Insect pests of food.

Contributors

Great Britain. Ministry of Food.
Corbet, Alexander Steven.
Hinton, H. E. (Howard Everest), 1912-1977.

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MINISTRY OF FOOD.

INSECT PESTS OF FOOD.

1. Hinton, H. E. The Larvae of the Lepidoptera associated with Stored Products.
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2. Corbet, A. S. & Tams, W. H. T. Keys for the Identification of the Lepidoptera infesting Stored Food Products.
   (Reprinted from the *Proceedings of the Zoological Society of London*, (B) **113**, pp. 55–148.)

With a Foreword

by

The Director of Infestation Control.

November, 1943.

FOREWORD.

The two papers which constitute this pamphlet were prepared under the direction of the Keeper of the Department of Entomology, British Museum (Natural History). Two of the authors, Dr. A. S. Corbet and Dr. H. E. Hinton, are now serving as officers in this Ministry.

Although both papers have been written primarily for the use of the Inspectors of the Ministry of Food, they will be of some help to others who are experienced in the processing, storage, and handling of commodities and who have long felt the need of a handy and authoritative guide to the identification of the moths and moth larvae they are likely to encounter.

Owing to the inclusion of a considerable number of species not frequently met with, the keys are necessarily complex. However, in the vast majority of instances the layman will be only concerned to identify the more common and injurious species. If, for example, the commodity is flour, the species concerned will be some or all of the following: *Ephestia sericarium*, *Ephestia elutella*, *Plodia interpunctella*, and *Hofmannophila pseudospretella*; and there will only rarely be other species involved. In such an instance considerable time and labour will be saved by using only those sections of the keys that deal with these species. Identifications of the adult moths should, except in the case of a few strikingly coloured species, *e.g.*, *Pyralis farinalis*, be confirmed by a comparison of their genitalia with the illustrations given in the text, and in practice it will often be found easier simply to compare the genitalia with the figures and to ignore the wing venation or the colour pattern. In fresh specimens the genitalia can be extruded by gentle pressure on the abdomen, squeezing from the middle to the hind end.

It need scarcely be added that, until the beginner has had some experience of this type of work, his identifications, particularly when control methods are likely to be applied, should be checked by a specialist. The moths and their larvae may be sent to the nearest Area Inspector of the Ministry of Food.

Acknowledgments are due to Dr. S. A. Neave, C.M.G., who, as Director of the Imperial Institute of Entomology and Honorary Secretary of the Zoological Society of London, arranged for the prompt publication of the papers and has made available an adequate number of reprints.

W. McAuley Gracie,
Director of Infestation Control.

Ministry of Food,
University College,
Gower Street, W.C.1.

October, 1943.

THE LARVAE OF THE LEPIDOPTERA ASSOCIATED WITH STORED PRODUCTS.

By H. E. Hinton, Ph.D.
Department of Entomology, British Museum (Nat. Hist.).

Introduction.

During the last year, while I was engaged in work on stored product pests for the Infestation Branch of the Ministry of Food, the necessity arose for identifying Lepidopterous larvae damaging stored food. It was soon found that with few exceptions the available descriptions of these larvae are quite inadequate, as they are usually based entirely on colour, and it became necessary to employ more precise methods. The arrangement of the setae (chaetotaxy) together with other structural characters proved to be reliable for distinguishing the species. By these means those concerned should be able to identify without undue difficulty most of the moth larvae they are likely to encounter. Altogether 35 out of some 70 species which have been found associated with stored products in all parts of the world, can be positively identified by means of the keys and descriptions given in this paper. These 35 species include all the more important British ones and seven which have not yet been recorded in Britain, *viz.*: *Celama sorghiella* (Riley), *Cryptoblabes gnidiella* (Mill.), *Acrobasis caryae*, Grote, *A. juglandis* (Le Baron), *Etiella zinckenella* (Treit.), *Pyroderces rileyi* (Wals.), and *Anchonoma xeraula*, Meyr.

The data concerning the distribution have been supplied by Dr. A. Steven Corbet and Mr. W. H. T. Tams and are based on authentic material in the British Museum. The order in which the families and lower systematic categories are arranged in the keys and descriptions is governed only by convenience and not by phylogenetic considerations, *e.g.*, the most primitive family, Tineidae, is dealt with last.

Method and Explanation of Terms.

The vast majority of the existing descriptions of the larvae of the Lepidoptera are based solely on colour and size, and, whatever may be the case as regards the Macrolepidoptera, these are of very little value for the purpose of identifying the larvae of

the Microlepidoptera. For example, the standard handbook of the British Lepidoptera by Meyrick (1928) describes the larva of the common clothes moth, *Tineola bisselliella*, as follows: "Larva whitish; head brown." It is clear that such a description will apply equally well to the majority of the Microlepidoptera and many of the Macrolepidoptera. Although this description is short, it is by no means unusually so. Even in the case of the more detailed descriptions of colour, such as those given by Buckler (1901) and Barrett (1904) for the larvae of the PYRALIDAE, the complete absence of any structural characters make them for the most part equally useless. Nor is the situation much better as regards the illustrations given by these and other authors. When the larvae have striking or unusual colour patterns, these illustrations are adequate, but the coloured drawings of the majority of the Microlepidoptera cannot be relied on for the positive identification of the species however much they may appeal to the aesthetic senses.

In order properly to study the structure and chaetotaxy of the larvae, it is necessary to preserve them in Pampel's fluid, alcohol, or any of the other well-known preservatives. Unfortunately, most of the existing collections of larvae in this country contain only blown specimens, and these have usually lost many of their setae, and the relative positions of the remaining setae have been distorted in the process of blowing.

Through the efforts chiefly of Dyar, Forbes, and Fracker and more recently of Heinrich, Gerasimov, and Benander, the classification of Lepidopterous larvae has been placed on a relatively sound footing, although much remains to be done. Keys to the families have been given by Fracker (1915), Forbes (1923), Brues & Melander (1932), and Gerasimov (1937), those of the last named being the most complete.

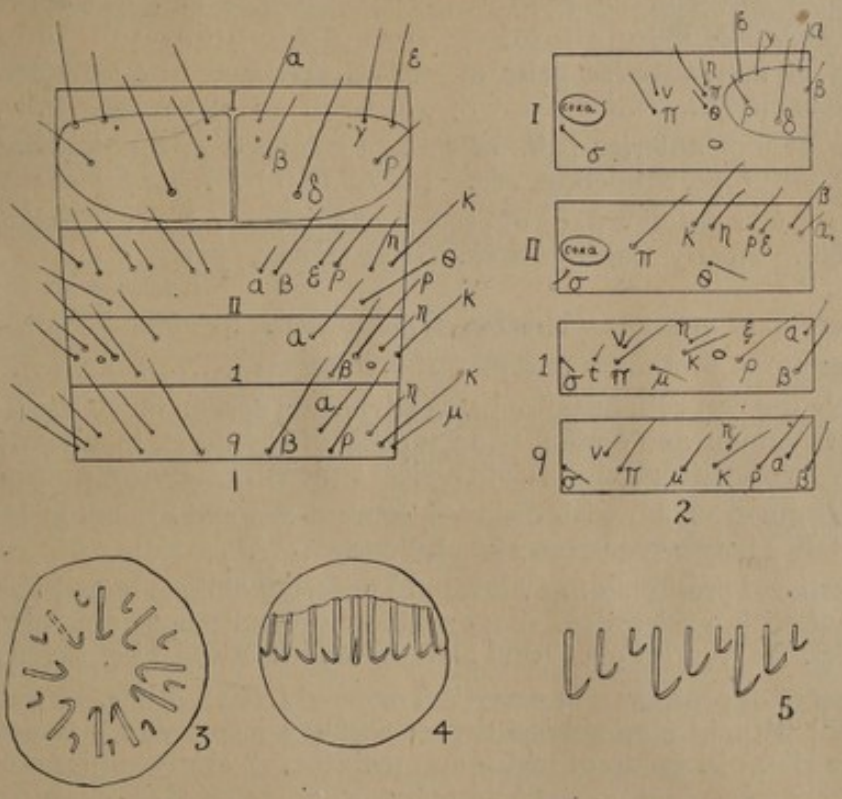
The nomenclature used here for the setae of the thorax and abdomen is that elaborated by Fracker (1915) and illustrated in figs. 1–2. Each seta is indicated by a lower case Greek letter, and the following is a list of the setae used in this paper:

α alpha	η eta	π pi
β beta	θ theta	ρ rho
γ gamma	κ kappa	σ sigma
δ delta	μ mu	ι tau
ε epsilon	ν nu	

Some of these setae are always associated with others in definite groups, and these groups are indicated by capital Greek letters as follows: Beta, B (α+β); Kappa, K (θ+κ+η); Rho, P (ε+ρ); and Pi, Π (ν+π on thorax, ν+π+ι on abdomen). Kappa and eta vary considerable in position in relation to each other, and in order to avoid confusion I have in all cases called the larger seta kappa and the smaller eta. On the prothorax of many families theta is present, and, apart from the fact that it is usually nearer to the spiracle than the other two, it is always smaller than eta. In all Lepidoptera the first-instar larva differs from the second and, although these differences vary in kind and degree with the particular species, the following setae are absent in the first-instar larva of all Frenatae (the suborder which includes the families dealt with here): theta and mu on all segments of thorax and abdomen and eta on meso- and metathorax.

There are three kinds of setae. The primary setae are all those present in the first instar, the subprimary setae are those having a definite position on the body but not present on the first instar of the more primitive groups, and the secondary setae are those which are numerous, have a general distribution, and are characteristic of the hairy caterpillars, *e.g.* ARCTIIDAE, some AGROTIDAE, etc., but are absent in the PYRALIDAE and all the true Microlepidoptera. Many larvae have a pinnaculum or small, usually oval area which is often highly pigmented and more or less sclerotised at the base of some or all of the setae.

The nomenclature of the head is similar to that given by Forbes (1910), and the few cephalic setae used in this paper are numbered in figs. 36, 38. Forbes' system of nomenclature is adopted only for the purposes of this paper, a better nomenclature and one now generally in use by the few workers who use the setal characters is explained by Heinrich (1916). The ocelli are numbered as shown in fig. 7, and the parts of the head are named as shown in fig. 36. The crochets of the prolegs of the species dealt with in this paper are arranged in a complete circle (fig. 3), a penellipse (fig. 86), or a mesoseries (fig. 4) and may be uniordinal (fig. 4), biordinal (fig. 3), or triordinal (fig. 5). In order to save space in the descriptions of families and species Roman numerals are used to designate the segments of the body behind the head: I, II, III for the thorax and 1, 2, 3, 4, &c., for the abdomen.



Figs. 1–5. (1) Dorsal view of prothorax and mesothorax and first and ninth abdominal segments. (2) Lateral diagrammatic view of same segments. (3) Biordinal crochets arranged in a complete circle. (4) Uniordinal crochets arranged in a mesoseries. (5) Triordinal crochets.

Lines next to figures refer to a length of 0·20 mm. unless otherwise indicated. All illustrations accompanied by an indication of magnification have been drawn with the aid of a camera lucida.

Key to the Larvae of the Moths associated with Stored Products.

1. Prolegs short, narrow, and often very indistinct and each with only two crochets (Thoracic legs small. Body 7 mm. long or less. Always inside grain except in first instar). Cosmopolitan. (GELECHIIDAE, part)...*Sitotroga cerealella*, Oliv.

   Prolegs distinct and well developed and each proleg always with many crochets.....2

2. Thorax and abdomen with numerous wart-like tubercles (fig. 6) which are thickly clothed with pointed spines and long, slender hairs. Abdomen with four pairs of prolegs. N. & S. America. (NOLIDAE)..... *Celama sorghiella* (C. V. Riley)

Thorax and abdomen without secondary hairs or spines but sometimes with a few sub-primary setae below level of spiracles. Abdomen with two or five pairs of prolegs.....3

3. Prolegs present only on sixth and tenth abdominal segments. Dorsal and most of ventral setae of thorax and abdomen short and club-shaped. Europe, temperate Asia, N. Africa. (GEOMETRIDAE).....*Sterrha inquinata* (Scop.)

Prolegs present on third to sixth and tenth abdominal segments. Dorsal and ventral setae of thorax and abdomen always long and pointed.....4

4. Crochets of four anterior pairs of prolegs arranged in a mesoseries (fig. 4) or penellipse (fig. 86).....5

Crochets of four anterior pairs of prolegs arranged in a complete or nearly complete circle.....6

5. Crochets of four anterior pairs of prolegs arranged in a uniordinal mesoseries (fig. 4). Europe, temperate Asia. (AGROTIDAE).....*Apamea sordens* (Hufn.)

Crochets of four anterior pairs of prolegs arranged in a bi- or triordinal penellipse (fig. 86). Nearly cosmopolitan. (PYRALIDAE, part)..... *Euchromius ocellea* (Haw.)

6. Kappa group of prothorax bisetose, theta absent. (PYRALIDAE) 7

Kappa group of prothorax trisetose, theta present.....23

7. Prothorax (fig. 29) with distance between rho and epsilon much less than distance between gamma and epsilon (Kappa setae of prothorax in a nearly horizontal line). In most tropical and subtropical regions.....*Etiella zinckenella* (Treit.)

Prothorax (figs. 39, 42) with distance between rho and epsilon at least as great as distance between gamma and epsilon.....8

8. Kappa setae of prothorax in a horizontal or feebly oblique line. First abdominal segment with a sclerotised ring enclosing a membranous area around base of seta rho. Pi group of meso- and metathorax sometimes bisetose. (Gallerinae) 9

Kappa setae of prothorax in a vertical or nearly vertical line. First abdominal segment without a sclerotised ring enclosing a membranous area around base of seta rho. Pi group of meso- and metathorax always unisetose.....13

9. Pi group of meso- and metathorax bisetose. Head with four ocelli on each side or without distinct ocelli ; mandible (figs. 14–15) without a subapical tooth on ventral surface of outer tooth.....10

Pi group of meso- and metathorax unisetose. Head with six ocelli on each side ; mandible (fig. 16) with a sublateral, subapical tooth which does not form part of outer margin but is on ventral surface of outer tooth.....11

10. Head with four ocelli (fig. 13) on each side ; mandible (fig. 14) with outer ventral margin not broadly or distinctly sinuate at apical third ; setae i and ii about equally distant from the puncture between them (fig. 11). Peritreme of spiracles (fig. 12) moderately pale brown and evenly thickened, the caudal part of each being no thicker than the anterior part. Prothorax with Kappa setae in a line opposite dorsal margin of spiracle or even above spiracle. Abdomen with eta of first eight segments directly anterior or antero-dorsal to kappa so that setae are in a feebly oblique line (fig. 12) ; seventh segment with nu nearly directly lateral (only slightly anterior) to pi. Prolegs with small crochets usually about two-thirds to four-fifths as long as large ones. Cosmopolitan.....*Galleria mellonella* (L.)

Head without distinct ocelli ; mandible (fig. 15) with outer ventral margin very broadly and distinctly sinuate at apical third ; puncture between setae i and ii much nearer to ii than to i and seta i nearly directly mesal to ii. Peritreme of spiracles black or nearly so and prothoracic and first seven abdominal spiracles with caudal part of peritreme twice or nearly twice as thick as anterior part. Kappa setae of prothorax in a line opposite ventral margin of spiracle. Abdomen with eta of first eight segments directly dorsal to kappa (fig. 18) so that these setae are in a vertical line ; seventh segment with nu nearly directly anterior (only slightly lateral) to pi. Prolegs with small crochets only one-third to one-half as long as large ones. Throughout old world.....*Achroia grisella* (F.)

11. Head (fig. 19) with boundaries of adfrontals joining coronal suture at a point three times as far from front as from vertical triangle. Spiracles with peritreme very thick, the caudal part of peritreme of eighth abdominal spiracle (fig. 22) four times as thick as base of seta rho of same segment. Pi group of abdominal segments three to six (fig. 21) with nu directly anterior or at most only slightly antero-lateral to pi. Kappa group of ninth abdominal segment (fig. 20) with mu usually twice as far from kappa as is eta. Eighth abdominal segment with distance between rho and epsilon slightly less than horizontal diameter of spiracle (Cuticle of abdomen pale yellow.). Cosmopolitan but apparently absent in tropics.....*Aphomia sociella* (L.)

Head (figs. 27, 23) with boundaries of adfrontals joining coronal suture at a point slightly to very much less than three times as far from front as from vertical triangle. Peritreme of eighth abdominal spiracle with caudal part only twice or less than twice as thick as basal part of seta rho of same segment (fig. 26). Pi group of abdominal segments three to six (fig. 25) with nu directly lateral or antero-lateral to pi. Kappa group of ninth segment (fig. 24) with mu no further from kappa than is eta or only very slightly further. Eighth abdominal segment with distance between rho and epsilon slightly greater than horizontal diameter of spiracle.....12

12. Head (fig. 23) with boundaries of adfrontals joining coronal suture at a point about half way or very slightly more than half way between front and vertical triangle. Abdomen with spiracles (fig. 26) with caudal and anterior part of peritreme of each equally thick or with caudal part only slightly thicker than anterior part ; Alpha, Beta, Rho and Kappa setae of segments one to seven nearly always with distinct pinnaculae (Cuticle of abdomen creamy-yellow or yellowish grey). Nearly cosmopolitan .....*Aphomia gularis* (Zell.)

Head (fig. 27) with boundaries of adfrontals joining coronal suture at a point about twice as far from front as from vertical triangle. Abdomen with dorsal and lateral setae of first seven segments without or, rather seldom, with only indistinct pinnaculae ; spiracles (fig. 28) with caudal part of peritreme one and a half to two times as thick as anterior part (Cuticle of abdomen usually white). Cosmopolitan.....*Corcyra cephalonica* (Staint.)

13. Mesothorax with a sclerotised ring enclosing a membranous area around base of seta rho. (Phycitinae).....14

Mesothorax without a sclerotised ring enclosing a membranous area around base of seta rho. (PYRALINAE) .....

14. Head (fig. 32) with front extending two-thirds of distance to vertical triangle. Abdomen with setae of first nine segments not arising from pinnaculae, but rho of eighth with a sclerotised ring around base ; Pi group of three to six with nu distinctly lateral to pi (Cuticle of non-sclerotised parts white. Second

ocellus often fused to first. Kappa group of first seven abdominal segments in a nearly vertical line. Spiracles distinctly projecting as in the species of *Ephestia*, and dorsal rim of each narrow). Cosmopolitan..... *Plodia interpunctella* (Hbn.)

Head (figs. 46–49) with front extending only half or very slightly more than half of distance to vertical triangle. Abdomen with all dorsal and lateral setae except sometimes epsilon arising from distinct pinnaculae ; Pi group of segments three to six with nu sometimes (*Cryptoblabes, Acrobasis, Ephestia sericarium*) directly anterior or even slightly mesal to pi and sometimes (*Ephestia*) antero-lateral to pi 15

15. Mandible (fig. 34) with a small, ventral, subapical notch on outer tooth. Prothorax (fig. 33) with beta distinctly nearer to delta than to alpha ; pronotal sclerite united with pre-spiracular sclerite. Abdomen with kappa of eighth segment directly dorsal to eta or nearly so (Non-sclerotised parts of cuticle dark brownish with pinnaculae blackish, each being surrounded by a pale area. First seven abdominal segments with Kappa setae in an oblique line.). Mediterranean Basin.....*Cryptoblabes gnidiella* (Mill.)

Mandible (figs. 48, 50) without a ventral, subapical notch on outer tooth. Prothorax (figs. 39, 42) with beta slightly or much nearer to alpha than to delta ; pronotal sclerite never united to sclerite in front of spiracle. Abdomen with kappa of eighth segment ventral or ventro-caudal to eta, very rarely slightly dorsal to eta.....16

16. Non-sclerotised parts of cuticle dark brownish or greyish brown with pinnaculae distinctly paler than adjacent parts of cuticle. Ocelli with second slightly nearer to third than to first (fig. 40). Maxillary mala (fig. 43) with both ventral spines apically bifid. Abdomen with Kappa setae of first seven segments in an oblique line ; epsilon of one to eight minute and very indistinct or absent. Peritreme of spiracles, particularly of prothorax and eighth abdominal segment, broad, flattened, not strongly projecting, and without a dorsal rim which is distinct from sides. (*Acrobasis*).....17

Non-sclerotised parts of cuticle white or nearly so that pinnaculae are distinctly darker than adjacent parts of cuticle. Ocelli with second nearer to first than to third or equally distant between first and third. Maxillary mala (fig. 46) with both ventral spines simple, the apex of each not being forked. Abdomen with Kappa setae of first seven segments in a vertical or nearly vertical line ; epsilon of one to eight moderately long and distinct. Peritreme of spiracles strongly projecting, vertical, and with a very narrow dorsal rim sharply distinct from the broad sides. (*Ephestia*).....18

17. Prothorax (fig. 39) with gamma only very slightly nearer to epsilon than to alpha (9 : 10). Abdomen with alpha of ninth segment nearer to beta than to rho and frequently on the same pinnaculum as beta. Southern United States.....*Acrobasis juglandis* (Le Baron)

Prothorax (fig. 42) with gamma only half as far from epsilon as from alpha. Abdomen with alpha of ninth segment nearer to rho than to beta on at least one side and sometimes on both right and left sides. United States..... *Acrobasis caryae*, Grote

18. Eighth abdominal segment with epsilon (fig. 53) separated from the spiracle by a distance equal to, distinctly less, or very slightly more than the diameter of the spiracle (Mandible with outer tooth, when viewed ventro-mesally, forming part of outer margin of mandible. Prothorax with diameter of spiracle about equal to distance between Kappa setae. Eighth abdominal spiracle about as broad as membranous area enclosed by sclerotised ring around base of seta rho of same segment. Pi group of abdominal segments three to six with nu always distinctly antero-lateral to pi ; eighth with nu antero-mesal to pi.). Cosmopolitan.....*Ephestia cautella* (Walker)

Eighth abdominal segment with epsilon (figs. 52, 54) separated from spiracle by a distance equal to nearly two or even three times the diameter of the spiracle..... 19

19. Mandible (fig. 58), when viewed ventro-mesally, with outer ventral tooth not forming part of outer margin of mandible, this margin being part of largest tooth. Prothorax (fig. 56) with diameter of spiracular opening as great or slightly greater than distance between Kappa setae. Eighth abdominal segment with spiracle (fig. 52) as broad or broader than membranous area enclosed by sclerotised ring around base of seta rho. Pi group of abdominal segments three to six with nu antero-lateral to pi except in fully grown larvae where nu is either directly anterior or even antero-mesal to pi; eighth segment with nu directly anterior or antero-lateral to pi, only in early instars being occasionally very slightly mesal to pi. Cosmopolitan.....*Ephestia sericarium* (Scott)

Mandible (fig. 57), when viewed ventro-mesally, with outer tooth forming part of outer margin of mandible. Prothorax (fig. 55) with diameter of spiracular opening distinctly less than distance between Kappa setae. Eighth abdominal segment with spiracle (fig. 54) not more than two-thirds as broad as membranous area enclosed by sclerotised ring around base of seta rho. Pi group of abdominal segments three to six with nu antero-lateral to pi; eighth segment with nu slightly mesal to pi. Cosmopolitan.....*Ephestia elutella* (Hbn.)

20. Pi group of ninth abdominal segment unisetose.....21

Pi group of ninth abdominal segment bisetose.....22

21. Head (fig. 63) with boundaries of adfrontals joining coronal suture at a point about half way or slightly less than half way between front and vertical triangle; with only four distinct ocelli on each side (fig. 65), the first two being fused and the fifth absent or scarcely noticeable; seta vii (fig. 65) antero-dorsal to second (really third) ocellus; mandible (fig. 66) with two large apical teeth and without a distinct ventral, subapical tooth. Abdomen with dorsal and ventral setae of first seven segments without distinct pinnaculae; Pi group of tenth segment arranged as shown in fig. 64 (Cuticle of thorax and abdomen whitish or greyish with second to seventh abdominal segments usually distinctly paler than others.). Cosmopolitan..... *Pyralis farinalis* (L.)

Head (fig. 67) with boundaries of adfrontals joining coronal suture at a point about three times as far from vertical triangle as from front; with six distinct ocelli on each side (fig. 69); seta vii (fig. 69) caudal to third and ventral to second ocellus; mandible (fig. 68) with two large apical teeth and with a third large but appressed, subapical, ventral tooth. Abdomen with all or nearly all dorsal and ventral setae situated on distinct pinnaculae; Pi group of tenth segment arranged as shown in fig. 70 (Cuticle of thorax and abdomen pale brown to dark olivaceous mottled with large, very dark brown or black patches). Cosmopolitan.....*Hypsopygia costalis* (F.)

22. Head with seta vii (fig. 75) between second and third ocelli but slightly nearer to third than to second; mandible (fig. 76) with outer ventral margin broadly and deeply sinuate before base and without a small ventral tooth before apex of large tooth. Abdomen with mu of ninth segment directly ventral to kappa and nearly twice as far from kappa as is eta from kappa (fig. 74), mu not being situated on the same pinnaculum as eta and kappa; alpha directly anterior to rho (Cuticle of thorax, except pronotal sclerite, dark slate-grey and abdomen paler slate-grey. Sometimes olive-brown mottled with darker patches). Europe, temperate Asia, Africa.....*Aglossa pinguinalis* (L.)

Head with seta vii directly dorsal to third ocellus (fig. 77) ; mandible (fig. 79) with outer ventral margin evenly rounded before base and with a short, inconspicuous ventral tooth before apex of large tooth. Abdomen with mu of ninth segment caudo-ventral to kappa and slightly nearer to kappa than is eta (fig. 78), all three setae of Kappa group being situated on the same pinnaculum ; alpha slightly but distinctly mesal to rho (Cuticle of thorax and abdomen densely mottled with moderately dark brown to very dark brown patches). Cosmopolitan..... *Aglossa caprealis* (Hbn.)

23. Kappa and eta of abdomen close together and often on same pinnaculum.....24

Kappa and eta of abdomen very widely separated. (TINEIDAE).....29

24. Pi of eighth abdominal segment bisetose and rho directly anterior to spiracle (fig. 91). Beta setae of ninth abdominal segment very close together and usually on same pinnaculum. (TORTRICIDAE).....25

Pi of eighth abdominal segment unisetose and rho usually dorsal (OECOPHORIDAE) but sometimes (*Pyroderces*) anterior to spiracle.....26

25. Ninth abdominal segment (fig. 91) with alpha on same pinnaculum as rho and closer to rho than to beta ; mu usually (80 per cent. of specimens) not on same pinnaculum as eta and kappa (fig. 91). Nearly cosmopolitan..... *Enarmonia pomonella* (L.)

Ninth abdominal segment with alpha on a separate pinnaculum and as close to beta as to rho ; mu on same pinnaculum as kappa and eta. Europe, Asia Minor, United States.....*Enarmonia nigricana* (F.)

26. Head with adfrontals extending to vertical triangle. Kappa and eta of prothorax (fig. 92) in a vertical line. Rho of eighth abdominal segment (fig. 93) directly anterior to spiracle. Queensland, southern United States, Jamaica, Hawaii (COSMOPTERYGIDAE, part).....*Pyroderces rileyi* (Wals.)

Head with adfrontals (figs. 113, 115) ending well before vertical triangle except in *Hofmannophila*. Kappa and eta of prothorax (fig. 96) in a feebly oblique or nearly horizontal line. Rho of eighth abdominal segment (fig. 97) directly dorsal to spiracle or nearly so. (OECOPHORIDAE).....27

27. Head (fig. 99) with six ocelli on each side. Mandible (fig. 101) with only one well developed apical tooth. Crochets triordinal. India to Japan..... *Anchonoma xeraula*, Meyr.

Head (figs. 107, 112) with less than six ocelli on each side. Mandible (fig. 111) with three well developed apical teeth. Crochets biordinal.....28

28. Head with adfrontals (fig. 114) extending in a very narrow line in coronal suture to, or nearly to, vertical triangle ; frontal puncture (fig. 110) only very slightly closer to frontal than to caudal clypeal seta ; each side with four ocelli (fig. 107) ; labium without a basal pit enclosed by a sclerotised line. Abdomen with Pi group of 1 bisetose ; Pi group of 3–6 (fig. 108) with nu lateral to pi ; spiracle of eight sometimes round but usually with vertical diameter distinctly greater than horizontal, being sometimes nearly twice as great. Trochanter of front leg without a gibbosity on inner or ventral side. Cosmopolitan..... *Hofmannophila pseudospretella* (Staint.)

Head with adfrontals (fig. 113) ending abruptly some distance from vertical triangle ; frontal puncture (fig. 115) twice as far from caudal clypeal as from frontal seta ; each side with two ocelli (fig. 112) ; labium (fig. 116) with a large, round, basal depression* defined by a thin line of heavily sclerotised

* In a few specimens this area is flat, in a few it is convex, but in all it is enclosed by a narrow sclerotised line.

cuticle. Abdomen with Pi group of 1 trisetose ; Pi group of 3–6 (fig. 109) with nu directly anterior to pi ; spiracle of eight always round or very broadly oval. Trochanter of front leg with a large, prominent gibbosity on inner or ventral side. Cosmopolitan.....*Endrosis sarcitrella* (L.)

29. Pi group of meso- and metathorax unisetose.....30

Pi group of meso- and metathorax bisetose.....32

30. Head with six ocelli on each side (fig. 119) ; front extending two-thirds of distance to vertical triangle. Prothorax (fig. 118) with rho nearly in a line with gamma and epsilon and much nearer to both of these than gamma is to epsilon. Pi group of first abdominal segment bisetose ; Pi of third to sixth abdominal segments with nu as near or slightly nearer to pi than is tau. Kappa and eta of first eight abdominal segments in an oblique line with kappa dorsal to eta and directly caudal to spiracle. Spiracles of seventh abdominal segment about three-fourths as large as those of eighth (Epsilon of first eight abdominal segments absent. Pi group of ninth abdominal segment bisetose. Fully grown larva 9–11 mm. long.). Europe, Japan.....*Tinea granella* (L.)

Head with two ocelli on each side or without distinct ocelli ; front extending less than one-half of distance to vertical triangle. Prothorax (fig. 121) with rho considerably behind gamma and epsilon and nearly as far or further from these than gamma is to epsilon. Pi group of first abdominal segment trisetose ; Pi of third to sixth abdominal segments with nu half again to three times as far from pi as is tau. Kappa and eta of first eight abdominal segments in a horizontal or nearly horizontal line, kappa being considerably below spiracle. Spiracles of seventh abdominal segment only about half as large as those of eighth 31

31. Head without distinct ocelli (without convex lenses, but sometimes with a few pigment spots below a large pale area of cuticle which is in usual position of fourth ocellus). Mandible (fig. 122) with a single large tooth. Prothorax (fig. 120) with kappa ventral and distinctly anterior to theta. Epsilon of first eight abdominal segments absent. Pi of ninth abdominal segment unisetose. Spiracles with peritreme black or nearly so. Fully grown larva 24–28 mm. long. Nearly cosmopolitan.....*Lindera tessellatella*, Blanch.

Head with two distinct ocelli on each side, each ocellus having a distinctly convex lens. Mandible (fig. 123) with three apical teeth and a smaller subapical tooth on ventral side of large outer tooth. Prothorax (fig. 124) with kappa directly ventral to theta. Epsilon of first eight abdominal segments present. Pi of ninth abdominal segment bisetose. Spiracles with peritreme moderately pale brown. Fully grown larva 12–14 mm. long. Britain.....*Tinea ditella* (Pierce & Metcalfe).

32. Head without ocelli. Pi setae of meso- and metathorax in a feebly oblique or nearly horizontal line. Pi group of ninth abdominal segment absent. Epsilon of first eight abdominal segments dorsal and considerably anterior to spiracle. Spiracles of seventh abdominal segment approximately as large as those of eighth. Cosmopolitan.....*Tineola bisselliella* (Hummel)

Head with one distinct ocellus on each side. Pi setae of meso- and metathorax in a vertical or nearly vertical line. Pi group of ninth abdominal segment unisetose (except possibly in *Tinea pellionella*). Epsilon of first eight abdominal segments more or less directly dorsal to spiracle. Spiracles of seventh abdominal segment only one-half to two-thirds as large as those of eighth 33

33. Kappa and eta of first eight abdominal segments in a nearly vertical line with kappa dorsal to eta and nearly directly caudal to spiracle. Cosmopolitan.....*Trichophaga tapetzella* (L.)

Kappa and eta of first eight abdominal segments in a horizontal or nearly horizontal line with kappa considerably below spiracle.....34

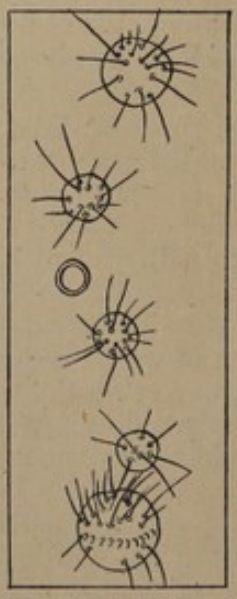
34. Prothorax (fig. 125) with distance between rho and epsilon about equal to that between epsilon and gamma ; kappa (fig. 126) between and below theta and eta so that it is ventro-caudad to eta. Pi setae of first nine abdominal segments long and distinct. Without a case. Europe.....*Tinea pallescentella*, Staint.

Prothorax (fig. 127) with distance between rho and epsilon twice as great as that between epsilon and gamma ; kappa (fig. 128) directly ventral to eta. Pi setae of first nine abdominal segments minute and scarcely visible. Always in a fusiform case which is dorso-ventrally flattened. Europe, N. Africa..... *Tinea pellionella* (L.)

NOLIDAE.

Only a single species of this family is dealt with here, *Celama sorghiella* (Riley). No specimens of this species are available, but from the descriptions given by Riley (1882) and Reinhard (1937), together with the characters of the family given by Fracker (1915), no difficulty was encountered in placing it in the key. The following summary of the characters of the NOLIDAE is compiled from Fracker (1915) :

Head smaller than prothorax, partially retractile, smooth and without secondary setae. Each side with six ocelli, the sixth being distant from the upper five, which are in a semicircle enclosing seta vii. Front extending less than half way to vertical triangle. Thoracic legs well developed. Prolegs well developed and present on segments 4–6 and 10 ; crochets in a mesoseries. Chaetotaxy as follows : I with four dorsal verrucae united ; II with four verrucae on each side in a transverse row ; 1–9 with verrucae of Beta, Rho, and Kappa present ; 1–8 with a single verruca between rho and mu, this being Kappa (kappa plus eta ?), which is ventro-caudal to spiracle ; 1–3 and 7 have mu and pi in the form of small verrucae, and sigma is a single seta ; 4–6 with mu discrete but setae of Pi group scattered over proleg and united with sigma ; 8–9 with mu absent but Pi present.



Nola cristatula.—Diagrammatic view of fifth abdominal segment to show chaetotaxy of the Nolidae (after Fracker).

The family NOLIDAE is considered by some writers to be only a subfamily of the ARCTIIDAE. The larvae may be distinguished at once from all Arctiids by having only four instead of five pairs of abdominal prolegs, those of the third abdominal segment being absent.

Celama sorghiella (Riley).

Mature Larva.—Length, 9–14 mm.; breadth, 3–4 mm. Cuticle yellowish or pale greenish-yellow with two moderately broad, brownish, dorsal stripes and sometimes narrow subdorsal and lateral lines of the same colour; dorsal line almost sulphur-yellow; head yellow; legs yellowish and brownish. Verrucae with short, stout, very sharp spines which are yellow with brownish tips, those of lateral verrucae being intermixed with a few long and slender hairs.

From all other larvae recorded in stored products, it may be distinguished by having densely spinose verrucae on the thorax and abdomen (fig. 6) and four pairs of prolegs.

GEOMETRIDAE.

Body usually slender and cylindrical with abdominal segments much longer than thoracic. Thoracic legs well developed. Prolegs absent on third, fourth, and fifth abdominal segments, very rarely present in a rudimentary form on these segments; crochets biordinal and arranged in a mesoseries. Chaetotaxy as follows: only primary setae present above the level of the spiracle; below eta subprimaries are always found and vary in number from one (lambda) to many.

As the larvae of no other family of the Lepidoptera have the prolegs reduced to two pairs (on 6 and 10), the vast majority of the GEOMETRIDAE can be assigned to their family at a glance.

Sterrha inquinata (Scop.)
(Fig. 7).

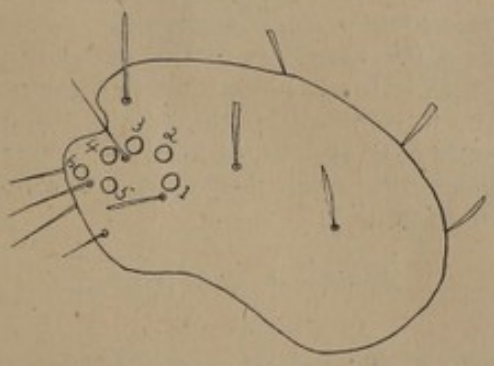


Fig. 7. *Sterrha inquinata* (Scop.).—Left lateral view of head.

Mature Larva.—Length, 17–20 mm.; breadth, 2–3 mm. Cuticle moderately pale yellowish-brown or greenish-brown with numerous small, irregularly shaped, pale reddish-brown patches; head dark brown. Surface—of dried specimens—with very dense, often confluent punctures which are one-third to one-half as coarse as an ocellus; head with punctures so frequently confluent that surface is coarsely rugose; surface of thorax and abdomen also with numerous large, moderately prominent, oval or irregular gibbosities. Setae of head, thorax, and abdomen occasionally long and slender but usually short (about four or five times as long as an ocellus), very stout, and feebly club-shaped. *Head* with six ocelli (fig. 7), the sixth equally distant from fourth and fifth and upper five arranged in a semicircle with caudal side open; seta vii between third and fourth ocelli. Adfrontals extending slightly more than two-thirds of distance to vertical triangle. *Spiracles* round, slightly projecting, and peritreme moderately dark brown; those of I and 6–8 about as large as ocelli and those of 1–5 about three-fourths as large. *Chaetotaxy* as follows: Kappa group of I bisetose, in a vertical line, separated from spiracle by

slightly more than three times the diameter of the peritreme, and separated from each other by less than the diameter of the spiracle. Pi group of I bisetose and of II–III unisetose, that of III being more caudal than lateral on leg swelling. Segments 1–7 with kappa distant from and directly behind spiracle, eight with kappa also distant but caudo-ventral to spiracle ; one with rho and eta in a vertical line slightly anterior to spiracle ; 2–5 with eta as in one but rho more anterior to spiracle than kappa is caudad ; 6–7 with rho much nearer to spiracle, and eight with rho as in one but eta directly below spiracle.

Two blown specimens have been examined. *S. inquinata* is the only Geometrid known to be associated with stored products, and it may therefore be distinguished from all other species dealt with here by having prolegs only on the sixth and tenth abdominal segments.

Agrotidae.

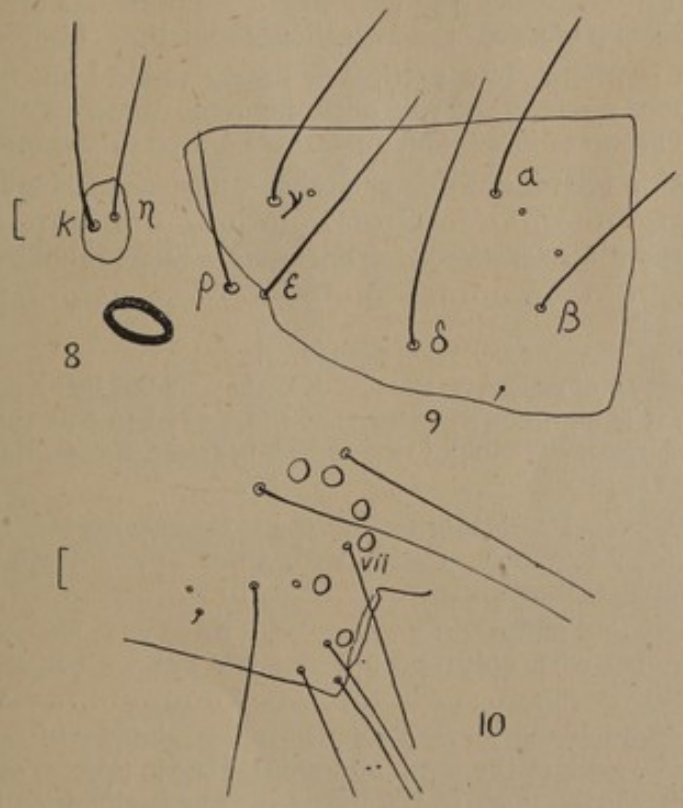
The larvae of this very large family are not easily defined. According to Fracker (1915), the genera may be divided into at least four distinct groups on whether the setae are primary or secondary, the crochets uniordinal or biordinal, etc. The species which have been found associated with stored products belong to Fracker's first group, a group which includes the vast majority of the species of the family. The larvae of this group possess the following combination of characters : " Larvae with primary setae only ; prothorax with beta above level of alpha, epsilon associated with rho between delta and spiracle, Kappa and Pi groups each bisetose ; mesothorax with alpha associated with beta, epsilon with rho, and kappa with eta, theta separate, Pi group unisetose ; metathorax similar. Abdominal segments 1 to 6 and 8 with alpha above level of beta, rho above level of spiracle, epsilon, when present, smaller, and located cephalodorsad of spiracle, kappa and eta widely separated, mu present, Pi group consisting of three setae on most segments ; sigma present ; no other setae present except sometimes a few members of the tau group and sometimes gamma ; segment 7 similar except that kappa is always much lower and closer to eta ; segment 9 with alpha, beta, and rho forming a triangle, kappa, eta, mu, pi, and sigma present. Prolegs present on segments 5, 6, and 10, at least, and usually on segments 3 and 4 ; crochets arranged in a mesoseries, uniordinal except in some Plusiinae and others, in which the crochets are biordinal."

Apamea sordens (Hufn.)

(Figs. 8–10).

Mature Larva.—Length, 30–35 mm. ; breadth, 4–5 mm. Cuticle pale olive-brown or grey-brown with setae and most of head and legs yellowish brown ; mandibles and crochets dark reddish brown to nearly black ; peritreme of spiracles black or nearly so ; pinnaculae dark olive brown to nearly black ; thorax and abdomen with three complete longitudinal whitish or pale yellowish stripes, one on mid-dorsal line, a broader one on each side below spiracles, and a narrower and less distinct line between level of spiracles and mid-dorsal line. *Head* with front extending about half way to vertical triangle and lateral boundaries of adfrontals joining coronal suture at a point about three times as far from vertical triangle as from front. Each side with six distinct ocelli (fig. 10) of which the second is equidistant between first and third or sometimes slightly nearer to the first than to the third and the fifth is caudal to and between fourth and sixth which are very widely separated. Mandible with three large apical teeth. *Spiracles* of 8 large, obovate with vertical diameter distinctly greater than horizontal, and with peritreme evenly thickened and moderately strongly projecting ; spiracles of 1–7 similar but slightly smaller ; spiracles of I similar and as large as those of 8. *Legs* with front coxae nearly contiguous and middle and hind coxae only slightly more widely separated. Prolegs with crochets uniordinal and arranged in a mesoseries or single longitudinal row. *Chaetotaxy* as follows : Head

with frontal puncture nearly as caudal as frontal seta and much nearer to the latter than to caudal clypeal seta ; puncture between setae i and ii only about half as far from i as from ii ; seta vii near to and caudo-ventral to fourth ocellus. Prothorax (fig. 9) with beta dorsal to alpha, nearly as caudal as delta, and about as far from the latter as from alpha ; epsilon nearly directly dorsal to rho and much nearer to the latter than to gamma which is as anterior as alpha ; Kappa (fig. 8) bisetose with setae in a vertical or nearly vertical line and separated by a distance equal to thickness of peritreme of prothoracic spiracle. Pi of I bisetose with setae in a feebly oblique or nearly horizontal line ; II–III unisetose ; 1 bisetose with nu antero-lateral to pi ; 2 trisetose with nu antero-lateral to pi and tau mesal and slightly anterior to pi ; 3–6 trisetose with nu nearly directly anterior to pi and nearly as far from the latter as is tau ; 7–9 unisetose. Ninth abdominal segment with alpha between and anterior to the beta but nearer to the latter than to rho ; Kappa unisetose. Kappa and eta of 1–6 and 8 widely separated and in an oblique or nearly vertical line with kappa caudo-dorsal to eta and directly caudal to spiracle ; kappa and eta of 7 much nearer together and in a nearly horizontal line well below spiracle. Rho of 1–8 directly dorsal to spiracle ; epsilon opposite dorsal margin of spiracle and separated from spiracle by slightly less to slightly more than the diameter of the latter. Prosternum with a large, median, protrusible vesicle near anterior margin.



Figs. 8–10. *Apamea sordens* (Hufn.).—(8) Kappa group of prothorax. (9) Dorsal view of prothorax. (10) Ocellar region of head.

From the larvae of all other species dealt with here, which have the crochets of the prolegs arranged in longitudinal rows (mesoseries), this may be distinguished by having five pairs of prolegs and no secondary setae.

Pyralidae.

The chief distinguishing feature of this family is the bisetose Kappa group of the prothorax combined with the absence of secondary setae on all parts of the body,

the five well developed but short pairs of prolegs nearly always bearing bi- or tri-ordinal crochets which are arranged on the four anterior pairs in two transverse bands (CHRYSAUGINAE), a complete or nearly complete circle (PYRALINAE, PHYCITINAE, GALLERIINAE, etc.), or a penellipse (CRAMBINAE, PYRAUSTINAE). Eta and kappa of the first eight abdominal segments are apparently always closely associated. There are nearly always six ocelli except in a few specialised forms, *e.g.*, *Pyralis*, *Galleria*, *Achroia*, etc., where they are reduced in number or are even absent. The epipharynx usually has three large sclerotised teeth on each side.

With the exception of *Etiella zinckenella* (Treit.), the species that are found associated with stored products may be placed in their appropriate subfamilies by means of the following key :

1. First four pairs of prolegs with crochets arranged in a penellipse. Eighth abdominal segment without a sclerotised ring enclosing a membranous area around base of seta rho.....CRAMBINAE

   First four pairs of prolegs with crochets arranged in a complete circle. Eighth abdominal segment with a distinct sclerotised ring enclosing a membranous area around base of seta rho.....2

2. Kappa setae of prothorax in a horizontal or feebly oblique line. First abdominal segment with a sclerotised ring enclosing a membranous area around base of seta rho. Pi group of meso- and metathorax sometimes bisetose...GALLERIINAE

   Kappa setae of prothorax in a vertical or nearly vertical line. First abdominal segment without a sclerotised ring enclosing a membranous area around base of seta rho. Pi group of meso- and metathorax always unisetose.....3

3. Mesothorax with a sclerotised ring enclosing a membranous area around base of seta rho .....PHYCITINAE

   Mesothorax without a sclerotised ring enclosing a membranous area around base of seta rho.....PYRALINAE

GALLERIINAE.

Although the larvae of only five species of GALLERIINAE belonging to four genera have been studied, it is abundantly clear that there exist in this subfamily two very distinct groups of genera. The chief differences between these groups are shown in the following table :

1. Pi group on meso- and metathorax bisetose. Head with less than six ocelli on each side ; mandible (figs. 14–15) with three apical teeth and without a ventral, subapical tooth.....*Galleria*, *Achroia*

   Pi group on meso- and metathorax unisetose. Head with six ocelli on each side ; mandible (fig. 16) with only two apical teeth but with a ventral, sublateral, subapical tooth.....*Aphomia*, *Corcyra*

These striking differences in larval structure are correlated with notable differences in the structure of the apex of the tenth abdominal tergite (uncus) of the adult males. In *Galleria* and *Achroia* the apex of the uncus is armed only with two stout hooks, whereas in *Aphomia*, *Corcyra*, and related genera the apex of the uncus is fringed with numerous coarse spines.

The rather specialised habits of *Galleria* and *Achroia* together with the obvious fact that these two genera must have been derived from forms possessing six ocelli on each side of the head of the larva would seem to suggest that the section of the subfamily containing these is the less primitive one. However, the evidence afforded by the structure of the mandibles and the possession of two Pi setae on the meso- and metathorax points to a contrary conclusion. The structure of the mandibles in *Galleria* and *Achroia* appears to be more primitive than that in *Aphomia*, etc., but probably little weight can be attached to structural differences in the mandibles as

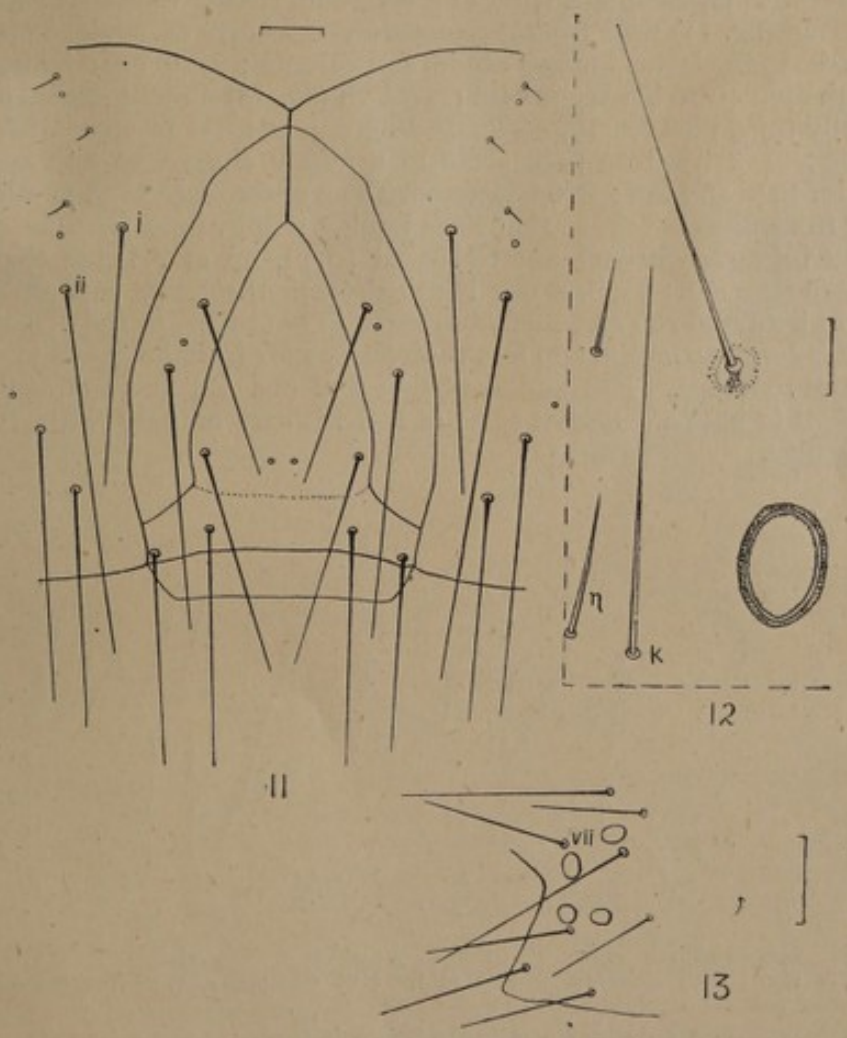
many instances are known of marked differences between the mandibles of species in the same genus. The primitive number of setae in the Pi group of the thorax is two, pi and nu. *Galleria* and *Achroia* are the only known genera of the Pyralidae* with two Pi setae on the meso- and metathorax, and, as it is scarcely likely that they are derived from an ancestor which had already lost one of the Pi setae, it seems probable that *Galleria*, *Achroia*, and related genera are the most primitive of the GALLERIINAE and possibly also of the PYRALIDAE.

A difference in the number of ocelli does not appear to constitute evidence that can be in any way compared in its phylogenetic importance with a difference in the number of primary setae, the number of ocelli apparently being a highly plastic character.

The larvae of the GALLERIINAE as a whole—if the classification of the adult PYRALIDAE based almost entirely on wing venation be accepted—differ from those of all other subfamilies in having a ring around base of seta rho of the first as well as the eighth abdominal segment. Three of the four genera of GALLERIINAE examined have the crochets nearly uniordinal in the mature larvae.

Galleria mellonella (L.)

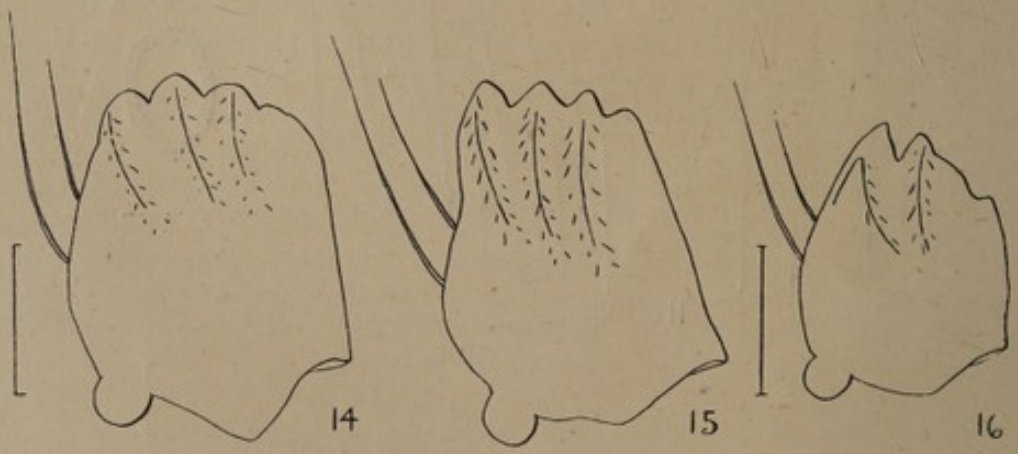
(Figs. 11–14).



Figs. 11–13. *Galleria mellonella* (L.).—(11) Head. (12) Spiracular region of eighth abdominal segment. (13) Ocellar region of head.

* According to Fracker (1915) and Forbes (1923), the CHRYSAUGINAE have the Pi group of the meso- and metathorax unisetose. Brues & Melander (1932) and Gerasimov (1937) claim that the Pi group of the two caudal thoracic segments is bisetose in the CHRYSAUGINAE.

Mature Larva.—Length, 22–25 mm. ; breadth, 4–5 mm. Cuticle moderately pale yellowish-brown or greyish-brown except as follows : setae, head, mouth-parts, sclerites of 1 and 10, peritreme of spiracles, parts of legs, and crochets darker and reddish-brown ; head with extreme anterior part, meso-ventral margin, and apices of mandibles very dark brown or black ; maxilla with cardo and stipes sometimes nearly black. Cuticle of non-sclerotised parts of thorax and abdomen with dense, microscopic, brown asperities. *Head* (fig. 11) with front extending more than two-thirds of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point which is about four or more times as far from front as from vertical triangle. Each side with only four distinct ocelli (fig. 13), first and second being fused together as well as third and fourth. Mandible (fig. 14) with three well developed apical teeth and without a ventral, subapical tooth. *Spiracles* of 8 (fig. 12) obovate with vertical diameter much greater than horizontal (12 : 9), nearly twice as large as those of 7 (12 : 7), and with caudal part of peritreme no thicker than anterior part ; spiracles of 1–6 similar but no larger than those of 7 ; spiracles of 2–6 sometimes scarcely noticeably smaller than those of 1 and 7 ; spiracles of 1 similar but slightly smaller than those of 8. *Legs* with front coxae separated by about half breadth of a front coxa ; middle and hind coxae about twice as widely separated as front. Prolegs with small crochets about two-thirds to four-fifths as long as large ones ; four anterior pairs of prolegs with crochets arranged in a complete circle. *Chaetotaxy* (figs. 11–13) as follows : Head (fig. 11) with frontal puncture very nearly as caudal as frontal seta and much nearer to the latter than to caudal clypeal seta ; setae i and ii about equally distant from the puncture between them ; seta vii (fig. 13) directly dorsal or mesal to second (actually third plus fourth) ocellus. Pi group of I–III bisetose with setae in a horizontal line ; 1–2 trisetose with setae in a nearly transverse line but with nu slightly anterior to pi and tau ; 3–6 trisetose with nu antero-lateral to pi and approximately as far from pi as is tau, so that lines joining them would form an equilateral triangle ; 7–8 bisetose with nu antero-lateral to pi, nu of 7 being slightly more lateral to pi than is nu of 8 ; 9 unisetose. Ninth abdominal segment with alpha between and anterior to beta and rho and scarcely nearer to beta than to rho ; Kappa group with eta antero-dorsal to kappa and less than half as far from kappa as is eta, which is nearly ventral to kappa. Eta and kappa of 1–8 (fig. 12) in an oblique line with eta antero-dorsal to kappa. Dorsal setae of 1–8 without or only with very feebly marked pinnaculae.



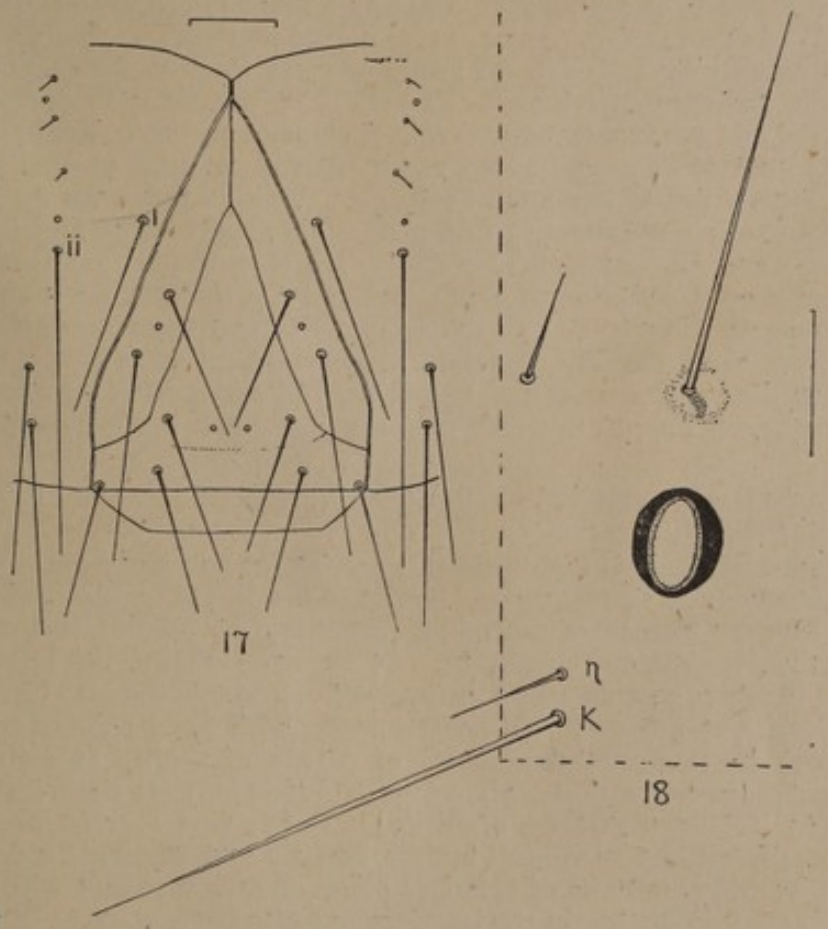
Figs. 14–16. Ventro-mesal view of mandibles of the GALLERIINAE. (14) *Galleria mellonella* (L.). (15) *Achroia grisella* (F.). (16) *Corcyra cephalonica* (Staint.).

Earlier Instars.—The smallest available larva is 9 mm. long and 1·8 mm. broad. It is similar to the mature larva but the boundaries of the adfrontals join the coronal suture at a point slightly less than three times as far from front as from vertical triangle.

This species and *Achroia grisella* (F.) are the only Pyralids dealt with here that have the Pi group of meso- and metathorax bisetose. *G. mellonella* is not closely related to *A. grisella*, from which it is easily distinguished by the presence of four distinct ocelli on each side of the head, the evenly thickened peritreme of the spiracles, and the position of eta antero-dorsal instead of directly dorsal to kappa on the first eight abdominal segments.

Achroia grisella (F.)

(Figs. 15, 17–18).



Figs. 17–18. *Achroia grisella* (F.).—(17) Head. (18) Spiracular region of eighth abdominal segment.

Mature Larva.—Length, 15–18 mm.; breadth, 2·5–3·0 mm. Cuticle white or pale greyish-white except as follows: setae, head, mouth-parts, dorsal sclerites of I and sometimes also 10, parts of legs, and crochets pale to moderately dark reddish-brown; head with extreme anterior region, meso-ventral margin opposite stipes and cardo, and apices of mandibles much darker red-brown to black; peritreme of spiracles very dark brown or black. *Head* (fig. 17) with front extending two-thirds of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point about four times as far from front as from vertical triangle. Ocelli absent; in a few specimens the cuticle is slightly modified and there appears to be a poorly developed lens in the usual position of the fourth ocellus, but the pigment normally lying beneath a lens is absent in all specimens examined. Mandible (fig. 15) with three well developed apical teeth, without a ventral subapical tooth, and with outer ventral

margin broadly and moderately deeply sinuate at apical third. *Spiracles* of 8 (fig. 18) obovate with vertical diameter much greater than horizontal, nearly twice as large as those of 7 (7·5 : 4·0), and with caudal part of peritreme distinctly thicker than anterior part; spiracles of 1–7 similar to those of 8 but much smaller and with caudal part of peritreme one and a half to twice as thick as anterior part, those of 1 and 7 being very slightly larger than those of 2–6; spiracles of I smaller than those of 8 (5·5 : 7·5) and with peritreme thickened as in those of 1–7. *Legs* with front coxae separated by a sixth or seventh of breadth of a front coxa; middle coxae four times and hind coxae five times as widely separated. Prolegs with small crochets only a third to a half as long as large crochets; four anterior pairs of prolegs with crochets arranged in a complete circle. *Chaetotaxy* (figs. 17–18) as follows: Head (fig. 17) with frontal puncture nearly as caudal as frontal seta and much nearer to the latter than to caudal clypeal seta; seta i twice as far as seta ii from puncture normally between them and i almost directly lateral to ii. Pi group of I–III bisetose with setae in a nearly horizontal line, but with anterior seta slightly more ventral than caudal seta; 1–2 trisetose with pi and tau in a transverse line, nu being anterior to both; 3–6 trisetose with nu antero-lateral to pi and about as far from pi as is tau so that lines joining them would form a nearly equilateral triangle; 7–8 bisetose with nu anterior and slightly lateral to pi; 9 unisetose. Ninth abdominal segment with alpha between and anterior to beta and rho and slightly nearer to rho than to beta; Kappa group with eta dorsal and slightly anterior to kappa and about a third as far from kappa as is eta, which is nearly directly ventral to kappa. Eta and kappa of 1–8 (fig. 18) in a vertical line, eta being directly dorsal to kappa. Dorsal setae of 1–8 without pinnaculae; sclerotised ring around base of seta rho of 1 and 8 often very indistinct, that of 1 being frequently absent, in which case the pigmented bar is sometimes scarcely visible.

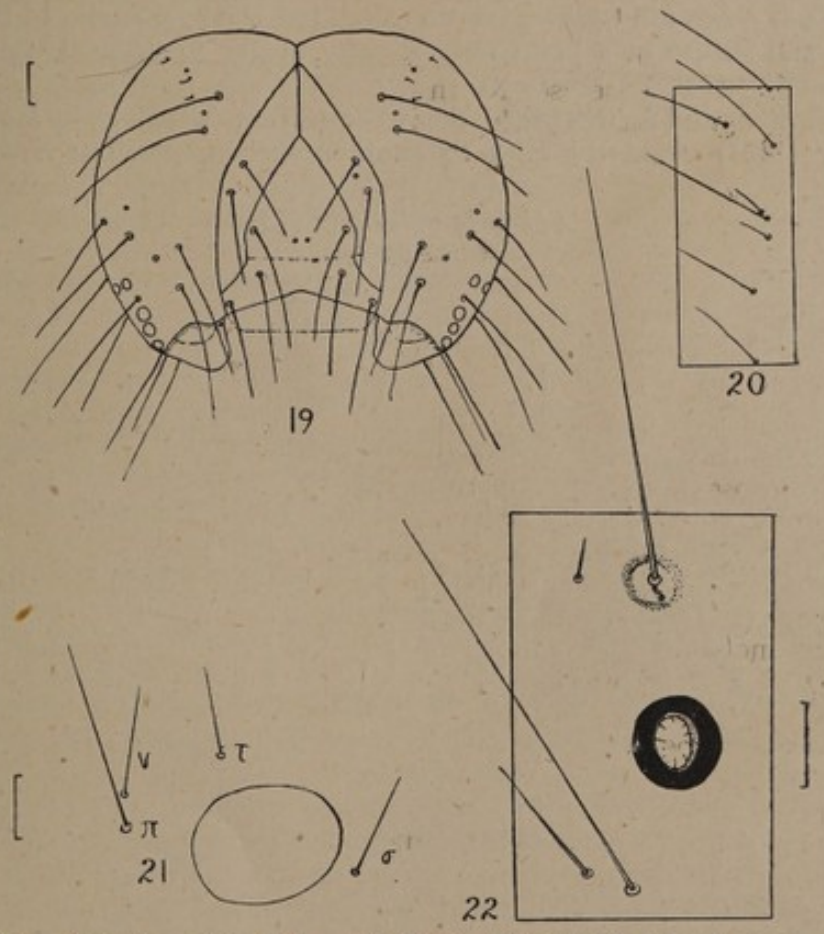
Earlier Instars.—The smallest available larva is 6 mm. long, and it is identical in structure with the mature larva.

This species and *Galleria mellonella* (L.) are, as far as I am aware, the only two species of the subfamily GALLERIINAE that have the Pi and group of the meso- and metathorax bisetose instead of unisetose. Both species inhabit beehives, and the ocelli are reduced in number or absent. Of the two species, the blind *A. grisella* appears to be the more specialised for life inside hives. *A. grisella* may be distinguished from *G. mellonella* as follows: (1) mature larvae with body shorter and relatively more slender; (2) non-sclerotised parts of cuticle of thorax and abdomen with asperities very indistinct and of same colour as cuticle between them instead of being much darker; (3) head without ocelli instead of having four on each side; (4) mandible (fig. 15) with outer ventral margin broadly and moderately deeply sinuate at apical third; (5) peritreme of spiracles black or nearly so and with caudal part (at least of I and 1–7) distinctly thicker than anterior part, whereas in *G. mellonella* the peritreme is moderately pale brown and evenly thickened; (6) front coxae separated by a sixth or seventh of breadth of a front coxa instead of by about a half of breadth of coxa; (7) prolegs with small crochets one-third to one-half instead of two-thirds to four-fifths as long as large crochets; (8) seta ii of head much nearer to puncture normally between i and ii than is i which is nearly directly lateral to ii; (9) Kappa setae of prothorax in a line opposite ventral instead of dorsal margin of spiracle; (10) eta and kappa of 1–8 (fig. 18) in a vertical instead of an oblique or nearly horizontal line; and (11) Pi group of 7 with nu nearly directly anterior instead of nearly directly lateral to pi.

Aphomia sociella (L.).
(Figs. 19–22).

Mature Larva.—Length, 22–27 mm.; breadth, 3–4 mm. Cuticle pale yellow except as follows: most of head and pronotal sclerite pale yellowish-brown; anterior part of head, meso-ventral margin opposite stipes and cardo, and apices of mandibles

very dark brown to black ; setae, mouth-parts, parts of legs, and crochets moderately pale reddish-brown ; peritreme of spiracles black or nearly so. *Head* (fig. 19) with front extending slightly more than half of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point about three times as far from front as from vertical triangle. (In fig. 19 the coronal suture appears relatively shorter than it actually is due to the fact that the head is strongly curved downwards near base.) Each side with six well developed ocelli, of which first and second are nearly contiguous as are also third and fourth. Mandible similar to that of *Corcyra cephalonica* (fig. 16) ; with two large apical teeth and a smaller, ventral, subapical tooth the outer margin of which is mesal to the ventro-lateral margin of the mandible. *Spiracles* of 8 (fig. 22) nearly round with vertical diameter only very slightly greater than horizontal, slightly larger than those of 7 (6·5 : 5·0), and caudal part of peritreme, which is only slightly thicker than anterior part, about four times as thick as base of seta rho ; spiracles of 1 similar to those of 7 ; spiracles of 2–6 only very slightly smaller than



Figs. 19–22. *Aphomia sociella* (L.).—(19) Head. (20) Ninth abdominal segment. (21) Pi group of fourth abdominal segment. (22) Spiracular region of eighth abdominal segment.

those of 1 and 7 but otherwise similar ; spiracles of I similar to those of 8 but slightly larger. *Legs* with front coxae separated by about a sixth or seventh of breadth of a front coxa ; middle coxae about five times and hind coxae about six or seven times as widely separated. Prolegs with crochets feebly biordinal, the small crochets being about three-fourths or more as long as the large ones ; four anterior pairs of prolegs with crochets arranged in a complete circle. *Chaetotaxy* (figs. 19–22) as follows : Head (fig. 19) with frontal puncture nearly as caudal as frontal seta and much nearer to the

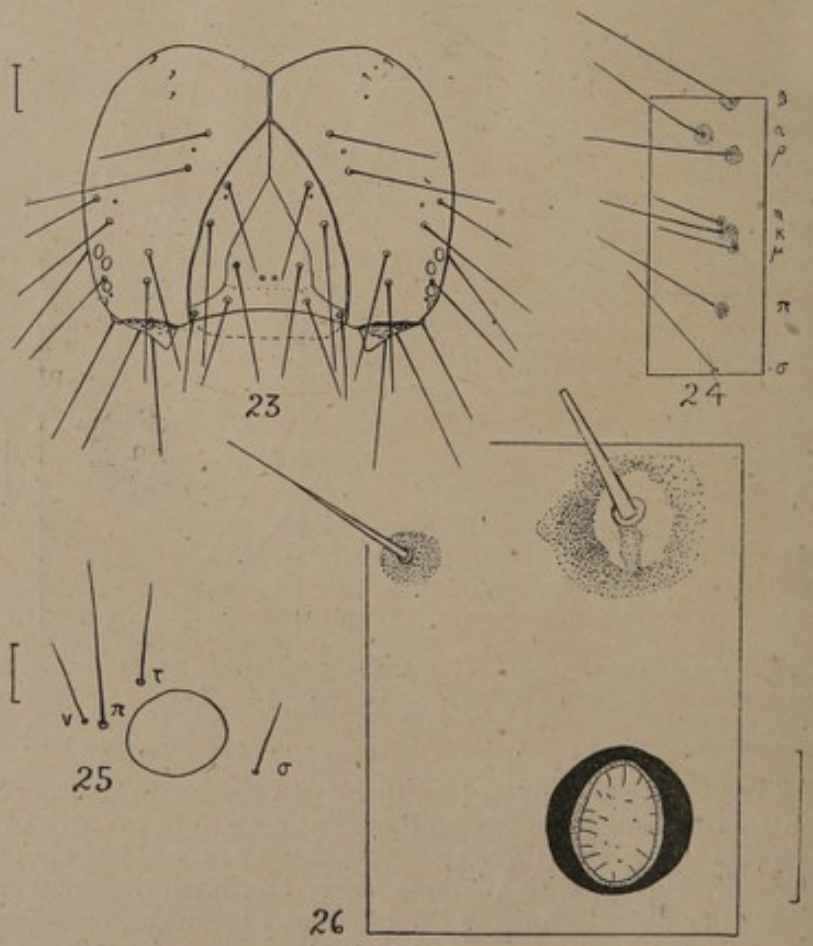
latter than to caudal clypeal seta ; seta vii between second and third ocelli but much nearer to third than to second. Pi group of I bisetose with setae in a horizontal line ; II–III unisetose ; 1–2 trisetose with setae in a transverse line but with nu slightly anterior to pi and tau ; 3–6 trisetose (fig. 21) with nu directly lateral to pi but in a few specimens (4 out of 23 examined) nu is also slightly but distinctly lateral to pi ; tau of 3–6 three times as far from pi as is nu ; 7–8 bisetose with nu nearly directly anterior and only slightly lateral to pi ; 9 unisetose. Ninth abdominal segment with alpha between and anterior to beta and rho ; Kappa group with eta only half as far from kappa as is mu and antero-dorsal instead of directly ventral to kappa ; two of 23 specimens examined eta and mu were about equally distant from kappa. Eta and kappa of 1–8 in an oblique line with eta more dorsal than kappa. Dorsal and ventral setae of 1–8 without distinct pinnaculae.

From all the species of the subfamily GALLERIINAE dealt with here this may be easily distinguished by having the peritreme of the spiracles of the eighth abdominal segment four times as thick as the base of seta rho of the same segment.

In a few not quite fully grown larvae examined, the boundaries of the adfrontals join the coronal suture at a point only slightly nearer to vertical triangle than to front.

The descriptions and figures purporting to be of *A. sociella* given by Hofmann (1875) and Buckler (1901) evidently refer to another species, possibly *Aphomia gularis* (Zell.).

Aphomia gularis (Zell.).
(Figs. 23–26).



Figs. 23–26. *Aphomia gularis* (Zell.).—(23) Head. (24) Ninth abdominal segment. (25) Pi group of fourth abdominal segment. (26) Spiracular region of eighth abdominal segment.

Mature Larva.—Length, 25–30 mm.; breadth, 3–4 mm. Cuticle whitish or greyish-white except as follows: setae, most of head and mouth-parts, pronotal sclerite, parts of legs, and crochets moderately pale to dark reddish-brown; peritreme of spiracles black or nearly so; head with anterior margin, a large oval patch on each side adjacent to caudal margin, meso-ventral margin opposite stipes and cardo, and apices of mandibles black or at any rate much darker brown than other parts of head; pinnaculae of thorax and abdomen smoky brown. Non-sclerotised parts of thorax and abdomen densely set with oval or irregularly shaped, microscopic asperities which are pale brown; cuticle also with a few much larger, oval, sclerotised, feebly depressed areas. *Head* (fig. 23) with front extending half of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point only slightly nearer to vertical triangle than to front. Each side with six well developed ocelli, of which the third and fourth are very close together or even contiguous. Mandible similar to that of *Corcyra cephalonica* (fig. 16); with two large apical teeth and a smaller ventral, subapical tooth, the outer margin of which is mesal to the ventro-lateral margin of the mandible. *Spiracles* of 8 nearly round with vertical diameter only slightly greater than horizontal, slightly larger than those of 7 (6 : 5), and caudal part of peritreme, which is not or only very slightly thicker than anterior part, less than twice as thick as base of seta rho of same segment; spiracles of 1 similar to those of 7, and those of 2–6 only slightly smaller but otherwise similar to those of 1 and 7; spiracles of I as large or very slightly larger than those of 8 and with caudal part of peritreme distinctly thicker than anterior part. *Legs* with front coxae separated by about a sixth or seventh of breadth of a front coxa; middle coxae about four and hind coxae about six or seven times as widely separated as front. Prolegs with crochets feebly biordinal, the small crochets being two-thirds to three-fourths as long as the large ones; four anterior pairs or prolegs with crochets arranged in a complete circle. *Chaetotaxy* as follows. Head (fig. 23) with frontal puncture slightly but distinctly nearer to frontal than to caudal clypeal seta; seta vii between second and third ocelli but slightly nearer to third than to second. Pi group of I bisetose with setae arranged in a horizontal line; II–III unisetose; 1–2 trisetose with setae in a transverse line but with nu slightly anterior to pi and tau; 3–6 trisetose (fig. 25) with mu antero-lateral (almost directly lateral) to pi and half or less than half as far from pi as is tau; 7–8 bisetose with mu anterior and only slightly lateral to pi; 9 unisetose. Ninth abdominal segment (fig. 24) with alpha between and anterior to beta and rho but very slightly nearer to rho than to beta; Kappa group with mu only very slightly further from kappa than is eta and with all three setae on the same pinnaculum. Eta and kappa of 1–8 in an oblique line with eta anterior and slightly dorsal to kappa. Dorsal and most of ventral setae of 1–8 with distinct pinnaculae.

Earlier Instars.—The smallest available larvae are 7 mm. long, and they differ in no important particular from the mature larva. The cuticle of the non-sclerotised parts of the thorax and abdomen is more nearly white so that the dark pinnaculae are much more conspicuous than is the case in mature specimens.

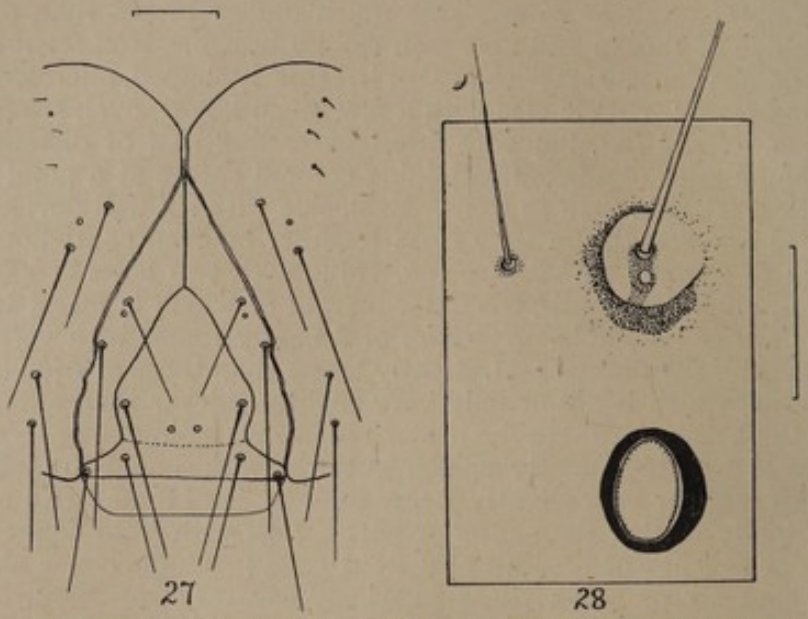
This species is very closely related to *Corcyra cephalonica*, and in fact it appears to be much more nearly related to the latter than to its congener, *Aphomia sociella* (L.). It may be distinguished from *C. cephalonica* as shown under the heading of the latter.

Corcyra cephalonica (Staint.).

(Figs. 16, 27–28).

Mature Larva.—Length, 15 mm.; breadth, 3 mm. Colour and structure nearly identical to *Aphomia gularis* (Zell.) except as follows: (1) cuticle of non-sclerotised parts of thorax and abdomen white instead of yellowish or greyish; (2) dorsal and lateral setae of first seven abdominal segments usually without pinnaculae but occasionally with rather indistinct pinnaculae; (3) head with boundaries of adfrontals

joining coronal suture at a point about twice as far from front as from vertical triangle ; and (4) peritreme of abdominal spiracles with caudal part about twice as thick as anterior part instead of equally thick or only very slightly thicker.



Figs. 27–28. *Corcyra cephalonica* (Staint.).—(27) Head. (28) Spiracular region of eighth abdominal segment.

Earlier Instars.—The smallest available larvae are 6 mm. long. These are similar to the mature larvae except that the boundaries of the adfrontals join the coronal suture at a point much nearer to front than to vertical triangle, and the small crochets are only one-half instead of two-thirds or three-fourths as long as the large ones.

This species is difficult to distinguish from *Aphomia gularis*, particularly as most of the differences mentioned above are subject to considerable variation. For example, the differences between the two species as regards the point at which the boundaries of the adfrontals join the coronal suture does not hold good in larvae that are not quite fully grown. In practice it has been found that the majority of specimens of *Corcyra cephalonica* can be immediately distinguished from *A. gularis* by their much whiter cuticle, absence of distinct pinnaculae on the first seven abdominal segments, and by the fact that the caudal part of the peritreme of the abdominal spiracles is distinctly thicker than the anterior part, being usually one and a half to twice as thick instead of very slightly or not at all thicker. The difference between the species as regards the relative thickness of the caudal and anterior parts of the peritreme of the abdominal spiracles appears to be a constant.

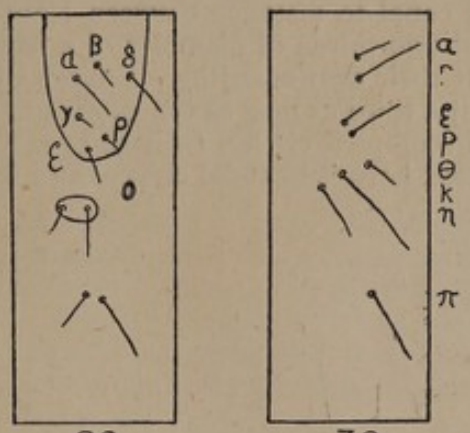
Phycitinae.

The larvae of this subfamily are easily distinguished from those of all others by having a sclerotised ring enclosing a membranous area around base of seta rho of the mesothorax. They are closely related to the Pyralinae with which they agree in having the kappa setae of the prothorax in a vertical or nearly vertical line and the crochets of the four anterior pairs of prolegs arranged in complete circles and biordinal, the small ones being only about a third as long as the large ones. The epipharynx has three large sclerotised teeth on each side as appears to be usual in the Pyralidae. As mentioned below, the larval characters of *Etiella zinckenella* (Treit.) suggest that this species should be referred to another subfamily.

Etiella zinckenella (Treit.)

(Figs. 29–30).

No larvae of this species are available and the following description is based on that given by Forbes (1923).



Figs. 29–30. *Etiella zinckenella* (Treit.).—(29) Prothorax. (30) Mesothorax. (After Forbes.)

Cuticle apple-green, reddish, or brown ; pinnaculae yellow with region immediately around base of setae black ; head amber yellow with a brown posterior line ; prothorax green with three pairs of black dots, the lateral ones being in a reddish shade. *Chaetotaxy* as follows : Prothorax (fig. 29) with beta slightly nearer to alpha than to delta and gamma very slightly nearer to epsilon than to alpha ; rho distinctly nearer to epsilon than to gamma, being nearer to epsilon than is gamma to epsilon ; Kappa setae in a horizontal line ; Pi group bisetose with setae in a nearly horizontal line. Mesothorax without a sclerotised ring enclosing a membranous area around base of seta rho ; Pi group unisetose.

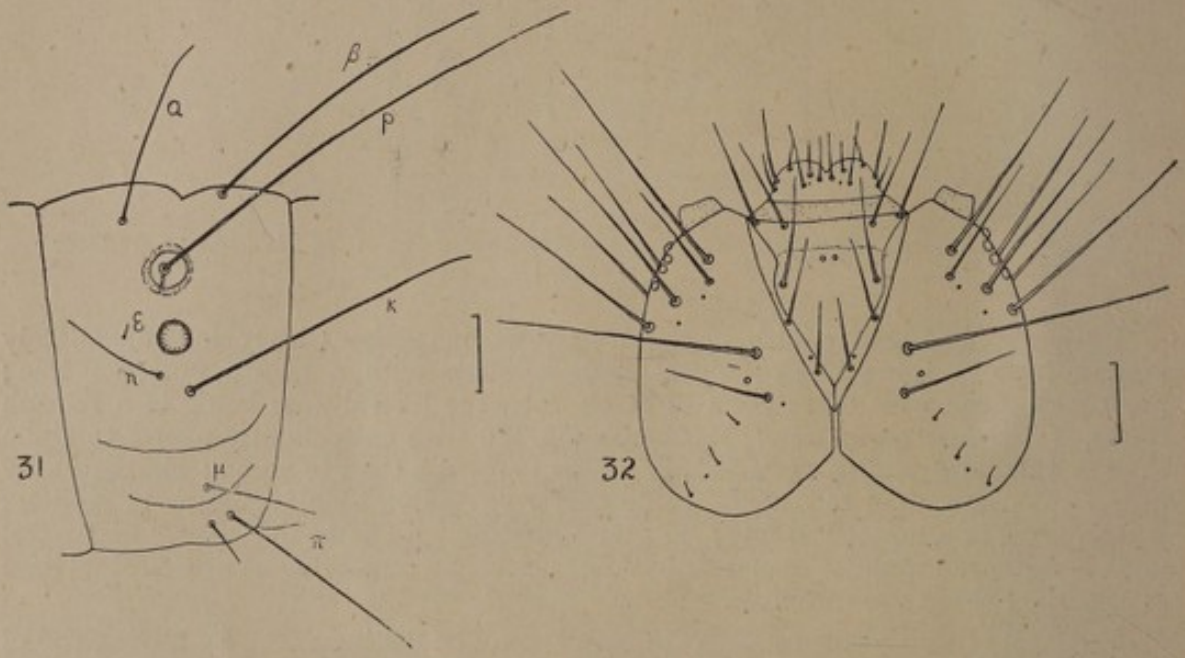
From all other Pyralids dealt with here it may be distinguished by having rho of the prothorax much nearer epsilon than is gamma to epsilon. If the larva described as that of *Etiella zinckenella* by Forbes (1923) has not been misidentified, the adult should be re-examined with a view to placing it in another subfamily. *E. zinckenella* differs strikingly from all other PHYCITINAE in having the Kappa setae of the prothorax in a horizontal instead of a vertical line and in not having a sclerotised ring enclosing a membranous area around base of seta rho of mesothorax.

Plodia interpunctella (Hbn.)

(Figs. 31–32).

Mature Larva.—Length, 10–13 mm. ; breadth, 1·8–2·2 mm. Cuticle white except as follows : most of head and mouth-parts, claws and crochets moderately pale yellowish brown or reddish brown ; head with meso-ventral margin opposite stipes and a small longitudinal patch on each side near base often very dark brown or black ; setae, sclerites of I and 10, peritreme of spiracles, and parts of legs pale yellowish brown. *Head* (fig. 32) with front extending two-thirds of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point slightly less than twice as far from vertical triangle as from front. Each side usually with six distinct ocelli but occasionally with only five as first and second may be more or less fused together ; in a few specimens examined the third and fourth are contiguous. Mandible with three distinct apical teeth, of which the middle one is the

largest ; outer tooth as in *Ephestia cautella* (fig. 48). *Spiracles* of 8 round, slightly smaller to slightly larger than membranous area enclosed by sclerite around base of seta rho, one-fourth larger than those of 7, and peritreme feebly projecting and evenly thickened, being very slightly less thick than basal part of seta rho ; spiracles of 7 similar to those of 8 but distinctly smaller ; spiracles of 1–6 similar but very slightly smaller than those of 7 ; spiracles of I slightly smaller but otherwise similar to those of 8 and diameter about equal to distance between Kappa setae. *Legs* with front coxae separated by about two-thirds of diameter of a front coxa ; middle and hind coxae separated by about their own breadths. Prolegs with crochets biordinal, the small crochets being about a third as long as the large ones ; crochets of four anterior pairs of prolegs arranged in complete circles. *Chaetotaxy* as follows : Head (fig. 32) with frontal puncture equidistant between caudal clypeal and frontal seta or very slightly



Figs. 31–32. *Plodia interpunctella* (Hbn.).—(31) Eighth abdominal segment. (32) Head.

nearer the latter ; seta vii antero-ventral and very near to second ocellus. Prothorax with beta only slightly nearer to alpha than to delta and gamma nearly twice as far from alpha as from epsilon (7 : 4). Pi group of I bisetose with setae in a nearly horizontal line ; II–III unisetose ; 1–2 trisetose with nu antero-lateral to pi, and tau more or less directly mesal to pi ; 3–6 trisetose with nu antero-lateral to pi and very nearly as far from pi as is tau so that lines joining the three would form a nearly equilateral triangle ; 7–8 bisetose with nu nearly directly anterior to pi ; 9 bisetose with nu mesal and slightly anterior to pi. Ninth abdominal segment with alpha between and anterior to beta and rho but only about half as far from rho as from beta ; Kappa group in a nearly vertical line with eta usually about half as far from kappa as is mu, but in many specimens the distance between the three setae is nearly equal ; eta often slightly anterior to kappa. Eta and kappa of 1–7 in a nearly vertical line and of 8 in a distinctly oblique line. Epsilon of 8 separated from spiracle by a distance approximately equal to the diameter of the spiracle. Setae of II–III and 1–9 not arising from pinnaculae ; ring around base of seta rho of I and 8 sometimes feebly sclerotised and rather indistinct.

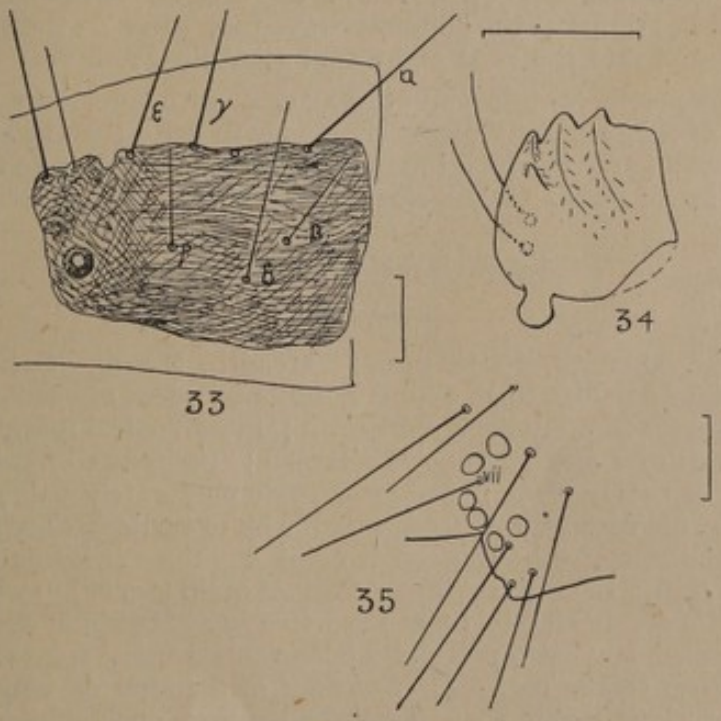
From all other PHYCITINAE dealt with here which have the non-sclerotised parts of the cuticle white, *Plodia interpunctella* may be distinguished by having no pinnaculae

on the meso- and metathorax and the first nine abdominal segments. It differs from all other PHYCITINAE dealt with here—with the possible exception of *Etiella zinckenella* (Treit.)—in having the front of the head extending two-thirds instead of approximately only one-half of the distance to the vertical triangle.

Cryptoblabes gnidiella (Mill.)

(Figs. 33–35).

Mature Larva.—Length, 11 mm.; breadth, 1·8 mm. Cuticle moderately dark grey-brown with faint purplish reflections in some lights except as follows: setae, most of head and mouthparts, sclerite of I, peritreme of spiracles, legs, and crochets reddish-brown or yellowish-brown; head with a longitudinal black or nearly black patch on meso-ventral margin opposite stipes; pinnaculae blackish-brown surrounded by paler areas. *Head* with front extending half way to vertical triangle and boundaries of adfrontals joining coronal suture at a point about three times as far from vertical triangle as from front. Each side with six distinct ocelli (fig. 35) of which the second is equidistant between first and third, and third and fourth are nearly contiguous. Mandible (fig. 34) with three distinct and well developed apical teeth; outer tooth



Figs. 33–35. *Cryptoblabes gnidiella* (Mill.).—(33) Prothorax. (34) Ventro-mesal view of right mandible. (35) Ocellar region of head.

with a small subapical notch or feebly developed tooth on ventral surface of third near outer margin. *Spiracles* of 8 round, nearly as large as membranous area enclosed by sclerotised ring around base of seta rho, and peritreme moderately strongly projecting, evenly thickened, and dorsal rim about as thick as basal part of seta rho; spiracles of 1–7 similar but only slightly more than half as large; spiracles of I about as large as those of 8 and outside diameter of peritreme about equal to distance between Kappa setae. *Legs* with hind coxae separated by slightly less than the diameter of a hind coxa (pro- and mesosternum are badly damaged in the single specimen available). Prolegs with crochets biordinal, the small crochets about a third as long as the large ones; four anterior pairs of prolegs with crochets arranged in a complete circle.

Chaetotaxy as follows: Head with frontal puncture slightly but distinctly nearer to frontal than to caudal clypeal seta; puncture between setae i and ii nearer to seta ii; seta vii (fig. 35) directly ventral to second ocellus. Prothorax (fig. 33) with dorsal sclerite extending laterally to join spiracular sclerite on a broad front; beta distinctly nearer to delta than to alpha, and gamma nearly twice as far from alpha as from epsilon. Pi group of I bisetose with setae in a nearly horizontal line; II–III unisetose; 1–2 trisetose with nu antero-lateral to pi and slightly nearer pi than is tau which is nearly directly mesal to the latter; 3–6 trisetose with nu directly anterior to pi and only about half as far from pi as is tau; 7 bisetose with nu nearly directly anterior and only slightly lateral to pi; 8 bisetose with nu anterior and only slightly mesal to pi; 9 bisetose with nu antero-mesal to pi. Ninth abdominal segment with alpha between and anterior to beta and rho but nearer to the latter; Kappa group with eta nearly directly anterior and only slightly dorsal to kappa, and mu nearly directly ventral to kappa and slightly further from the latter than is eta. Eta and kappa of 1–7 in an oblique line with eta antero-dorsal to kappa; 8 with eta and kappa in a nearly vertical line with kappa dorsal and only slightly caudal to eta. Epsilon of 1–8 minute, that of 8 being anterior to spiracle and separated from spiracle by a distance equal to about four or five diameters of the latter. Setae of I–III and 1–10 arising from pinnaculae except epsilon of 1–8; each pinnaculum is surrounded by a broad area, which is paler than adjacent parts of cuticle, and, if this area be considered part of pinnaculum, Kappa and Pi groups of the abdomen have their setae on the same pinnaculum. Ring around base of seta rho of II and 8 well sclerotised and very distinct.

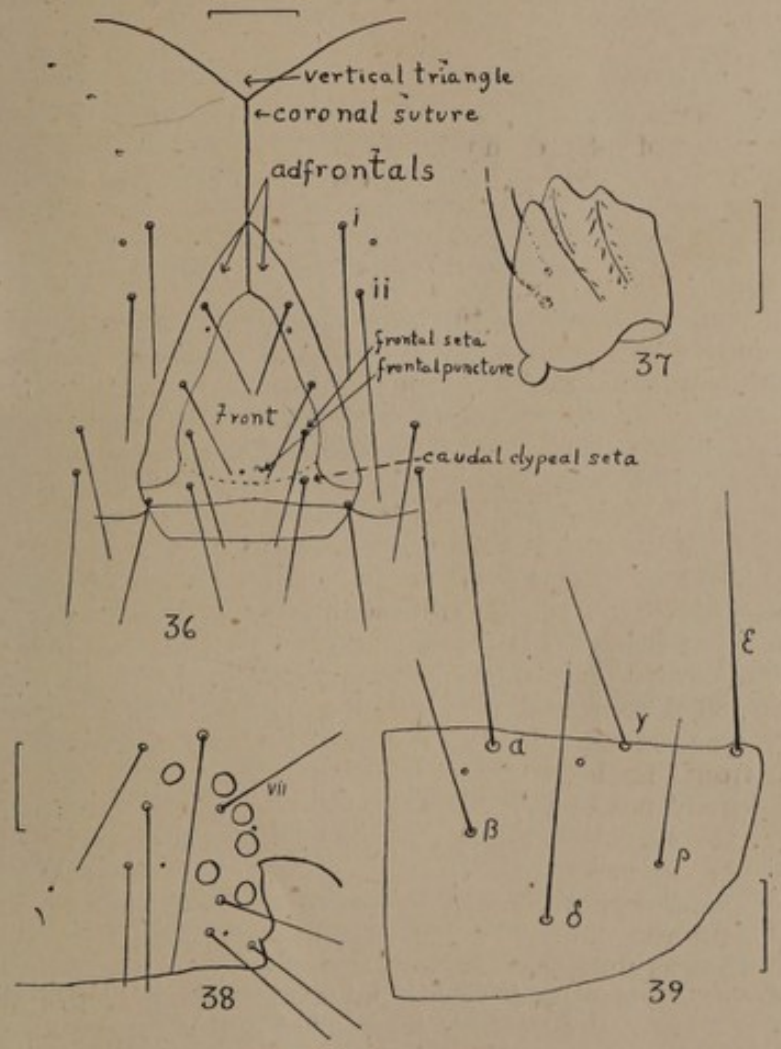
From all other members of the PHYCITINAE dealt with here, it may be distinguished by having beta of the prothorax distinctly nearer to delta than to alpha. This is the only Pyralid known to me in which the pronotal sclerite is joined to the pre-spiracular sclerite along a broad front. Only a single blown specimen has been examined.

Acrobasis juglandis (Le Baron)

(Figs. 36–39).

Mature Larva.—Length, 16–18 mm.; breadth, 2 mm. Cuticle dark greyish brown with a slight purplish tinge except as follows: most of head and mouth-parts, legs and crochets moderately dark red-brown; meso-ventral margin of head black; setae and sclerites of I and 10 yellowish brown; peritreme of spiracles very dark brown to black or nearly black; and pinnaculae moderately pale grey or yellowish brown. *Head* (fig. 36) with front extending half way to vertical triangle and boundaries of adfrontals joining coronal suture at a point less than twice as far from vertical triangle as from front. Each side with six distinct ocelli (fig. 38) of which the second is slightly but distinctly nearer to third than to first. Mandible (fig. 37) with three distinct apical teeth. Maxillary mala with both ventral apical spines forked distally as shown in *Acrobasis caryae* (fig. 43). *Spiracles* of 8 round or very feebly obovate, about a fifth or sixth larger than membranous area enclosed by sclerotised ring around base of seta rho, and peritreme at most only feebly projecting and with caudal part, which is as thick as basal part of seta rho, slightly thicker than anterior part; spiracles of 7 similar but only about two-thirds as large; spiracles of 1–6 similar to those of 7 but with those of 1 about a fifth larger; spiracles of I larger than those of 8 (4·8 : 3·5) and with outside diameter distinctly greater than distance between Kappa setae. *Legs* with front coxae separated by about a fifth of breadth of a front coxa; middle coxae about five and hind coxae about six or seven times as widely separated. Prolegs with crochets biordinal, the small crochets being about a third as long as large ones; four anterior pairs of prolegs with crochets arranged in a complete circle. *Chaetotaxy* as follows: Head (fig. 36) with frontal puncture equidistant between caudal, clypeal and frontal seta; puncture between setae i and ii slightly nearer i than ii; seta vii (fig. 38) between and ventral to second and third ocelli. Prothorax (fig. 39) with beta slightly nearer to alpha than to delta, and gamma

nearly as far from epsilon as from alpha (24·5 : 28·5). Pi group of I bisetose with setae in a horizontal line ; II–III unisetose ; 1–2 trisetose with nu antero-lateral to pi and about as far from pi as is tau, which is directly mesal to pi, pi and tau and sometimes also nu being on the same pinnaculum ; 3–6 trisetose with nu directly anterior or even slightly mesal to pi and about as far from pi as is tau, tau and nu being nearer together than either is to pi and all three being on the same pinnaculum ; 7 bisetose with nu anterior and slightly lateral to pi and usually on the same pinnaculum ; 8–9 bisetose with nu antero-mesal to pi and on same pinnaculum. Ninth abdominal segment with alpha between and anterior to beta and rho but distinctly nearer to beta than to rho, often arising from the same pinnaculum ; Kappa setae in a nearly vertical line with eta distinctly nearer to kappa than is mu, eta and kappa always and mu sometimes arising from the same pinnaculum. Eta and kappa of 1 in an oblique line with eta antero-dorsal to kappa ; 2–6 in a nearly horizontal line with kappa



Figs. 36–39. *Acrobasis juglandis* (Le Baron).—(36) Head. (37) Ventro-mesa right mandible. (38) Ocellar region. (39) Prothorax.

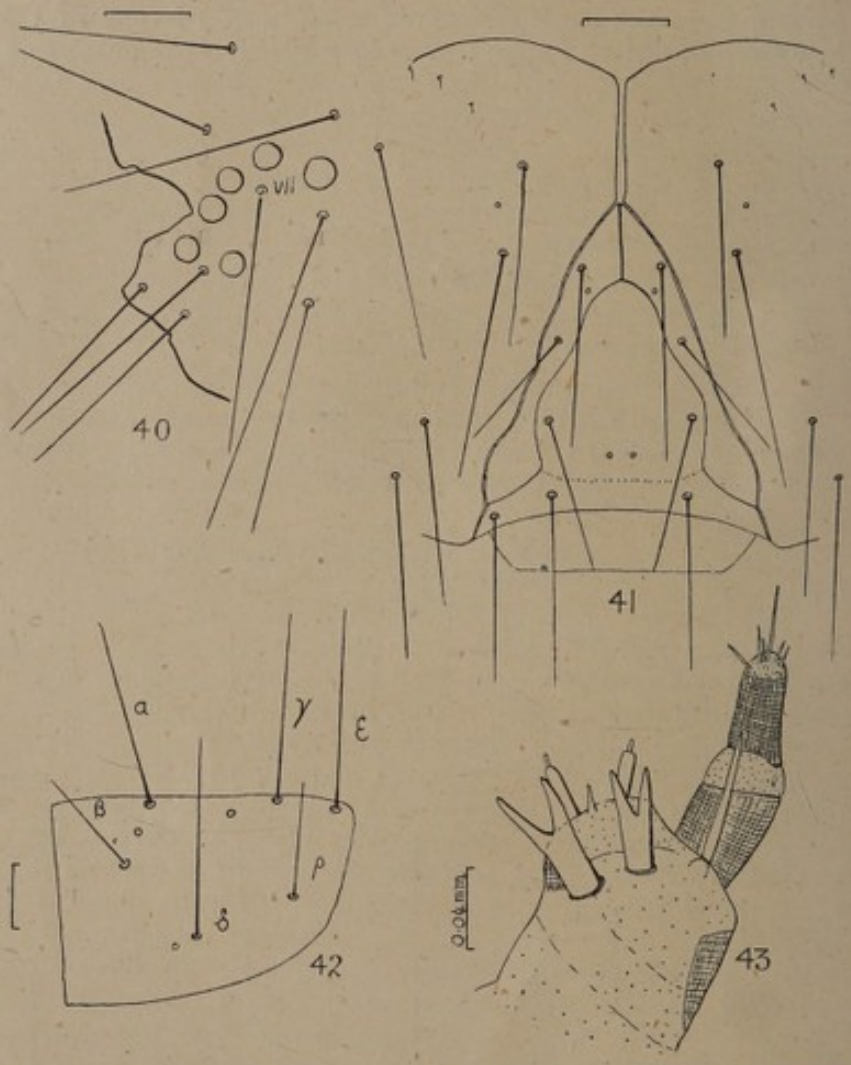
nearly directly caudal to eta ; 8 with kappa dorso-caudal to eta ; 1–8 with Kappa setae always arising from same pinnaculum. Epsilon of 1–8 represented by a minute puncture. Setae of I–III and 1–10 arising from pinnaculae, which are paler than adjacent parts of cuticle. Ring around base of seta rho of II and 8 broad and well sclerotised. Non-sclerotised parts of cuticle of thorax and abdomen with dense, microscopic asperities.

This species is closely related to *Acrobasis caryae* from which it may be distinguished as shown under the heading of *A. caryae*. Both species of *Acrobasis* differ from all other Pyralids considered in this paper by having the two ventral spines of the maxillary mala forked at apex.

The above description is based on four apparently mature larvae preserved in alcohol. These larvae were determined as *A. juglandis* by Dr. C. Heinrich.

Acrobasis caryae, Grote.

(Figs. 40–43).



Figs. 40–43. *Acrobasis caryae*, Grote.—(40) Ocellar region. (41) Head. (42) Prothorax. (43) Maxillary mala from dorsal view.

Mature Larva.—Length, 17 mm.; breadth, 2 mm. Cuticle (of specimens preserved in spirit) moderately pale yellow-brown or grey-brown; head reddish-brown and other sclerotised parts of cuticle pale yellowish-brown except peritreme of spiracles which is very dark brown. According to Forbes (1923) living larvae are "... : greenish gray, with dark brown head, shining yellow-green cervical shield, and light brown subdorsal plate on mesothorax." Structurally very similar to *Acrobasis juglandis* (Le Baron) but differing principally as follows: (1) head (fig. 41) with seta i no nearer than ii to puncture between them; (2) prothorax

(fig. 42) with gamma twice as far from alpha as from epsilon, whereas in *A. juglandis* gamma is only slightly further from alpha than from epsilon (fig. 39); (3) Pi group of 8 with nu directly anterior or only very slightly mesal to pi, whereas in *A. juglandis* nu is distinctly anterio-mesal to pi; and (4) alpha of 9 nearer to rho than to beta on at least one side (2 specimens) or nearer to rho than to beta on both sides (2 specimens).

Four apparently mature larvae preserved in alcohol were examined. These larvae were determined as *A. caryae* by Dr. C. Heinrich. Of the differences given above between this species and *A. juglandis*, the position of seta gamma of the prothorax in relation to alpha and epsilon is the most conspicuous. The position of the posterior adfrontal seta varies slightly in both species, but in *A. caryae* it is sometimes distinctly caudal to the front.

Ephestia, Guenée.

The four species of *Ephestia* which have been examined by me are all very similar in structure. The mature larvae vary considerably in size and colour, but no differences have been found with regard to these characteristics, which in practice are of much use in distinguishing the species, though large specimens of *E. sericarium* (*kühniella*) are larger than any of *E. cautella* or *E. elutella*. The description given immediately below applies to the larvae of all four species, and the distinguishing features of each being listed under the heading of the particular species.

Mature Larva (in alcohol).—Cuticle white or pale yellowish white (pinkish in live specimens; very pale greenish in some *E. sericarium*) except as follows: setae, most of head and mouth-parts, sclerites of I and 10, peritreme of spiracles, parts of legs, and crochets moderately pale to moderately dark yellowish-brown; head often reddish-brown and nearly always with two black or very dark brown patches on each side, one on meso-ventral margin opposite stipes and cardo and one adjacent to caudal margin; pinnaculae and sclerotised ring around rho of II and 8 usually dark grey-brown, but pinnaculum of beta of 9 usually yellowish brown like sclerite of 10. *Head* (figs. 44, 49) with front extending one-half or slightly more than one-half (*E. cautella*) of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point two or three times as far from vertical triangle as from front. Each side with six distinct ocelli (fig. 45) of which the second is nearer to the first than to the third or equidistant between first and third. Mandible (figs. 57–58) with three large apical teeth of which the third (normally the most lateral tooth) is sometimes slightly mesal (*E. sericarium*), the outer margin of the mandible—when viewed ventro-mesally—being in these instances part of the second or largest tooth. Maxillary mala (fig. 46) with both ventral spines simply pointed and not forked at apex. *Spiracles* of 8 round or nearly so, slightly smaller to slightly larger (*E. sericarium*, *E. cautella*) or distinctly smaller (*E. elutella*) than membranous area enclosed by sclerotised ring around base of seta rho, and peritreme evenly thickened and rather strongly projecting with dorsal rim much narrower and sides about twice as thick as basal part of seta rho; spiracles of 7 similar to those of 8 but only one-half to three-fifths as large; spiracles of 1–6 similar, those of 1 and 7 being sometimes slightly larger than those of 2–6; spiracles of I slightly smaller than those of 8. *Legs* with front coxae separated by about one-third or slightly more of breadth of a front coxa; middle coxae nearly twice and hind coxae two to three times as widely separated as front. Prolegs with crochets biordinal, the small crochets being about a third as long as large ones; crochets of four anterior pairs of prolegs arranged in complete circles. *Chaetotaxy* as follows: Head (figs. 44–49) with frontal puncture about equidistant between frontal and caudal clypeal seta or slightly nearer the latter; puncture between setae i and ii usually equidistant between these setae, but sometimes slightly nearer to i than to ii; seta vii ventral to second ocellus and caudal to third (fig. 45). Prothorax

with gamma twice or slightly less than twice as far from alpha as from epsilon ; beta always slightly nearer to alpha than to delta, but in some specimens of *E. elutella* beta is twice as far from delta as from alpha. Pi group of I bisetose with setae in a nearly horizontal line ; II–III unisetose ; 1–2 trisetose with nu antero-lateral to pi and about as far from pi as is tau which is directly mesal to pi ; 3–6 trisetose with nu antero-lateral to pi except in mature specimens of *E. sericarium* where it is directly anterior or even antero-mesal to pi, nu being in nearly all instances slightly nearer to pi than is tau ; 7 bisetose with nu anterior and slightly lateral to pi ; 8 bisetose with nu antero-lateral (*E. sericarium*), directly anterior or even very slightly mesal (*E. elutella*) or distinctly antero-mesal (*E. cautella*) to pi ; 9 bisetose with nu mesal and slightly anterior to pi. Ninth abdominal segment with alpha anterior and slightly dorsal to rho and on same pinnaculum as the latter ; Kappa setae with eta antero-dorsal (sometimes nearly directly dorsal) to kappa and slightly nearer to kappa than is eta, which is directly ventral to kappa ; all three kappa setae often arising from the same pinnaculum, but sometimes with only eta and kappa on the same pinnaculum, and, more rarely, with each of these arising from a different pinnaculum. Eta and kappa of 1–7 in a vertical or nearly vertical line with kappa ventral to eta and sometimes also slightly caudal ; 8 with eta and kappa in an oblique line, kappa being caudo-ventral to eta ; kappa and eta of 1–8 often arising from same pinnaculum. Epsilon of 1–8 distinct and not arising from a pinnaculum ; 8 with epsilon separated from spiracle by slightly less to three or more times the diameter of the spiracle. Thorax with Alpha, Beta, Rho, Kappa, and Pi arising from pinnaculae ; abdomen similar except that epsilon never and Pi seldom arise from pinnaculae. Ring around base of seta rho of II and 8 broad and well sclerotised.

First Instar.—The first-instar larvae of three species (*E. cautella*, *E. sericarium* and *E. elutella*) have been examined. The first instar differs from the later instars in that mu is absent on the abdomen, theta on the meso- and metathorax, and in *E. elutella* theta is never present on the eighth abdominal segment. The pinnaculae of II–III and 1–9 are not developed, but the ring around rho of II and 8 is usually sufficiently well sclerotised to be distinct. The crochets are uniordinal instead of biordinal, and each proleg has 6–7 instead of 40–60 crochets. The first instar larvae of these three species may be distinguished as follows :—

1. Eighth abdominal segment with seta epsilon separated from spiracle by a distance equal to very slightly more, or to distinctly less, than the diameter of the spiracle..... *E. cautella* (Wlk.)

   Eighth abdominal segment with seta epsilon separated from the spiracle by a distance equal to much more than the diameter of the latter.....2

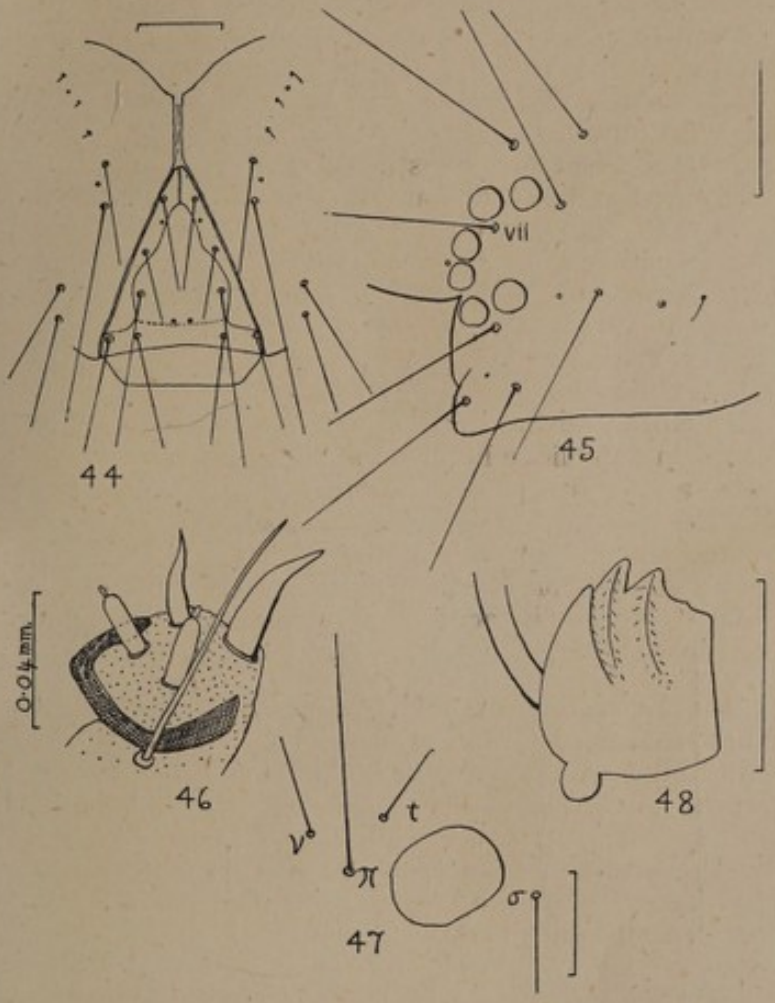
2. Mandible, when viewed ventro-mesally, with outer ventral tooth not forming part of outer margin of mandible but displaced mesally so that this margin is part of second or largest tooth. Spiracle of prothorax with diameter slightly greater than distance between Kappa setae.....*E. sericarium* (Scott)

   Mandible, when viewed ventro-mesally, with lateral margin of third or outer tooth forming the lateral ventral margin of the mandible. Spiracle of prothorax with diameter slightly less than distance between Kappa setae..... *E. elutella* (Hbn.)

Comparative Notes.—Any larva (excluding first-instar larvae) found on stored food which has a large sclerotised ring enclosing a membranous area at base of seta rho of mesothorax combined with a white or nearly white cuticle with darker and conspicuous pinnaculae is a species of *Ephestia*.

Ephestia cautella (Walker)

(Figs. 44–48, 53).

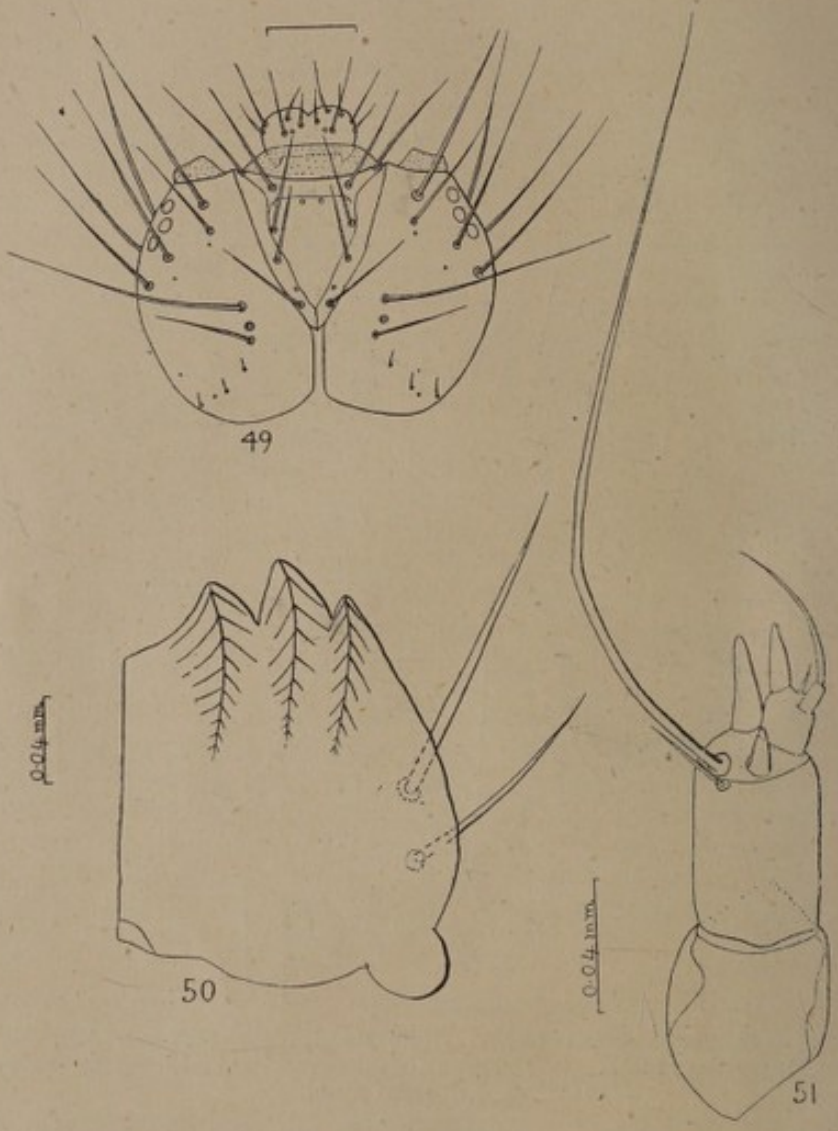


Figs. 44–48. *Ephestia cautella* (Walker).—(44) Head. (45) Ocellar region. (46) Dorso-lateral view of maxillary mala. (47) Pi group of fourth abdominal segment. (48) Ventro-mesal view of right mandible.

Mature Larva.—Length, 12–14 mm.; breadth, 1·8–2·0 mm. Specimens preserved in alcohol are usually distinctly darker and more yellowish or greyish white than the other species dealt with here. All instars may be distinguished from *E. sericarium* and *E. elutella* by having epsilon of 8 separated from the spiracle by distinctly less (rarely very slightly more) than the diameter of the latter instead of by nearly two to three or more diameters. Nu of the Pi group of 8 is distinctly mesal to pi, whereas in the other species it is distinctly lateral, only rarely being very slightly mesal in *E. elutella*. Nu of 3–6 is always distinctly antero-lateral to pi, whereas in fully grown larvae of *E. sericarium* nu is directly anterior or even slightly mesal to pi. The mandibles are similar to those of *E. elutella* and differ from those of *E. sericarium* as described under the heading of the latter species.

Ephestia figulilella, Gregson.

(Figs. 49–51).

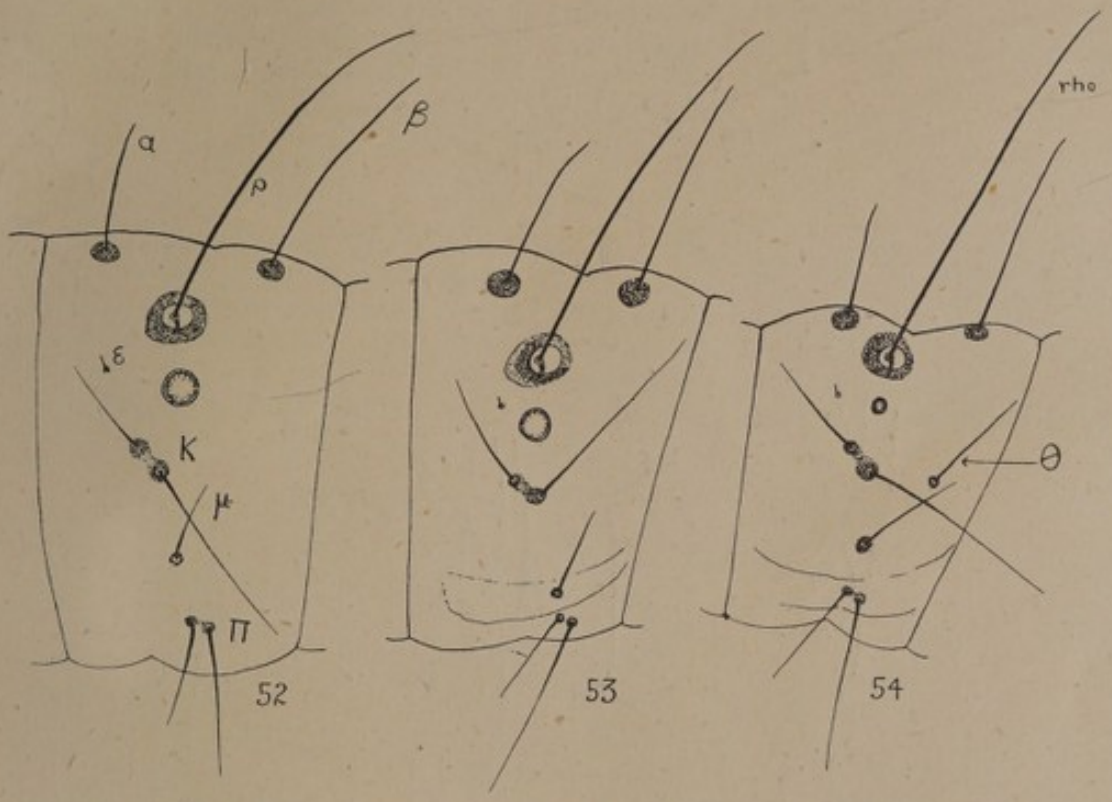


Figs. 49–51. *Ephestia figulilella*, Gregson.—(49) Head. (50) Meso-ventral view of left mandible. (51) Antenna.

Only a single bred specimen has been examined, which is 8 mm. long and 1·3 mm. broad. It is very close to *E. cautella*, and, until more specimens are available, cannot be satisfactorily distinguished from the latter species. The pinnaculae of the abdominal setae are more feebly pigmented than in *E. cautella*, and epsilon of 8 is separated from the spiracle by a distance about equal to the diameter of the spiracle, whereas in *E. cautella* epsilon is nearly always separated from the spiracle by distinctly less than the diameter of the latter. The puncture between setae i and ii of the head is relatively much larger in *E. figulilella* than *E. cautella*.

Ephestia sericarium (Scott)

(Figs. 52, 56, 58).

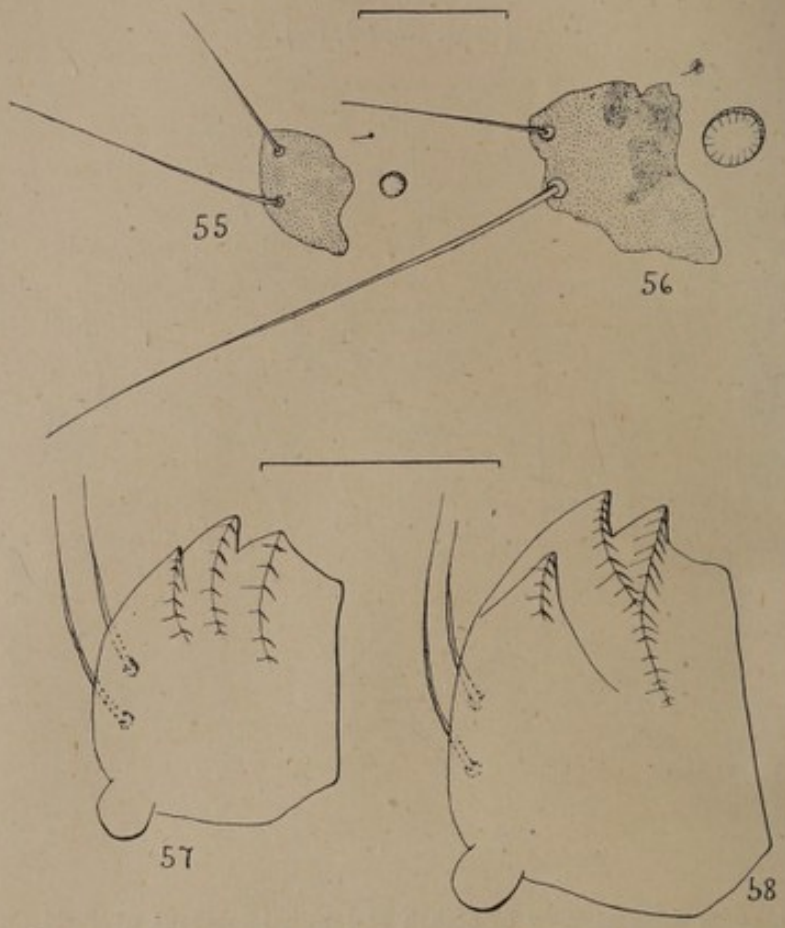


Figs. 52–54.—(52) Lateral view of eighth abdominal segment of *Ephestia sericarium* (Scott). (53) Same of *E. cautella* (Walker). (54) Same of *E. elutella* (Hbn.).

Mature Larva.—Length, 15–20 mm ; breadth, 2–3 mm. All instars may be distinguished from *E. cautella*, *E. figulilella*, and *E. elutella* by having the third (normally the outer) tooth of the mandible (fig. 58) subventral and more mesal than is usual so that when the mandible is viewed meso-ventrally its outer margin is part of the second or largest tooth instead of being part of the third tooth. From *E. cautella* and *E. figulilella*, it is also distinguished by having epsilon of 8 separated from the spiracle by two to three diameters of the latter instead of only by one.

Ephestia elutella (Hbn.)

(Figs. 54–55, 57).



Figs. 55–58. (55) Spiracle and Kappa group of prothorax of *Ephestia elutella* (Hbn.). (56) Same of *E. sericarium* (Scott). (57) Ventro-mesal view of right mandible of *E. elutella*. (58) Same of *E. sericarium*.

Mature Larva.—Length, 10–15 mm.; breadth, 1·0–1·5 mm. Identical with *E. sericarium* except as follows: (1) mandible (fig. 57) with lateral margin of outer or third tooth forming part of outer ventral margin of mandible; (2) prothorax with diameter of spiracular opening distinctly less than distance between Kappa setae (fig. 55); (3) spiracle of eighth abdominal segment of mature or nearly mature arvae (fig. 54) not more than two-thirds as broad as membranous area enclosed by sclerotised ring around base of seta rho; (4) eighth abdominal segment with nu anterior and slightly mesal to pi, whereas in *E. sericarium* the fully grown larva has nu either directly anterior or antero-lateral to pi, nu being mesal to pi only occasionally in the earlier instars of the latter species; and (5) nu of 3–6 always antero-lateral to pi, whereas in fully grown larvae of *E. sericarium* nu is directly anterior or even antero-lateral to pi. In many specimens of *E. elutella* theta is present on either the right or left side of the eighth abdominal segment, and in a few specimens it is present on both sides. Intermediate instars of *E. elutella* cannot be easily distinguished from those of *E. sericarium* without examining the mandibles.

Pyralinae.

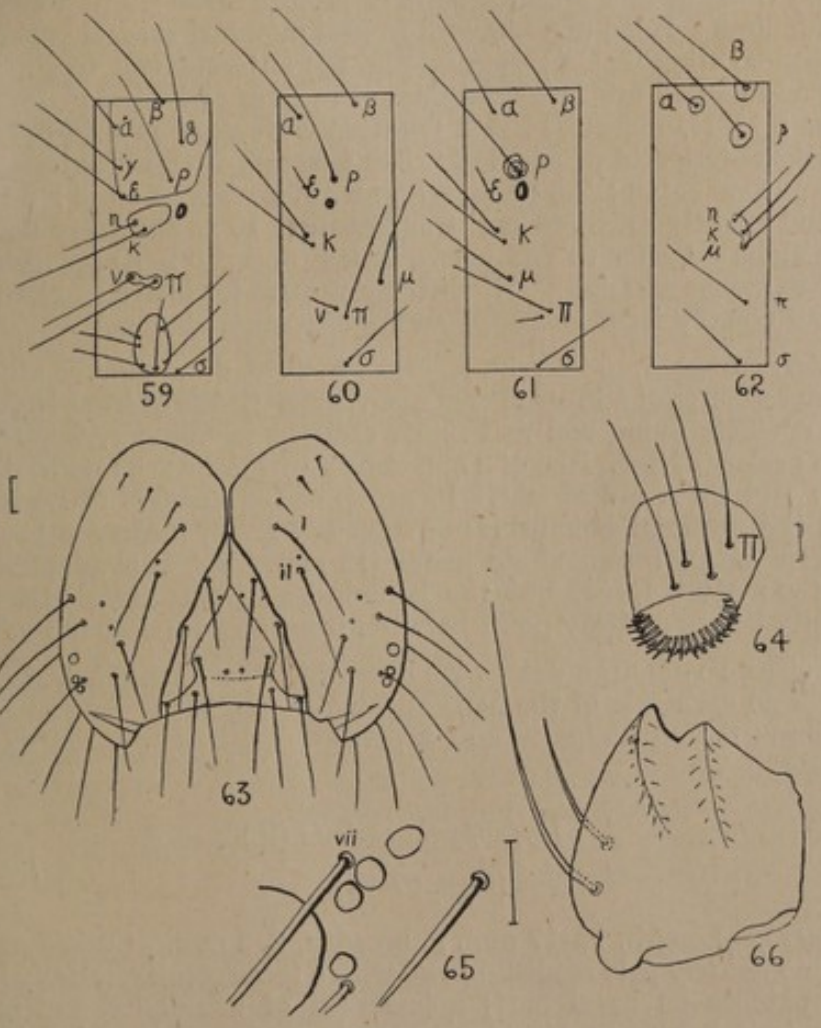
The larvae of this subfamily are very nearly related to those of the Phycitinae, and Fracker (1915) and other writers have been unable to distinguish them from the

PHYCITINAE as a whole. The presence of a sclerotised ring around the base of seta rho only on the eighth abdominal segment will serve to distinguish them from the PHYCITINAE, which, as far as is known, always have a sclerotised ring around the base of seta rho of the mesothorax as well as around the base of seta rho of the eight abdominal segment. The PYRALINAE are similar to the PHYCITINAE in having the crochets of the four anterior pairs of prolegs biordinal (in the later instars) and arranged in a complete circle. In the PYRALINAE the large crochets are three or four times as long as the small ones.

Pyralis farinalis (L.)

(Figs. 59–66).

Mature Larva.—Length, 20–25 mm. ; breadth, 3–4 mm. Cuticle whitish except as follows : setae, head, pronotal sclerite, parts of legs, and crochets moderately pale brown, the head and mandibles being distinctly reddish-brown ; dorsal and lateral sclerites of tenth abdominal segment pale brown ; apical part of mandibles, latero-caudal margin of head, and meso-ventral part opposite cardo usually black or nearly so ; peritreme of spiracles always black ; non-sclerotised parts of thorax and abdomen



Figs. 59–66. *Pyralis farinalis* (L.).—(59) Prothorax. (60) Seventh abdominal segment. (61) Eighth abdominal segment. (62) Ninth abdominal segment. (63) Head. (64) Pi group of tenth abdominal segment. (65) Ocellar region. (66) Ventro-mesal view of right mandible.

densely and regularly set with small (about as broad as seta epsilon of abdomen), flat-topped asperities which are usually brown or blackish-brown anteriorly and caudally so that thorax and first abdominal segment as well as caudal three or four abdominal segments appear greyish, the intermediate segments being distinctly paler. *Head* (fig. 63) with front extending about half of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point about half way between front and vertical triangle. Each side with only four distinct ocelli (fig. 65); the first and second ocelli are fused together and the fifth is usually absent but is sometimes barely distinguishable. Mandible (fig. 66) with two large apical teeth and with a slight subapical notch (not a distinct tooth) on ventral ridge of large lateral tooth. *Spiracles* of 8 obovate with vertical diameter distinctly greater than horizontal, twice as long as those of 7, and middle caudal part of peritreme about twice as broad as anterior part; spiracles of 1–7 very broadly oval with vertical diameter only slightly greater than horizontal, those of 1 and 7 being slightly larger than intermediate spiracles, and middle caudal peritreme of each two to three times as broad as middle anterior part; spiracles of I similar to those of 8 but very slightly smaller. *Legs* with front coxae separated by about one-fifth breadth of a front coxa; middle coxae about four times and hind coxae about six times as widely separated as front. Prolegs with crochets biordinal, the small crochets only a third or fourth as long as the large ones, and those of four anterior pairs of prolegs arranged in a complete circle. *Chaetotaxy* as follows: Head (fig. 63) with frontal puncture scarcely nearer to frontal seta than to caudal clypeal seta; seta vii (fig. 65) antero-dorsal to second (actually third as first and second are fused) ocellus. Pi group of I bisetose with setae in a horizontal line; II–III unisetose; 1–2 trisetose with setae in a transverse line but with nu slightly anterior to pi and tau; 3–6 trisetose with nu antero-lateral to pi and nearer to pi than is tau; 7 bisetose with nu antero-lateral to pi; 8 bisetose with nu anterior and slightly mesal to pi; 9 unisetose; 10 as shown in fig. 64. Ninth (fig. 62) with alpha anterior to and between beta and rho; Kappa group with eta antero-dorsal to kappa and mu nearly directly ventral (or lateral) to kappa, eta and mu being about equally far from kappa and on the same pinnacula.

First Instar.—Length, 0·82 mm.; breadth, 0·13 mm. shortly after hatching. Head with inner sutures of adfrontal area not visible. Coxae of front legs contiguous; prolegs with crochets uniordinal and much reduced in number, there being about nine to ten on prolegs of 3–6. Rho of 8 apparently without a sclerotised circle around its base. Mu and theta are absent. Pi group of 1–6 appears to be bi- instead of trisetose, but the material at hand is not sufficiently well preserved to be certain of this. One larva of an intermediate instar (12 mm. long) is available. This larva is similar to the mature larva, but the boundaries of the adfrontals join coronal suture distinctly before midway point between front and vertical triangle.

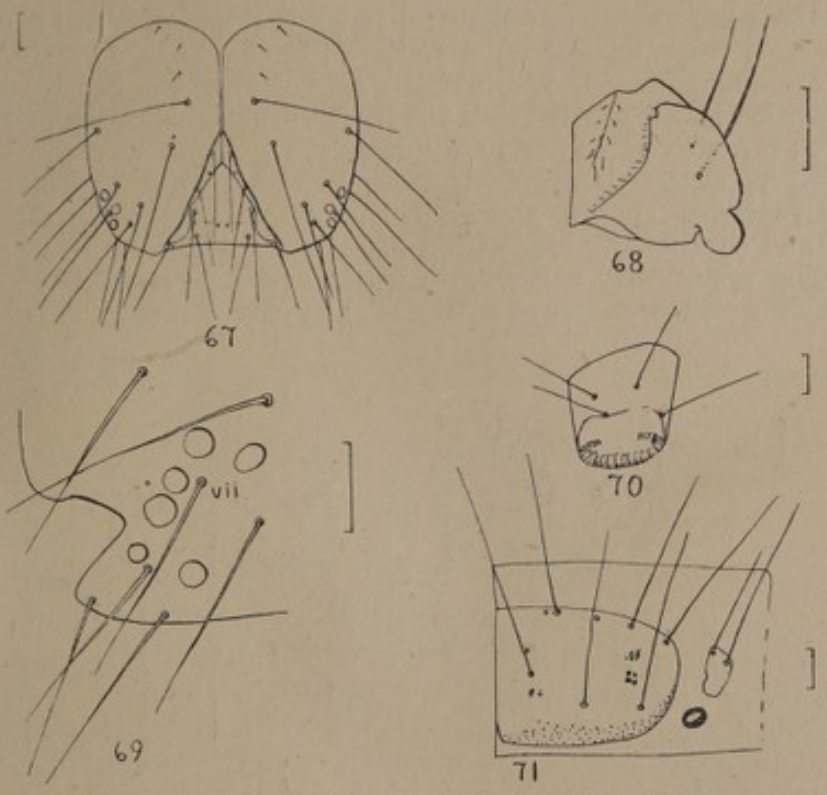
From the other PYRALINAE dealt with here, this may be distinguished by having only four ocelli on each side of the head and by having the outer boundaries of the adfrontals joining the coronal suture at a point about half way between front and vertical triangle.

Hypsopygia costalis (F.)

(Figs. 67–71).

Mature Larva.—Length, 15–17 mm.; breadth, 2–3 mm. Cuticle pale brown to black. Head moderately pale reddish-brown with a few irregular, usually longitudinal, dark brown patches on basal half; apical part of mandibles and meso-ventral, margin very dark brown to black. Pronotal sclerite, legs, crochets, and setae yellowish to reddish-brown. Peritreme of spiracles dark brown to black. Thorax and abdomen very variable in colour but usually yellowish-brown or olive-brown with dorsal and ventral surface very densely mottled with dark olivaceous to black

patches ; non-sclerotised parts of thorax and abdomen very densely and regularly set with flat-topped, irregularly hexagonal, feebly elevated, microscopic asperities. *Head* (fig. 67) with front extending slightly more than one-third of distance to vertical triangle and boundaries of adfrontals joining coronal suture at a point about three times as far from vertical triangle as from front. Each side with six ocelli (fig. 69).



Figs. 67–71. *Hypsopygia costalis* (F.).—(67) Head. (68) Ventro-mesal view of left mandible. (69) Ocellar region. (70) Pi group of tenth abdominal segment. (71) Prothorax.

Mandible (fig. 68) with two moderately developed apical teeth and with a large but appressed, bifid, subapical, ventral tooth. *Spiracles* of 8 obovate with vertical diameter distinctly greater than horizontal (6 : 4), much longer than spiracles of 7 (6 : 4), and with caudal margin only distinctly thicker than anterior ; spiracles of 1–7 slightly more broadly oval than those of 8 and with caudal margin of each noticeably thicker than anterior margin ; spiracles of 1 and 7 are slightly but distinctly larger than intermediate ones ; spiracles of I similar to those of 8. *Legs* with front coxae nearly contiguous, separated by a seventh or less of breadth of a front coxa ; middle coxae about two or three times and hind coxae about three or four times as widely separated as front ones. Prolegs with crochets biordinal, the small crochets only a fourth as long as the large ones, and those of four anterior pairs of prolegs arranged in a complete circle. *Chaetotaxy* similar to that of *Pyralis farinalis* except as already mentioned in the key. In addition, Pi group of 3–6 has nu slightly further from pi than is tau.

Earlier Instars.—The smallest larva available is 8 mm. long. This specimen is similar to the mature larva, but the spiracles are more broadly oval and the cuticle of the thorax and abdomen is considerably paler than appears to be usual in fully grown specimens.

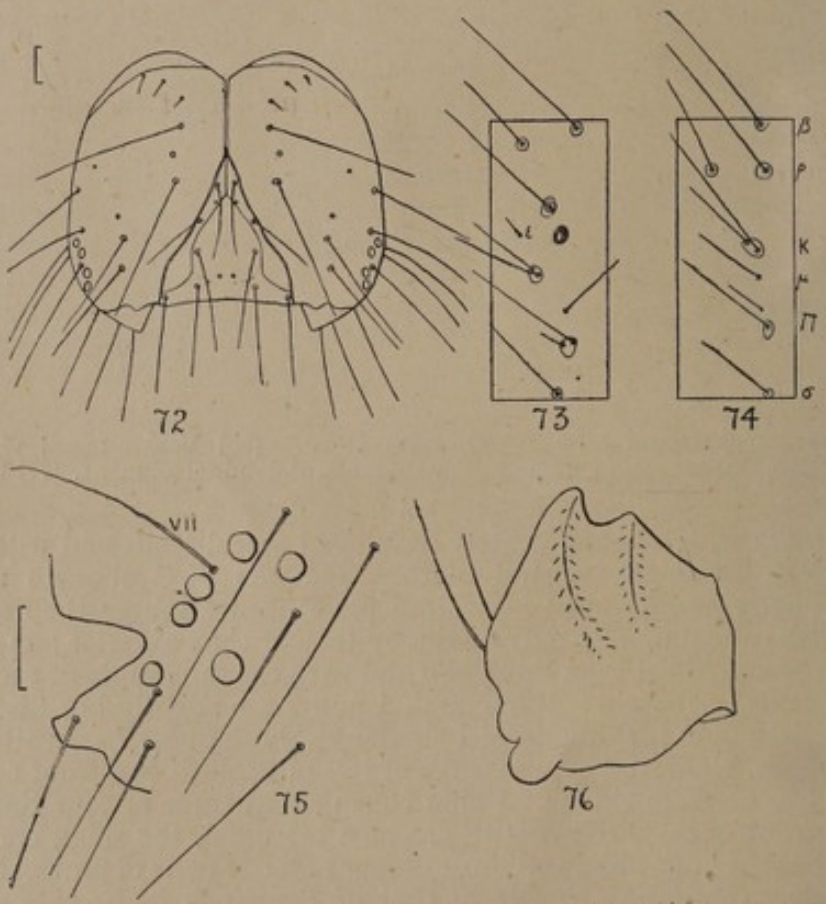
In colour and general appearance this larva resembles that of *Aglossa caprealis* (Hbn.) from which, however, it may be easily distinguished by the unisetose instead

of bisetose Pi group of 9, the position of seta vii on the head, and the large, appressed, subapical, ventral tooth on the mandible.

Aglossa pinguinalis (L.)

(Figs. 72–76).

Mature Larva.—Length, 20–35 mm.; breadth, 2·5–4·0 mm. Cuticle rather variable in colour but usually as follows: head, mouth-parts, dorsal sclerites of I and 10, parts of legs, crochets, and setae yellowish-brown to moderately pale reddish-brown; apices of mandibles and peritreme of spiracles black or nearly so; thorax and abdomen greyish-white to nearly black, the thorax usually being distinctly darker than the abdomen; non-sclerotised parts very densely, regularly, microscopically asperate and with larger, oval, sclerotised depressions which form irregular but usually symmetrical patterns. Thorax and abdomen of some specimens moderately dark olive-brown and occasionally also with a distinct reddish tint. *Head* (fig. 72) with front extending very nearly half way to vertical triangle and lateral boundaries of adfrontals joining coronal suture at a point slightly less than twice as far from vertical



Figs. 72–76. *Aglossa pinguinalis* (L.).—(72) Head. (73) Eighth abdominal segment. (74) Ninth abdominal segment. (75) Ocellar region. (76) Ventro-mesal view of right mandible.

triangle as from front. Each side with six ocelli (fig. 75). Mandible (fig. 76) with two moderately well developed apical teeth; outer ventral margin deeply and broadly sinuate before base. *Spiracles* of 8 broadly oval with vertical diameter slightly but distinctly greater than horizontal, nearly twice as large as those of 7, and with caudal part of peritreme one and a half to two times as broad as anterior part;

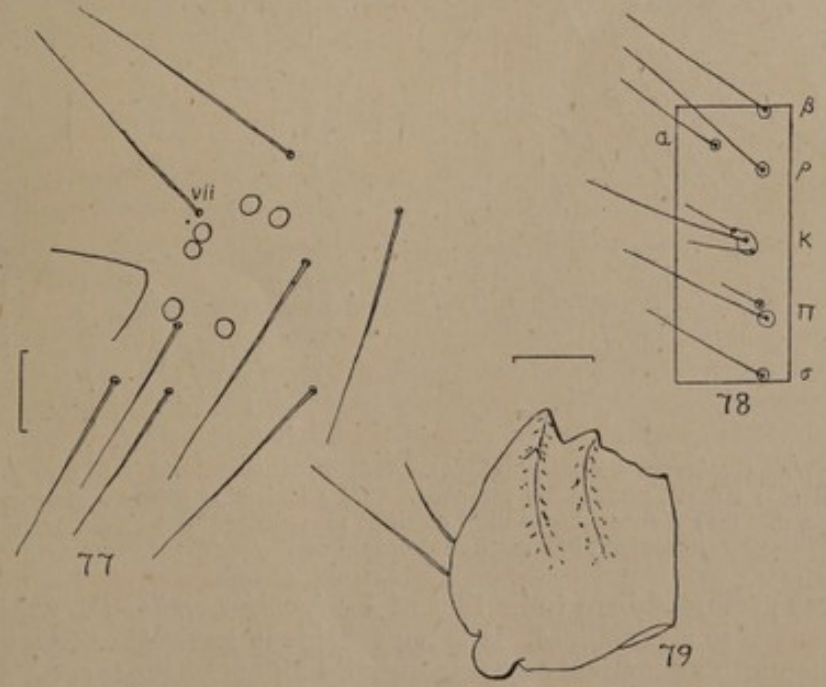
spiracles of 1–7 nearly round, those of 2–7 being slightly smaller than those of 1 ; spiracles of I similar but slightly larger than those of 8. *Legs* with front coxae separated by about a third breadth of a front coxa and middle and hind coxae separated by about breadth of coxae. Prolegs with crochets biordinal, the small crochets only a fourth or third as long as large ones, and those of four anterior pairs of prolegs arranged in a complete circle. *Chaetotaxy* as follows : Head (fig. 72) with frontal puncture slightly nearer to caudal clypeal seta than to frontal seta ; seta vii between second and third ocelli but slightly nearer third than second. Pi group of I bisetose with setae in a horizontal line ; II–III unisetose ; 1–2 trisetose with setae in a transverse line but with nu slightly anterior to pi and tau ; 3–6 trisetose with nu antero-lateral to pi and distinctly nearer to pi than is tau to pi ; 7 bisetose with nu lateral and slightly anterior to pi ; 8 bisetose with nu anterior and slightly mesal to pi ; 9 (fig. 74) bisetose with nu lateral and very slightly anterior to pi ; 10 with caudal setae more lateral as well as more mesal than anterior setae. Ninth (fig. 74) with alpha more or less directly anterior to rho ; mu directly ventral to kappa and much further from the latter than is eta which is antero-dorsal to kappa ; eta and kappa on same pinnaculum.

The bisetose Pi group of the ninth abdominal segment will serve to distinguish this larva from the other species of PYRALINAE dealt with here except *Aglossa caprealis* (Hbn.), but from the latter it is easily distinguished as shown in the key. The deep and broad sinuation near base of outer ventral margin of the mandible is an important diagnostic character for this species.

Aglossa caprealis (Hbn.)

(Figs. 77–79).

Mature Larva.—Length, 25 mm. ; breadth, 3 mm. Colour similar to that of *Hypsopygia costalis* (F.) but often with a distinct bronzy lustre. Structure and chaetotaxy essentially similar to that of *A. pinguinalis* except as noted in the key. The spiracles are less broadly oval than in *A. pinguinalis* and the vertical diameter of



Figs. 77–79. *Aglossa caprealis* (Hbn.).—(77) Ocellar region. (78) Ninth abdominal segment. (79) Ventro-mesal view of right mandible.

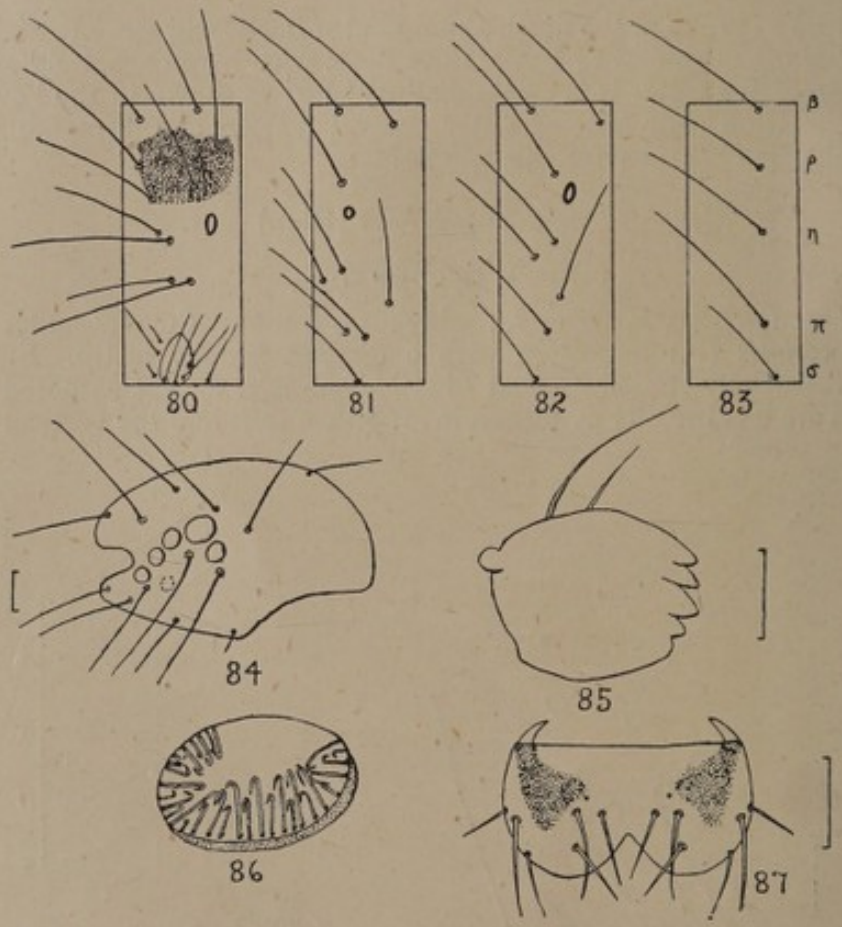
each is considerable greater than the horizontal. Only one blown specimen has been examined, and it is not possible to compare the arrangement of the Pi group of 10 with that of *A. pinguinalis*.

Crambinae.

The larvae of this sub-family cannot easily be characterised. According to Fracker (1915), they may be divided into two distinct groups as follows : (1) kappa and mu of 9 absent or extremely minute and eta large and not associated with other setae, Pi group of II unisetose, and crochets triordinal and arranged in a complete circle ; and (2) similar to above but with crochets biordinal and arranged in a penellipse. From the Pyraustinae the latter group of the Crambinae can only be distinguished by having biordinal instead of triordinal crochets, a character which is subject to great variation even within the same species and cannot therefore be considered to be satisfactory for separating two subfamilies.

Euchromius ocellea (Haw.)

(Figs. 80–87).



Figs. 80–87. *Euchromius ocellea* (Haw.).—(80) Prothorax. (81) Seventh abdominal segment. (82) Eighth abdominal segment. (83) Ninth abdominal segment. (84) Left side of head. (85) Ventro-mesal view of right mandible. (86) Diagrammatic view of crochets of fourth abdominal proleg. (87) Labrum.

The larvae presumed here to be that of *Euchromius ocellea* (Haw.) has triordinal crochets arranged in a penellipse. It is remarkable in having not only kappa and mu absent on the ninth abdominal segment but also alpha. This is apparently the only known larva in the superfamily Pyralidoidea (*sensu* Fracker) in which alpha of 9 is lost.

Mature Larva.—Length, 14 mm.; breadth, 3·5 mm. Cuticle pale yellowish-white except as follows: dorsal surface of head black with seven large pale yellowish patches, one on middle of front, one each side between frontal suture and ocelli, one each side directly behind the latter near hind margin, and one each side partly enclosed by ocelli; ventral surface of head with a few irregular dark markings, the more conspicuous of which is a mesal, oblong, black patch on each side opposite cardo; mandibles black or very dark brown but other mouthparts pale brown; pronotum with a large, broadly oval, black patch on each side (fig. 80): spiracles with peritreme black or very dark brown; setae brown but with Pi group and sigma of 3–6 black or nearly so. *Head* with front extending to caudal fourth and adfrontals extending nearly to vertical triangle so that coronal suture is only about as long as breadth of largest ocellus. Each side with five well developed ocelli and one rudimentary ocellus arranged as shown in fig. 84. *Spiracles* of 8 obovate with vertical diameter much greater than horizontal and nearly twice as large as those of 7; spiracles of 1–7 nearly round and approximately equal in size; spiracles of I nearly as large as those of 8 and obovate with vertical diameter distinctly greater than horizontal. *Legs* with coxae of I contiguous, of II separated by about a third breadth of middle coxa, and of III separated by half breadth of hind coxa. Prolegs with crochets usually biordinal, occasionally triordinal, and arranged in a penellipse (fig. 86). *Chaetotaxy* as shown in figs. 80–84. Head with frontal puncture nearly as caudal as frontal seta and very much more distant from caudal clypeal seta than from frontal seta. Pi group of I bisetose with setae in a horizontal line; II–III unisetose; 1 bisetose; 2 trisetose with setae forming an equilateral triangle the apex of which is caudal; 3–6 trisetose with nu anterior and only slightly mesal to pi and about as far from pi as from tau, nu being directly lateral (or dorsal) to tau; 7 bisetose with the two setae in a longitudinal row; 8–9 unisetose, ninth (fig. 83) with alpha, kappa, and mu absent and eta large and not associated with other seta.

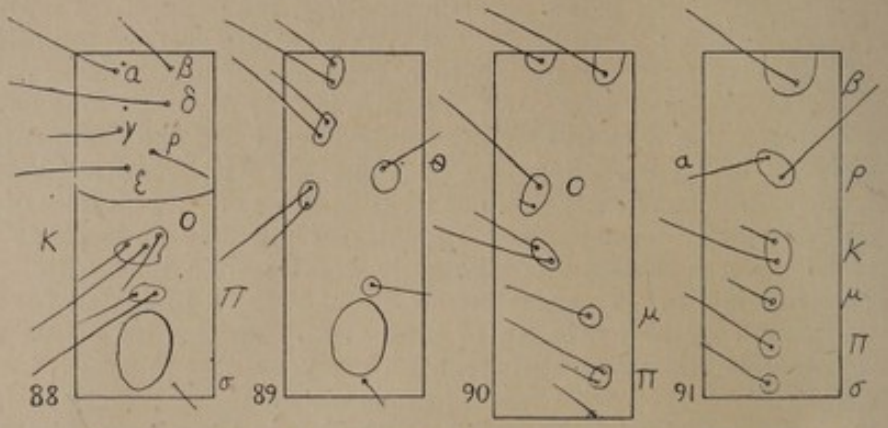
The above description is based on a single larva (presumed to be this species because *E. ocellea* is the only species of CRAMBINAE known to be associated with stored food) which appears to be mature. It was found in a warehouse in Cheshire; Frodsham, ii.1943 (*J. M. Holborn*). *E. ocellea* is the only species dealt with here which has the crochets arranged in a penellipse and lacks alpha, kappa, and mu on the ninth abdominal segment.

TORTRICIDAE.

The larvae of this family have the front extending one-fourth to three-fourths of the distance to the vertical triangle and the adfrontals reach or nearly reach the vertical triangle. There are six distinct ocelli on each side. The spiracles are round or broadly oval. Prolegs are always present on segments 3–6 and 10, and the four anterior pairs have the crochets arranged in complete circles, the crochets being either uni- or biordinal. An anal fork is often present. The Kappa group of the prothorax is always trisetose, and Pi of the eighth abdominal segment is always bisetose except in the Phaloniinae where it is unisetose. Seta rho of the eighth abdominal segment is directly anterior to the spiracle except in a few rare cases.

The larvae are structurally very similar to the GELECHIIDAE and OECOPHORIDAE. However, only a few genera, *e.g.*, *Nothris*, *Hypsolophus*, *Dasystoma*, etc., of the latter families have rho of the eighth abdominal segment directly anterior to the spiracle, and, when this is the case, Pi of 8 is apparently always unisetose. Most of the GELECHIIDAE and OECOPHORIDAE have Pi of 8 unisetose, but exceptions are known, *e.g.*, *Depressaria*. On 9 the beta setae are close together, often on the same pinnaculum, whereas in the GELECHIIDAE and OECOPHORIDAE these setae are usually rather widely separated, seldom being on the same pinnaculum. Many genera of both the TORTRICIDAE and GELECHIIDAE have a well developed anal fork.

The larva of the codling moth, *E. pomonella* (L.) and related species of *Enarmonia* are sometimes found in warehouses, having been brought in with fruits and seeds. They may be distinguished from all other species dealt with here by possessing the following combination of characters : Kappa of prothorax trisetose ; rho of 8 directly anterior to spiracle ; Pi of 8 bisetose ; and anal fork absent. *E. nigricana* (F.) has not been seen, but it is included in the key on characters given by Fracker (1915).



Figs. 88–91. *Enarmonia pomonella* (L.).—(88) Prothorax. (89) Mesothorax. (90) Eighth abdominal segment. (91) Ninth abdominal segment.

Gelechiidae.

The distinguishing features of this family have been summarised by Fracker (1915) and more fully by Benander (1937). The single Gelechiid, *Sitotroga cerealella*, Oliv., considered in this paper is an extremely specialised form adapted to feeding inside grain kernels where all instars except the first are found. The mature larva is 4–7 mm. long, strongly curved, with thorax much stouter than abdomen, which is gradually narrowed behind, and white with head pale brown and mandibles moderately dark reddish brown. From all other moth larvae associated with stored products it may be distinguished by its short, narrow, and often very indistinct prolegs, each of which has only two widely separated crochets.

Cosmopterygidae.

Detailed descriptions of the larvae of this family are too few to make it possible to select a character or a combination of characters which will serve to distinguish the larvae from those of all other families. The characterisation of the family given by Fracker (1915) excludes in nearly every particular *Pyroderces rileyi*.

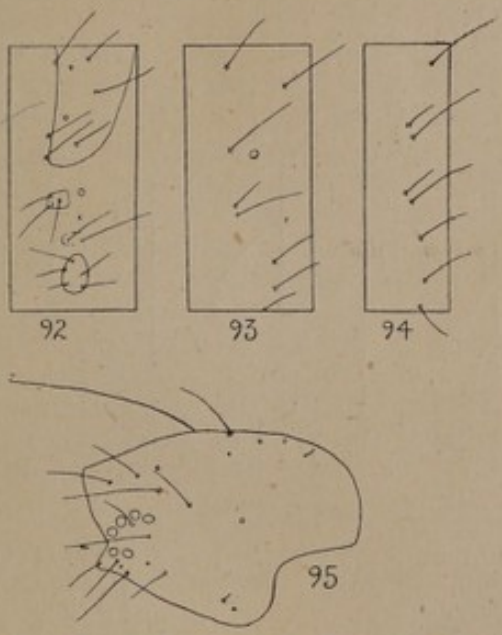
Pyroderces rileyi (Wals.)

(Figs. 92–95).

The description given below is based on that of Busck (1917) and Heinrich (1921) and on the illustrations given by these two authors.

Mature Larva.—Length, 7–8 mm. Cuticle deep wine red except as follows : setae and sclerite of 10 pale brown ; head pale brown with blackish mouth-parts ; pronotal sclerite strongly sclerotised and dark brown. *Head* with front extending about four-fifths of distance to vertical triangle ; adfrontals extending to vertical triangle. Epipharynx with three large spines on each side. Mandible with four large, acute, apical teeth and a fifth less well developed, apically rounded, mesal tooth. Each side with six distinct ocelli. *Legs* normal. Prolegs with crochets unevenly biordinal and those of four anterior pairs arranged in a complete circle, each proleg

having 20–24 crochets. *Chaetotaxy* as follows: Head with frontal puncture far removed from caudal clypeal seta and nearly opposite frontal seta; puncture between setae i and ii about three times as far from ii as from i; seta vii directly ventral to second ocellus and caudal to third. Prothorax with beta slightly nearer to alpha than to delta and very slightly less caudal than delta; gamma three times as far from alpha as from epsilon; rho more or less equally distant from gamma and epsilon and further from both than epsilon is to gamma; Kappa group with eta nearly directly dorsal to kappa and theta caudo-dorsal to kappa. Pi group of I bisetose with setae in a horizontal line; II–III unisetose; 1–6 trisetose, nu of 3–6 being antero-lateral to pi; 8–9 unisetose. Ninth abdominal segment (fig. 94) with alpha antero-dorsal to rho and much nearer to the latter than to beta; beta setae nearer to each other than to alpha; Kappa group with eta antero-dorsal to kappa and only a third as far from the



Figs. 92–95. *Pyroderces rileyi* (Wals.).—(92) Prothorax. (93) Eighth abdominal segment. (94) Ninth abdominal segment. (95) Left view of head. (After Heinrich.)

latter as is mu which is nearly directly ventral to kappa. Eta and kappa of 1–8 in a nearly vertical line with kappa ventral and also sometimes slightly caudal to eta. Rho of 8 (fig. 93) nearly directly anterior to spiracle and rho of 1–7 dorsal to spiracle; 1–8 with epsilon absent. Pinnaculae absent or indistinct.

From all other larvae dealt with in this paper which have Kappa of the prothorax trisetose and eta and kappa of the abdomen adjacent, this may be distinguished by having eta of I directly dorsal to kappa and Pi or 8–9 unisetose instead of bisetose.

Oecophoridae.

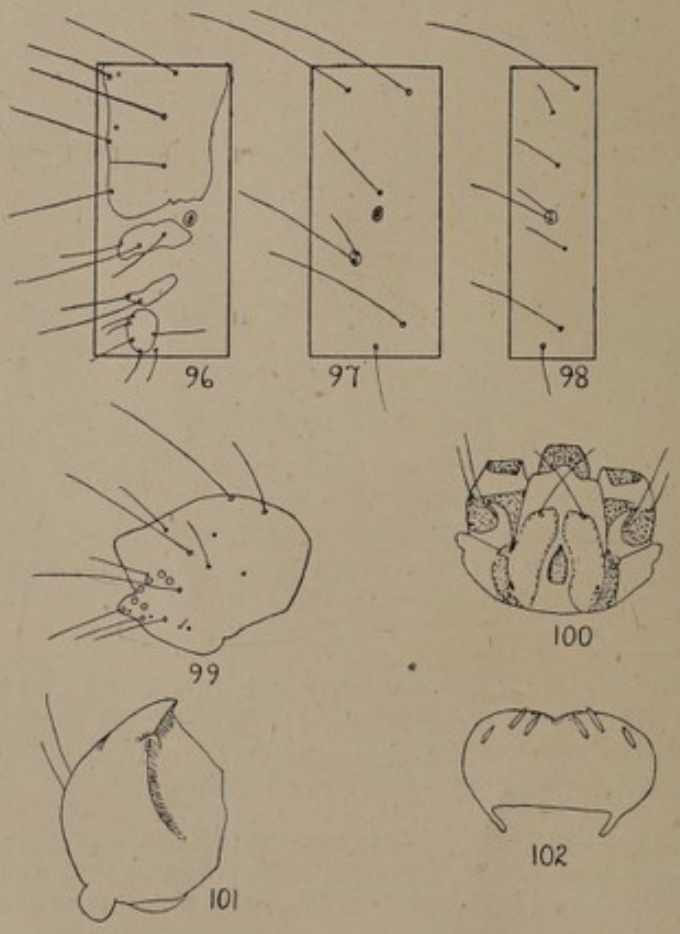
Head with six ocelli on each side except in *Hofmannophila* and *Endrosis* which have four and two respectively. Adfrontals nearly always extending to vertical triangle, but in all instars of *Endrosis* and other genera ending considerably before vertical triangle. Epipharynx with three large spines on each side. Labium sometimes (*Anchonoma, Endrosis, Dasycera*) with a median basal pit. Spiracles round or oval with vertical diameter greater than horizontal. Spiracles of 8 sometimes two or three times as large as those of 7. Thoracic legs always well developed. Prolegs short,

stout, and well developed ; crochets in a complete circle and usually biordinal except in the first one or two instars where they are uniordinal. Anal fork absent. Chaetotaxy as follows : Kappa of I trisetose with setae usually arranged in a horizontal line. Rho of 1–8 dorsal to spiracle, often very slightly antero-dorsal. Kappa and eta of 1–8 are close together and often, as in *Anchonoma*, *Endrosis* and *Hofmannophila*, arranged in a vertical row below and slightly anterior to spiracle. Pi of 8 unisetose. Alpha of 9 more lateral than beta but closer to beta than to rho.

Anchonoma xeraula, Meyr.

(Figs. 96–102).

No larvae of this species have been seen. The description given below is based on that of Heinrich (1920).



Figs. 96–102. *Anchonoma xeraula*, Meyr.—(96) Prothorax. (97) Eighth abdominal segment. (98) Ninth abdominal segment. (99) Left side of head. (100) Ventral view of labium to show postmental pit. (101) Ventro-mesal view of right mandible. (102) Ventral view of labrum. (After Heinrich.)

Mature Larva.—Length, 22–23 mm. ; breadth, 2·0–2·5 mm. Cuticle white except as follows : Setae whitish yellow. Head blackish-brown, paler brown in ocellar, sub-ocellar, frontal, and adfrontal areas ; mandibles paler brown, except at tip and along ridges, than dark parts of head ; mentum blackish brown ; and other

sclerotised areas of labial and maxillary parts yellow-brown. Prothorax with dorsal, pre-spiracular, and Pi sclerites evenly dark brown. Mesothorax with a brown sclerite bearing a minute seta on each side on antero-dorsal intersegmental area ; sclerotised area about alpha slightly brownish. Abdomen with sclerite of 10 yellowish-brown. Legs with sclerotised areas brownish-yellow to dark brown ; front margin of coxae blackish ; prolegs with crochets pale brown. Spiracles rimmed with black. *Head* with front extending slightly less than half of distance to vertical triangle and lateral boundaries of adfrontals joining coronal suture at a point about three times as far from vertical triangle as from front. Each side with six distinct ocelli (fig. 99). Mandible (fig. 101) with a single large apical tooth and a subapical notch or rudimentary tooth on ventral side of large tooth. Labium (fig. 100) with a large, obovate, concave sclerotisation on submentum. *Spiracles* broadly oval, those of 8 twice as large as those of 1–7 and approximately as large as those of I. *Legs* normal. Prolegs with crochets unevenly and irregularly triordinal ; four anterior pairs with crochets arranged in complete circles and each with 45–50 crochets. *Chaetotaxy* as follows : Head with frontal puncture slightly nearer to frontal than to caudal clypeal seta ; puncture between setae i and ii much nearer to ii than to i ; seta vii (fig. 99) near and directly dorsal to third ocellus. Prothorax (fig. 96) with beta very slightly more caudal than delta and nearer to the latter than to alpha ; gamma only slightly nearer to alpha than to epsilon ; rho nearly as far from epsilon as from gamma and nearly as distant from the two latter as they are from each other ; Kappa setae with eta and kappa in a nearly horizontal line with eta nearer to kappa than is theta which is caudo-dorsal to kappa. Pi group of I bisetose with setae in a nearly horizontal line ; II–III unisetose ; 3–6 trisetose with nu antero-mesal to pi ; 7 bisetose ; 8–9 unisetose. Ninth abdominal segment (fig. 98) between and anterior to rho and beta but distinctly nearer the latter ; Kappa setae in a nearly vertical line, kappa and eta being on same pinnaculum and eta only about a fifth as far from kappa as is mu. Eta and kappa of 1–8 (fig. 97) in a vertical or nearly vertical line with eta dorsal to kappa and both on same pinnaculum or tubercle.

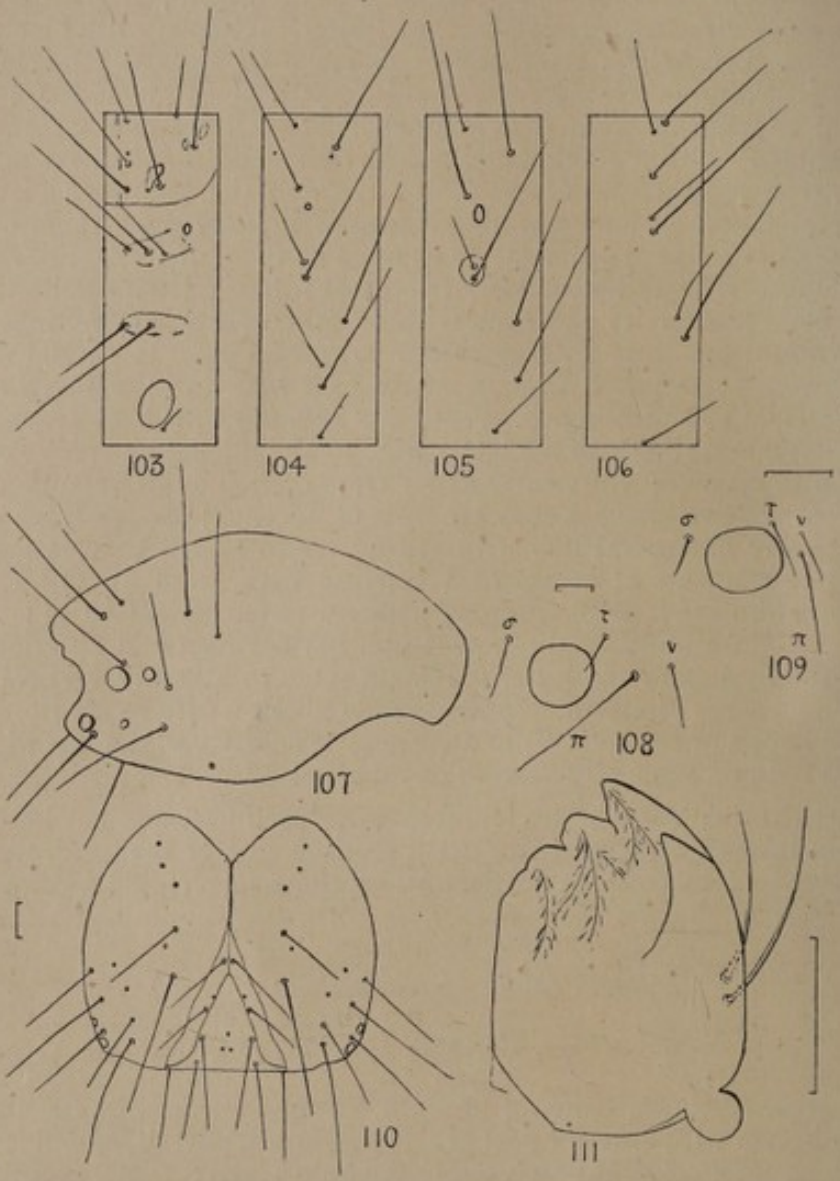
From the two other Oecophorids found in stored products, this may be distinguished by having six instead of four or two ocelli on each side of the head, mandible with only one instead of three large teeth, and crochets unevenly triordinal instead of biordinal.

Hofmannophila pseudospretella (Staint.)

(Figs. 103–108, 110–111, 114).

Mature Larva.—Length, 16 mm. ; breadth, 3 mm. Cuticle white except as follows : head reddish-brown with anterior part of clypeus, apical part of mandibles, and sometimes an oblong meso-ventral patch opposite cardo black ; setae, mouth-parts, prothoracic tergite as well as sclerite anterior to spiracle of I, tergite of 10, peritreme of spiracles, parts of legs, and crochets moderately pale brown. *Head* with four ocelli (fig. 107), but in a few specimens first and second are not fused and there are five ocelli. Adfrontals (fig. 114) produced to a fine point caudally and extending as a narrow line in epicranial suture to, or nearly to, vertical triangle. Frontal puncture (fig. 110) only slightly nearer to frontal than to caudal clypeal seta. Labium without a pit. *Spiracles* of 8 usually distinctly oval with vertical diameter greater than horizontal, sometimes reniform with vertical diameter twice as great as horizontal, and sometimes round or nearly so ; spiracles of 7 only one-third to one-half as large as those of 8 and round or oval ; spiracles of 1–6 similar to those of 7 ; spiracles of I less than twice as large as those of 1 and feebly oval to reniform. *Legs* without a gibbosity on ventral (or inner) side of front trochanters. Prolegs with crochets biordinal. *Chaetotaxy* as shown in figs. 103–108, 110. Pi group of 1 bisetose, 2–6 trisetose, 7 bisetose, and 8–9 unisetose. Pi group of 3–6 with nu dorsal (or lateral) to pi.

Earlier Instars.—First and second (?) instars differ from more mature larvae in having uniordinal instead of biordinal crochets as well as having fewer crochets on each proleg. The adfrontals do not extend posteriorly beyond about caudal two-fifths of head, and the adfrontal area is not delimited laterally by a distinct suture.



Figs. 103–111.—(103) Prothorax of *Hofmannophila pseudospretella* (Staint.). (104) Seventh abdominal segment of same. (105) Eighth abdominal segment of same. (106) Ninth of same. (107) Left side of head of same. (108) Pi group of third abdominal segment of same. (109) Same of *Endrosis sarcitrella* (L.). (110) Head of *H. pseudospretella*. (111) Ventro-mesal view of left mandible of same.

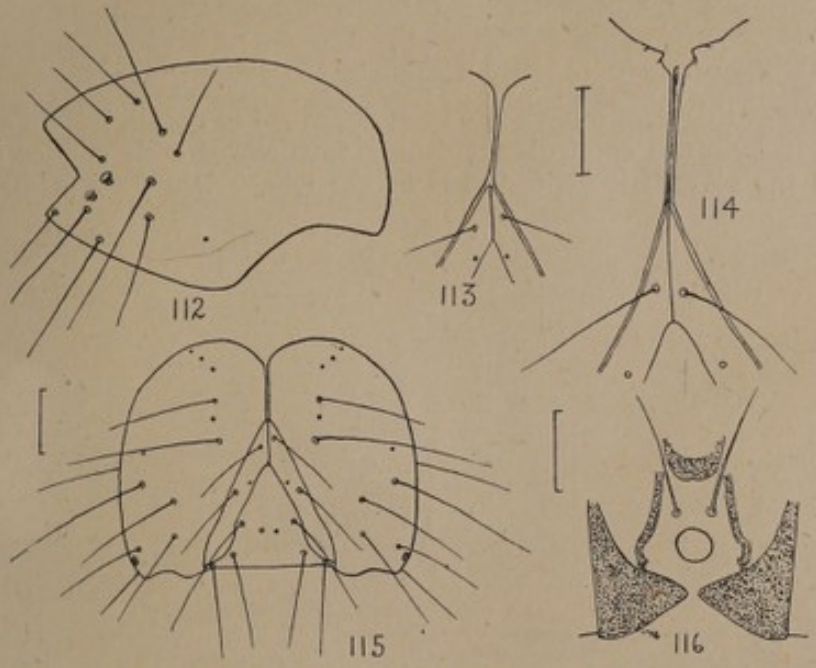
Lepesme (1938) has described the differences between the adults of *Hofmannophila* and *Borkhausenia*. Although he has used *B. stipella* (L.) (a congener of the genotype of *Borkhausenia, B. minutella* L.) for his comparison with *H. pseudospretella*, the differences he describes are sufficient for the removal of *pseudospretella* from *Borkhausenia*. The larva of *B. stipella* has been briefly described by Benander (1937), and a comparison of this larva with that of *H. pseudospretella* supports the conclusion, arrived at by a study of the adults, that the two species belong in different genera. The larva of *Borkhausenia* differs from that of *Hofmannophila* in having six instead of

four ocelli and in having the adfrontals fully developed and extending on a broad front to the vertical triangle instead of being reduced caudally (fig. 110).

The larva of *Hofmannophila* is evidently less specialised than that of *Endrosis*, and, as regards both the reduction of the ocelli and adfrontals, is an annectant link between most of the OECOPHORINAE and *Endrosis*.

Endrosis sarcitrella (L.)

(Figs. 109, 112–113, 115–116).



Figs. 112–116.—(112) Left side of head of *Endrosis sarcitrella* (L.). (113) Enlarged view of caudal region of adfrontals and coronal suture of same. (114) Same of *Hofmannophila pseudospretella* (L.). (115) Head of *E. sarcitrella*. (116) Labium of same to show postmental pit.

Mature Larva.—Length, 10–11 mm.; breadth, 1·5–2·0 mm. Externally nearly identical to *H. pseudospretella* in colour. The principal structural differences between the two species are as indicated in the key.

Earlier Instars.—No first instar larvae are available, but the second (?) instar differs from the more mature larvae in having the rim of the labial pit only indistinctly sclerotised. It is probable that in the first instar the crochets will be uniordinal and fewer in number.

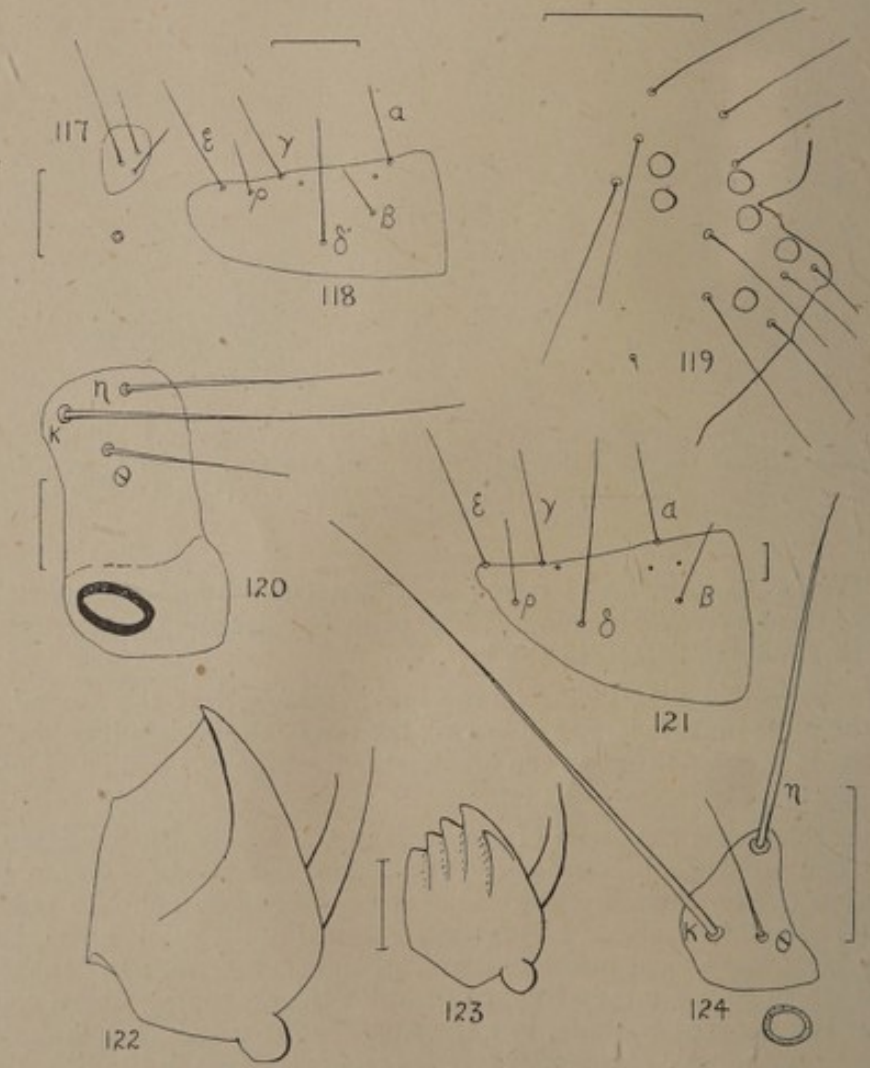
Fracker (1915) places the larva of *Endrosis* in the family BLASTOBASIDAE rather than in the OECOPHORIDAE because according to him seta rho of 8 is caudo-dorsal to the spiracle and the crochets are uniordinal instead of biordinal. In point of fact, however, seta rho of 8 (and also of 1-7) is antero-dorsal to the spiracle and the crochets are distinctly biordinal except in the first and second (?) instars. In Fracker's (1915) key *Endrosis* traces to the family STENOMIDAE, as the adfrontals and a considerable distance from the vertical triangle, but the fact that it traces to this family is due only to a defect in his key. Benander (1937) places *Endrosis* in the BLASTOBASINAE, and his characterisation of the larvae of this group is based entirely on *Endrosis sarcitrella* (L.), the larvae of typical genera of the BLASTOBASINAE being unknown to him. However, a comparison of the larva of *Endrosis sarcitrella* with such typical OECOPHORINAE as *Harpella forficella*, Scop., *Alabonia bractella* (L.) and *Dasycera*

sulphurella, F., shows clearly that *Endrosis* should remain in the OECOPHORINAE. The larva of *Dasycera sulphurella* possesses on the basal part of the labium a deep, heavily sclerotised pit which would appear to be homologous to the peculiar labial pit of *Endrosis*. This larva is also similar to *Endrosis* in possessing a prominent gibbosity on the inner side of the front trochanter. Furthermore, all those who have based their conclusions on a study of adult structures agree in placing *Endrosis* in the OECOPHORINAE.

The larva of *Endrosis* may be distinguished from all other known OECOPHORIDAE by having only two instead of four or six ocelli and the adfrontals much shortened caudally so that there is a long epicranial suture.

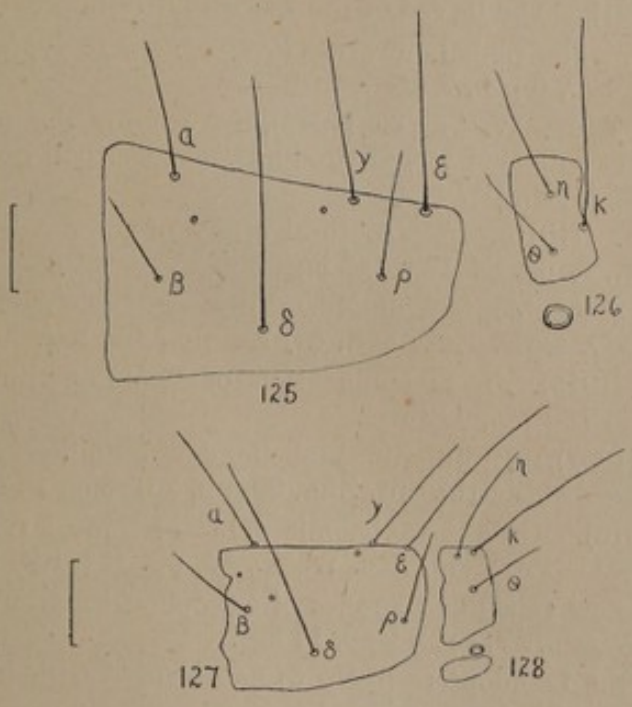
TINEIDAE.

The members of this family have not been described in detail, but an attempt has been made to include the chief distinguishing features of each species in the key. In addition to the seven species included in the key, *Tinea parasitella*, Hbn., and



Figs. 117–124.—(117) Kappa group of prothorax of *Tinea granella* (L.). (118) Prothorax of same. (119) Ocellar region of same. (120) Kappa group of prothorax of *Lindera tessellatella*, Blanch. (121) Prothorax of same. (122) Ventro-mesal view of left mandible of same. (123) Same of *Tinea ditella*, Pierce & Metcalfe. (124) Kappa group of prothorax of same.

Scardia boleti, F., have been examined, and from a study of all of these it appears that the family characters are as follows: Head with adfrontals extending to or nearly to the vertical triangle, and front extending one-third to three-fourths of the distance to the vertical triangle. Ocelli vary in number from one to six or are altogether absent (*Tineola*), but when six are present, the first and second are in a vertical line and are considerably caudad to the third and fourth, which are also in a vertical line, an arrangement typical also of the family AEGERIIDAE. Epipharynx with three large, subapical spines on each side. Mandibles each with one to five apical teeth. Maxillary mala with three large, ventro-mesal spines. Spiracles round or oval with the vertical diameter greater than the horizontal and usually moderately large and conspicuous. Thoracic legs well developed; Prolegs present on 3–6 and 10, and each of four anterior pairs with a complete circle of uniordinal crochets. Anal fork absent. Chaetotaxy as follows: Kappa group of prothorax trisetose; alpha setae on 1–8 further apart than beta setae except in *Scardia*; and kappa and eta of 1–8 always very widely separated and in a horizontal or a vertical line, but if in a vertical line with kappa directly caudal to spiracle; Pi and Sigma setae of 8–9 sometimes much reduced or absent.



Figs. 125–128.—(125) Prothorax of *Tinea pallescentella* Staint. (126) Kappa group of prothorax of same. (127) Prothorax of *Tinea pellionella* (L.). (128) Kappa group of prothorax of same.

The trisetose Kappa group of the prothorax combined with the very widely separated kappa and eta of the first eight abdominal segments will serve to distinguish the members of this family from those of all others dealt with in this paper. The two chief family characters mentioned by Fracker (1915), *i.e.* setae alpha nearer together than beta on abdomen and the close approximation of the Kappa setae of the prothorax, are characters confined to a few genera.

It is clear from a study of the larvae that the genus *Tinea* contains many unrelated species, a fact borne out by a study of the genitalia of the adult males. If the few species which have been studied were divided into genera on the basis of larval characters, *T. pallescentella* and *T. pellionella* could probably be included in the same genus, but the three remaining species would be in three different genera.

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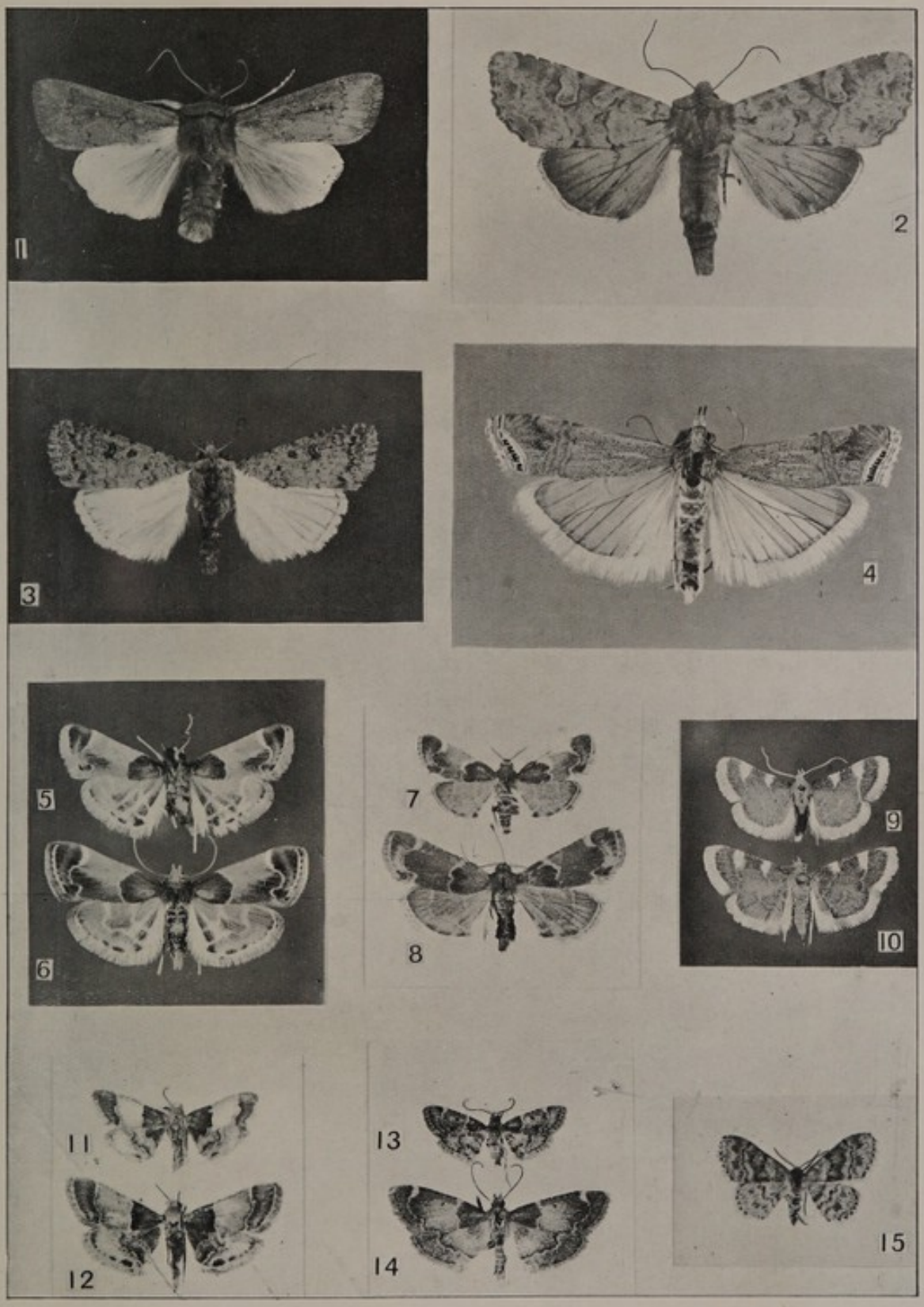
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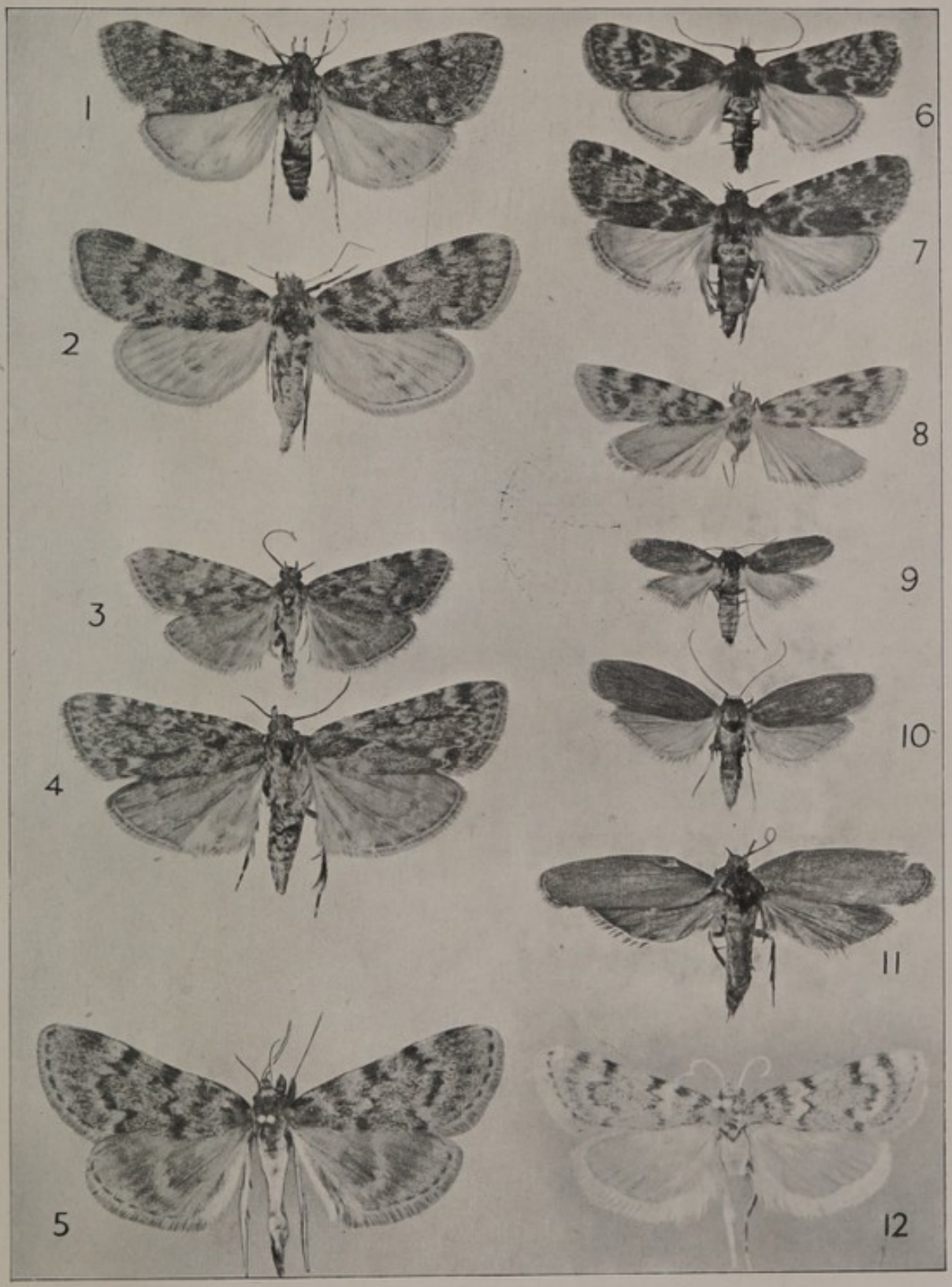
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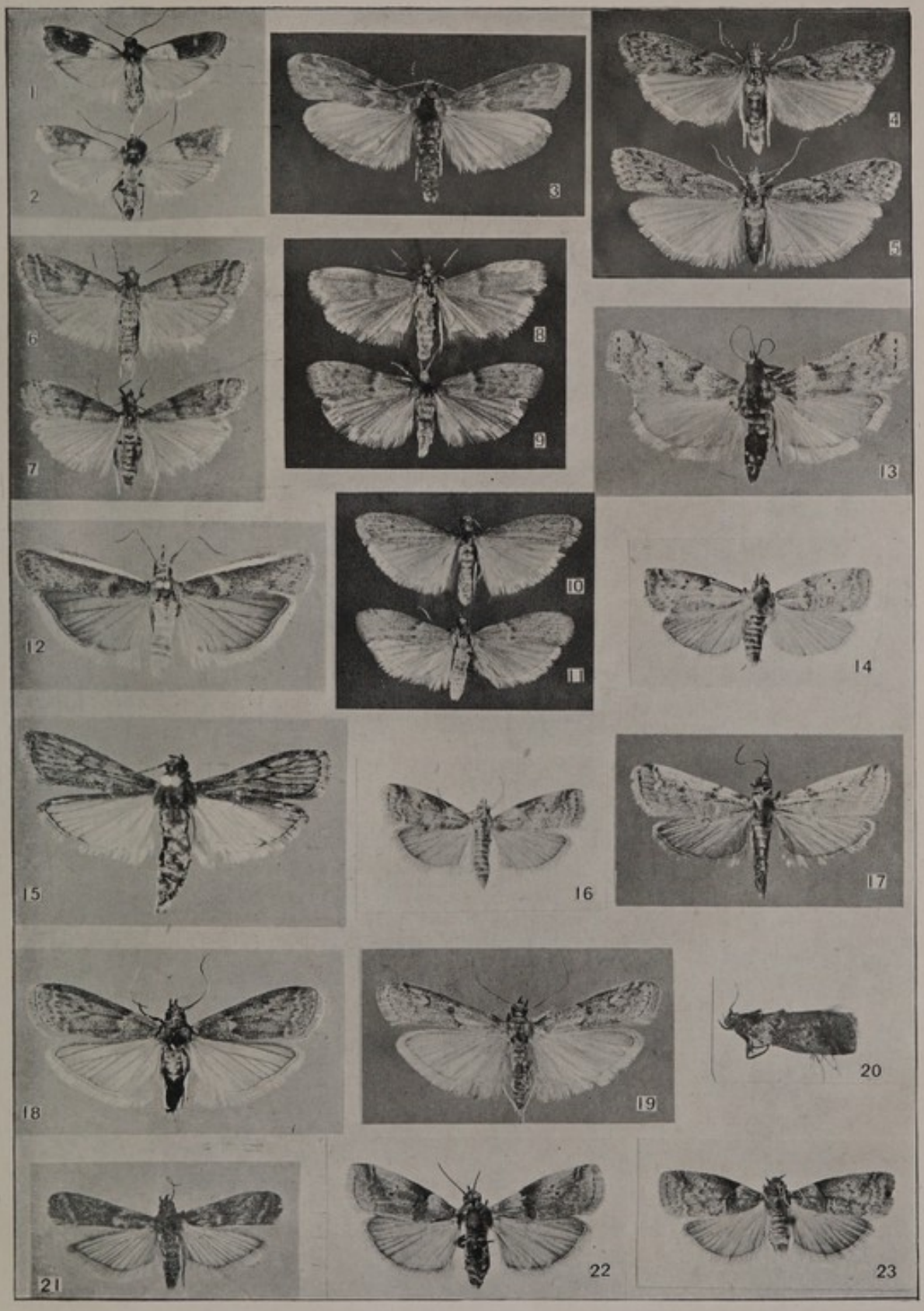
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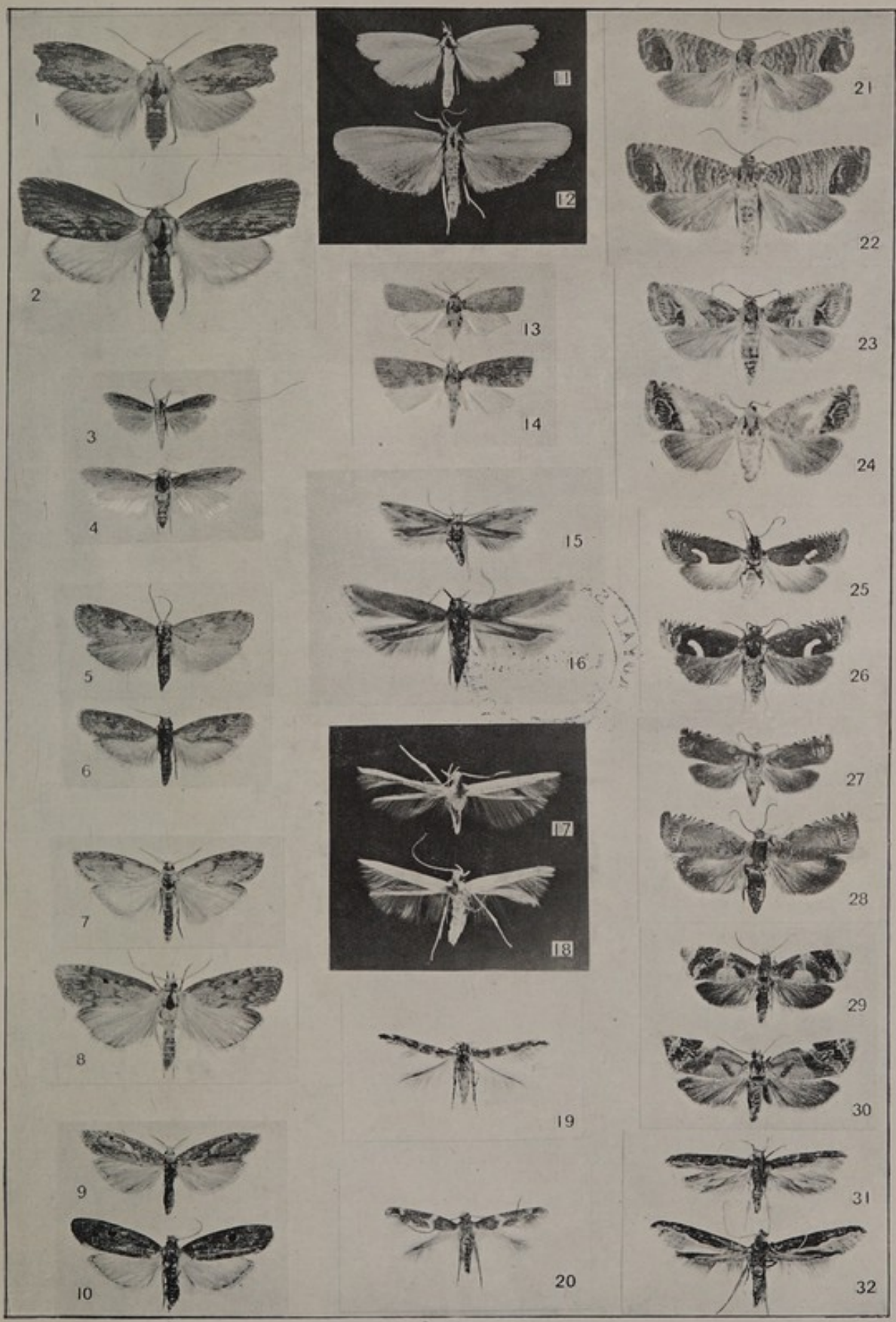
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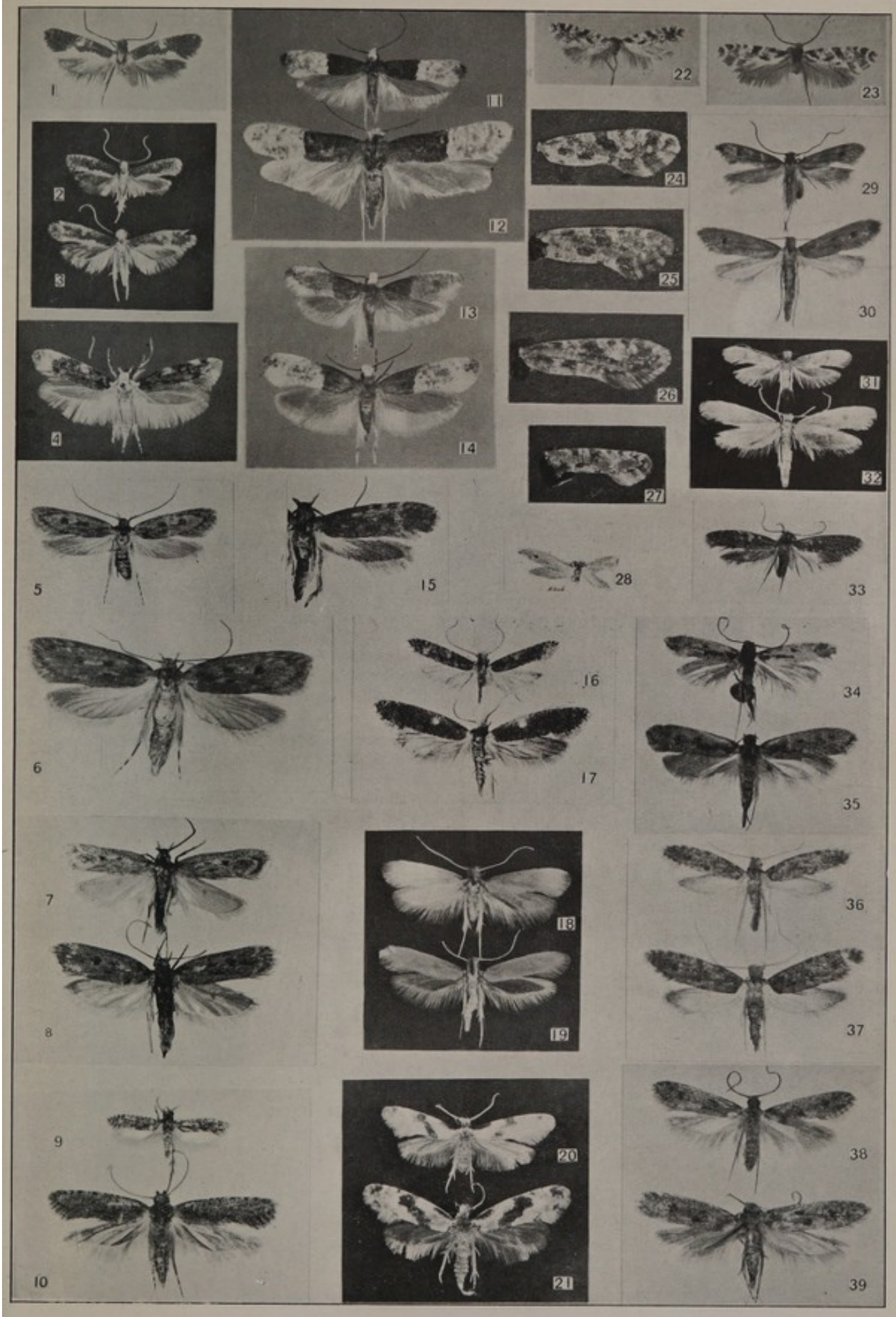
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Keys for the Identification of the Lepidoptera infesting Stored Food Products.

By A. STEVEN CORBET, D.Sc., Ph.D., D.I.C., and W. H. T. TAMS, F.Z.S., F.R.E.S. (British Museum, Natural History).

(Plates I.–V.*; Text-figures 1–287.)

In the keys which follow, an attempt has been made to give the salient characters whereby the adult moths of the larvæ infesting stored products can be readily identified. Many species can only be determined positively by an examination of the genitalia and, where species are so similar that their identification cannot be based on superficial characters alone, attention is directed in the keys to the important genitalia differences.

The keys have a practical bias and a strict phylogenetic arrangement has not always been followed. The figures following the name of each species in the key refer to the length of the forewing and are based on specimens of established identity and mostly represent dissected material.

In order not to overload the keys unduly, they are preceded by a list of the included species in phylogenetic order, with synonyms, the distribution so far as we have been able to trace it from Museum material and authentic records, and a brief indication of the kind of stored materials known to be infested by the larvæ. In some instances it may appear that the species has a slender claim to a place in this work but, in most cases, such moths are included because it is strongly suspected that they may prove ultimately to be pests of stored products. There are a few examples of species which were formerly thought to be single entities but are now known to constitute groups of two or more very similar but quite distinct species occurring together in the same geographical areas. It is obvious that all the members of such a complex should be included in the present work, even if some of them have not yet been incriminated.

We have been at some pains to stabilize the nomenclature by making it accord with the International Rules for Zoological Nomenclature, and this has entailed certain alterations of generic and trivial names with a few species. In most cases, the reasons for the changes made have been discussed in a series of papers entitled "Observations on species of Lepidoptera infesting stored products" which have appeared in the *Entomologist*, 1943, **76**. The exact original spelling of the names has been adhered to throughout.

Circumstances have necessitated this work being carried through without delay, and we have been unable to pursue matters not immediately relevant to the main project.

Rarely is it an easy matter to identify a small moth in imperfect condition although, when the possibilities are limited, it may be possible to seize on two or three outstanding characters which make the recognition of certain species tolerably certain. In the case of an obscure moth and with strictly limited material, it is usually, preferable to set a specimen or two before beginning the task of determination. A set specimen can be handled with safety, and examination of the characters of the head can be performed without much difficulty; then the venation can be studied (usually by examination of the under surface after application of a drop or two of benzene, toluene or xylene), without damage to the moth. In some cases, it may be necessary to detach one pair of wings for examination, and these can be placed on a microscope slide under a cover-slip after removal of the scales by gentle

* For explanation of the Plates, see p. 144.

application of a fine camel's hair brush. The pair of wings remaining on the specimen should be kept intact in order to study the pattern and, where necessary, identification can be confirmed by examination of the genitalia.

With some species, an identification based on a single worn female is of little value, for not only are the genitalia characters very similar in some groups of closely allied species, but the characteristic organs in the female genitalia may easily become damaged in the course of the investigation. It is not generally appreciated, perhaps, that a specific determination of a small and obscure moth from a single female specimen may be an impossibility.

It must be understood that the characters for the separation of families and genera given in the keys do not necessarily apply to the species in these groups which are not dealt with in the present investigation.

Notes on Structural Characters.

Although almost all the descriptive terms employed in the keys are to be found in such standard works as that of Meyrick, 1928, 'Revised Handbook of British Lepidoptera,' the following notes may be helpful to those unaccustomed to working with the Lepidoptera.

In addition to the long, filiform, segmented, paired *antennæ* situated in front of or between the compound eyes, the head carries the coiled tongue or *proboscis*, and also the labial and maxillary palpi (text-figs. 202, 203), although the latter are often rudimentary or absent. The *maxillary palpi* are 5- or 6-jointed, folded appendages arising from the base of the tongue. The more prominent, three-jointed *labial palpi* project outside the maxillary palpi and, while the basal segment is small and inconspicuous, the second and third segments show considerable diversity in form and scaling. The labial palpi may be porrect (*i. e.* projecting horizontally in front of the head), or curved and ascending. In this paper, the legs are not used for diagnostic purposes, other than the position of the hairs on the *hind tibiæ* (*i. e.* the sub-terminal segment of the hind legs).

In the classification of the Lepidoptera, the wing venation is of primary importance. The anterior or upper margin of the wing is termed the *costa*, the outer margin remote from the thorax is the *termen*, while the lower margin of the wing is the *dorsum*. The anterior wing tip is the *apex*, while the angle formed by the termen and the dorsum is the *tornus*. In some of the Tinæina dealt with here, the apices of the wings are acuminate, being produced almost to a point.

The veins run longitudinally from the base of the wing towards the termen, although a few of the anterior veins terminate on the costa. The approximately elongate, triangular area extending from the base outwards is termed the *cell*, and the transverse veins closing it are the *discoidals*. In some species of Agrotidæ and Geometridæ, there is a small accessory cell, or *areole*, on the forewing beyond the upper angle of the cell.

In this paper, we have employed the numerical system of notation. Normally, on the forewing, 10 veins arise from the cell or originate from veins arising from the cell, while 6 veins have their origin in this way on the hindwing: in both wings, vein 2 is the first vein emitted by the cell, vein 1 *b* is always present on both wings, but the presence of veins 1 *a* and 1 *c* on the hindwing and of vein 1 *a* on the forewing varies from one group to another. In species in which the veins are *stalked*, there is often a tendency for the length of the stalk to vary in individuals and, in some specimens, the length of the stalk may be so increased that the two veins are coincident. Whether veins are stalked or separate (*i. e.* arising directly from the cell) is often an important diagnostic character. Frequently, and especially on the forewing, one or more veins may be entirely absent.

The *interspaces* or areas between the veins are numbered according to the vein forming the posterior boundary, *e. g.* the space between veins 2 and 3 is termed space 2.

In describing the position of the markings on the wing, reference is made to the salient points already mentioned. Thus, the position of a marking may be described as sub-apical, costal, ante-medial (*i. e.* before the middle of the wing), or post-discal (*i. e.* beyond the discal cell, or region of the discoidals).

On both wings, the termen is finely ciliated, and the length of the cilia is a ready means of separating the Pyralidæ from the Tinæina. In some subfamilies of Pyralidæ, there is a *pecten* or comb of hair-scales along the lower margin of the cell.

In the moths considered here, the wings are held together by a *frenulum*, which consists of a few stout bristles projecting from the base of the costa on the hindwing, and is locked in position on the underside of the forewing by an arrangement termed the *retinaculum* near the base of the cell. In the male, the frenulum appears to comprise a single strand, although actually it is composed of several bristles cemented together ; usually, the frenulum is multiple in the female, although it is single as in the male in some moths, *e. g.* the subfamily Phycitinæ. The retinaculum comprises a series of stiff hairs in both sexes but, usually, the male has also a curved chitinous bar or process directed downwards from the upper margin of the forewing cell.

In some species of Lepidoptera, the male possesses one or more secondary sexual characters. In the species here considered, these may take the form of a costal fold on the underside of the forewing (*i. e.* the forewing is folded over near the base of the costal margin), which usually encloses an extrusible tuft of hair-scales or, on the underside of the forewing, there may be a hair-tuft above the cell, or a small swelling near the base of the costa.

In some moths, the females are apterous but, in all the species considered here, both sexes are fully winged.

Notes on the Male and Female Genitalia.

A concise account of the genitalia in Lepidoptera has been published by Beirne (1942, *Ent. Rec.* **54**, pp. 17–22, 37–39 ; "The morphology of the male genitalia of the Lepidoptera." 1942, *Ent. Rec.* **54**, pp. 81–83 ; "The morphology of the female genitalia of the Lepidoptera "), but the following summary may be useful to those who have not access to any standard work on the subject.

In the male (see text-fig. 218), the strongly sclerotized ninth abdominal segment consists of a dorsal portion (the *tegumen*) bearing the *uncus*, and a ventral portion (the *vinculum*) to which is attached the *valvæ* or claspers. Ventrally, the vinculum exhibits a dilatation, known as the *saccus*.

Two arms, frequently united distally and arising from the sides of the tegumen, are known as the *gnathos*. The anal tube is visible in the membrane between the uncus and the gnathos, but it is not sclerotized and is usually destroyed by boiling in potash. The intromittent organ, the *ædeagus*, lies between the claspers. The membranous, apical part of the ædeagus, the *vesica*, is eversible and frequently has sclerotized spines or plates (*cornuti*) on its surface. The vesica is normally retracted and so the cornuti appear to be attached to the interior of the ædeagus.

In many species, some of the sclerotized portions of the male genitalia are clothed with hair-scales but, usually, this has been omitted from the figures as its presence would obscure important outlines in many cases. In all the diagrams, the ædeagus is shown complete in outline as if the other organs were transparent.

In the female, the prominent *ovipositor lobes* (see text-fig. 237) are situated at the apex of the abdomen. They are usually hairy and their shape is characteristic of the genus or subfamily rather than of the species. Each lobe gives rise to a sclerotized rod, and these rods, which are termed the *posterior apophyses*, are short in species which drop their eggs while in flight but quite

long in forms which oviposit in crevices. The eighth abdominal segment bears a further pair of sclerotized rods, the *anterior apophyses*, which have a similar function to that of the posterior apophyses and are very long in the species in which the abdomen is extended during oviposition.

In addition to the openings of the anus and oviduct at the extreme end of the abdomen, there is an external opening of the bursa copulatrix (see text-fig. 286) on the ventral side of the eighth segment which is concerned with copulation. This opening is termed the *ostium bursæ* (referred to as the ostium in the keys), and frequently its sides are sclerotized, when it may be of taxonomic value. The *bursa copulatrix* is a large blind sac which accommodates the everted vesica during copulation, and it is connected with the ostium by a tube of varying length and width, the *ductus bursæ*. In many species, the bursa copulatrix has some sclerotized areas on the walls, the *signa*, which may be in the form of one or more spines, or a dentate plate, or some other shape. Sometimes, the bursa copulatrix is found distended and containing membranous flask-shaped capsules. These are the *spermatophores* enclosing the spermatozoa, and it is believed that they are introduced into the ostium bursæ in this form by the male.

The Families of Moths infesting Stored Products.

The species of moths infesting stored products may be separated into families on the characters given below. In the male of a few species of Pyralidæ and in a single species of Tortricidæ, there is a costal fold on the underside of the forewing near the base of the wing.

Agrotidæ.—Hind wing with vein 8 shortly anastomosed with the upper margin of the cell near the base only. Forewing with vein 5 arising nearer the origin of vein 4 than of vein 6: vein 1 *b* simple: a small accessory cell (areole) present (text-figs. 1–3). Robust moths with rather stout bodies.

Geometridæ.—Hindwing with vein 8 arising free, but anastomosed with the upper margin of the cell before the middle and then continuing free to the margin of the wing. Forewing with vein 5 arising from the middle of the discocellulars or from nearer the origin of vein 6 than of vein 4: vein 1 *b* furcate at the base, but the lower branch is weak: a small accessory cell present (text-fig. 10). Rather delicate moths with slender bodies.

Pyralidæ.—Hindwing with vein 8 arising free but anastomosed with, or closely approximated to, vein 7 beyond the cell and thence diverging. Forewing with vein 5 (when present) with its origin nearer to vein 4 than to vein 6: veins 8 and 9 stalked (vein 9 absent in *Ephestia* and *Plodia*): vein 1 *b* furcate at the base in the subfamily Galleriinæ and in *Hypsopygia costalis* (text-figs. 13–32). Slender moths with comparatively long legs.

Tortricidæ.—Hindwing with vein 8 separate from the upper margin of the cell and not nearer the costa than the cell. Forewing with veins 3, 4 and 5 more or less approximate at their origins: vein 1 *b* furcate at the base (text-figs. 171, 172). Rather small moths with comparatively broad wings.

Tinæina.—Hindwing with vein 8 separate from the upper margin of the cell and from vein 7, except in *Sitotroga cerealella*, where it touches the cell for a short distance beyond the middle. In the family Tinæidæ, vein 8 is nearer the costa than the upper margin of the cell. Forewing with the origin of vein 5 never much nearer to the origin of vein 4 than to that of vein 6: vein 1 *b* furcate at the base. In some species, the venation is reduced in both wings (text-figs. 188–201). Mostly small moths with narrow, elongate wings.

In the group of families collectively known as the Tinæina, the hindwing cilia are at least as long as half the width of the wing, except in *Anchonoma xeraula*, where the cilia are hardly this length. In the species belonging to the other families considered above, the hindwing cilia are not as long as half the width of the hindwing, except in the males of *Achroia* and *Aphomia*, where the cilia may reach this length.

I. Key for the Separation of Adults of Species of Agrotidæ and Geometridæ infesting Stored Products.

Family AGROTIDÆ.

Subfamily Hadeninæ.

Leucania zeæ (Duponchel, 1827). (Text-figs. 1, 4, 7.)

Synonym : *indistincta* Christoph, 1887.
Distribution : southern Europe and North Africa.
Larval food : ears of maize.

Subfamily Amphipyrinæ.

Apamea sordens (Hufnagel, 1767). ("The Rustic Shoulder-knot.") (Text-figs. 2, 5, 8.)

Synonyms : *basilinea* ([Schiffermüller & Denis], 1775) ; *nebulosa* (Vieweg, 1790) ; *grisescens* (Staudinger, 1889) ; *pallida* Tutt, 1891 ; *unicolor* Tutt, 1891 ; *cinerascens* Tutt, 1891 ; *basistriga* (Staudinger, 1892).
Distribution : Europe and temperate Asia.
Larval food : wheat and other grain, and grasses.

Caradrina clavipalpis (Scopoli, 1763). ("The Pale Mottled Willow.") (Text-figs. 3, 6, 9.)

Synonyms: *grisea* (Hufnagel, 1767) ; *quadripunctata* (Fabricius, 1775) ; *cubicularis* ([Schiffermüller & Denis], 1775) ; *leucoptera* (Thunberg, 1791) ; *laciniosa* (Donzel, 1848) ; *pulverosa* (Walker, 1856) ; *milleri* (Schulz, 1862).
Distribution : practically throughout the more temperate regions of the world.
Larval food : seeds, grasses, especially grain in the ear, and meal.

Key for the Separation of Species of Agrotidæ.

1. Eyes large, round, and covered with very fine short, erect hairs. Upperside forewing buff, with a slight reddish hue, with a white dot in the lower angle of the cell just below the origin of vein 3, an obscure series of minute, dark, post-discal streaks, and a very obscure series of minute, black, marginal, interneural dots : upperside hindwing white to fuscous.
Leucania zeæ (Dup.) (pl. i. fig. 1).
(15·0–18·5 mm.)

Eyes naked and not ciliated. Upperside forewing not as above but with a reniform spot at the end of the cell ..... 2.

2. Abdomen with a dorsal series of crests. Forewing and hindwing with termen crenulate. Upperside forewing buff brown, clouded with reddish brown in the medial area, with the usual Agrotid markings and a black, sinuate, longitudinal stripe below the base of the cell : upperside hindwing pale greyish buff, shading to dark brown towards the termen.
Apamea sordens (Hufn.) (pl. i. fig. 2).
(18·0–19·5 mm.)

Abdomen without crests. Forewing and hindwing not crenulate. Upperside forewing pale greyish brown, with the usual Agrotid markings darker brown and rather obscure, and without a dark stripe below the cell : upperside hindwing white, with the veins becoming slightly fuscous toward the termen.
Caradrina clavipalpis (Scop.) (pl. i. fig. 3).
(10·5–15·0 mm.)

Family GEOMETRIDÆ.

Sterrha inquinata (Scopoli, 1763). ("The Rusty Wave.") (Text-figs. 10–12.)

Synonyms : *herbariata* (Fabricius, 1798) ; *pusillaria* (Hübner [1796]–[1799]) ; *microsaria* (Boisduval, 1840).
Distribution : Europe, western Asia, north Africa.
Larval food : dried plants.

Forewing with vein 10 stalked with veins 7, 8 and 9. Upperside pale ochreous white, both wings with rather irregular, diffuse, rusty, transverse lines, the medial and post-discal lines on the forewing becoming wider at the costa and dorsum; both wings sparsely dusted with rusty dots and with a prominent series of dark marginal dots. **Sterrha inquinata** (Scop.) (pl. i. fig. 15). (7·0–9·5 mm.)

II. Key for the Separation of Adults of Species of Pyralidæ infesting Stored Products.

Subfamily Pyralinæ.

Aglossa caprealis (Hübner [1800]–[1809]). ("The Small Tabby.") (Text-figs. 33, 97, 135.)

Synonyms: *capreolatus* (Haworth, 1810); *domalis* Guenée, 1854; *enthealis* (Hulst, 1886).

Distribution: Cosmopolitan, according to Meyrick.

Larval food: refuse of wheat stacks, clover ricks, and maize.

Aglossa pinguinalis. ("The Large Tabby.")

(*a*) Subspecies **pinguinalis** (Linnæus, 1758). (Text-figs. 13, 34, 39, 98, 136.)

Synonyms: *pinguis* (Fabricius, 1798); *pinguinatus* (Haworth, 1810); *pinguiculatus* (Haworth, 1810); *streatfieldii* Curtis, 1833; *maroccana* Schmidt, 1934.

Distribution: Europe to North Africa and the Cameroons.

(*b*) Subspecies **asiatica** Erschoff, 1872. (Text-figs. 35, 40, 99.)

Synonym: *abdidalis* Christoph, 1873.

Distribution: Egypt to Persia and Turkestan.

(*c*) Subspecies **indistincta** Corbet & Tams, 1943. (Text fig. 41.)

Synonyms: none.

Distribution: North-west India and Baluchistan.

Larval food: refuse of cereals, dried seeds, and husks of grasses.

Aglossa dimidiatus (Haworth, 1810). ("The Tea Tabby.") (Text-figs. 36, 42, 100, 137.)

Synonyms: *dimidialis* Guenée, 1854; *micalialis* Walker, 1859; *achatina* Butler, 1879; *circularis* (Motschulsky, 1860) may be a synonym, being so placed by Rebel.

Distribution: India, China, and Japan.

Larval food: stored tea, stored rice, and insect specimens.

Aglossa tanya Corbet & Tams, 1943. (Text-figs. 37, 43, 101, 138.)

Synonyms: none.

Distribution: India.

Larval food: not known, but the species may be a pest of stored products.

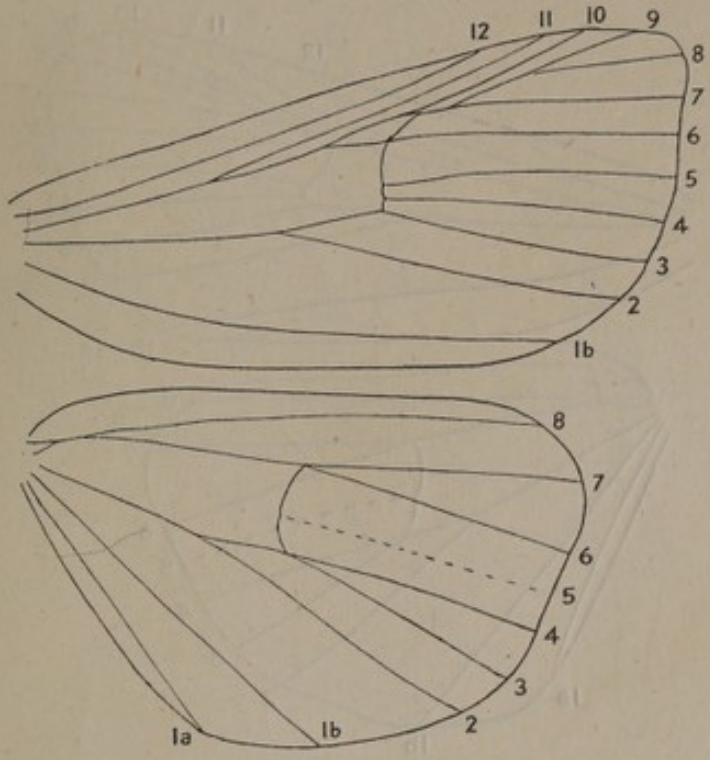
Hypsopygia costalis (Fabricius, 1775). ("The Gold Fringe.") (Text-figs. 14, 44, 102, 139.)

Synonyms: *fimbrialis* ([Schiffermüller & Denis], 1775); *costatus* (Haworth, 1810); *hyllalis* (Walker, 1859); *rubrocilialis* (Staudinger, 1870); *aurotænialis* (Christoph, 1881).

Distribution: Cosmopolitan.

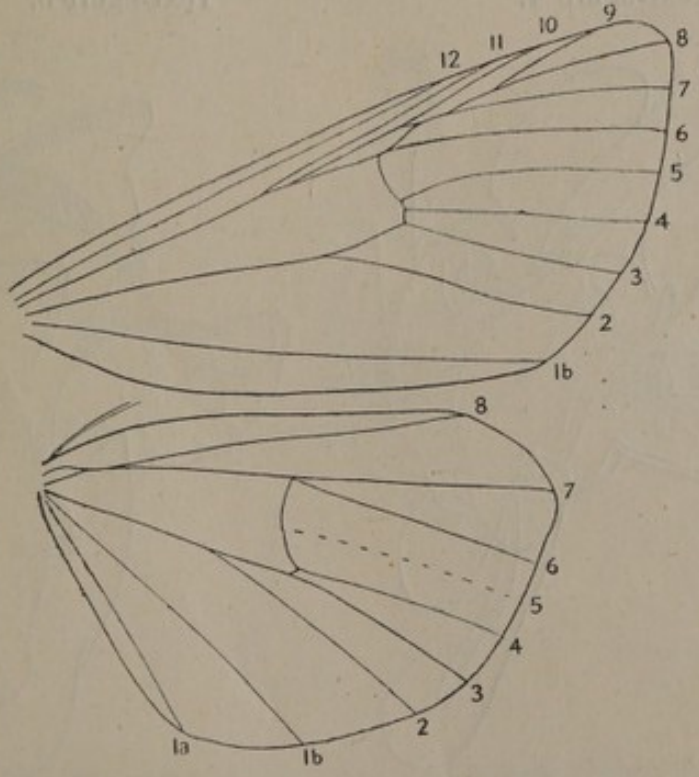
Larval food: stored clover hay.

Text-figure 1.



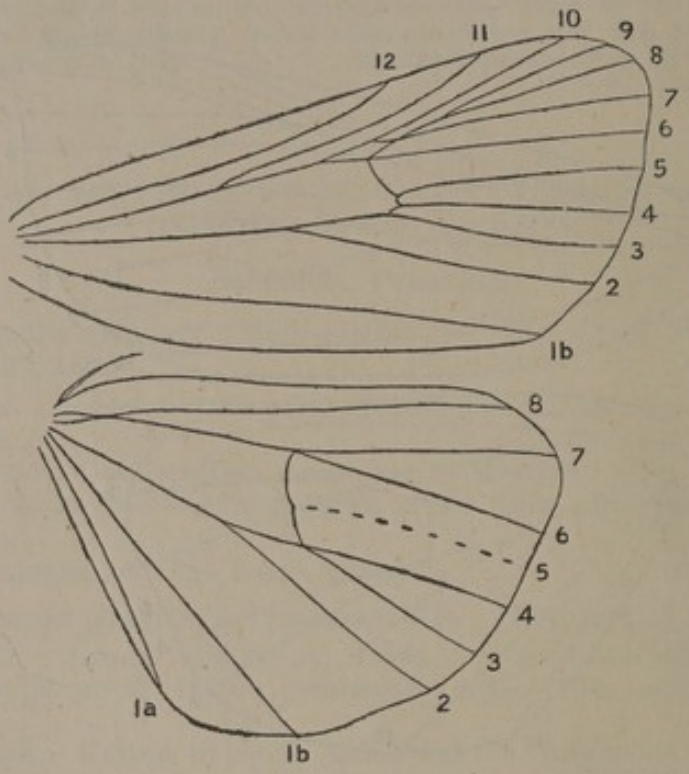
Neuration of *Leucania zeæ* (Dup.), ♀.

Text-figure 2.



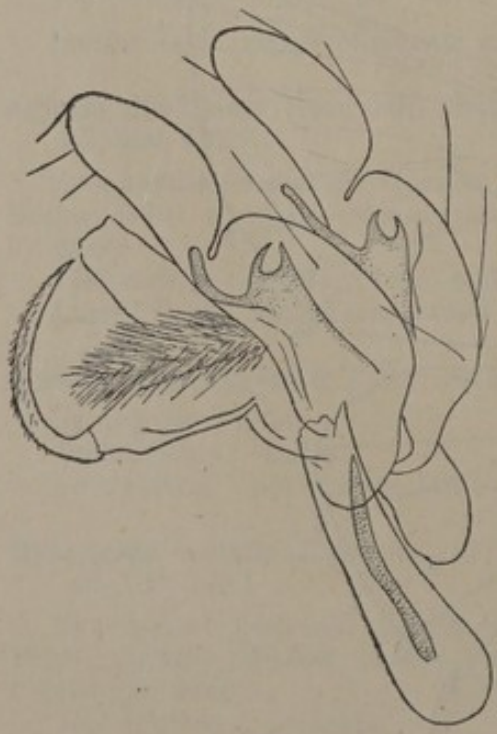
Neuration of *Apamea sordens* (Hufn.) ♀.

Text-figure 3.



Neuration of *Caradrina clavipalpis* (Scop.), ♀.

Text-figure 4.

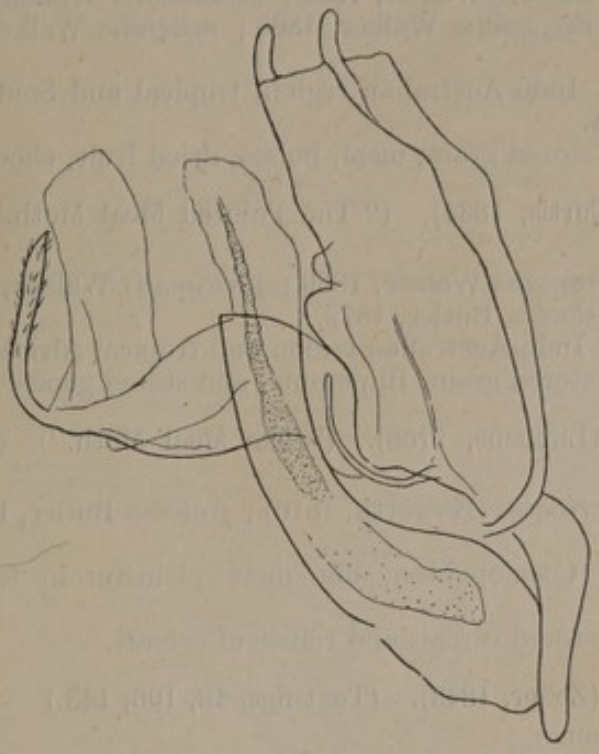


Male genitalia of *Leucania zeæ* (Dup.).

Text-figure 5.

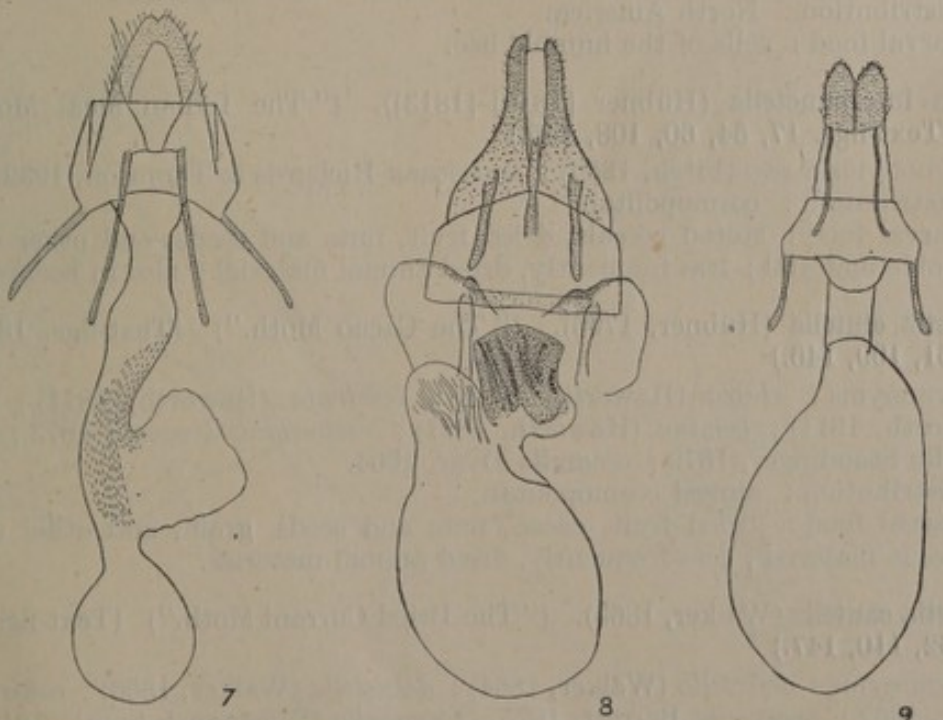
Male genitalia of *Apamea sordens* (Hufn.).

Text-figure 6.



Male genitalia of *Caradrina clavipalpis* (Scop.).

Text-figures 7–9.



Female genitalia of *Leucania zeæ* (Dup.) (7); *Apamea sordens* (Hufn.) (8); *Caradrina clavipalpis* (Scop.) (9).

Pyralis manihotalis Guenée, 1854. (Text-figs. 45, 103, 140.)

Synonyms: *vetusalis* Walker, 1859; *gerontesalis* Walker, 1859; *laudatella* (Walker, 1863); *despectalis* Walker, 1865; *miseralis* Walker, 1865; *achatina* Butler, 1877.

Distribution: Indo-Australian region, tropical and South Africa, tropical America, Hawaiia.

Larval food: stored grain, meal, pulses, dried fruit, chocolate, etc.

Pyralis pictalis (Curtis, 1834). ("The Painted Meal Moth.") (Text-figs. 46, 104, 141.)

Synonyms: *pronealis* Walker, 1859; *proximalis* Walker, 1862; *bractiatella* (Walker, 1863); *elachia* Butler, 1879.

Distribution: Indo-Australian region and tropical Africa.

Larval food: stored grain, Illipe nuts, and stored goods.

Pyralis farinalis (Linnæus, 1758). ("The Meal Moth.") (Text-figs. 15, 47, 105, 142.)

Synonyms: *farinatus* (Haworth, 1810); *fraterna* Butler, 1879; *meridionalis* Schmidt, 1934.

Distribution: Cosmopolitan, but more plentiful in temperate than in tropical regions.

Larval food: stored cereals and refuse of cereals.

Pyralis lienigialis (Zeller, 1843). (Text-figs. 48, 106, 143.)

Synonyms: none.

Distribution: Britain and northern Europe.

Larval food: not known, but the species may be a pest of stored products.

Subfamily Phycitinæ.

Vitula edmandsii (Packard, 1864). (Text-figs. 16, 53, 107, 144.)

Synonyms: *dentosella* Ragonot, 1887; *serratilineella* Ragonot, 1887.

Distribution: North America.

Larval food: cells of the humble bee.

Plodia interpunctella (Hübner [1810]–[1813]). ("The Indian Meal Moth.") (Text-figs. 17, 54, 60, 108, 145.)

Synonyms: *zeæ* (Fitch, 1856); *americana* Richards & Thomson, 1932.

Distribution: cosmopolitan.

Larval food: stored cereals, dried fruit, nuts and seeds, and other dried vegetable material; less frequently, dried animal material; also in beehives.

Ephestia elutella (Hübner, 1796). ("The Cacao Moth.") (Text-figs. 18, 55, 61, 109, 146.)

Synonyms: *elutea* (Haworth, 1811); *semirufa* (Haworth, 1811); *rufa* (Haworth, 1811); *gemina* (Haworth, 1811); *roxburghii* Gregson, 1873; *unicolorella* Staudinger, 1879; *amarella* Dyar, 1904.

Distribution: almost cosmopolitan.

Larval food: dried fruit, cacao, nuts and seeds, grain, and other dried vegetable material; less frequently, dried animal material.

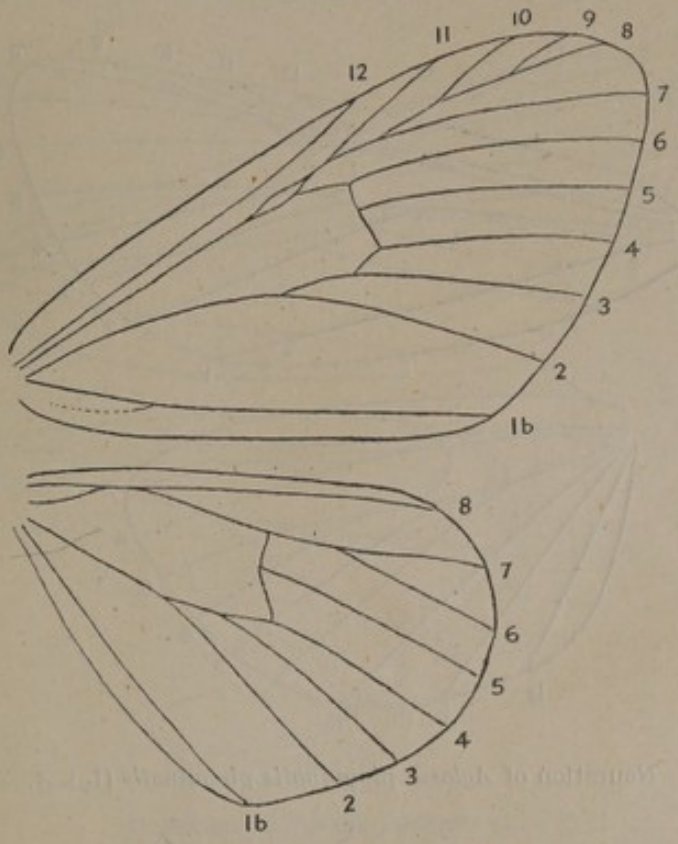
Ephestia cautella (Walker, 1863). ("The Dried Currant Moth.") (Text-figs. 56, 62, 110, 147.)

Synonyms: *defectella* (Walker, 1864); *desuetella* (Walker, 1866); *cahiritella* Zeller, 1867; *passulella* Barrett, 1875; *formosella* (Wileman & South, 1918).

Distribution: cosmopolitan.

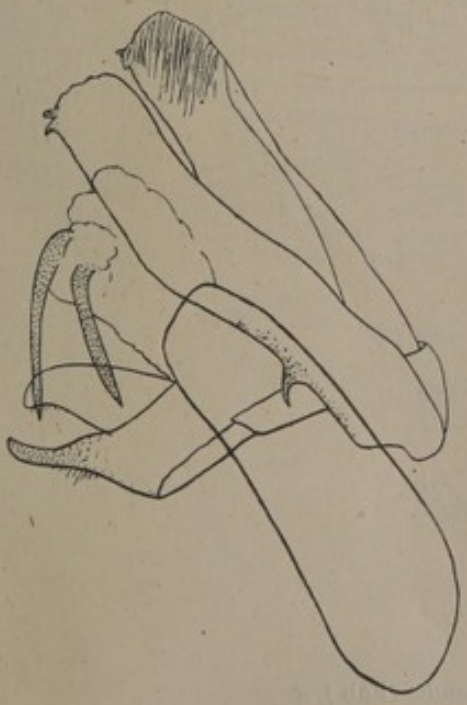
Larval food: principally dried fruits, but also cereals, meal, nuts, and seeds.

Text-figure 10.



Neuration of *Sterrha inquinata* (Scop.), ♂.

Text-figure 11.

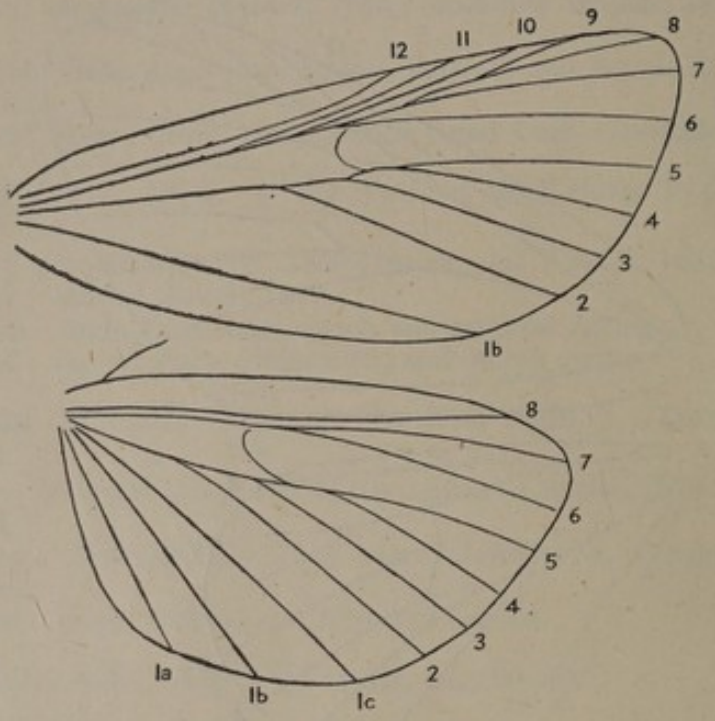


Male genitalia of *Sterrha inquinata* (Scop.).

Text-figure 12.

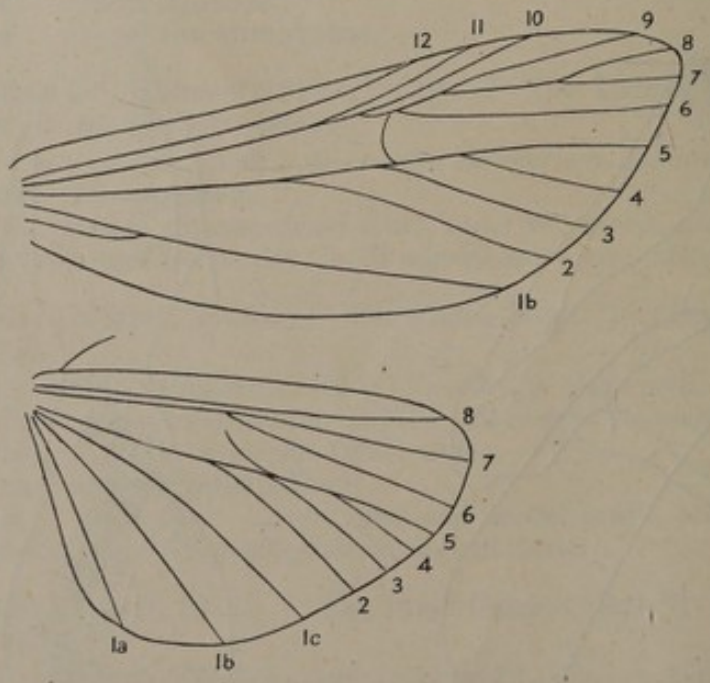
Female genitalia of *Sterrha inquinata* (Scop.).

Text-figure 13.



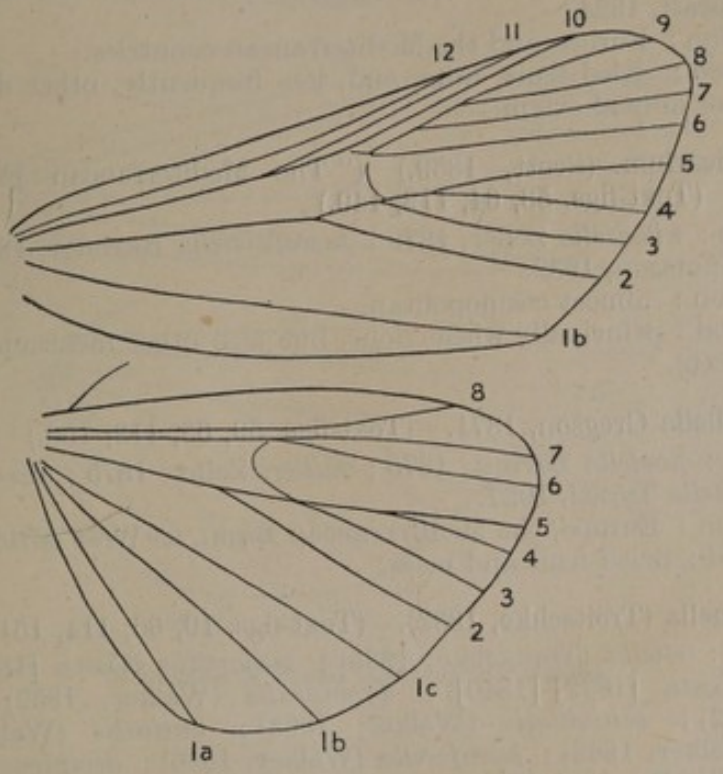
Neuration of *Aglossa pinguinalis pinguinalis* (L.). ♂.

Text-figure 14.



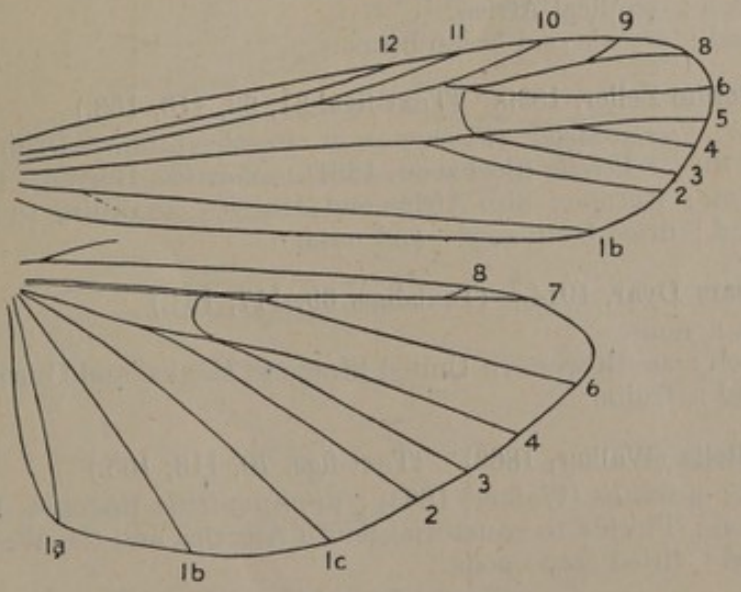
Neuration of *Hypsopygia costalis* (Fab.), ♂.

Text-figure 15.



Neuration of *Pyralis farinalis* (L.), ♂.

Text-figure 16.



Neuration of *Vitula edmandsii* (Pack.), ♂.

Ephestia calidella (Guenée, 1845). (Text-figs. 57, 63, 111, 148.)

Synonyms: *ficella* Stainton, 1859; *xanthotricha* Staudinger, 1859; *bengasiella* Turati, 1924.

Distribution: Europe and the Mediterranean countries.

Larval food: dried fruit, nuts, and, less frequently, other dried material of vegetable or animal origin.

Ephestia sericarium (Scott, 1859.) ("The Mediterranean Flour or Mill Moth.") (Text-figs. 58, 64, 112, 149.)

Synonyms: *kühniella* Zeller, 1879; *fuscofasciella* Ragonot, 1887; *gitonella* Richards & Thomson, 1932.

Distribution: almost cosmopolitan.

Larval food: principally wheat flour, but also other meal and flour, nuts, and dried insects.

Ephestia figulilella Gregson, 1871. (Text-figs. 59, 65, 113, 150.)

Synonyms: *ficulella* Barrett, 1875; *milleri* Zeller, 1875; *venosella* Turati, 1926; *ernestinella* Turati, 1927.

Distribution: Europe, the Mediterranean Basin, to West Africa and India.

Larval food: dried fruit and meal.

Etiella zinckenella (Treitschke, 1832). (Text-figs. 19, 66, 114, 151.)

Synonyms: *etiella* (Treitschke, 1835); *majorellus* (Costa [1832]–[1840]); *colonnellus* (Costa [1832]–[1840]); *dymnusalis* (Walker, 1859); *heraldella* (Guenée, 1862); *scitivittalis* (Walker, 1863); *anticalis* (Walker, 1863); *indicatalis* (Walker, 1863); *hastiferella* (Walker, 1866); *decipiens* Staudinger, 1870; *spartiella* (Rondani, 1876); *sabulinus* (Butler, 1879); *madagascariensis* Saalmüller, 1879–1880.

Distribution: southern Europe, and in almost all the warmer parts of the world.

Larval food: seeds of leguminous plants.

Mussidia nigrivenella Ragonot, 1888. (Text-figs. 20, 67, 115, 152.)

Synonyms: none.

Distribution: tropical Africa.

Larval food: cereals and cacao beans.

Myelois ceratoniæ Zeller, 1839. (Text-figs. 21, 68, 116, 153.)

Synonyms: *ceratoniella* (Fischer von Roeslerstamm, 1839); *pryerella* (Vaughan, 1870); *zellerella* (Sorhagen, 1881); *phœnicis* Durrant, 1915.

Distribution: Europe; also Africa and America, according to Meyrick.

Larval food: dried fruit, seeds, and nuts.

Myelois venipars Dyar, 1914. (Text-figs. 69, 117, 154.)

Synonyms: none.

Distribution: south-western United States to Mexico and Central America.

Larval food: fruits.

Myelois transitella (Walker, 1863). (Text-figs. 70, 118, 155.)

Synonyms: *notatalis* (Walker, 1863); *duplipunctella* Ragonot, 1887.

Distribution: Florida to equatorial South America and the West Indies.

Larval food: dried cacao pods.

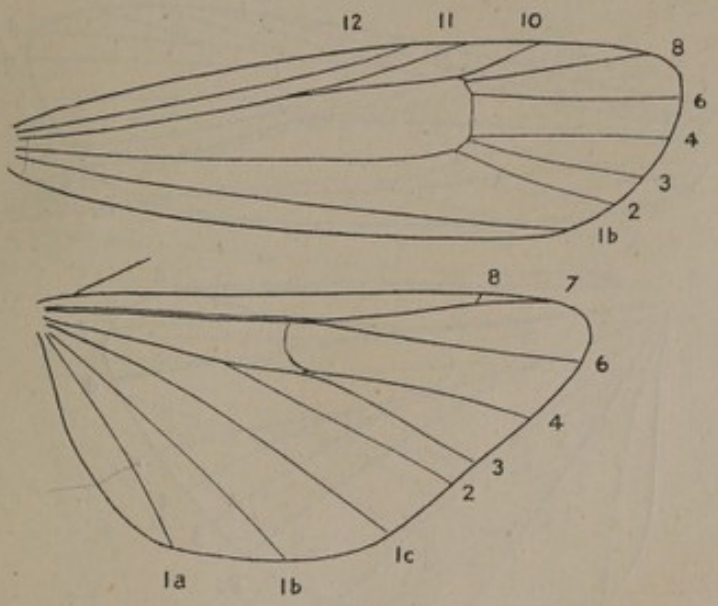
Cryptoblabes gnidiella (Milliére, 1867). (Text-figs. 22, 71, 72, 119, 156.)

Synonym: *wockiana* (Briosi, 1877).

Distribution: Mediterranean Basin.

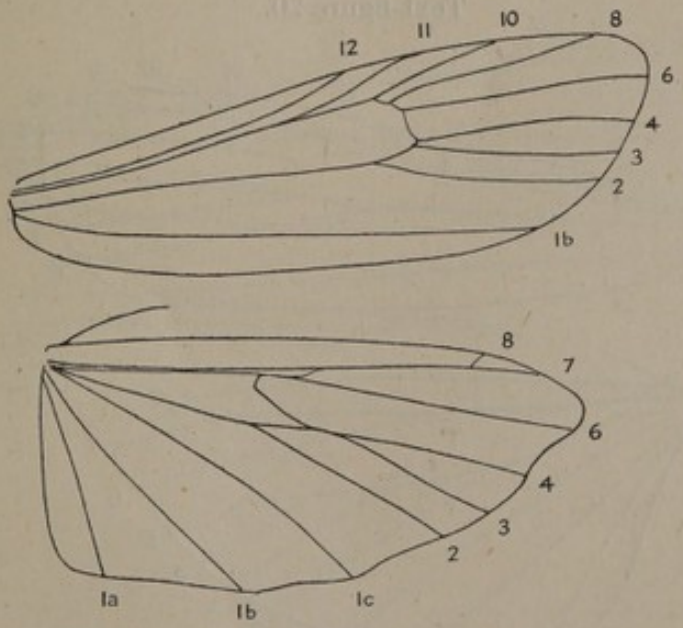
Larval food: dried fruits and seeds.

Text-figure 17.



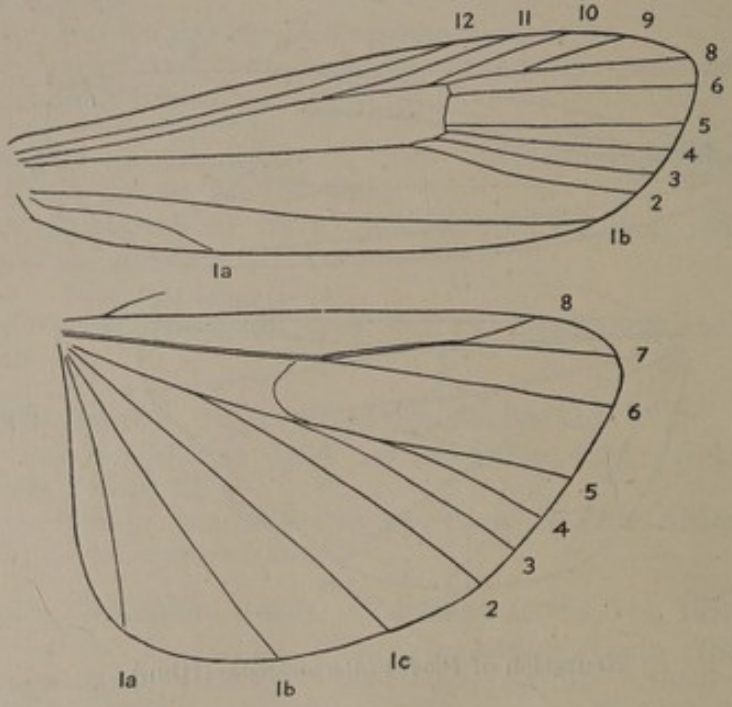
Neuration of *Plodia interpunctella* (Hbn.).

Text-figure 18.



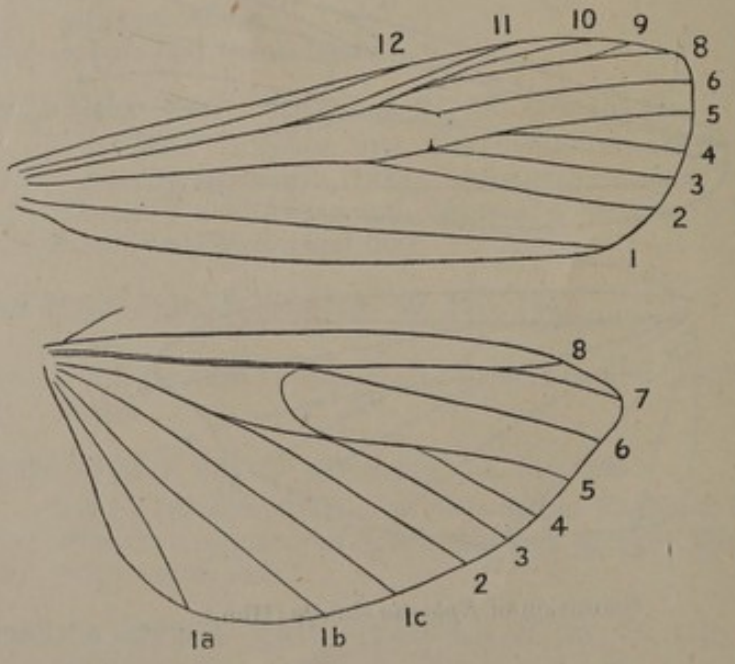
Neuration of *Ephestia elutella* (Hbn.).

Text-figure 19.



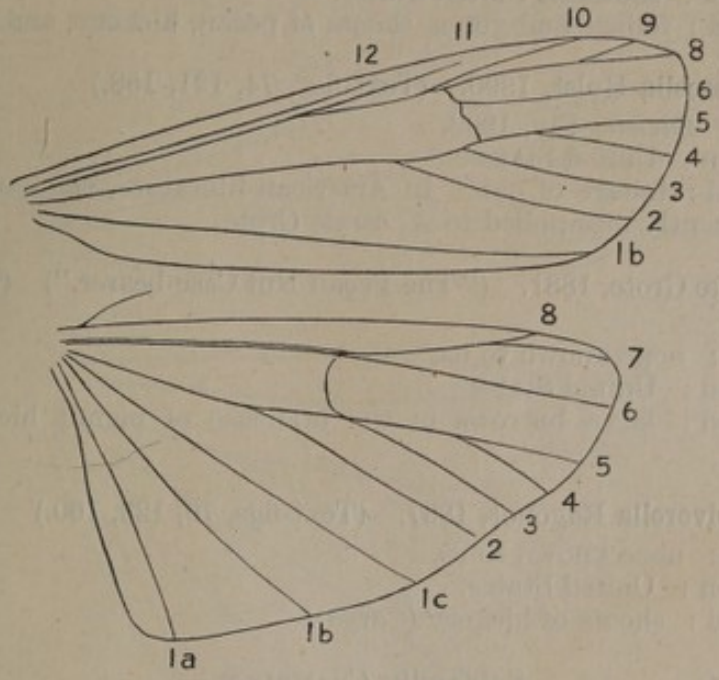
Neuration of *Etiella zinckenella* (Treit.).

Text-figure 20.



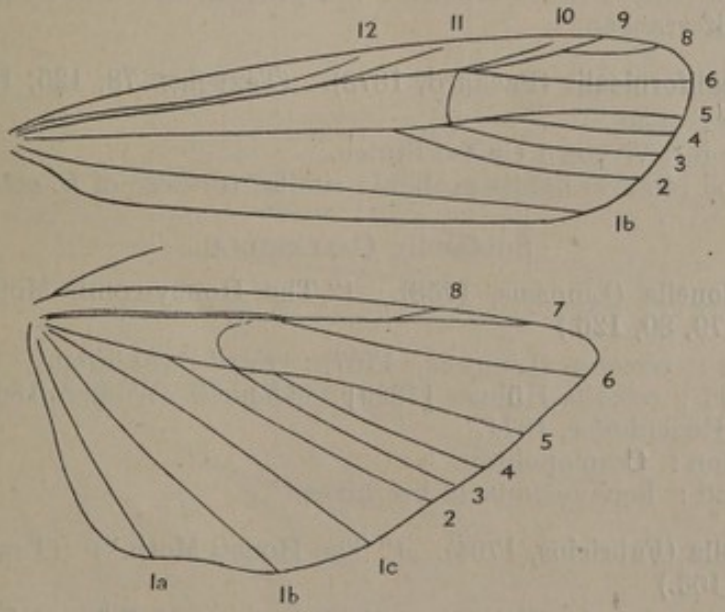
Neuration of *Mussidia nigrivenella* Rag., ♀.

Text-figure 21.



Neuration of *Myelois ceratoniæ* Zell.

Text-figure 22.



Neuration of *Cryptoblabes gnidiella* (Mill.).

Acrobasis juglandis (Le Baron, 1872). ("The Walnut Case-bearer.") (Text-figs. 23, 73, 120, 157.)

Synonyms: none.
Distribution: southern United States.
Larval food: foliage and young shoots of pecan, hickory, and walnut.

Acrobasis hebescella Hulst, 1890. (Text-figs. 74, 121, 158.)

Synonym: *sylviella* Ely, 1909.
Distribution: United States.
Larval food: foliage of oak. In American literature, the name *hebescella* has been frequently misapplied to *A. caryæ* Grote.

Acrobasis caryæ Grote, 1881. ("The Pecan Nut Case-bearer.") (Text-figs. 75, 122, 159.)

Synonyms: none known to us.
Distribution: United States.
Larval food: larva burrows in the branches of pignut hickory (*Carya porcina*).

Acrobasis caryivorella Ragonot, 1887. (Text-figs. 76, 123, 160.)

Synonyms: none known to us.
Distribution: United States.
Larval food: shoots of hickory (*Carya*).

Subfamily Crambinæ.

Euchromius ocellea (Haworth, 1811). ("The Necklace Veneer.") (Text-figs. 24, 77, 124, 161.)

Synonyms: *funiculella* (Treitschke, 1832); *cyrilli* (Costa, ? 1832); *cirillella* (Costa [1832]–[1840]); *texana* (Robinson, 1870).
Distribution: almost cosmopolitan.
Larval food: unknown, but Meyrick considered it likely that the species was introduced into Britain amongst the packing material of grocery cases from the Mediterranean.

Euchromius californicalis (Packard, 1873). (Text-figs. 78, 125, 162.)

Synonyms: none.
Distribution: Western United States.
Larval food: larval habits probably similar to those of *E. ocellea*.

Subfamily Galleriinæ.

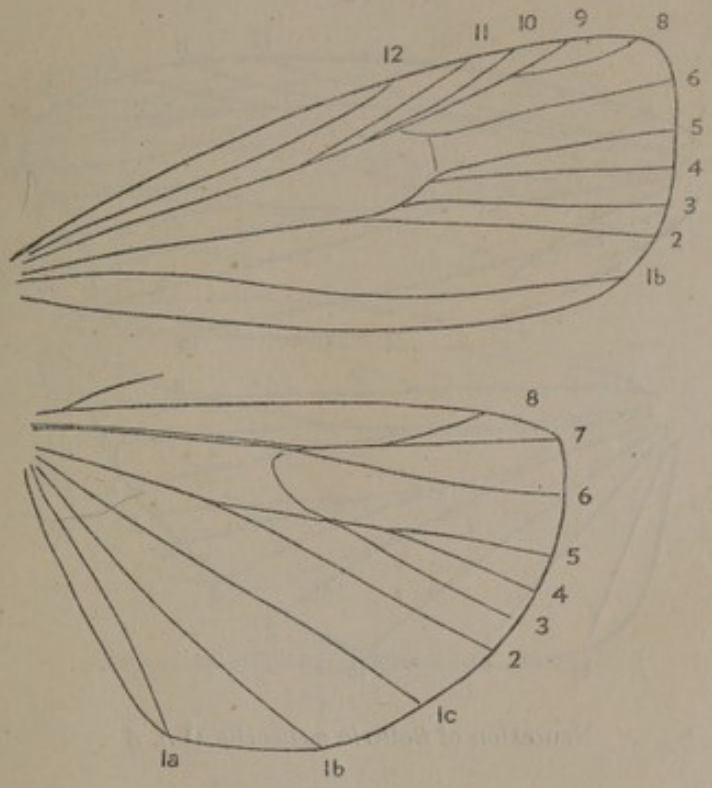
Galleria mellonella (Linnæus, 1758). ("The Honey-comb Moth.") (Text-figs. 25, 79, 80, 126.)

Synonyms: *cereana* (Linnæus, 1767); *cerella* (Fabricius, 1775); *cerea* Haworth, 1811; *cerealis* Hübner [1825]; *obliquella* (Walker, 1866); *austrina* R. Felder & Rogenhofer, 1874.
Distribution: Cosmopolitan.
Larval food: honey-combs in bee-hives.

Achroia grisella (Fabricius, 1794). ("The Honey Moth.") (Text-figs. 26, 81, 82, 127, 163.)

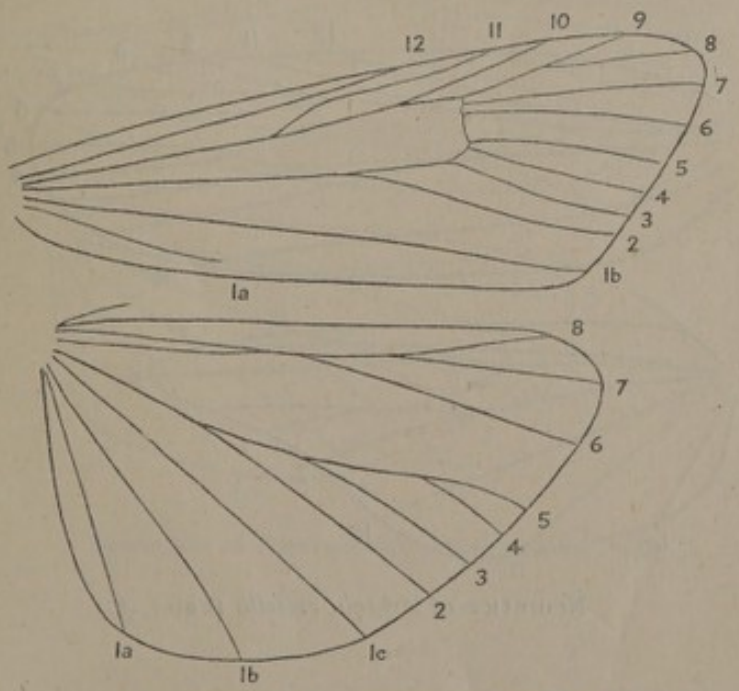
Synonyms: *alvearia* (Fabricius, 1798); *cinereola* Hübner [1800]–[1803]; *alvea* (Haworth, 1811); *alveariella* (Guenée, 1845); *obscurevittella* Ragonot, 1901.
Distribution: throughout the Old World.
Larval food: wax of honey-combs in bee-hives; occasionally, dried fruit and dried insects.

Text-figure 23.



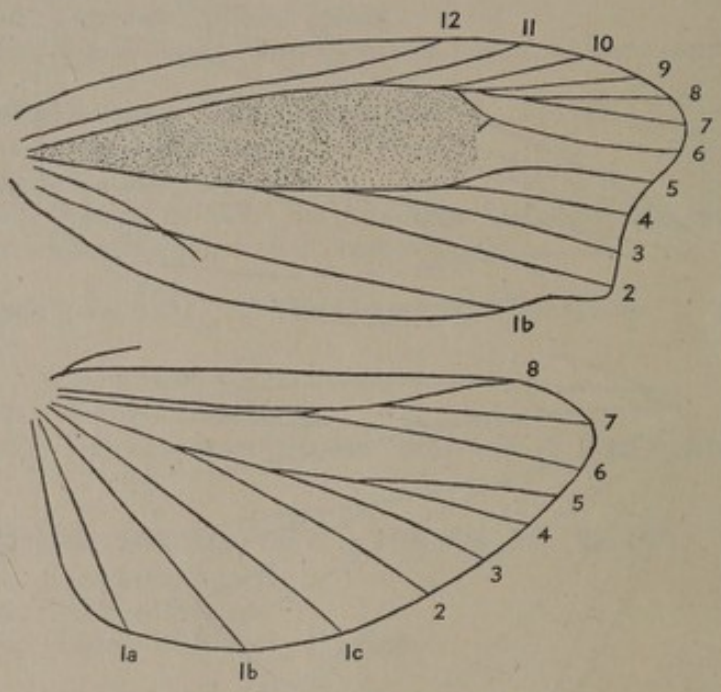
Neuration of *Acrobasis juglandis* (Le Baron).

Text-figure 24.



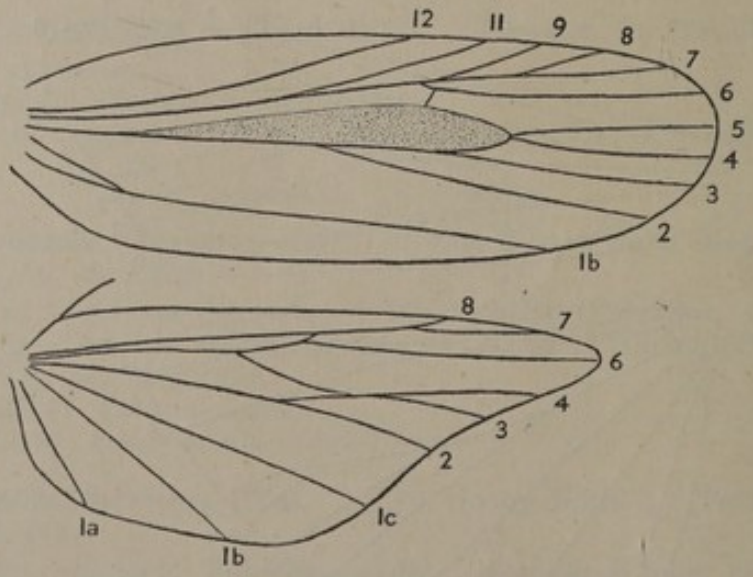
Neuration of *Euchromius ocellea* (Haw.), ♂.

Text-figure 25.



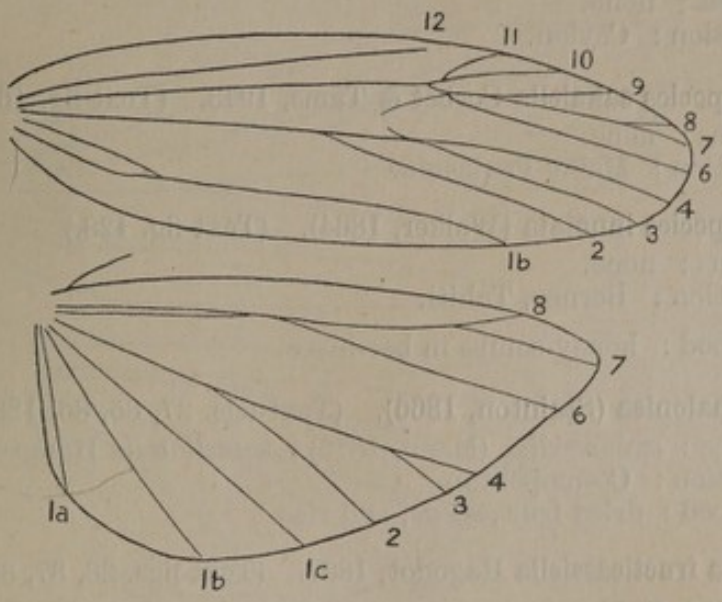
Neuration of *Galleria mellonella* (L.), ♂.

Text-figure 26.



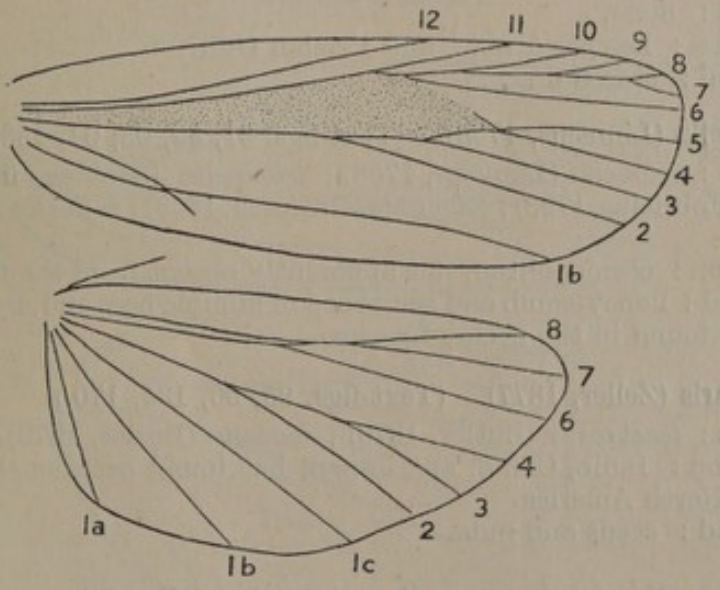
Neuration of *Achroia grisella* (Fab.), ♂.

Text-figure 27.



Neuration of *Corcyra cephalonica* (Staint.), ♀.

Text-figure 28.



Neuration of *Trachylepidia fructicassiella* Rag., ♂.

Achroia innotata.

(*a*) Subspecies **lankella** Corbet & Tams, 1943. (Text-figs. 83, 84.)
Synonyms: none.
Distribution: Ceylon.

(*b*) Subspecies **sakaiella** Corbet & Tams, 1943. (Text-fig. 164.)
Synonyms: none.
Distribution: Malay Peninsula.

(*c*) Subspecies **innotata** (Walker, 1864). (Text-fig. 128.)
Synonyms: none.
Distribution: Borneo, Tahiti.

Larval food: honey-combs in bee-hives.

Corcyra cephalonica (Stainton, 1866). (Text-figs. 27, 85, 86, 129, 165.)
Synonyms: *œconomellus* (Mann, 1872); *translineella* Hampson, 1901.
Distribution: Cosmopolitan.
Larval food: dried fruit, seeds, and rice.

Trachylepidia fructicassiella Ragonot, 1887. (Text-figs. 28, 87, 88, 130, 166.)
Synonyms: none.
Distribution: Egypt to Ceylon and India.
Larval food: seed pods of *Cassia fistula*.

Doloessa viridis Zeller, 1848. (Text-figs. 29, 89, 90, 131, 167.)
Synonyms: *figurana* (Walker, 1863); *ornata* (Wileman), 1910.
Distribution: Indo-Australian region.
Larval food: fallen leaves of *Cocos nucifera*.

Arenipses sabella Hampson, 1901. (Text-figs. 30, 91, 92, 132, 168.)
Synonyms: none.
Distribution: Egypt, Arabia, and Persian Gulf.
Larval food: stored dates.

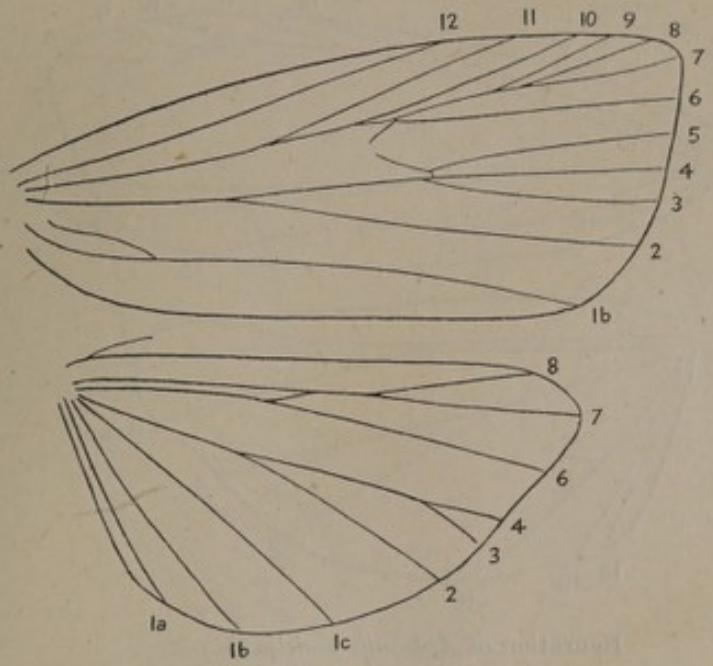
Aphomia sociella (Linnæus, 1758). (Text-figs. 31, 32, 93, 94, 133, 169.)
Synonyms: *colonella* (Linnæus, 1758); *tribunella* ([Schiffermüller & Denis], 1775); *socia* (Fabricius, 1798); *colonatus* (Haworth, 1809); *rufinella* Krulikowsky, 1909.
Distribution: cosmopolitan, but apparently absent from the tropics.
Larval food: honey-comb and bee-brood of humble bees and, less frequently, the larvæ are found in the nests of wasps.

Aphomia gularis (Zeller, 1877). (Text-figs. 95, 96, 134, 170.)
Synonyms: *tenebrosus* (Butler, 1879); *modesta* (Butler, 1879).
Distribution: India, China, and Japan, but found occasionally in Britain, Europe, and North America.
Larval food: seeds and nuts.

Key for the Separation of Species of Pyralidæ.

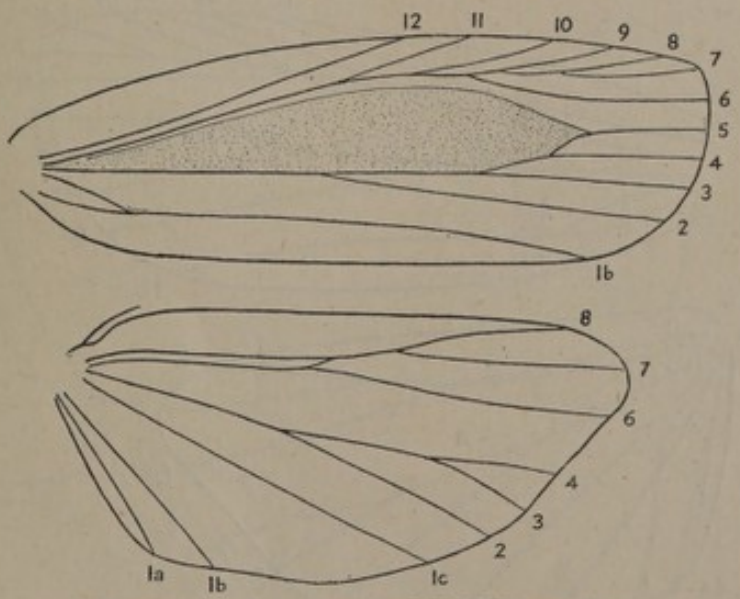
1. Upperside hindwing without a pecten of hairs on the lower margin of the cell. Hindwing vein 8 free. Upperside hindwing usually with at least indications of two narrow irregular lines running across the wing. Male without a costal fold or a costal hair-tuft on the underside of the forewing..... PYRALINÆ. 2.
Upperside hindwing with a well-defined pecten of hairs on the lower margin of the cell towards the base. Hindwing vein 8 anastomosed with vein 7 for part of its length. Upperside hindwing unmarked except for a darkening towards the apex in some species. Male with a costal fold or a costal hair-tuft on the underside of the forewing in some species ..... 10.

Text-figure 29.



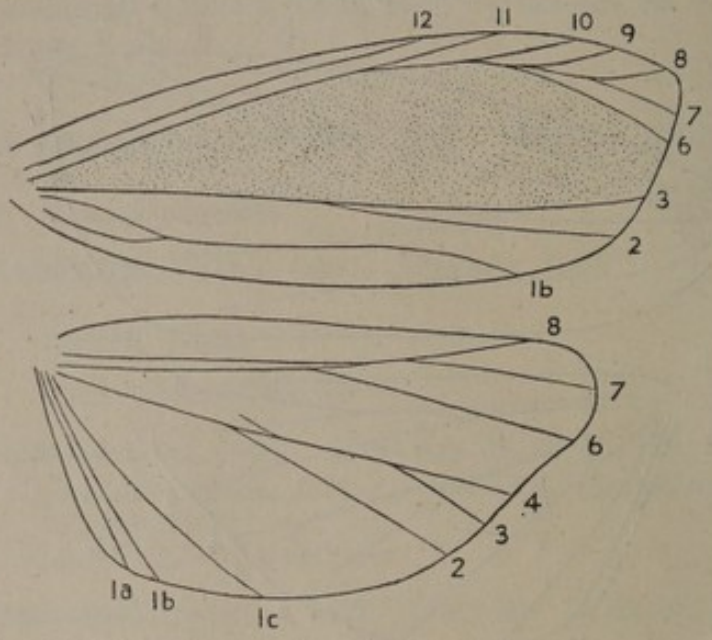
Neuration of *Doloessa viridis* Zell., ♂.

Text-figure 30.



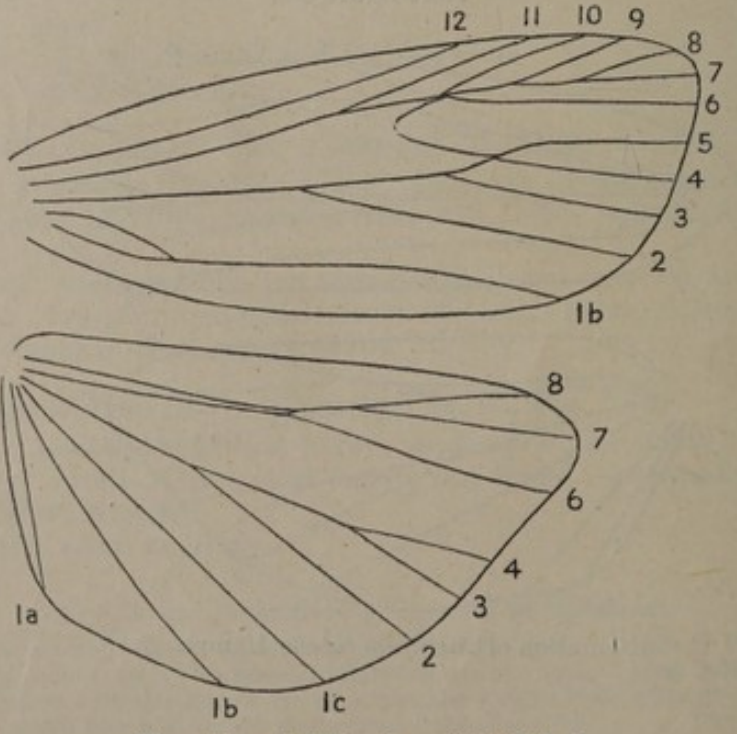
Neuration of *Arenipses sabella* Hamps., ♂.

Text-figure 31.



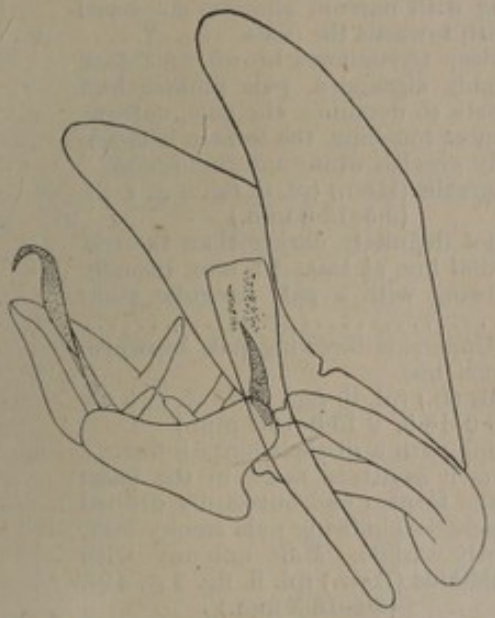
Neuration of *Aphomia sociella* (L.), ♂.

Text-figure 32.



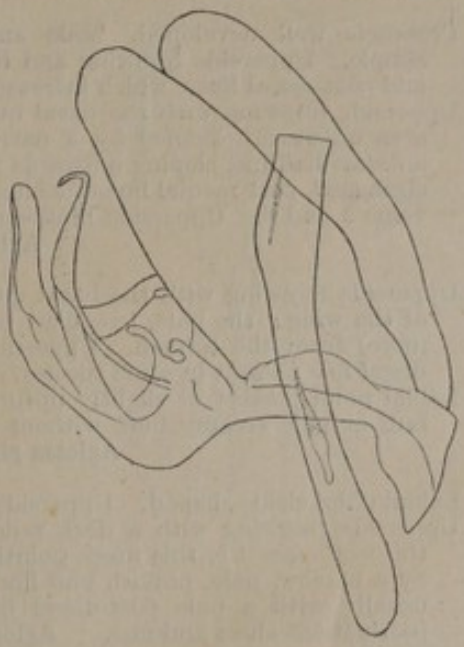
Neuration of *Aphomia sociella* (L.), ♀.

Text-figure 33.



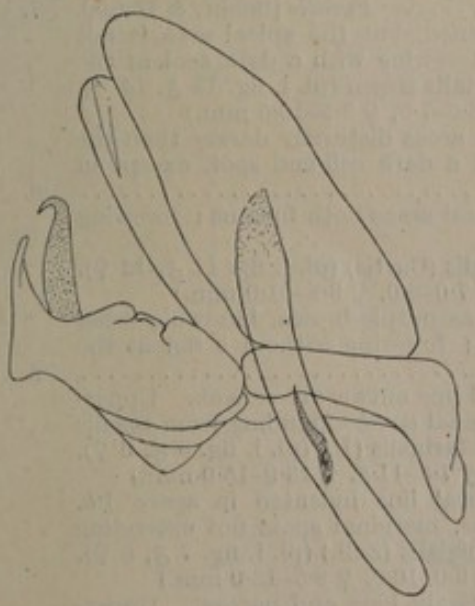
Male genitalia of *Aglossa caprealis* (Hbn.).

Text-figure 34.



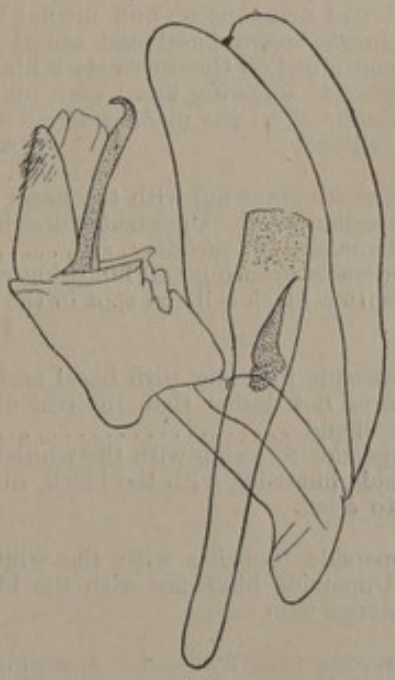
Male genitalia of *A. pinguinalis pinguinalis* (L.).

Text-figure 35.



Male genitalia of *A. pinguinalis asiatica* Erschoff.

Text-figure 36.



Male genitalia of *A. dimidiatus* (Haw.).

2. Proboscis absent. Male antennæ ciliated with long and prominent setiferous spines. Upperside forewing greyish buff or ochreous buff, dark dusted, and with irregular dark brown markings which are usually obscure..... *Aglossa* Latr. 3.

Proboscis well developed. Male antennæ finely ciliated, female antennæ simple. Upperside forewing and hindwing with narrow, sinuate, sub-basal and post-discal lines, which increase in width towards the costa ..... 6.

3. Upperside forewing with the basal quarter deep ferruginous brown, this dark area outwardly defined by a narrow, highly zigzagged, pale pinkish buff ante-medial line, sloping outwards from costa to dorsum; the pale, narrow, zigzagged, post-medial line touching, or almost touching, the termen between veins 2 and 6. Upperside hindwing pearly greyish white and unmarked. **Aglossa caprealis** (Hbn.) (pl. ii. fig. 6 ♂, 7 ♀). (9·5–12·0 mm.)

Upperside forewing with the basal quarter not definitely darker than the rest of the wing; the pale, irregular, post-medial line at least 1·5 mm. (usually more) from the termen. Upperside hindwing with a pale irregular post-discal line present in some species..... 4.

4. Labial palpi porrect or slightly upturned. Upperside forewing pale brownish buff or pale creamy buff, without a pinkish hue. **Aglossa pinguinalis** (L.) (pl. ii. figs. 1, 12 ♂, 2, 5 ♀). (♂ 10·0–16·0, ♀ 15·0–18·5 mm.)

Labial palpi sickle-shaped. Upperside forewing with a distinct pinkish hue... 5.

5. Upperside forewing with a dark reddish brown sagittate mark in the basal third of space 1 *b*, this mark pointing to the termen and outwardly defined by a narrow, pale, pinkish buff line. Upperside hindwing pale smoky buff, usually with a pale post-discal line faintly visible. Male antennæ with pectinations short and fine. **Aglossa dimidiatus** (Haw.) (pl. ii. fig. 3 ♂, 4♀). (8·5–16·5 mm.)

Upperside forewing without a conspicuous sagittate mark in the basal third of space 1 *b*. Upperside hindwing pale buff to pale greyish brown, with the post-discal line obsolete. Male antennæ with the pectinations long and prominent, as in the other *Aglossa* species. **Aglossa tanya** Cbt. & Tams (pl. ii. fig. 8 ♂.). (♂ 10·0–11·5 mm., ♀ 12·5 mm.)

6. Cilia above and below bright yellow. Forewing with vein 1 *b* furcate at the base. Upperside crimson-purple with the narrow transverse stripes bright yellow. **Hypsopygia costalis** (Fab.) (pl. i. fig. 9 ♂, 10 ♀). (7·5–10·5 mm.)

Cilia not yellow. Forewing with vein 1 *b* simple. Upperside forewing with a broad ochreous or buff medial band, separated from the darker brown or purple-brown basal and apical areas by narrow whitish lines, which are continued on the rather dark hindwing..... *Pyralis* [Schiff. & Denis]. 7.

7. Upperside forewing basal area may be darkened, but the apical area is not darker than the median area. Upperside forewing with a dark spot at the cell-end. **Pyralis manihotalis** Guen. (pl. i. fig. 13 ♂, 14 ♀). (♂ 6·5–7·5, ♀ 9·5–10·5 mm.)

Upperside forewing with the basal and apical areas distinctly darker than the median area. Upperside forewing without a dark cell-end spot, except in females of *P. pictalis* ..... 8.

8. Upperside forewing and hindwing with the basal areas both fuscous; forewing with a black cell-end spot in the female. **Pyralis pictalis** (Curtis) (pl. i. fig. 11 ♂, 12 ♀). (♂ 7·0–8·0, ♀ 9·5–11·0 mm.)

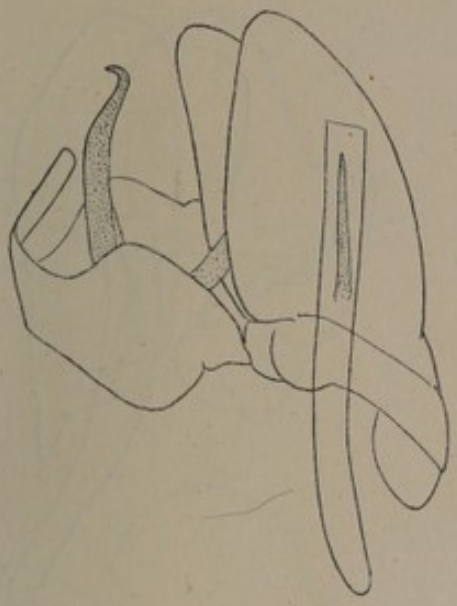
Upperside forewing with basal and apical areas purple-brown, hindwing basal area not darker than the rest of the wing; forewing without a dot at the cell-end ..... 9.

9. Upperside forewing with the whitish sub-basal line outwardly convex. Upperside hindwing with the black, diffuse, marginal spots extending from tornus to apex. **Pyralis farinalis** (L.) (pl. i. fig. 5 ♂, 6 ♀). (♂ 7·5–11·5, ♀ 13·0–15·0 mm.)

Upperside forewing with the whitish sub-basal line indented in space 1 *b*. Upperside hindwing with the black, diffuse, marginal spots not extending above vein 2. **Pyralis lienigialis** (Zell.) (pl. i. fig. 7 ♂, 8 ♀). (♂ 9·0–10·0, ♀ 9·5–12·0 mm.)

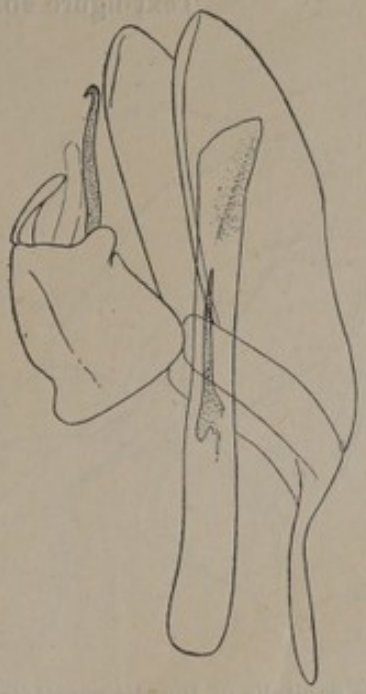
10. Forewing vein 7 absent. Forewing comparatively long and narrow. Upperside forewing pale greyish or buff brown, usually with rather obscure dark sub-basal and post-discal lines: upperside hindwing white or greyish white. In some species, on the underside of the forewing, the male has a costal fold near the base of the wing enclosing extrusible hairs ..... Phycitinæ. 11.

Text-figure 37.



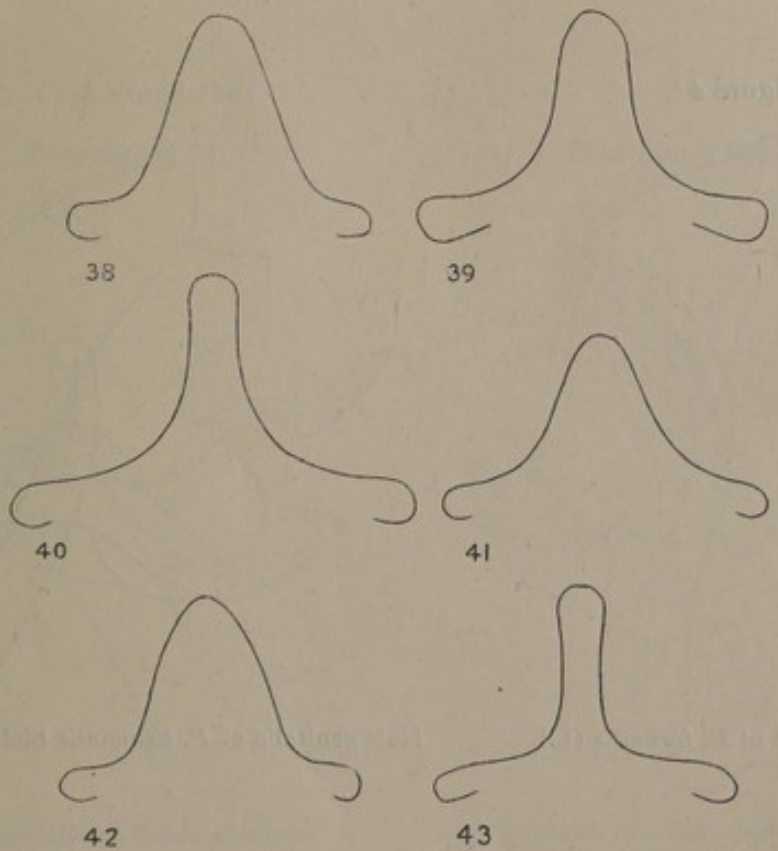
Male genitalia of *A. tanya* Cbt. & Tams.

Text-figure 44.



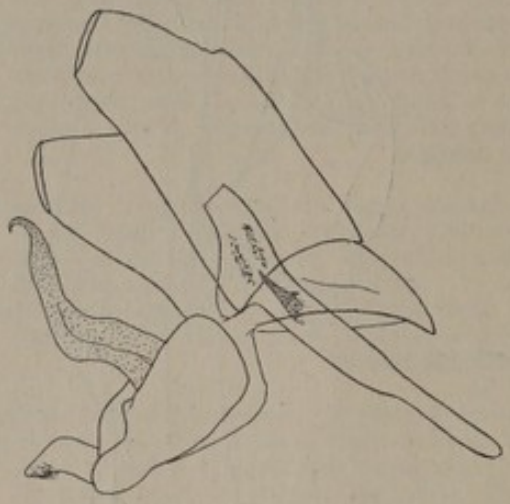
Male genitalia of *Hypsopygia costalis* (Fab.).

Text-figures 38–43.



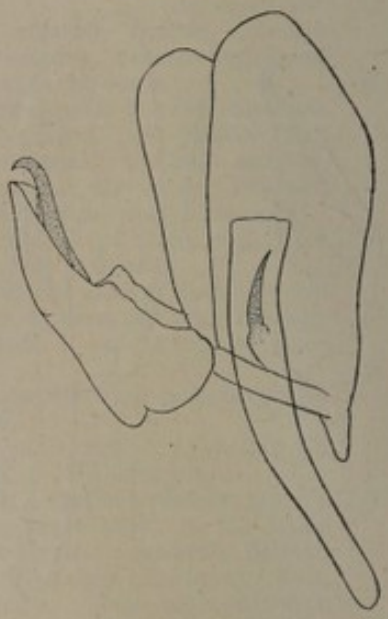
Ventral view of uncus of *A. caprealis* (Hbn.) (38); *A. pinguinalis pinguinalis* (L.) (39); *A. pinguinalis asiatica* Erschoff (40); *A. pinguinalis indistincta* Cbt. & Tams (41); *A. dimidiatus* (Haw.) (42); *A. tanya* Cbt. & Tams (43).

Text-figure 45.



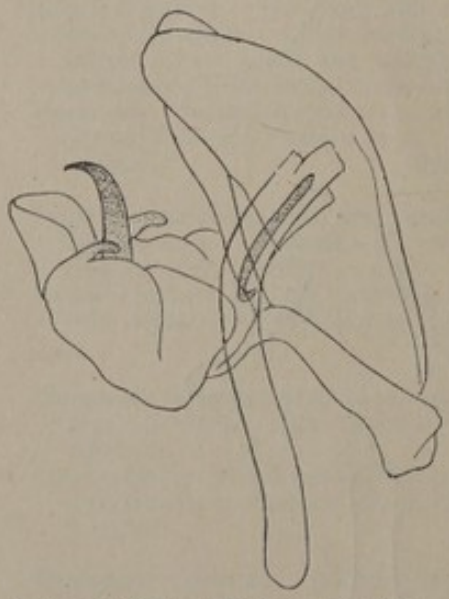
Male genitalia of *Pyralis manihotalis* Guen.

Text-figure 46.



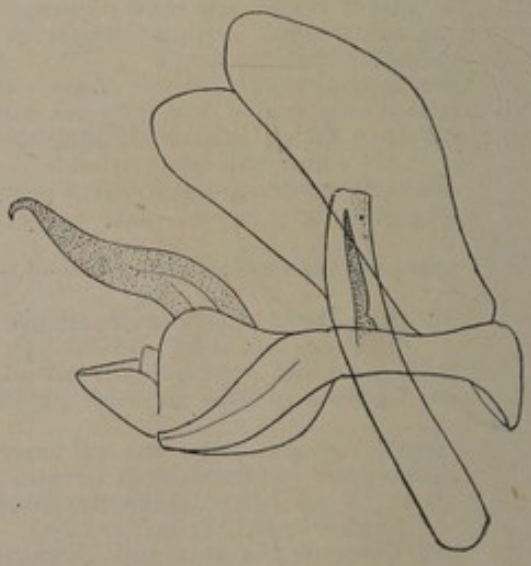
Male genitalia of *P. pictalis* (Curt.).

Text-figure 47.



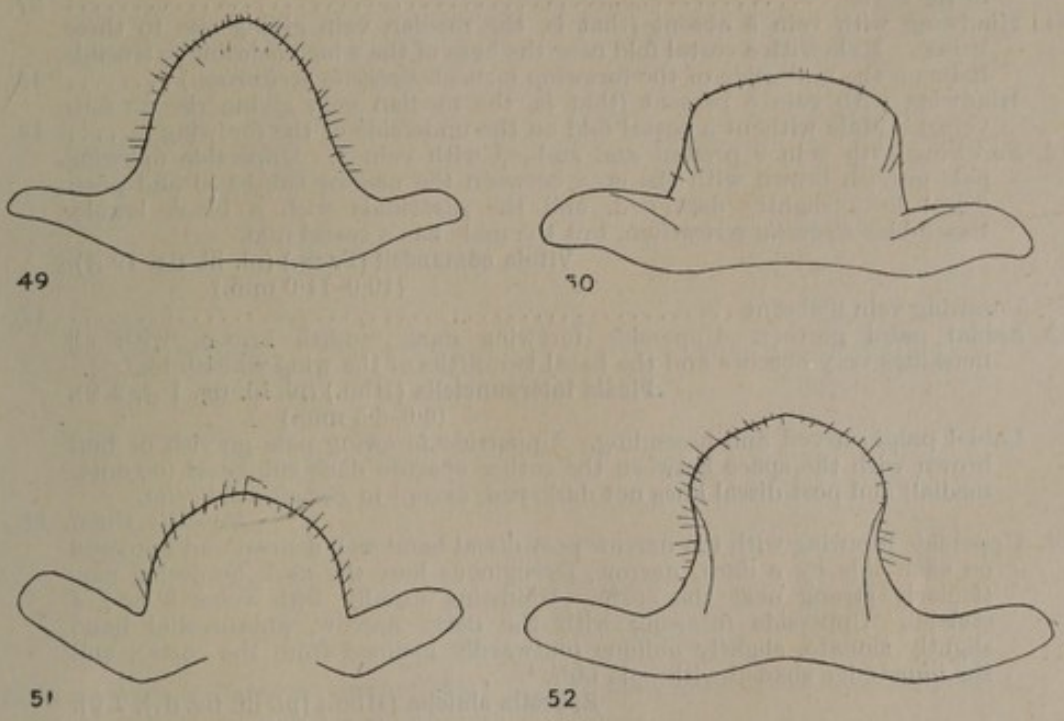
Male genitalia of *P. farinalis* (L.).

Text-figure 48.



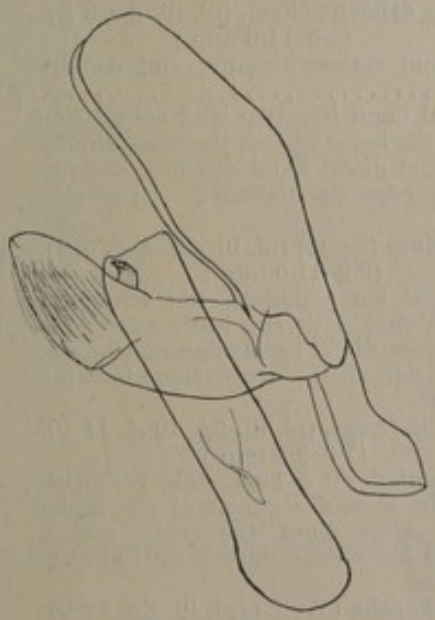
Male genitalia of *P. lienigialis* (Zell.).

Text-figures **49–52.**



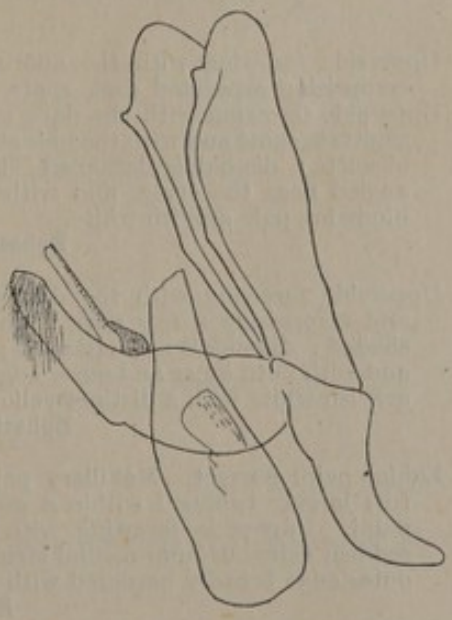
Ventral view of uncus of *P. pictalis* (Curt.) (49); *P. farinalis* (L.) (50); *P. lienigialis* (Zell.) (51); *P. manihotalis* Guen. (52).

Text-figure 53.



Male genitalia of *Vitula edmandsii* (Pack.)

Text-figure 54.



Male genitalia of *Plodia interpunctella* (Hbn.).

Forewing vein 7 present. Upperside forewing not marked as above. Male without a costal fold on the underside of the forewing but, in a few species, this sex has a costal hair-tuft above the cell or a swollen area near the base of the costa ..... 27.

11. Hindwing with vein 5 absent (that is, the median vein giving rise to three veins). Male with a costal fold near the base of the wing enclosing extrusible hairs on the underside of the forewing (except *Ephestia sericarium*) ..... 12.

Hindwing with vein 5 present (that is, the median vein giving rise to four veins). Male without a costal fold on the underside of the forewing ..... 18.

12. Forewing with vein 9 present and stalked with vein 8. Upperside forewing pale greyish brown with the area between the narrow sub-basal and post-discal lines slightly darkened, and the discoidals with a black lunule. Resembles *Ephestia sericarium*, but the male has a costal fold.

Vitula edmandsii (Pack.) (pl. iii. fig. 19 ♂).
(10·0–11·0 mm.)

Forewing vein 9 absent ..... 13.

13. Labial palpi porrect. Upperside forewing dark reddish brown, with all markings very obscure and the basal two-fifths of the wing whitish buff.

Plodia interpunctella (Hbn.) (pl. iii. fig. 1 ♂, 2 ♀).
(6·0–8·5 mm.)

Labial palpi curved and ascending. Upperside forewing pale greyish or buff brown with the space between the rather obscure dark sub-basal (or ante-medial) and post-discal lines not darkened, except in *Ephestia calidella*.

Ephestia Guen. 14.

14. Upperside forewing with the narrow post-discal band well defined and bordered on each side by a dark, narrow, ferruginous line, the dark bordering particularly strong near the costa. Hindwing usually with veins 3 and 4 stalked. Upperside forewing with the dark, narrow, ante-medial band slightly sinuate, slightly oblique (outwardly inclined from the costa), and the inner edge shaded with pale buff.

Ephestia elutella (Hbn.) (pl. iii. fig. 6 ♂, 7 ♀).
(7·0–9·0 mm.)

Upperside forewing with the post-discal band rather obscure and not well defined. Hindwing with veins 3 and 4 not stalked ..... 15.

15. Upperside forewing with the dark ante-medial band straight, rather broad, prominent and continuous, and inwardly broadly bordered by pale scales.

Ephestia cautella (Wlk.) (pl. iii. fig. 8 ♂, 9 ♀).
(6·5–8·5 mm.)

Upperside forewing with the ante-medial band not straight, but curved or angled ..... 16.

16. Upperside forewing with the dark ante-medial band prominent, sharply angled at vein 1 *b*, and inwardly broadly shaded with pale buff.

Ephestia calidella Guen. (pl. iii. fig. 3 ♂).
(9·0–11·0 mm.)

Upperside forewing with the ante-medial band rather obscure, and usually comprising separated dark spots ..... 17.

17. Upperside forewing with the dark ante-medial band irregular and comprising sagittate spots and with the pale shading on the inner edge of the band almost obsolete; discoidals darkened; the pale post-discal band obscure, sharply angled near the costa, and with the inner edge dark shaded. Upperside hindwing pale greyish white.

Ephestia sericarium (Scott) (pl. iii. fig. 4 ♂, 5 ♀).
(9·0–11·0 mm.)

Upperside forewing with the dark ante-medial band sinuate, not irregular, and comprising a few dark rounded spots, and with the inner edge pale shaded; discoidals not darkened; the pale post-discal band obscure, sinuate, and with both inner and outer edges equally darkened. Upperside hindwing greyish white with a distinct yellowish tinge.

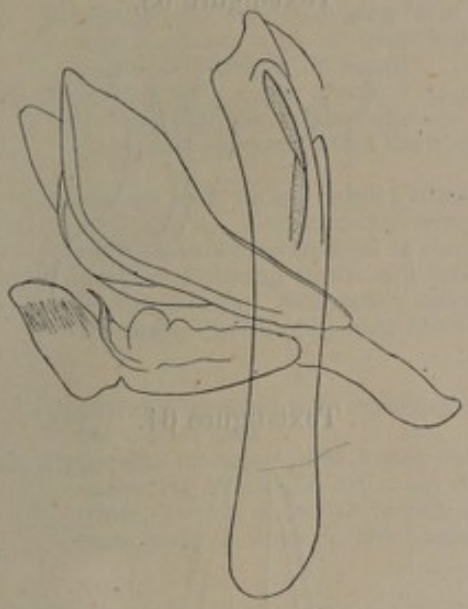
Ephestia figulilella Gregs. (pl. iii. fig. 10 ♂, 11 ♀).
(7·0–9·5 mm.)

18. Labial palpi porrect. Maxillary palpi represented by a long, pale yellowish tuft largely confined within a groove in the second segment of the labial palpi. Upperside forewing with a white stripe along the costa, and a reddish ochreous ante-medial stripe with its inner edge dark brown and its outer edge broadly bordered with pale yellow.

Etiella zinckenella (Treit.) (pl. iii. fig. 12 ♀).
(9·0–12·0 mm.)

Labial palpi with the second and third segments upturned. Maxillary palpi inconspicuous. Upperside forewing not as above ..... 19.

Text-figure 55.

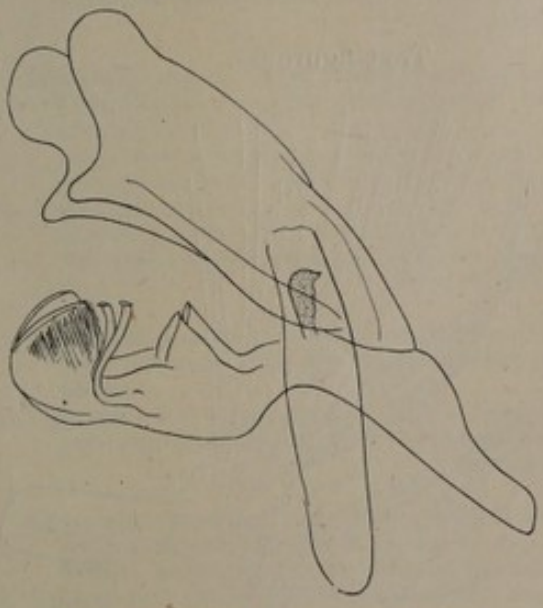


Male genitalia of *Ephestia elutella* (Hbn.).

Text-figure 56.

Male genitalia of *E. cautella* (Wlk.).

Text-figure 57.

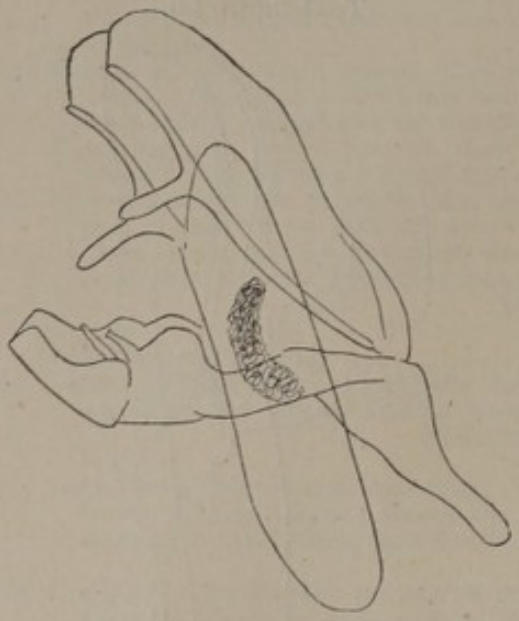


Male genitalia of *E. calidella* Guen.

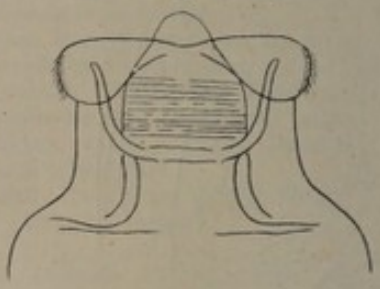
Text-figure 58.

Male genitalia of *E. sericarium* (Scott).

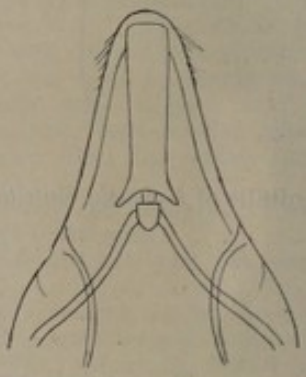
Text-figure 59.



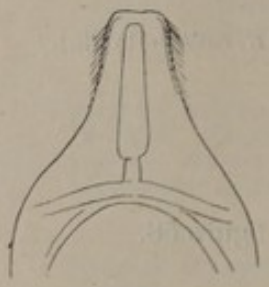
Text-figure 63.



Text-figure 64.

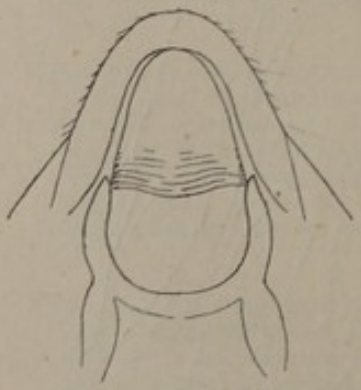


Text-figure 60.

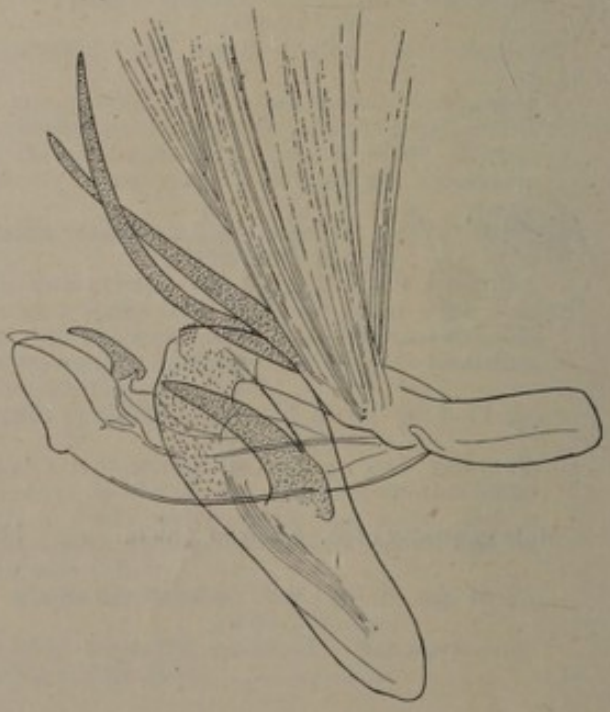


Text-figure 61.

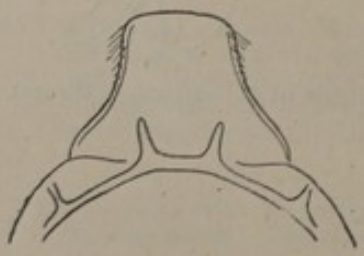
Text-figure 62.



Text-figure 66.



Text-figure 65.



Male genitalia of *E. figulilella* Gregs. (59); Ventral view of uncus of *Plodia interpunctella* (Hbn.) (60); *Ephestia elutella* (Hbn.) (61); *E. cautella* (Wlk.) (62); *E. calidella* Guen. (63); *E. sericarium* (Scott) (64); *E. figulilella* Gregs. (65); Male genitalia of *Etiella zinckenella* (Treit.) (66).

19. Forewing with vein 10 arising from vein 8. Antennæ prominently pectinated in basal half (pectinations visible with the naked eye). Upperside forewing greyish brown and unmarked except for the darkened veins and discoidals.
Mussidia nigrivenella Rag. (pl. iii. fig. 15 ♂).
(11·00–14·0 mm.)

Forewing with vein 10 arising from the cell. Antennæ not pectinated. Upperside forewing with at least indications of sub-basal (or ante-medial) and post-discal stripes or bands ..... 20.

20. Hindwing with veins 4 and 5 long stalked. Upperside forewing pale greyish brown, with the rather obscure ante-medial and post-discal bands equally prominent, and with two dark spots (often faint) on the discoidals.
Myelois Hbn. 21.

Hindwing with vein 5 arising from the end of the cell or very shortly stalked with vein 4. Upperside forewing rather similar in *Cryptoblabes gnidiella*, but without this combination of characters in *Acrobasis*..... 23.

21. Upperside forewing uniformly coloured greyish brown, ground-colour whiter in the female. Somewhat resembling *Ephestia sericarium*, particularly in the male, but the forewing has vein 5 present.
Myelois ceratoniæ Zell. (pl. iii. fig. 18).
(9·0–11·0 mm.)

Upperside forewing not uniformly coloured, the costal area much whiter than the dorsal area ..... 22.

22. Upperside forewing with costal half of wing greyish white, the whitened area extending below the cell; the dorsal half only sparsely dusted with greyish white, having a greyish brown appearance; the dark medial line extending from costa to dorsum, but becoming fainter in the dorsal area.
Myelois venipars Dyar (pl. iii. fig. 13♀).
(11·0–11·5 mm.)

Upperside forewing with costal area strongly whitened from near the base to the dark post-discal band, the whitened area hardly extending below the cell, and the dark medial line not below the median vein: dorsal half of wing distinctly reddish. **Myelois transitella** (Wlk.) (pl. iii. fig. 17 ♀).
(9·5–11·5 mm.)

23. Hindwing cell comparatively short, hardly more than one-third the length of the costa. Hindwing with veins 3 and 4 separated at their origins. Male basal segment of antennæ without a tooth. Upperside forewing greyish brown, with the pale ante-medial and post-discal bands sinuate and very faint, the former outwardly and the latter inwardly darkened: usually, with two small, obscure dark dots at the cell-end.
Cryptoblabes gnidiella (Mill.) (pl. iii. fig. 21 ♂).
(6·0–7·0 mm.)

Hindwing cell as usual, nearly half the length of the costa. Hindwing with veins 3 and 4 arising from a point. Male basal segment of antennæ with a prominent tooth. Upperside forewing with a ferruginous to dark brown ante-medial band, above which the costa is dark shaded, and a pale sinuate post-discal band; at the cell-end two small dark dots .... *Acrobasis* Zell. 24.

24. Upperside forewing without a sub-basal ridge of raised scales. Upperside forewing with a prominent, dark brown, triangular spot on the costa above the ante-medial band, and with its apex not extending below the cell.
Acrobasis juglandis (Le Baron) (pl. iii. fig. 16 ♀).
(7·5–8·0 mm.)

Upperside forewing with a prominent sub-basal ridge of raised scales. Upperside forewing with the dark shading above the ante-medial band not as above ..... 25.

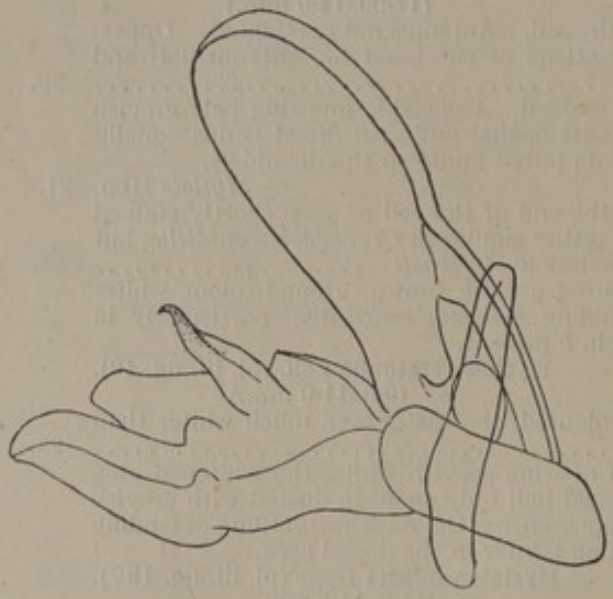
25. Upperside forewing pale grey with a faint ochreous tinge. Upperside hindwing pale ochreous brown, with the margins darker brown.
Acrobasis hebescella Hulst (pl. iii. fig. 14 ♀).
(8·5–9·5 mm.)

Upperside forewing dark brown, with a faint purple hue, and some pale grey scaling in the basal and medial areas. Upperside hindwing tinged purple-brown, becoming darker towards the margins ..... 26.

26. Upperside forewing distal edge of the sub-basal ridge of raised scales with a flesh-coloured border; basal and medial areas rather uniform greyish.
Acrobasis caryæ Grote (pl. iii. fig. 20, 23 ♀).
(8·5–9·0 mm.)

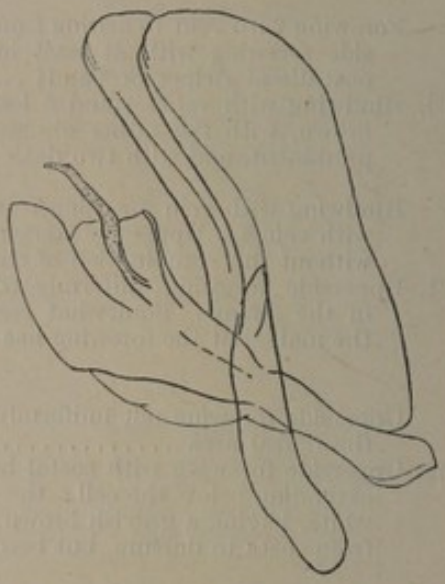
Upperside forewing distal edge of the sub-basal ridge of raised scales with a deep reddish brown border; basal area dark brown, becoming whitish grey towards the dark medial line, and with a whitish grey triangular patch on the costa with its apex near the end of the cell.
Acrobasis caryivorella Rag. (pl. iii. fig. 22 ♀).
(10·0 mm.)

Text-figure 67.



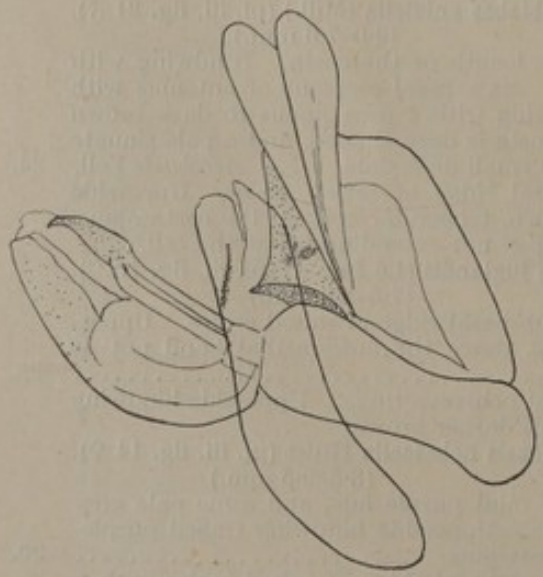
Male genitalia of *Mussidia nigrivenella* Rag.

Text-figure 68.



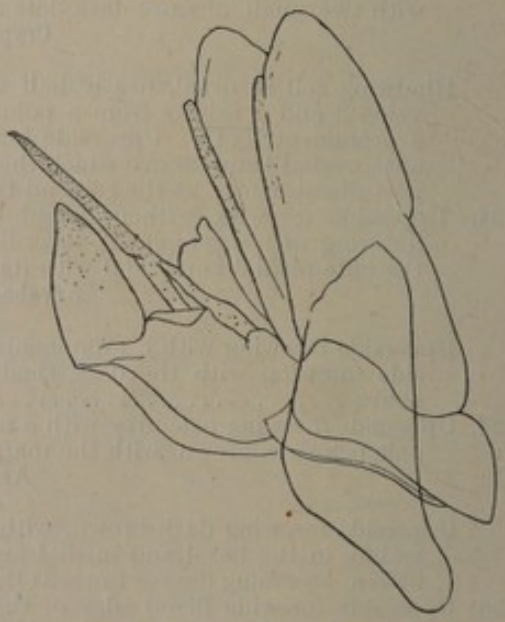
Male genitalia of *Myelois ceratoniæ* Zell.

Text-figure 69.



Male genitalia of *M. venipars* Dyar.

Text-figure 70.

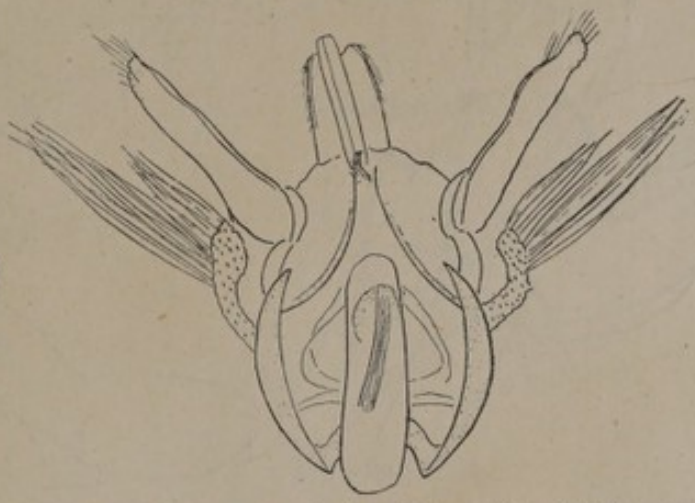


Male genitalia of *M. transitella* (Wlk.)

Text-figure 71.

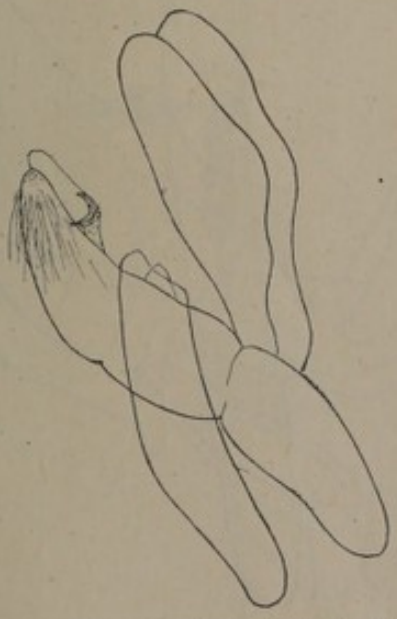
Male genitalia of *Cryptoblabes gnidiella* (Mill.) (the long hair-scales on the sacculus not shown).

Text-figure 72.



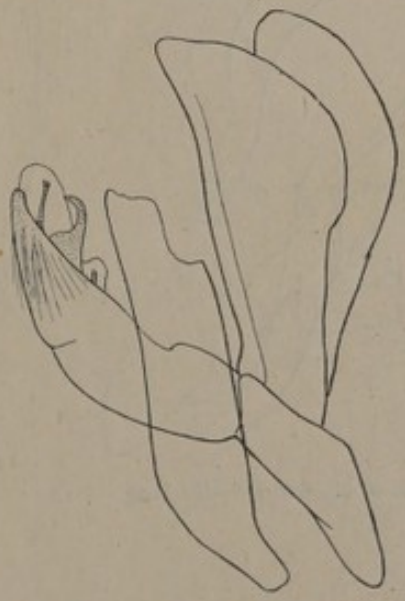
Ventral view of genitalia of *C. gnidiella* (Mill.).

Text-figure 73.



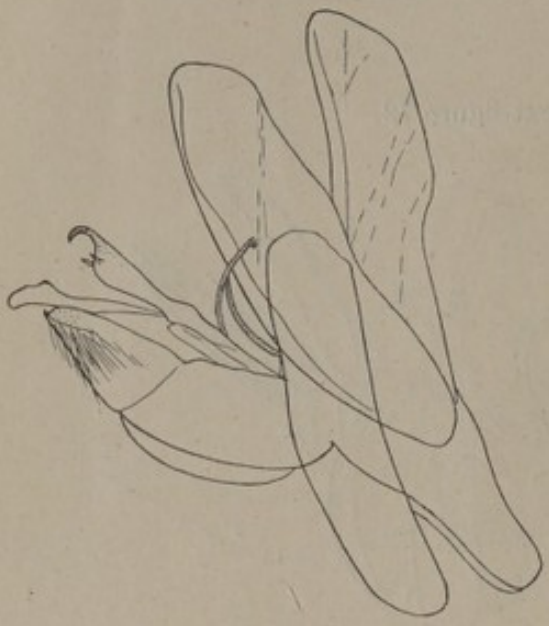
Male genitalia of *Acrobasis juglandis* (Le Baron).

Text-figure 74.



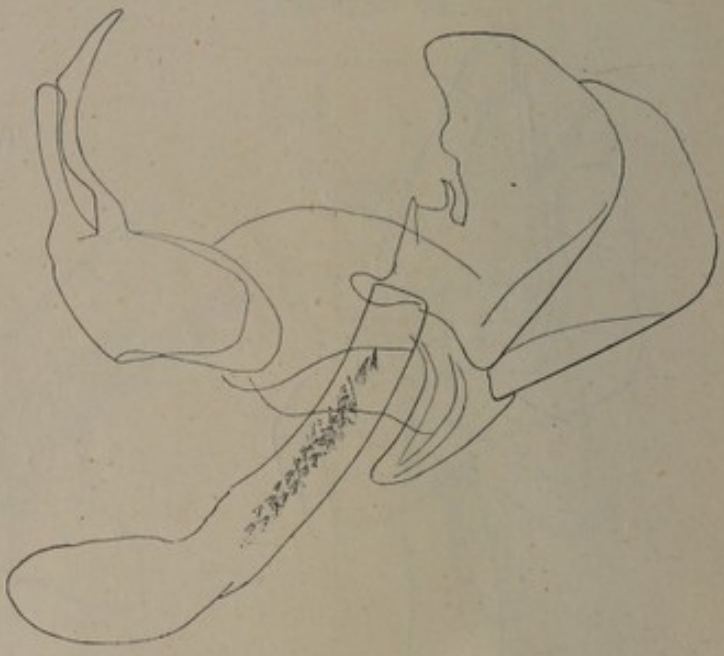
Male genitalia of *A. hebescella* Hulst.

Text-figure 75.



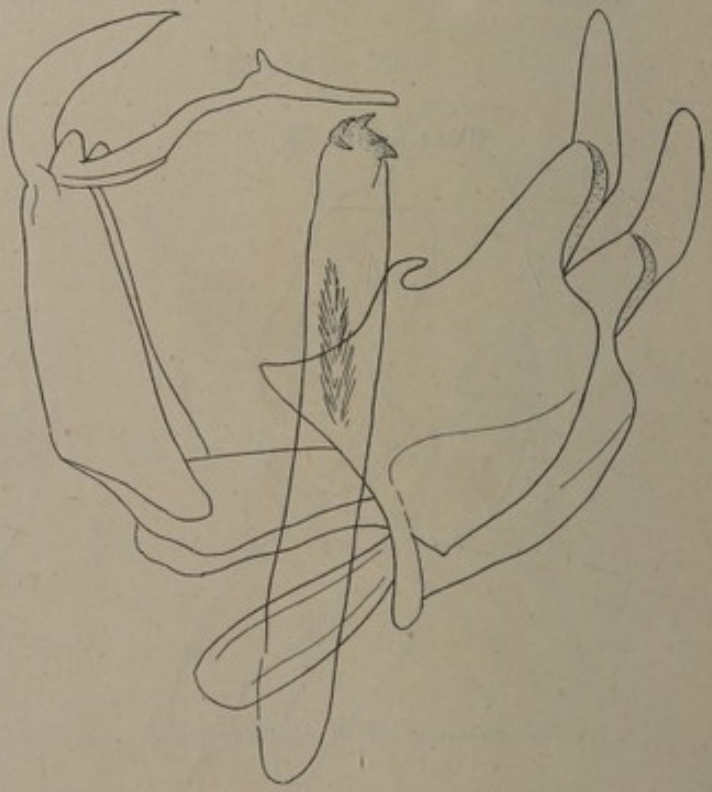
Male genitalia of *A. caryæ* Grote.

Text-figure 77.



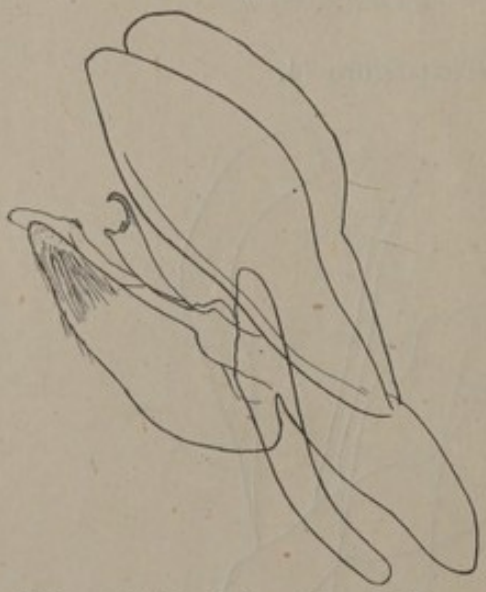
Male genitalia of *Euchromius ocellea* (Haw.).

Text-figure 78.



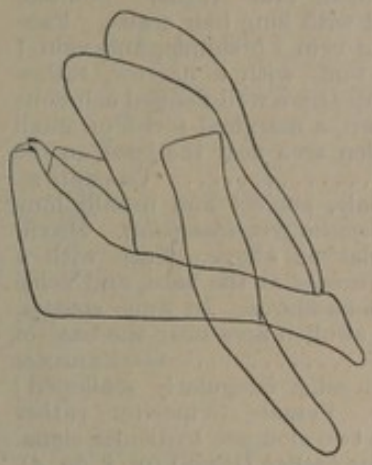
E. californicalis (Pack.).

Text-figure 76.

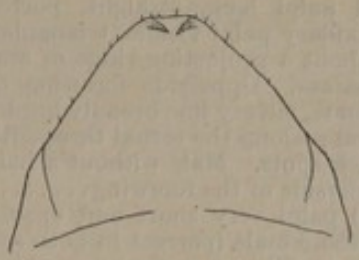


Male genitalia of *A. caryivorella* Rag.

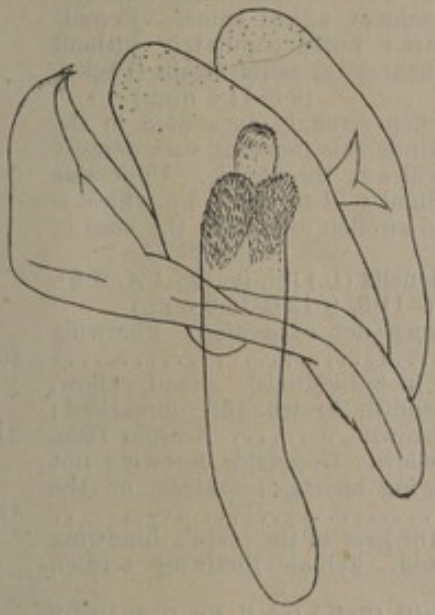
Text-figure 79.



Text-figure 80.



Text-figure 81.



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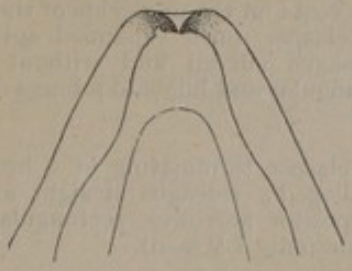

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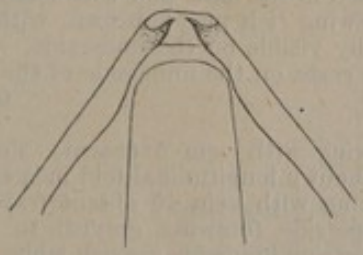

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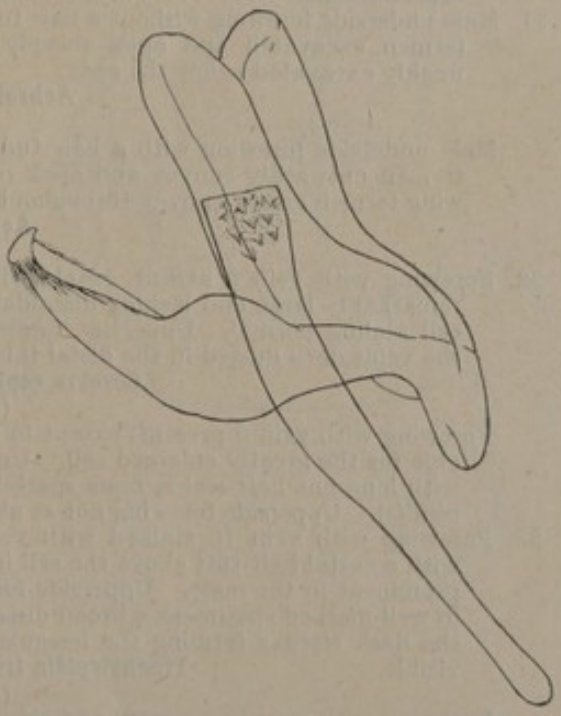
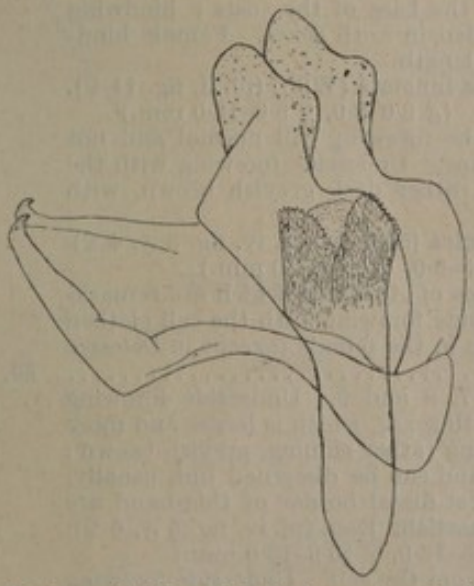


Text-figure 83.



Male genitalia of *Galleria mellonella* (L.) (79). Ventral view of uncus of *G. mellonella* (L.) (80). Male genitalia of *Achroia grisella* (Fab.) (81). Ventral view of uncus of *A. grisella* (Fab.) (82). Male genitalia of *A. innotata lankella* Cbt. & Tams (83). Ventral view of uncus of *A. innotata lankella* Cbt. & Tams (84). Male genitalia of *Corcyra cephalonica* (Staint.) (85).

27. Labial palpi long, straight, porrect, rough scaled, and rather pointed. Maxillary palpi visible, triangular in shape and with long hair scales. Face without a projecting ridge of scales. Forewing vein 1 *b* simple, and vein 7 separate. Upperside forewing pale ochreous buff, with a narrow, rather sinuate, silvery line broadly bordered on both sides by a well-defined ochreous band; along the tornal three-fifths of the termen, a marginal series of small black spots. Male without a hair-tuft or swollen area near the base on the underside of the forewing ..... CRAMBINÆ. 28.

Labial palpi very short and upturned in the male, porrect and usually long in the female (porrect in both sexes of *Trachylepidia fructicassiella*). Maxillary palpi not conspicuous and not triangular as above. Face with a projecting ridge of scales. Forewing vein 1 *b* furcate at the base, and veins 8 and 9 arising out of vein 7. Upperside not as above. In some species, the male with a costal tuft above the cell or a swollen area near the base of the costa on the underside of the forewing ..... GALLERIINÆ. 29.

28. Male clasper much expanded apically and inner edge irregularly scalloped; ædeagus curved and without apical spines. Female ovipositor rather triangular and bilobate; bursa copulatrix with two elongate lenticular signa.
Euchromius ocellea (Haw.) (pl. i. fig. 4).
(8·0–11·5 mm.)

Male clasper terminating in a broad, finger-like process and inner edge not scalloped; ædeagus straight and with prominent apical spines. Female ovipositor narrower, rectangular and bilobate; bursa copulatrix without signa (only 1 ♀ seen). **Euchromius californicalis** (Pack.).
(9·5–11·5 mm.)

29. Hindwing with vein 5 present. Forewing termen strongly excavated in the male and slightly excavated in the female. Underside forewing very densely scaled in the male and with long, fine hair-scales in the female. Upperside forewing rich purple-brown, with a longitudinal fold in space 1 *b* which is easily visible on the underside. Male with a swollen area near the base of the costa on the underside of the forewing.
Galleria mellonella (L.) (pl. iv. fig. 1 ♂, 2 ♀).
(♂ 9·5–11·5, ♀ 13·0–16·0 mm.)

Hindwing with vein 5 absent. Forewing termen not excavated. Forewing without a longitudinal fold in space 1 *b* ..... 30.

30. Forewing with vein 10 absent (rarely present in individuals). Head yellow. Upperside forewing greyish to ochreous reddish brown and unmarked; upperside hindwing greyish white to greyish brown ..... *Achroia* Hbn. 31.

Forewing with vein 10 present. Head not yellow. Upperside forewing not as above, the species with this wing colouring having markings, or the veins darkened ..... 32.

31. Male underside forewing without a hair tuft at the base of the costa; hindwing termen excavated and apex sharply pointed. Female hindwing termen weakly excavated below the apex.
Achroia grisella (Fab.) (pl. ii. fig. 9 ♂, 10 ♀).
(♂ 7·0–9·0, ♀ 9·5–12·0 mm.)

Male underside forewing with a hair tuft at the base of the costa; hindwing termen outwardly convex and apex rounded in both sexes. Female hindwing termen gently convex throughout its length.
Achroia innotata (Wlk.) (pl. ii. fig. 11 ♀).
(♂ 8·0–9·0, ♀ 9·0–13·0 mm.)

32. Forewing with vein 5 absent. Male with the forewing cell normal and not remarkably large and lacking discoidal veins. Underside forewing with the cell scaling normal. Upperside forewing rather dark greyish brown, with the veins dark dusted in the distal third.
Corcyra cephalonica (Staint.) (pl. iv. fig. 3 ♂, 4 ♀).
(♂ 7·5–9·0, ♀ 8·5–11·0 mm.)

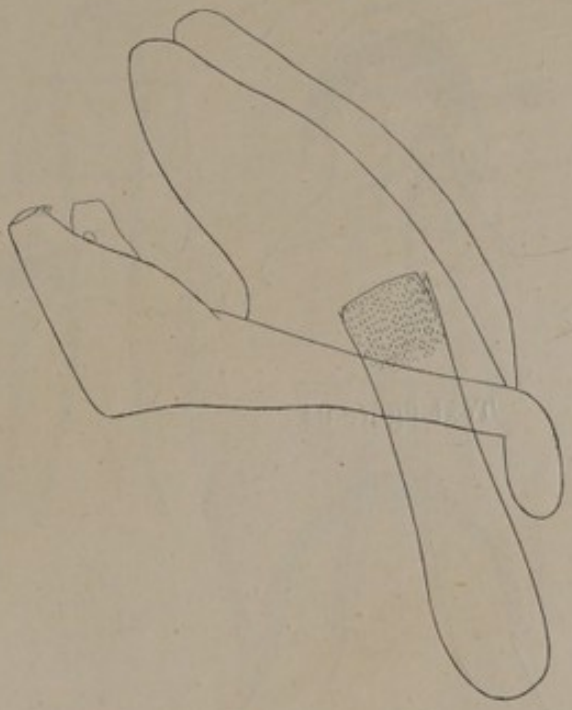
Forewing with vein 5 present, except in males of *Aphomia*, which are remarkable for the greatly enlarged cell. Underside forewing with the cell clothed with long fine hair-scales, more sparsely so in the female (except in *Doloessa viridis*). Upperside forewing not as above ..... 33.

33. Forewing with vein 10 stalked with veins 7, 8 and 9. Underside forewing with a costal hair-tuft above the cell in both sexes, which is larger and more prominent in the male. Upperside forewing rather shining, greyish brown; in well-marked specimens a broad discal band can be discerned but, usually, the dark streaks forming the irregular post-discal border of this band are visible. **Trachylepidia fructicassiella** Rag. (pl. iv. fig. 5 ♂, 6 ♀).
(♂ 8·5–12·0, ♀ 13·0–16·0 mm.)

Forewing with vein 10 separate and arising from the cell. Underside forewing with a costal hair-tuft only in the male of *Aphomia gularis*. Upperside forewing not as above ..... 34.

Text-figure 86.

Text-figure 87.



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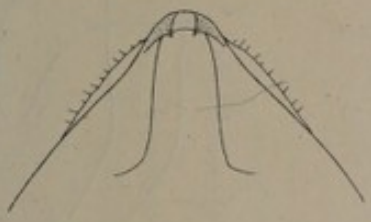

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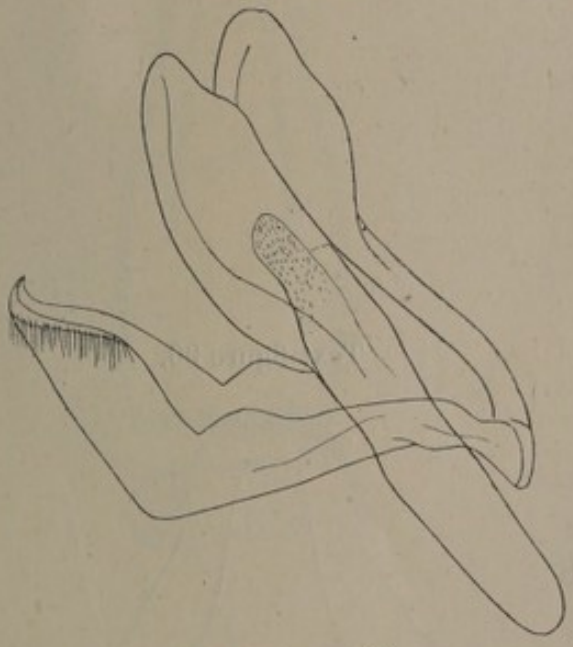
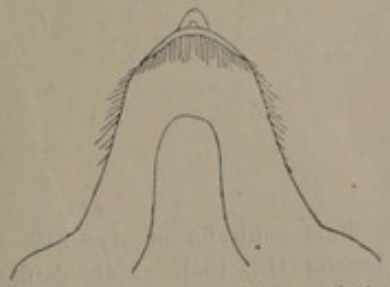


Text-figure 91.

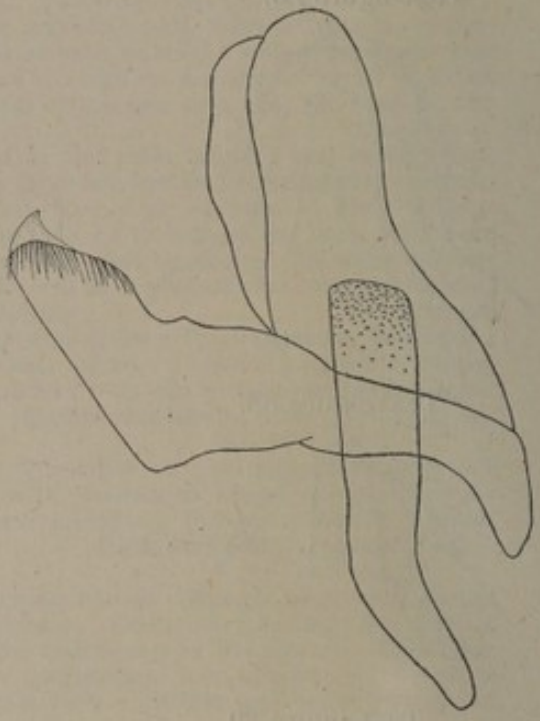
Text-figure 90.



Ventral view of uncus of *C. cephalonica* (Staint.) (86). Male genitalia of *Trachylepidia fructicassiella* Rag. (87). Ventral view of uncus of *T. fructicassiella* Rag. (88). Male genitalia of *Doloessa viridis* Zell. (89). Ventral view of uncus of *D. viridis* Zell. (90). Male genitalia of *Arenipses sabella* Hamps. (91).

Text-figure 92.

Text-figure 93.



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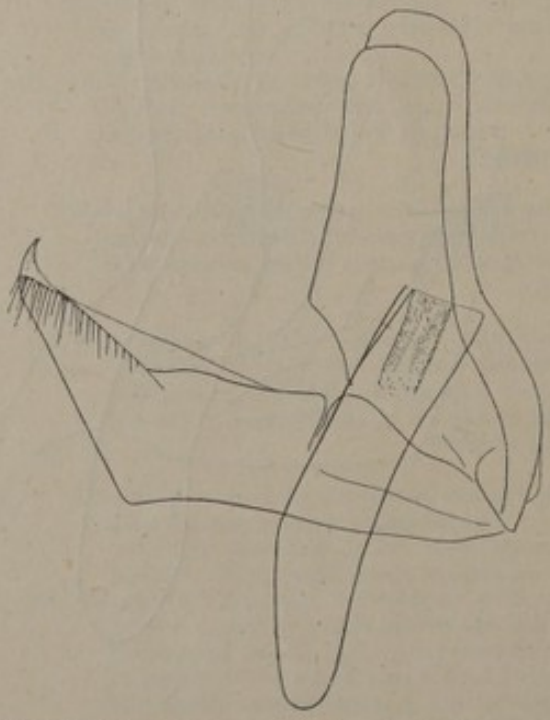
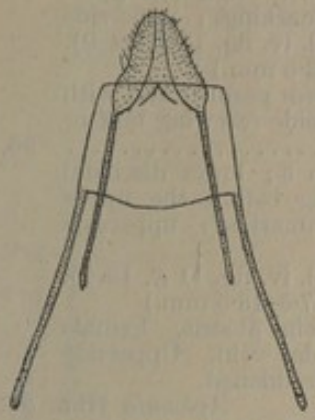
Text-figure 95.



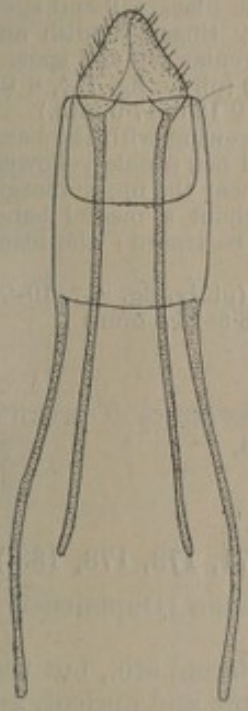
Text-figure 96.

Ventral view of uncus of *A. sabella* Hamps. (92). Male genitalia of *Aphomia sociella* (L.) (93). Ventral view of uncus of *A. sociella* (L.) (94). Male genitalia of *A. gularis* (Zell.) (95). Ventral view of uncus of *A. gularis* (Zell.) (96).

Text-figure 97.



Text-figure 98.



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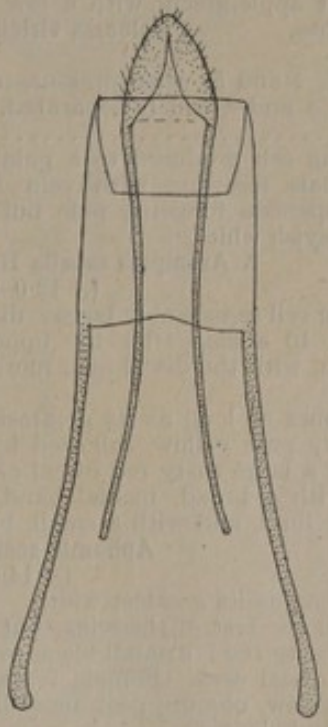

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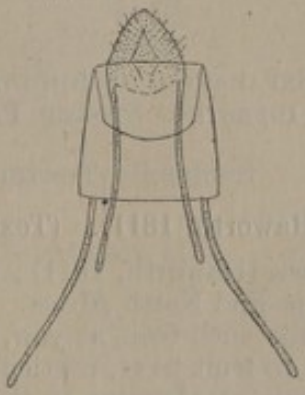

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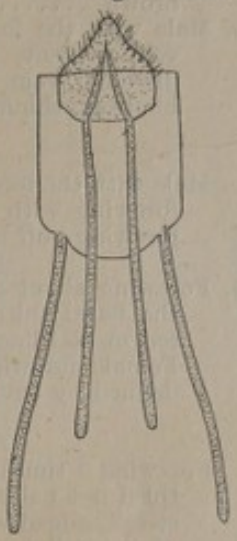
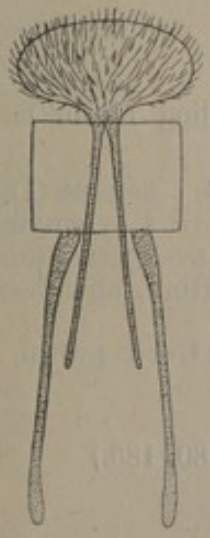


Text-figure 102.

Text-figure 103.



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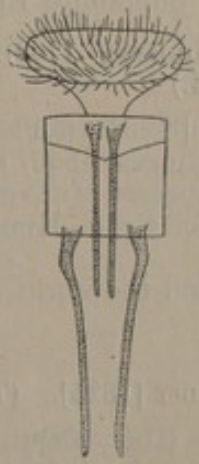


Ovipositor lobes and anterior and posterior apophyses of *Aglossa caprealis* (Hbn.) (97); *A. pinguinalis pinguinalis* (L.) (98); *A. pinguinalis asiatica* Erschoff (99); *A. dimidiatus* (Haw.) (100); *A. tanya* Cbt. & Tams (allotype from India, Jubbulpore) (101); *Hypsopygia costalis* (Fab.) (102); *Pyralis manihotalis* Guen. (103); *P. pictalis* (Curt.) (104).

34. Forewing with veins 3, 4 and 5 closely approximated at their origins. Upperside forewing bright apple-green, with a few brown markings; upperside hindwing shining whte. **Doloessa viridis** Zell. (pl. iv. fig. 13 ♂, 14 ♀). (9·5–13·5 mm.)

Forewing with veins 3, 4 and 5, when present, more or less parallel and with the origins of veins 3 and 4 widely separated. Upperside forewing buff or brown ..... 35.

35. Male with the forewing cell produced to a point at vein 5; lower discoidal vein present. Female forewing with vein 10 arising before the upper discoidal vein. Upperside forewing pale buff and unmarked; upperside hindwing shining greyish white. **Arenipses sabella** Hamps. (pl. iv. fig. 11 ♂, 12 ♀). (♂ 12·0–14·0, ♀ 17·5–18·5 mm.)

Male with the forewing cell remarkably large; discoidal veins absent. Female forewing with vein 10 arising after the upper discoidal vein. Upperside forewing buff brown, with the discal area more or less reddened. *Aphomia* Hbn. 36.

36. Forewing about 2½ times as long as its greatest width. Male forewing with the basal third very pale yellow, followed by an irregular, diffuse, rusty red medial line and a large rusty red discal patch; no black cell-end spot. Female forewing with a broad, medial band, slightly tinged reddish and defined by irregular lines, and with a small, black, circular cell-end spot. **Aphomia sociella** (L.) (pl. iv. fig. 7 ♂, 8 ♀). (♂ 14·0–15·0, ♀ 12·0–17·0 mm.)

Forewing 3 times as long as its greatest width. Male forewing with the basal third not paler than the rest of the wing, but the cell has a pale yellowish streak, edged with rusty red; a small black oval dot near the upper margin of the cell in the discal area. Female forewing without a medial band, although a dark, narrow, obscure post-discal line can be traced; the black cell-end spot large and elongate. **Aphomia gularis** (Zell.) (pl. iv. fig. 9 ♂, 10 ♀). (♂ 8·5–12·0, ♀ 8·5–13·5 mm.)

III. Key for the Separation of Adults of Species of Tortricidæ infesting Stored Products.

Subfamily Tortricinæ.

Batodes angustiorana (Haworth, 1811). (Text-figs. 171, 173, 178, 183.)

Synonyms: *rotundana* (Haworth, 1811); *dumeriliana* (Duponchel, 1834).

Distribution: Europe and North Africa.

Larval food: normally such trees as yew, privet, larch, etc., but the larvæ can cause great damage to fruit trees, particularly apple and apricot, and they have been found in greenhouses feeding on the pulp of young grapes.

Subfamily Eucosminæ.

Enarmonia pomonella (Linnæus, 1758). ("The Codling Moth.") (Text-figs. 172, 174, 179, 184.)

Synonyms: *pomonana* ([Schiffermüller & Denis], 1775); *pomona* (Fabricius, 1793); *putaminana* (Staudinger, 1859) also appears to be a synonym. This and the following three species of *Enarmonia* Hbn. have been known also under the generic names of *Cydia* Hbn., *Laspeyresia* Hbn., and *Carpocapsa* Treits.

Distribution: throughout the world where the apple tree is grown.

Larval food: apples.

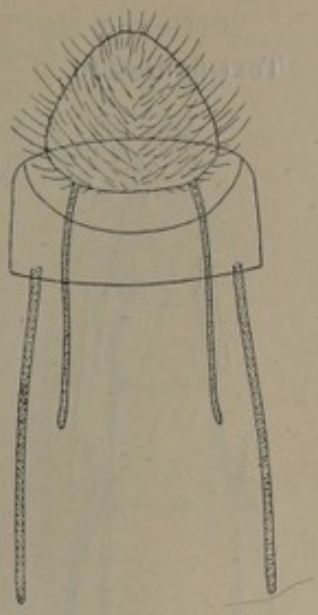
Enarmonia splendana Hübner [1825]. (Text-figs. 175, 180, 185.)

Synonym: *reaumurana* (Heinemann, 1863).

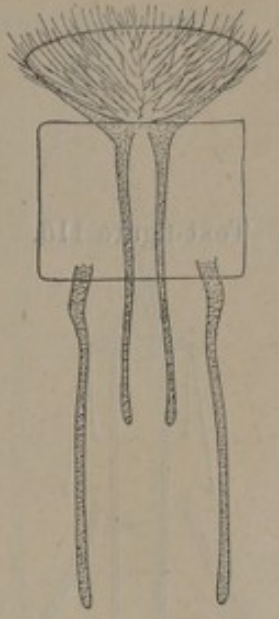
Distribution: Europe and temperate Asia.

Larval food: acorns, but occasionally walnuts and Spanish chestnuts.

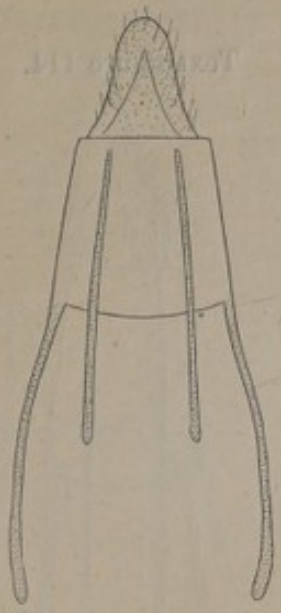
Text-figure 105.



Text-figure 106.

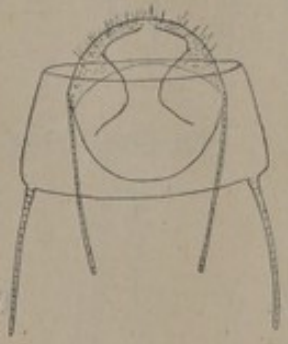


Text-figure 107.



Text-figure 108.

Text-figure 110.



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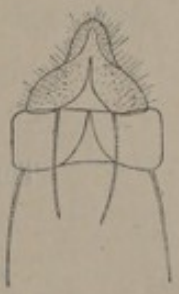
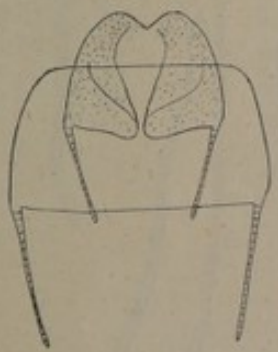


Text-figure 112.

Text-figure 113.

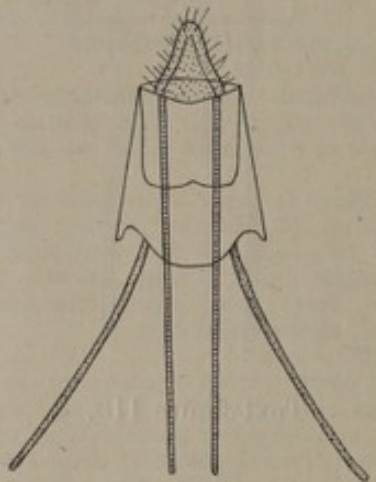
Text-figure 111.



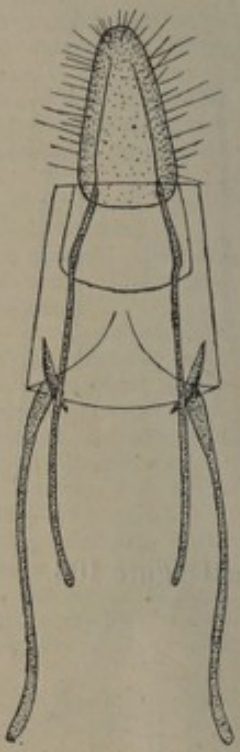
Ovipositor lobes and anterior and posterior apopnyses of *P. farinalis* (L.) (105); *P. lienigialis* (Zell.) (106); *Vitula edmandsii* (Pack.) (107); *Plodia interpunctella* (Hbn.) (108); *Ephestia elutella* (Hbn.) (109); *E. cautella* (Wlk.) (110); *E. calidella* (Guen. (111); *E. sericarium* (Scott) (112); *E. figulilella* Gregs. (one scale-tuft removed) (113).

Text-figure 114.

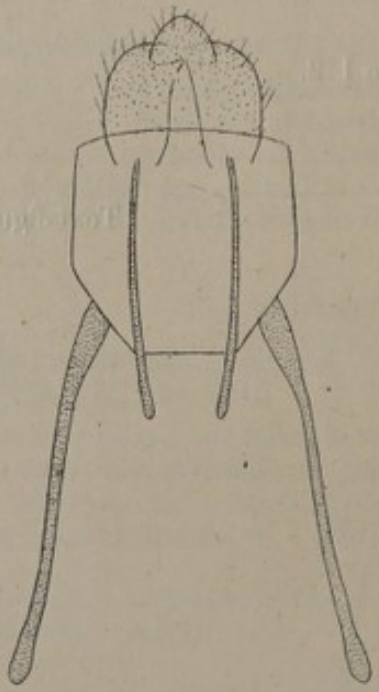
Text-figure 115.



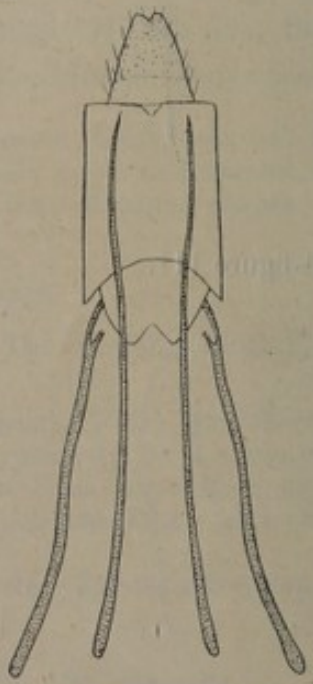
Text-figure 116.



Text-figure 117.



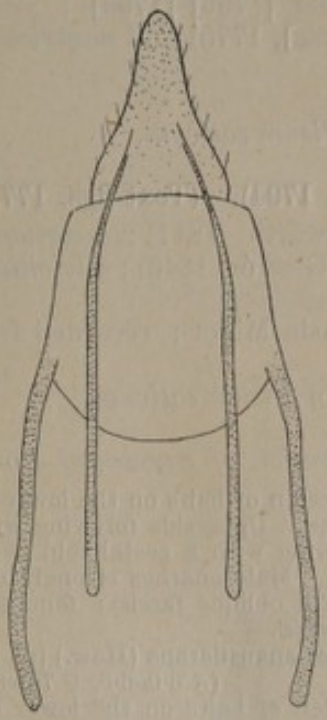
Text-figure 118.



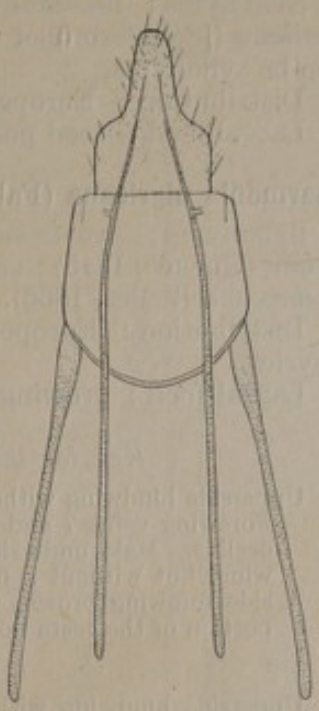
Ovipositor lobes and anterior and posterior apophyses of *Etiella zinckenella* (Treit.) (114); *Mussidia nigrivenella* Rag. (115); *Myelois ceratoniæ* Zell. (116); *M. venipars* Dyar (117); *M. transitella* (Wlk.) (118).

Text-figure 119.

Text-figure 120.



Text-figure 121.



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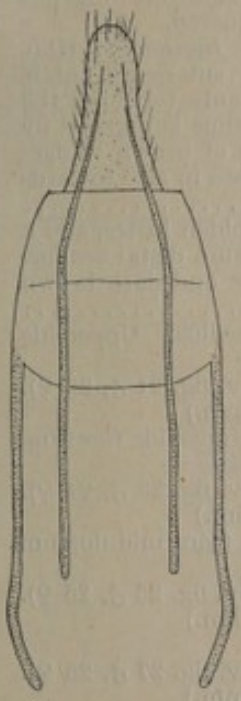

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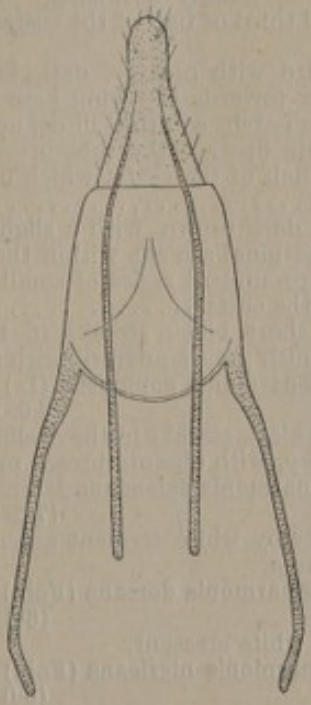

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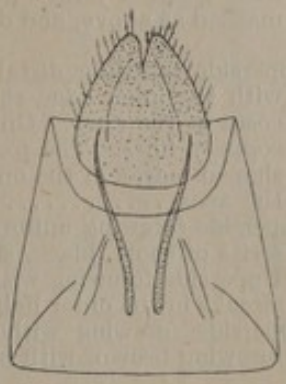

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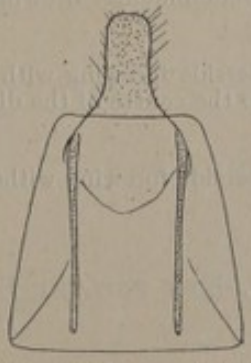


Ovipositor lobes and anterior and posterior apophyses of *Cryptoblabes gnidiella* (Mill.) (119); *Acrobasis juglandis* (Le Baron) (120); *A. hebescella* Hulst (121); *A. caryæ* Grote (122); *A. caryivorella* Rag. (123); *Euchromius ocellea* (Haw.) (124); *E. californicalis* (Pack.) (125).

Enarmonia dorsana (Fabricius, 1775). (Text-figs. 176, 181, 186.)

Synonyms: *lunulana* (Hübner [1796]–[1799]); *jungiana* (Frölich, 1828). *lunulana* ([Schiffermüller & Denis], 1775) and *megerleana* (Frölich, 1828) may also be synonyms.

Distribution: Europe.

Larval food: seed pods of *Pisum sativum*.

Enarmonia nigricana (Fabricius, 1794). (Text-figs. 177, 182, 187.)

Synonyms: *proximana* (Haworth, 1811); *nebritana* (Treitschke, 1830); *pisana* (Guenée, 1845); *viciana* (Guenée, 1845); *gilviciliana* (Staudinger, 1859); *tenebrosana* (Zeller, 1866).

Distribution: Europe and Asia Minor; recorded from North America by Meyrick.

Larval food: growing pods of *Pisum sativum*.

Key for the Separation of Species of Tortricidæ.

1. Upperside hindwing without a pecten of hairs on the lower margin of the cell. Forewing veins 7 and 8 stalked. Upperside forewing without a sub-tornal ocellus. Male underside forewing with a costal fold near the base of the wing, but without a hair-tuft. Male gnathos strongly developed. Upperside forewing brown, with dark oblique fasciæ; female paler: the distal portion of the costa not chequered.

Batodes angustiorana (Haw.) (pl. iv. fig. 29 ♂, 30 ♀).
(♂ 6·0–6·5, ♀ 7·0–8·0 mm.)

Upperside hindwing with a pecten of hairs on the lower margin of the cell. Forewing with veins 7 and 8 free. Upperside forewing with an ocellus, which comprises a rather irregular, sub-tornal patch, with metallic edging, and, in some species, with short black streaks. Male without a costal fold. Male gnathos undeveloped or weakly developed. Upperside forewing not marked as above, and distal third or half of the costa chequered.

Enarmonia Hbn. 2.

2. Upperside forewing distal third with a large, dark brown, sub-ovate patch, with the inner edge convex towards the wing base and only touching the costa at the apex. On this patch, a rather ill-defined ocellus is marked by coppery lines. The forewing has a rather obscure series of brown wedge-shaped marks in the outer half of the costa, which increases in size towards the apex ..... 3.

Upperside forewing uniformly dark brown, with a slightly golden lustre, and a series of short, black, submarginal streaks within the obscure distal ocellus. Upperside forewing with a prominent series of small white and dark brown streaks in the outer half of the costa ..... 4.

3. Upperside forewing without short black streaks in the ocellus. Upperside forewing brown, with brownish grey transverse striations.

Enarmonia pomonella (L.) (pl. iv. fig. 21 ♂, 22 ♀).
(8·0–10·0 mm.)

Upperside forewing with short black streaks in the ocellus. Upperside forewing predominantly brownish grey, with obscure brown markings.

Enarmonia splendana Hbn. (pl. iv. fig. 23 ♂, 24 ♀).
(7·5–8·5 mm.)

4. Upperside forewing with a creamy white crescent extending from mid-dorsum to the centre of the discal area.

Enarmonia dorsana (Fab.) (pl. iv. fig. 25 ♂, 26 ♀).
(6·0–7·5 mm.)

Upperside forewing without a white crescent.

Enarmonia nigricana (Fab.) (pl. iv. fig. 27 ♂, 28 ♀).
(6·0–7·0 mm.)

IV. Key for the Separation of Adults of Species of Tinæina infesting Stored Products.

Family GELECHIIDÆ.

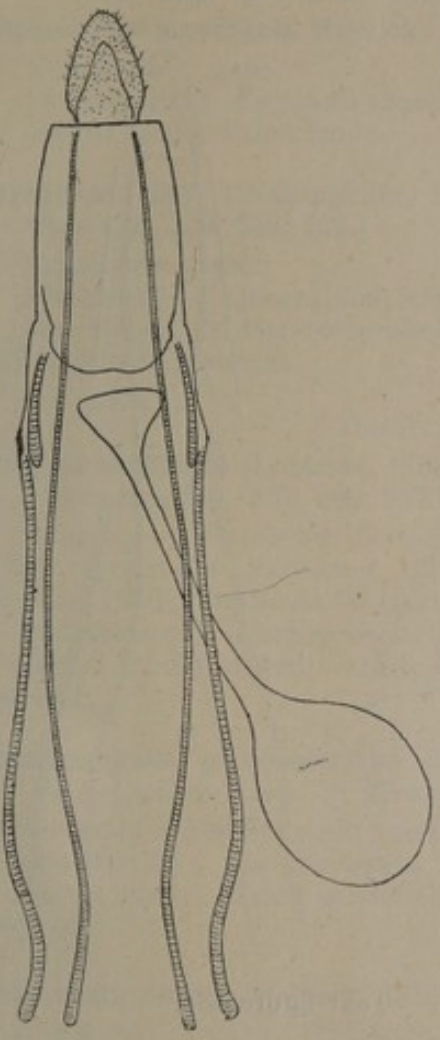
Sitotroga cerealella (Olivier, 1789). ("The Angoumois Grain Moth.") (Text-figs. 188, 204, 237, 264.)

Synonyms: *arctella* Walker, 1864; *coarctatella* Zeller, 1877; *melanarthra* Lower, 1910; *palearis* Meyrick, 1913.

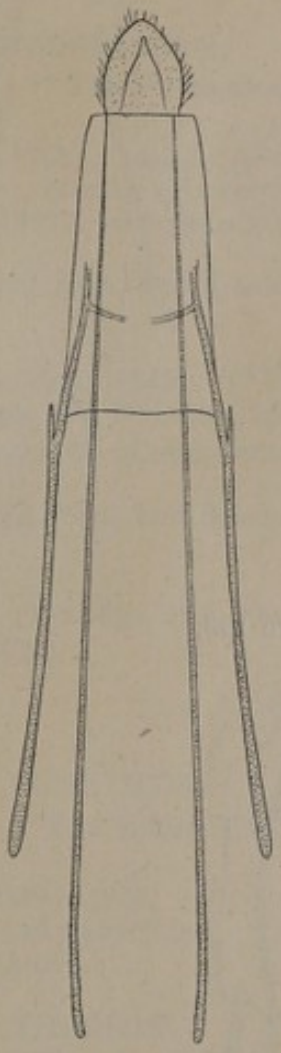
Distribution: Cosmopolitan.

Larval food: stored cereals.

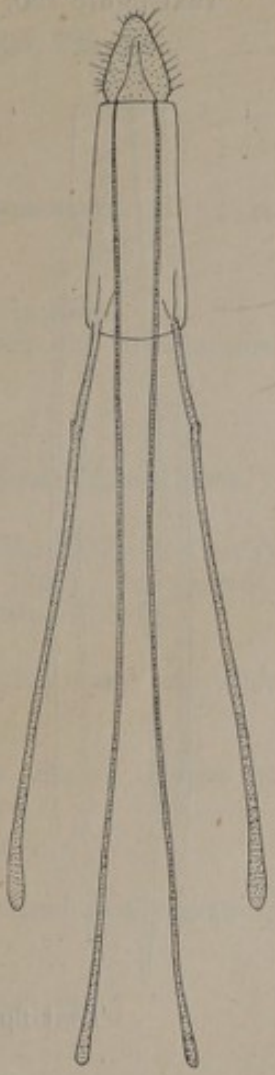
Text-figure 126.



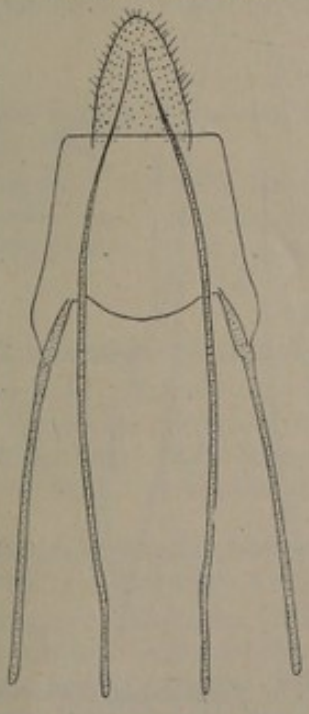
Text-figure 127.



Text-figure 128.

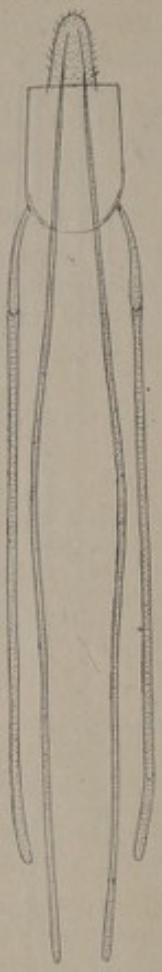


Text-figure 129.

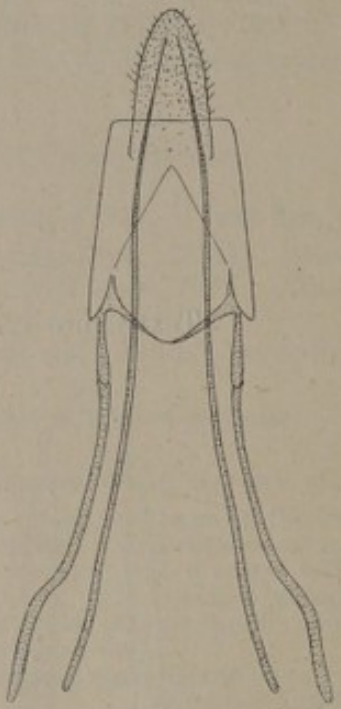


Ovipositor lobes and anterior and posterior apophyses of *Galleria mellonella* (L.) (also showing bursa copulatrix) (126); *Achroia grisella* (Fab.) (127); *A. innotata innotata* (Wlk.) (co-type from Sarawak) (128); *Corcyra cephalonica* (Staint.) (129).

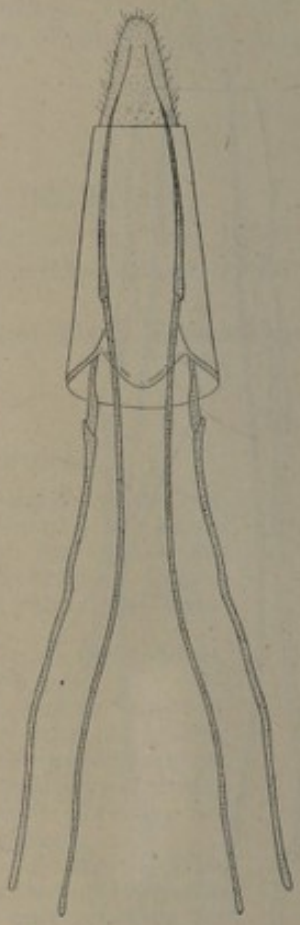
Text-figure 130.



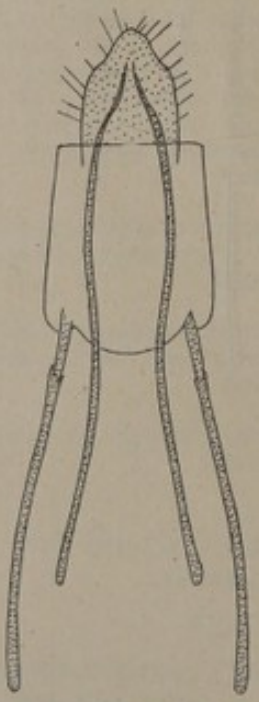
Text-figure 131.



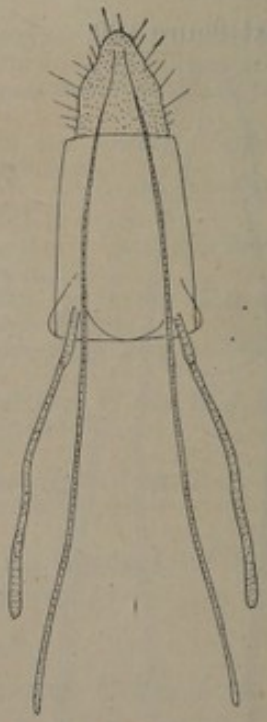
Text-figure 132.



Text-figure 133.



Text-figure 134.



Ovipositor lobes and anterior and posterior apophyses of *Trachylepidia fructicassiella* Rag. (130); *Doloessa viridis* Zell. (131); *Arenipses sabella* Hamps. (132); *Aphomia sociella* (L.) (133); (134) *A. gularis* (Zell.).

Family COSMOPTERYGIDÆ.

Batrachedra amydraula Meyrick, 1916. (Text-figs. 189, 205, 238, 265.)

Synonyms : none.
Distribution : Egypt to southern India.
Larval food : dried fruit.

Pyroderces rileyi (Walsingham, 1882). (" The Pink Corn-worm.") (Text-figs. 190, 206, 239, 266.)

Synonyms : none.
Distribution : Queensland, southern U.S.A., Jamaica, Hawaiia.
Larval food : rotten cotton-bolls in the field, stored cereals and dried animal and vegetable material.

Family ŒCOPHORIDÆ.

Endrosis sarcitrella (Linnæus, 1758). (" The White-shouldered House Moth.") (Text-figs. 191, 207, 240, 267.)

Synonyms : *fenestrella* (Scopoli, 1763) ; *lactella* ([Schiffermüller & Denis], 1775) ; *betulinella* (Fabricius, 1787) ; *sarcitea* (Haworth, 1828) ; *kennicottella* Clemens, 1860 ; *subditella* (Walker, 1863) ; *antarctica* Staudinger, 1898.
Distribution : Cosmopolitan.
Larval food : stored cereals, dried fruit, and dried animal and vegetable material.

Hofmannophila pseudospretella (Stainton, 1849). (" The Brown House or False Clothes Moth.") (Text-figs. 192, 208, 241, 268.)

Synonym : *Borkhausenia pseudospretella* of many authors.
Distribution : Cosmopolitan.
Larval food : stored cereals, dried fruit, and dried animal and vegetable material.

Anchonoma xeraula Meyrick, 1910. (Text-figs. 193, 209, 242, 269.)

Synonym : *kuwanii* (Heinrich, 1920).
Distribution : India to Japan.
Larval food : stored cereals.

Family LYONETIIDÆ.

Oinophila v-flava (Haworth, 1828). (" The Yellow V.") (Text-figs. 194, 210, 243, 270.)

Synonym : *v-flavella* Herrich-Schäffer, 1855.
Distribution : Europe, Madeira, and Canary Is.
Larval food : dried vegetable material.

Family TINÆIDÆ.

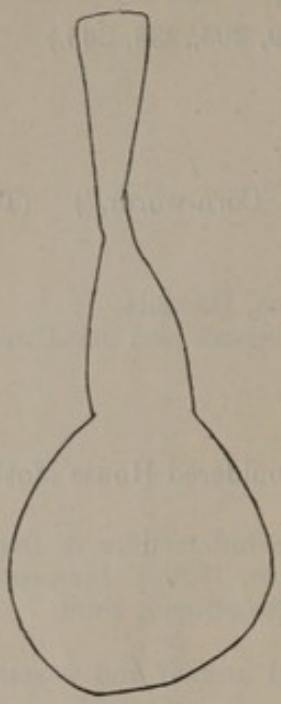
Spatularia mimosæ (Stainton, 1859). (Text-figs. 195, 211, 244, 271.)

Synonyms : *fuligineella* van Deventer, 1904 ; *seminivora* (Walsingham, 1899) ; *ophionota* (Meyrick, 1907).
Distribution : Indo-Malayan region.
Larval food : seed pods of leguminous plants.

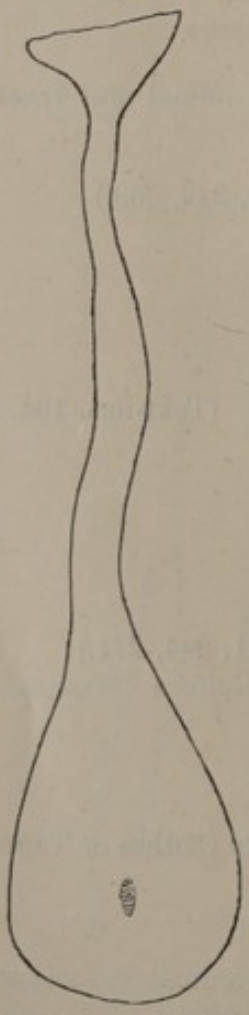
Trichophaga tapetzella (Linnæus, 1758). (" The White-tip Clothes or Tapestry Moth.") (Text-figs. 196, 212, 245, 272.)

Synonym : *palæstrica* (Butler, 1877).
Distribution : Cosmopolitan.
Larval food : carpets, clothing, furs, and other dried animal and vegetable matter.

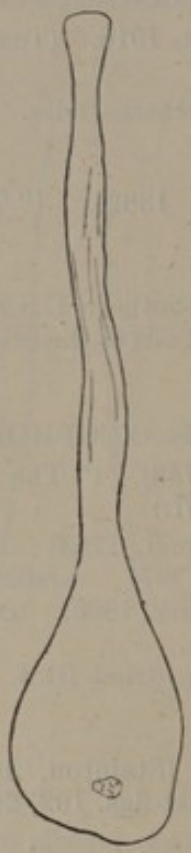
Text-figure 135.



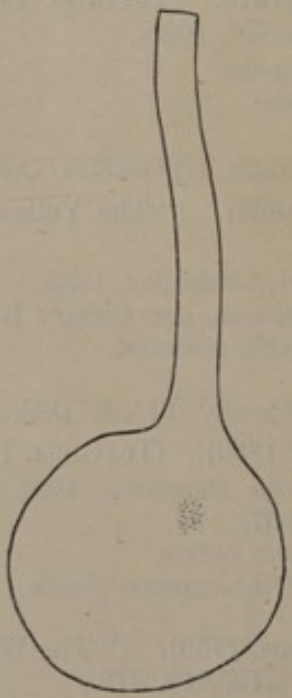
Text-figure 136.



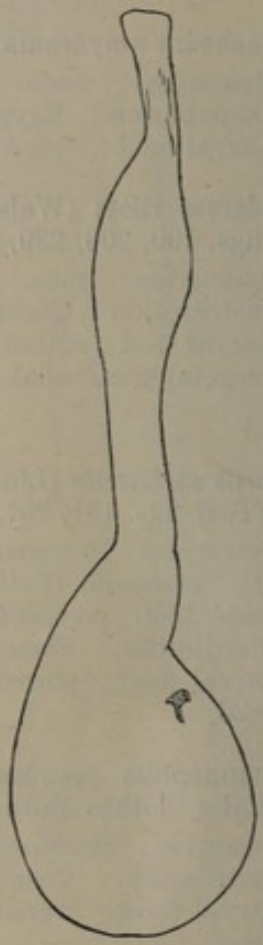
Text-figure 137.



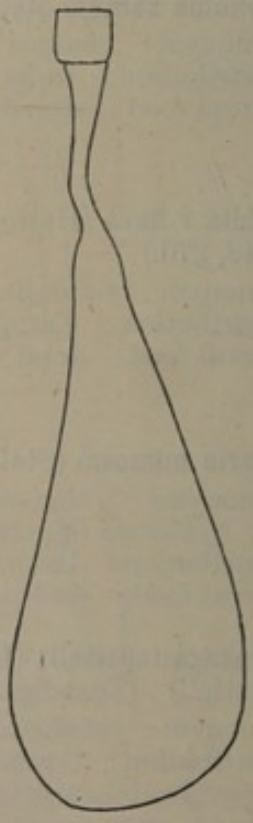
Text-figure 138.



Text-figure 139.

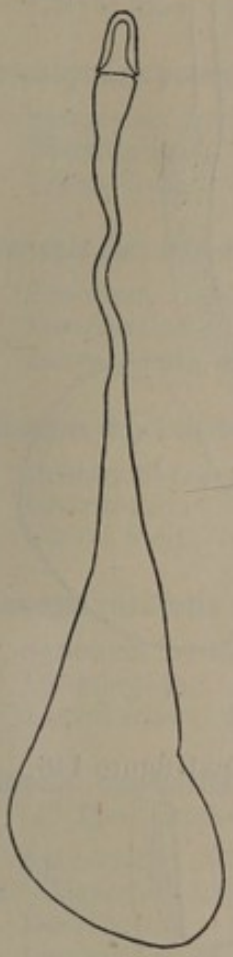


Text-figure 140.

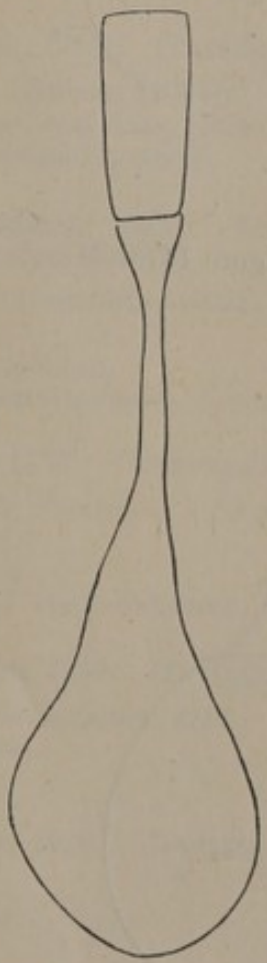


Bursa copulatrix of *Aglossa caprealis* (Hbn.) (135); *A. pinguinalis pinguinalis* (L.) (136); *A. dimidiatus* (Haw.) (137); *A. tanya* Cbt. & Tams (allotype from India, Jubbulpore) (138); *Hypsopygia costalis* (Fab.) (139); *Pyralis manihotalis* Guen. (140).

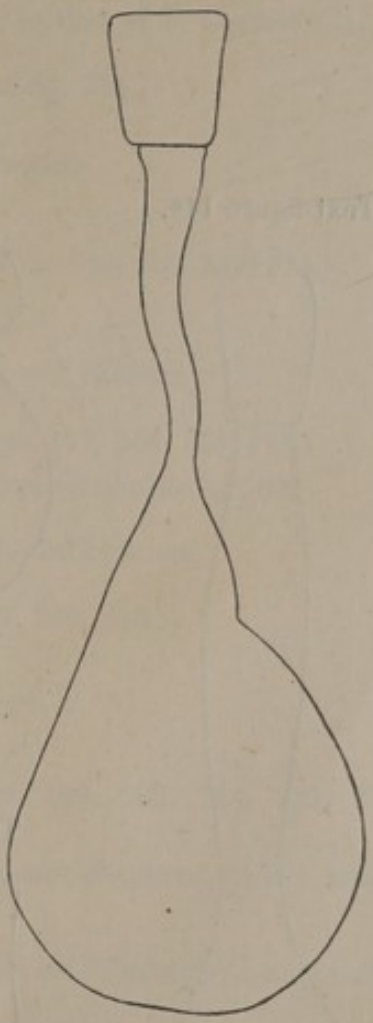
Text-figure 141.



Text-figure 142.

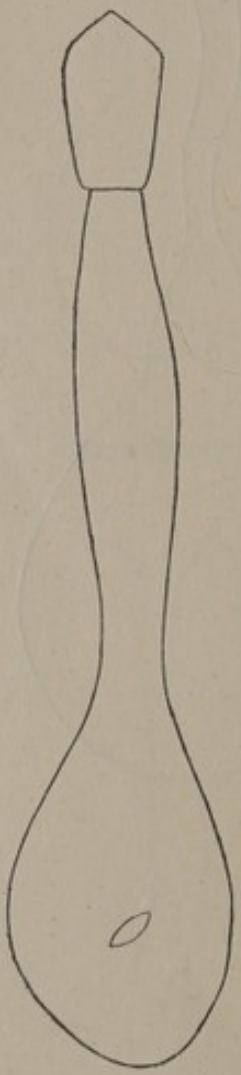


Text-figure 143.

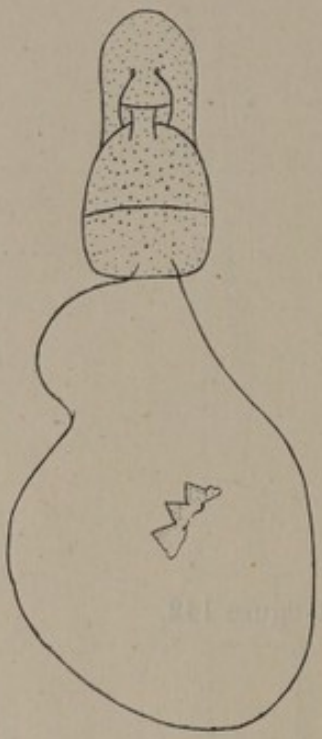


Bursa copulatrix of *P. pictalis* (Curt.) (141); *P. farinalis* (L.) (142); *P. lienigialis* (Zell.) (143).

Text-figure 144.



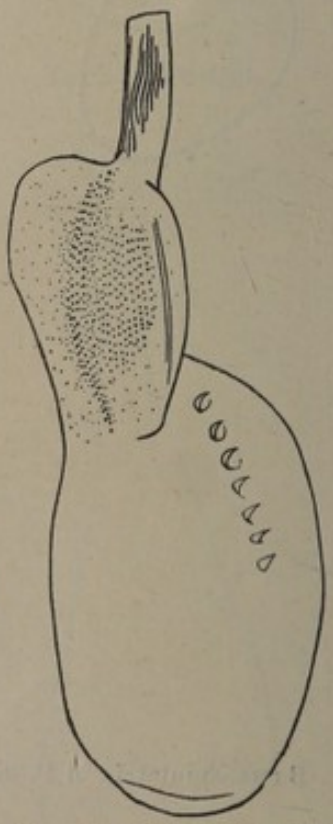
Text-figure 145.



Text-figure 146.

Text-figure 147.

Text-figure 148.



Bursa copulatrix of *Vitula edmandsii* (Pack.) (144); *Plodia interpunctella* (Hbn.) (145); *Ephestia elutella* (Hbn.) (146); *E. cautella* (Wlk.) (147); *E. calidella* Guen. (148).

Trichophaga abruptella (Wollaston, 1858). (Text-figs. 213, 246, 273.)

Synonyms : *bipartitella* (Ragonot, 1892) ; *amina* Meyrick, 1925.
Distribution : Mediterranean Basin and the Near East.
Larval food : unknown, but probably similar to that of *T. tapetzella* (L.).

Trichophaga perena Corbet & Tams, 1943. (Text-fig. 214.)

Synonyms : none.
Distribution : Africa and the Indo-Malayan region.
Larval food : hides and clothing.

Monopis ferruginella (Hübner [1810]–[1813]). (Text-figs. 215, 247, 274.)

Synonym : *splendella* (Hübner [1810]–[1813]).
Distribution : Europe.
Larval food : seeds, dried vegetable material, and clothing.

Monopis crocicapitella (Clemens, 1859). (Text-figs. 197, 216, 248, 275.)

Synonyms : *lombardica* (Hering, 1889) ; *heringi* (Richardson, 1893).
Distribution : Cosmopolitan.
Larval food : seeds, dried vegetable material, and clothing.

Monopis rusticella (Clerck, 1759). (Text-figs. 217, 249, 276.)

Synonym : *rusticella* (Hübner [1796]).
Distribution : Europe, east Asia, United States.
Larval food : dried animal material.

Tineola bisselliella (Hummel, 1823). (Text-figs. 198, 202, 218, 250, 277.) (" The Common Clothes Moth.")

Synonyms : *crinella* (Treitschke, 1832) ; *destructor* Stephens, 1834 ; *lanariella* (Clemens, 1859).
Distribution : Cosmopolitan.
Larval food: dried animal material, clothing, and stored cereals (occasionally).

Tinæa arcella Fabricius, 1777. (Text-figs. 219, 251, 278.)

Synonyms : *clematella* Fabricius, 1781 ; *repandella* Hübner [1796]–[1799] ; *clematea* (Haworth, 1828).
Distribution : Europe.
Larval food : decayed wood and fungi.

Tinæa ruricolella Stainton, 1849. (Text-figs. 220, 224, 279.)

Synonym : *cochylidella* Stainton, 1854.
Distribution : England.
Larval food : fungi.

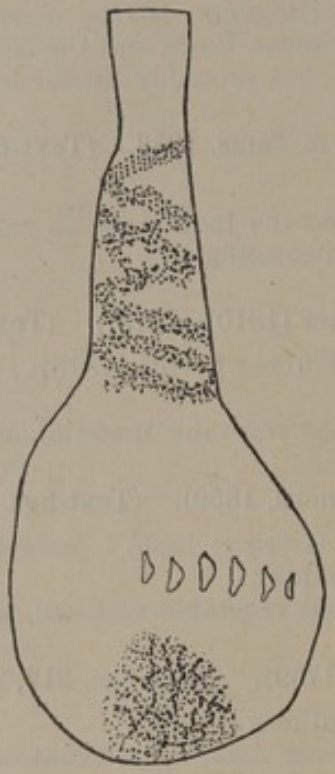
Tinæa cloacella Haworth, 1828. (Text-figs. 221, 225, 252,.280.)

Synonyms : none.
Distribution : Europe.
Larval food : fungi.

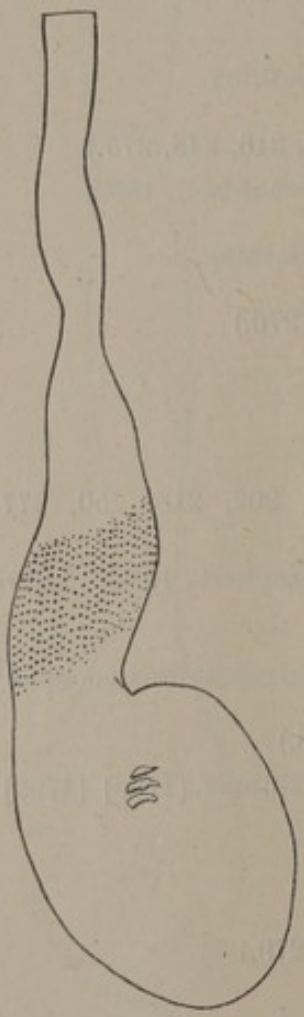
Tinæa granella (Linnæus, 1758.) (Text-figs. 222, 226, 253, 281.) (" The Corn Moth.")

Synonym : *mancuniella* Hodgkinson, 1880, may be a synonym.
Distribution : Europe, Japan.
Larval food : stored grain, bulbs, and fungi.

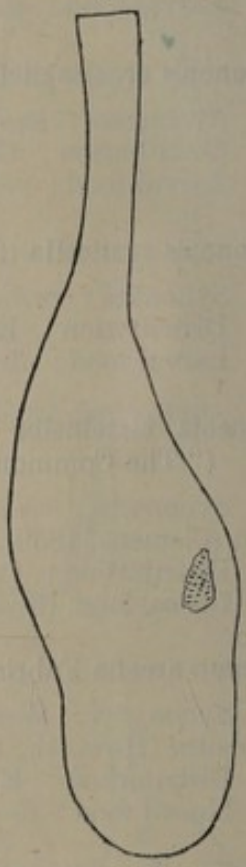
Text-figure 150.



Text-figure 149.



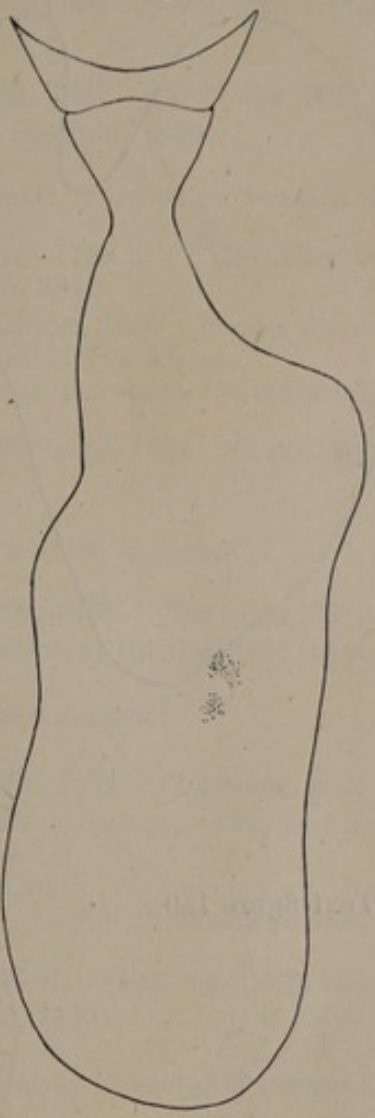
Text-figure 152.



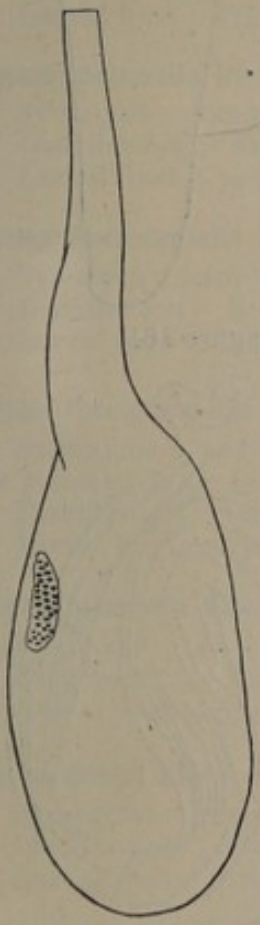
Text-figure 151.

Bursa copulatrix of *E. sericarium* (Scott) (149); *E. figulitella* Gregs. (150); *Etiella zinckenella* (Treit.) (151); *Mussidia nigrivenella* Rag. (152).

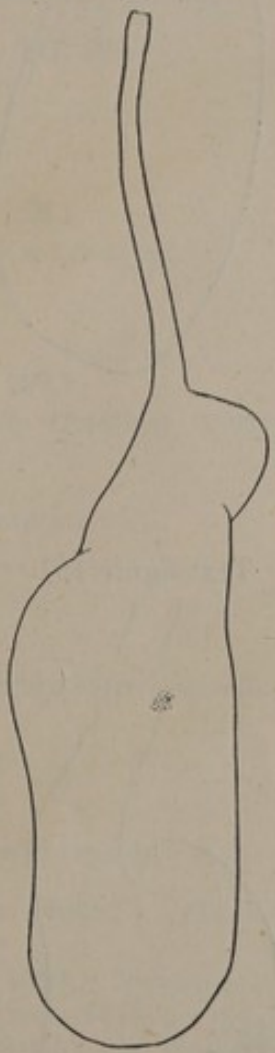
Text-figure 154.



Text-figure 153.



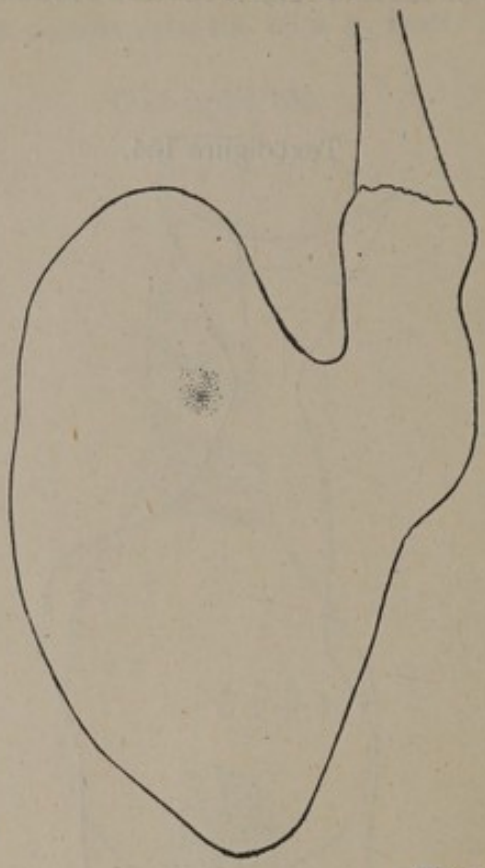
Text-figure 155.



Bursa copulatrix of *Myelois ceratoniæ* Zell. (153); *M. venipars* Dyar (154); *M. transitella* (Wlk.) (155).

Text-figure 156.

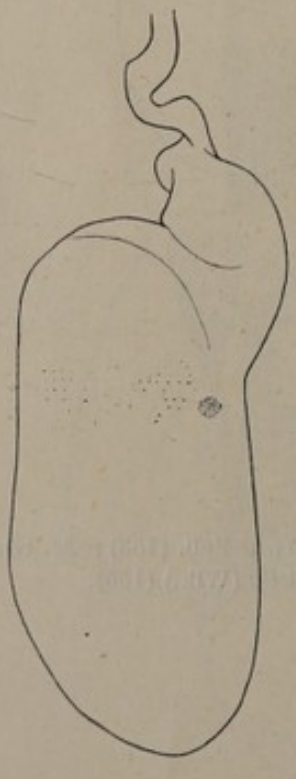
Text-figure 158.



Text-figure 160.

Text-figure 161.

Text-figure 159.



Text-figure 157.

Bursa copulatrix of *Cryptoblabes gnidiella* (Mill.) (156); *Acrobasis juglandis* (Le Baron) (157); *A. hebescella* Hulst (158); *A. caryæ* Grote (159); *A. caryivorella* Rag. (160); *Euchromius ocellea* (Haw.) (161).

Tinæa infimella Herrich-Schäffer, 1851. (Text-figs. 223, 227, 254, 282.)

Synonym : *personella* Pierce & Metcalfe, 1934.
Distribution : Europe.
Larval food : as yet fungi only known with certainty, but may be a pest of stored cereals.

Tinæa pallescentella Stainton, 1851. (Text-figs. 203, 228, 255, 283.)

Synonym : *nigrifoldella* Gregson, 1856.
Distribution : Europe.
Larval food : stored cereals, dried skins, woollen material.

Tinæa pellionella (Linnæus, 1758.) ("The Case-bearing Clothes Moth.") (Text-figs. 199, 229, 256, 284.)

Synonyms : *dubiella* Stainton, 1859 ; *lanella* Pierce & Metcalfe, 1934.*
Distribution : Europe and North Africa.
Larval food : dried animal and vegetable material, clothing, seeds, etc.

Tinæa metonella Pierce & Metcalfe, 1934. (Text-figs. 230, 257, 285.)

Synonyms : none.
Distribution : Europe.
Larval food : probably woollen material.

Tinæa flavescentella Haworth, 1828. (Text-figs. 231, 258, 286.)

Synonym : *tristigmatella* Costa [1832]–[1840] is probably a synonym.
Distribution : Europe.
Larval food : furs, woollen material.

Tinæa fuscipunctella Haworth, 1828. (Text-figs. 232, 259, 287.)

Synonyms : *nubilipennella* Clemens, 1859, and *frigidella* (Packard, 1867) are believed to be synonyms.
Distribution : Cosmopolitan.
Larval food : dried fruit, dried animal and vegetable material.

Tinæa insectella Fabricius, 1794. (Text-figs. 233, 260.)

Synonym : *misella* Zeller, 1839.
Distribution : Europe.
Larval food : dried animal and vegetable material, possibly stored cereals.

Tinæa ditella Pierce & Metcalfe, 1938. (Text-figs. 234, 261.)

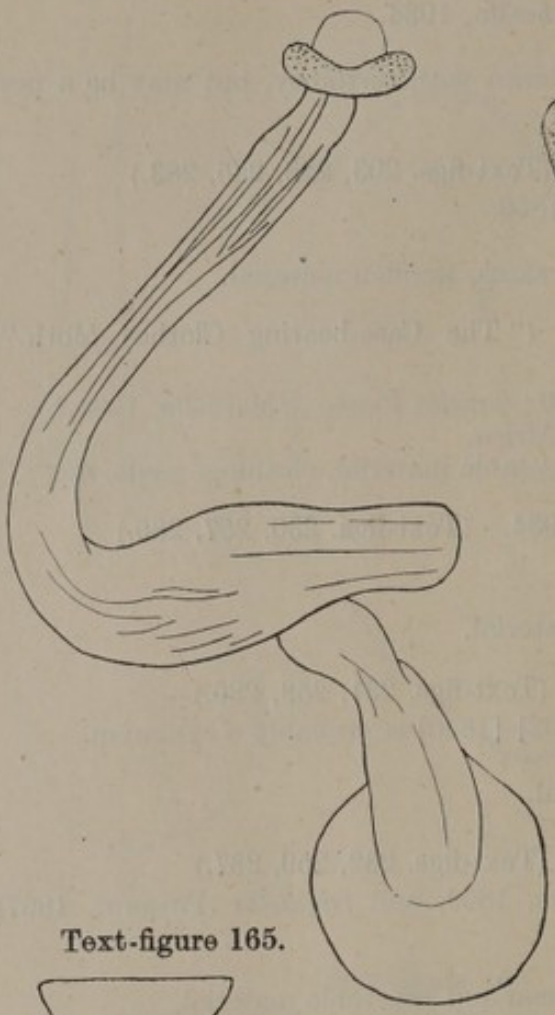
Synonyms : none.
Distribution : England.
Larval food : dried vegetable material and, possibly, stored cereals.

Setomorpha rutella Zeller, 1852. ("The Tropical Tobacco Moth.") (Text-figs. 200, 235, 262.)

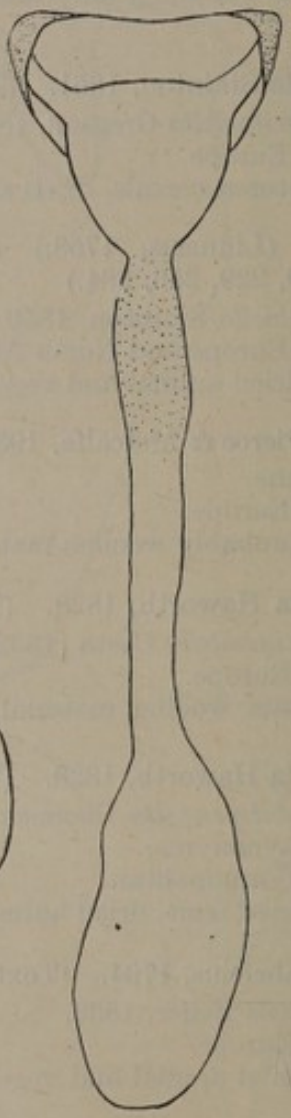
Synonyms : *rupicella* Zeller, 1852 ; *opersella* Zeller, 1873 ; *inamœnella* Zeller, 1873 ; *ruderella* Zeller, 1873 ; *multimaculella* (Chambers, 1878) ; *dryas* (Butler, 1881) ; *corticinella* Snellen, 1885 ; *bogotatella* Alpheraky *nec* Walker, 1889 ; *discipunctella* Rebel, 1892 ; *margalæstriata* Keuchenius, 1917 ; *euryspoda* (Lower, 1918) ; *tineoides* Dammerman *nec* Walsingham, 1919 ; *cariosella* (Fletcher, 1929) ; *fractiliniella* (Fletcher, 1929).
Distribution : tropical and sub-tropical regions of the Old and New World.
Larval food : stored cereals, seeds, tobacco, and other dried vegetable material.

* Since the completion of this work we have had access to the genitalia preparation of the male holotype of *T. lanella* and consider it probable that it represents a distinct species.

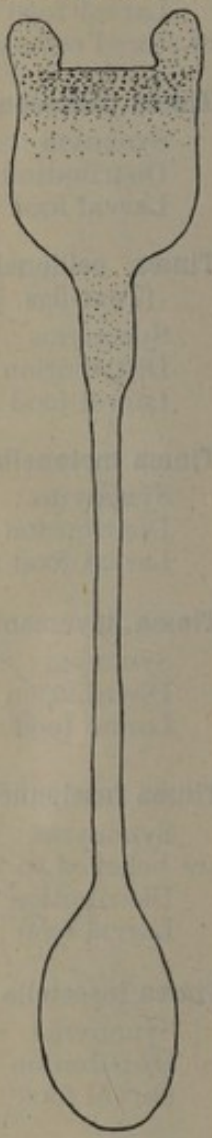
Text-figure 162.



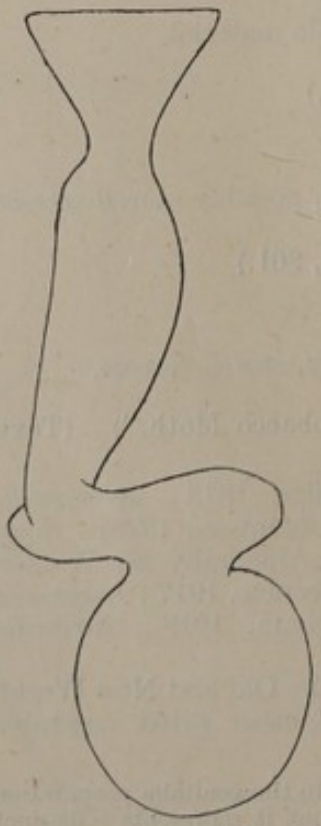
Text-figure 163.



Text-figure 164.



Text-figure 165.



Bursa copulatrix of *E. californicalis* (Pack.)(162); *Achroia grisella* (Fab.) (163); *A. innotata sakaiella* Cbt. & Tams (164); *Corcyra cephalonica* (Staint.) (165).

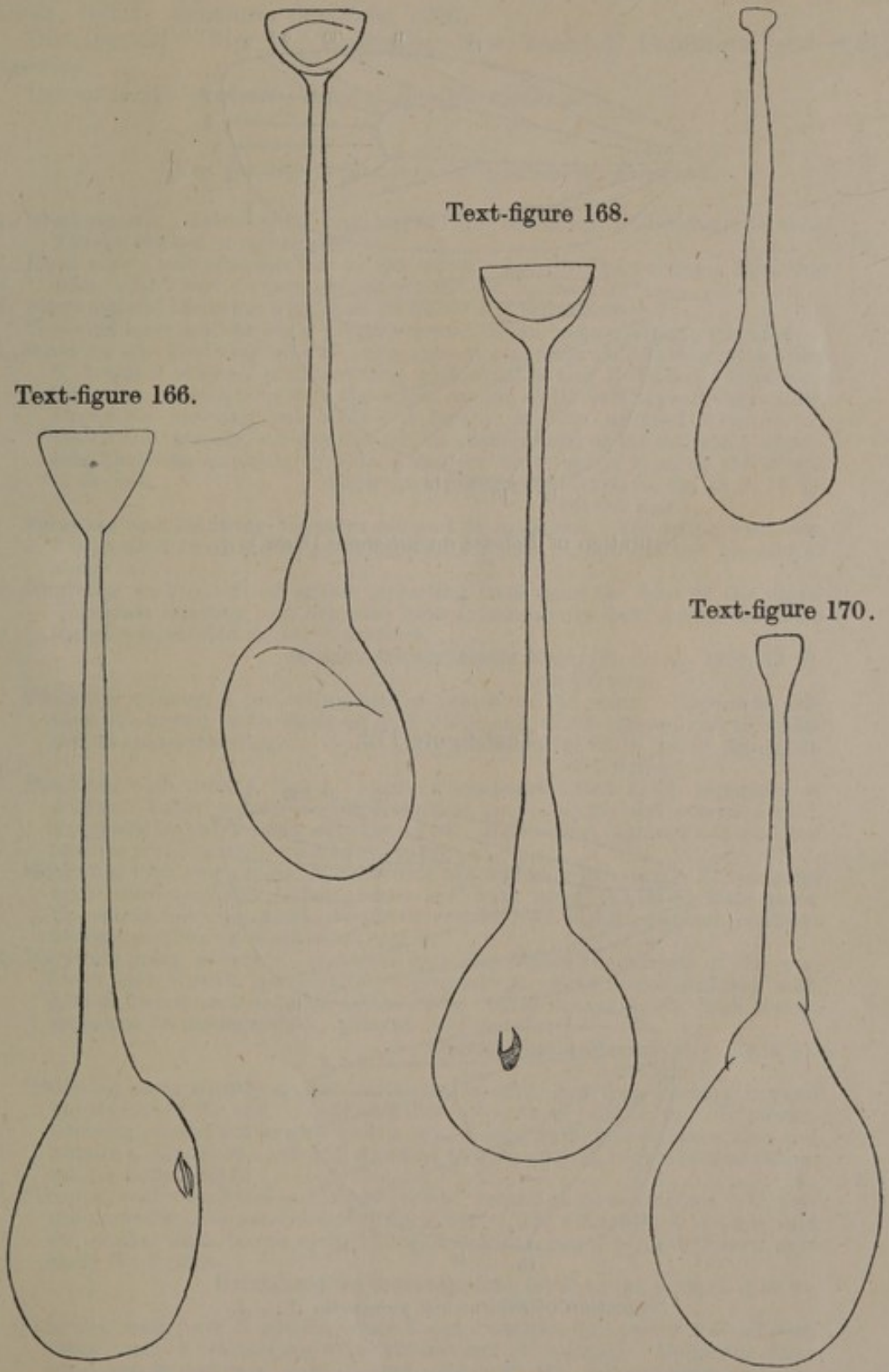
Text-figure 167.

Text-figure 169.

Text-figure 168.

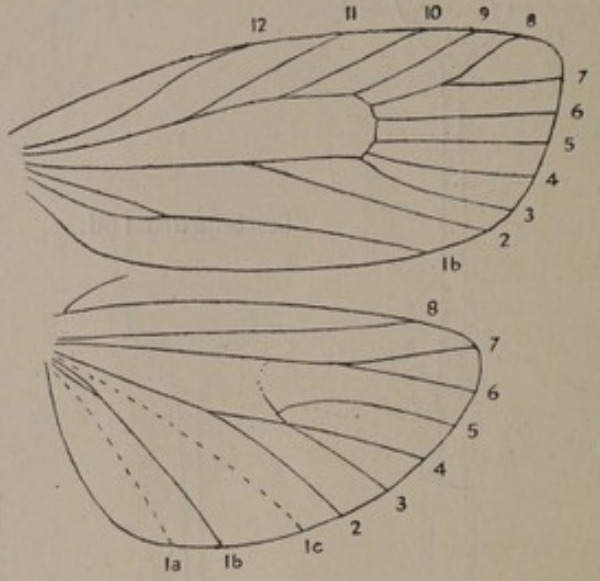
Text-figure 166.

Text-figure 170.



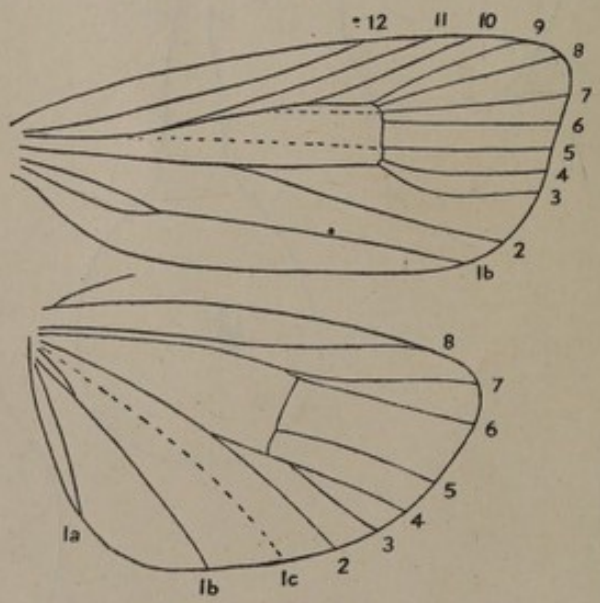
Bursa copulatrix of *Trachylepidia fructicassiella* Rag. (166); *Doloessa viridis* Zell. (167); *Arenipses sabella* Hamps. (168); *Aphomia sociella* (L.) (169); *A. gularis* (Zell.) (170).

Text-figure 171.



Neuration of *Batodes angustiorana* (Haw.), ♂.

Text-figure 172.



Neuration of *Enarmonia pomonella* (L.), ♂.

Lindera tessellatella Blanchard, 1852. (Text-figs. 201, 236.)

Synonyms : *bogotatella* (Walker, 1864) ; *simulella* (Dietz, 1905) ; *cruciferella* (Dietz, 1905) ; *calcularis* (Meyrick, 1906).

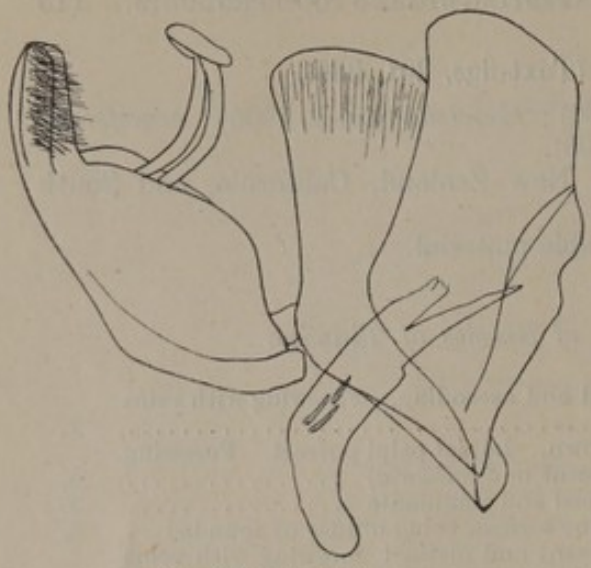
Distribution : Fiji Is., Australia, New Zealand, California, and South America.

Larval food : probably dried vegetable material.

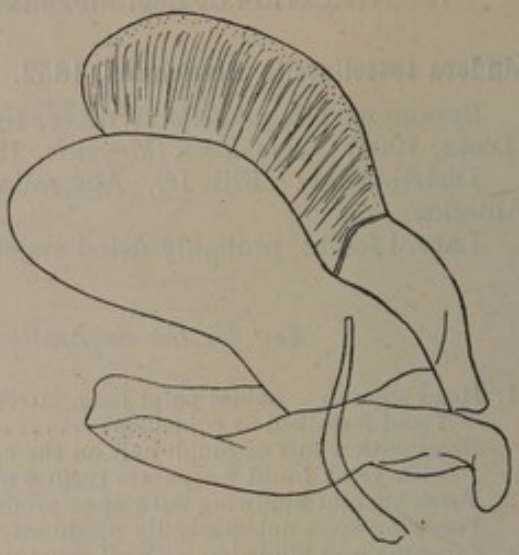
Key for the Separation of Species of Tinæina.

1. Head smooth. Labial palpi long, curved and ascending. Forewing with veins 7 and 8 stalked or coincident ..... 2.
   Head with a tuft of rough hair on the crown. Labial palpi porrect. Forewing with veins 7 and 8 separate (vein 8 absent in *Spatularia*) ..... 9.
2. Forewing and hindwing with apex produced and acuminate ..... 3.
   Forewing apex not markedly produced, the termen being obtuse or rounded... 5.
3. Forewing and hindwing with all veins present and distinct, forewing with veins 6, 7 and 8 stalked, and hindwing with veins 6 and 7 stalked. Hindwing with vein 8 contiguous with the upper margin of the cell beyond the middle. Upperside forewing pale ochreous brown, slightly suffused with darker brown and, usually, a black dot can be distinguished at the cell-end : upperside hindwing smoky grey with a narrow white stripe running the length of the cell. **Sitotroga cerealella** (Oliv.) (pl. iv. fig. 15 ♂, 16 ♀). (6·0–9·0 mm.)
   Forewing and hindwing venation reduced or indistinct. Hindwing with vein 8 separated from the upper margin of the cell. Upperside not marked as above ..... 4.
4. Hindwing with a tuft of spines projecting from near the base of the costa. Upperside forewing pale ochreous brown, indistinctly dark dusted and with the sub-dorsal fold slightly darkened. **Batrachedra amydraula** Meyr. (pl. iv. fig. 17 ♂, 18 ♀). (5·0–6·5 mm.)
   Hindwing without a projecting tuft of spines on the costa. Upperside pale chestnut brown, with three or four black and white oblique and irregular stripes across the wing. **Pyroderces rileyi** Wals. (pl. iv. fig. 18 ♀). (4·5–5·0 mm.)
5. Hindwing with veins 5, 6 and 7 more or less parallel and widely separated at origins. Labial palpi with third segment long, acicular and smooth scaled. Upperside forewing costa not chequered. Male eighth segment not modified to form a chitinous, hoop-like structure ..... 6.
   Hindwing with veins 5 and 6 stalked or approximate at origin. Labial palpi with third segment rather obtuse and with some projecting hair-scales. Upperside forewing costa chequered. Male with eighth segment modified to form a chitinous hoop-like structure ..... 8.
6. Hindwing costa excavated and vein 2 arising before the middle of the cell. Head and thorax pure white. Upperside forewing white suffused with golden brown and, usually, a few rather indistinct, elongate, dark brown spots can be distinguished ; pattern very variable. **Endrosis sarcitrella** (L.) (pl. v. fig. 4 ♀). (7·0–9·5 mm.)
   Hindwing costa slightly arched and not excavated, and vein 2 arising beyond the middle of the cell. Head and thorax brown or buff brown. Upperside forewing ground colour pale buff brown, dusted with dark brown scales, and usually a dark brown cell-end spot and two short, dark brown medial stripes can be distinguished ..... 7.
7. Forewing with vein 9 free and hindwing with veins 3 and 4 not stalked. Upperside forewing often rather heavily dark dusted, and with the cell-end spot and the medial dark brown spots prominent and a series of dark brown dots along the termen. **Hofmannophila pseudospretella** (Staint.) (pl. v. fig. 5 ♂, 6 ♀). (7·5–10·0 mm.)
   Forewing with vein 3 absent, veins 2 and 4 stalked, and vein 9 stalked with veins 7 and 8 ; hindwing with veins 3 and 4 stalked. Upperside forewing usually sparsely dark dusted and with the cell-end spot and the medial dark spots rather faint ; termen without a series of dark brown dots. **Anchonoma xeraula** Meyr. (pl. v. fig. 7 ♂, 8 ♀). (9·0–13·0 mm.)

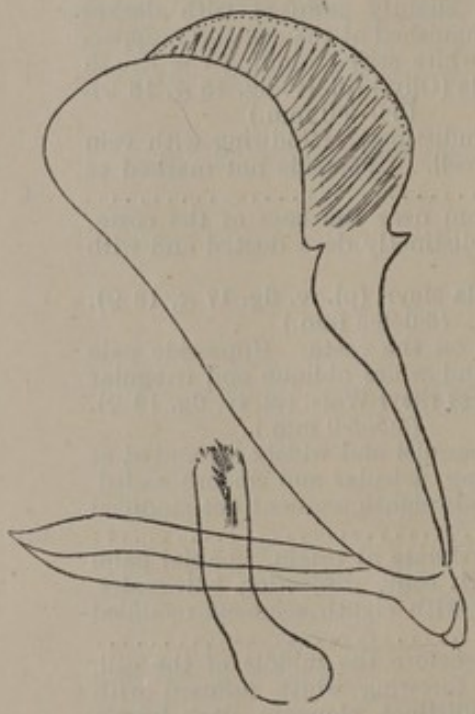
Text-figure 173.



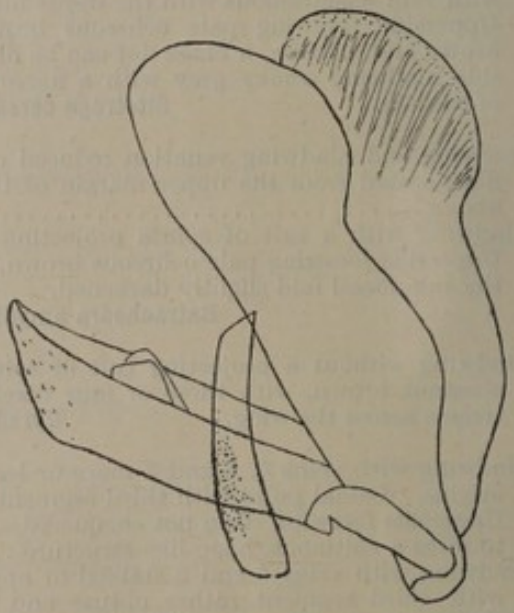
Text-figure 175.



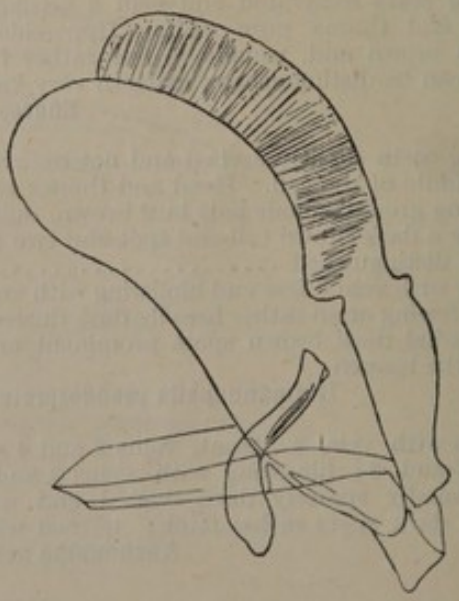
Text-figure 174.



Text-figure 176.

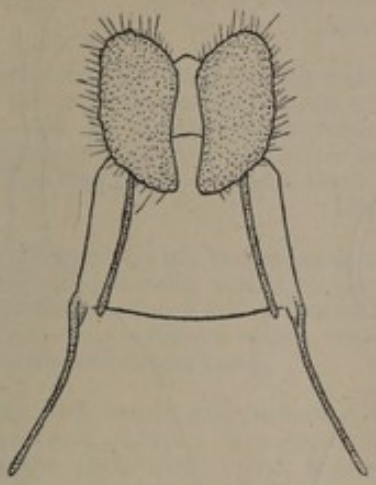


Text-figure 177.

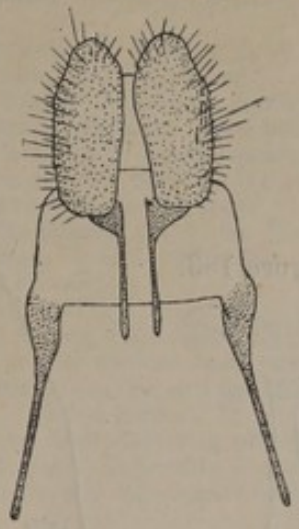


Male genitalia of *Batodes angustiorana* (Haw.) (173); *Enarmonia pomonella* (L.) (174); *E. splendana* Hbn. (175); *E. dorsana* (Fab.) (176); *E. nigricana* (Fab.) (177).

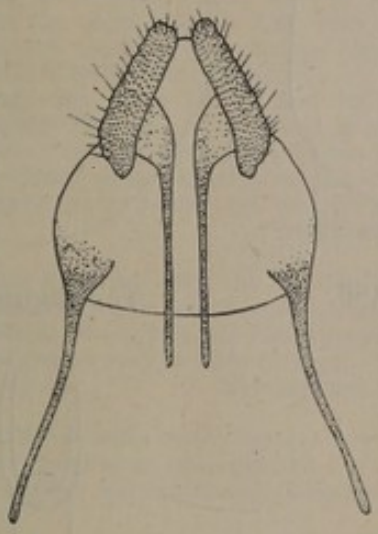
Text-figure 178.



Text-figure 179.

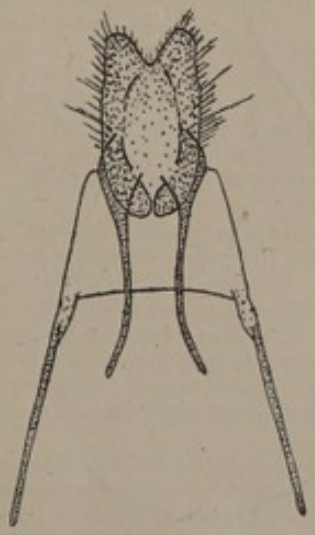


Text-figure 180.



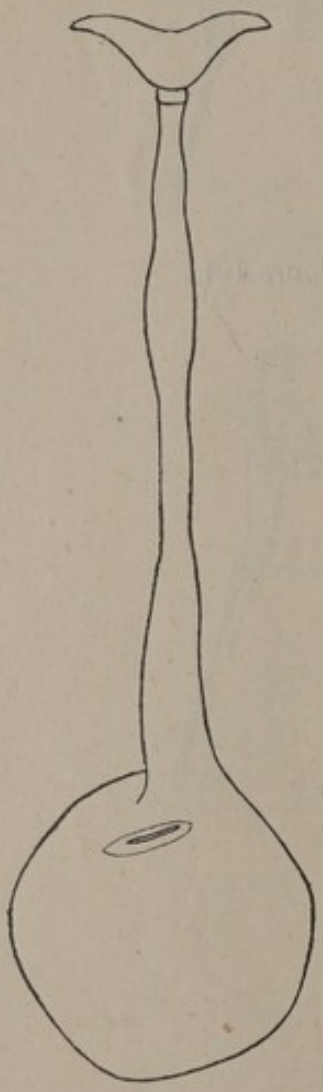
Text-figure 181.

Text-figure 182.

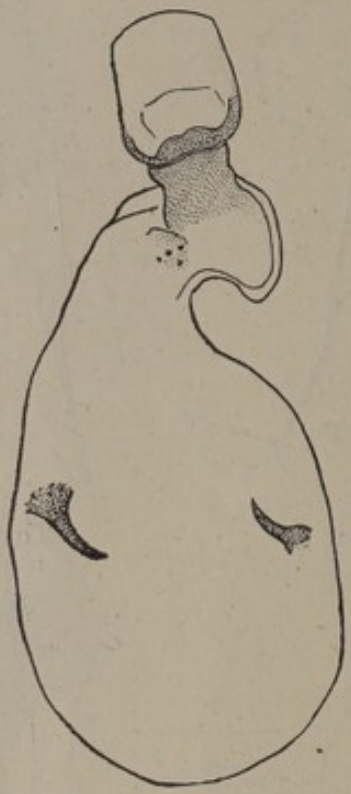


Ovipositor lobes and anterior and posterior apophyses of *Batodes angustiorana* (Haw.) (178); *Enarmonia pomonella* (L.) (179); *E. splendana* Hbn. (180); *E. dorsana* (Fab.) (181); *E. nigricana* (Fab.) (182).

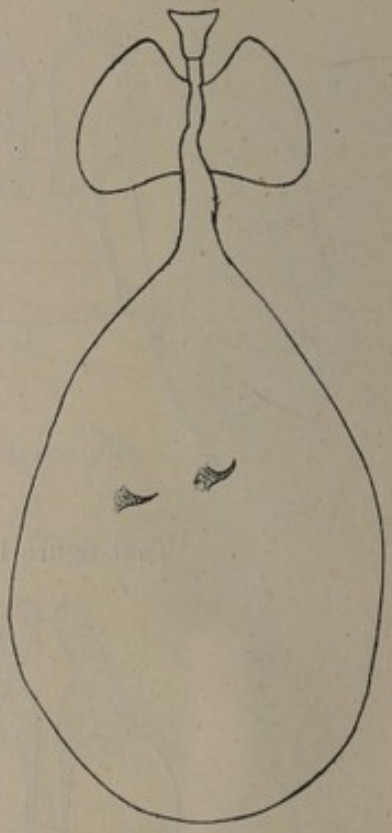
Text-figure 183.



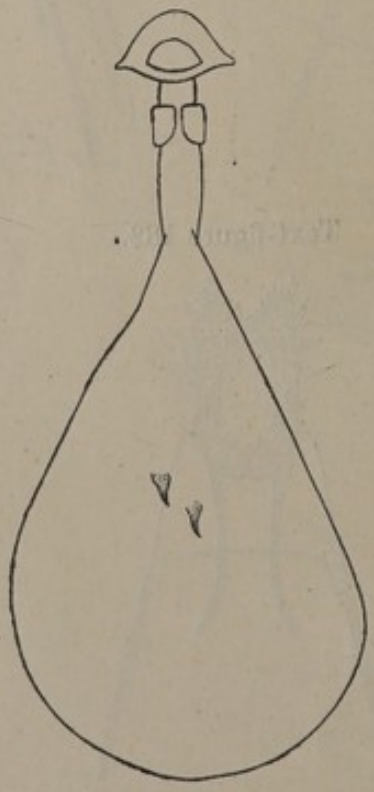
Text-figure 184.



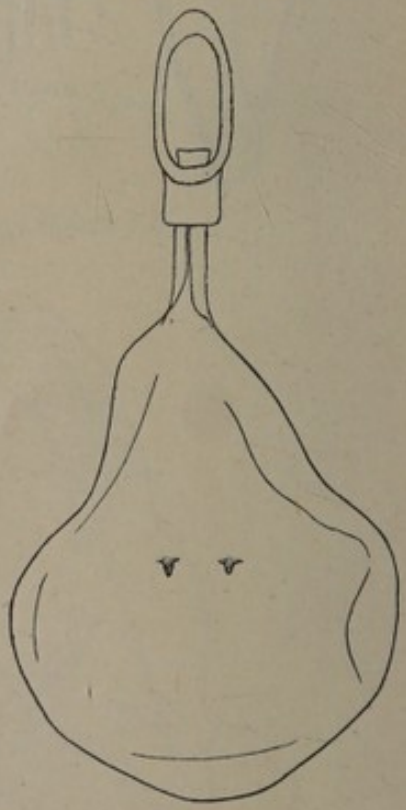
Text-figure 185.



Text-figure 186.



Text-figure 187.



Bursa copulatrix of *Batodes angustiorana* (Haw.) (183); *Enarmonia pomonella* (L.) (184); *E. splendana* Hbn. (185); *E. dorsana* (Fab.) (186); *E. nigricana* (Fab.) (187).

8. Hind tibiæ with long hairs above. Upperside forewing pale brownish ochreous, and rather heavily marked with small, irregular, dark brown spots and dots, the male more heavily marked than the female.
Setomorpha rutella Zell. (pl. v. fig. 9 ♂, 10 ♀).
(♂ 6·0–7·0 mm., ♀ 9·0–11·5 mm.)

Hind tibiæ densely clothed with hairs above and below. Upperside forewing pale shining ochreous buff, marked with rather small, irregular, dark brown spots and, in addition, with three rather prominent dark brown quadrate spots, one beyond the end of the cell, a second in the cell between the cell-end spot and the base, and a third below and between these two spots.
Lindera tessellatella Blanch. (pl. v. fig. 15 ♂).
(♂ 8·0–9·0 mm., ♀ 11·5–13·0 mm.)

9. Forewing and hindwing with apex produced and acuminate ..... 10.
Forewing and hindwing with apex not markedly produced ..... 11.

10. Venation much reduced and indistinct. Length of forewing < 4·5 mm. Upperside forewing ochreous brown with a yellowish angled median band and a yellowish post-discal band. **Oinophila v-flava** (Haw.) (pl. iv. fig. 20 ♀).
(3·5–4·5 mm.)

Forewing with vein 8 absent, otherwise forewing and hindwing with all veins present and distinct. Length of forewing > 4·5 mm. Upperside forewing dark chocolate-brown, with a pale ochreous white line running from the base along the dorsum and termen to the apex.
Spatularia mimosæ (Staint.) (pl. iv. fig. 31 ♂, 32 ♀).
(6·0–7·5 mm.)

11. Forewing with veins 10, 11 and 12 concurrent, vein 10 running into vein 9 before the costa, vein 11 into vein 10 and vein 12 into vein 11, these three veins not reaching the costa. Upperside forewing basal half dark brown and distal half creamy white ..... *Trichophaga* Rag. 12.

Forewing with veins 10, 11 and 12 not concurrent, all reaching the costa. Upperside forewing not marked as above ..... 14.

12. Upperside forewing with the division between the dark brown basal area and the creamy white distal area oblique, outwardly slightly concave and with the dark brown basal area broader at the costa than along the dorsum.
Trichophaga tapetzella (L.) (pl. v. fig. 13 ♂, 14 ♀).
(8·5–12·0 mm.)

Upperside forewing with the division between the dark brown basal area and the creamy white distal area straight and at right angles to the dorsum.... 13.

13. Upperside forewing with the distal area almost pure white; hindwing diaphanous white, with a very faint buff tinge. Larger size. Male clasper approximately rectangular. **Trichophaga abruptella** (Woll.) (pl. v. fig. 11 ♂, 12 ♀).
(7·5–11·5 mm.)

Upperside forewing with the creamy white distal area with a distinct buff tinge; hindwing pale greyish brown with a bronze sheen. Smaller size. Male clasper approximately triangular, with edges sinuate.
Trichophaga perena Cbt. & Tams.
(6·0–8·0 mm.)

14. Forewing with vein 11 arising well beyond the middle of the cell and veins 3 and 4 stalked. Upperside forewing dark brown with a white cell-end spot which is also visible on the underside..... *Monopis* Hbn. 15.

Forewing with vein 11 arising well before the middle of the cell and veins 3 and 4 not stalked. Forewing not marked as above..... 17.

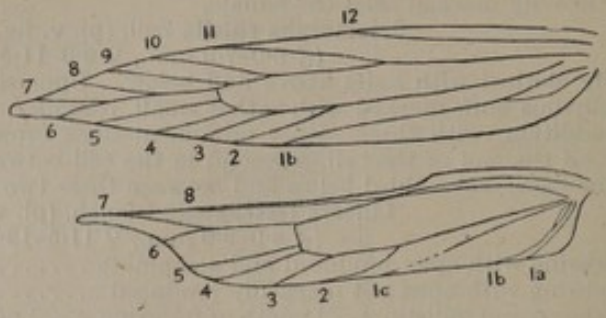
15. Forewing with veins 7 and 8 stalked. Upperside forewing more or less uniformly coloured ferruginous brown, slightly flecked with darker brown, and without a pale dorsal stripe; usually an obscure whitish cell-end spot.
Monopis rusticella (Clerck) (pl. v. fig. 16 ♂, 17 ♀).
(6·5–8·5 mm.)

Forewing with veins 7 and 8 free and arising from the cell. Upperside forewing with a conspicuous yellowish white or yellowish buff stripe along the dorsum and a prominent white spot at the end of the cell ..... 16.

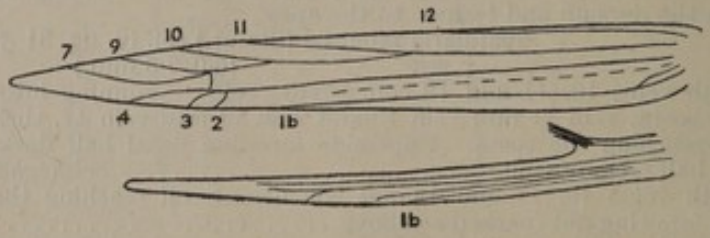
16. Upperside forewing with the anterior edge of the yellowish white dorsal stripe not uniform in width, being excavated below the white cell-end spot and then rising to a tooth between this spot and the tornus. Upperside forewing very dark purple-brown; cilia almost black. Upperside hindwing pale purple brown. **Monopis ferruginella** (Hbn.) (pl. v. fig. 1 ♀).
(6·0–7·0 mm.)

Upperside forewing with the yellowish white dorsal stripe more or less uniform in width and not prominently toothed beyond the white cell-end spot. Upperside forewing brown, flecked with pale ochreous; cilia pale buff, brown at tips. Upperside hindwing pale greyish white.
Monopis crocicapitella (Clemens) (pl. v. fig. 2 ♂, 3 ♀).
(5·0–7·0 mm.)

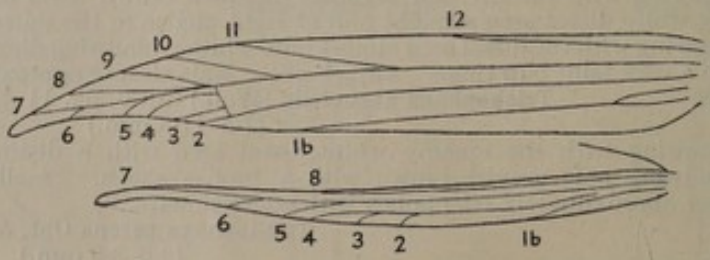
Text-figure 188.



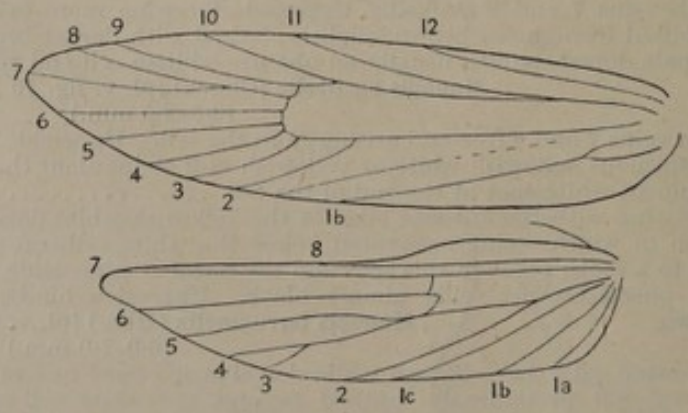
Text-figure 189.



Text-figure 190.

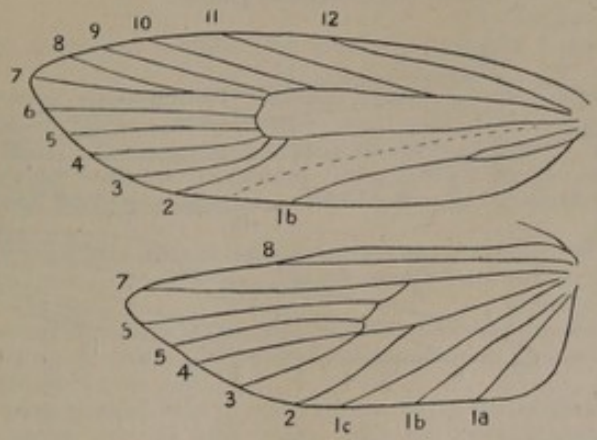


Text-figure 191.

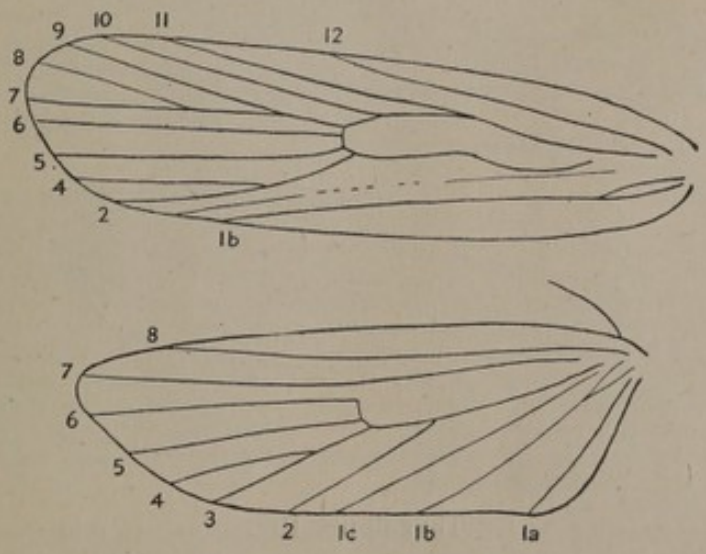


Neuration of *Sitotroga cerealella* (Oliv.), ♀ (188); *Batrachedra amydraula* Meyr. (189): *Pyroderces rileyi* (Wals.), ♂ (190); *Endrosis sarcitrella* (L.), ♂ (191).

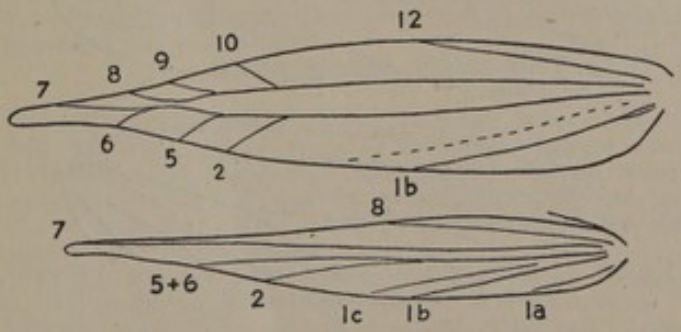
Text-figure 192.



Text-figure 193.

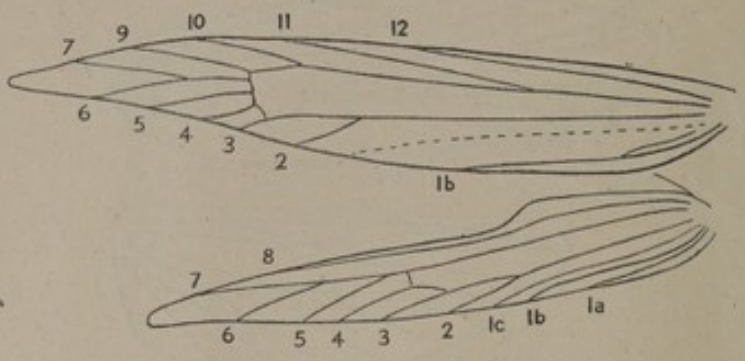


Text-figure 194.

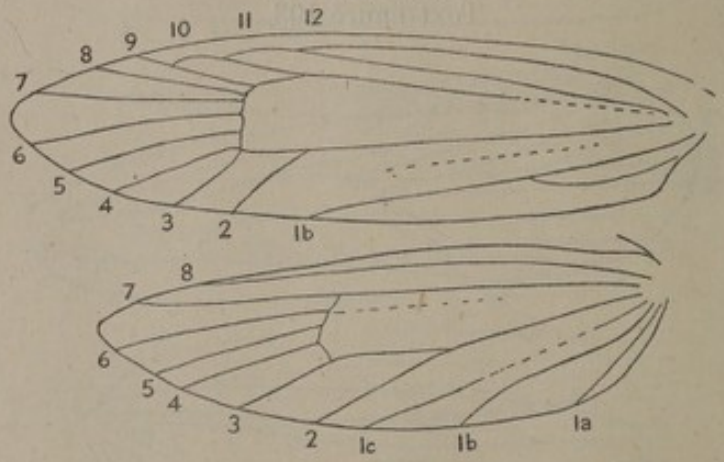


Neuration of *Hofmannophila pseudospretella* (Staint.) (192); *Anchonoma xeraula* Meyr., ♂ (193); *Oinophila v-flava* (Haw.) (194).

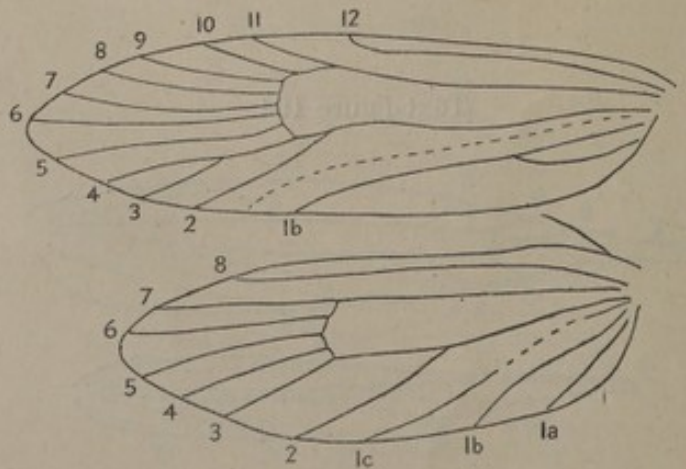
Text-figure 195.



Text-figure 196.



Text-figure 197.



Neuration of *Spatularia mimosæ* (Staint.) (195); *Trichophaga tapetzella* (L.) (196); *Monopis crocicapitella* (Clemens) (197).

17. Maxillary palpi very short and inconspicuous (fig. 202). Upperside forewing pale ochreous buff and entirely unmarked.
Tineola bisselliella (Hummel) (pl. v. fig. 18 ♂, 19 ♀). (5·0–7·5 mm.)

Maxillary palpi long and filiform (fig. 203). Upperside forewing with spots or markings ..... *Tinæa* Geoff. 18.

18. Upperside forewing with a dark reddish brown or chocolate-brown angled medial stripe or fascia. Male clasper with an arm-like projection arising from the surface. Female bursa copulatrix without signa..... 19.

Upperside forewing without a distinct dark medial stripe or fascia. Male clasper without such a projection. Female bursa copulatrix with signa in some species ..... 23.

19. Upperside forewing white with a reddish brown angled medial stripe from costa to dorsum. **Tinæa arcella** Fab. (pl. v. fig. 20 ♂, 21 ♀). (6·0–7·0 mm.)

Upperside forewing not pure white and with a chocolate-brown angled medial fascia, consisting of three irregular contiguous or conjoined spots, as well as other irregular brown markings ..... 20.

20. Upperside forewing ground colour pale reddish buff, with a faint golden sheen, in some examples flecked with white, and the dark brown markings not strongly contrasted with the ground: in many specimens, the markings in the basal and distal areas are almost obsolete. Male clasper approximately triangular. Female ostium bottle-shaped.
Tinæa ruricolella Staint. (pl. v. fig. 27). (5·0–7·0 mm.)

Upperside forewing ground colour white or whitish, with the dark chocolate-brown markings strongly contrasted with the whitish ground; basal and distal areas always with dark markings ..... 21.

21. Upperside forewing with the large dark spot at the cell-end with its lower edge prolonged basally to form a dark streak. Male clasper with a prominent shoulder, and uncus with two small projections. Female ostium cup-shaped and not much broader than the ductus bursæ.
Tinæa cloacella Haw. (pl. v. fig. 26). (6·0–7·0 mm.)

Upperside forewing with the large dark spot at the cell-end with its lower edge not prolonged basally to form a dark streak..... 22.

22. Upperside forewing ground colour whitish buff; the six or seven dark chocolate-brown costal spots clearly defined, more or less equally prominent, regularly spaced, and with a tendency to be outlined with whitish, and with the basal costal spot not larger than the sub-basal costal spot; the dark oval spot near the centre of the dorsum with its lower edge clearly defined and faintly outlined with whitish; the small dark rounded spot at the base of space 4 obscure or obsolete and not lying in a whitened area. Forewing fringe not conspicuously streaked with white. Male clasper distally truncated, gnathos not serrate. Female ostium cup-shaped and twice as broad as the ductus bursæ. **Tinæa granella** (L.) (pl. v. fig. 25). (5·0–7·0 mm.)

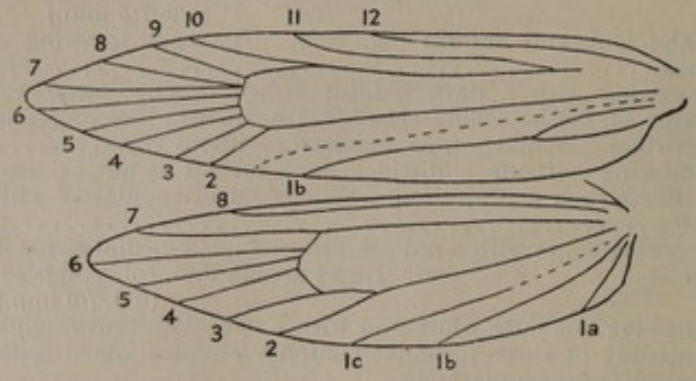
Upperside forewing ground colour pure shining white; the dark costal spots less prominent and regular than in *T. granella*, and with the basal costal spot produced, roughly resembling an isosceles triangle with its base on the costa and much larger than the sub-basal costal spot; the dark spot near the centre of the dorsum smaller, and usually narrower and elongate; the small dark rounded spot at the base of space 4 usually prominent and lying in a circular white patch. Forewing fringe strongly streaked with white. Male clasper with apex strongly produced, gnathos deeply serrate. Female ostium suggests a pair of spectacles.
Tinæa infimella H.-Sch. (pl. v. fig. 22 ♂, 23 ♀, 24). (5·0–7·0 mm.)

23. Upperside forewing pale greyish buff or buff brown, with a silken sheen, not dark dusted or only sparsely so, and the costal margin not chequered. Upperside forewing with three dark spots usually present, these comprising a round spot at the cell-end, and two short stripes, placed one above the other, in the medial area. Male saccus much longer than the clasper, which is simple and roughly oval in shape ..... 24.

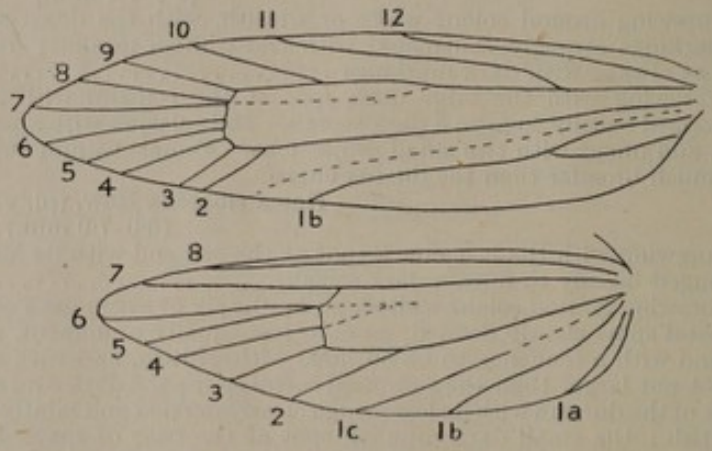
Upperside forewing heavily dark dusted and the costal margin chequered. Male saccus not longer than the clasper, which is not simple ..... 27.

24. Upperside forewing with a dark streak along the basal half of the sub-dorsal fold. Length of forewing usually greater than 7·0 mm. Male cornuti comprise a bundle of five or six short, stout spines of length not greater than the diameter of the ædeagus. Female anterior apophyses markedly longer than the posterior apophyses.
Tinæa pallescentella Staint. (pl. v. fig. 34 ♂, 35 ♀). (7·0–12·0 mm.)

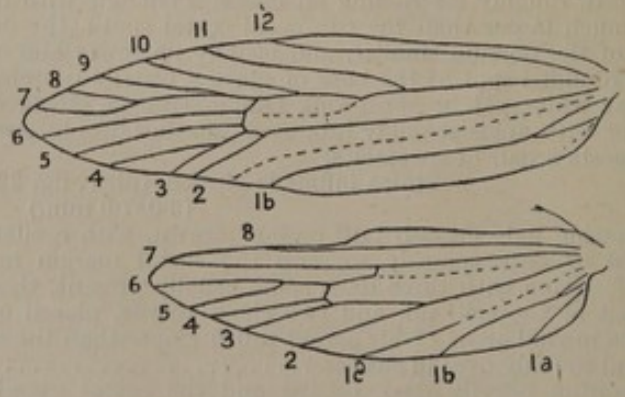
Text-figure 198.



Text-figure 199.

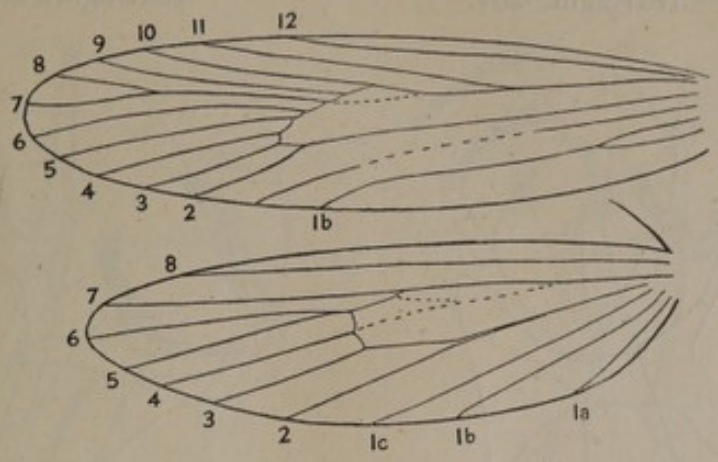


Text-figure 200.

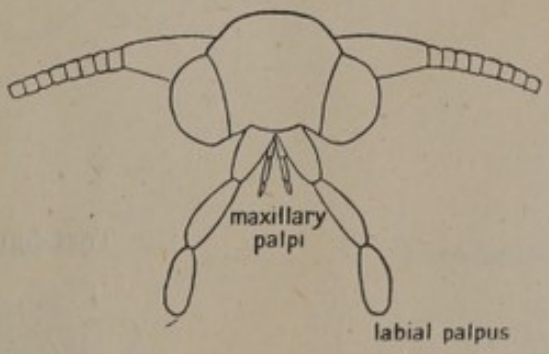


Neuration of *Tineola bisselliella* (Hummel) (198); *Tinæa pellionella* (L.) (199); *Setomorpha rutella* Zell., ♀ (after Diakonoff) (200).

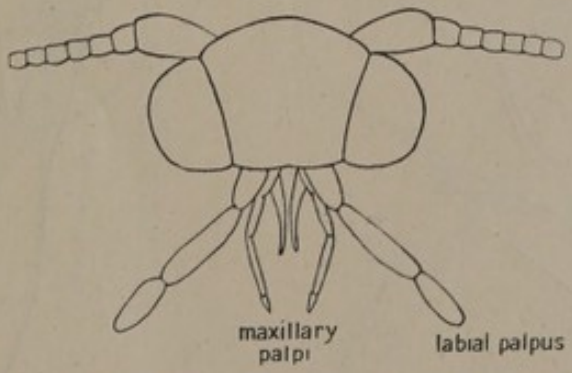
Text-figure 201.



Text-figure 202.

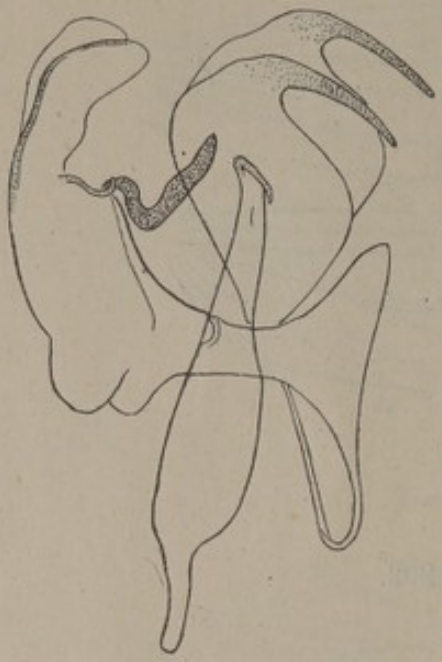


Text-figure 203.



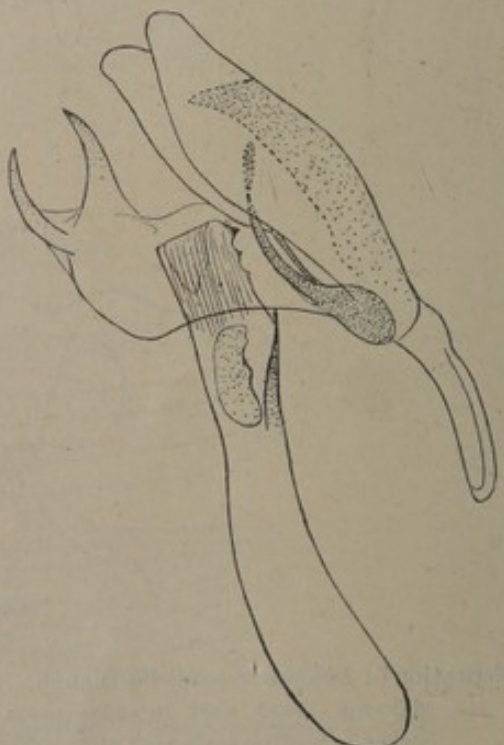
Neuration of *Lindera tessellatella* Blanch., ♂. (201). Head of *Tineola bisselliella* (Hummel), showing short and inconspicuous maxillary palpi (202); *Tinæa pallescentella* Staint., showing long and filiform maxillary palpi (203).

Text-figure 204.

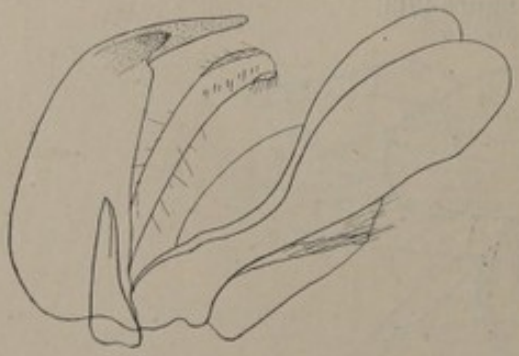


Text-figure 205.

Text-figure 207.



Text-figure 206.



Male genitalia of *Sitotroga cerealella* (Oliv.) (204); *Batrachedra amydraula* Meyr. (205); *Pyroderces rileyi* (Wals.) (206); *Endrosis sarcitrella* (L.) (207).

Text-figure 208.

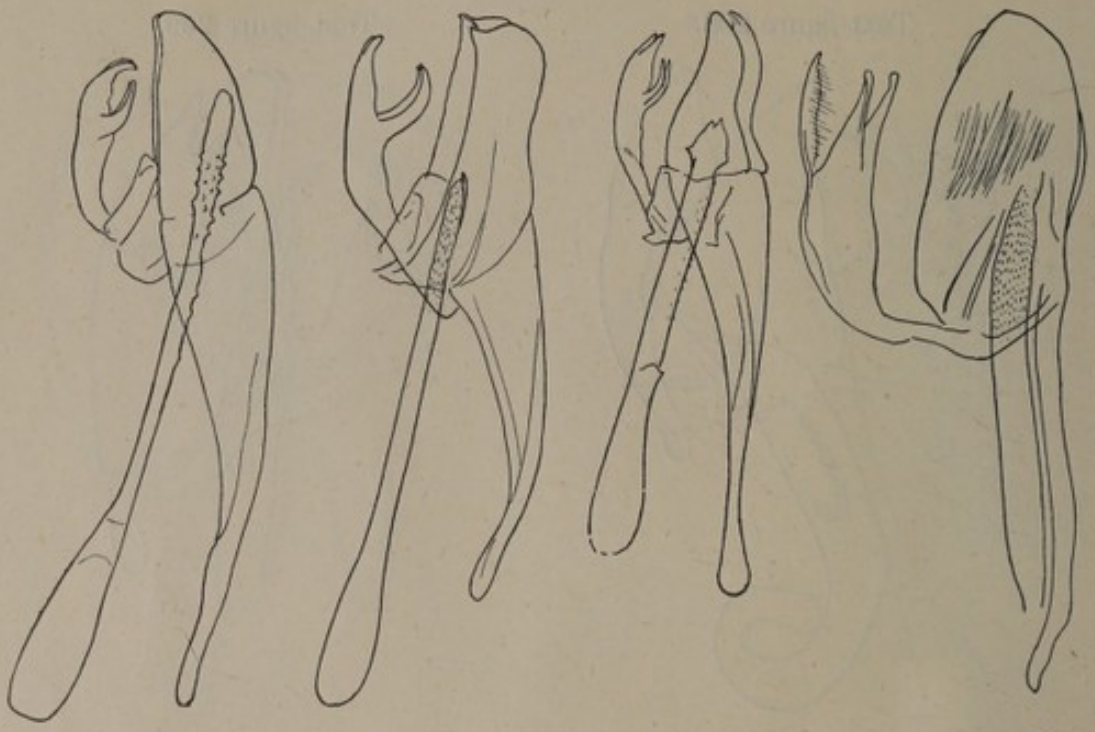
Text-figure 209.

Text-figure 210.

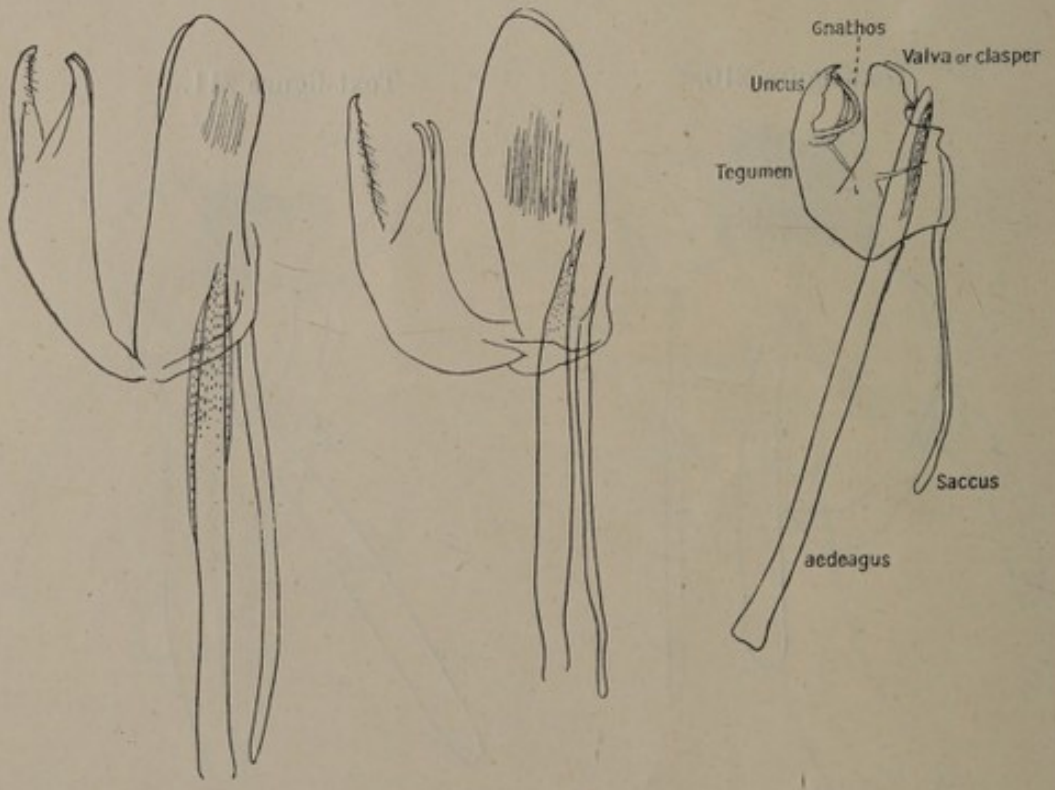
Text-figure 211.

Male genitalia of *Hofmannophila pseudospretella* (Staint.) (208); *Anchonoma xeraula* Meyr. (209); *Oinophila v-flava* (Haw.) (210); *Spatularia mimosæ* (Staint.) (211).

Text-figure 212. Text-figure 213. Text-figure 214. Text-figure 215.

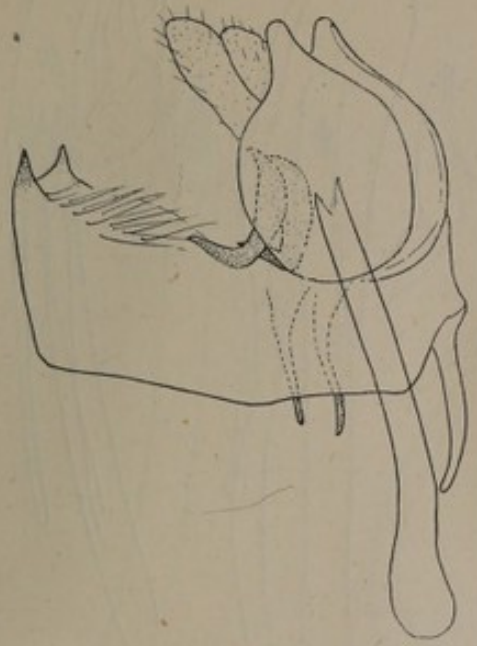


Text-figure 216. Text-figure 217. Text-figure 218.

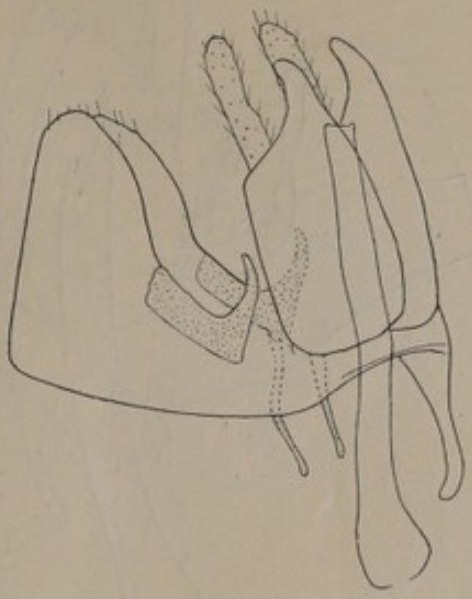


Male genitalia of *Trichophaga tapetzella* (L.) (212); *T. abruptella* (Woll.) (213); *T. percna* Cbt. & Tams (holotype from Gold Coast) (214); *Monopis ferruginella* (Hbn.) (215) *M. crocicapitella* (Clemens) (216); *M. rusticella* (Clerck) (217); *Tineola bisselliella* (Hummel) (218).

Text-figure 219.



Text-figure 221.



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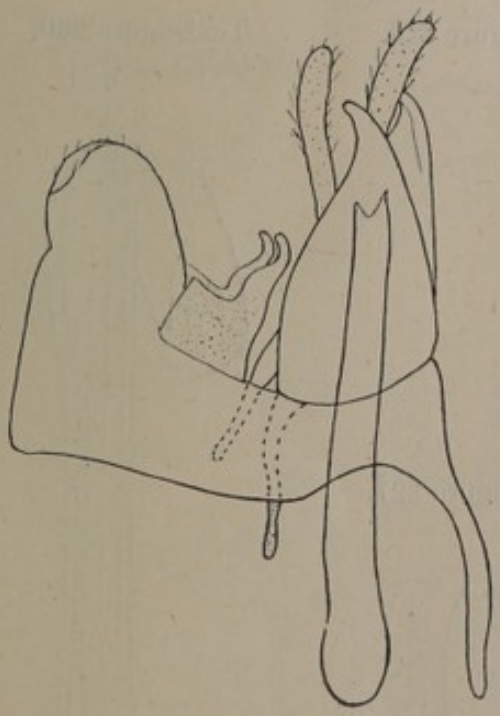
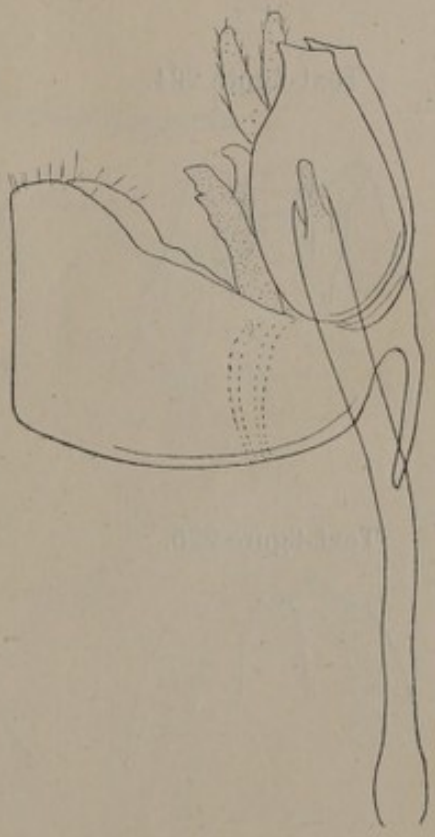
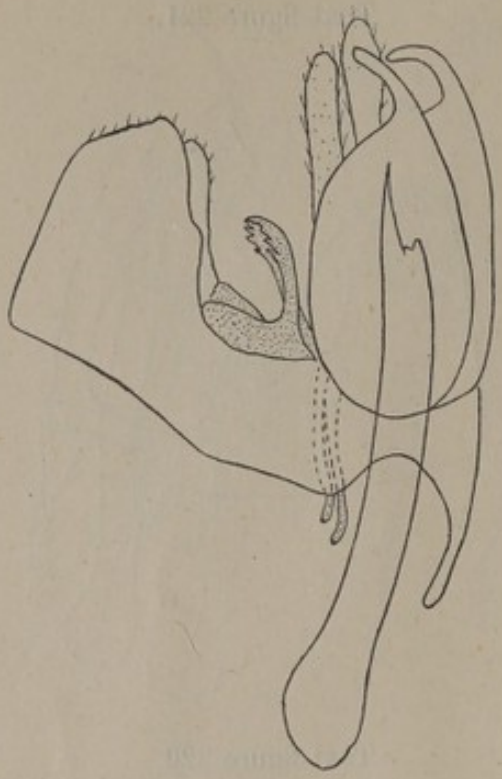


Text-figure 222.



Male genitalia of *Tinæa arcella* Fab. (219); *T. ruricolella* Staint. (220); *T. cloacella* Haw. (221); *T. granella* (L.) (222).

Text-figure 223.



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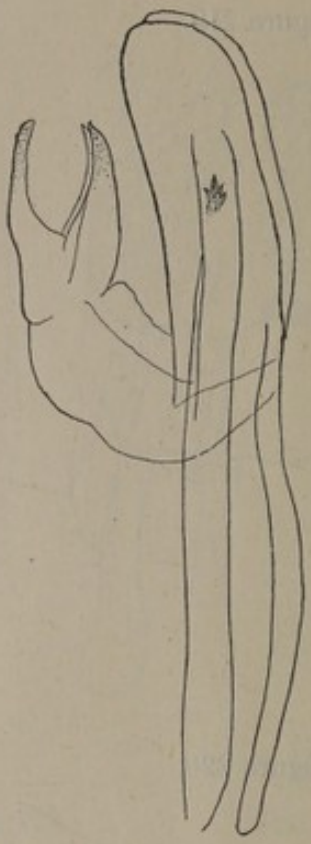

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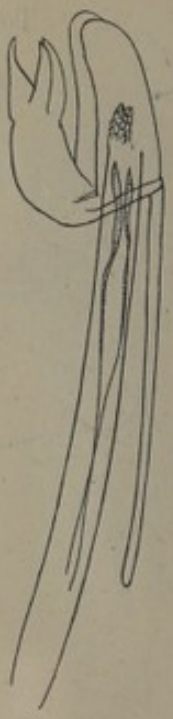


Text-figure 224.

Text-figure 226.

Text-figure 230.

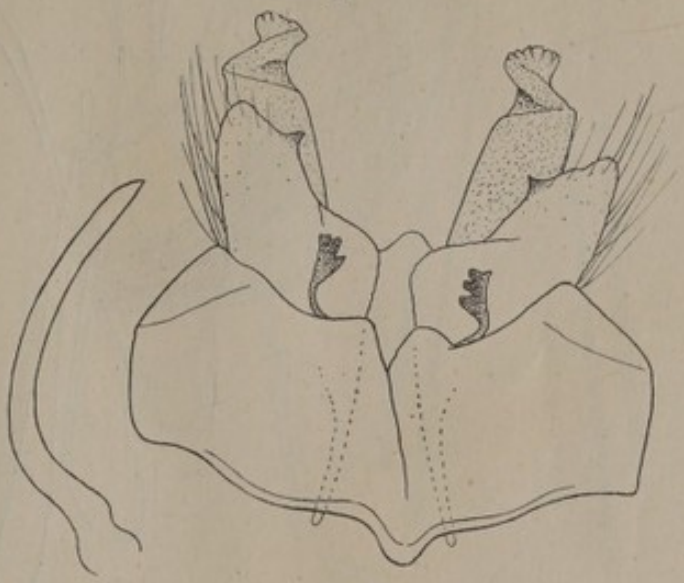
Text-figure 225.

Text-figure 227.

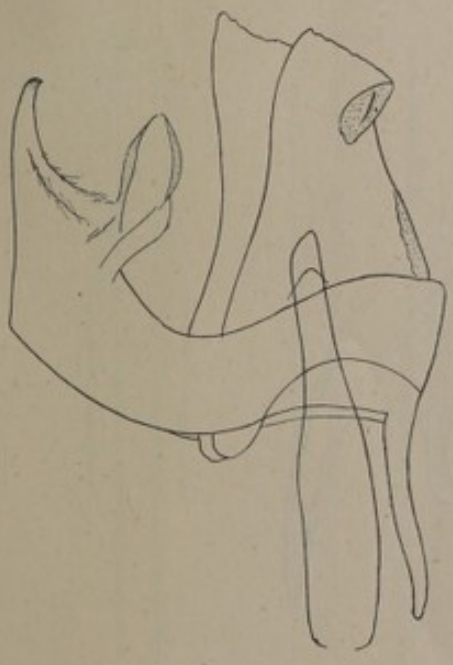
Male genitalia of *T. infimella* H.-Sch. (223); Ventral view of uncus of *T. ruricolella* Staint. (224); *T. cloacella* Haw. (225); *T. granella* (L.) (226); *T. infimella* H.-Sch. (227); Male genitalia of *T. pallescentella* Staint. (228); *T. pellionella* (L.) (229); *T. metonella* Pce. & Met. (230).

Text-figure 231.

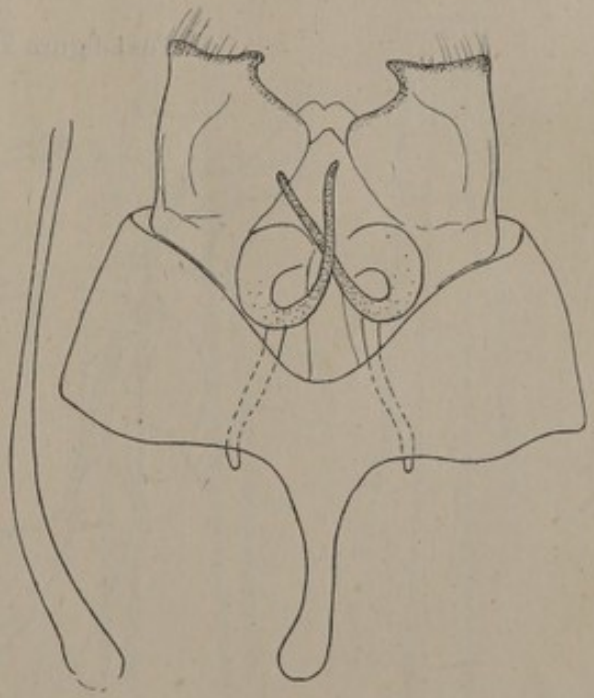
Text-figure 233.



Text-figure 232.

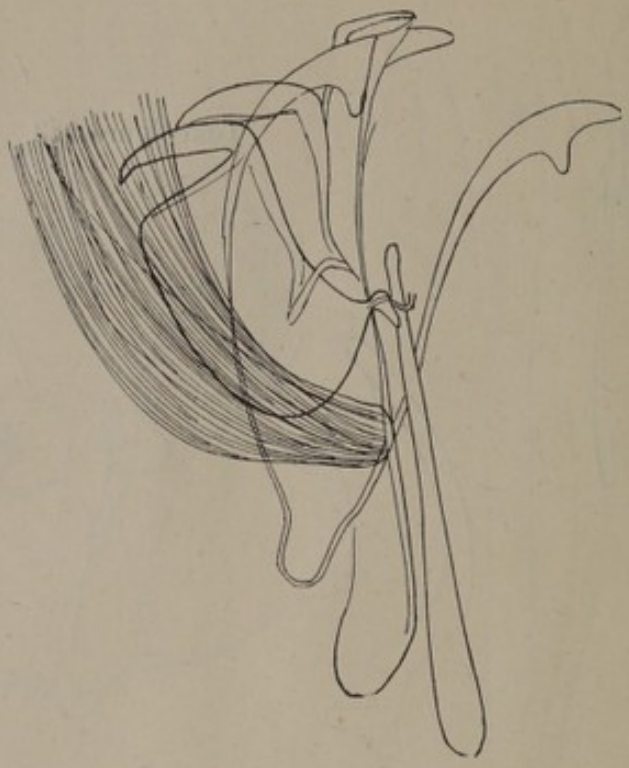


Text-figure 234.



Male genitalia of *T. flavescentella* Haw. (231); *T. fuscipunctella* Haw. (232); *T. insectella* Fab. (ventral view) (233); *T. ditella* Pce. & Met. (ventral view) (234).

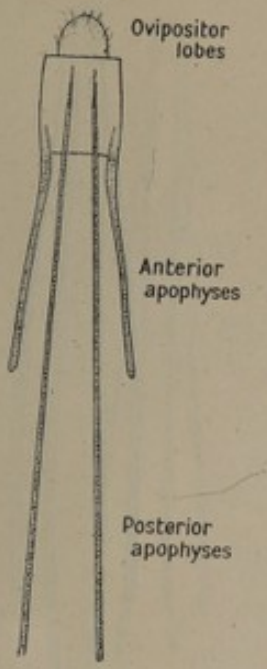
Text-figure 235.



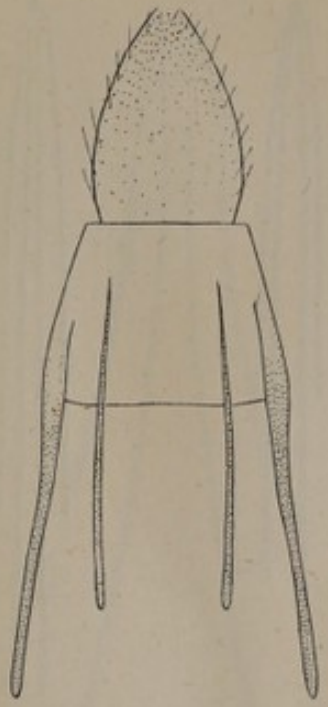
Text-figure 236.

Male genitalia of *Setomorpha rutella* Zell. (235); *Lindera tessellatella* Blanch. (236).

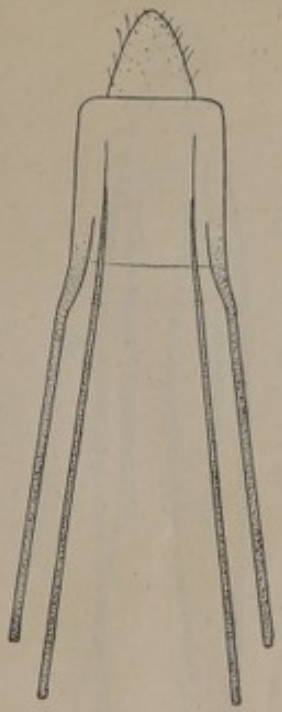
Text-figure 237.



Text-figure 238.

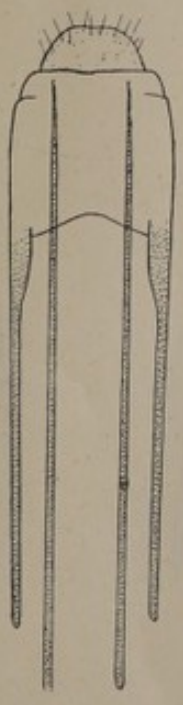


Text-figure 239.



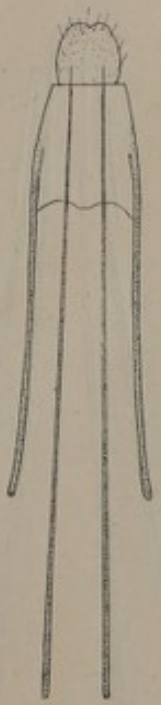
Text-figure 240.

Text-figure 241.



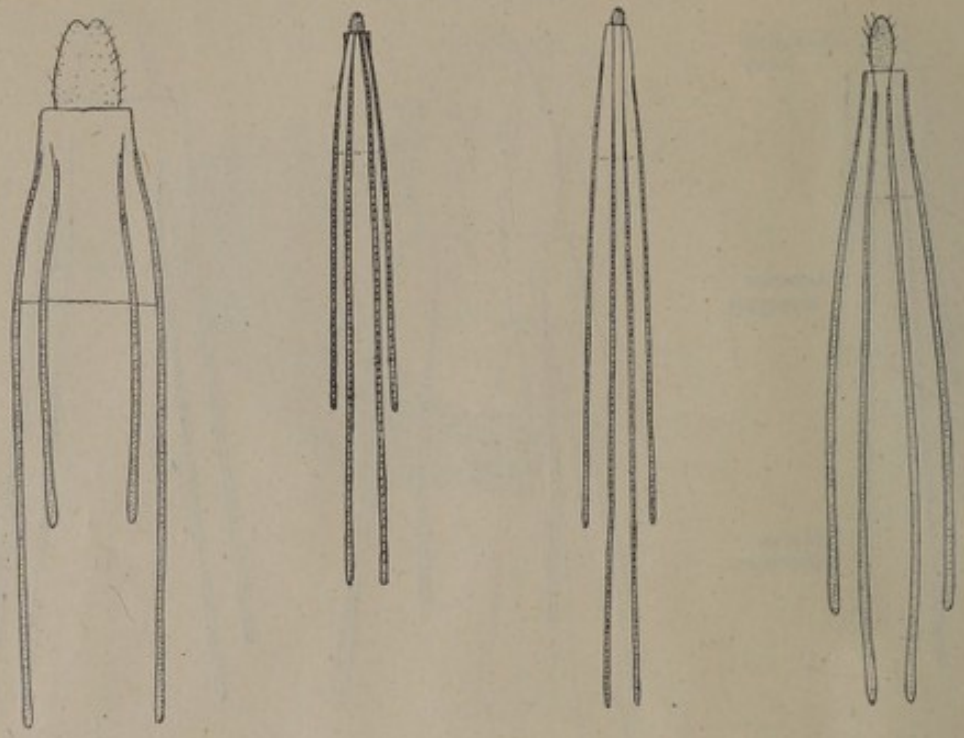
Text-figure 242.

Text-figure 243.

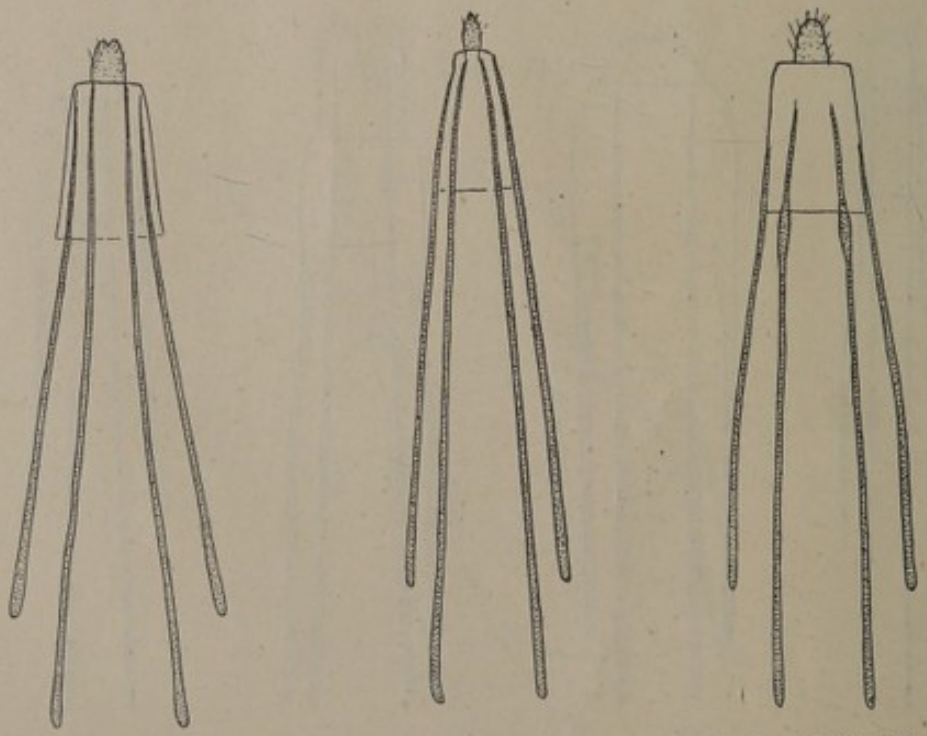


Ovipositor lobes and anterior and posterior apophyses of *Sitotroga cerealella* (Oliv.) (237); *Batrachedra amydraula* Meyr. (238); *Pyroderces rileyi* (Wals.) (239); *Endrosis sarcitrella* (L.) (240); *Hofmannophila pseudospretella* (Staint.) (241); *Anchonoma xeraula* Meyr. (242); *Oinophila v-flava* (Haw.) (243).

Text-figure 244. Text-figure 245. Text-figure 246. Text-figure 247.



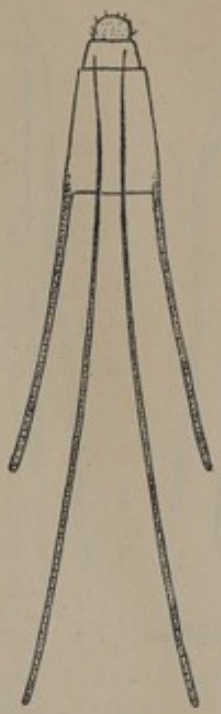
Text-figure 248. Text-figure 249. Text-figure 250.



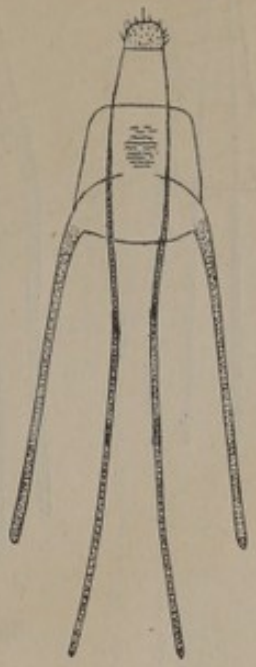
Ovipositor lobes and anterior apophyses of *Spatularia mimosæ* (Staint.) (244); *Trichophaga tapetzella* (L.) (245); *T. abruptella* (Woll.) (246); *Monopis ferruginella* (Hbn.) (247); *M. crocicapitella* (Clemens) (248); *M. rusticella* (Clerck) (249); *Tineola bisselliella* (Hummel) (250).

Text-figure 251.

Text-figure 252.

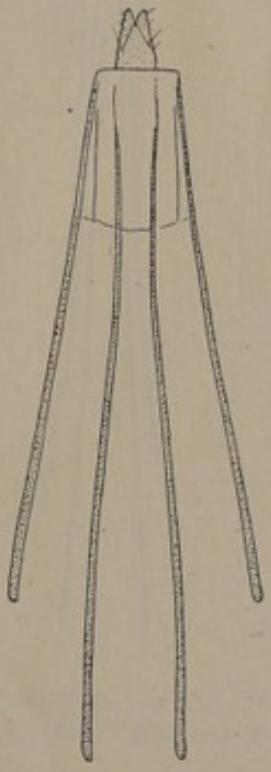


Text-figure 253.

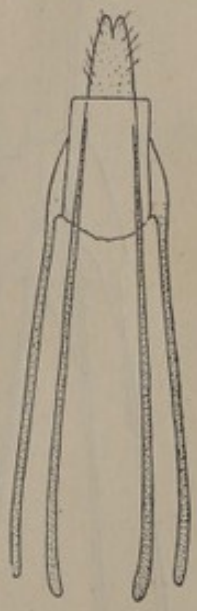


Text-figure 254.

Text-figure 255.

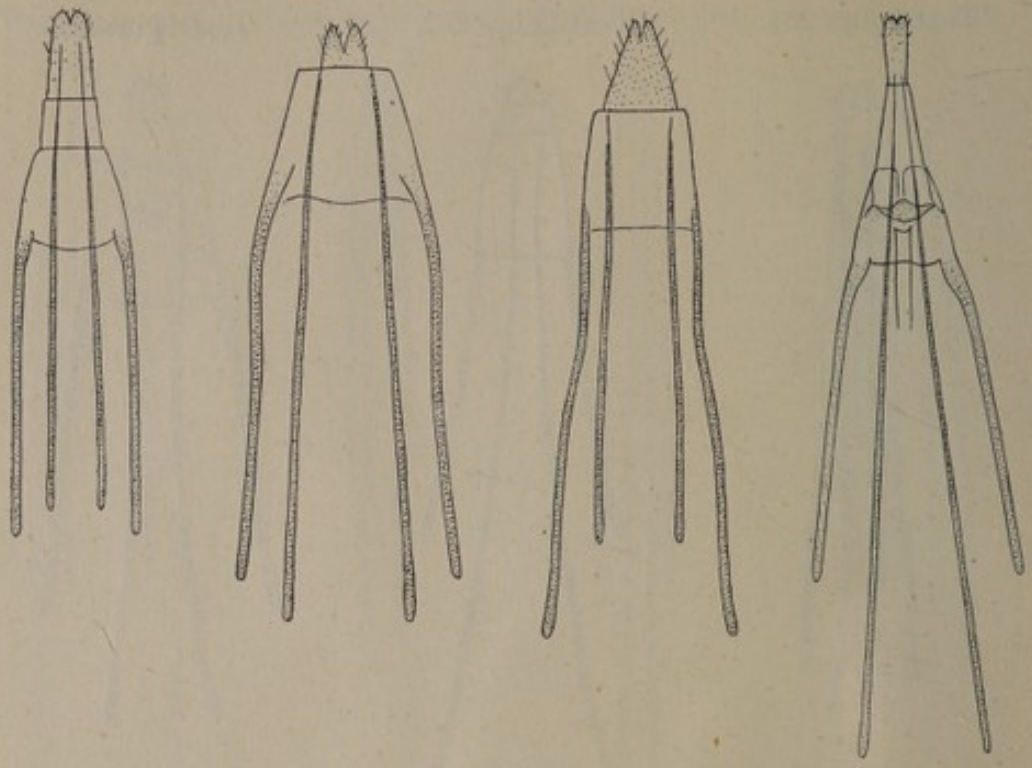


Text-figure 256.

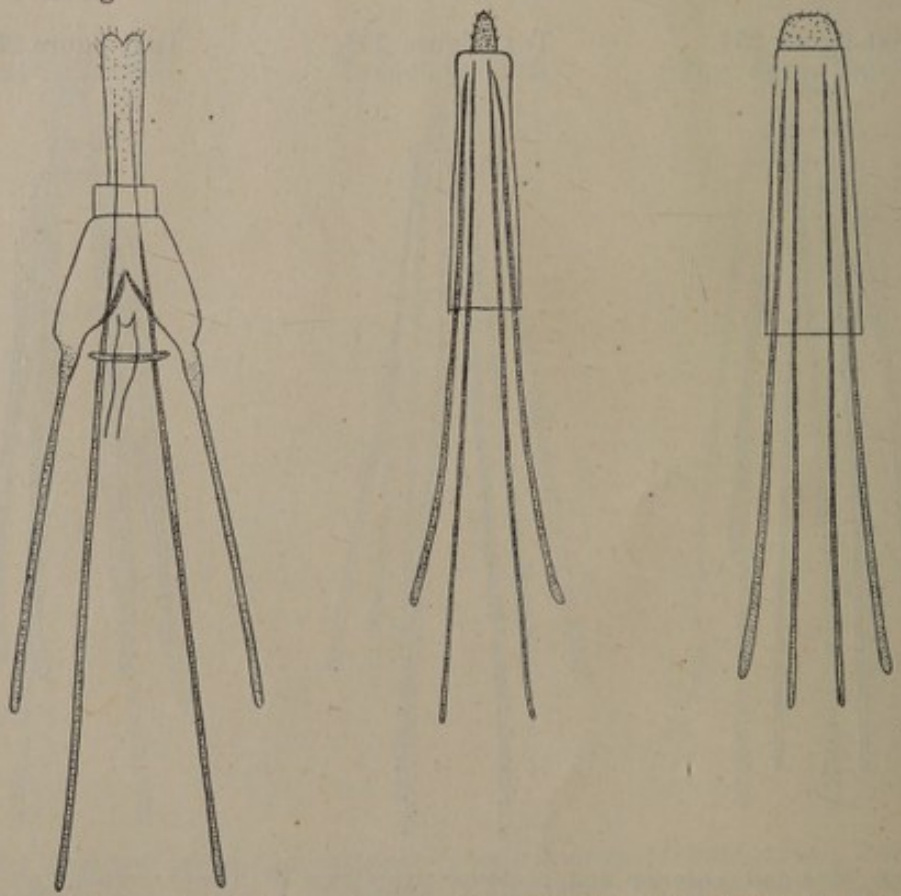


Ovipositor lobes and anterior and posterior apophyses of *Tinæa arcella* Fab. (251); *T. cloacella* Haw. (252); *T. granella* (L.) (253); *T. infimella* H.-Sch. (254); *T. pallescentella* Staint. (255); *T. pellionella* (L.) (256).

Text-figure 257. Text-figure 258. Text-figure 259. Text-figure 260.

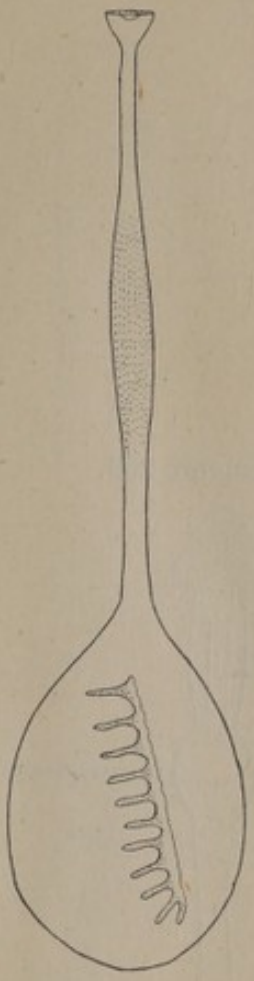


Text-figure 261. Text-figure 262. Text-figure 263.

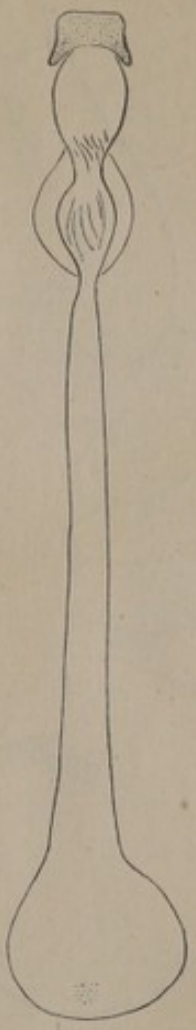


Ovipositor lobes and anterior and posterior apophyses of *T. metonella* Pce. & Met. (allotype from England) (257); *T. flavescentella* Haw. (258); *T. fuscipunctella* Haw. (259); *T. insectella* Fab. (showing ostium) (260); *T. ditella* Pce. & Met. (showing ostium) (261); *Setomorpha rutella* Zell. (262); *Spatularia mimosæ* (Staint.) (263).

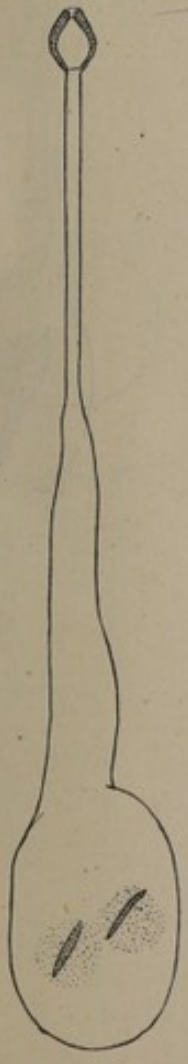
Text-figure 265.



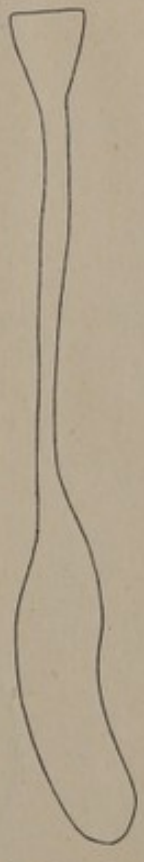
Text-figure 267.



Text-figure 264.

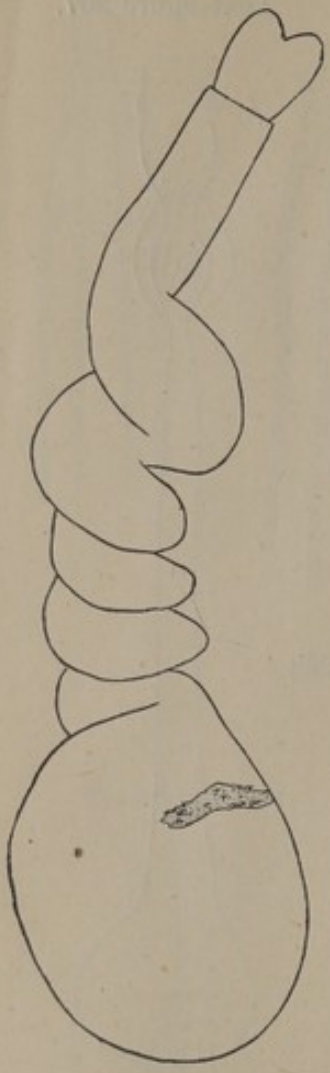


Text-figure 266.

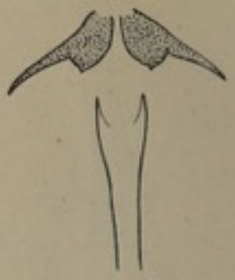


Bursa copulatrix of *Sitotroga cerealella* (Oliv.) (264); *Batrachedra amydraula* Meyr. (265); *Pyroderces rileyi* (Wals.) (266); *Endrosis sarcitrella* (L.) (267).

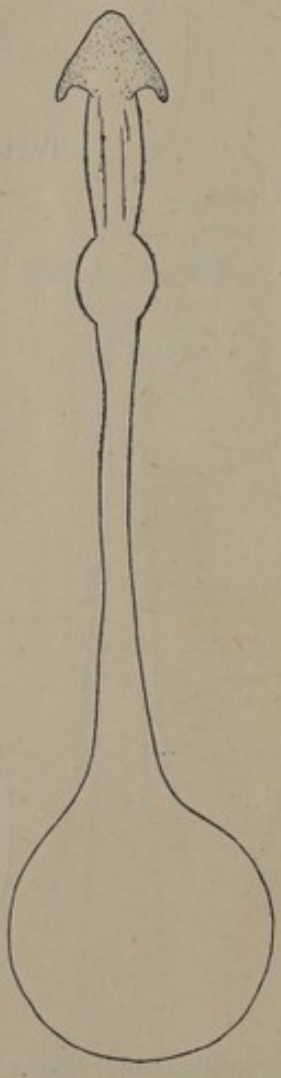
Text-figure 268.

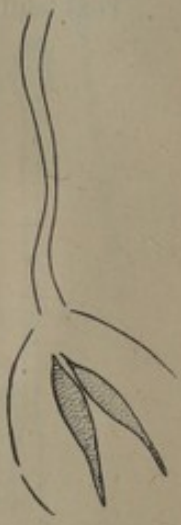


Text-figure 270.



Text-figure 269.





Bursa copulatrix of *Hofmannophila pseudopretella* (Staint.) (268); *Anchonoma xeraula* Meyr. (269).; *Oinophila v-flava* (Haw.) (270).

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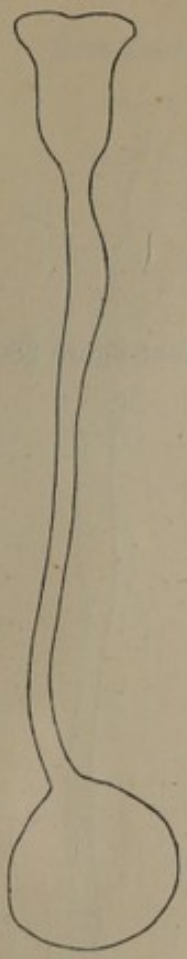
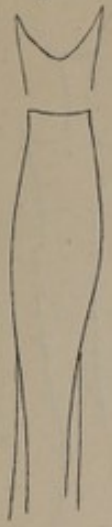
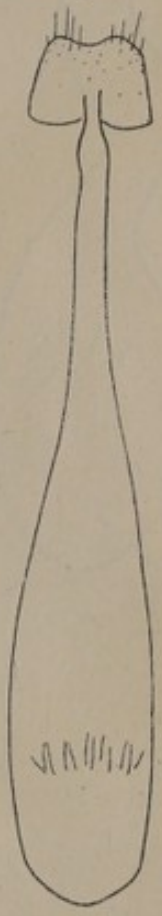


Text-figure 273.

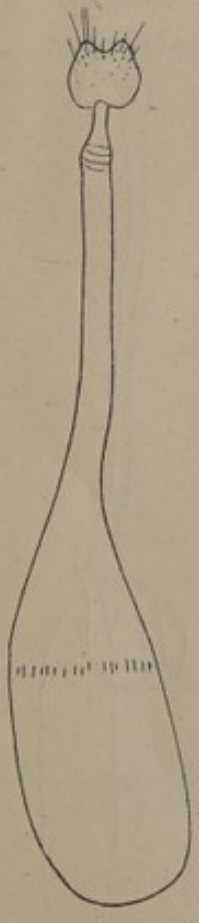


Text-figure 275.

Text-figure 276.



Text-figure 274.



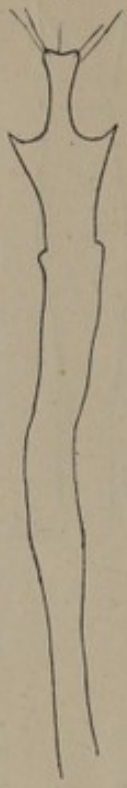
Text-figure 272.

Bursa copulatrix of *Spatularia mimosæ* (Staint.) (271); *Trichophaga tapetzella* (L.) (ostium and ductus only) (272); *T. abruptella* (Woll.) (ostium and ductus only) (273); *Monopis ferruginella* (Hbn.) (274); *M. crocicapitella* (Clemens) (275); *M. rusticella* (Clerck) (276).

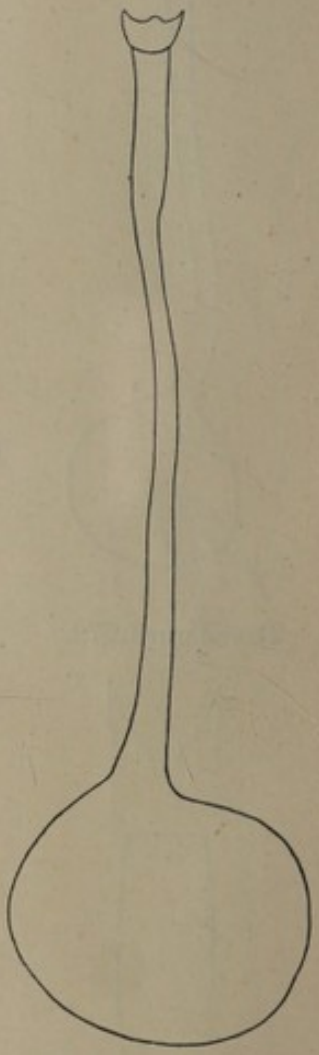
Text-figure 277.

Text-figure 278.

Text-figure 279.



Text-figure 280.

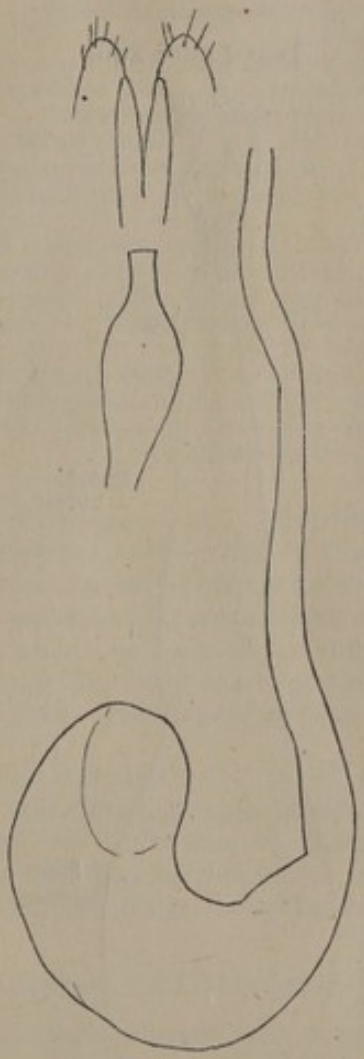


Text-figure 281.

Bursa copulatrix of *Tinecola bisselliella* (Hummel) (277); *Tinæa arcella* Fab. (278); *T. ruricolella* Staint. (279); *T. cloacella* Haw. (280); *T. granella* (L.) (281).

Text-figure 282.

Text-figure 283.



Text-figure 284.

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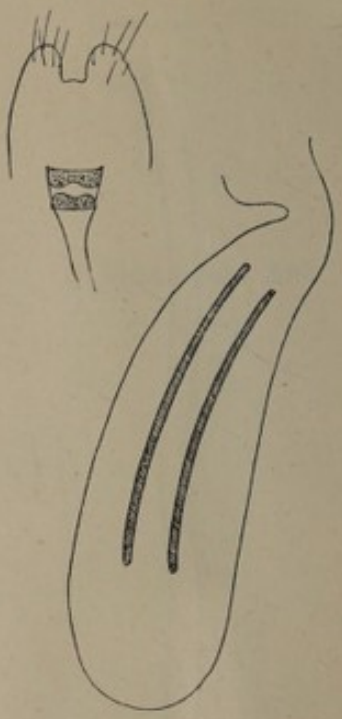
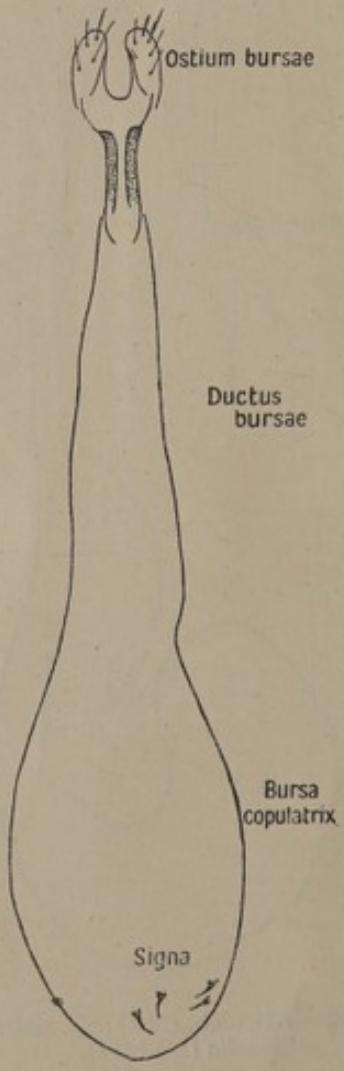
Text-figure 285.

Text-figure 287.



Text-figure 286.



Bursa copulatrix of *T. metonella* Pce. & Met. (allotype from England) (285); *T. flavescentella* Haw. (286); *T. fuscipunctella* Haw (287).

Upperside forewing without a dark streak along the basal half of the sub-dorsal fold. Length of forewing usually less than 7·0 mm. Male cornuti not as above. Female anterior apophyses not markedly longer than the posterior apophyses ..... 25.

25. Upperside forewing pale greyish brown and dusted, sometimes very sparsely, with dark scales. Upperside forewing cell-end spot rather prominent and the two short medial stripes usually faint or almost obsolete. Male cornuti consist of two very long tapered spines. Female bursa copulatrix with one (rarely) or two signa : for ostium see fig. 284.
Tinæa pellionella (L.) (pl. v. fig. 29 ♂, 30 ♀). (4·5–7·0 mm.)

Upperside forewing pale buff brown with the dark dusting very sparse. Upperside forewing with the cell-end spot and the two short medial stripes usually equally prominent. Male cornuti not as above. Female bursa copulatrix with two to five signa ..... 26.

26. Male saccus about twice the length of the clasper ; cornuti comprising two very long tapered spines each ending in a beaked process. Female bursa copulatrix with two signa ; for ostium see fig. 285.
Tinæa metonella Pce. & Met. (pl. v. fig. 28). (5·5–7·0 mm.)

Male saccus rather longer than the length of the clasper ; cornuti comprising a bundle of long teeth. Female bursa copulatrix with three to five signa ; for ostium see fig. 286. **Tinæa flavescentella** Haw. (pl. v. fig. 31 ♂, 32 ♀). (4·5–7·5 mm.)

27. Upperside forewing with the usual three dark spots of the *T. pellionella* group (see no. 23) usually recognizable, and a dark streak along the basal half of the sub-dorsal fold. **Tinæa fuscipunctella** Haw. (pl. v. fig. 38 ♂, 39 ♀). (5·5–8·0 mm.)

Upperside forewing with the three dark spots of the *T. pellionella* group not distinguishable, and without a dark streak along the basal half of the sub-dorsal fold ..... 28.

28. Upperside forewing ground colour pale buff, and with the small dark brown markings often rather clearly defined. The female much darker than the male and resembling *T. ditella*. Male saccus long and prominent. Female ostium without a dark bar. **Tinæa insectella** Fab. (pl. v. fig. 36 ♂, 37 ♀). (♂ 6·0–7·5 mm., ♀ 6·0–9·0 mm.)

Upperside forewing ground colour dark brownish buff, heavily dusted with dark brown and the markings not clearly defined. Male saccus very short and hardly distinguishable. Female ostium with a dark bar.
Tinæa ditella Pce. & Met. (pl. v. fig. 33). (6·0–9·0 mm.)

Our thanks are due to Professor J. W. Munro and Dr. O. W. Richards, of the Imperial College of Science, who initiated this work and who supplied us with a list of Lepidopterous species whose larvæ were known to infest stored food products or were suspected of having propensities in this direction. We have relied largely on this list to which we have added comparatively few species.

We wish also to express our indebtedness to our colleague, Mr. H. Stringer, who placed his knowledge of the Microlepidoptera at our disposal and helped us in many ways.

During the later stages of this work, Dr. H. E. Hinton was engaged in a study of the chætotaxy of the Lepidopterous larvæ infesting stored products and the results of his work are in course of publication elsewhere. Some interesting facts emerged from this investigation of the larvæ and we are grateful to Dr. Hinton for bringing these to our notice.

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EXPLANATION OF THE PLATES.

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Fig. 1. *Leucania zeæ* (Dup.).
2. *Apamea sordens* (Hufn.).
3. *Caradrina clavipalpis* (Scop.).
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6. *Pyralis farinalis* (L.), ♀.
7. *Pyralis lienigialis* (Zell.), ♂.
8. *Pyralis lienigialis* (Zell.), ♀.
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10. *Hypsopygia costalis* (Fab.), ♀.
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(The names of synonyms are in italics.)

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