn jeder für den Naturschutz im Allgemeinen und für den Naturschutz des Hirschkäfers *Lucanus cervus* im Speziellen aufgeschlossene Redakteur der entsprechenden regionalen Tageszeitungen sich dazu entschließen könnte, aktuelle Informationen über die Populationsdynamik, den Schutzbedarf und die Schutzwürdigkeit des Hirschkäfers *Lucanus cervus* aus erster Hand nach deren Eingang in der Redaktion durch baldmöglichste Veröffentlichung auch den Lesern des Printmediums zur Verfügung zu stellen, und damit durch Multiplikation der frischen Nachrichten aus der laufenden Naturschutzarbeit ebenfalls einen wertvollen Beitrag zur Umsetzung der europäischen Naturschutzrichtlinie für den Hirschkäfer *Lucanus cervus* leisten würde. Der über meine ursprüngliche Erwartung beträchtlich hinausgegangene Erfolg der Mobilisierung zahlreicher Naturfreunde zur Mitteilung ihrer Beobachtungen und Funde des Hirschkäfers *Lucanus cervus* aufgrund der Publikation etlicher Notizen in mehreren regionalen Tageszeitungen und die daraus resultierende unerwartet umfangreiche Konzeption und rasche Fertigstellung meines Buches, in dem alle bis zum Redaktionsschluß eingegangenen Meldungen von Vorkommen des Hirschkäfers *Lucanus cervus* im Raum um Heidelberg und Mannheim enthalten und ausgewertet sind, sollte für jeden Redakteur der entsprechenden regionalen Tageszeitungen, welcher dem Naturschutz grundsätzlich positiv gegenübersteht und sich des signifikanten Potentials seiner eigenen Fördermöglichkeiten als Multiplikationsinitiator bewußt ist, Ansporn und Verpflichtung sein, auch in Zukunft durch zeitnahen Abdruck der eingereichten Beiträge zum Verhalten und Naturschutz des Hirschkäfers *Lucanus cervus* die Leser des Presseorgans laufend über den Schutzbedarf und die Schutzwürdigkeit zu informieren sowie zur Weitergabe ihrer Registrierungen und zu ihrer

Teilnahme an der Anwendung der empfohlenen Schutzmaßnahmen für den herausragenden, berühmtesten und spektakulärsten Käfer in der mitteleuropäischen Insektenfauna zu stimulieren.

7.3 Regelmäßige Meldung von Beobachtungen zur zentralen Auswertung

Jeder Naturfreund kann auch dadurch den Schutz des Hirschkäfers *Lucanus cervus* unterstützen, in dem er alle Funde und Beobachtungen des größten und bekanntesten mitteleuropäischen Käfers so genau wie möglich an mich für den Raum um Heidelberg und Mannheim oder an andere Stellen in anderen Gebieten zur zentralen Auswertung und Dokumentation durch Publikation meldet. Aus der regionalen Übersicht, welche auf einer möglichst breiten Datenbasis gründet, kann ich mit zunehmender Zahl der einzelnen Nachweise und mit steigender flächiger Verdichtung der zahlreichen Registrierungen mit größerer Sicherheit allgemeine Schlußfolgerungen ziehen und spezielle Schutzmaßnahmen empfehlen. Die Zusammenstellung meiner Studie der Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* (MADER 2009a) hat mir unerwartet eindrücklich aufgezeigt, daß jeder einzelne Fund und jede einzelne Beobachtung sehr wichtige Mosaiksteine für die umfassende Interpretation des Gesamtbildes der biogeographischen Verbreitung und das fundamentale Verständnis der Populationsdynamik und Ökologie des herausragenden, auffälligsten und berühmtesten Käfers in der einheimischen Insektenfauna darstellen, welche in der rasterförmigen Zusammenschau aller einzelnen Meldungen die Grundlage für die Konzeption der Schutzmaßnahmen bildet. Ich plane die Fortsetzung meiner Erforschung der Populationsdynamik und Ökologie des Hirschkäfers *Lucanus cervus* sowie die Promotion der Schutzmaßnahmen in den kommenden Jahren und würde mich sehr freuen, wenn alle Naturfreunde, welche mit ihren Mitteilungen über Funde und Beobachtungen des Hirschkäfers *Lucanus cervus* zum Gelingen meines Buches beigetragen haben, mir auch in den kommenden Jahren ihre Ergebnisse zur zentralen Auswertung und Veröffentlichung zur Verfügung stellen würden, und wenn auch alle Naturfreunde, welche sich bisher noch nicht bei mir gemeldet haben, mir in den folgenden Jahren ihre Nachweise des Hirschkäfers *Lucanus cervus* zur zusammenfassenden Analyse und Interpretation überlassen würden.

Berichte von Funden und Beobachtungen des Hirschkäfers *Lucanus cervus* im Raum um Heidelberg und Mannheim sowie in dessen Umgebung, welche ich etwa zwischen Worms im Norden und Karlsruhe im Süden sowie zwischen Neustadt an der Weinstraße im Westen und Heilbronn im Osten abgrenze, und die sich sowohl von Norden nach Süden als auch von Westen nach Osten über mehr als 100 km erstreckt, erbitte ich an mich (am besten per e-Mail: dr.detlef.mader@web.de). Kontaktadressen und Anlaufstellen für Meldungen von Funden und Beobachtungen des Hirschkäfers *Lucanus cervus* in anderen Gebieten in Deutschland und in anderen Ländern Europas sowie Informationen über Vorkommen und Lebensweise finden sich im Internet unter den Adressen http://www.agnu-haan.de/hirschkaefer und http://maria.fremlin.de/stagbeetles.

Jeder Naturfreund, der an weiteren Einzelheiten von laufender Forschung und Schutz des Hirschkäfers *Lucanus cervus* interessiert ist und der aktiv an der Arbeit an Schutz und Erfassung des Hirschkäfers *Lucanus cervus* teilnehmen möchte, sollte auch erwägen, der European Stag Beetle Group beizutreten, welche eine internationale Arbeitsgruppe von Wissenschaftlern und Amateuren ist, die sich mit der Studie und Erforschung des Hirschkäfers *Lucanus cervus* und verwandten Arten befassen (Kontakt durch e-mail an: european-stag-beetle-group@googlegroups.com).

7.4 Mithilfe bei der Sammlung von Notizen aus Tageszeitungen

Ich würde mich auch sehr freuen, wenn möglichst viele Naturfreunde mir helfen würden, an entlegener Stelle veröffentlichte Meldungen von Funden und Beobachtungen des Hirschkäfers *Lucanus*

cervus zusammenzutragen und auszuwerten. Zu diesen abseits publizierten Berichten über das Auftreten des Hirschkäfers *Lucanus cervus* zählen vor allem Artikel in kleineren regionalen und überregionalen Fachzeitschriften außerhalb der Entomologie und ganz besonders Beiträge und Fotos mit Erläuterungen in regionalen und überregionalen Tageszeitungen, denn in diesen Printmedien ist die themengebundene oder stichwortorientierte Literaturrecherche vor allem in den älteren Jahrgängen jenseits der Periode der Digitalisierung und elektronischen Verfügbarkeit sehr schwierig und äußerst zeitaufwendig. Die Suche in den vorgenannten Presseorganen wird auch dadurch erschwert, daß darin enthaltene Berichte und Meldungen über den Hirschkäfer *Lucanus cervus* leider nur sehr selten oder gar nicht in zusammenfassenden Veröffentlichungen zitiert werden, wodurch Einstiegshilfen für die Quellenerschließung weitgehend fehlen.

Ich bin daher jedem Naturfreund, welcher zufällig Notizen über den Hirschkäfer *Lucanus cervus* in Tageszeitungen und Fachzeitschriften kennt oder sogar aus zurückliegenden Ausgaben ausgeschnitten hat, für Hinweise oder Kopien sehr dankbar, denn diese wertvollen Meldungen von aufmerksamen Beobachtern gehen leider häufig in den laufenden Metern der Archive verloren. Ich habe in meinem Buch (MADER 2009a) zahlreiche Notizen aus regionalen Tageszeitungen über den Hirschkäfer *Lucanus cervus* zusammengestellt und ausgewertet und konnte damit seine Verbreitung in etlichen Regionen, aus denen diesbezügliche Publikationen in wissenschaftlichen Periodika nicht vorliegen oder nur unzureichende Detaildaten enthalten, zumindest umreißen und skizzieren, und ich habe bei dieser Presseschau festgestellt, daß in den Berichten über das Vorkommen des Hirschkäfers *Lucanus cervus* in regionalen Tageszeitungen, welche sich oftmals auf Fotos mit Erläuterungen beschränken, gerade für die flächenmäßige faunistische Erfassung der Verbreitung unschätzbar wertvolle zitierfähige Nachweise enthalten sind, deren nahezu unauffindbares Verschwinden in den laufenden Metern der Archive sehr bedauerlich wäre.

7.5 Engagement gegen chemische Maikäferbekämpfungsaktionen

In 2008 und zurückliegenden Jahren wurden in Teilen der Oberrheinebene um Heidelberg und Mannheim wiederholt chemische Maikäferbekämpfungsaktionen durchgeführt, wobei Kontakt- und Fraßinsektizide von Hubschraubern und Schleppern aus auf die Bäume gesprüht werden, sobald die ersten Maikäfer *Melolontha* zwischen Mitte bis Ende April und Anfang bis Mitte Mai erschienen sind und mit der Paarung, Fortpflanzung und Eiablage beginnen. Die chemischen Maikäferbekämpfungsaktionen, welche bisher schon in etlichen Jahren in Teilen der Oberrheinebene um Heidelberg und Mannheim stattgefunden haben, zielen auf die Dezimierung und Begrenzung eines Teils der Bestände der beiden häufigsten Arten des Maikäfers, welche den Waldmaikäfer *Melolontha hippocastani* FABRICIUS 1801 und den Feldmaikäfer *Melolontha melolontha* LINNAEUS 1758 (Scarabaeidae) umfassen. Leider sind zu dem relativ frühen Zeitpunkt zwischen Mitte bis Ende April und Anfang bis Mitte Mai, an dem in der Regel mit der Durchführung der chemischen Maikäferbekämpfungsaktionen begonnen wird, auch schon die ersten Exemplare des Hirschkäfers *Lucanus cervus* aktiv, und es sind aus 2008 mehrere Beispiele bekanntgeworden, wie offensichtlich einige Populationen des Hirschkäfers *Lucanus cervus* massiv durch die großflächige Ausbringung des Vernichtungsmittels im Rahmen der chemischen Maikäferbekämpfungsaktionen geschädigt wurden, wobei aufgrund des relativ frühen Zeitpunktes besonders zahlreiche Männchen getötet wurden, welche dann als Kopulationspartner für die häufig erst später erscheinenden Weibchen fehlen, womit der Fortpflanzungserfolg des Hirschkäfers *Lucanus cervus* erheblich eingeschränkt oder sogar gefährdet wird (Zusammenstellung von Fällen der Dezimierung und Beeinträchtigung von Populationen des Hirschkäfers *Lucanus cervus* aufgrund von chemischen Maikäferbekämpfungsaktionen in MADER 2009a). Über die Vernichtung von zahlreichen Exemplaren des Hirschkäfers *Lucanus cervus* durch chemische Maikäferbekämpfungsaktionen hat auch WANNER (1954) berichtet (vgl. auch FRIESE 1956, FREUDE 1957).

Falls in den kommenden Jahren erneut derartige chemische Maikäferbekämpfungsaktionen geplant werden (2010 wird in Südhessen und Mittelbaden ein Massenauftreten des Maikäfers *Melolontha* erwartet; RHEIN-NECKAR-ZEITUNG 2009e, 2010a, 2010b, 2010c, 2010f, 2010g), bei denen durch die mögliche Vernichtung einer größeren Anzahl von Individuen des Hirschkäfers *Lucanus cervus* die Ziele des internationalen Naturschutzes massiv untergraben werden und sogar auf europäischer Ebene besonders geschützte Insekten in ihrem Bestand erheblich eingeschränkt und gefährdet werden, sollte jeder Naturfreund durch massive und wiederholte Intervention bei den verantwortlichen Stellen sowie durch Information der Öffentlichkeit aufgrund von Meldungen, Aufrufen und Notizen in örtlichen Mitteilungsblättern und regionalen Tageszeitungen versuchen, mit seinem persönlichen Beitrag mitzuhelfen, eventuell eine Reduzierung des Umfanges oder gar eine Absage der geplanten chemischen Maikäferbekämpfungsaktionen zu erreichen.

Der Hirschkäfer *Lucanus cervus* steht in Deutschland und in anderen Ländern Europas schon seit langer Zeit in der Gruppe der gefährdeten Insekten an vorderer Stelle und deshalb unter strengem Naturschutz (REICHSNATURSCHUTZGESETZ 1935, NATURSCHUTZVERORDNUNG 1936; BUNDESNATURSCHUTZGESETZ 1976, 1998; BUNDESARTENSCHUTZVERORDNUNG 1980, 1986, 1999; COUNCIL OF EUROPE 1982; FAUNA-FLORA-HABITAT-RICHTLINIE 1992, 1997), ist eine besonders geschützte Art gemäß BUNDESARTENSCHUTZVERORDNUNG (1980, 1986, 1999) und ist auch eine Art des Anhangs II der Fauna-Flora-Habitat-Richtlinie der Europäischen Union, welcher Arten von gemeinschaftlichem Interesse enthält, für deren Erhaltung europaweit besondere Schutzgebiete ausgewiesen werden müssen und spezielle Schutzmaßnahmen zu ergreifen sind (FAUNA-FLORA-HABITAT-RICHTLINIE 1992, 1997). Der Hirschkäfer *Lucanus cervus* ist auch in der Roten Liste der gefährdeten Arten in Deutschland (BLAB, NOWAK, TRAUTMANN & SUKOPP 1984; BUNDESAMT FÜR NATURSCHUTZ 1998; BINOT-HAFKE, GRUTTKE, LUDWIG & RIECKEN 2000) enthalten und wurde auch als Indikatorinsekt für naturgemäßen Eichenwald im Naturschutzprogramm der Europäischen Gemeinschaft eingestuft (TOCHTERMANN 1992). Es ist deshalb mit den Zielen des internationalen Naturschutzes nicht vereinbar, wenn wesentliche Teile der Populationen des Hirschkäfers *Lucanus cervus* im Rahmen der Durchführung von chemischen Maikäferbekämpfungsaktionen aufgrund der Einwirkung des ausgebrachten Giftstoffes getötet werden.

Im Gegensatz zu den heutzutage populären und standardmäßig angewandten chemischen Maikäferbekämpfungsaktionen, welche infolge der großflächigen Verteilung des Giftstoffes zwangsläufig auch den Hirschkäfer *Lucanus cervus* und zahlreiche andere Insekten durch die unausweichliche Vernichtung vieler Individuen in ihren Beständen massiv schädigen, haben die früher gängigen lediglich mechanischen Maikäferbekämpfungsaktionen durch großmaßstäbliches Absammeln unzähliger Exemplare des Maikäfers *Melolontha* von zahlreichen Bäumen unter Einsatz von etlichen Helfern (ESCHERICH 1916) überhaupt keine Beeinträchtigung anderer Insekten hervorgerufen, und es wäre deshalb sehr wünschenswert, wenn man wieder zu diesen bewährten naturschutzgerechten, insektenfreundlichen und umweltverträglichen konservativen Methoden der kontrollierten Begrenzung der Populationsdichte des Maikäfers *Melolontha* zurückkehren würde und die infolge ihrer vielen sinnlosen und unerwünschten Nebenwirkungen auf andere Insekten den Zielen des internationalen Naturschutzes zuwiderlaufenden chemischen Maikäferbekämpfungsaktionen einstellen würde.

Ebenso sollte auch der Gebrauch von verschiedenen Insektiziden, Herbiziden, Fungiziden und anderen chemischen Vernichtungsmitteln in Gartenbau, Obstbau, Weinbau, Landwirtschaft und Forstwirtschaft, bei dem als unvermeidbarer und zwangsläufiger Nebeneffekt auch viele Exemplare des Hirschkäfers *Lucanus cervus* und zahlreicher anderer Insekten durch den Kontakt mit den toxischen Materialien getötet werden, auf die gezielte Anwendung nur noch in streng begrenzten Ausnahmefällen oder bei besonders akuter Notwendigkeit sowie in minimalem räumlichem und zeitlichem Umfang beschränkt werden.

7.6 Rechtzeitige Publikation von Forschungsergebnissen

Jeder Wissenschaftler, der Forschungen zu Populationsdynamik, Ökologie und Schutz des Hirschkäfers *Lucanus cervus* betreibt, sollte nicht vergessen oder vernachlässigen, die Ergebnisse seiner Untersuchungen rechtzeitig zu publizieren. Resultate langjähriger Studien, welche nicht zeitnah veröffentlicht werden, sind für die Wissenschaft verloren und helfen auch nicht dem Hirschkäfer *Lucanus cervus* in der jeweils laufenden Generation in seinem Kampf um das Überleben der Populationen in der jeweils folgenden Generation. Es hat leider in der Wissenschaft schon wiederholt bedauerliche und tragische Beispiele dafür gegeben, daß der erhebliche Einsatz von Zeit und Geld für langfristige Forschungen am Ende umsonst gewesen ist, wenn die Ergebnisse der Untersuchungen nicht zeitnah zusammengeschrieben und in Druck gegeben wurden, und daß der beträchtliche Aufwand an Arbeitskraft und Finanzmitteln für die Sammlung von Beobachtungen, Interpretationen und Konklusionen letztlich niemandem mehr nutzen konnte, wenn der Autor es nicht rechtzeitig geschafft hat, seine Studien mit der Publikation der Resultate unvergänglich zu dokumentieren und damit der Nachwelt zu erhalten.

Ich möchte deshalb ebenso wie schon mein Buch (MADER 2009a) auch mein vorliegendes Supplement zu Populationsdynamik, Ökologie und Schutz des Hirschkäfers *Lucanus cervus* dem Andenken an ERNST TOCHTERMANN widmen, welcher seit 1969 am Forstamt Bischbrunn westnordwestlich Marktheidenfeld im Spessart westnordwestlich Würzburg im Maintal im zentralen Teil von Deutschland als Revierleiter tätig war und in 1985 mit seiner Erfindung der Hirschkäfermeiler oder Hirschkäferwiegen (TOCHTERMANN 1987, 1992, in HAMBERGER 2006) einen bahnbrechenden Fortschritt im Schutz des Hirschkäfers *Lucanus cervus* erzielt hat. Die von ERNST TOCHTERMANN konzipierten und in mehreren Beiträgen in forstwissenschaftlichen Fachzeitschriften (TOCHTERMANN 1987, 1992) publizierten Hirschkäfermeiler oder Hirschkäferwiegen sind inzwischen die am besten bekannteste Schutzmaßnahme für den Hirschkäfer *Lucanus cervus* geworden und werden in ganz Deutschland und im europäischen Ausland als Standardaktion immer wieder in Wäldern, Parks und Gärten installiert. Mit seiner überragenden Entwicklung und Anwendung der Hirschkäfermeiler oder Hirschkäferwiegen hat ERNST TOCHTERMANN einen Meilenstein im Schutz des Hirschkäfers *Lucanus cervus* gesetzt und bleibende Werte für die Erhaltung der Populationen geschaffen.

Seit seiner Erfindung und Dokumentation der Hirschkäfermeiler oder Hirschkäferwiegen (TOCHTERMANN 1987, 1992) hat ERNST TOCHTERMANN umfangreiche Forschungen über den Hirschkäfer *Lucanus cervus* in Deutschland und Ungarn durchgeführt und hat auch sehr viel Literatur gesammelt, und hat immer geplant, die Ergebnisse seiner langjährigen Untersuchungen in einer Monographie über den Hirschkäfer *Lucanus cervus* zusammenzufassen (TOCHTERMANN in HAMBERGER 2006). Leider ist ERNST TOCHTERMANN seit 05.05.2008 (SIGRUN TOCHTERMANN, mündl. Mitt. 2008) nicht mehr unter uns und konnte deshalb sein angefangenes Lebenswerk über den Hirschkäfer *Lucanus cervus*, an dem er bereits über zwei Jahrzehnte gearbeitet hatte, nicht mehr vollenden und veröffentlichen, und es ist bedauerlicherweise ungewiß, was mit seinen nachgelassenen Notizen und Manuskriptentwürfen geschehen wird.

Ich möchte diesen tragischen Umstand als Mahnung an alle Naturfreunde richten, welche nach der Durchsicht meines Buches (MADER 2009a) und meines vorliegenden Supplementes zu Populationsdynamik, Ökologie und Schutz des Hirschkäfers *Lucanus cervus* vielleicht zu der Auffassung gelangen sollten, daß ich darin zu viele Details berücksichtigt hätte, denn das unvollendete Lebenswerk von ERNST TOCHTERMANN ist ein trauriges Beispiel dafür, daß am Ende niemand mehr einen Nutzen aus den zahlreichen Beobachtungen, Ergebnissen und Schlußfolgerungen haben kann, wenn sie nicht rechtzeitig durch Publikation unvergänglich dokumentiert werden und damit auch dann noch der Allgemeinheit und der Wissenschaft zur Verfügung stehen, wenn der Autor und Herausgeber selbst nicht mehr dazu befragt werden kann.

8 Dimensionen und Effektivität der Schutzmaßnahmen für Imagines und Larven

Dimensionen und Effektivität der Schutzmaßnahmen für Imagines und Larven des Hirschkäfers *Lucanus cervus* werden anhand der kurzfristigen und langfristigen Wirksamkeit der Schutzmaßnahmen sowie der Verbreiterung des horizontalen und vertikalen Substratangebotes erläutert. Zusammen mit den natürlichen Selbstschutzmechanismen des Hirschkäfers *Lucanus cervus* infolge der verborgenen Lebensweise im Wald, der relativ langen Flugzeit, der asynchronen Verteilung der Schwärmabende, der überwiegenden Aktivität in der Abenddämmerung, und der Abschirmung des Weibchens durch das Männchen während der Kopulation ergeben die kurzfristigen und langfristigen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* ein umfassendes Hilfspaket, welches bei konsequenter Durchführung der Fülle der möglichen Aktionen eine optimistische Prognose für den Fortbestand und die Erweiterung der Populationen des Hirschkäfers *Lucanus cervus* in der Zukunft erlaubt.

8.1 Kurzfristige Wirksamkeit der Schutzmaßnahmen

Bei der Beurteilung der Effektivität der Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* kann zwischen kurzfristiger und langfristiger Wirksamkeit unterschieden werden. Die kurzfristigen Schutzmaßnahmen unterstützen die möglichst effektive Fortpflanzung der aktuellen Generation des Hirschkäfers *Lucanus cervus* und haben zum Ziel, möglichst viele Männchen und Weibchen der Generation des laufenden Jahres vor der vorzeitigen nichtnatürlichen Mortalität zu retten oder zu bewahren, damit möglichst viele Weibchen der aktuellen Generation durch Kopulation mit Männchen befruchtet werden und ihre Eier ablegen können. Bei der Durchführung der kurzfristigen Schutzmaßnahmen kommt es deshalb darauf an, daß von den vorhandenen Populationen des Hirschkäfers *Lucanus cervus* innerhalb der Generation des laufenden Jahres möglichst viele Weibchen das natürliche Ende ihres Lebenszyklus erreichen, an dem sie Paarung und Eiablage erledigt haben und damit die Grundlage für den Fortbestand der Population in der nachfolgenden Generation geschaffen haben. Die Priorität der kurzfristigen Schutzmaßnahmen liegt daher in der Vermeidung der vorzeitigen nichtnatürlichen Mortalität möglichst vieler Männchen und Weibchen der aktuellen Generation des Hirschkäfers *Lucanus cervus*, wobei jedes Exemplar, welches das natürliche Ende seines Lebenszyklus erreicht, einen bedeutenden Beitrag zur Sicherung des Fortbestandes der Population in der nächsten Generation leistet.

Die kurzfristigen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* umfassen den Transitservice an Wegen und Straßen am Waldrand, die zeitweise Sperrung von Wegen und Straßen am Waldrand für den Verkehr, das Umdrehen auf dem Rücken liegender Männchen und Weibchen, die Abdeckung und Kontrolle von Wasserbehältern in Gärten, die Überprüfung von Rasenflächen vor dem Mähen, und das Engagement gegen chemische Maikäferbekämpfungsaktionen, sowie teilweise auch das Angebot von natürlichen und künstlichen Saftaustritten an Bäumen in Gärten und Streuobstwiesen, die Pflege von Kirschbäumen in Gärten und Streuobstwiesen, und die Anlage von Komposthaufen und Totholzdeponien mit ausreichend langer Lagerzeit in Gärten und Streuobstwiesen.

8.2 Langfristige Wirksamkeit der Schutzmaßnahmen

Die langfristigen Schutzmaßnahmen unterstützen die möglichst effektive Fortpflanzung der zukünftigen Generationen des Hirschkäfers *Lucanus cervus* und haben zum Ziel, durch die Verbesserung und Verbreiterung des Substratangebotes die Eiablage der Weibchen sowohl qualitativ als auch

quantitativ zu optimieren. Obwohl die langfristigen Schutzmaßnahmen teilweise auch schon der aktuellen Generation des Hirschkäfers *Lucanus cervus* eine bessere und breitere Basis für den Erfolg der Fortpflanzung bieten, liegt die Priorität bei ihrer Durchführung in der Unterstützung des Brutgeschäfts der nachfolgenden Generationen innerhalb der vorhandenen Populationen, welche durch die Förderung des Substratangebotes die Chance erhalten, ihren Umfang zu stabilisieren oder sogar zu erweitern. Die langfristigen Schutzmaßnahmen sollen nicht nur die möglichst permanente Erhaltung der bereits bestehenden Populationen des Hirschkäfers *Lucanus cervus* unterstützen, sondern sollen auch dazu beitragen, daß die vorhandenen Populationen sich räumlich ausdehnen können oder daß sogar an bisher nicht besiedelten Bereichen in kürzerer oder weiterer Entfernung von bereits bestehenden Populationen neue eigenständige Populationen in stabiler Ausbildung entstehen und sich auf Dauer etablieren können.

Die langfristigen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* beinhalten die Anlage von Komposthaufen und Totholzdeponien mit ausreichend langer Lagerzeit in Gärten und Streuobstwiesen; das Stehenlassen von natürlichen Baumstümpfen und das Aufstellen von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern; die Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen, die Installation von Hirschkäferpflastern, die Anpflanzung von Kirschbäumen in Gärten und Streuobstwiesen, und die Ausweisung von Bannwaldflächen, sowie teilweise auch das Angebot von natürlichen und künstlichen Saftaustritten an Bäumen in Gärten und Streuobstwiesen, die Pflege von Kirschbäumen in Gärten und Streuobstwiesen, und das Engagement gegen chemische Maikäferbekämpfungsaktionen. Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* mit sowohl kurzfristiger Effektivität als auch langfristiger Wirksamkeit, welche keinen unmittelbaren Einfluß auf die Populationen haben, aber infolge wichtiger mittelbarer Konsequenzen wesentliche Beiträge zur Erweiterung der Bandbreite der Unterstützung und Optimierung der kurzfristigen und langfristigen Schutzmaßnahmen für den Hirschkäfer *Lucanus cervus* erzielen, umfassen die Multiplikation durch Sensibilisierung von weiteren Naturfreunden und die regelmäßige Meldung von Beobachtungen zur zentralen Auswertung.

8.3 Verbreiterung des horizontalen und vertikalen Substratangebotes

Die verschiedenen Schutzmaßnahmen zur Verbreiterung, Verbesserung und Ergänzung des Substratspektrums für den Hirschkäfer *Lucanus cervus* über das natürliche Substratangebot von vermorschtem, vermodertem, zersetztem und verfaulendem Holz von alten, kranken und abgestorbenen Eichen und anderen Bäumen hinaus, welche die Anlage von Komposthaufen und Totholzdeponien mit ausreichend langer Lagerzeit in Gärten und Streuobstwiesen; das Stehenlassen von natürlichen Baumstümpfen und das Aufstellen von künstlichen Baumstümpfen in Gärten, Streuobstwiesen und Wäldern; die Errichtung von Hirschkäfermeilern oder Hirschkäferwiegen, die Installation von Hirschkäferpflastern, die Anpflanzung und Pflege von Kirschbäumen in Gärten und Streuobstwiesen, und die Ausweisung von Bannwaldflächen umfassen, haben sowohl kurzfristige als auch langfristige Wirksamkeit. Die kurzfristige Effektivität der verschiedenen Schutzmaßnahmen zur Verbreiterung des Substratangebotes für den Hirschkäfer *Lucanus cervus* ergänzt das horizontale Substratspektrum innerhalb des laufenden Jahres, welches die Grundlage der Fortpflanzung der aktuellen Generation optimiert, wohingegen die langfristige Effektivität die vertikale Substratpalette in der Abfolge der Jahre wesentlich erweitert und damit die Basis für die Entwicklung der Populationen des Hirschkäfers *Lucanus cervus* auch in den Folgejahren erheblich verbessert.

Die Verbreiterung des Substratspektrums für den Hirschkäfer *Lucanus cervus* durch Bereitstellung eines zusätzlichen Angebotes von alten, kranken und abgestorbenen Eichen und anderen Bäumen sowie von gelagertem Totholz unterschiedlicher Holzarten mit einem günstigen Zersetzungsstadium

über die natürliche Substratpalette hinaus ist deshalb eine wesentliche Investition in den Fortbestand der Populationen nicht nur innerhalb der aktuellen Generation des laufenden Jahres, sondern auch innerhalb der nachfolgenden Generationen in den zukünftigen Jahren. Die diversifizierte Erweiterung des horizontalen Substratspektrums innerhalb des laufenden Jahres zielt in erster Linie auf die Optimierung der Fortpflanzung der aktuellen Generation des Hirschkäfers *Lucanus cervus* und damit auf die Sicherstellung der Stabilisierung der Populationen in der nächsten Generation, bis zu deren Erscheinen der Zersetzungsgrad und die Zersetzungsgeschwindigkeit des Holzes der alten, kranken und abgestorbenen Eichen und anderer Bäume sowie von gelagertem Totholz unterschiedlicher Holzarten entsprechend dem progressiven Zersetzungsprozeß weiter fortgeschritten sind und die Substrateigenschaften sukzessive verbessert haben.

Die Verbreiterung der vertikalen Substratpalette in der Abfolge der Jahre soll dagegen in erster Linie die Basis dafür schaffen, daß in den nachfolgenden Generationen des Hirschkäfers *Lucanus cervus* die bestehenden Populationen nicht nur stabilisiert und gesichert werden, sondern durch zunehmend günstigere Substratbedingungen aufgrund des fortschreitenden Zersetzungsstadiums des Holzes der alten, kranken und abgestorbenen Eichen und anderer Bäume sowie von gelagertem Totholz unterschiedlicher Holzarten auch die Erweiterung der bestehenden Populationen und die Gründung von zusätzlichen Populationen unterstützt werden.

9 Selbstschutzmechanismen des Hirschkäfers

Der Hirschkäfer *Lucanus cervus* wartet nicht passiv ab, ob und wann welche der vorstehend erläuterten Schutzmaßnahmen mit welcher Intensität, Effektivität und Nachhaltigkeit von Naturschützern für ihn durchgeführt werden, sondern betreibt selbst aktiv Daseinsvorsorge mit mehreren ausgeklügelten Selbstschutzmechanismen, welche bei ihrer näheren ökologischen und ethologischen Betrachtung und Analyse selbstverständlich Erstaunen und Bewunderung für den Einfallsreichtum und die Intelligenz des größten und spektakulärsten Käfers in der mitteleuropäischen Insektenfauna verdienen. Der Hirschkäfer *Lucanus cervus* verläßt sich nicht passiv darauf, ob und in welchem zeitlichen und räumlichen Umfang externe Schutzmaßnahmen von Naturschützern für ihn angewendet werden, sondern begrenzt intern selbst aktiv das Risiko von vorzeitigen Verlusten in seinen Populationen durch Räuber und Verkehr aufgrund der Absicherung seines Lebens mit einer Reihe von ausgereiften Selbstschutztechniken, welche in jeder Generation permanent und ubiquist zur uneingeschränkten Anwendung kommen und ihn in gewisser Weise von der Durchführung von räumlich diskontinuierlichen und zeitlich unregelmäßigen externen Schutzmaßnahmen von Naturschützern unabhängig machen. Der Hirschkäfer *Lucanus cervus* ist deshalb selbst ein wesentlicher Faktor in der Palette der verschiedenen Schutzmaßnahmen und gibt mit seinen ausgefeilten Selbstschutzmechanismen sogar den Naturschützern wertvolle Hinweise zur Verbesserung der von ihnen durchgeführten Schutzmaßnahmen, wichtige Anregungen zur Vervollständigung des Spektrums der differenzierten Schutzmaßnahmen, unersetzliche Nachweise der Effektivität von speziellen Schutzmaßnahmen, und entscheidende Tips zur Optimierung der Wirksamkeit der unterschiedlichen Schutzmaßnahmen.

Der Hirschkäfer *Lucanus cervus* lebt überwiegend verborgen im Wald und kommt nur untergeordnet im Wald und an den Rändern von Wald und Wiesen oder Feldern sowie in Gärten, Streuobstwiesen und Parks vorwiegend in waldnahen Bereichen von Siedlungen zum Vorschein, wodurch der größte Teil der Populationen einer Beobachtung nicht zugänglich ist und daher auch nicht durch den Verkehr auf den Wegen und Straßen am Waldrand gefährdet werden kann sowie weniger exponiert der Gefahr der Erbeutung durch Räuber ausgesetzt ist. Mit dieser weitgehend verborgenen intrasilvanen Lebensweise schützt der Hirschkäfer *Lucanus cervus* quasi sich selbst, und weitere Selbstschutzmechanismen sind die relativ lange Flugzeit, welche sich in der vollen Spanne über fast

3 Monate erstreckt, die asynchrone Verteilung der Schwärmabende innerhalb der Erscheinungsperiode, die überwiegende Aktivität in einer auf wenige Stunden begrenzten Zeit während des Tages in der Abenddämmerung, und die Abschirmung des Weibchens durch das Männchen während der Kopulation mit dem käfigartigen Gerüst seiner geweihartig verlängerten Mandibeln und mit dem überstehenden Panzer seines Körpers.

9.1 Verborgene Lebensweise im Wald

Jeder Naturfreund kennt den Hirschkäfer *Lucanus cervus* aus Naturführern, Biologieunterricht und Museen, aber nur wenige haben ihn gelegentlich in der Natur gesehen, weil der größte Teil der Individuenmengen der Populationen des Hirschkäfers *Lucanus cervus* verborgen im Wald lebt und an den Waldrändern nur ein kleiner Teil der Individuenzahlen der Populationen zum Vorschein kommt und beobachtet werden kann. Aufgrund der verborgenen intrasilvanen Lebensweise des Hirschkäfers *Lucanus cervus,* der sich überwiegend versteckt im Wald aufhält, schützt der Hirschkäfer *Lucanus cervus* praktisch sich selbst, denn die überwiegenden Teile der Populationen, welche nicht am Waldrand in Erscheinung treten, können auch nicht durch den Verkehr auf Wegen und Straßen am Waldrand gefährdet werden und haben auch ein geringeres Risiko, durch Räuber erbeutet zu werden. Die weitgehend verborgene Lebensweise des Hirschkäfers *Lucanus cervus* im Wald und das begrenzte Erscheinen von limitierten Fraktionen der Populationen an den Waldrändern hat dazu geführt, daß er als seltenes Insekt eingestuft wurde, obwohl er in Wirklichkeit im vollen Umfang seiner großenteils versteckt im Wald lebenden Populationen gar nicht so selten ist, wie allgemein angenommen wird, sondern lediglich ein Meister der zurückgezogenen Existenz, des diskreten Auftretens und des introvertierten Verhaltens im intrasilvanen Milieu ist. Der Selbstschutz des Hirschkäfers *Lucanus cervus* infolge seiner weitgehend verborgenen Lebensweise im Wald gründet sich daher besonders auf die Ausnutzung von intrasilvanen ökologischen Nischen und refugialen Inseln in verschiedenen Teilen der Waldgebiete mit unterschiedlicher Ausdehnung sowohl in unmittelbarer Nähe als auch in größerer Entfernung von den Waldrändern, und auf das Erscheinen von lediglich begrenzten Segmenten der Populationen im Wald und an den Rändern von Wald und Wiesen oder Feldern sowie in Gärten, Streuobstwiesen und Parks besonders in waldnahen Bereichen von Siedlungen, wo die limitierten Ausschnitte des Spektrums entdeckt werden können und einer Beobachtung zugänglich sind.

Der Selbstschutz des Hirschkäfers *Lucanus cervus* infolge seiner weitgehend verborgenen Lebensweise im Wald ist auch ein Grund dafür, daß er einerseits von vielen Naturfreunden an zahlreichen Lokalitäten immer wieder in zufälligen Einzelfunden in disperser Verteilung in Raum und Zeit entdeckt wird, wohingegen andererseits etliche Naturfreunde in ihrem Leben den Hirschkäfer *Lucanus cervus* entweder lediglich einmal oder nur wenige Male oder sogar überhaupt nicht in der Natur gesehen haben. Die Auswertung der zahlreichen Fundmeldungen von über 600 Naturfreunden aus über 225 Lokalitäten, welche mich als Resonanz auf meine Aufrufe zur Mitteilung von Beobachtungen des Hirschkäfers *Lucanus cervus* in mehreren regionalen Tageszeitungen (Rhein-Neckar-Zeitung 2008a, 2008b, 2008c, 2008d, 2009a, 2009b, 2009c; Schwetzinger Zeitung 2008, Bruchsaler Rundschau 2008; Mannheimer Morgen 2009a, 2009b; Weinheimer Nachrichten 2009) erreicht haben, hat ergeben, daß die meisten Naturfreunde in zwei bis neun Jahrzehnten ihres Lebens lediglich einmal oder wenige Male den Hirschkäfer *Lucanus cervus* in der Natur entdecken konnten, wobei die einzelnen Begegnungen oftmals im Abstand von vielen Jahren oder sogar mehreren Jahrzehnten erfolgt sind. Etliche Naturfreunde haben sogar erst jetzt den Hirschkäfer *Lucanus cervus* erstmals in ihrem Leben in der Natur angetroffen, und aus den Berichten zahlreicher Naturfreunde weiß ich, daß es sogar viele Menschen gibt, die noch nie in ihrem Leben einen Hirschkäfer *Lucanus cervus* in der Natur entdeckt haben. Viele Naturfreunde, welche in ihrem Leben bisher lediglich einmal oder nur wenige Male dem Hirschkäfers *Lucanus cervus* in der Natur begegnet sind, haben mir aus-

drücklich bestätigt, daß sie häufig in Wald, Feld und Wiesen unterwegs sind, sehr naturverbunden sind, und mit offenen Augen für Tiere und Pflanzen durch die Natur gehen, und deshalb hätten sie den Hirschkäfer *Lucanus cervus* entdecken müssen, falls er sich entlang der von ihnen abgelaufenen Strecken gezeigt hätte. Etliche Naturfreunde haben mir auch berichtet, daß sie schon seit vielen Jahren regelmäßig die gleichen Wege im Wald marschieren oder joggen und in dieser Zeit jedoch lediglich einmal oder nur wenige Male dem Hirschkäfer *Lucanus cervus* dort begegnet sind.

Ich selbst habe von 2007 bis 2009 an vielen Tagen jeweils nachmittags entlang einer ausgesuchten Strecke am Waldrand von Nußloch Insekten beobachtet (MADER 2010b) und habe bei meinen insgesamt mehreren Hundert nachmittäglichen Patrouillen des ausgewählten Intervalls nur ein einziges Mal am 13.06.2009 gegen 14 Uhr ein laufendes Männchen des Hirschkäfers *Lucanus cervus* auf dem Weg am Waldrand von Nußloch gefunden, und dieser isolierte Nachweis ist auch ein typisches Beispiel eines zufälligen Einzelfundes in disperser Verteilung in Raum und Zeit, welcher an den auf die singuläre Beobachtung folgenden Tagen, Wochen und Monaten nicht reproduzierbar war. In analoger Weise habe ich die Population des Hirschkäfers *Lucanus cervus* am Waldrand von Tairnbach zuerst lediglich durch Funde von einzelnen überfahrenen Weibchen entdeckt, als ich von 2007 bis 2009 an vielen Tagen jeweils nachmittags entlang einer ausgesuchten Strecke am Waldrand von Tairnbach Insekten beobachtet habe (MADER 2010b), und bei meinen insgesamt mehreren Hundert nachmittäglichen Patrouillen des ausgewählten Intervalls habe ich nur ein einziges Mal am 01.06.2008 gegen 18 Uhr ein lebendes Exemplar des Hirschkäfers *Lucanus cervus* auf dem Weg am Waldrand von Tairnbach angetroffen, als ich später als üblich meinen nachmittäglichen entomologischen Kontrollgang durchgeführt habe, und dieses unikale Individuum war jenes einzelne fliegende Männchen, welches direkt neben meinen Füßen gelandet ist und mir damit die Existenz der Population unmittelbar vor die Augen geführt hat, woraufhin ich die regelmäßige Überwachung der Lokalität in der Abenddämmerung begonnen habe und dabei nicht nur den außergewöhnlichen Schwärmabend des Hirschkäfers *Lucanus cervus* am 05.06.2008 erlebt habe, sondern auch an vielen anderen Tagen zahlreiche fliegende und laufende Männchen und Weibchen registrieren konnte.

Ein besonders markantes Beispiel für den Selbstschutz des Hirschkäfers *Lucanus cervus* durch seinen überwiegend versteckten Aufenthalt im Wald ist ein Zeitraum von 13 Tagen vom 12.07.2008 bis 24.07.2008, in dem ich am Waldrand von Tairnbach während meiner allabendlichen Beobachtungen keine Individuen entdecken konnte, wohingegen ich am 11.07.2008 und davor sowie dann wieder am 25.07.2008 und 26.07.2008 laufende Weibchen auf dem asphaltierten Weg am Waldrand gesehen habe. Dieses Intervall von 13 Tagen ohne Entdeckung eines Exemplares zwischen der letzten Sichtung eines Individuums am 11.07.2008 und der erneuten Feststellung von zwei laufenden Weibchen am 25.07.2008 belegt sehr anschaulich die verborgene intrasilvane Lebensweise des Hirschkäfers *Lucanus cervus,* welcher die ganze Zeit im Wald vorhanden war, aber in diesem Intervall vom 12.07.2008 bis 24.07.2008 nicht auf dem asphaltierten Weg am Waldrand in Erscheinung getreten ist. Durch sein verborgenes Verhalten im Wald hat es der Hirschkäfer *Lucanus cervus* in Tairnbach während dieser Zeit vermieden, auf dem asphaltierten Weg am Waldrand der Gefährdung aufgrund von Überfahren durch den Verkehr sowie infolge von Erbeutung durch Räuber ausgesetzt zu sein, vor der er in seinem intrasilvanen Milieu mit ökologischen Nischen und refugialen Inseln geschützt war. Von anderen Lokalitäten haben mir mehrere Naturfreunde, welche mir aufgrund meiner vorgenannten Aufrufe zur Mitteilung von Beobachtungen des Hirschkäfers *Lucanus cervus* in mehreren regionalen Tageszeitungen ihre Entdeckungen gemeldet haben, auch aus dem Zeitraum vom 12.07.2008 bis 24.07.2008 Funde von laufenden und ebenfalls überfahrenen Individuen sowie von Resten durch Räuber erbeuteter Exemplare berichtet.

In ähnlicher Weise habe ich bei meiner regelmäßigen Patrouille am Waldrand von Tairnbach in Mai und Juni 2009 an etlichen Abenden lediglich Caput-Thorax-Torsi als reliktische Zeugen der Erbeutung von Männchen und Weibchen des Hirschkäfers *Lucanus cervus* durch Räuber gefunden,

welche vermutlich im Wald von Vögeln gefangen wurden und deren unverdauliche Reste nach dem Verzehr des Hinterleibes auf den Weg am Waldrand geworfen wurden, wohingegen ich lebenden Individuen des Hirschkäfers *Lucanus cervus* an vielen Tagen, an denen ich nur residuale Fragmente als Überbleibsel von Mahlzeiten räuberischer Vögel entdeckt habe, nicht begegnet bin. Auch an diesen Tagen war der Hirschkäfer *Lucanus cervus* stets im Wald von Tairnbach vorhanden, hat sich jedoch zumindest bei meinen abendlichen Kontrollgängen nicht am Waldrand gezeigt, wohingegen er im Laufe des Tages von einigen spitzfindigen Räubern im Wald aufgestöbert und erbeutet wurde, wie sich in den auf dem Weg am Waldrand entsorgten reliktischen Abfällen widerspiegelt.

Die verborgene intrasilvane Lebensweise als Selbstschutz des Hirschkäfers *Lucanus cervus,* infolge derer ich sowohl in 2008 als auch in 2009 nicht an allen Abenden meiner Beobachtungen während der Flugzeit am Waldrand von Tairnbach in der Zeit meiner Patrouille der ausgesuchten Strecke des Weges fliegende oder laufende Männchen oder Weibchen entdeckt habe, steht in markantem Gegensatz zur offenen extrasilvanen Lebensweise des Aurorafalters *Anthocharis cardamines*, von dem sowohl in 2008 als auch in 2009 an jedem Tag während der Flugzeit mehrere Männchen an den Waldrändern von Tairnbach und Nußloch derart auffällig in beiden Richtungen entlanggeflogen sind, daß ich bei jeder Passage des ausgewählten Intervalls des Weges am Waldrand sowohl in Tairnbach als auch in Nußloch an jedem Tag während der Flugzeit problemlos mehrere Exemplare registrieren konnte. Die offene extrasilvane Lebensweise des Aurorafalters *Anthocharis cardamines* hat sich in einem derart ausgeprägten Auftreten etlicher Männchen an den Waldrändern von Nußloch und Tairnbach manifestiert, daß die aufgrund ihrer charakteristischen apfelsinenfarbigen Flecken auf den Vorderflügeln im Sonnenschein markant orange leuchtenden Männchen innerhalb der Gesellschaft der anderen herumfliegenden Weißlinge nicht übersehen werden konnten, wodurch eine effektive und unkomplizierte Erfassung der auf und ab fliegenden Männchen des Aurorafalters *Anthocharis cardamines* an den Waldrändern von Nußloch und Tairnbach für die selenozyklische Interpretation der Populationsdynamik (MADER 2010b) an jedem Tag zweifelsfrei und fehlerlos durchgeführt werden konnte. Die fliegenden Männchen des Aurorafalters *Anthocharis cardamines* an den Waldrändern von Nußloch und Tairnbach konnten an jedem Tag während der Flugzeit regelmäßig und uneingeschränkt reproduzierbar nachgewiesen werden, wohingegen die fliegenden und laufenden Männchen und Weibchen des Hirschkäfers *Lucanus cervus* am Waldrand von Tairnbach nicht an jedem Abend während der Flugzeit und damit nur unregelmäßig sowie lediglich eingeschränkt reproduzierbar beobachtet werden konnten. Die intrasilvane verborgene Lebensweise als Selbstschutz des Hirschkäfers *Lucanus cervus,* infolge derer ich sowohl in 2008 als auch in 2009 nicht an allen Abenden meiner Kontrollen während der Flugzeit am Waldrand von Tairnbach in der Zeit meiner Überwachung der abgesteckten Zone des Weges fliegende oder laufende Männchen oder Weibchen entdeckt habe, steht auch in prägnantem Kontrast zur offenen kombiniert extrasilvanen und intrasilvanen Lebensweise des Maikäfers *Melolontha* und des Junikäfers *Amphimallon solstitiale*, welche in 2009 am Waldrand von Tairnbach an jedem Abend während der Flugzeit mit etlichen Individuen in Erscheinung getreten sind, die den Waldrand entlanggeflogen sind, um einzelne Bäume am Waldrand und in der Wiese am Bach herumgeflogen sind, und auf dem Weg am Waldrand herumgekrabbelt sind, und von denen häufig auch während des Tages mehrere Exemplare entlang des Waldrandes oder über die Wiese geflogen sind sowie auf dem Weg am Waldrand herumgekrabbelt sind.

9.2 Relativ lange Flugzeit

Der Hirschkäfer *Lucanus cervus* schützt sich selbst nicht nur durch seine verborgene Lebensweise im Wald, sondern auch durch seine relativ lange Flugzeit von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder Anfang August, welche sich in der vollen Spanne über fast 3 Monate erstreckt. Im Vergleich mit etlichen anderen Käfern und anderen Insekten, welche eine deutlich kür-

zere Flugzeit von etwa 1 – 1,5 Monaten oder sogar nur 2 – 3 Wochen aufweisen, verteilt der Hirschkäfer *Lucanus cervus* die Risiken der nichtnatürlichen Mortalität auf die relativ lange Flugzeit in erster Linie dadurch, daß die Länge der Flugzeit in der vollen Spanne von fast 3 Monaten die Lebensdauer der Imagines nach dem Verlassen der Puppenwiege im Boden und dem Erscheinen an der Erdoberfläche von etwa 4 – 8 Wochen erheblich überschreitet. Dadurch fliegen im ersten Teil der Flugzeit von Anfang Mai bis Mitte Juni in erheblichem Ausmaß andere Segmente der Populationen des Hirschkäfers *Lucanus cervus* als im zweiten Teil der Flugzeit von Mitte Juni bis Ende Juli oder Anfang August, und dieses versetzte oder gestaffelte Erscheinen der Imagines von verschiedenen Fraktionen der Populationen mit nur untergeordneter bis akzessorischer Überlappung und Interferenz verringert die Gefahr von Verlusten durch letale Ereignisse dadurch, daß jeweils nur Ausschnitte der Populationen davon betroffen sind, wohingegen die jeweils anderen Abteilungen der Populationen dem Risiko der Dezimierung durch andere mortale Vorfälle ausgesetzt sind, welchen die entsprechend gegenläufigen Gruppen der Populationen nicht exponiert sind.

Die diskrete Überdeckung unterschiedlicher Intervalle der gesamten Spanne der Flugzeit des Hirschkäfers *Lucanus cervus* von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder Anfang August durch separate Segmente der Populationen wird vor allem dadurch belegt, daß von vielen Naturfreunden, welche mir bezugnehmend auf meine Aufrufe zur Mitteilung von Beobachtungen des Hirschkäfers *Lucanus cervus* in mehreren regionalen Tageszeitungen (Rhein-Neckar-Zeitung 2008a, 2008b, 2008c, 2008d, 2009a, 2009b, 2009c; Schwetzinger Zeitung 2008, Bruchsaler Rundschau 2008; Mannheimer Morgen 2009a, 2009b; Weinheimer Nachrichten 2009) ihre Funde gemeldet haben, bereits im ersten Teil der Flugzeit von Anfang Mai bis Mitte Juni immer wieder vollständige und unbeschädigte tote Exemplare entdeckt wurden, welche offensichtlich ohne äußere Einwirkung natürlich verendet waren, und ebenso im späten Abschnitt des zweiten Teils der Flugzeit von Mitte Juni bis Ende Juli oder Anfang August auch noch zahlreiche frische lebende Individuen angetroffen wurden, welche nur wenige oder gar keine Spuren der Abnutzung aufgewiesen haben und deshalb auch erst relativ spät geschlüpft sind. Mit der vorgenannten Verteilung wird dokumentiert, daß im zweiten Teil der Flugzeit von Mitte Juni bis Ende Juli oder Anfang August zahlreiche Exemplare des Hirschkäfers *Lucanus cervus* erst dann schlüpfen und ihren Lebenszyklus als Imagines erst dann beginnen, nachdem etliche der schon im ersten Teil der Flugzeit von Anfang Mai bis Mitte Juni geschlüpften Individuen ihren Lebenszyklus als Imagines schon beendet haben und bereits natürlich gestorben sind.

Das versetzte oder gestaffelte Erscheinen der Imagines von verschiedenen getrennten Fraktionen der Populationen des Hirschkäfers *Lucanus cervus* spiegelt sich auch in einer oftmals bimodalen Verteilung der Häufigkeit des Auftretens der Exemplare während der jeweiligen Flugzeit wider, wie sie den phänologischen Histogrammen und/oder Tabellen in Sprecher-Uebersax & Durrer (1998), Sprecher-Uebersax (2001), Hilpüsch (2004), Fremlin (2009) und Fremlin & Fremlin (2010) entnommen werden kann (Mader 2010b), wohingegen in anderen Jahren lediglich eine unimodale Verteilung der Frequenz des Erscheinens der Individuen entwickelt ist. Die zweigipfelige Verteilung der Abundanz des Vorkommens der Exemplare des Hirschkäfers *Lucanus cervus* in etlichen der in den vorgenannten Studien analysierten Jahren unterstreicht, daß diejenigen Individuen, welche die erste Spitze der Häufigkeitsverteilung gebildet haben, in vielen Fällen möglicherweise dann bereits nicht mehr vorhanden sind, wenn eine zweite Gruppe mit anderen Individuen die zweite Spitze der Häufigkeitsverteilung erzeugt, welche ihrerseits wahrscheinlich noch nicht anwesend waren, als die erste Gruppe von Individuen den ersten Peak des Erscheinens hervorgerufen hat, wohingegen bei einer eingipfeligen Verteilung des Vorkommens der Exemplare die räumliche und zeitliche Separation diskreter Fraktionen der Populationen des Hirschkäfers *Lucanus cervus* während der jeweiligen Flugzeit nicht stattgefunden hat. Die diskontinuierliche Ausbildung mehrerer segregierter Fraktionen der Populationen des Hirschkäfers *Lucanus cervus,* welche voneinander entweder völlig isoliert sind oder nur marginal überlappen, wie in einer bimodalen Häufigkeitsverteilung reflektiert wird,

fungiert als Selbstschutzmechanismus nicht nur gegen die Gefahr der vorzeitigen nichtnatürlichen Mortalität aufgrund der Erbeutung durch Räuber und infolge von Überfahren durch den Verkehr, sondern auch gegen die Bedrohung durch letale Einwirkungen markanter Schlechtwetterphasen zwischen mehreren aufeinanderfolgenden Schönwetterperioden. Die selenozyklische Auswertung der bipolaren und unipolaren Abundanzspektren des Hirschkäfers *Lucanus cervus* aufgrund der phänologischen Dokumentationen in SPRECHER-UEBERSAX & DURRER (1998), SPRECHER-UEBERSAX (2001), HILPÜSCH (2004), FREMLIN (2009) und FREMLIN & FREMLIN (2010) ist in MADER (2010b) enthalten.

Die zwischenzeitlichen Kälteeinbrüche der Eisheiligen, der Schafskälte und der Julikälte, welche mit verstärkten Niederschlägen und reduzierten Temperaturen bis in Extremfällen sogar Nachtfrösten und Schneefall mehrere aufeinanderfolgende Schönwetterperioden unterbrechen und voneinander trennen und damit die Lebensbedingungen der Populationen verschlechtern, treffen aufgrund des versetzten oder gestaffelten Erscheinens der Imagines von verschiedenen Fraktionen der Populationen nicht den gesamten Bestand des Hirschkäfers *Lucanus cervus,* sondern jeweils nur Segmente des totalen Umfanges der Populationen, wohingegen andere Gruppen von Individuen infolge des versetzten oder gestaffelten Erscheinens zumindest einigen dieser Intermezzos mit ungünstigem klimatischem und meteorologischem Hintergrund nicht exponiert werden. Verluste durch Verkehr und Räuber werden ebenfalls dadurch minimiert, daß in den betreffenden Zeitfenstern jeweils nur Segmente der Populationen des Hirschkäfers *Lucanus cervus* durch Überfahren und Erbeutung vorzeitig aus dem Entwicklungskreislauf gezogen werden können, wohingegen andere Fraktionen der Populationen diesen Gefahren in anderen Zeitintervallen ausgesetzt sind, in denen die Auswirkung der nichtnatürlichen Mortalitätsfaktoren differenziert ausfallen kann.

RINK (2007) und RINK & SINSCH (2008) haben an Populationen des Hirschkäfers *Lucanus cervus* im Moseltal zwischen Cochem und Trier im westlichen Teil von Deutschland ermittelt, daß die Schlüpfaktivität der Exemplare Mitte Mai begonnen hat und Mitte Juni geendet hat, wodurch das versetzte oder gestaffelte Erscheinen der Individuen vor und nach den Eisheiligen sowie vor und nach der Schafskälte belegt wird. SPRECHER-UEBERSAX (2001) hat an Populationen des Hirschkäfers *Lucanus cervus* in der Umgebung von Basel im nordwestlichen Teil der Schweiz ebenso wie RINK (2007) und RINK & SINSCH (2008) an Populationen des Hirschkäfers *Lucanus cervus* im Moseltal zwischen Cochem und Trier im westlichen Teil von Deutschland auch festgestellt, daß die ersten Männchen etwa 1 Woche vor den ersten Weibchen geschlüpft sind, und daß die letzten Weibchen etwa 1 Woche nach den letzten Männchen geschlüpft sind, wodurch sich eine zusätzliche Segregation und Überlappung des Erscheinens der Exemplare in den jeweiligen Lebensräumen und Zeitfenstern ergibt, welche ebenfalls wesentlich zu einer markanten Ausprägung der diskontinuierlichen Verteilung separater Fraktionen der Populationen in verschiedenen Abschnitten der Flugzeit beiträgt.

9.3 Asynchrone Verteilung der Schwärmabende

Das versetzte oder gestaffelte Auftreten der Imagines des Hirschkäfers *Lucanus cervus* von verschiedenen Segmenten der Populationen in unterschiedlichen Abschnitten der Flugzeit von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder Anfang August bewirkt auch die asymmetrische und asynchrone Verteilung der Schwärmabende innerhalb der Erscheinungsperiode, wodurch ein zusätzlicher Effekt dieses Selbstschutzmechanismus des Hirschkäfers *Lucanus cervus* erreicht wird. Mit den voneinander abgekoppelten Phasen der gesteigerten Aktivität an den in verschiedenen Populationen an unterschiedlichen Terminen stattfindenden Schwärmabenden geht der Hirschkäfer *Lucanus cervus* vor allem Etappen erhöhten Nahrungsbedarfes einiger räuberischer Vögel während der Aufzucht ihrer Jungen besser aus dem Weg als bei symmetrischer und synchro-

ner Schaltung der Schwärmabende in allen Populationen. Die gesamte Flugzeit des Hirschkäfers *Lucanus cervus,* welche sich in der vollen Spanne über fast 3 Monate erstreckt, ist länger als die kritische Entwicklungsphase des Nachwuchses etlicher räuberischer Vögel, und die diskontinuierliche Verteilung der Schwärmabende des Hirschkäfers *Lucanus cervus* in Raum und Zeit setzt zwar einige Segmente der Populationen der vermehrten Attacke und Erbeutung durch räuberische Vögel während der entscheidenden Wachstumsphase ihrer Jungen aus, wohingegen andere Fraktionen der Populationen des Hirschkäfers *Lucanus cervus* erst dann den Höhepunkt ihrer Aktivität erreichen, wenn der maximale Nahrungsbedarf mehrerer räuberischer Vögel bereits überschritten ist.

Die asymmetrische und asynchrone Verteilung der Schwärmabende innerhalb der Erscheinungsperiode des Hirschkäfers *Lucanus cervus* führt auch dazu, daß die Phasen der gesteigerten Aktivität einiger Populationen bereits vor den zwischenzeitlichen Kälteeinbrüchen der Eisheiligen, der Schafskälte und der Julikälte stattfinden, welche mit verstärkten Niederschlägen und reduzierten Temperaturen bis in Extremfällen sogar Nachtfrösten und Schneefall mehrere aufeinanderfolgende Schönwetterperioden unterbrechen und voneinander trennen und damit die Lebensbedingungen der Populationen verschlechtern, wohingegen die Höhepunkte der Aktivität anderer Populationen des Hirschkäfers *Lucanus cervus* erst nach diesen Intermezzos mit ungünstigem klimatischem und meteorologischem Hintergrund ausgeprägt sind. Aufgrund der voneinander abgekoppelten Phasen der gesteigerten Aktivität an den in verschiedenen Populationen des Hirschkäfers *Lucanus cervus* an unterschiedlichen Terminen stattfindenden Schwärmabenden werden von den markanten Unterbrechungen der längeren Perioden mit sommerlich warmem und sonnigem Wetter durch kürzere Phasen mit kühlem und feuchtem Wetter jeweils nur Segmente der Populationen betroffen, wohingegen andere Fraktionen der Populationen den signifikanten Interruptionen der Schönwetterperioden durch Kälteeinbrüche entgehen und dadurch ihre Aufgabe der Fortpflanzung und Eiablage zur Begründung und Sicherstellung des Fortbestandes der Populationen des Hirschkäfers *Lucanus cervus* in der nächsten Generation ungestörter erfüllen können.

9.4 Überwiegende Aktivität in der Abenddämmerung

Der Hirschkäfer *Lucanus cervus* schützt sich selbst nicht nur durch seine verborgene Lebensweise im Wald, seine relativ lange Flugzeit von etwa Anfang bis Mitte Mai bis etwa Mitte bis Ende Juli oder Anfang August, und die asynchrone Verteilung der Schwärmabende innerhalb seiner Erscheinungsperiode, sondern auch durch seine überwiegende Aktivität in einer auf wenige Stunden begrenzten Zeit während des Tages in der Abenddämmerung. Während der meisten Zeit des Tages lebt der Hirschkäfer *Lucanus cervus* hauptsächlich zurückgezogen im Wald und kommt nur gelegentlich in einzelnen Exemplaren am Waldrand und auf Wegen im Wald zum Vorschein, und wird dort von vielen Naturfreunden an zahlreichen Lokalitäten immer wieder in zufälligen Einzelfunden in disperser Verteilung in Raum und Zeit entdeckt. Die überwiegende Aktivität des Hirschkäfers *Lucanus cervus* ist jedoch auf die kurze Episode der Abenddämmerung an der Grenze zwischen dem Ende des Tages und dem Beginn der Nacht beschränkt, in der die meisten Individuen laufend und fliegend unterwegs sind.

Die Konzentration des Erscheinens des Hirschkäfers *Lucanus cervus* auf die Abenddämmerung an der Grenze zwischen dem Ende des Tages und dem Beginn der Nacht entzieht erhebliche Teile der Populationen den Gefahren der Verluste durch Verkehr und Räuber während des Tages und trägt somit wesentlich dazu bei, daß die meisten Exemplare nur in einem begrenzten Intervall des Tages dem Risiko der vorzeitigen nichtnatürlichen Mortalität ausgesetzt sind. Die Gefahr des Überfahrens durch Verkehr und der Erbeutung durch Räuber ist für den Hirschkäfer *Lucanus cervus* in der Abenddämmerung bedeutend geringer als während des Tages, weil der Verkehr abends oftmals schwächer ist als tagsüber und viele Räuber abends weniger aktiv sind und auch mit hereinbrechen-

der Dunkelheit ihre potentielle Beute schlechter sehen können. Letzterer Umstand ist sicher auch ein Grund dafür, daß der Hirschkäfer *Lucanus cervus* für seine Phasen gesteigerter Aktivität an wenigen ausgeprägten Schwärmabenden, an denen die meisten Individuen laufend und fliegend unterwegs sind, bevorzugt die Tage um den Neumond auswählt, an denen es im krepuskulären Milieu nach dem Sonnenuntergang und nach dem Erlöschen des Abendrotes rascher und intensiver dunkel wird als an den Tagen um den Halbmond oder den Vollmond, an denen nach dem Verschwinden der Sonne am Horizont der Mond am Himmel unabhängig von dem vorübergehenden Glänzen des Abendrotes eine markante und permanente Beleuchtung der hereinbrechenden Nacht bietet. Andererseits finden die akzentuierten Schwärmabende des Hirschkäfers *Lucanus cervus* häufig auch an den Tagen um den Halbmond oder den Vollmond statt, an denen die romantische lunare Illumination der Abenddämmerung und der beginnenden Dunkelheit, welche temporär noch durch das Strahlen des Abendrotes akzentuiert wird, wahrscheinlich das Zueinanderfinden von Männchen und Weibchen des Hirschkäfers *Lucanus cervus* erleichtert und beschleunigt, wodurch aufgrund schnellerer Partnerkontakte und Kopulation ebenfalls das Risiko von Verlusten infolge der Erbeutung durch Räuber vor der stattgefundenen Paarung limitiert wird. An den Tagen um den Neumond haben die Männchen und Weibchen des Hirschkäfers *Lucanus cervus* in der krepuskulären Konstellation nach dem Abtauchen der Sonne unter den Horizont besonders nach dem Verglühen des Abendrotes in der finsteren Aura der anbrechenden Dunkelheit ohne Erhellung des Himmels durch den Mondschein sicher mehr Zeit für das Zusammentreffen und die Paarung, sind jedoch dafür auch länger dem Risiko der Prädation vor dem Abschluß der Kopulation exponiert, sofern sie in der unbeleuchteten Obskurität der beginnenden Nacht von Räubern aufgespürt werden können.

9.5 Abschirmung des Weibchens durch das Männchen bei der Kopulation

Die vorstehend erläuterten Selbstschutzmechanismen des Hirschkäfers *Lucanus cervus,* welche seine verborgene Lebensweise im Wald, seine relativ lange Flugzeit von etwa Anfang bis Mitte Mai bis etwa Anfang bis Mitte Juli oder Anfang August, die asynchrone Verteilung der Schwärmabende innerhalb seiner Erscheinungsperiode, und seine überwiegende Aktivität in einer auf wenige Stunden begrenzten Zeit während des Tages in der Abenddämmerung beinhalten, betreffen in ihrer Kombination oftmals nur Fraktionen der Populationen in den entsprechenden Lebensräumen und Zeitfenstern, wohingegen sie in ihrem kompletten Spektrum meist nicht den gesamten Umfang der Populationen erfassen. Weiterhin können die vorstehend erläuterten Selbstschutzmechanismen des Hirschkäfers *Lucanus cervus* eine wesentliche und entscheidende Schwachstelle im Lebenszyklus nicht ausreichend abdecken, bei der die Individuen relativ ungeschützt den Angriffen vor allem räuberischer Vögel ausgesetzt sind. Während der Kopulation sind Männchen und Weibchen des Hirschkäfers *Lucanus cervus* miteinander verbunden und aufgrund der Konzentration auf die Paarung mit entsprechender Erregung ist besonders das Männchen abgelenkt, so daß die konjunkten Partner während dieser Zeit die leichte Beute von räuberischen Vögeln werden können. An dieser Stelle kommt für den außergewöhnlich großen Hirschkäfer *Lucanus cervus* ein zusätzlicher Selbstschutzmechanismus zum Tragen, welcher in erster Linie durch seine herausragende Größe ermöglicht wird und durch die markant unterschiedlichen Dimensionen der sexualdimorphen Männchen und Weibchen noch verstärkt wird, wohingegen andere kleinere Käfer aufgrund ihrer mangelnden Größe und in vielen Fällen auch wegen der lediglich geringen oder sogar völlig fehlenden morphologischen Differenzen von Männchen und Weibchen nicht von diesem Sicherungseffekt Gebrauch machen können.

Bei der Paarung steht das Männchen des Hirschkäfers *Lucanus cervus* über dem Weibchen und sichert dieses durch seine Mandibeln ab, welche wie das Gerüst eines Käfigs wirken, so daß das Weibchen einerseits vor dem Abschluß der Kopulation nicht weglaufen kann und andererseits durch die Abdeckung des Männchens vor der Erbeutung durch räuberische Vögel geschützt ist,

welche bevorzugt das exponierte Männchen schnappen, wohingegen das abgeschirmte Weibchen unter dem Panzer des Männchens oftmals dadurch den Freßfeinden entkommen kann, daß es sich unter dem stabilen Schutzschild des Männchens notfalls vom Baum fallen lassen kann. Das Männchen des Hirschkäfers *Lucanus cervus* wirkt somit bei Angriffen räuberischer Vögel auf das kopulierende Pärchen wie ein Prellbock, an dem die Attacken räuberischer Vögel enden und unter dem das Weibchen verborgen und geschützt ist. Das Männchen des Hirschkäfers *Lucanus cervus* betreibt also insofern eine aktive Brutfürsorge, als es durch seine Abschirmung des Weibchens mit seinem Körper bei der Kopulation unter Akzeptanz des Risikos, daß es selbst zum Opfer von räuberischen Vögeln wird, das Weibchen während der Paarung unter seinem Panzer vor Freßfeinden schützt, so daß das Weibchen eine größere Chance als das Männchen hat, die Kopulation zu überleben und danach mit der Eiablage den Fortpflanzungsvorgang abzuschließen. Die Strategie des Männchens des Hirschkäfers *Lucanus cervus*, für das Gelingen des Transfers seiner Spermien in den Genitaltrakt des Weibchens während der Kopulation seinen widerstandsfähigen Körper als gepanzerten Schutzschild für das darunter verborgene Weibchen im Extremfall bis zu seiner eigenen Erbeutung durch räuberische Vögel einzusetzen, erfolgt in dem Bewußtsein, daß sein Lebensziel ausschließlich die Ablieferung seiner Spermien durch intravaginale Ejakulation im Abdomen des Weibchens während der Paarung beinhaltet, denn nach erfolgter Befruchtung ist das Weibchen im weiteren Verlauf des Brutgeschäftes vom Männchen unabhängig, welches lediglich zur Spermieninjektion in den Vaginalbereich des Weibchens bei der Begattung gebraucht wird, jedoch bei der anschließenden Oviposition nicht mehr benötigt wird.

Das Männchen des Hirschkäfers *Lucanus cervus* nutzt damit seine außergewöhnliche Größe, mit der es das deutlich kleinere Weibchen während der Kopulation nicht nur vollständig überdeckt, sondern oftmals durch den Überstand an den Rändern des Körpers und im Bereich des Kopfes mit den geweihartig verlängerten Mandibeln, welche wie ein Käfig fungieren, unter einem Schutzschild verschwinden läßt, um das Weibchen während der Paarung unter dem Panzer seines Körpers zu verstecken und damit vor dem Zugriff durch räuberische Vögel zu verbergen. Die Strategie des Männchens des Hirschkäfers *Lucanus cervus* zielt damit ab dem Moment, in dem es seinen Beitrag zum Fortpflanzungszyklus mit dem Vollzug der Kopulation durch intravaginale Ejakulation seiner Spermien im Abdomen des Weibchens geleistet hat, ausschließlich auf die Sicherung des Erfolgs der Weitergabe seiner Spermien zur Befruchtung der Eier innerhalb des Weibchens, und das Männchen opfert deshalb notfalls sich selbst, um die Chance des Weibchens zu erhöhen, nach erfolgreicher Paarung den Fortpflanzungszyklus der jeweiligen Generation mit der Eiablage abzuschließen und damit den Fortbestand der Population in der nächsten Generation zu begründen und sicherzustellen. Bei dieser Strategie profitiert das Männchen des Hirschkäfers *Lucanus cervus* entscheidend von seiner außergewöhnlichen Größe, denn im Gegensatz zu vielen kleineren Käfern, wo sich räuberische Vögel gleich das ganze Pärchen als Paket schnappen, ist das große Männchen des Hirschkäfers *Lucanus cervus* für die meisten räuberischen Vögel eine derart große Portion von Protein und Fett, daß sie sich zunächst damit begnügen und auch vollauf damit beschäftigt sind, dem Männchen das weiche Abdomen abzupicken und die unverdaulichen Reste des harten Panzers, welche Kopf (einschließlich der geweihartig vergrößerten Mandibeln), Brust, Deckflügel und Beine umfassen, abzutrennen und fallen- bzw. liegenzulassen. In dem Moment, wo die Kopulation von Männchen und Weibchen des Hirschkäfers *Lucanus cervus* dadurch beendet wird, daß ein räuberischer Vogel das Männchen erbeutet und vom Weibchen entfernt, hat das Weibchen die Gelegenheit, sich vom Paarungsort fallen zu lassen und am Boden zu verstecken oder zu entkommen, während das Männchen als Opfer der Prädatoren diese vorübergehend mit sich beschäftigt und damit von dem Weibchen ablenkt sowie einen entscheidenden Zeitvorteil für die Flucht und das Verschwinden des Weibchens in einer sicheren Deckung herausholt.

Aufgrund der erheblichen Variabilität der Größe der Individuen des Hirschkäfers *Lucanus cervus* wird der maximale Wirkungsgrad des Selbstschutzmechanismus der Abschirmung des Weibchens

bei der Kopulation durch große und sehr große Männchen erreicht, bei denen infolge der extremen Größe die Überdeckung und der Überstand ihres Panzers über dem Weibchen sowie die käfigartige Funktion der geweihartig verlängerten Mandibeln bei der Paarung optimal entwickelt sind und dem unter diesem gepanzerten Schutzschild verborgenen Weibchen eine größtmögliche Absicherung bieten, wohingegen die vorgenannten Verhältnisse bei mittelgroßen Männchen lediglich suboptimal ausgebildet sind und bei kleinen Männchen in Abhängigkeit von der Größe der Weibchen zunehmend ungünstiger ausfallen.

Die Wirksamkeit dieses Selbstschutzmechanismus des Hirschkäfers *Lucanus cervus* wird dadurch unterstrichen, daß die meisten Ansammlungen von Caput-Thorax-Torsi auf Wegen und unter Bäumen, welche die Rückstände der Mahlzeiten räuberischer Vögel darstellen, überwiegend bis fast ausschließlich Reste von Männchen und nur untergeordnet bis akzessorisch oder überhaupt nicht Fragmente von Weibchen beinhalten. Die Effektivität dieses Selbstschutzmechanismus des Hirschkäfers *Lucanus cervus* wird auch dadurch belegt, daß gegen Ende der Flugzeit in vielen Populationen fast nur noch Weibchen übriggeblieben sind, wohingegen die am Anfang der Flugzeit oftmals signifikant überwiegenden Männchen fast alle bereits natürlich verendet sind oder von Vögeln und anderen Räubern erbeutet wurden.

10 Anerkennung

Ich danke allen Naturfreunden, welche sich aufgrund meiner Aufrufe zur Mitteilung von Beobachtungen des Hirschkäfers *Lucanus cervus* in regionalen Tageszeitungen bei mir gemeldet haben und mir über ihre Funde berichtet haben, für ihre Unterstützung meiner Studie durch ihre wertvollen Beiträge, ohne die meine Auswertung bei weitem nicht so detailliert ausgefallen wäre. Ich danke allen Naturfreunden für ihre Mithilfe bei der Abfassung meiner Studie durch ihre selbstlose Mitteilung ihrer Funde des Hirschkäfers *Lucanus cervus* und ihre Genehmigung zur Publikation der mir überlassenen Daten. Ich würde mich sehr freuen, wenn sie mir auch in den kommenden Jahren wieder ihre Nachweise und Beobachtungen des Hirschkäfers *Lucanus cervus* melden und für die Veröffentlichung zur Verfügung stellen würden.

Ich danke ganz besonders dem einzelnen Männchen des Hirschkäfers *Lucanus cervus,* welches am Abend des 01.06.2008 direkt neben meinen Füßen gelandet ist, als ich am Waldrand in Tairnbach den Weg entlanggegangen bin, und welches mein Interesse an dieser Population stimuliert hat und meinen Forschungsenthusiasmus ausgelöst hat, der nur wenige Tage später explodiert ist, als ich das außergewöhnliche Glück hatte, ein herausragendes Schwärmen von zahlreichen Männchen und Weibchen des Hirschkäfers *Lucanus cervus* um die Bäume am Waldrand in Tairnbach in der Dämmerung vor dem Einbruch der Nacht am 05.06.2008 zu beobachten, welches zwei Tage nach dem Neumond am 03.06.2008 stattgefunden hat. Ich habe gleich verstanden, daß das einzelne Männchen des Hirschkäfers *Lucanus cervus* mich mit seiner Landung direkt vor meinen Füßen aufgefordert hat, sich seiner Sache anzunehmen und den Naturschutz des Hirschkäfers *Lucanus cervus* wissenschaftlich zu erforschen, und habe deshalb sofort das mir praktisch vom Himmel vor die Füße gefallene Thema aufgegriffen und bearbeitet.

Alle Einzelheiten, welche ich in meinem Buch (MADER 2009a) und in meinem vorliegenden Supplement über den Hirschkäfer *Lucanus cervus* dokumentiert habe, sind in ihrer Summe ausschließlich dazu bestimmt, möglichst zahlreiche Naturfreunde für den Schutzbedarf und die Schutzwürdigkeit des Hirschkäfers *Lucanus cervus* zu sensibilisieren und von der Notwendigkeit der konsequenten Durchführung der vorgeschlagenen Schutzmaßnahmen zu überzeugen. Das wichtigste Ziel meiner Naturschutzarbeit für den Hirschkäfer *Lucanus cervus* ist ein Beitrag dazu, daß der Hirschkäfer

Lucanus cervus in möglichst zahlreichen Populationen ungefährdet über viele Generationen überleben kann und auch dann noch in ausreichender Verbreitung in gesicherten Beständen ohne konkrete Bedrohung in jedem Jahr aufs Neue erscheinen wird, wenn als Zeugnisse meines Engagements für seinen Schutz nur noch die Exemplare meines Buches und meines Supplementes in den Regalen der Bibliotheken vorhanden sein werden.

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12 Status

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Alphabetical index of Latin names of investigated insects

The various beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects which are incorporated into the interpretation of the relationships of swarm phases, mass flights and peak occurrences with the new moon and full moon phases of the lunar cycle are listed in an alphabetical index of Latin names as follows. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature includes abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies. The different mushrooms which are analyzed concerning the relationships of mass growth with the new moon and full moon phases of the lunar cycle in comparison with the various insects are also compiled.

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The selenocyclical interpretation of the population dynamics of various insects includes the following beetles (Coleoptera):

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the Chequered Skipper *Carterocephalus palaemon* Pallas 1771 (Hesperiidae) 297
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the Dotted Footman *Pelosia muscerda* Hufnagel 1766 (Arctiidae) …. 350
the Raspberry Clearwing *Pennisetia hylaeiformis* (Laspeyres 1801) (Sesiidae) …. 424
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the Pearly Underwing *Peridroma saucia* (Hübner 1808) (Noctuidae) …. 406
the Buff-Tip *Phalera bucephala* Linnaeus 1758 (Notodontidae) …. 418
the Map-Winged Swift *Pharmacis fusconebulosa* de Geer 1778 (Hepialidae) …. 406
the Lesser Sallow Prominent *Pheosia gnoma* (Fabricius 1777) (Notodontidae) …. 415
the Angle Shades *Phlogophora meticulosa* Linnaeus 1758 (Noctuidae) …. 385
the Reed Leopard *Phragmataecia castaneae* (Hübner 1790) (Cossidae) …. 424
the Ruby Tiger *Phragmatobia fuliginosa* Linnaeus 1758 (Arctiidae) …. 345
the Gold Spot *Plusia festucae* Linnaeus 1758 (Noctuidae) …. 444
the Lempke´s Gold Spot *Plusia putnami* (Grote 1873) (Noctuidae) …. 406
the December Moth *Poecilocampa populi* Linnaeus 1758 (Lasiocampidae) …. 423
the Large Ranunculus *Polymixis flavicincta* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) …. 447
the Cameo *Polymixis gemmea* (Treitschke 1825) (Noctuidae) …. 437
the Black-Banded *Polymixis xanthomista* (Hübner 1819) (Noctuidae) …. 437
the Guernsey Underwing *Polyphaenis sericata* Esper 1787 (Noctuidae) …. 344
the Frosted Green *Polyploca ridens* (Fabricius 1787) (Thyatiridae) …. 422
the Marbled White Spot *Protodeltote pygarga* (Hufnagel 1766) (Noctuidae) …. 407
the Shining Marbled *Pseudeustrotia candidula* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) …. 395
the Green Silver-Lines *Pseudoips prasinana* (Warren 1913) (Noctuidae) …. 433
the Pale Prominent *Pterostoma palpina* (Clerck 1759) (Notodontidae) …. 418
the Coxcomb Prominent *Ptilodon capucina* Linnaeus 1758 (Notodontidae) …. 417
the Plumed Prominent *Ptilophora plumigera* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae) …. 359
the Bordered Sallow *Pyrrhia umbra* (Hufnagel 1766) (Noctuidae) …. 377

the Dark Forester *Rhagades pruni* Schiffermüller (in Denis & Schiffermüller 1775) (Zygaenidae) 376
the Large Wainscot *Rhizedra lutosa* (Hübner 1803) (Noctuidae) 361
the Straw Dot *Rivula sericealis* (Scopoli 1763) (Noctuidae) 449
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the Pinion-Streaked Snout *Schrankia costaestrigalis* Stephens 1834 (Noctuidae) 408
the Blair´s Wainscot *Sedina buettneri* (E. Hering 1858) (Noctuidae) 450
the Flame Wainscot *Senta flammea* (Curtis 1828) (Noctuidae) 450
the Dew Moth *Setina roscida* Schiffermüller (in Denis & Schiffermüller 1775) (Arctiidae) 354
the White Colon *Sideridis albicolon* (Hübner 1813) (Noctuidae) 398
the Reed Dagger *Simyra albovenosa* (Goeze 1781) (Noctuidae) 396
the Stout Dart *Spaelotis ravida* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) ... 409
the Argentine *Spatalia argentina* Schiffermüller (in Denis & Schiffermüller 1775) (Notodontidae) 419
the Privet Hawk-Moth *Sphinx ligustri* Linnaeus 1758 (Sphingidae) 353
the Buff Ermine *Spilarctia luteum* (Hufnagel 1766) (Arctiidae) 403
the White Ermine *Spilosoma lubricipeda* Linnaeus 1758 (Arctiidae) 410
the White Tiger *Spilosoma menthastri* (Esper 1786) (Arctiidae) 402
the Water Ermine *Spilosoma urticae* (Esper 1789) (Arctiidae) 408
the Feathered Footman *Spiris striata* (Linnaeus 1758) (Arctiidae) 351
the Small Mottled Willow *Spodoptera exigua* (Hübner 1808) (Noctuidae) 412
the Lobster Moth *Stauropus fagi* Linnaeus 1758 (Notodontidae) 415
the Orange-Tailed Clearwing *Synanthedon andrenaeformis* (Laspeyres 1801) (Sesiidae) 426
the Dale´s Oak Clearwing *Synanthedon conopiformis* (Esper 1782) (Lepidoptera: Sesiidae) 426
the Red-Belted Clearwing *Synanthedon myopaeformis* (Borkhausen 1789) (Sesiidae) 425
the Yellow-Legged Clearwing *Synanthedon vespiformis* (Linnaeus 1761) (Sesiidae) 425
the Scarce Silver Y *Syngrapha interrogationis* Linnaeus 1758 (Noctuidae) 411
the Nine-Spotted Moth *Syntomis phegea* Linnaeus 1758 (Arctiidae) 410
the Figure of Eighty *Tethea ocularis* Linnaeus 1767 (Thyatiridae) 411
the Poplar Lutestring *Tethea or* Schiffermüller (in Denis & Schiffermüller 1775) (Thyatiridae) 421
the Satin Lutestring *Tetheella fluctuosa* (Hübner 1813) (Thyatiridae) 356
the Straw Underwing *Thalpophila matura* (Hufnagel 1766) (Noctuidae) 344
the Oak Processionary *Thaumetopoea processionea* Linnaeus 1758 (Thaumetopoeidae) 355
the Hedge Rustic *Tholera cespitis* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) 363
the Feathered Gothic *Tholera decimalis* (Poda 1761) (Noctuidae) 442
the Round-Winged Muslin *Thumatha senex* (Hübner 1808) (Arctiidae) 363
the Peach Blossom *Thyatira batis* Linnaeus 1758 (Thyatiridae) 423
the Pale Eggar *Trichiura crataegi* Linnaeus 1758 (Lasiocampidae) 411
the Four-Spotted Moth *Tyta luctuosa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) 411
the Green-Brindled Dot *Valeria oleagina* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) 448
the Barred Hook-Tip *Watsonalla cultraria* (Fabricius 1775) (Drepanidae) 355
the Orange Sallow *Xanthia citrago* Linnaeus 1758 (Noctuidae) 429
the Pale-Lemon Sallow *Xanthia ocellaris* (Borkhausen 1792) (Noctuidae) 431
the Heath Rustic *Xestia agathina* (Duponchel 1827) (Noctuidae) 400

the Neglected Rustic *Xestia castanea* (Esper 1798) (Noctuidae) …. 400
the Setaceous Hebrew Character *Xestia c-nigrum* (Linnaeus 1758) (Noctuidae) …. 388
the Triple-Spotted Clay *Xestia ditrapezium* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) …. 427
the Square-Spotted Clay *Xestia rhomboidea* (Esper 1790) (Noctuidae) …. 400
the Double Square-Spot *Xestia triangulum* (Hufnagel 1766) (Noctuidae) …. 424
the Square-Spot Rustic *Xestia xanthographa* Schiffermüller (in Denis & Schiffermüller 1775) (Noctuidae) …. 360
the Blood Droplet Moth *Zygaena carniolica* Scopoli 1763 (Zygaenidae) …. 334
the Variable Burnet *Zygaena ephialtes* Linnaeus 1767 (Zygaenidae) …. 335
the Six-Spot Burnet *Zygaena filipendulae* Linnaeus 1758 (Zygaenidae) …. 185
the Narrow-Bordered Five-Spot Burnet *Zygaena lonicerae* (Scheven 1777) (Zygaenidae) …. 335
the Slender Scotch Burnet *Zygaena loti* Schiffermüller (in Denis & Schiffermüller 1775) (Zygaenidae) …. 336
the Transparent Burnet *Zygaena purpuralis* (Brünnich 1763) (Zygaenidae) …. 336
the Transalpine Burnet *Zygaena transalpina* (Esper 1781) (Zygaenidae) …. 335
the Five-Spot Burnet *Zygaena trifolii* Esper 1783 (Zygaenidae) …. 335
the New Forest Burnet *Zygaena viciae* Schiffermüller (in Denis & Schiffermüller 1775) (Zygaenidae) …. 336

Dragonflies

The selenocyclical interpretation of the population dynamics of various insects includes the following dragonflies (Odonata):

the Southern Migrant Hawker *Aeshna affinis* Linden 1820 (Aeshnidae) …. 465
the Southern Hawker *Aeshna cyanea* Rambur 1842 (Aeshnidae) …. 466
the Brown Hawker *Aeshna grandis* Linnaeus 1758 (Aeshnidae) …. 511
the Norfolk Hawker *Aeshna isosceles* O.F. Müller 1767 (Aeshnidae) …. 512
the Migrant Hawker *Aeshna mixta* Latreille 1805 (Aeshnidae) …. 464
the Green Hawker *Aeshna viridis* Eversmann 1836 (Aeshnidae) …. 468
the Emperor Dragonfly *Anax imperator* Leach 1815 (Aeshnidae) …. 508
the Lesser Emperor Dragonfly *Anax parthenope* Sélys 1839 (Aeshnidae) …. 509
the Hairy Dragonfly *Brachytron pratense* O.F. Müller 1764 (Aeshnidae) …. 512
the Golden-Ringed Dragonfly *Cordulegaster boltonii* (Donovan 1807) (Cordulegasteridae) …. 510
the Downy Emerald *Cordulia aenea* Linnaeus 1758 (Corduliidae) …. 510
the Scarlet Dragonfly *Crocothemis erythraea* Brullé 1832 (Libellulidae) …. 507
the Western Clubtail *Gomphus pulchellus* Sélys 1840 (Gomphidae) …. 503
the Common Clubtail *Gomphus vulgatissimus* Linnaeus 1758 (Gomphidae) …. 503
the Lilypad Whiteface *Leucorrhinia caudalis* (Charpentier 1840) (Libellulidae) …. 512
the Broad-Bodied Chaser *Libellula depressa* Linnaeus 1758 (Libellulidae) …. 461
the Scarce Chaser *Libellula fulva* O.F. Müller 1764 (Libellulidae) …. 463
the Four-Spotted Chaser *Libellula quadrimaculata* Linnaeus 1758 (Libellulidae) …. 457
the Small Pincertail *Onychogomphus forcipatus* Linnaeus 1758 (Gomphidae) …. 510
the Green Snaketail *Ophiogomphus cecilia* (Fourcroy 1785) (Gomphidae) …. 502
the Southern Skimmer *Orthetrum brunneum* Fonscolombe 1837 (Libellulidae) …. 506
the Keeled Skimmer *Orthetrum coerulescens* (Fabricius 1798) (Libellulidae) …. 507
the Black-Tailed Skimmer *Orthetrum cancellatum* Linnaeus 1758 (Libellulidae) …. 503
the Brilliant Emerald *Somatochlora metallica* (Linden 1825) (Corduliidae) …. 511
the Black Darter *Sympetrum danae* (Sulzer 1776) (Libellulidae) …. 475

the Yellow-Winged Darter *Sympetrum flaveolum* Linnaeus 1758 (Libellulidae) …..... 476
the Red-Veined Darter *Sympetrum fonscolombii* (Sélys 1840) (Libellulidae) …..... 476
the Ruddy Darter *Sympetrum sanguineum* (O.F. Müller 1764) (Libellulidae) …..... 471
the Common Darter *Sympetrum striolatum* Charpentier 1840 (Libellulidae) …..... 469
the Vagrant Darter *Sympetrum vulgatum* Linnaeus 1758 (Libellulidae) …..... 473

Damselflies

The selenocyclical interpretation of the population dynamics of various insects includes the following damselflies (Odonata):

the Banded Demoiselle *Calopteryx splendens* (Harris 1782) (Calopterygidae) …..... 455
the Beautiful Demoiselle *Calopteryx virgo* Linnaeus 1758 (Calopterygidae) …..... 452
the Willow Emerald Damselfly *Chalcolestes viridis* (Linden 1828) (Lestidae) …..... 485
the Southern Damselfly *Coenagrion mercuriale* Charpentier 1825 (Coenagrionidae) …..... 477
the Azure Damselfly *Coenagrion puella* Linnaeus 1758 (Coenagrionidae) …..... 478
the Variable Damselfly *Coenagrion pulchellum* Linden 1825 (Coenagrionidae) …..... 482
the Common Blue Damselfly *Enallagma cyathigerum* Charpentier 1840 (Coenagrionidae) ….. 487
the Goblet-Marked Damselfly *Erythromma lindenii* (Sélys 1840) (Coenagrionidae) …..... 502
the Red-Eyed Damselfly *Erythromma najas* Hansemann 1823 (Coenagrionidae) …..... 500
the Small Red-Eyed Damselfly *Erythromma viridulum* Charpentier 1840 (Coenagrionidae) ….. 501
the Blue-Tailed Damselfly *Ischnura elegans* Linden 1820 (Coenagrionidae) …..... 492
the Scarce Blue-Tailed Damselfly *Ischnura pumilio* Charpentier 1840 (Coenagrionidae) …..... 496
the Southern Emerald Damselfly *Lestes barbarus* (Fabricius 1798) (Lestidae) …..... 482
the Emerald Spreadwing Damselfly *Lestes dryas* (W.F. Kirby 1890) (Lestidae) …..... 483
the Emerald Damselfly *Lestes sponsa* (Hansemann 1823) (Lestidae) …..... 484
the Small Emerald Damselfly *Lestes virens* (Charpentier 1828) (Lestidae) …..... 484
the White-Legged Damselfly *Platycnemis pennipes* (Pallas 1771) (Platycnemididae) …..... 497
the Large Red Damselfly *Pyrrhosoma nymphula* (Sulzer 1776) (Coenagrionidae) …..... 489
the Common Winter Damselfly *Sympecma fusca* (Linden 1820) (Lestidae) …..... 486

Other insects

The selenocyclical interpretation of the population dynamics of various insects includes the following other insects:

the Black Bean Aphid *Aphis fabae* Scopoli 1763 (Hemiptera: Aphididae) …..... 518
the Bean Aphid *Aphis rumicis* Linnaeus 1758 (Hemiptera: Aphididae) …..... 518
the Hawthorn Fly *Bibio marci* Linnaeus 1758 (Diptera: Bibionidae) …..... 519
the Burrowing Mayfly *Ephoron virgo* (Olivier 1791) (Ephemeroptera: Polymitarcyidae) …..... 512
the Cosmopolitan Grain Psocid *Lachesilla pedicularia* Linnaeus 1758 (Psocoptera: Lachesillidae) …..... 519
the Mason Bee *Megachile parietina* (Geoffroy in Fourcroy 1785) (Hymenoptera: Megachilidae) …..... 516
the Common Elbowed Red Ant *Myrmica scabrinodis* Nylander 1846 (Hymenoptera: Formicidae) …..... 519
the Peach-Potato Aphid *Myzus persicae* (Sulzer 1776) (Hemiptera: Aphididae) …..... 518
the Burrowing Mayfly *Oligoneuriella rhenana* (Imhoff 1852) (Ephemeroptera: Oligoneuriidae) …..... 515
the Lettuce-Root Aphid *Pemphigus bursarius* (Linnaeus 1758) (Hemiptera: Aphididae) …..... 518

the Springtail *Sminthurus ater* Latreille (Collembola: Sminthuridae) …..... 518
the Carpenter Bee *Xylocopa violacea* Linnaeus 1758 (Hymenoptera: Anthophoridae) …..... 515

In the context of the evaluation of the relationships of swarm phases, mass flights and peak occurrences of various insects with the new moon and full moon phases of the lunar cycle, comments are also given on the following species:

the Death´s-Head Hawk-Moth *Acherontia atropos* Linnaeus 1758 (Lepidoptera: Sphingidae) ….. 34
the Honey Bee *Apis mellifera* Linnaeus 1758 (Hymenoptera: Apidae) …..... 517
the Berger´s Clouded Yellow *Colias alfacariensis* Ribbe 1905 (Lepidoptera: Pieridae) …..... 197
the Plain Tiger *Danaus chrysippus* Linnaeus 1758 (Lepidoptera: Danaidae) …..... 207
the Delta Mud Wasp *Delta unguiculatum* (Villers 1789) (Hymenoptera: Eumenidae) …..... 516
the Praying Mantis *Mantis religiosa* Linnaeus 1758 (Mantodea: Mantidae) …..... 34
the Mason Bee *Osmia anthocopoides* Schenck 1853 (Hymenoptera: Megachilidae) …..... 516
the Clouded Apollo *Parnassius mnemosyne* Linnaeus 1758 (Papilionidae) …..... 237
the Canarian Large White *Pieris cheiranthi* (Hübner 1808) (Lepidoptera: Pieridae) …..... 207
the Mud Dauber *Sceliphron destillatorium* (Illiger 1807) (Hymenoptera: Sphecidae) …..... 516
the Indian Red Admiral *Vanessa indica* (Herbst 1794) (Lepidoptera: Nymphalidae) …..... 207

Mushrooms

The selenocyclical interpretation of the mass growth of different mushrooms in comparison with the population dynamics of various insects includes the following mushrooms:

the Field Mushroom *Agaricus campestris* Linnaeus 1753 (Agaricales: Agaricaceae) …..... 526
the Fly Agaric *Amanita muscaria* Linnaeus 1753 (Agaricales: Amanitaceae) …..... 525
the Honey Fungus *Armillaria mellea* (Vahl 1792) (Agaricales: Marasmiaceae) …..... 527
the Edible Bolete *Boletus edulis* Bulliard 1782 (Boletales: Boletaceae) …..... 522
the Ink Cap *Coprinus comatus* (O.F. Müller 1797) (Agaricales: Coprinaceae) …..... 524
the Saffron Milk Cap *Lactarius deliciosus* Linnaeus 1753 (Russulales: Russulaceae) …..... 526
the Parasol Mushroom *Macrolepiota procera* (Scopoli 1772) (Agaricales: Lepiotaceae) …..... 523
the Slippery Jack *Suillus luteus* (Linnaeus 1753) (Boletales: Boletaceae) …..... 525

In the context of the evaluation of the relationships of mass growth of mushrooms with the new moon and full moon phases of the lunar cycle, comments are also given on the following species:

the Toadstool *Agaricus xanthodermus* Genevier 1876 (Agaricales: Agaricaceae) …..... 526
the Inkstain Bolete *Boletus pulverulentus* Opatowski 1836 (Boletales: Boletaceae) …..... 523
the Chanterelle *Cantharellus cibarius* Linnaeus 1753 (Cantharellales: Cantharellaceae) …..... 523
the Octopus Stinkhorn *Clathrus archeri* (Berkeley 1860) (Phallales: Phallaceae) …..... 523
the Sulphur Tuft *Hypholoma fasciculare* (Hudson 1778) (Agaricales: Strophariaceae) …..... 527
the Milk Cap *Lactarius fluens* Boudier 1899 (Russulales: Russulaceae) …..... 526
the Woolly Milk Cap *Lactarius torminosus* (Schäffer 1774) (Russulales: Russulaceae) …..... 526
the Clouded Agaric *Lepista nebularis* (Batsch 1789) (Agaricales: Tricholomataceae) …..... 524
the Gem-Studded Puffball *Lycoperdon perlatum* Persoon 1801 (Agaricales: Agaricaceae) …..... 527
the Umber-Brown Puffball *Lycoperdon umbrinum* Persoon 1801 (Agaricales: Agaricaceae) ….. 524
the Cauliflower Mushroom *Sparassis crispa* (Wulfen in Jacquin 1781) (Polyporales: Sparassidaceae) …..... 527
the Larch Bolete *Suillus grevillei* (Klotzsch 1832) (Boletales: Boletaceae) …..... 523
the Bay Bolete *Xerocomus badius* (Fries 1818) (Boletales: Boletaceae) …..... 523
the Red Cracking Bolete *Xerocomus chrysenteron* (Bulliard 1791) (Boletales: Boletaceae) ….. 523

Postface

The timely publication of my book on population dynamics, ecology and conservation of the Stag Beetle *Lucanus cervus* Linnaeus 1758 (Coleoptera: Lucanidae) in the region around Heidelberg and Mannheim in the southwestern part of Germany (Mader 2009) still before the beginning of the flight season of the most spectacular and best known beetle in the entomofauna of Middle Europe in spring 2009 has been my first step in the documentation of the life history of the Stag Beetle *Lucanus cervus* since a single male has landed right next to my feet on 01.06.2008 after a period of abt. 35 years when I had not encountered any individual in its natural environment. The suite of additional data which has been obtained by own observations, reports from friends of nature and review of the literature after the publication of my book has allowed the further elaboration and the enhanced assessment of various aspects of the biology of the Stag Beetle *Lucanus cervus* and has stimulated the edition of this volume as supplement and extension of my book that contains extended and actualized evaluations of three sections of my compilation of the life history of the Stag Beetle *Lucanus cervus* where the new material has been integrated. The new results on ethology, ecology and phaenology of the Stag Beetle *Lucanus cervus* have been incorporated into revised and enlarged outlines of three chapters of my monograph which are presented as a collection of three papers in this volume. The three articles in this volume comprising summaries of long-term population dynamics, short-term population dynamics and swarming behaviour, and conservation measures of the Stag Beetle *Lucanus cervus* represent thus an actualization of my book based on the additional results which have been collected in 2009, and constitute my second step in the documentation of the life history of the Stag Beetle *Lucanus cervus* that is published after the end of the flight season 2009 of the most spectacular and best known beetle in the entomofauna of Middle Europe and is therefore available before the beginning of the flight season in spring 2010. The second article on the selenocyclical population dynamics of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects represents a considerable broadening of the spectrum of investigated species beyond the aspects which have been discussed in my book, and this significant widening of the suite of more than 500 evaluated species has resulted in the establishment of this issue as an additional volume to my book on the Stag Beetle *Lucanus cervus*.

I would be very grateful if many readers of my articles in this volume would enlarge and complete their literature record on the Stag Beetle *Lucanus cervus* by ordering a copy of my book (price 49 €) with me. I intend to continue my work on population dynamics, ecology and conservation of the Stag Beetle *Lucanus cervus* during the next years, and all the returns from the sale of my book will be exclusively utilized for the funding of my research of the life history of the Stag Beetle *Lucanus cervus* and the application of the results in the promotion of conservation measures for the Stag Beetle *Lucanus cervus*. The Stag Beetle *Lucanus cervus* is since long time in Germany and in other countries of Europe under rigorous nature protection which has been further restricted in the European Union in the last years. The goal of my research of the life history of the Stag Beetle *Lucanus cervus* and the application of the results in the promotion of conservation measures for the Stag Beetle *Lucanus cervus* is to contribute to the achievement of the aims of the fauna-flora-habitat-directive of the European Union in an extent as wide as possible and to help to secure the pronounced position of the Stag Beetle *Lucanus cervus* in the entomofauna of Middle Europe permanently. Every reader of my articles in this supplement who would order a copy of my book with me would significantly support my work on the life history and conservation of the Stag Beetle *Lucanus cervus* and would thus also provide an important contribution to the enhancement of the nature protection for the Stag Beetle *Lucanus cervus* in the framework of the conservation program of the European Union.

The central part of my book on the Stag Beetle *Lucanus cervus* comprises the evaluation of the reports of finds and observations by more than 600 friends of nature from more than 225 localities in the region around Heidelberg and Mannheim in the southwestern part of Germany who have contacted me in response to my calls for contributions in regional newspapers in 2008 and who have told me their finds and observations of the Stag Beetle *Lucanus cervus*. The study area around Heidelberg and Mannheim extends for more than 100 km both from north to south and from west to east. More than 150 of these friends of nature have been able to report me long-term records of the regular annual appearance of individuals of the Stag Beetle *Lucanus cervus* for periods of up to 50 – 75 years at abt. 75 localities which has permitted to extend the interpretation of population dynamics and ecology of the Stag Beetle *Lucanus cervus* to periods of several decades or even more than half a century. The documentation of the long-term existence of numerous stable populations where the individuals of the Stag Beetle *Lucanus cervus* occur regularly in every year for periods of up to three quarters of a century includes an outstanding data collection which is unique in the entomological literature. Because the compilation of the records of the regular annual appearance of the Stag Beetle *Lucanus cervus* for periods of several decades or even more than half a century is unmatched in the entomological literature, the long-term population dynamics of the Stag Beetle *Lucanus cervus* have been selected as one of the topics for the presentation of an extended and completed summary of aspects of its life history in this volume.

The second essential part of my book constitutes the evaluation of the swarming behaviour and the peak activity of the Stag Beetle *Lucanus cervus* and various other insects in correlation with the new moon at the end of the preceding lunar cycle or at the beginning of the following lunar cycle as well as with the full moon at the middle or central point of the lunar cycle. The selenocyclical interpretation of the swarming behaviour and the peak activity of the Stag Beetle *Lucanus cervus* and various other insects has revealed that particularly the new moon and the full moon have significant influences on the culmination of the activity of the corresponding generations. The meteorological and astronomical framework of the distribution of the frequency of the Stag Beetle *Lucanus cervus* and various other insects is particularly illustrated by an outline of the five longer periods of dry and warm weather in spring and summer 2008 which have been interrupted and separated by the shorter phases of wet and cool weather of the May cold (Ice Saints), June cold (sheep cold), July cold and August cold, as well as by an overview of the distribution of the new moon and the full moon from April to October. The results of my regular and systematical observations of the distribution of the frequency of the Stag Beetle *Lucanus cervus* at the locality Tairnbach southsoutheast of Heidelberg from 01.06.2008 to 15.08.2008 are compiled in tables and are evaluated concerning short-term population dynamics and ecology as an example of the significance of the continuous daily monitoring of the occurrence of the Stag Beetle *Lucanus cervus* during its flight period. Because the selenocyclical assessment of the distribution of the frequency of occurrence of the Stag Beetle *Lucanus cervus* and various other insects has turned out to represent a fundamental advance in the understanding of the triggering of swarm phases, mass flights and peak abundances, the short-term population dynamics and swarming behaviour of the Stag Beetle *Lucanus cervus* and various other insects have also been selected as one of the topics for the presentation of a revised and enlarged outline of aspects of its life history in this volume. The significance of the correlation of swarm events or mass flights of the Stag Beetle *Lucanus cervus,* other beetles, diurnal butterflies, nocturnal butterflies, dragonflies, damselflies and other insects with the new moon and full moon phases of the lunar cycle is also documented in the title of this volume on moon-related population dynamics and ecology of various insects. The selenocyclical evaluation of the dates of observations of significant quantities of insects based on the review of the literature incorporates abt. 15 species of beetles, more than 100 species of diurnal butterflies, more than 300 species of nocturnal butterflies, abt. 30 species of dragonflies and abt. 20 species of damselflies.

The third outstanding part of my book encompasses recommendations of various simple conserva-

tion measures for the Stag Beetle *Lucanus cervus* which could be executed by every friend of nature without problems at his house and in his garden as well as in forest, forest margin, orchard and street, and that could lead to a significant improvement of the conditions of life and reproduction of the Stag Beetle *Lucanus cervus* in the summation of the effects of all the participating friends of nature. The proposed conservation measures for the Stag Beetle *Lucanus cervus* include the transit service at streets and roads at the forest margin, the temporary closure of streets and roads at the forest margin for the traffic, the turnaround of males and females which are found lying on their back, the accumulation of compost heaps and dead wood piles with sufficient deposit time in gardens and orchards; the maintenance of natural tree stumps and the installation of artificial tree stumps in gardens, orchards and forests; the construction of stag beetle pyramids, piles and cradles; the installation of stag beetle pavements, the delineation of forest regions with restricted or prohibited cultivation, the supply of sap runs on trees in gardens and orchards, the planting and cultivation of cherry trees in gardens and orchards, the cover and control of water containers in gardens, the inspection of lawns before mowing, the multiplication by sensitization of other friends of nature, the regular reporting of observations for central evaluation, and the engagement against actions of chemical destruction of populations of the Cockchafer *Melolontha*. Because of the significant impact of the support by every single friend of nature and as a consequence of the fact that every single female of the Stag Beetle *Lucanus cervus* has the capability of securing and guaranteing the survival of at least parts of the population in the next generation if it arrives at its natural end of life after successful copulation and oviposition, an extended and actualized summary of the most important conservation measures for the Stag Beetle *Lucanus cervus* has been integrated as the final chapter into this volume.

My book on the Stag Beetle *Lucanus cervus* contains also a comprehensive evaluation of the literature (scientific journals and newspapers), and includes as a result of the review of the literature also compilations of the wood types which have been so far confirmed as substrates for the development of the larvae of the Stag Beetle *Lucanus cervus*, as well as compilations of the hitherto reported predators of the Stag Beetle *Lucanus cervus* that comprise mainly birds and mammals. Further sections with overviews of the evaluated literature incorporate figures, nature protection, morphology, metamorphosis, movement, flight times, synanthropy and threat of the Stag Beetle *Lucanus cervus*. A separate chapter provides an overview of occurrences of the Stag Beetle *Lucanus cervus* in various other regions in Germany and surrounding countries which have been documented in the recent literature (scientific journals and newspapers).

I would particularly welcome if many readers of my articles in this volume would report me their own finds and observations of the Stag Beetle *Lucanus cervus* in its natural environment from any place and any time of occurrence. I plan to continue my research of the life history of the Stag Beetle *Lucanus cervus* especially along the lines of the topics of the three articles in this supplement, and I would therefore be very pleased to receive as much contributions as possible on long-term population dynamics, short-term population dynamics and swarming behaviour, and conservation measures of the Stag Beetle *Lucanus cervus* for my integrated evaluation and synoptical interpretation. I would also be grateful if the readers of my articles in this volume would send me significant photographs of males and females of the Stag Beetle *Lucanus cervus* in its natural environment, would inform me on notes of the occurrence of the Stag Beetle *Lucanus cervus* in newspapers and remote journals, and would report me the names and affiliations of other people working currently on the Stag Beetle *Lucanus cervus* which are not quoted with their publications in the reference lists in my papers in this volume and in my book. I would also very much appreciate if the readers of my articles in this supplement would supply me with the corresponding material also on the Rhinoceros Beetle *Oryctes nasicornis* which I intend to evaluate for comparative interpretation. The easiest and quickest possibility to send me observations, informations, photographs and orders of my book of the Stag Beetle *Lucanus cervus* is by e-mail: dr.detlef.mader@web.de.

LINNAEUS, C. (1758): Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. 10th ed., **1**: 824 pp.; Salvius, Stockholm.
MADER, D. (2009a): Populationsdynamik, Ökologie und Schutz des Hirschkäfers (*Lucanus cervus*) im Raum um Heidelberg und Mannheim. 418 pp.; Regionalkultur, Ubstadt-Weiher. ISBN 978-3-89735-594-1. Hardcover, 49 €.