SYNOPSIS OF THE NW EUROPEAN MICROLEPIDOPTERA WITH SPECIAL REFERENCE TO THE ECOLOGY AND TAXONOMY OF THE DUTCH SPECIES.

PART 1.

INTRODUCTION AND PYRALIDAE (GALLERIINAE)

(Mededeling EIS-Nederland, no. 1)

by

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With 53 text-figures and 6 plates

INTRODUCTION

The present work is intended to give a treatment of the taxonomy and ecology of the Microlepidoptera found in northwest Europe. Until now no study has been published covering especially this part of Europe. Special attention will be paid to the species observed in The Netherlands.

In 1851 the first annotated list of the Dutch Microlepidoptera compiled by H. W. de Graaf appeared in the first volume of the 'Bouwstoffen voor eene Fauna van Nederland'. In the third volume of that work (1859-1866), partly in co-operation with P. C. T. Snellen (1866), the same author published a completely revised list of Dutch Microlepidoptera. This list appeared between 1859 and 1866. In 1882, Snellen's outstanding work, 'De Vlinders van Nederland, Microlepidoptera' appeared. No coherent treatise on Dutch Microlepidoptera has been published since then. A recent contribution is that of Lempke, who published a checklist of Dutch Lepidoptera in 1976. His classification and nomenclature are mainly based on the second edition of the British check list of Kloet & Hincks (1972). Although Lempke was the first for a long time to take stock, it is still a pity that the identifications of the Microlepidoptera, observed in The Netherlands, could not all be verified (Lempke, 1976: 5).

With regard to the other parts of northwest Europe, many local studies have been published, though the majority of them dates from before World War II. Recent contributions are those of Heuser et al. (1971) for the Palatine (Germany), and Bradley et al. (1973) and Heath et al. (1976) for Great Britain and Ireland.

It seemed that a modern treatment of the subject would be extremely welcome, first of all for the applied entomologists, but also for ecologists, especially those concerned with nature conservancy, and, last but not least, for serious amateurs, who collect data for faunistic work.

Identification of the Microlepidoptera certainly is a serious problem for the entomologists, especially at the initial stage of their studies, mainly because there are only few well-illustrated handbooks on the 'micro's' available, in contrast to those on the Macrolepidoptera.

In order to simplify identification, the synopsis is provided with illustrations. Moreover, keys are given for the species found in northwest Europe. As far as the Dutch Leaf Rollers (Tortricidae) are concerned, Bentinck & Diakonoff's monograph (1968) supplied a long felt need. Their book deals with 276 species, i.e., about 20% of the species of micro's found in The Netherlands. However, the faunistic part of this work has to be brought up to date.

Generally there is no difference of opinion among the European workers about the definition of the group of Lepidoptera, which is, by tradition, denoted as Microlepidoptera. Though this division of the order has no scientific basis, which has been recognized already in the 19th century, the use of the terms 'Macro-' and 'Microlepidoptera' is very convenient. In the present work the same families will be included as in the Microlepidoptera Palaearctica. Only one exception is made. In a volume of that series, which is still to be published, the Psychidae will be treated integrally (Amsel, 1965: XV). However, this family will be excluded from the present work since the whole group has already been well treated in Lempke's catalogue (1936-1970).

THE INCLUDED SPECIES AND THE GEOGRAPHICAL LIMITS OF THE AREA

The main purpose of the present synopsis is to give a detailed faunistic survey of the species found in The Netherlands so far. For that purpose the material in the museums and private collections had to be revised completely. Moreover it is intended to give a survey of the distribution of these species in the neighbouring area of northwest Europe.

The adjacent parts of northwest Europe can be considered as a rather coherent area from the biogeographical point of view. Important zoogeographical contributions dealing with northwest European Lepidoptera were published by Jordan (1886) for northwest Germany, by Lempke (1936-1970: (893)-(907)) for The Netherlands and by Beirne (1947: 237-372; 1952b) and E. B. Ford (1945: 122-151, 305-324; 1955: 118-130, 150-169) for Great Britain and Ireland. Therefore, species found in the neighbouring areas and not in The Netherlands are included. Thus more natural limits of the area are obtained. This design has a practical advantage because the work is less likely to become out of date as a result of the discovery of new species for the fauna. The geographical limitation of northwest Europe adopted here is shown in fig. 1.

In the period, in which the first part of Lempke's catalogue (1936-1970) appeared, the problem whether a species should be incorporated in the 'list' or not, was still a debatable point as is clear from the argument in the 'Entomologische Berichten, Amsterdam' at the time. Undoubtedly such an argument resulted from the idea among some naturalists, that the local fauna remains static. This static concept was not only due to a lack of ecological understanding, but might have also been caused by the ideal of the collectors to possess a complete collection. Detailed ecological investigations and patient faunistic work have proved that the populations, constituting the Dutch and northwest European fauna, do not show such a static pattern. On the contrary, they are subject to continuous quantitative and qualitative changes.

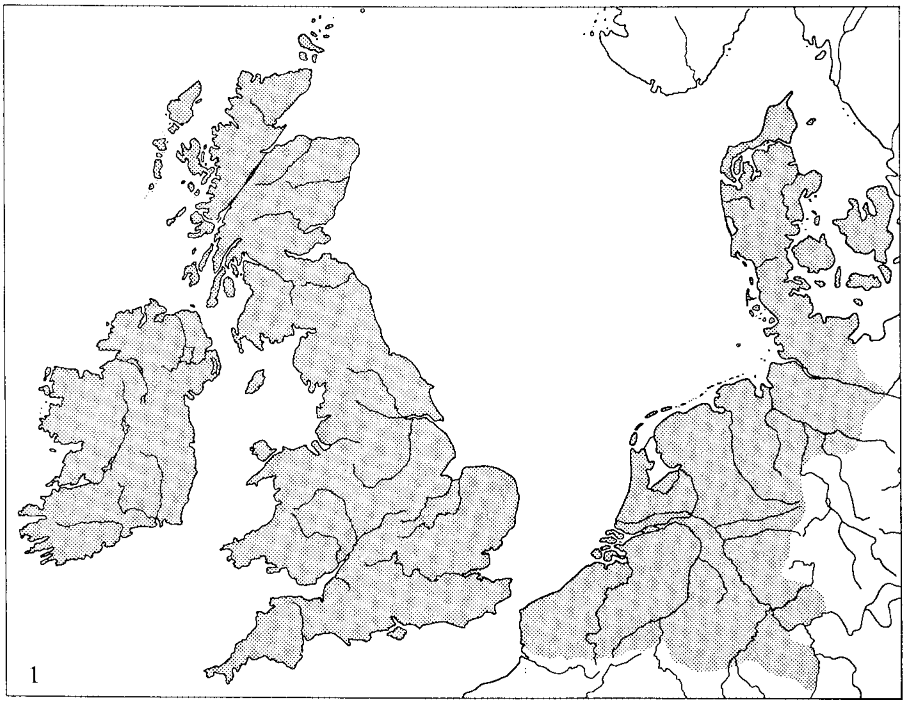


Fig. 1. The region treated in the present paper.

The species treated can be classified in six ecological categories:

1. — The permanent residents, which consist of populations living continuously in their habitats during the whole year, do not create problems with regard to the faunal list. These populations may change in numbers from generation to generation. Long-term studies of animal populations, which were sampled carefully, showed that the numbers fluctuate or oscillate in time (figs. 2, 3). It is concluded that such fluctuations occur normally in animal populations so that in the same habitat the species can be characterized at one time as rare and at another time as common; the fluctuations show a great amplitude. In spite of this difference in numbers from generation to generation, a mean density level over many years can be determined for each species in the habitat, as shown in the example of fig. 2. It is understood that population densities of the same species will differ spatially from habitat to habitat (fig. 3).

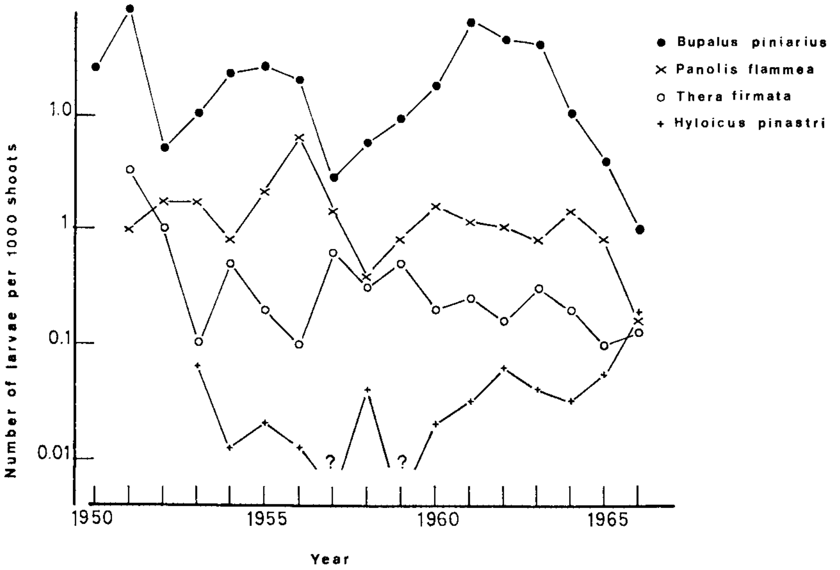


Fig. 2. Fluctuations in population densities of four species of moths in the same habitat, a wood of Scotch Pine in the Hoge Veluwe, The Netherlands (after Klomp, 1968).

2. — The limits of the range of several species pass through northwest Europe. It should be emphasized that the limits of the ranges are by no means fixed lines but subject to continuous shifts. Such populations occur uninterruptedly in their habitats for a couple of years, after which they disappear for some time, perhaps forever. On the other hand, rapid range extensions occur, resulting in the presence of species rarely, if ever, observed before and thus obtaining the status of a resident.

3. — Animals do not spread only within their habitats, but also sometimes leave them. Consequently, individuals are observed outside their normal environment. This type of dislocation, which (a) has no definite direction, (b) is not confined to fixed periods of the season and (c) generally refers to only a small fraction of the population, is called dispersion.

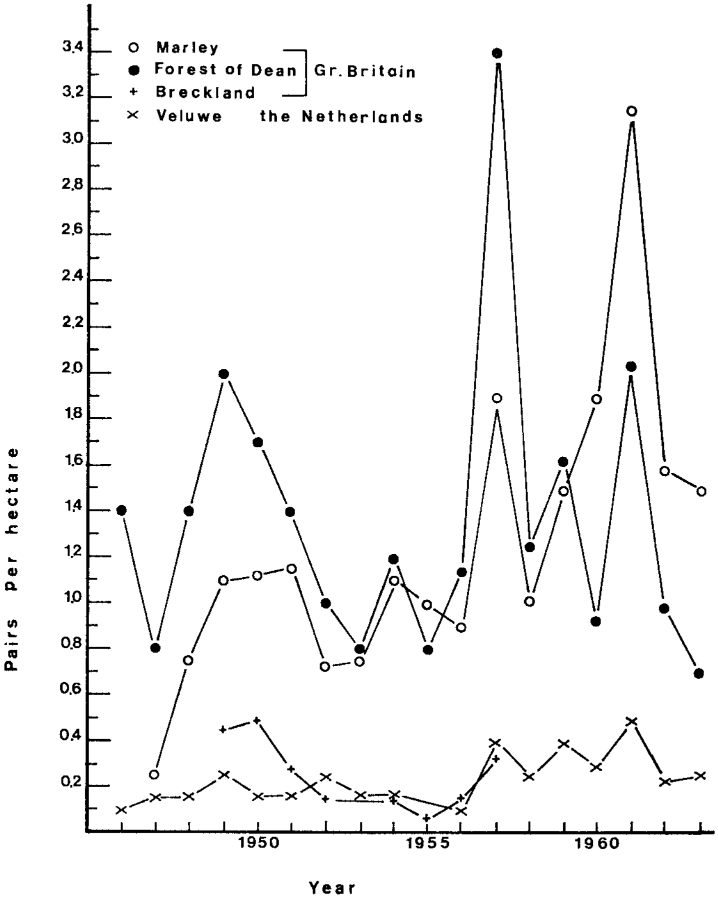


Fig. 3. Fluctuations of population density of four different populations of the same species, the Great Tit (*Parus major* L.) (after Lack, 1966).

4. — A number of species cannot be found in any stage of development in northwest Europe during the winter period. In the spring and early summer, individuals of these species reach northwest Europe, mainly from the South. They breed here and some authors have deduced from occasional records that their offspring returns in autumn and breeds in the Mediterranean area; their offspring in turns comes north to breed the following summer.

This behaviour is called migration. In some species this shift of the population occurs each year on a large scale. In others migration to northwest Europe takes place irregularly and in varying numbers. Also some species reach northwest Europe exceptionally.

5. — A separate category is composed of species, of which the larvae live in stored products. Until about 50 years ago, many naturalists were opposed to the incorporation into the faunal list of those species, that generally live indoors and cannot survive local natural conditions. However, Diakonoff (1938: LI-LII) pointed out that actually the pests of stored products account for a considerable fraction of the fauna. Some of these species are introduced artificially again and again in northwest Europe.

6. — Finally the reviser of a faunal list is confronted with a number of records, referring to artificially and incidentally introduced specimens as well as apocryphal records, which evidently are to be attributed to errors or to unusual methods of labelling. Such cases are considered individually.

The following prefixes are used:

* not found in The Netherlands, but known from northwest Europe
† no records known since 1900
? doubtful record.

INFORMATION INCLUDED

For each species in this work, data are provided on:

(a) Geographical distribution. First an overall picture of the known range is given, next its distribution in northwest Europe is described and finally its occurrence in The Netherlands is surveyed in detail, usually the localities being stated. For reasons of uniformity these will be mentioned in a similar way to that of Lempke (1936-1970). The localities are arranged according to the provinces. The following abbreviations have been used: Fr. = Friesland, Gr. = Groningen, Dr. = Drente, Ov. = Overijsel, Gld. = Gelderland, Utr. = Utrecht, N.H. = N.-Holland, Z.H. = Z.-Holland, Zl. = Zeeland, N.B. = N.-Brabant and Lbg. = Dutch Limburg. Within the provinces the localities are arranged alphabetically.

In nearly all cases distribution maps are supplied in order to give a clear picture of the distribution patterns in northwest Europe. For the Dutch maps the Universal Transverse Mercator projection (U.T.M. grid) is used. With this system, which is now employed internationally, the distribution maps of different countries can be fitted together without difficulty.

Sometimes the specimens, referred to in Dutch literature, could not be traced in the present collections and almost certainly are lost. If there is no doubt about their identification, the localities concerned are included, provided with their reference.

(b) Voltinism. Unless the number of records is very low, histograms are given, showing the number of adults registered per decade, based on field data. Moreover the extreme dates are quoted in the text. As usual, the indication 'until the second decade' means: up to and including the second decade. These data as well as breeding results form an indication of the voltinism in The Netherlands.

(c) Habitat. A short characterization of the type or types of habitat of the northwest European populations will be given. Data on the feeding habits of the larvae are mainly derived from literature and the sources quoted. Perhaps this information will stimulate the study of the bionomics of the species. This is urgently needed because many data are quoted in the literature since the last century and sometimes can be traced to a single observation.

(d) Genitalia. The genitalia of both sexes are described briefly, whith special attention to distinguishing characters.

(e) Variability of external characters. The most important trends in the adults of Dutch populations are indicated in the text. Moreover local differences in characters are considered carefully. The variation of the Microlepidoptera is not less extensive than that of the Macrolepidoptera, but has hardly been studied in detail so far. The creation of new names for infraspecific forms is minimized in this synopsis. Practically nothing has been published on the variability of the immature stages in Lepidoptera.

(f) Behaviour of the adults. Remarks are given about the undisturbed behaviour of the adults. As so little is known at present on this subject, only incidental observations are available.

ILLUSTRATIONS

Photographs are provided of all species found in northwest Europe so far, including a large number of intraspecific forms. Where possible, Dutch specimens were used for this purpose. Locality, date, name of the collector and the present location are mentioned in the captions to the plates.

The genitalia of both sexes of the species, found in northwest Europe, are drawn. I much prefer drawings to photographs because in drawings the characteristic features can be expressed more clearly. Besides sketches are provided in the keys in order to facilitate the identification.

Keys. With the usual terse, dichotomic keys, a number of specimens may be misidentified, even though the alternatives have been chosen correctly. This is due to intraspecific variation of specific characters. We tried to construct more elaborate keys including aberrant forms.

Unless mentioned otherwise, the size of the moths is expressed in the length of the costa, with the expanse added in brackets. For the notation of the wing neuration, Herrich-Schäffer's system has been adopted, as also done by Bentinck & Diakonoff (1968). For a survey of the different systems, used for the notation of the wing venation, see Hannemann et al. (1974: 145) and Heath et al. (1976: 19).

THE MATERIAL

The following Dutch collections were used:

1. Asselbergs, J. E. F., Hoogerheide.
2. Boer Leffef, F., Renkum.
3. Cox, A. L., Mook.
4. Elfferich, N. W., Rotterdam.
5. Fries Natuurhistorisch Museum (Frisian Museum of Natural History), Leeuwarden.
6. Heijnsbergen, S. van, Naarden.
7. Huisman, K. J., Melissant.
8. Instituut voor Zoölogische Taxonomie (Institute of Taxonomical Zoology), Amsterdam, in which are incorporated the collections of: Albarda, Backer, Van der Beek, Bisschop van Tuinen, Van den Brandt, Ter Haar, Helmers, Kinker, Lodeesen, Lycklama à Nijeholt, Van Medenbach de Rooy, J. Th. Oudemans and Schuijt.
9. Kleinpaste, R. H., Wageningen.
10. Koster, J. C., Callantsoog.
11. Kuchlein, J. H., Wageningen.
12. Landbouwhogeschool (Agricultural University, dept. of Entomology), Wageningen, comprising the collections of: Sikkema, Tutein Nolthenius and the old collection of the 'Nederlandsche Entomologische Vereeniging'.
13. Langohr, G. R., Simpelveld.
14. Lucas, J. A. W., Rotterdam.
15. Made, J. G. van der, Hien (Gld.), R. Vis and D. A. Vestergaard combined.
16. Natuurhistorisch Museum (Museum of Natural History), Maastricht, here are now the collections of Rijk, Kortebos and Scholten.
17. Natuurhistorisch Museum (Museum of Natural History), Rotterdam, in which the collections Dulfer and Haverhorst are incorporated.

18. Nieuwland, K. N., Amersfoort.
19. Oudejans, R. C. H. M., Scherpenzeel.
20. Peerdeman, M. P., Amsterdam.
21. Plantenziektenkundige Dienst (Plant Protection Service), Wageningen.
22. Rijksmuseum van Natuurlijke Historie (National Museum of Natural History), Leiden, comprising the collections of Van Aartsen, Bentinck, Van Berk, Diakonoff, Doets, Dijkstra, Havelaar, Heylaerts, De Joncheere, Kallenbach, Snellen, Snellen van Vollenhoven and Ritsema.
23. Vári, L., Pretoria, South Africa.
24. Wit, A. K. H., Wageningen.
25. Wolf, H. W. van der, Eindhoven.
26. Wolschrijn, J. B., Heerde.

Moreover material has been received from the British Museum, Natural History (Dr. P. E. S. Whalley), London; Entomologisches Institut der Eidg. Techn. Hochschule (Prof. Dr. W. Sauter), Zürich; Naturhistorisches Museum (Dr. F. Kasy), Vienna; Transvaalmuseum, Pretoria (Dr. L. Vári), and from the late Dr. S. Bleszyński.

I am very grateful to the owners or keepers of the collections involved for their generous assistance. The names of the owners are always mentioned in full. Those of the museums are abbreviated in a convenient way.

CLASSIFICATION AND NOMENCLATURE

During the first decades of this century, classification and nomenclature offered few problems to the authors of faunistic studies on Lepidoptera in this region as this was the period of the almost unchallenged sovereignty of the catalogue of Staudinger & Rebel (Rebel, 1901). In most faunistic studies of this period the classification and nomenclature of this catalogue have been adopted. It needs no argument that this stability offered great practical advantages. However, in the meantime taxonomic investigations continued, involving more characters in the classification. In many cases genera were split up, families divided into two or more, etc. Moreover the rigid interpretation of the rules of zoological nomenclature, especially with regard to type-investigation by recent authors also led to many changes of names. The consequence of this development was that often in faunistic studies, recently published in this part of Europe, diverse classifications and nomenclature were adopted. This led unavoidably to confusion and uncertainty among many naturalists.

The classification and nomenclature, used in the present work, are explained briefly in the text. The arrangement of the families adopted proceeds from higher to lower forms. Within the greater taxonomic units, however, the arrangement essentially proceeds from less specialized to higher specialized forms. The advantage of this classification is that the system adopted in Lempke's catalogue (1936-1970) is continued and, moreover, that the main lines of the familiar system, used in the catalogue of Staudinger & Rebel (Rebel, 1901), are retained. Thus the Pyralidae are treated first.

Co-OPERATORS

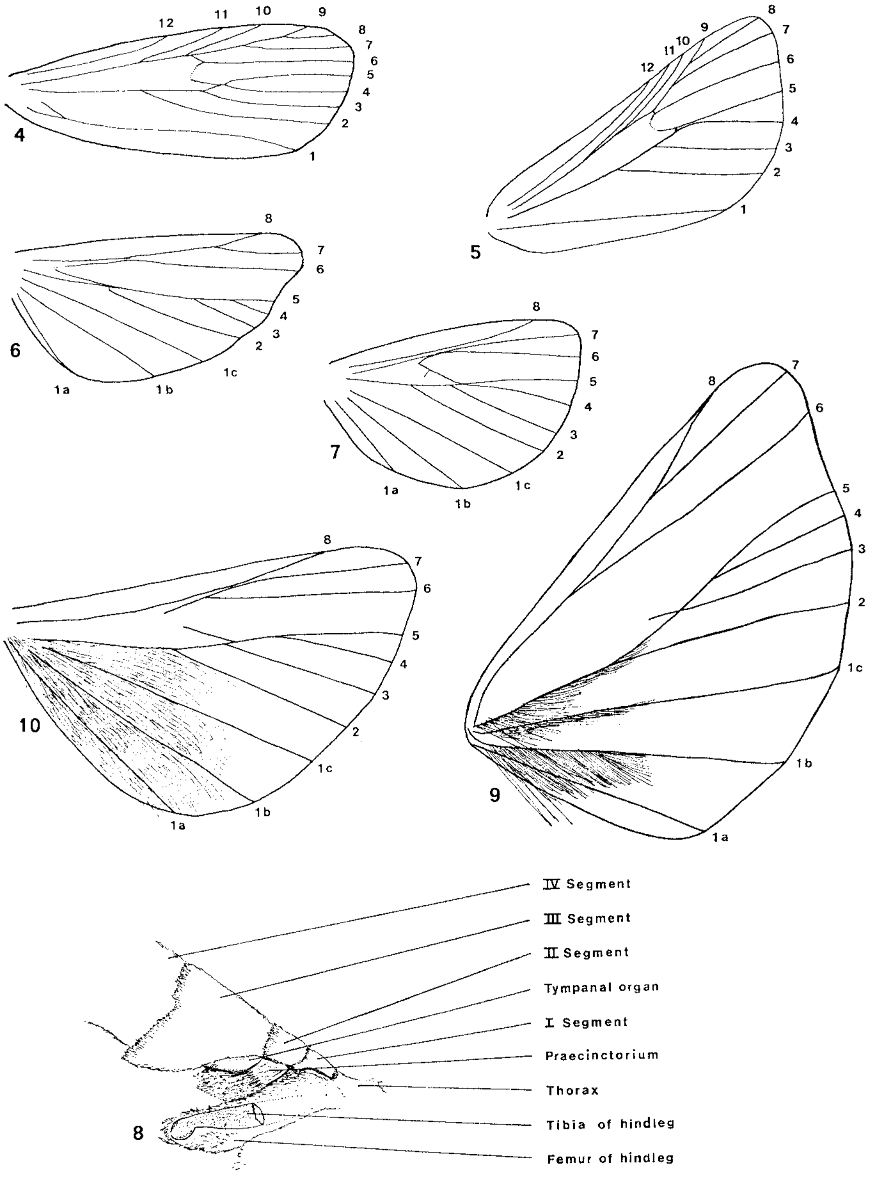
It stands to reason that this work can be completed only with the co-operation of workers in the field. My debt is great to the colleagues who promised to contribute. Their names will be mentioned in the various parts of this work.

PYRALIDAE

Within the order of the Lepidoptera, the Pyralidae constitute a clearly defined group, as compared with many other groups of Lepidoptera. This distinction applies both to the adults and to the larvae. On the other hand it is not easy for less trained lepidopterologists to work with the characteristics of this group.

In the first place, the Pyralidae are characterized by their wing venation: in the hindwing vein 8 is either anastomosing with 7 and stalked beyond the cell (fig. 6) or free but approximated to vein 7 (fig. 7). Moreover the hindwing has three anal veins (figs. 6, 7, 9 and 10), which are not always discernible without removing the scales. Finally the Pyralidae, just as the Geometridae, always possess a pair of tympanic bullae in the ventral part of the basal segment of the abdomen. Sometimes the tympanal organ is well visible in place, but can be better studied after a slide is made of the complete abdomen. In some groups of the Pyralidae the tympanic bullae are fused medially, but in other groups, e.g., the Galleriinae, these are completely separated (pl. 6 figs. 1, 2). In the former groups a praecinctorium (the "Keilhäutchen" of Börner, 1953: 404) is always present (Munroe, 1972: 10-12). The praecinctorium consists of a chitinous membrane with a tuft of scales distally. It hangs down into the cavity between the thorax and the abdomen and can be observed in situ (fig. 8).

The classification of the group of the Pyralidae presents some problems. Different authors, although using different taxonomic characters, show nevertheless a certain concensus of opinion.



Figs. 4-5. Neuration of the forewing; 4, *Lamoria anella* (Den. & Schifferm.); 5, *Aglossa pinguinalis* (L.). Figs. 6-7. Neuration of the hindwing; 6, *Lamoria anella* (Den. & Schifferm.); 7, *Aglossa pinguinalis* (L.). Fig. 8. *Schoenobius gigantella* (Den. & Schifferm.), ventrolateral view of the tympanic organ with the praecinctorium. Figs. 9-10. Hair pattern in the basal area of the hindwing; 9, *Agriphila tristella* (Den. & Schifferm.); 10, *Pyralis farinalis* (L.).

I prefer the family status for the taxon of the Pyralidae, as do Amsel (1956), Hasenfuss (1960: 227), Munroe (1972: 6-8), Hannemann et al. (1974: 282-283), among others. In my opinion the promotion of the group to superfamily, also including some other groups of Lepidoptera, as proposed by Meyrick (1890: 433-436; 1895: 360-361) and Pierce & Metcalfe (1938), is not very satisfactory because it obscures the distinct taxonomic position of the Pyralidae. This does not apply to the systems used by Marion (1954: 187-188) and Hannemann (1964), in which the family rank of the Pyralidae is raised to that of superfamily (simply to obtain a more balanced classification of the subfamilies), because they do not include other groups of Lepidoptera in this subfamily. There are also practical reasons in favour of the family status of the Pyralidae: in the 'Microlepidoptera Palaearctica' the group is considered a family in the same way as in the catalogue of Staudinger & Rebel (Rebel, 1901) and the checklist of Kloet & Hincks (1972).

According to Hannemann et al. (1974), the family of the Pyralidae can be subdivided into six subfamilies: Galleriinae, Crambinae, Phycitinae, Pyralinae, Acentropinae and Pyraustinae. There is by no means agreement about this classification or the relation of the subfamilies to one another. The division of Hannemann et al. will be followed in this synopsis. It departs considerably from the classification of Ragonot (1891) and Hampson (1895), adopted by Staudinger & Rebel (Rebel, 1901). In the latter classification the Schoenobiinae, Anerastiinae, Endotrichinae, Nymphulinae (Hydrocampinae) and Scopariinae were recognized as separate subfamilies. Consequently, according to this system ten subfamilies of the Pyralidae are represented in northwest Europe versus six in the classification of Hannemann et al. The latter authors did not explain their system; for this reason I shall try to do it briefly here.

Both the Galleriinae and the Crambinae constitute distinct groups, treated in the same way in both systems.

The Phycitinae include the tribes Anerastiini and Phycitini according to Hasenfuss (1960: 229), Hannemann (1964) and Shaffer (1968). They do not consider the Anerastiinae a separate subfamily alongside the Phycitinae.

Besides the Pyralini also the Endotrichini are incorporated as a tribus in the Pyralinae. The subfamily of the Endotrichinae was established by Ragonot (1891: 511) and adopted by Hampson (1896) and Staudinger & Rebel (Rebel, 1901). Meyrick (1895: 426) and Pierce & Metcalfe (1938: 38), however, placed them in the Pyralinae on different grounds. Recently this view has been supported by Whalley (1961: 733-734) and Hasenfuss (1960: 236-237). The former author based his conclusions on the morphology of the adults, the latter author on his studies of the larval characters.

In the Pyraustinae the Scopariini, Schoenobiini, Nymphulini and Pyraustini will be included as tribes. There is much diversity of opinion as to both the rank of these taxa and their relation to one another. The subdivision of the Pyraustinae mentioned above is mainly in accordance with the views of Meyrick (1895: 397-423) and Marion (1952: 260-270). The classification given by Ragonot (1891) and adopted by Hampson (1895), Staudinger & Rebel (Rebel, 1901) and recently by Munroe (1972: 11-14) presents problems, because particularly his subfamilies Nymphulinae and Scopariinae could not be defined with sufficient sharpness. Consequently Amsel (1956: 27-28) combined the Nymphulinae with the Pyraustinae and Sylvén (1946: 9) arrived at the same conclusion with regard to the Scopariinae and the Pyraustinae. In accordance with the views of Marion (1953: 126), the Schoenobiinae will be considered a subfamily of the Pyraustinae as was also done by Hannemann et al. (1974: 294). However Hasenfuss (1960: 237-238), who studied the morphology of the larvae of a number of European species, recognized the four tribes of the Pyraustinae as clearly distinct. Also Munroe (1958: 301; 1972: 11-14), who noted the affinity of the Scopariinae and the Schoenobiinae to the Crambinae and the Pyraustinae as well, maintained essentially Hampson's subdivision.

The taxonomic position of the species *Acentria nivea* (Olivier) is controversial. Hampson (1895: 919) arranged the species under the Schoenobiinae in which he was followed by Staudinger & Rebel (Rebel, 1901: 11) and Munroe (1972: 11). Pierce & Metcalfe (1938: 33) placed *Acentria* among the Nymphulinae although the genitalia deviate markedly. Hasenfuss (1960: 238) shared their opinion on the ground of his studies of the morphology of the larvae. Marion (1955: 41), however, underlined the unique position of this species and proposed to create a separate family for *Acentria*; I here assign to it the rank of subfamily.

The further infrafamiliar classification will be explained with the treatment of the subfamilies.

The sequence of the subfamilies may remain practically the same as in the catalogue of Staudinger & Rebel (Rebel, 1901): the Galleriinae and the Crambinae have the most primitive characters, the Pyraustinae are evidently more specialized. Between them may be placed the intermediate subfamilies of the Phycitinae and Pyralinae.

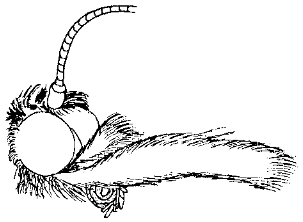
For the morphology of the early stages of the Pyralidae I refer to Buckler (1901), Barrett (1904) and Hasenfuss (1960) and for the pests of stored products to Hinton (1943: 175-203).

KEY TO THE SUBFAMILIES OF THE PYRALIDAE

1. Hindwing upper side with lower margin of cell towards base distinctly clothed with long hairs, forming a dense comb (pecten). Other veins in hindwing may also possess such fringes of hair (fig. 9) 2
— Hindwing upper side without such fringes of hair along veins. Basal area of hindwing clothed with long hairs (fig. 10) 4
2. Forewing with vein 7 absent (fig. 13) . . . . Phycitinae
— Forewing with vein 7 present; 7 and 8 usually stalked (fig. 4) . . 3
3. Maxillary palpi conspicuous, roughly scaled. Labial palpi long and porrect; seen from above, generally longer than head. Ocelli present (fig. 11) . . . . Crambinae
— Maxillary palpi smoothly scaled and not easily discernible. Labial palpi generally not longer than head, as seen from above, and sometimes different in both sexes of the same species. Ocelli absent (fig. 12) . . . . Galleriinae
4. Forewing with vein 7 originating from stalk of 8 and 9 (fig. 5) . . . . Pyralinae
— Forewing with vein 7 originating from cell (fig. 15) 5
5. Proboscis present and well developed (fig. 16) . . Pyraustinae (part)
— Proboscis absent or minute (fig. 17) 6
6. In northwest European species expanse larger than 9.0 (18.0) mm . . . . Pyraustinae (part)
— Expanse less than 8.5 (17.0) mm . . . . Acentriinae

GALLERIINAE

This subfamily has not been revised since the works of Ragonot (1901) and Hampson (1917: 17-58). Whalley (1964) prepared a catalogue of the genera and species of the Galleriinae. Consequently the classification of the subfamily up to the time of writing essentially is based on the wing venation. However, the wing venation shows a wide variability in the Galleriinae, as shown by Kuchlein & Kleinpaste (1977) and Kleinpaste (1977). The variability of such a crucial character easily leads to misidentifications. In specimens with asymmetrical wing venation it is even possible that, following the usual keys, the left side of a specimen may be assigned to one, the right side to another genus! For the numbering of the veins the reader is referred to figs. 4 and 6, the wing venation of *Lamoria anella* (Denis & Schiffermüller).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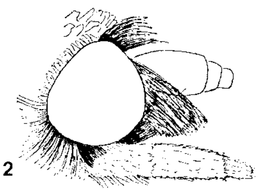
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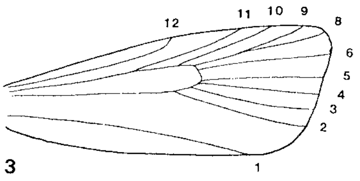

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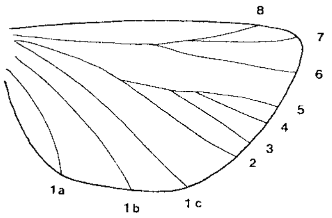

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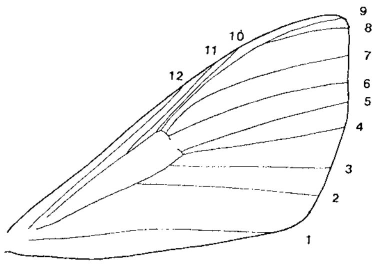

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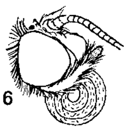
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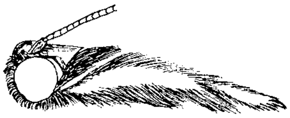
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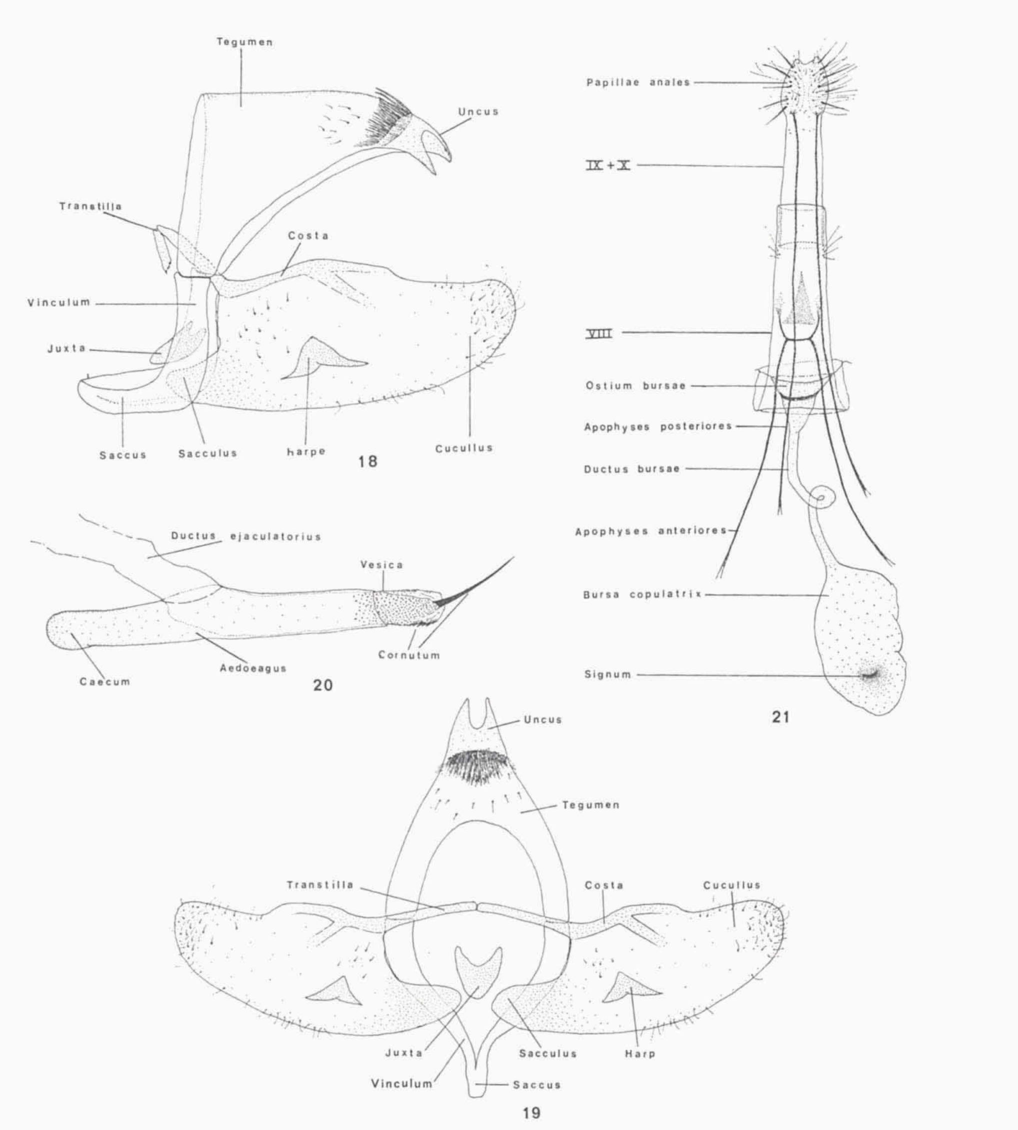
Fig. 11. *Agriphila straminella* (Den. & Schifferm.), head. Fig. 12. *Galleria mellonella* (L.), head of the female. Figs. 13-15. Neuration; 13, *Metriostola betulae* (Goeze), forewing; 14, do., hindwing; 15, *Pleuroptya ruralis* (Scop.), forewing. Figs. 16-17. Head; 16, *Pleuroptya ruralis* (Scop.); 17, *Schoenobius gigantella* (Den. & Schifferm.).

The genitalia of the Galleriinae are simple and sometimes very similar in species so far attributed to different genera. Sketches of genitalia, showing a number of characteristics occurring in the Galleriinae, are given in the figs. 18, 19, 20 and 21.

This survey clearly indicates that the establishment of a sound classification of the Galleriinae will be a difficult task. Nevertheless I am trying to classify the few northwest European species with due observance of the external characters, the genitalia and the morphology of the larvae.

For the species with a bifid uncus, Whalley (1964) established the tribus Galleriini with only two northwest European species of bee moth. The other species found in this part of Europe belong to Whalley's tribus Thiratabini, in which the apex of the uncus is fringed with numerous coarse spines. The larvae of these two distinct groups of genera are also clearly recognized, as appears from the studies of Hinton (1943: 176-177) and Hasenfuss (1960), so that Whalley's division is a natural one.



Figs. 18-21. Schematic representation of genitalia of the Galleriinae; 18-20, male genitalia, 18, lateral view, 19, ventral view; 20, aedeagus; 21, female genitalia.

Within the tribus Galleriini the genus *Galleria* Fabricius is without any doubt more primitive than *Achroia* Hübner. Within the tribus Thiratabini, the larvae of *Melissoblaptes* Zeller show the most primitive characters (Hasenfuss, 1960: 230). In my opinion *Melissoblaptes zelleri* (De Joannis) and *Lamoria anella* (Denis & Schiffermüller) are closely related, the only sound difference being the presence of a characteristic large spine-shaped cornutus in the latter species. Nevertheless, in this work, the two species are kept in two separate genera, awaiting a thorough revision of the Galleriinae, involving more species than the few found in northwest Europe. *Aphomia sociella* (Linnaeus), *Paralipsa gularis* (Zeller) and *Arenipses sabella* Hampson, have to be considered congeneric. The genitalia are very similar; *Corcyra cephalonica* (Stainton) is closely related, also in larval structure (Hinton, 1943: 183; Hasenfuss, 1960: 230).

Up to the present about 125 species of Galleriinae have been described, eight of which are found in northwest Europe and seven in The Netherlands.

The northwest European species possess sexual dimorphism. Both sexes may differ in size, colour and markings, wing venation and size of the labial palpi. The infraspecific variability is considerable among the Galleriinae; its study has been neglected so far.

The ecology of the early stages is very interesting. The majority of the northwest European species is of economic importance, the larvae being pests of stored products or inhabiting bee-hives. The majority of the species can be bred with detritus, also the larva of *Aphomia sociella* (Linnaeus), which normally lives in the nests of bumblebees and wasps. All larvae of the northwest European species spin tunnels. Pupation takes place in tough cocoons, which are often found spun together in masses.

The ecological interrelationship between the social Hymenoptera and the larvae of the Galleriinae living in their colonies is not easily characterized. When the larvae feed on debris in the colonies they may be considered commensals, but if the honeycombs are eaten, the relationship may be seen as a form of interspecific competition. If finally the brood is attacked, the caterpillars behave as real predators.

Key to the genera of the Galleriinae

1\. Hindwing with veins 2, 3, 4 and 5 present (fig. 6) 2

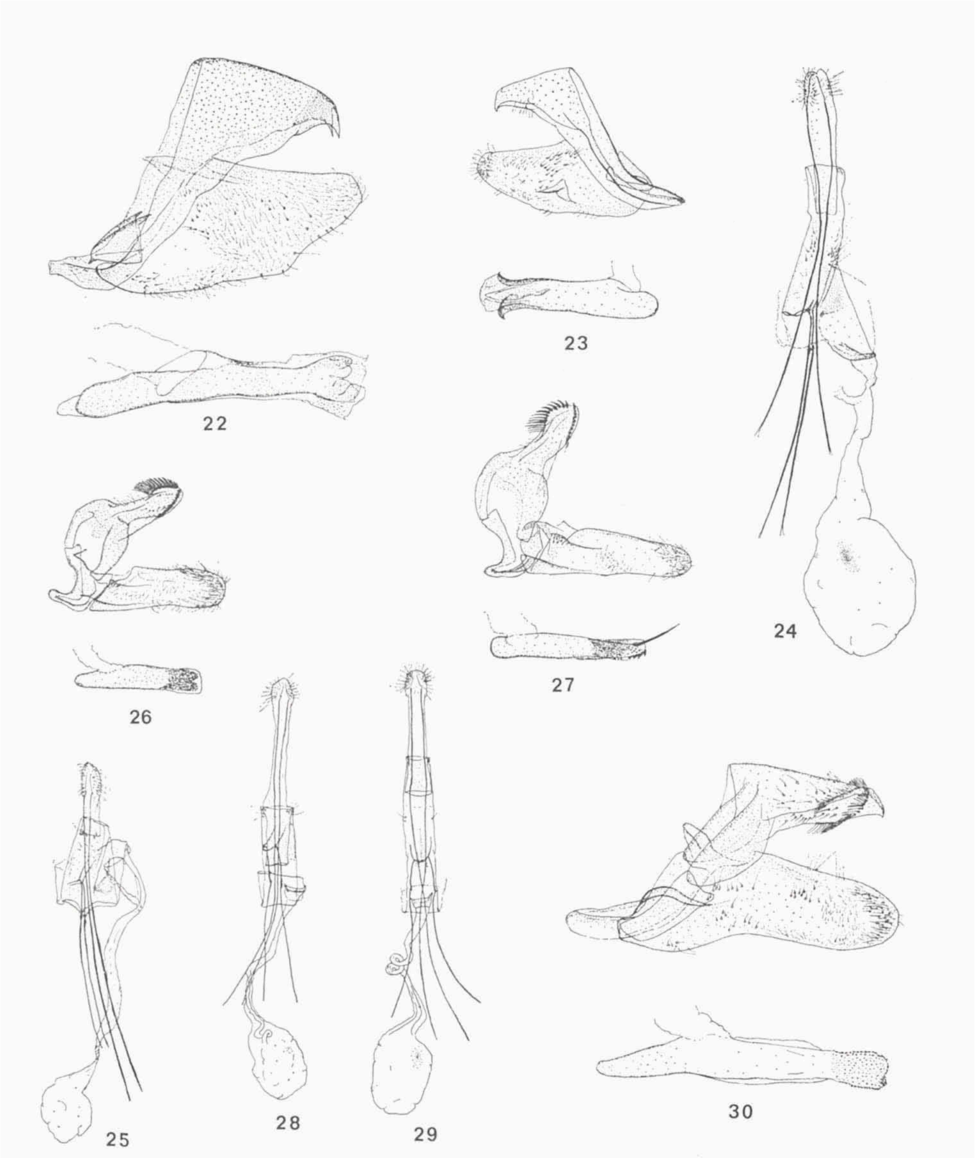
— Hindwing with one or more veins of the group 2, 3, 4 and 5 absent . 5

2\. Forewing with vein 7 arising either from stalk of 8 and 9, or together with 9 from 8 (exceptionally 9 is absent). Forewing with the cell always closed (fig. 4) . . . . *Lamoria*

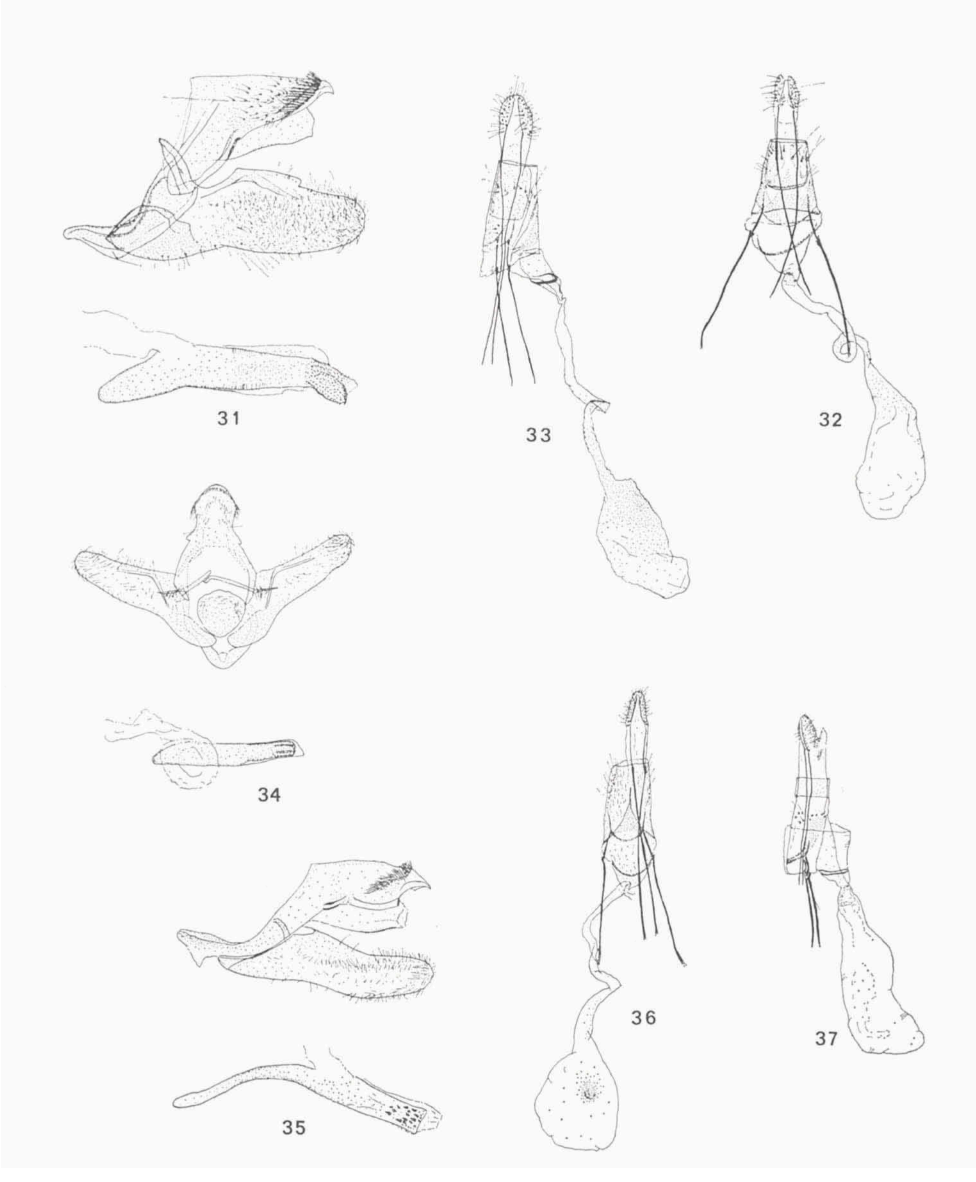
— Forewing with vein 9, which is always present, arising from stalk of 7 and 8. Forewing with cell open or closed 3

3\. Forewing with termen concave or, exceptionally, straight. Quotient: maximum length to maximum width of forewing ca. 2.5 . . *Galleria*

— Forewing with termen convex. Quotient: maximum length to maximum width of forewing ca. 3.0 4



Figs. 22, 24. *Galleria mellonella* (L.), genitalia; 22, male; 24, female. Figs. 23, 25. *Achroia grisella* (F.), genitalia; 23, male; 25, female. Figs. 26, 28. *Melissoblaptes zelleri* (De Joannis), genitalia; 26, male; 28, female. Figs. 27, 29. *Lamoria anella* (Den. & Schifferm.), genitalia; 27, male; 29, female. Fig. 30. *Aphomia sociella* (L.), male genitalia.



Figs. 31, 33. *Aphomia gularis* (Zell.), genitalia; 31, male; 33, female. Fig. 32. *Aphomia sociella* (L.), female genitalia. Figs. 34, 36. *Aphomia sabella* (Hamps.), genitalia; 34, male; 36, female. Figs. 35, 37. *Corcyra cephalonica* (Staint.), genitalia; 35, male; 37, female.

4. Male genitalia with costa of valva thickened (fig. 31). Female genitalia with a conspicuous signum present (fig. 33) . . . . *Aphomia gularis* f. *marionella* nov.
— Male genitalia with costa of valva not thickened (fig. 26). Female genitalia with signum inconspicuous (fig. 28) . . . . *Melissoblaptes zelleri* f. *pseudolamoria* nov.
5. Forewing with all twelve veins present 6
— Forewing with one or more veins absent 7
6. Hindwing with the stalk of veins 7 and 8 shorter than the half of the length of 8 . . . . *Aphomia*
— Hindwing with the stalk of veins 7 and 8 longer than 2/3 of the length of 8 . . . . *Melissoblaptes*
7. Forewing with the veins 2, 3, 4 and 5 present . . . . *Achroia*
— Forewing with one vein absent from the group 2, 3, 4 and 5 . . . 8
8. Proboscis present. Forewing with the cell always open . . *Aphomia*
— Proboscis absent. Forewing with the cell mostly closed . . *Corcyra*

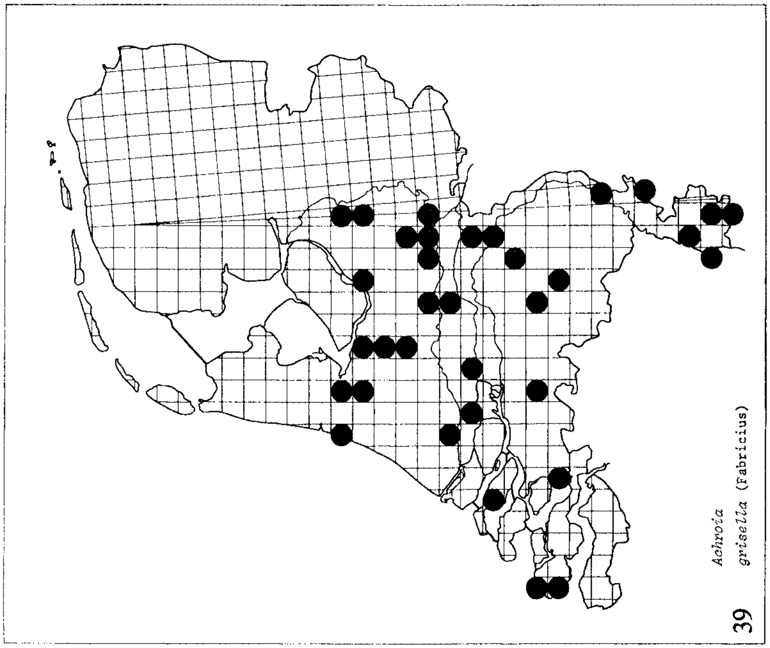
GALLERIINI

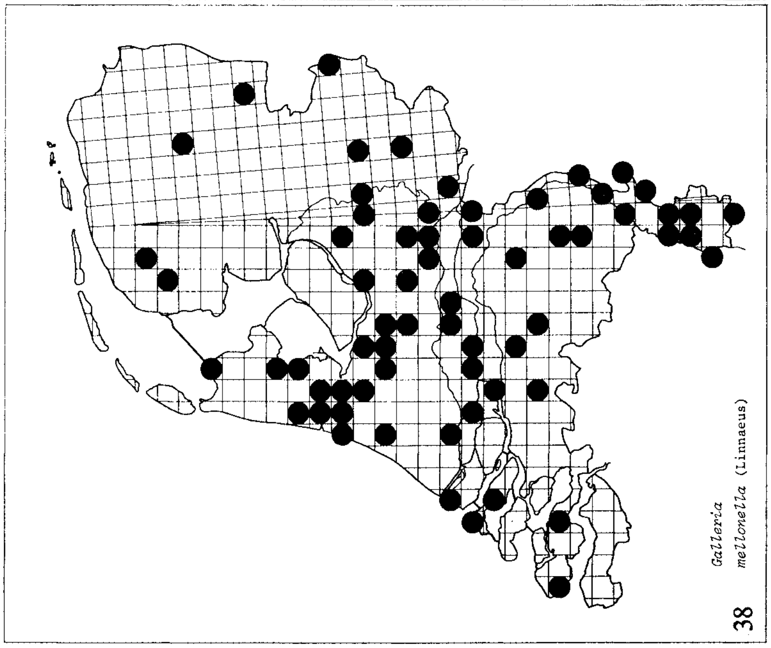
Galleria Fabricius, 1798

1. **Galleria mellonella** (Linnaeus, 1758) (figs. 12, 22, 24, 38, 50, pl. 1 figs. 1-4)

Beirne, 1952a: 52, fig. 8 (venation forewing), fig. 9 (venation hindwing), pl. 1 fig. 9 (adult ♂), pl. 1 fig. 10 (adult ♀). — De Crombrugghe de Picquendaele, 1906: 12. — Van Deurs, 1942: 11-12, fig. 2 (wing venation), pl. 1 fig. 6 (adult ♀). — Hampson, 1917: 53. — Hannemann, 1964: 81-82, fig. 2a (wing venation), fig. 2b (head), fig. 2c (♂ genitalia), fig. 2d (♀ genitalia), pl. 6 fig. 19 (adult ♂). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 163. — Pierce & Metcalfe, 1938: 13, pl. 7 (♂ and ♀ genitalia). — Rebel, 1901: 2; 1910-1913: 190, pl. 81 fig. 10 (adult ♀). — Snellen, 1882: 116-117. — Whalley, 1964: 565-566.

Geographical distribution. The present range of this species for the greater part covers that of the honey bee (*Apis mellifera* Linnaeus) and that of *Apis indica* Fabricius. The northern limit of the range of the honey bee certainly extends further northward than that of *G. mellonella*. The limit of the latter passes in Europe through south Norway, central Sweden and the extreme south of Finland. The honey bee has been kept successfully even in Greenland, where no Honeycomb Moth has been recorded so far (Wolff, 1971a: 164). Neither has the species been observed at the higher altitudes of the Alps. There is evidence that this species arrived at its almost cosmopolitan status in recent times. It was probably introduced in the New World round the middle of the 19th century (Borchert, 1966: 344). It has also been transported to Australia and it is assumed that its occurrence in Indonesia is





Figs. 38-39. Distributions in The Netherlands; 38, *Galleria mellonella* (L.); 39, *Achroia grisella* (F.).

also due to artificial introduction. Paddock (vide Borchert, l.c.) supposed that *G. mellonella* originates from the Middle East.

This species has been a pest of economic importance to apiculture for a long time, as appears from the writings of Aristotle, Virgil and Pliny. Since the 17th and 18th centuries there have been records of the Honeycomb Moth in northwest Europe (e.g., Swammerdam, 1737-1738, pl. 26 fig. 2).

In northwest Europe it is widely distributed but so far is not known from the Orkneys.

Occurrence in The Netherlands. First record: 1868 (Inst. Tax. Zoöl. Amst.). The material, quoted earlier by De Graaf (1851: 41; 1864: 206) is apparently lost.

Localities (fig. 38), Fr.: Leeuwarden, IJsbrechtum; Dr.: Assen, Hoogeveen (De Graaf, 1864: 206); Ov.: Almelo, Deventer, Holten; Gld.: Acquoy, Arnhem, Bennekom, Beusichem, Hoenderloo, Lobith, Lunteren, Nijmegen, Oosterbeek, Putten, Ruurlo, Ubbergen, Vaassen, Velp (De Graaf, l.c.), Vierhouten, Wageningen, Wamel; Utr.: Baarn, de Bilt, Breukelen; N.H.: Amsterdam, Bloemendaal, Bussum, Egmond-Binnen, Haarlem, Heemskerk, Hilversum, Hoorn, Muiderberg, Naardermeer, Oosthuizen, Wieringen, Wormerveer; Z.H.: Dordrecht, Hendrik-Ido-Ambacht, Leiden, Melissant, Oegstgeest, Oostvoorne, Ouddorp, Rotterdam, Spijk; Zl.: Goes, Valkenisse; N.B.: Asten, Biesbosch, Boekel, Breda, Deurne, Dongen, Ginneken, Haaren; Lbg.: Amstenrade, Belfeld, Epen, Geysteren, Leudal, Maastricht, Meerssen, Meynweg, Posterholt, Schinveld, Stein, Venlo, Vlodrop.

The data suggest strongly that the Honeycomb Moth rarely occurs in the northern and northeastern parts of The Netherlands. The localities mentioned are taken from the collections, but, since the adults are caught less frequently, the picture of its occurrence thus obtained, may be very incomplete. Therefore, Ir. J. A. F. M. Mommers, who is in touch with the practice of apiculture in The Netherlands, was asked about his experiences with regard to the bee moths. He informed me (pers. comm.) that both *G. mellonella* and *Achroia grisella* occur in all apiaries, and, as far as the Dutch Frisian Islands are concerned, with certainty on the islands of Terschelling and Schiermonnikoog. He remarked further that both species of bee moth occur now less frequently than in former times. According to Mr. Mommers, this development is probably partly due to the disappearance of the straw skeps and partly to the decline of apiculture. Moreover most bee-keepers use good methods of sanitation and inspection now. Already in 1900, J. Th. Oudemans (1900: 497-498) pointed out this development and also Beirne (1952a: 52) gives similar findings for Great Britain and Ireland.

Voltinism. The rate of development appears to be very variable. In the field the adults are recorded from the second decade of May (20.v. [1]), Inst. Tax. Zoöl., Amst.) until the end of October (21.x.1911, Mus. Rot.). It can be inferred from the histogram (fig. 50), which is not easily interpretable because of the overlap of broods, that generally two generations occur, but in warm summers three broods can be produced. The dates, provided by Cox (pers. comm.), suggest that in 1975 three generations occurred. Beirne (1952a: 52) assumed two overlapping broods for Great Britain and Ireland and also in northwest Germany the species is supposed to be bivoltine (Grabe, 1955: 1). Heylaerts (1869: 198) bred no less than five generations in The Netherlands during the hot summer of 1868, but such a number of broods is exceptional in northwest Europe. In the tropics the development is completed in about 34 days (Kalshoven, 1950: 401). The full-grown larva hibernates.

Habitat. The larva is often found in old bee-hives and stored stocks of wax. The bee moths especially attack weak colonies, in which the entrance to the hives is not continuously guarded by the bees, so that the female of the moth is able to penetrate into the hive. The larva lives in long whitish silk-lined tunnels. When full-grown, it forms a strong cocoon, in which it pupates. These cocoons are frequently spun together in masses. The diet of the larva of the Honeycomb Moth consists both of wax and the rests of the pollen. The digestion of the wax appears to be effected partly by the secretion of the larva itself and certainly partly with the aid of bacteria (Wigglesworth, 1974: 509). The larva does not develop when bred on pure wax (Heddergott & Weidner, 1953: 285).

Initially, the young larva feeds on debris upon the floor of the hive. Afterwards, it also tunnels in the combs (Oudemans, 1900: 498; Heddergott & Weidner, 1953: 285). The damage in the honeycombs is not so much caused by the consumption of the beeswax as by the destruction of the cells and the tunnelling in the combs. As a result of the latter activities, the larvae and pupae of the bees are covered with the webs of the larvae of the moth. Consequently, the development of the brood is affected adversely, but also the adult bees are hindered in their movements by the webs (Oudemans, 1900: 498).

Based on the frequent captures in Bavaria of the adults, far away from apiaries, Pfister (1958: 96) assumed that the larva may have other sources of food. So far there is no evidence from the field for this assumption. The statement of Boer Leffef (1961: 41), that the larva of *G. mellonella* lives in nests of bumblebees, must be erroneous. In the laboratory the larva can be bred successfully on a number of substrates. As a result the Honeycomb Moth has become a favourite experimental species.

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1) The year is not mentioned on the label.

Borchert (1966: 344) stated that generally the larvae of the two species of bee moth are not found simultaneously. On the contrary, Kunike (1930: 305) observed that both species mostly occur in the apiaries together. This interspecific relationship deserves closer attention!

Male genitalia (fig. 22). The two species of bee moth are easily distinguished from the other northwest European Galleriinae by the shape of the uncus, which is bifid. *A. grisella* possesses a conspicuous projection on the valva, absent in *G. mellonella.*

Female genitalia (fig. 24). The bursa has a marked signum. Among the northwest European Galleriinae, besides *G. mellonella,* only one species, *Arenipses sabella,* has a distinct signum. In the former species, however, this signum is not nearly so sharply marked as in *A. sabella.*

Variability of external characters.

1. Sexual dimorphism (pl. 1 fig. 1, ♂, and fig. 2, ♀). There is a marked difference between both sexes. The forewings of the male are yellowish grey-brown, the hindwings are almost entirely dark-brown. The forewings of the female are darkened purple-brown, the hindwings are yellowish white with a dark suffusion on the distal part of the hindwings. Head and thorax are yellowish white in the male and brownish in the female. The labial palpi are as long as the head in the male and twice as long as the head in the female (fig. 12). Finally, the males are on the average smaller than the females, the mean being 9.9 (21.4) mm and 11.7 (25.4) mm, respectively.

2. The size of the adults is very variable. Among the specimens bred both very small and very large moths are found. Males smaller than 9.0 (17.0) mm are recorded from Wageningen (Inst. Tax. Zoöl., Amst.), Amsterdam (Kuchlein) and Wormerveer (Wolschrijn). Males larger than 13.5 (31.0) mm from Amsterdam (Inst. Tax. Zoöl., Amst., Kuchlein), and Boekel (Cox). Females smaller than 11.5 (23.0) mm from Wageningen (Inst. Tax. Zoöl., Amst.) and Boekel (Cox), and females larger than 16.0 (34.0) mm from Wormerveer (Wolschrijn), Posterholt (Cox), and Stein (Inst. Tax. Zoöl., Amst.).

3. The wing venation is variable, especially the complex of the veins 6, 7 and 8 of the hindwing. The majority of the specimens examined showed a configuration of these veins similar or identical to that showed in fig. 6 1). Three distinct forms are:

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1) Hannemann (1964: 83, fig. 2a) figured the wing venation of an aberrant specimen, in which evidently vein 2 is absent. Obviously this author based the short diagnosis of the genus *Galleria* on this specimen, because the absence of vein m_2 is considered a characteristic of the genus (l.c.: 81).

- f. *octavaseparata* nov. In the hindwing vein 8 free, not anastomosing with 7. This configuration is found in the subfamily Pyralinae, as shown in fig. 7. Holotype: ♀, Wageningen, 13.ix.1957 (Kuchlein).
- f. *rudiella* nov. In the hindwing the stalk of veins 7 and 8 completely free. Holotype: ♂, Wageningen, 7.ix.1957 (Kuchlein). Both in males and females among the specimens from Wageningen.
- f. *octavaabsens* nov. In the forewing vein 8 absent. Holotype: ♂, Wageningen, 28.i.1977 (Kuchlein).

Finally a very exceptional configuration was found in a specimen, with, in the hindwings, 1 b and 1 c stalked. Wageningen (Kuchlein).

4. The shape of the forewing is variable, especially the course of the termen.

- f. *rectimarginella* nov. (pl. 1 fig. 3). The termen is not concave, but perfectly straight. Holotype: ♀, Wageningen, 15.ix.1957 (Kuchlein). Also: Wormerveer (Wolschrijn), Amsterdam, de Bilt, Bloemendaal, Oosterbeek, Rotterdam, Venlo, Wageningen (Inst. Tax. Zoöl., Amst.), Wageningen, Amsterdam, Hilversum, Breda (Rijksmus. N.H., Leid.), Boekel (Cox).

5. Colour and markings of the wings show a considerable variation. Generally, when the colour is lighter the markings are reduced.

- f. *crombruggheella* Dufrane (1930: 69). See pl. 1 fig. 4. The ground colour is much lighter than in the main form. The markings are nearly absent. Oosterbeek (Inst. Tax. Zoöl., Amst.), Amsterdam (Rijksmus. N.H., Leid., Kuchlein). So far I saw this form only in males.

Behaviour of adults. In The Netherlands, the moths are rarely observed in the field and exceptionally are attracted by sugar and light. They fly around old bee-hives in the darkness (Beirne, 1952a: 52) and have been captured by light near an apiary (Cox, pers. comm.).

Achroia Hübner, 1819

2. **Achroia grisella** (Fabricius, 1794) (figs. 23, 25, 39, 51, pl. 1 fig. 5)

Beirne, 1952a: 48-49, fig. 10 (venation forewing), pl. 1 fig. 10 (adult). — De Crombrugghe de Picquendaele, 1906: 11. — Van Deurs, 1942: 10, pl. 1 fig. 3 (adult). — Hampson, 1917: 44. — Hannemann, 1964: 90, fig. 8a (wing venation), fig. 8b (head), fig. 8c (♂ genitalia), fig. 8d (♀ genitalia), pl. 7 fig. 13 (adult). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 161. — Pierce & Metcalfe, 1938: 12, pl. 7 (♂ and ♀ genitalia). — Rebel, 1901: 1, 1910-1913: 189, pl. 81 fig. 11 (adult). — Snellen, 1882: 120. — Whalley, 1964: 566-567.

Geographical distribution. The range of the Honey Moth is similar to that of *Galleria mellonella*. The species is now distributed via apiculture everywhere in the tropical, subtropical and temperate zones of the world. Its northern limit in Europe passes through Scandinavia like that of the Honeycomb Moth.

The Honey Moth is recorded from the greater part of northwest Europe, but evidently is less widely distributed and generally occurring in lower numbers than the Honeycomb Moth.

Occurrence in The Netherlands. First record: 1862 (Rijksmus. N.H., Leid.). Localities (fig. 39). Gld.: Arnhem, Heerde, Hoenderloo, Leuvenum, Nijmegen, Oosterbeek, Putten, Vaassen, Velp, Wageningen, Wamel; Utr.: Amerongen, Zuilen; N.H.: Amsterdam, Amsterdamse Bos, Hilversum, Naardermeer, Overveen; Z.H.: Dordrecht, Melissant, Rotterdam, Spijk; Zl.: Oostkapelle, Valkenisse; N.B.: Bergen op Zoom, Boekel, Boxtel, Breda, Cuyk, Eindhoven, Liesel, Nederwetten, Valkenswaard; Lbg.: Belfeld, Eys, Epen, Houthem, Maastricht, Posterholt, Vijlen, Wittem.

There is a striking resemblance in the distribution of the two species of bee moth in The Netherlands. *G. mellonella* has been rarely captured in the northern part of The Netherlands; for *A. grisella* not even one collector's record is known! Though Mr. Mommers (pers. comm., see p. 24) stated that bee moths occur in all Dutch apiaries, both species apparently are less widely distributed in the northern provinces. The distribution of this moth is less wide and generally its numbers are lower than for the Honeycomb Moth as was inferred by Mommers from apiculture. For the decline of this species see p. 24.

Voltinism. In the field the adults are recorded from 20.v. (1930, Mus. Maastricht) to 3.x. (1907, Inst. Tax. Zoöl., Amst.). See fig. 51. As for *G. mellonella* the results cannot be interpreted easily because of the overlap of broods. Apparently there are two or three generations per year. Heylaerts (1869: 198) bred no less than four generations during the hot summer of 1868. Beirne (1952a: 52) assumed two overlapping broods in Great Britain and Ireland. No findings of the voltinism have been published for the rest of northwest Europe.

Habitat. The larva lives normally in bee-hives and stored stocks of wax. Its behaviour and ecology are very similar to those of *G. mellonella*; this species is also a serious pest in apiaries.

Unlike the Honeycomb Moth, it is sometimes recorded as a pest of stored products, such as dried apples, dried currants and copra. Dufrane (1930: 67) stated, however, that De Crombrugghe failed in breeding the larva with dried apples. Besides dried insects are mentioned as food (Forbes, 1923: 535). In The Netherlands the larva was once found in "Mollplatten", a cork product used as bottom for insect boxes (Elton, 1956: 12-14). A remarkable case of infestation is recorded from a telephone exchange in Indonesia, where the larva attacked telephone wires, of which the isolating material was made of wax (Leefmans, 1937: xxxiv-xxxv). Kiriakoff (1965: 2) described 'nests' as the environment of the larva; this must be incorrect and certainly he meant bee-hives.

For the simultaneous occurrence of the species of bee moth see p. 26.

Male genitalia (fig. 23), see p. 26.

Female genitalia (fig. 25). Signum is absent. Ductus bursae is very long compared with that of *Galleria mellonella* and *Corcyra cephalonica.* Anapophyses are approximately half as long as postapophyses. In the Honeycomb Moth as well as in *C. cephalonica,* the anapophyses are markedly longer than half of the postapophyses.

Variability of external characters. The species is pictured in pl. 1 fig. 5 (♀).

1. The size of the adults is variable. The females are generally larger than the males. Especially among the bred adults very small specimens occur. Very small males (5.5 (10.5) mm and smaller) are recorded from Amsterdam (Mus. Tax. Zoöl., Amst.) and Wageningen (Wolschrijn). Adults of 20.0 mm and larger were described by Dufrane (1930: 67) as f. *major.* Specimens of 10.5 (23.0) mm and larger were found in Arnhem, Oosterbeek, Nijmegen, Breda (Mus. Tax. Zoöl., Amst.), Naardermeer (Wolschrijn) and Boekel (Cox).

2. The pattern of the wing venation appears to be very variable. In about the half of the Dutch specimens examined vein 8 and the stalk of veins 7 and 9 of the forewing originate from the cell. For the present this is considered to represent the nominate form [1]). The others belong to:

f. *kaysha* nov. Forewing with the stalk of 7 and 9 originating from vein 10. Holotype: Breda, ♀, 27.ix.1868 (Inst. Tax. Zoöl., Amst.).

Other distinct variations in wing venation are:

f. *absens* nov. Forewing not only without vein 8, but also without 9. Holotype: Wageningen, ♀, 13.ix.1957 (Kuchlein).

f. *aperta* nov. Hindwing with cell open (normally closed). Holotype: Wageningen, ♂, 12.ix.1957 (Kuchlein).

f. *nonapresens* nov. Hindwing with vein 9. Holotype: Wageningen, 12.ix. 1957 (Kuchlein). Moreover: Amsterdam (Rijksmus. N.H., Leid.).

Behaviour of the adults. In the same way as the Honeycomb Moth the adults are rarely observed in the field and occasionally are attracted by sugar

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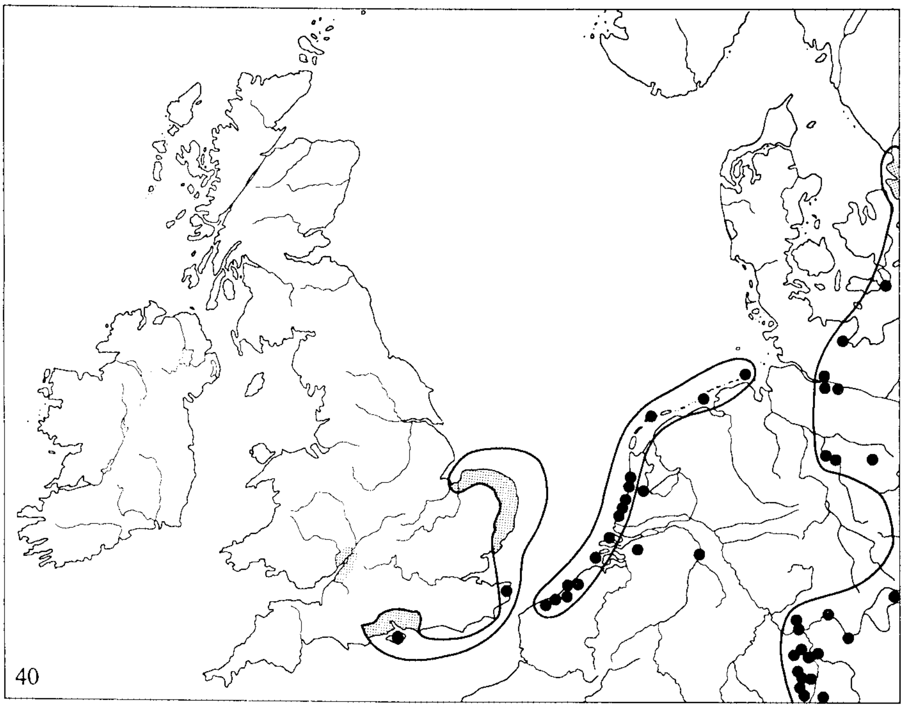
[1]) Fabricius' type material of *A. grisella* is lost (Zimsen, 1964: 577), but of *A. alvearia,* the name used by Fabricius for this species afterwards, still two specimens exist, both in rather worn condition (Dr. E. Schmidt Nielsen, pers. comm.). The designation of neo- and lectotypes is necessary.



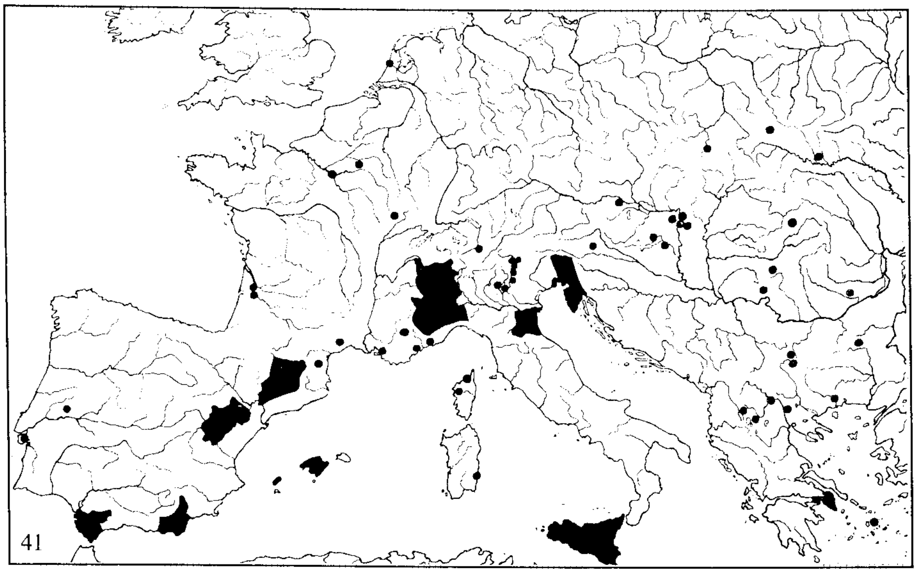


Fig. 40. *Melissoblaptes zelleri* (De Joannis), distribution in NW Europe. Fig. 41. *Lamoria anella* (Den. & Schifferm.), distribution in Europe.

and light. Observations of courtship and mating were published by Kunike (1930: 308-313). A mass flight of thousands of specimens has been observed by Van Aartsen at Valkenisse on 23.ix.1962. The people took great pains to kill the moths, which flew about and alighted everywhere (Helmers, pers. comm.).

THIRATABINI

Melissoblaptes Zeller, 1839

3. **Melissoblaptes zelleri** subsp. **zelleri** (De Joannis, 1932) (figs. 26, 28, 40, 42, 52, pl. 1 fig. 6, pl. 2 figs. 1-4, pl. 5 fig. 4)

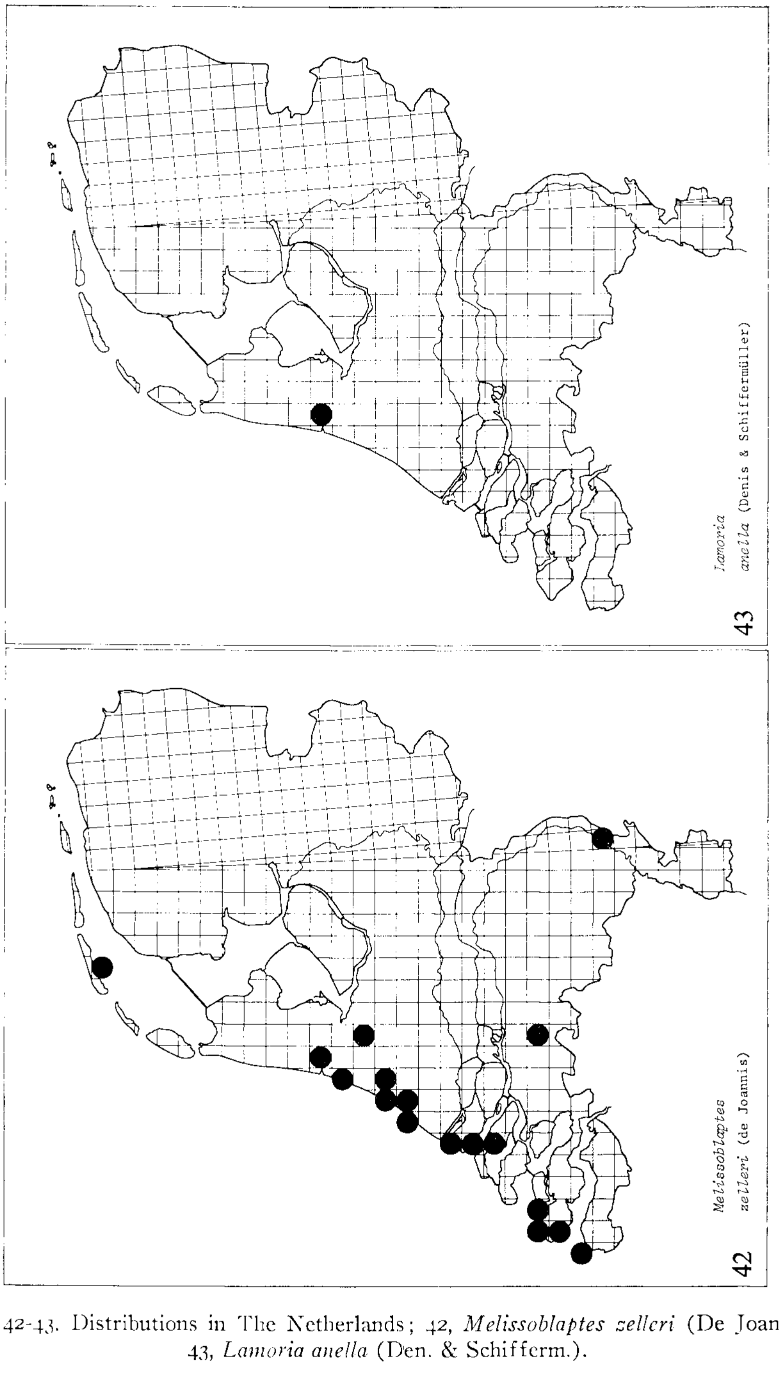
Beirne, 1952a: 50, fig. 12 (venation of hindwing), pl. 1 fig. 3 (adult ♂), pl. 1 fig. 4 (adult ♀). — De Crombrugghe de Picquendaele, 1906: 11 (as *bipunctanus* Z.). — Van Deurs, 1942: 10, pl. 1 fig. 4 (adult ♀). — Hampson, 1917: 39 (as *bipunctanus* Z.). — Hannemann, 1964: 86-87, fig. 6a (♂ genitalia), fig. 6b (♀ genitalia), pl. 7 fig. 7 (adult ♀). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 161-162. — Pierce & Metcalfe, 1938: 14, pl. 7 (♂ and ♀ genitalia). — Rebel, 1901: 1 (as *bipunctanus* Z.); 1910-1913: 190, pl. 81 fig. 9 (adult) (as *bipunctanus* Z.). — Snellen, 1882: 117-118 (as *bipunctanus* Curtis). — Whalley, 1964: 577-578.

Geographical distribution. The range of this species is restricted to the Palaearctic region and extends from west Europe to central Asia. It is not known in north Europe and not recorded with certainty from the Mediterranean area.

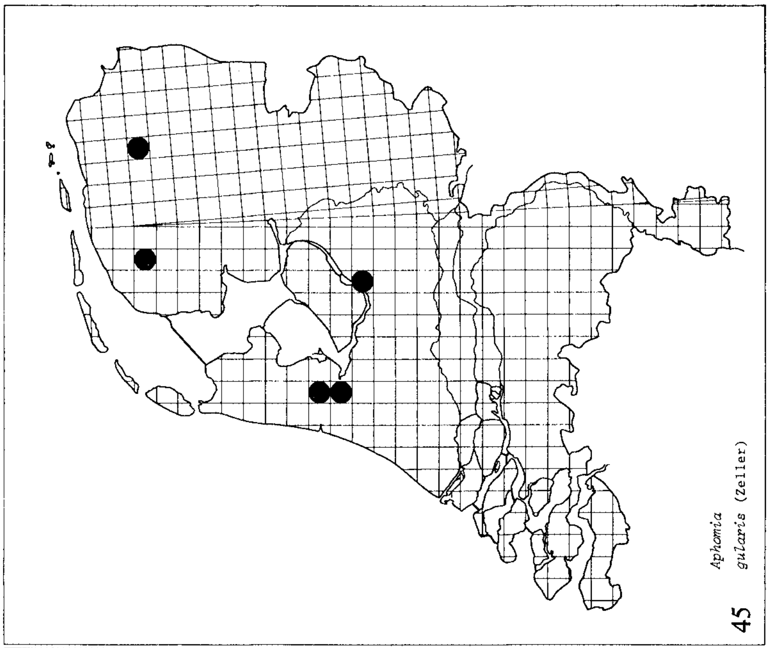
In northwest Europe a striking disjunction occurs. As is clear from the distribution map (fig. 40), the species is found in a small strip along the coasts of England, The Netherlands, Belgium and France (Dépt. du Nord) and on the Frisian Islands. Besides it occurs eastward and southward from the line from south Sweden to the Palatine. Based on its geographical distribution *M. zelleri* can be considered a Siberian fauna element (see De Lattin, 1967: 378-380). Moreover, this type of disjunction suggests that the species invaded the west twice. The remaining populations of the first invasion are now concentrated along the coasts. Similar examples among the Macrolepidoptera are mentioned by Lempke (1936-1970: (900)). The second invasion is possibly still in progress: the species has been found near Hamburg (West Germany) since 1939 (Evers, 1960: 81).

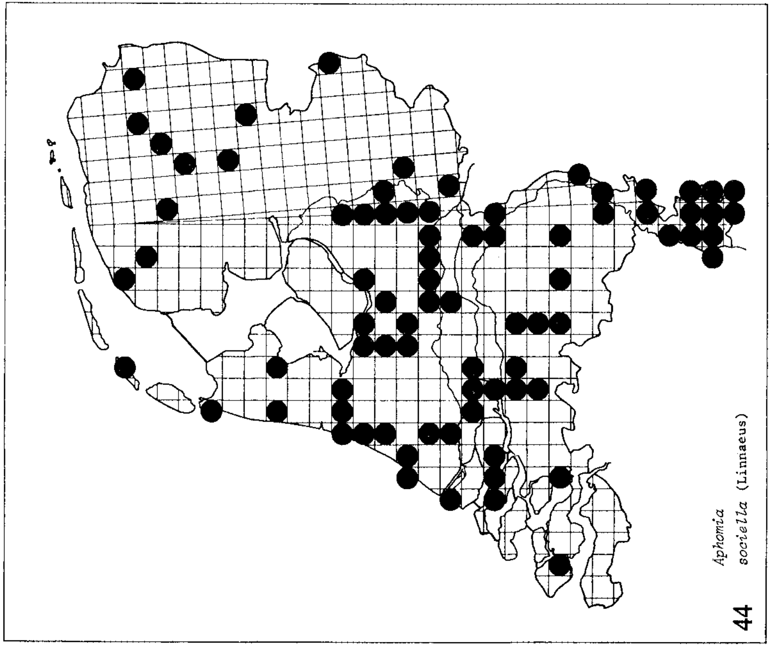
Occurrence in The Netherlands. First record: 1871 (Rijksmus. N.H., Leid.). The material mentioned by De Graaf (1851: 41; 1864: 205) is apparently lost.

Localities (fig. 42): Fr.: Terschelling; N.H.: Aerdenhout, Amsterdamse



Figs. 42-43. Distributions in The Netherlands; 42, *Melissoblaptes zelleri* (De Joannis); 43, *Lamoria anella* (Den. & Schifferm.).





Figs. 44-45. Distributions in The Netherlands; 44, *Aphomia sociella* (L.); 45, *Aphomia gularis* (Zell.).

Bos, Bentveld, Heemskerk, Overveen, Zandvoort; Z.H.: Goeree, 's-Gravenhage, Kijkduin, Leiden (De Graaf, 1864: 205), Melissant, Nieuw Helvoet, Noordwijk, Noordwijk aan Zee, Oostvoorne, Scheveningen (De Graaf, l.c.), Wassenaar (De Graaf, 1851: 41); Zl.: Cadzand, Oostkapelle, Valkenisse, Vrouwenpolder; N.B.: Breda; Lbg.: Belfeld.

Apart from the incidental capture of two females, in the Amsterdamse Bos and at Belfeld, respectively, all localities are situated nearby the North Sea coast. Noteworthy are the two specimens of Heylaerts' collection, caught in the Mastbosch near Breda, 24.vii.1871 and 26.vii.1871, respectively (Rijksmus. N.H., Leid.). With regard to similar records of Macrolepidoptera in the neighbourhood of Breda in the last century, Lempke (1936-1970: (901)) pointed out that during the beginning of the Atlanticum the coastal line passed through the Province of North-Brabant near Breda and that these specimens may be relicts of former coastal populations.

Voltinism. Univoltine (fig. 52). From 16.vi. (1930, Rijksmus. N.H., Leid.) to 11.ix (1928, Inst. Tax. Zoöl., Amst.).

This species hibernates as a larva (L.T. Ford, 1936: 93).

Habitat. In the area round the North Sea the species occurs on coastal sandhills, where, according to Beirne (1952a: 50), it seems to prefer damper situations. However, the German local lists record *M. zelleri* from habitats of a different kind: bare sandy soils and localities close to towns e.g. a railway station and a storage yard. Observations on the early stages are recorded by Schütze (1931: 213) and L. T. Ford (1936: 93-94). The larva inhabits a silken tube on and below the surface of the sand and feeds on the moss *Brachythecium albicans*, in England, and on the roots of *Ammophila arenaria* in Germany. The larva can be bred with dry vegetable and animal material, notably hay, dead insects and bread (Hasenfuss, 1960: 42). However, it has never been mentioned as a pest of storage products. Van Rossem et al. (1968: 207) recorded the larva from stored chocolate and nougat. Mr. C. F. van de Bund informed me that this reference is almost certainly a misidentification.

Male genitalia (fig. 26). The aedeagus has a large number of small cornuti. In *Lamoria anella*, apart from these small cornuti, the aedeagus has some larger ones and a long erect spine, which is apparently characteristic for the species of *Lamoria* Walker.

Female genitalia (fig. 28). The female genitalia of *M. zelleri* and *L. anella* are very similar. The main difference is found in the sclerotization of the 8th tergite. In *L. anella* this structure has the shape of an arrow with two posterior points (fig. 29). In *M. zelleri* this arrow-shaped sclerite does not possess such marked points. In *M. zelleri* as well as in *M. anella* the bursa is delicately scobinate; the wall of the bursa may have an oval signum, a cluster of minute points (pl. 5 fig. 4). These structures are not easily discovered, especially in *M. zelleri*, though in this species sometimes two of these signa occur.

Variability of external characters. From Asia subspecies of *M. zelleri* are described, which are coloured predominantly pale yellow or reddish. In the British Museum (N.H.), Mr. R. H. Kleinpaste compared specimens belonging to the populations from the coastal sandhills of northwest Europe with central European specimens (among them those of Zeller) and observed no marked differences between the two series. Therefore the northwest European populations seem to belong to the subspecies *zelleri* De Joannis.

The Dutch populations are extremely variable.

1. Sexual dimorphism (pl. 1 fig. 6, ♂, and pl. 2 fig. 1, ♀). Generally the forewing of the female is darker than in the male. Besides the male is considerably smaller than the female, viz., male 8.5 (18.0) mm — 12.5 (25.0) mm, female 11.5 (25.0) mm — 17.0 (36.5) mm.

2. The wing venation is variable.

f. *pseudoanella* Kuchlein & Kleinpaste (1977). In the forewing vein 9 arises generally from the stalk of 7 and 8. In this form 7 arises either from the stalk of veins 8 and 9, or together with 9, from 8. This position is the same as that in *L. anella* (fig. 4). Zandvoort, Cadzand (Inst. Tax. Zoöl., Amst.), Oostvoorne (V. d. Made, Vis & Vestergaard).

f. *afurcata* nov. Forewing with 4 and 5 free from the cell. Holotype: Oostkapelle, 1.vii.1961 (Kuchlein). Furthermore: Oostvoorne (V. d. Made, Vis & Vestergaard).

f. *janiella* nov. Forewing with 4 absent. Holotype: Cadzand, vii.1963 (Inst. Tax. Zoöl., Amst.).

f. *pseudolamoria* nov. Hindwing with 4 (stalked with 5). This configuration occurs in *Lamoria* Walker (fig. 6) and *Galleria* Fabricius! Holotype: Valkenisse (Rijksmus. N.H., Leid.). An asymmetrical specimen was mentioned earlier by Rebel (1903: 289) from Bulgaria.

3. Colour and markings of the wings vary widely.

f. *pallens* nov. pl. 2 fig. 2. Ground colour of the forewings is pale yellow. These light-coloured specimens are mainly males. Holotype: Zandvoort, ♂, 11.ix.1928 (Inst. Tax. Zoöl., Amst.), Overveen (Rijksmus. N.H., Leid.), Valkenisse (Inst. Tax. Zoöl., Amst.), Oostvoorne (V. d. Made, Vis & Vestergaard).

f. *obscura* nov. pl. 2 fig. 3. Ground colour of the forewing is brown and suffused with black-brown scales. The tendency in the forewings of getting darker occurs especially in females. Holotype: Oostvoorne, ♀, 15.vii.1964 (V. d. Made, Vis & Vestergaard). Furthermore: Overveen (Rijksmus. N.H., Leid.).

f. *impunctanus* nov. pl. 2 fig. 4. In the forewing the discal spots are absent. Holotype: Overveen, ♀, 19.viii.1970 (Rijksmus. N.H., Leid.). Furthermore: Overveen (Wolschrijn), Valkenisse (Inst. Tax. Zoöl., Amst.).

Behaviour of the adults. The courtship behaviour was described by Hinneberg (1891: 71-73), Rapp (1936: 1) and L. T. Ford (1936: 93). At dusk the males rest on the ground or on lower herbage with vibrating and half raised wings for a second or so at short intervals, producing a smell, that resembles honey or wax. The females make short but vigorous flights over the herbage. The courtship may occur very locally and incidentally a large number of moths is involved (Rapp, 1936: 25). The older and less detailed observations of Snellen (1882: 118) and Sorhagen (1886: 62), according to which the male is more active than the female, are almost certainly incorrect.

The moths are attracted by light and sugar. Mass flights by light were recorded at Scheveningen, The Netherlands (De Graaf 1859-1864: 205) and in the Palatine (Heuser et al., 1971: 15).

Lamoria Walker, 1863

4. **Lamoria anella** (Denis & Schiffermüller, 1775) (figs. 4, 6, 27, 29, 41, 43, pl. 2 figs. 5-6, pl. 6 fig. 1)

Hampson, 1917: 51. — Hannemann, 1964: 81, fig. 1a (wing venation), fig. 1b (head), fig. 1c (♂ genitalia), fig. 1d (♀ genitalia), pl. 15 fig. 4 (adult ♀). — Lhomme, 1935: 163-164. — Rebel, 1901: 2; 1910-1913: 190. — Whalley, 1964: 584.

Geographical distribution. The range extends from west Europe and the Mediterranean area to central Asia and perhaps further eastward (fig. 41). Except from The Netherlands no reliable records are known from northwest Europe. Meyrick (1928: 401) and Beirne (1941: 64) have their doubts about old records from Great Britain and Ireland. Hannemann (1964: 81) does not include the old German records either. Perhaps these old records of *L. anella* actually refer to *M. zelleri* because *zelleri* was considered a synonym of *L. anella* for some time in the last century. Also the two species sometimes are very much alike. Undoubtedly this species is a resident in the Mediterranean area and the Middle East and has to be considered an occasional migrant in northwest Europe (Kuchlein & Kleinpaste, 1977).

Occurrence in The Netherlands. Locality (fig. 43). N.H.: Heemskerk, 22.vii.1963, two females, captured by Van Aartsen (Kuchlein).

Voltinism. In the Mediterranean and the Middle East the species occurs from May to September, probably in two broods.

Habitat. Data on the early stages, published so far, show a wide variety of life histories. Undoubtedly confusion with other Galleriinae occurred. The larva has been reported from the nests of *Vespula sylvestris* (Scopoli) and *Polistes gallicus* (Linnaeus) (Lhomme, 1935: 164) and from the nests of bees (Nickerl, 1906: 1). Millière would have bred the larvae on *Inula viscosa* and Chrétien succeeded in breeding them with the anthidia of *Aster amellus* (Lhomme, l.c.).

Male genitalia (fig. 27). See p. 34.

Female genitalia (fig. 29). See pp. 34, 35.

Variability of external characters.

1. Sexual dimorphism (pl. 2 fig. 5, ♂; pl. 2 fig. 6, ♀). There is a marked difference between both sexes. The female is generally larger than the male, the mean being 14.0 (30.0) mm and 11.5 (25.0) mm, respectively (measured in specimens from south Europe). Moreover the labial palpi are very short in the male (smaller than 1.5 times the diameter of the eye) and long and porrect in the female (larger than 1.5 times the diameter of the eye).

2. The wing venation appears to be very variable (Kuchlein & Kleinpaste, 1977). The Dutch specimens show the main pattern (figs. 4, 6).

3. Colour and markings of the wings show a considerable variation. The two females from Heemskerk are suffused black-grey, but evidently their suffusion is not so strong as in the f. *insulana* Schawerda (1931: 56), described from Corsica, in which even the markings of the forewing are absent.

Behaviour of the adults. Nickerl (1906: 1) said that the moths swarm around *Echium* on sunny slopes, which seems unlikely. The moths are attracted to light.

Aphomia Hübner, 1825

KEY TO THE SPECIES OF APHOMIA

1. Forewing unicolorous ochreous without markings . . . . *sabella*

— Forewing not unicolorous ochreous; with markings present . . . 2

2. Male with a conspicuous tuft of golden hairs on underside of forewing, from near base. Female forewing with only one discal spot, wider than one fifth of the greatest width of the forewing . . . . *gularis*

— Male without a tuft of hairs on underside of forewing. Female forewing normally with two discal spots, each narrower than one sixth of greatest width of forewing . . . . *sociella*

5. **Aphomia sociella sociella** (Linnaeus, 1758) (figs. 30, 32, 44, 53, pl. 3 figs. 1-6, pl. 4 fig. 1)

Beirne, 1952a: 51, fig. 13 (venation hindwing), pl. 1 fig. 5 (adult ♂), pl. 1 fig. 6 (adult ♀). — De Crombrugghe de Picquendaele, 1906: 11-12. — Van Deurs, 1942: 11, pl. 1 fig. 5 (adult ♀). — Hampson, 1917: 38. — Hannemann, 1964: 82, 84, fig. 3a (wing venation), fig. 3b (head), fig. 3c (♂ genitalia), fig. 3d (♀ genitalia), pl. 6 fig. 20 (adult ♂). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 162-163. — Pierce & Metcalfe, 1938: 13, pl. 7 (♂ and ♀ genitalia). — Rebel, 1901: 1; 1910-1913: 190, pl. 81 fig. 8 (adult ♂ and ♀). — Snellen, 1882: 119. — Whalley, 1964: 576-577.

Geographical distribution. The range covers nearly the whole Holarctic region. In Europe the species is found in the Alpine valleys up to 1500-2000 m. It has not been recorded in Scandinavia north of 55° N.B., but is widespread throughout northwest Europe.

Occurrence in The Netherlands. First record: 1861 (Rijksmus. N.H., Leid.). Localities (fig. 44): Fr.: St. Annaparochie, Beetsterzwaag, Fochteloër Veen, Huizum (De Graaf, 1864: 206), Leeuwarden, Vlieland; Gr.: Glimmen, Winschoten; Dr.: Dwingelo, Eelde, Gees; Ov.: Denekamp; Gld.: Apeldoorn, Arnhem, Bennekom, Ede, Groesbeek, Heerde, Heteren, Laagsoeren, Lobith, Loenen, Nijkerk (De Graaf, l.c.), Nijmegen, Oosterbeek, Putten, Renkum, Vaassen, Veenendaal (archive Plantenz. Dienst, Wag.), Velp (De Graaf, l.c.), Vorden, Wageningen, Wamel, Zutphen (De Graaf, l.c.); Utr.: Amersfoort, Leersum, Utrecht; N.H.: Aerdenhout, Amsterdam, Bentveld, Bergen, Bussum, Den Helder, de Glip, Haarlem, Halfweg, Heemskerk, Hilversum, Hoorn, Laren, Muiderberg, Naarden, Naardermeer, Overveen, Vogelenzang; Z.H.: Dordrecht, Giessendam, Goeree, 's-Gravenhage, Hendrik-Ido-Ambacht, Katwijk, Leiden, Leidschendam, Melissant, Middelharnis, Noordwijkerhout, Numansdorp, Oegstgeest, Oostvoorne, Rotterdam, Schelluinen, Schiebroek, Sommelsdijk, Voorburg, Zevenhuizen (Van Pelt Lechner, 1896: 76); Zl.: Walcheren (De Graaf, l.c.); N.B.: Bergen op Zoom, Biesbosch, Breda, Cuyk, Deurne, Eindhoven, Ginneken, 's-Hertogenbosch, Nederwetten, Nuenen, Oisterwijk, Oosterhout, Westelbeers; Lbg.: Benzenrade, Bunde, Diependal, Echt, Epen, Eperheide, Geulle, Hoensbroek, Holset, Houthem, Lemiers, Maastricht, Meerssen, Montfort, Posterholt, Roggel, Rolduc, Schaesberg, Schin op Geul, Simpelveld, Stein, Swalmen, Tegelen, Valkenburg, Venlo, Vijlen, Wijlre.

Widespread throughout the country including the Dutch Frisian Islands (Vlieland).

Voltinism. Fig. 53. From the first decade of May (2.v.1972, Langohr) to the third decade of August (26.viii.1866, Inst. Tax. Zoöl., Amst.). Hibernates as full-grown larva.

Habitat. The larva lives generally in the nests of bumblebees, but exceptionally is found in the subterranean nests. It has been recorded from the nests of *Bombus pascuorum* (Scopoli), *B. hypnorum* (Linnaeus), *B. muscorum* (Linnaeus), *B. hortorum* (Linnaeus) and *B. lapidarius* (Linnaeus). Less frequently the larva lives in the nests of wasps, viz. of *Vespa vulgaris* Linnaeus and *V. norvegica* Fabricius. From a nest of the latter species J. Th. Oudemans bred a series of adults (Inst. Tax. Zoöl., Amst.). Quite exceptionally *A. sociella* is found in bee-hives. In northwest Europe it has been recorded only once, in Westphalia (Uffeln, 1930: 29). According to the labels Heylaerts bred the larva on beeswax (Rijksmus. N.H., Leid.). Similarly to the Bee Moths the young larva initially feeds on debris and the paper-like walls of the nests, but afterwards it attacks the honeycombs and even the brood. It tunnels through the entire nest and finally the larvae of *sociella* may ruin the colony completely. This process has been described for a colony of *Bombus pascuorum* in The Netherlands by Uittien (1925: 116-118).

Sometimes the larva is found in abandoned bird boxes or bird's nests, also in The Netherlands. It is suggested that these previously have been inhabited by bumblebees or wasps, which may be gradually destroyed as a result of the activity of the larvae of *A. sociella*. There are some observations, which support this idea. Evers (1938: 4) mentioned a record of *sociella* from a wasp colony, which lived in a bird box and according to Hase (1926: 560-565) the larva has been found in a colony of *Bombus lapidarius*, living in an abandoned tit box. On the other hand, the larva is recorded from nest boxes in Finland, where it is said to feed on nest material and on offal of the young birds (Kivirikko, 1941: 206-207). Though Mariani (1947: 113) mentioned tree bark as food, the only safe proof of existance without association with Hymenoptera thus far was yielded in Denmark, where the larvae lived in a narrow space between two parts of a folding-bed placed in a loft (Wolff, 1971b: 141-144). In captivity the larva has been bred with a mixture of flour, honey and leaves (Lhomme, 1935: 136).

Male genitalia (fig. 30). The male genitalia are very similar to those of *A. gularis* and *A. sabella*. However, there are differences as to the course and, the thickness of the subcostal ridge of the valva in the three species (figs. 31 and 34).

Female genitalia (fig. 32). The female genitalia are similar to those of *A. gularis* and *A. sabella*. In contrast to both other northwest European species of *Aphomia*, *A. sociella* does not show a trace of a signum.

Variability of external characters. A number of subspecies has been described. The northwest European populations undoubtedly belong to the nominal subspecies. The infrasubspecific variability is extremely great.

1. Sexual dimorphism (pl. 3 fig. 1, ♂; pl. 3 fig. 2, ♀). The most conspicuous difference in appearance between the two sexes is the colour of the basal area of the forewing. In the main form of the male this area is yellowish-white with a pink tint. In the female there is no difference in colour between the basal area and the rest of the wing. Moreover the female has two black discal dots on the forewing, which are absent in the male. Finally the male is generally somewhat smaller than the female.

2. The size of the adults varies considerably. Very small specimens are described as f. *minor* Dufrane (1930: 68). Males of 8.0 (18.5) mm and smaller are recorded from Putten (Inst. Tax. Zoöl., Amst.). Males of 16.0 (33.0) mm and larger from Leidschendam (Inst. Tax. Zoöl., Amst.). Females of 11.0 (24.0) mm and smaller from Bussum (Inst. Tax. Zoöl., Amst.), 16.0 (34.0) mm from Wamel and Overveen (Inst. Tax. Zoöl., Amst.).

3. The venation is variable in the forewing as well as in the hindwing.

f. *octavaseparata* nov. Hindwing with vein 8 free, not anastomosing with 7. This configuration is found in the subfamily Pyralinae, as shown in fig. 7. Holotype: ♂, Bussum, 3.vi.1957 (Kuchlein). Furthermore: Oostvoorne (V. d. Made, Vis & Vestergaard).

4. Colour and markings of the wings show a wide variation in both sexes.

f. *obscura* Schmidt (1934: 534) (pl. 3 fig. 3). Forewing darkly suffused with markings hardly visible. In the male especially the darkened basal part of the forewing is conspicuous. Hindwing is also darker. Renkum (Kleinpaste), Hilversum (Oudejans), Tegelen (Rijksmus. N.H., Leid.), Bussum, Apeldoorn (Inst. Tax. Zoöl., Amst.).

f. *grisella* nov. (pl. 3 fig. 4). Ground colour of the forewing not brownish, but grey. Markings very distinct. Holotype: ♀, Hilversum, 26.vii.1965 (Oudejans). Furthermore: Halfweg (Rijksmus. N.H., Leid.), Putten (Inst. Tax. Zoöl., Amst.).

f. *pallens* nov. (pl. 3 fig. 5). In the male the colour of the forewing beyond the antemedial line has for the greater part the same colour as the basal area. Holotype: ♂, Vorden, 24.viii.1910 (Rijksmus. N.H., Leid.). Furthermore: Dordrecht, Epen, Overveen (Rijksmus. N.H., Leid.), Heteren, Leeuwarden, Middelharnis, Oisterwijk, Oostvoorne, Overveen, Venlo (Rijksmus. N.H., Leid.), Wageningen (Kuchlein).

f. *afasciella* nov. (pl. 3 fig. 6). The dark suffusion of the antemedial is absent. Ground colour as in the nominate form. Holotype: ♀, Oostvoorne 23.v.1961 (V. d. Made, Vis & Vestergaard). Furthermore: Beetsterzwaag, Breda, Bussum, Hilversum (Rijksmus. N.H., Leid.), Apeldoorn, Arnhem, Bussum (Inst. Tax. Zoöl., Amst.), Oostvoorne (V. d. Made, Vis & Vestergaard), Heerde (Wolschrijn), Hilversum (Oudejans).

f. *striatella* nov. The first discal dot in the female linear, longer than the diameter of the second discal dot. Holotype: ♀, Beetsterzwaag, 5.vi.1959 (Rijksmus. N.H., Leid.). Furthermore: Fochteloër Veen, Hilversum (Rijksmus. N.H., Leid.), Bentveld, Cuyk, Nijmegen, Overveen, Putten, Vorden (Inst. Tax. Zoöl., Amst.), Geulle, Nijmegen (Cox), Hilversum (Oudejans), Muiderberg (Wolschrijn).

f. *confluens* nov. (pl. 4 fig. 1). In the female both discal dots are connected by dark scales. Holotype: ♀, Breda, 8.vii.1876 (Rijksmus. N.H., Leid.). Furthermore: Overveen (Inst. Tax. Zoöl., Amst.) [1]).

5. The shape of the forewing is variable.

f. *lanceolata* Dufrane (1930: 68-69). This form has been described after a specimen from Nancy (France), which mainly was characterized by its narrow wings [2]). Specimens with costa of the forewing more than three times as long as the greatest width of the forewing are recorded from Nijmegen (Inst. Tax. Zoöl., Amst.) and Laren (Oudejans).

Behaviour of the adult. In the daytime the adults rest on trunks, walls and fences and also near the ground between the herbage. The species is attracted to light and is frequently found indoors.

6. **Aphomia gularis** (Zeller, 1877) (figs. 31, 33, 45, 46, pl. 4 figs. 2-4, pl. 6 fig. 2)

Beirne, 1952a: 51-52, pl. 1 fig. 7 (adult ♂), pl. 1 fig. 8 (adult ♀). — Hampson, 1917: 38. — Hannemann, 1964: 84, fig. 4a (wing venation), fig. 4b (head), fig. 4c (♂ genitalia), fig. 4d (♀ genitalia), pl. 7 fig. 15 (adult ♀, erroneously denoted as a ♂), pl. 7 fig. 16 (adult ♂, erroneously denoted as a ♀). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 162. — Pierce & Metcalfe, 1938: 13, pl. 7 (♂ and ♀ genitalia). — Whalley, 1964: 587-588.

Geographical distribution. Initially the species has been recorded only in southeast and east Asia, mainly in the subtropical area. Since about 1890, apparently, it has been artificially introduced in other parts of the world, e.g., north America and Europe.

In northwest Europe it has been introduced in England (1891), Germany (1907), France (1907), The Netherlands (1913), Sweden (1950), on the Faroe Islands (1954) and in Denmark (1955). The localities in northwest Europe are shown in fig. 46.

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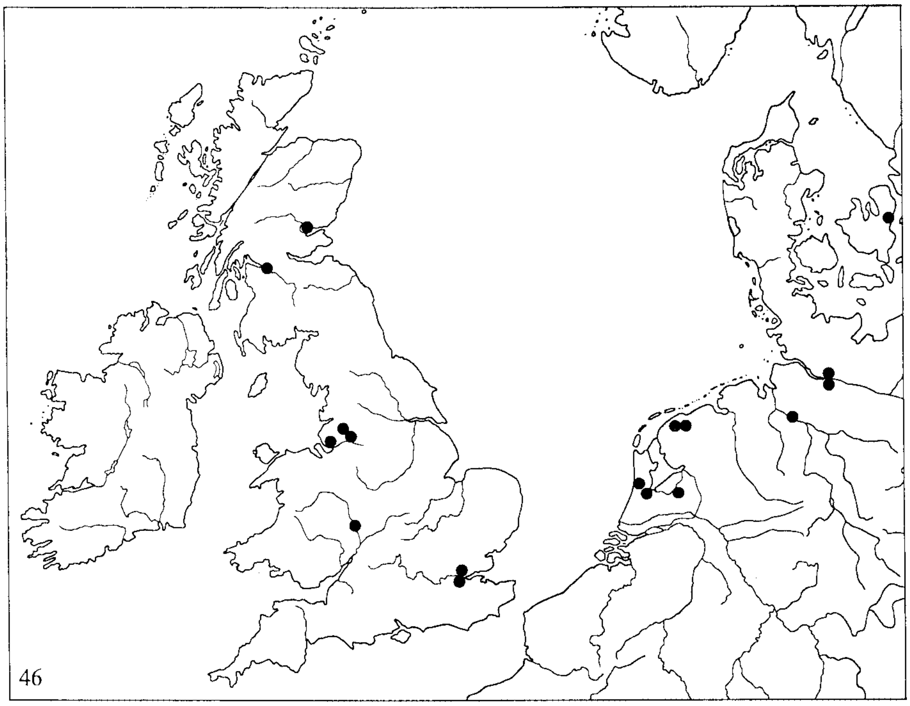
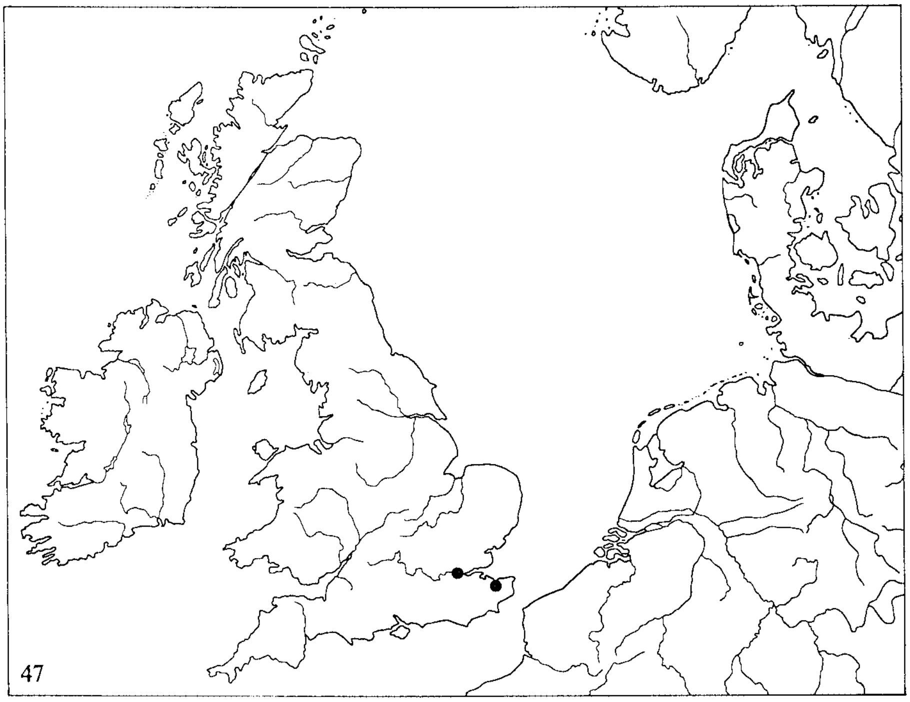
1) Comparison of series of moths captured in the last century with specimens caught during the last decade strongly suggests a shift from lighter to darker forms both in males and females.

2) Therefore, Dufrane's type does not originate from Belgium as has been quoted erroneously in the Zoological Record, Pars Insecta, 1930: 270, and has been cited since in the literature.





Figs. 46-47. Distributions in NW Europe; 46, *Aphomia gularis* (Zell.); 47, *Aphomia sabella* (Hamps.).

Occurrence in The Netherlands. First record: 1913 (Inst. Tax. Zoöl., Amst.), see Kuchlein (1978).

Localities (fig. 45): Fr.: Leeuwarden, 1959 (1 ♂, Rijksmus. N.H., Leid.); Gr.: Groningen, 1937 (Diakonoff, 1938: li); Gld: Ermelo, 1913 (1 ♂ and 2 ♀, Inst. Tax. Zoöl., Amst.); N.H.: Amsterdam, 1936 and 1937 (numerous in some warehouses according to Diakonoff (1937a: 313-315), specimens in Rijksmus. N.H., Leid., and Inst. Tax. Zoöl., Amst.); again in 1968 (2 ♂ in coll. Houkes, according to B. J. Lempke (pers. comm.)); Zaanstreek, 1958 (Van Rossem et al., 1959: 87).

Voltinism. By far the most adults in the collections were collected in June, probably the first brood (25.v.1968 (Houkes) to 10.vii.1959 (Rijksmus. N.H., Leid.)). Moreover, large numbers of dead moths have been found on fly papers in a warehouse in November (1936) and the moths were abundant during August and September (Diakonoff, 1937a: 313-314). These data point to the occurrence of two broods per year. The same is concluded at room-temperature in Hamburg (Zacher, 1935: 37) and for unheated warehouses in London (Smith, 1956: 656), whereas Beirne (1952a: 52) considered it univoltine. It is evident that the voltinism is related to the conditions in the locality, where the population lives. Under experimental conditions a faster rate of development than two generations per year has been achieved (Liebers, 1937: 10-11). The species hibernates as a larva.

Habitat. In Europe the larva is found so far only in warehouses, where it attacks almonds, walnuts, flax seed, dried fruit, cacao beans, peanuts, etc. In the Netherlands it has been found feeding on apricot kernels (Diakonoff, 1937a: 313) and on linseed cake (V. Rossem et al., 1959: 87).

Diakonoff (1937c: lxxxvii-lxxxviii) established that *A. gularis* was able to hibernate in unheated warehouses. However, the small number of records from The Netherlands strongly suggests that *A. gularis* did not settle permanently.

Male genitalia (fig. 31). Very similar to those of *A. sociella* and *A. sabella* (see p. 39).

Female genitalia (fig. 33). Similar to those of *A. sociella* and *A. sabella.* Signum present, but less pronounced than in *A. sabella.*

Variability of external characters.

1. Sexual dimorphism (pl. 4 fig. 2, ♂; pl. 4 fig. 3, ♀). There are marked differences in appearance between the two sexes. The forewing of the male is bluish grey with a characteristic yellow, reddish-brown-edged spot. In the narrow distal part of the spot are two black dots. The forewing of the female is greyish brown with one large distinct discal spot. The female is generally larger than the male.

2. The wing venation is less variable than in other species of the Galleriinae found in northwest Europe.

f. *marionella* nov. In the hindwing vein 5 is present (fig. 6). Holotype: Amsterdam 11.vi.1937 (Inst. Tax. Zoöl., Amst.).

3. Colour and markings of the wings.

f. *impunctella* nov. (pl. 4 fig. 4). In the forewing of the male the proximal dot is absent. Holotype: ♂, Amsterdam 15.vi.1937 (Rijksmus. N.H., Leid.).

Behaviour of the adults. The moth flies at dusk and is hidden in daytime in dark places of the warehouse (Liebers, 1937: 9). The specimen found in Leeuwarden was resting on a wall outdoors (Dijkstra, 1961: 208).

7. **Aphomia sabella** (Hampson, 1901) comb. nov. (figs. 34, 36, 47, pl. 4 figs. 5-6)

Hampson, 1917: 36. — Kloet & Hincks, 1972: 44. — Rebel, 1901: 1. — Whalley, 1964: 578.

Geographical distribution. The moth is recorded from North Africa and the Middle East and has been artificially introduced in England, where it has been reported from London and Canterbury (Buxton, 1921: 290). It is not known from the other northwest European countries (fig. 47).

Voltinism. In the Middle East from March to October, but the adults are most numerous in April. The species is supposed to be multivoltine (Wiltshire, 1957: 123).

Habitat. In England the larva has attacked stored dates (Buxton, 1921: 290). There are records of *A. sabella* as a pest of stored dates in the Middle East also. According to Wiltshire (1957: 123) the larva attacks more often the growing date, but only occasionally the stored date. However, so far there is no record of serious damage (Munier, 1973: 89), probably due to the ignorance of *A. sabella* as a pest of stored fruits. Besides the larva is able to feed on vegetable and animal debris, as has been shown by Chrétien (1917: 408-410).

Male genitalia. The male genitalia (fig. 34) resemble closely those of *A. sociella* and *A. gularis* (see p. 39).

Female genitalia (fig. 36). The female genitalia are similar to those of *A. sociella* and *A. gularis*. As in *A. gularis* a signum is present, but in *sabella* it is more conspicuous.

Variability of external characters.

1. Sexual dimorphism (pl. 4 fig. 5, ♂; pl. 4 fig. 6, ♀). The female generally is larger than the male.

2. Wing venation. There is a considerable variation in the wing venation as is stated by Kleinpaste (1977).

Corcyra Ragonot, 1885

8. **Corcyra cephalonica** (Stainton, 1866) (figs. 35, 37, 48-49, pl. 5 figs. 1-3)

Beirne, 1952a: 49-50, fig. 11 (venation forewing), pl. 1 fig. 2 (adult). — Hampson, 1917: 36. — Hannemann, 1964: 88, fig. 7a (wing venation), fig. 7b (head), fig. 7c (♂ genitalia), fig. 7d (♀ genitalia), pl. 7 fig. 18 (adult ♂). — Kloet & Hincks, 1972: 44. — Lempke, 1976: 38. — Lhomme, 1935: 161. — Pierce & Metcalfe, 1938: 13, pl. 7 (♂ and ♀ genitalia). — Rebel, 1901: 1; 1910-1913: 189. — Whalley, 1964: 579-580.

Geographical distribution. At present the species is nearly cosmopolitan. It has been assumed that it originates from southeast Asia and has been spread artificially all over the world.

In northwest Europe it is mainly recorded from sea-ports (fig. 48).

Occurrence in The Netherlands. First record: 1915 (Rijksmus. N.H., Leid.).

Localities (fig. 49): N.H.: Amsterdam (repeatedly, since 1927), Haarlem, 1936 (Diakonoff, 1937b: xxxii-xxxiii); Z.H.: Rotterdam (repeatedly, since 1915).

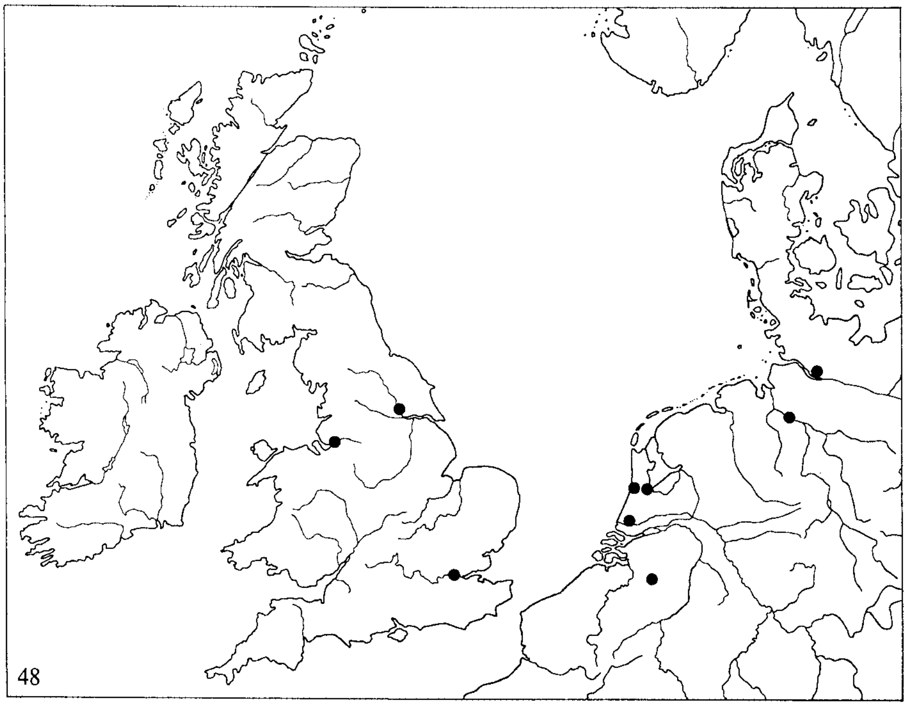


Fig. 48. Distribution in NW Europe of *Corcyra cephalonica* (Staint.).

Voltinism. In The Netherlands most adults have been found between 1.vi. (1947, Inst. Tax. Zoöl., Amst.) and 31.vii. (1948, Kuchlein). Moreover the moths appear from September (Inst. Tax. Zoöl., Amst.) to January (Rijksmus. N.H., Leid.). In northwest Europe probably not more than one or two generations per year. In the tropics no less than eight generations per year may occur under favourable conditions (Heddergott & Weidner, 1953: 282).

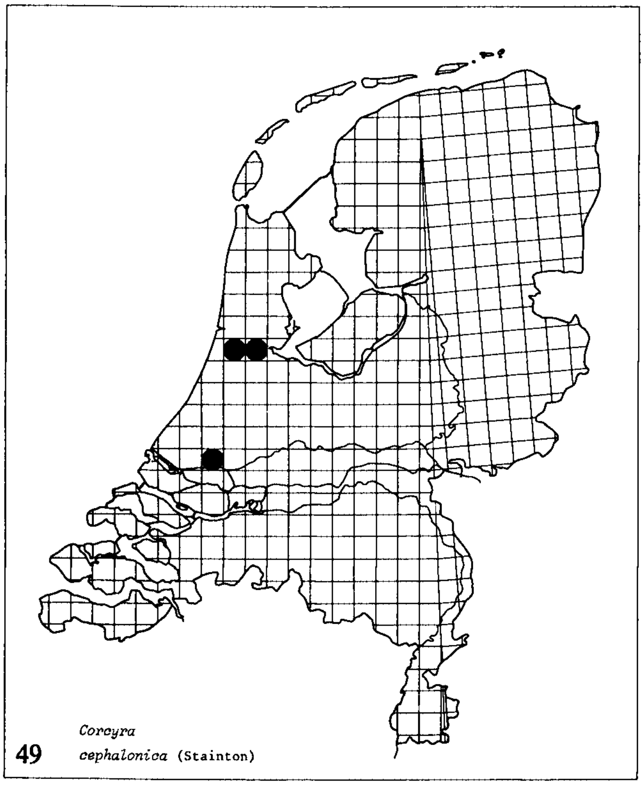


Fig. 49. Distribution in The Netherlands of *Corcyra cephalonica* (Staint.).

Habitat. The larva is an important pest of stored products. In The Netherlands it has attacked rice meal, grains of rice, peanuts, scales of cotton-seed, dried currents, cocoa beans and copra. It is not certain whether *C. cephalonica* is able to hibernate in northwest Europe in unheated warehouses. In heated places it does hibernate, as I could establish in my own house, where the larvae lived in a bag of rice during the winter of 1946-1947. However, even more than in *A. gularis*, the data suggest that this species has not settled permanently in northwest Europe and is being repeatedly introduced from elsewhere.

Male genitalia (fig. 35). From the northwest European species of *Aphomia* they differ by the shape of the caecum, which is notably longer, and by the absence of the ridge on the valva. See p. 39.

Female genitalia (fig. 37). Among the northwest European Galleriinae this species is characterized by the short and wide ductus bursae.

Variability of the external characters. The main form is pictured in pl. 5 fig. 1 (♀).

1. The size of the adults varies considerably. The females are generally larger than the males. Especially among bred adults very small specimens occur. A dwarf male (6.0 (13.0) mm) is recorded from Amsterdam (Inst. Tax. Zoöl., Amst.). Two large females (10.0 (21.0) mm) from Amsterdam as well (Inst. Tax. Zoöl., Amst.).

2. The wing venation is variable.

f. *quartaabsens* nov. In the hindwing vein 4 is absent. Holotype: ♂, Amsterdam, 22.vi.1963 (Kuchlein).

f. *furcatella* nov. In the forewing vein 11 does not originate from the cell, but is stalked with vein 10. This form was already pictured by Chittenden (1919). Holotype: ♀, Amsterdam, 7.v.1963 (Kuchlein).

3. Colour and markings of the wings.

f. *translineella* Ragonot (1901: 491, pl. 51 fig. 26). See pl. 5 fig. 2. The forewing has two fasciae. Amsterdam (Inst. Tax. Zoöl., Amst., Rijksmus. N.H., Leid., Kuchlein).

f. *astrigatella* nov. (pl. 5 fig. 3). In the forewing the veins are not darkly suffused. This form resembles superficially *Achroia grisella*. Holotype: ♀, Amsterdam, 23.x.1970 (Rijksmus. N.H., Leid.).

Behaviour of the adults. The moth flies at night. In the daytime it rests on rafters, walls, etc. in the characteristic position with its wings tightly folded and the front of its body raised on the straightened legs.

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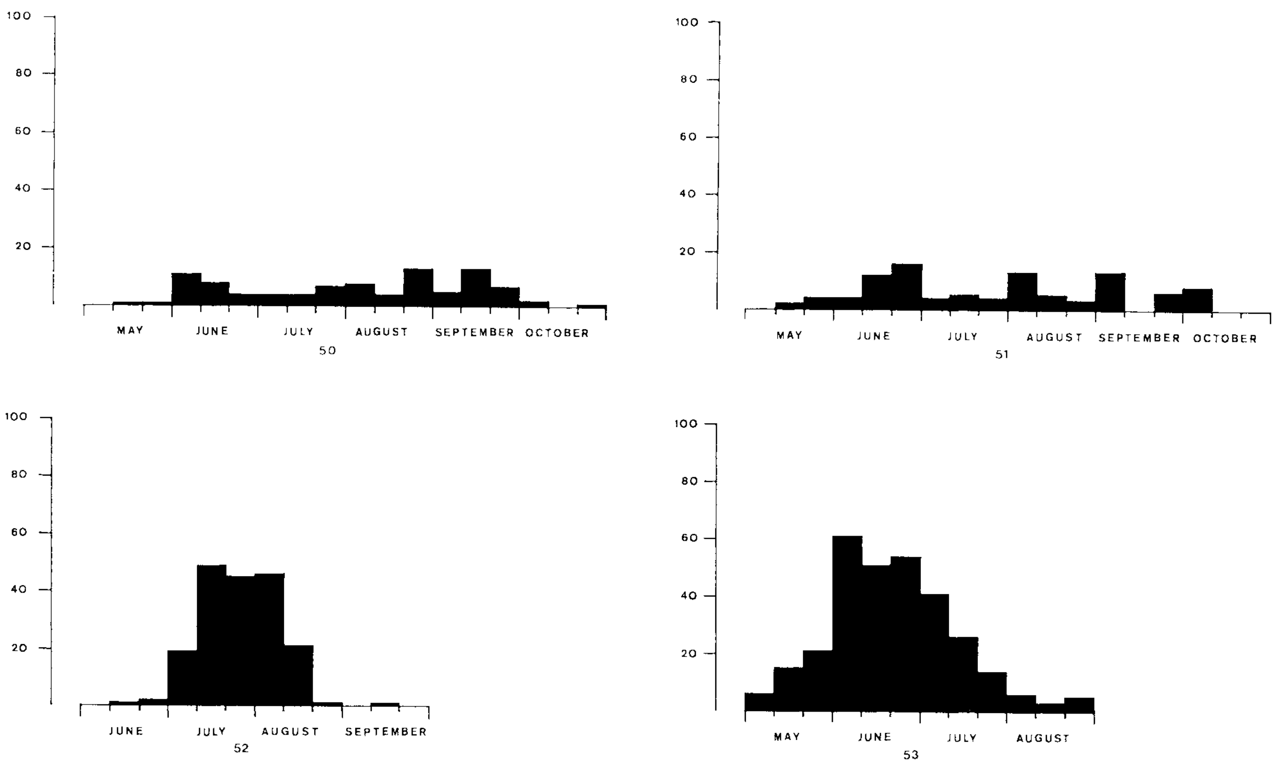

Figs. 50-53. Flight diagrams of the adults registered in the field per decade; 50, *Galleria mellonella* (L.), 93 records; 51, *Achroia grisella* (F.), 99 records; 52, *Melissoblaptes zelleri* (De Joannis), 185 records; 53, *Aphomia sociella* (L.), 303 records.

SAMENVATTING

Het doel van het onderhavige werk is om een poging te wagen een eigentijds, geïllustreerd overzicht samen te stellen van de in NW Europa gevonden Microlepidoptera. Dit is tot dusver niet eerder gebeurd. Speciale aandacht wordt geschonken aan de in Nederland aangetroffen soorten.

Bij elke in dit overzicht opgenomen soort wordt een karakteristiek van de geografische verspreiding, alsmede een gedetailleerde uiteenzetting over het voorkomen in Nederland gegeven. In veel gevallen zal dit vergezeld gaan van verspreidingskaarten, waarbij voor de Nederlandse kaartjes het "U.T.M.-grid" is gebruikt. Voorts worden gegevens verstrekt over de vliegtijd der vlinders en, wanneer de omvang van het geregistreerde materiaal dit rechtvaardigt, worden deze gepresenteerd in de vorm van histogrammen. Bovendien zal worden getracht de habitat van de Nederlandse populaties in enkele woorden te karakteriseren en worden gegevens over het voedsel en notities over het ongestoord gedrag van de adulte motten verstrekt.

De genitaliën, die in de moderne taxonomie en bij de identificatie van grote betekenis zijn, worden afgebeeld, terwijl in de tekst de morfologie van de geslachtsorganen kort wordt gekarakteriseerd. Tenslotte worden de belangrijkste trends in de variabiliteit van het uiterlijk van de volwassen vlinders bij de Nederlandse populaties aangegeven en wordt bovendien aandacht geschonken aan geografische verschillen in kenmerken.

Tabellen zijn opgenomen ter identificatie van de verschillende taxa. Bij de gebruikelijke opzet van de tabellen, waarmee de soorten kunnen worden gedetermineerd, is het mogelijk, dat bij sommige soorten een aantal tot die soort behorende individuen, bij overigens volkomen correcte keuze van de alternatieven, onjuist of niet kan worden geïdentificeerd. Dit laatste is meestal het gevolg van de variabiliteit van één of meer discriminerende kenmerken. Gepoogd is de tabellen zodanig in te richten, dat ook deze „afwijkende" vormen correct op naam kunnen worden gebracht.

De gebruikte nomenclatuur is modern. De volgorde der families zal in grote lijnen gaan van meer gespecialiseerd naar primitief. Binnen de grotere taxonomische eenheden zullen evenwel de taxa van minder gespecialiseerd naar meer gespecialiseerd worden behandeld. Aldus wordt de meest logische aansluiting verkregen, met name op Lempke's catalogus van Nederlandse Macrolepidoptera (1936-1970).

In deze eerste aflevering wordt het werk ingeleid en komt van de familie der Pyralidae de subfamilie der Galleriinae aan de orde.

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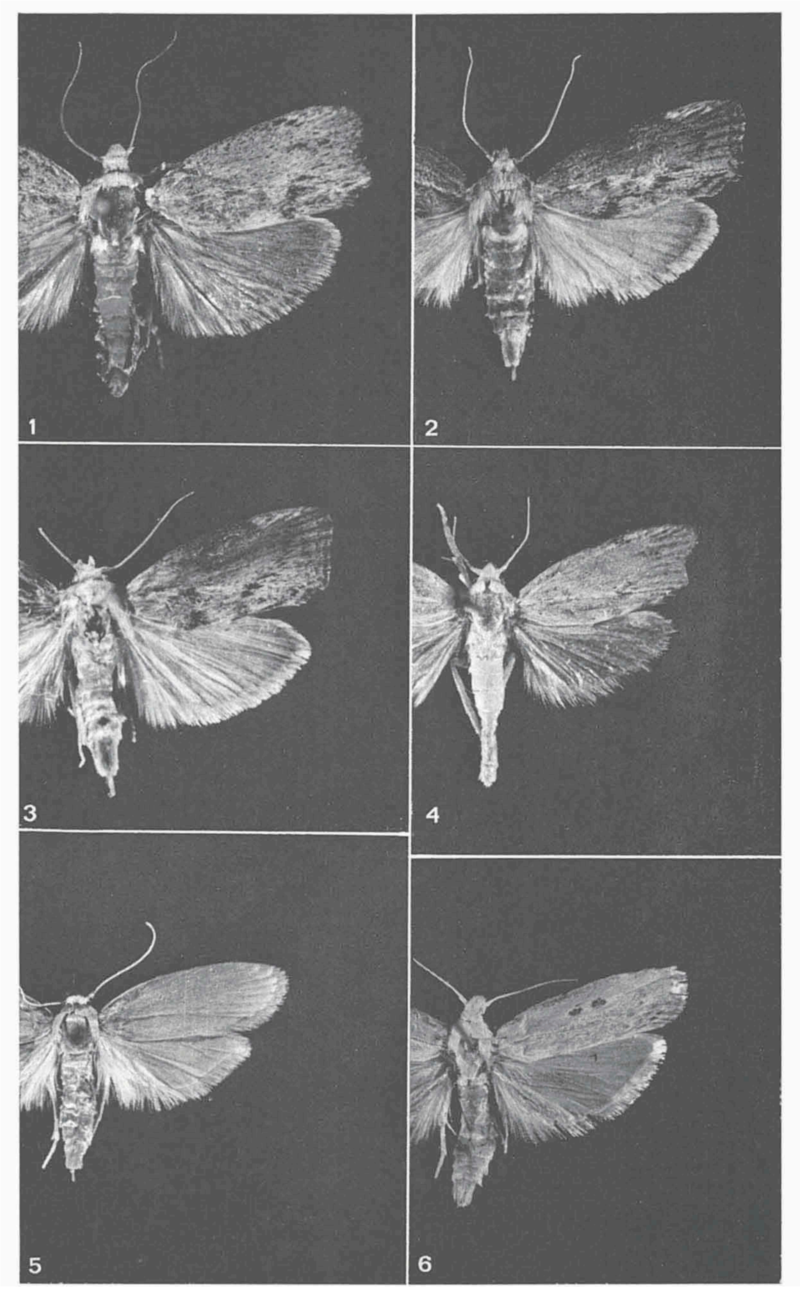
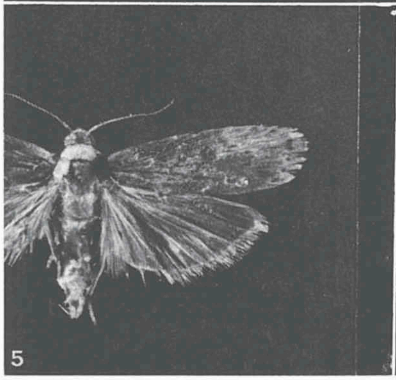
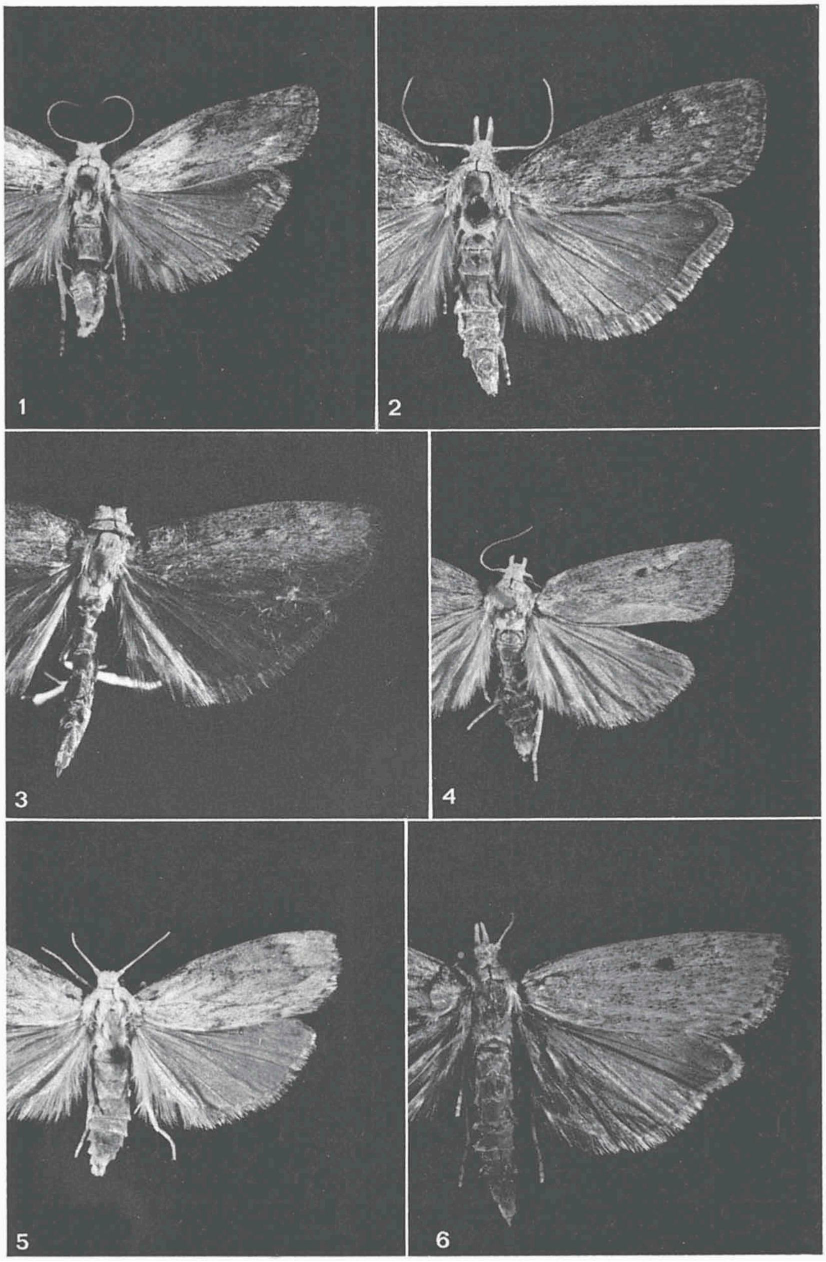


Figs. 1-4. *Galleria mellonella* (L.); 1, ♂, Wageningen, 24.ix.1957; 2, ♀, Wageningen, 15.ix.1957; 3, f. *rectimarginella* nov., ♀, Wageningen, 15.ix.1957, holotype; 4, f. *crombruggheella* Dufrane, ♂, Amsterdam, 30.ix.1949 (all a.o., author's coll.). Fig. 5. *Achroia grisella* (F.), ♀, Amsterdam laboratorium, e.l., 24.ix.1948, C. Doets leg. Fig. 6. *Melissoblaptes zelleri* (De Joannis), ♂, Overveen, 27. viii.1969, B. van Aartsen leg. (both Rijksmuseum N.H., Leiden).



Figs. 1-4. *Melissoblaptes zelleri* (De Joannis); 1, ♀, Aerdenhout, 6.vii.1952, T. H. van Wisselingh leg. (author's coll.); 2, f. *pallens* nov., ♂, Zandvoort, 11.ix.1928, G. A. Bentinck leg., holotype (Inst. Tax. Zoöl., Amst.); 3, f. *obscura* nov., Oostvoorne, 15.vii.1964, holotype (coll. Van der Made, Vis and Vestergaard); 4, f. *impunctanus* nov., ♀, Overveen, 19.viii.1970, B. van Aartsen leg., holotype (Rijksmuseum N.H., Leiden). Figs. 5-6. *Lamoria anella* (Den. & Schifferm.); 5, ♂, St. Jean Cap Ferrat, Alpes Maritimes, France, 9.ix.1962; 6, ♀, Heemskerk, 23.vii.1963, B. van Aartsen leg. (both author's coll.).



Figs. 1-6. *Aphomia sociella* (L.); 1, ♂, Heerde, 15.vi.1975; 2, ♀, Heerde, 1.vi.1975 (both coll. Wolschrijn); 3, f. *obscura* Schmidt, ♀, Renkum, 2.vii.1974 (coll. Kleinpaste); 4, f. *griseella* nov., ♀, Hilversum, 26.vii.1965, holotype (coll. Oudejans); 5, f. *pallens* nov., ♂, Vorden, 24.viii.1910, N. A. de Joncheere leg., holotype (Rijksmuseum N.H., Leiden); 6, f. *afasciella* nov., ♀, Oostvoorne, 23.v.1964, holotype (coll. Van der Made, Vis and Vestergaard).

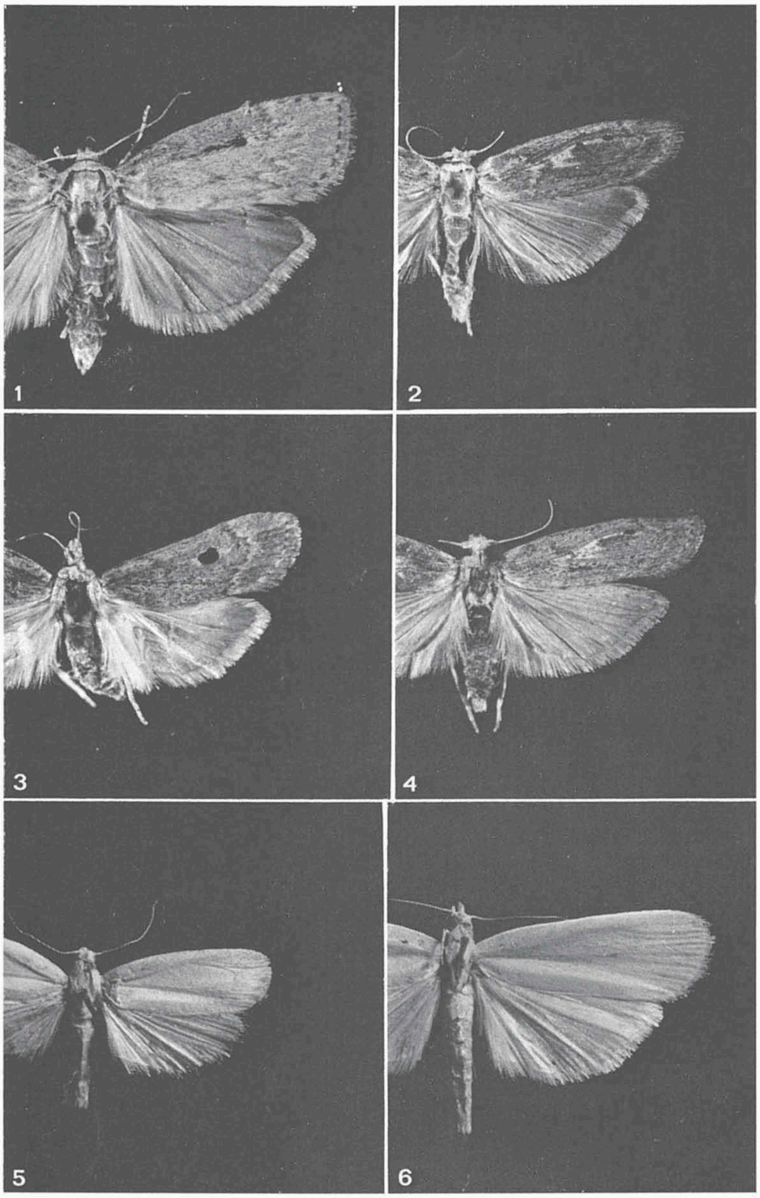
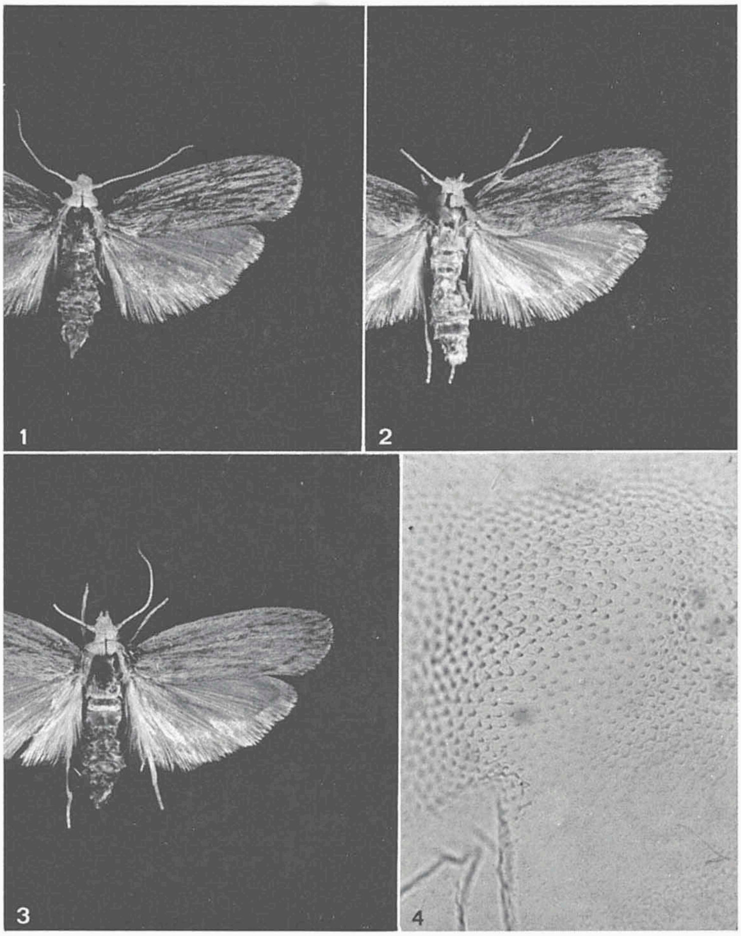
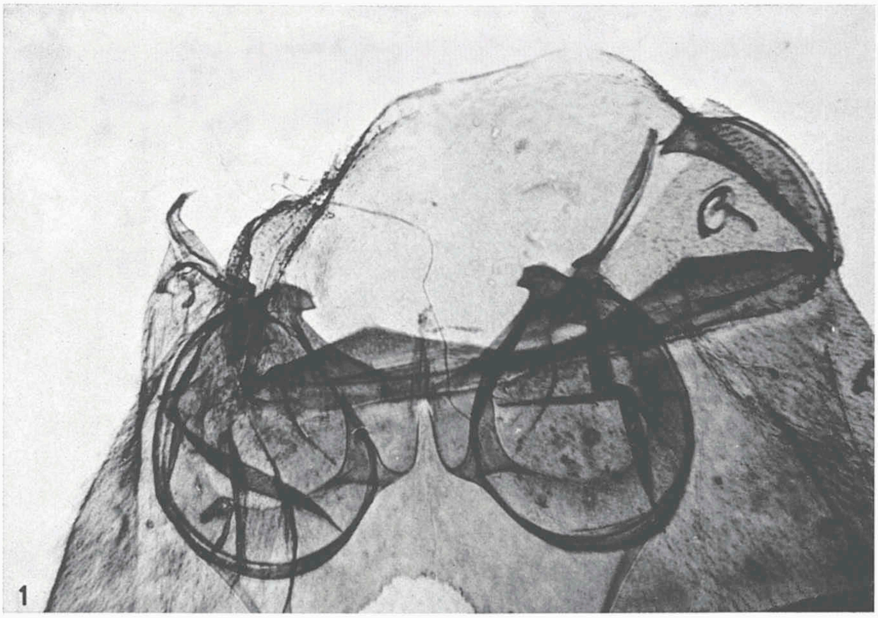
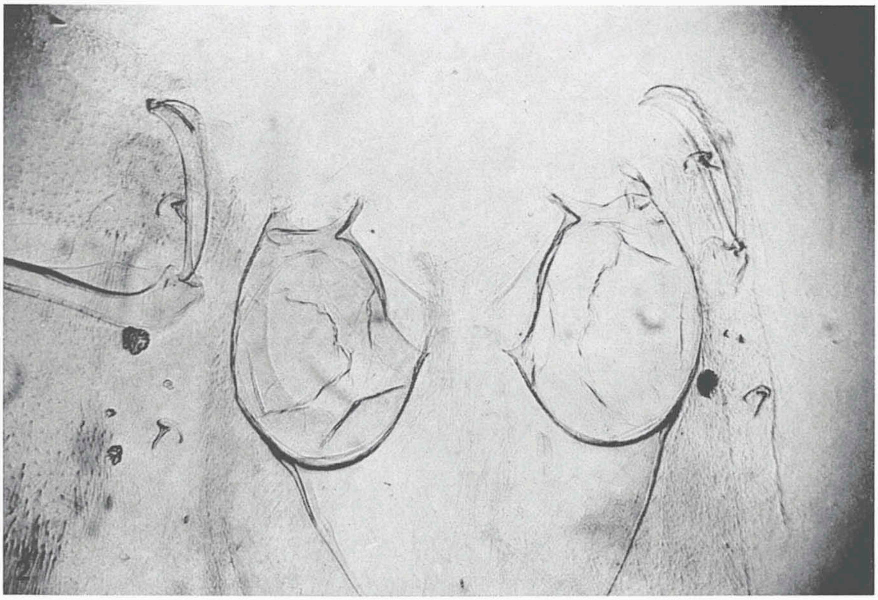


Fig. 1. *Aphomia sociella* (L.) f. *confluens* nov., ♀, Breda, 8.vii.1876, F. J. M. Heylaerts, holotype (Rijksmuseum N.H., Leiden). Figs. 2-4. *Aphomia gularis* (Zell.); 2, ♂, Amsterdam, 15.vi.1937; 3, ♀, Amsterdam, 26.vi.1937; 4, f. *impunctella* nov., ♂, Amsterdam, 15.vi.1937, holotype (all A. Diakonoff leg., Rijksmuseum N.H., Leiden). Figs. 5-6. *Aphomia sabella* (Hamps.); 5, ♂, Nakheila R. Atbara (Sudan), 7.ii.1904; 6, ♀, Abal Qazar (Saudi Arabia); 10.i.1953 (Brit. Mus., (N.H.), London).



Figs. 1-3. *Corcyra cephalonica* (Staint.); 1, ♀, Amsterdam, 23.x.1970; 2, f. *translineella* Ragonot, ♀, Amsterdam, 22.x.1970; 3, f. *astrigatella* nov., ♀, Amsterdam, 23.x.1970, holotype (all B. van Aartsen leg., Rijksmuseum N.H., Leiden). Fig. 4. *Melissoblaptes zelleri* (De Joannis), signum, X250 (slide K 312).





Figs. 1-2. Abdominal tympanal organs; 1, *Lamoria anella* (Den. & Schifferm.) (slide K 308); 2, *Aphomia gularis* (Zell.) (slide K 311); both × 50.