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Protection and
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KEYS FOR THE IDENTIFICATION OF SOME FREQUENTLY INTERCEPTED LEPIDOPTEROUS LARVAE

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Prepared by D. M. Weisman, Systematic Entomology Laboratory, Biosystematics and Beneficial Insects Institute, Agricultural Research Service, USDA, Washington, DC 20560

Contents

Introduction

The following keys are intended to aid in recognizing the lepidopterous larvae most frequently intercepted at United States ports of entry. This paper is essentially an expansion of Capps' keys used by quarantine inspectors since 1939. It includes the 50 species in Capps (1963) and 40 additional species, mostly from the Old World. The characters have been reworked to accommodate the added species, and the Heinrich system of setal nomenclature has been replaced by the more generally used Hinton (1946) system.

These keys are based on mature larvae and may not work for some of the earlier instars. The characters used to separate the families are not diagnostic for the families but are intended only to separate the included species. The host and distribution should be considered in making a determination.

Many of the drawings are diagrammatic, particularly the setal maps, and are intended only to illustrate characters referred to in the text. In examining setal maps showing lateral views, the head of the larva is to the left; in dorsal and ventral views, the head is toward the top of the figure. In figures showing crochets, the meson is to the left and the head is toward the top of the figure.

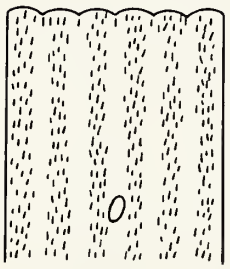
Acknowledgments

I thank G. L. Godfrey, Illinois Natural History Survey; R. W. Hodges and J. M. Kingsolver, Systematic Entomology Laboratory, U.S. Department of Agriculture; and members of the Animal and Plant Health Inspection Service, Plant Protection and Quarantine Training Center, USDA, for suggestions and corrections.

I am indebted to Molly K. Ryan for inking the line drawings.

1. Body with numerous short secondary setae, primary setae not evident (fig. 1) 2

1' Body without numerous short secondary setae, primary setae evident (fig. 2) 4



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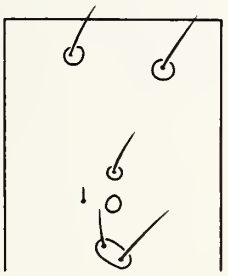
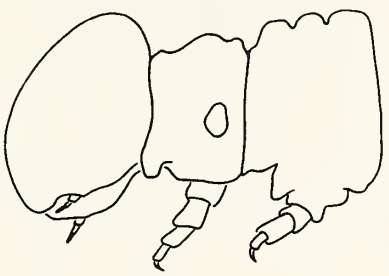


2

2(1). Head much larger than prothorax (fig. 3); prothorax shorter than succeeding segments (fig. 3); crochets biordinal or triordinal in a laterally elongated circle (fig. 4); body widest at middle . . . . . HESPERIIDAE p. 10

2'. Head equal to the diameter of body or much smaller; prothorax not shorter than succeeding segments; crochets in a mesoseries (fig. 5); body depressed or cylindrical 3

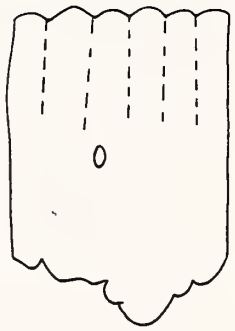


3

4

5

3(2'). Body cylindrical, not depressed; abdominal segments divided into 6 or fewer annulets (fig. 6); head about size of prothorax (fig. 7); crochets in continuous mesoseries (extra short series of crochets may be present) (fig. 8) . . . . . PIERIDAE p. 10



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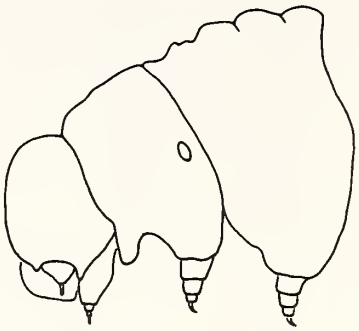
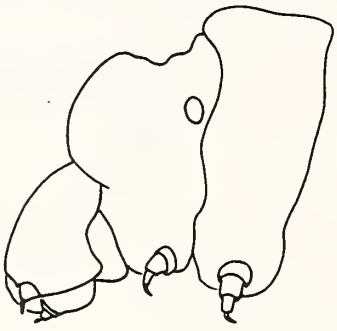


7

8

3'. Body depressed, spindle shaped; abdominal segments not divided into annulets; head about one-third size of prothorax, retractile (fig. 9); crochets in mesoseries interrupted at center by spatulate lobe (fig. 10) . . . . . LYCAENIDAE p. 12



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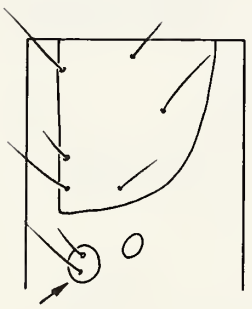
10

4(1'). Prolegs present only on abdominal segments 6 and 10 . . . . . GEOMETRIDAE p. 12

4'. Prolegs present on more abdominal segments 5

5(4'). Two setae in the prespiracular group of the prothorax (fig. 11) 6

5'. Three setae in the prespiracular group of the prothorax (fig. 12) 8



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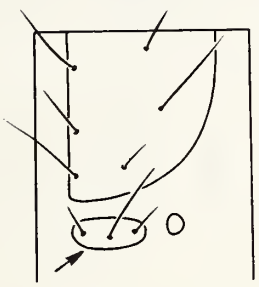
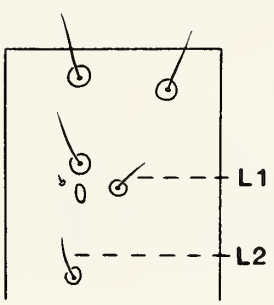


12

6(5). Abdominal segments 1 to 8 with seta L1 behind and seta L2 below the spiracle (fig. 13); subdorsal setae below the prothoracic shield (fig. 14); crochets in a mesoseries (fig. 15) . . . . . NOCTUIDAE p. 13



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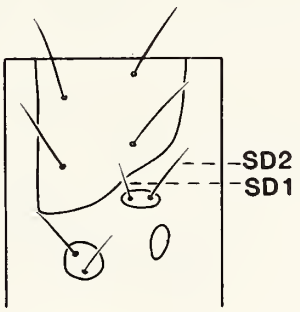

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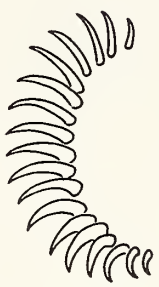

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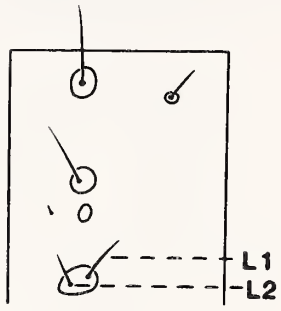
6'. Abdominal segments 1 to 8 with setae L1 and L2 close together below the spiracle (fig. 16); subdorsal setae on the prothoracic shield (fig. 11); crochets in a complete circle (fig. 17) or a penellipse (fig. 18) 7



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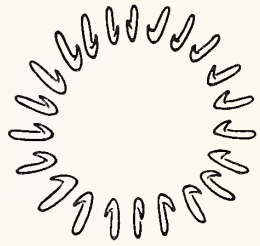

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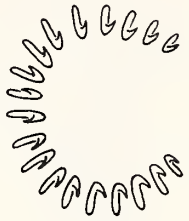
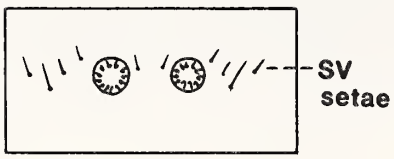


18

7(6'). Four subventral setae present on abdominal segments 3 to 6 (fig. 19); spiracles on abdominal segment 8 well above level of those on preceding segments (fig. 20) . . . . . CARPOSINIDAE p. 17



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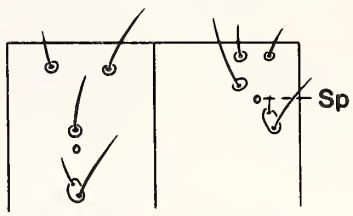
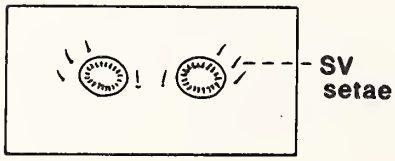


20

7'. Three subventral setae present on abdominal segments 3 to 6 (fig. 21); spiracles on abdominal segment 8 on a level with those of preceding segments (fig. 22) . . . . . PYRALIDAE p. 18



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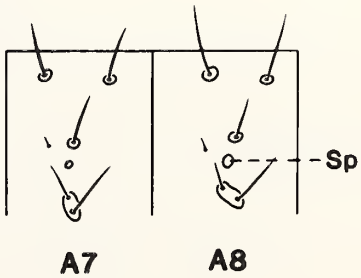

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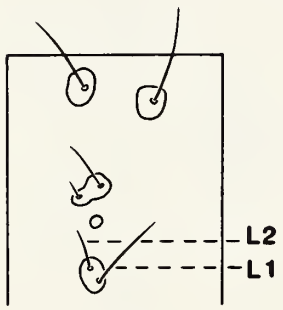
8(5'). Setae L1 and L2 of abdominal segments 3 to 6 close together below the spiracle, often on the same pinaculum (fig. 23) 9

8'. Setae L1 and L2 of abdominal segments 3 to 6 widely separated below the spiracle or below and behind the spiracle (fig. 24) 16



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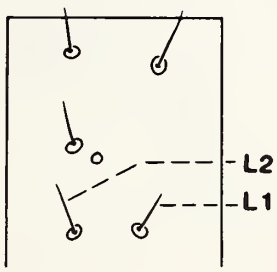

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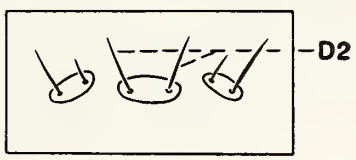
9(8). Paired setae D2 of abdominal segment 9 on a single pinaculum (fig. 25) 10

9'. Paired setae D2 of abdominal segment 9 not on a single pinaculum (fig. 26) 11



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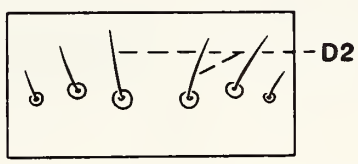
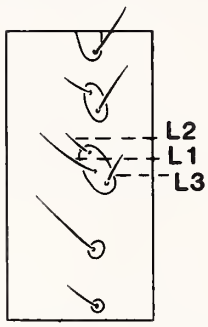


26

10(9). Three lateral setae present on abdominal segment 9 (fig. 27) . . . . . TORTRICIDAE p. 41

10'. Two lateral setae present on abdominal segment 9 (fig. 28) . . . . . COCHYLIDAE p. 45



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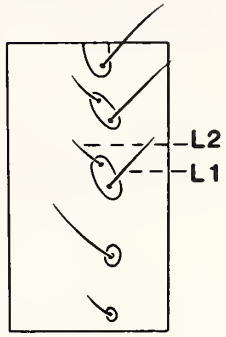
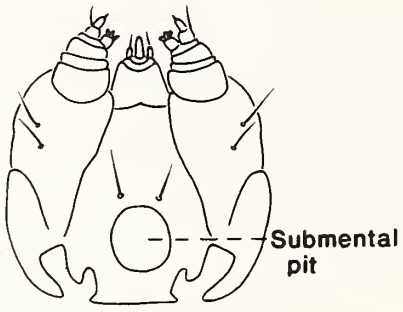


28

11(9'). Submentum with a large oval pit (fig. 29); seta SD1 of abdominal segment 8 above and slightly behind the spiracle (fig. 30); abdominal segments 1 to 7 often with sclerotized ring around seta SD1 . . . . . BLASTOBASIDAE p. 46

11'. Submentum without an oval pit; or, if pit is present, seta SD1 of abdominal segment 8 above and in front of spiracle (fig. 31) 12



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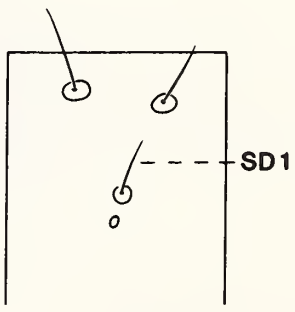

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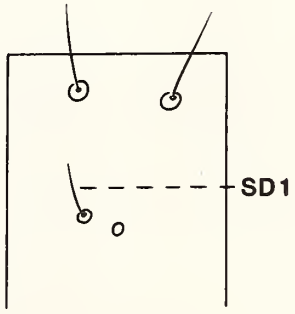

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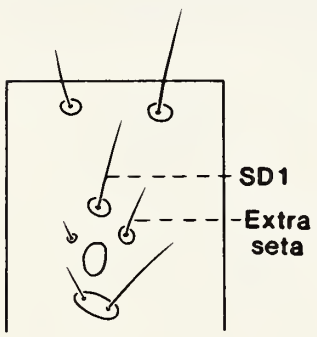
12(11'). Proleg-bearing segments (3 to 6) of abdomen with an extra unnamed seta behind the spiracle (fig. 32) . . . . . COSSIDAE p. 46

12'. Proleg-bearing segments of abdomen without an extra seta behind the spiracle (fig. 33) 13



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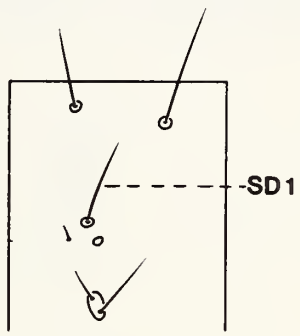
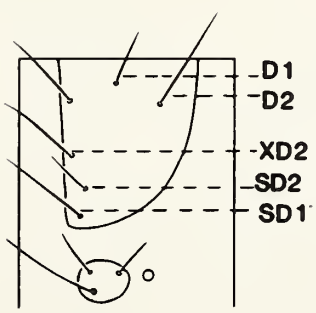


33

13(12'). Prothoracic shield with seta SD2 slightly behind line of seta SD1 and XD2, D2 behind seta D1 and much closer to midline than to lateral margin (fig. 34); abdominal segment 9 with setae D1, D2, and SD1 on common pinaculum (fig. 35) . . . . . ARGYRESTHIIDAE p. 47

13'. Prothoracic shield with seta SD2 well behind line of setae SD1 and XD2, seta D2 below seta D1 and approximately midway between midline and lateral margin (fig. 36); abdominal segment 9 with setae D1, D2, and SD1 on 2 or 3 separate pinacula (figs. 37, 38, 39) 14



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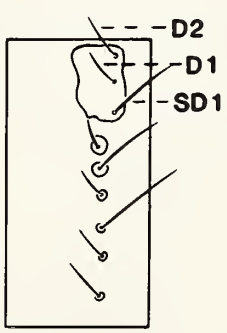

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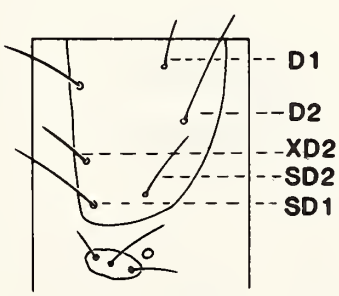
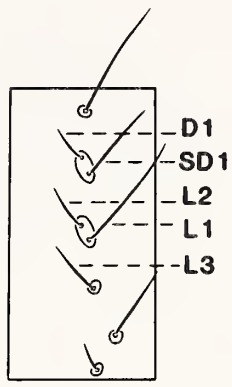


36

14(13'). Abdominal segment 9 with setae D1 and SD1 on common pinaculum, setae L1 and L2 on separate common pinaculum, seta L3 on its own pinaculum (fig. 37) . . . . COSMOPTERIGIDAE p. 47

14'. Abdominal segment 9 with setae D1 and SD1 not closely associated, not on same pinaculum (figs. 38, 39) 15



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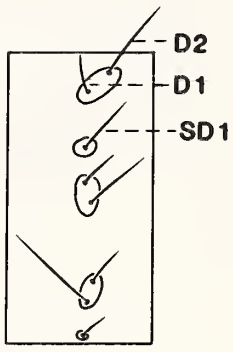

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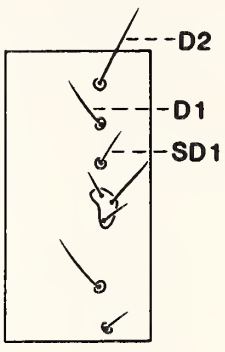
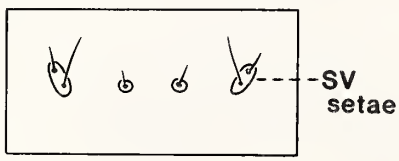


39

15(14'). Abdominal segment 9 with seta D1 closely associated with and forward of seta D2 (fig. 38); abdominal segment 1 may have 2 or 3 setae in subventral group . . . OECOPHORIDAE p. 48

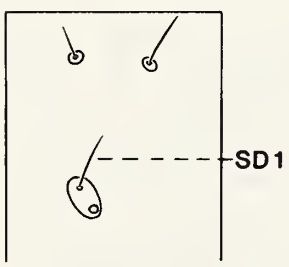
15'. Abdominal segment 9 with seta D1 equidistant from setae D2 and SD1, usually the three setae in line (fig. 39); abdominal segment 1 always with 2 setae in subventral group (fig. 40) . . . . . GELECHIIDAE p. 49



40

16(8'). Pinaculum of seta SD1 enclosing spiracle on abdominal segments 1 to 8 (fig. 41); crochets of abdominal prolegs in a uniordinal circle enclosing a short longitudinal series of crochets (fig. 42) . . . . . ACROLEPIIDAE p. 52

16'. Pinaculum of seta SD1 on abdominal segments 1 to 8 not enclosing spiracle; crochets in circle or ellipse without enclosed series (figs. 43, 44, 45) 17



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17(16'). Crochets of abdominal prolegs in a biserial circle (fig. 43); seta L3 missing on abdominal segment 9 (fig. 201) . . . . . PLUTELLIDAE p. 52

17'. Crochets of abdominal prolegs in a uniserial circle or ellipse, rows of very small spinules may be present on the prolegs anterior or posterior to the crochets (figs. 44, 45); seta L3 usually present on abdominal segment 9 (missing in Tineola) (figs. 218, 220) . . . . . TINEIDAE p. 53

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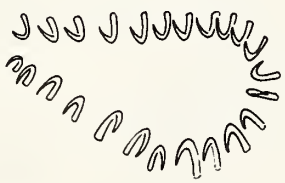

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HESPERIIDAE

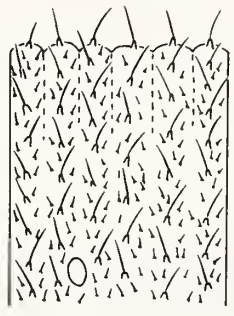
Most species have an anal fork present; abdominal segments indistinctly annulated . . . . . Species of Hesperiidae

Distribution: Worldwide
Hosts: citrus, canna, palm spp., and many other plants

PIERIDAE

1. Body with soft vestiture of very fine white setae borne on small to very small chalazae (fig. 46); body green 2

1'. Body with a few very large, broad-based, seta-bearing chalazae interspersed among numerous small setae (fig. 47); body yellow and brown 3



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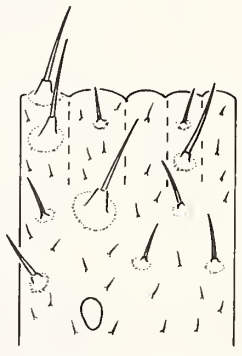


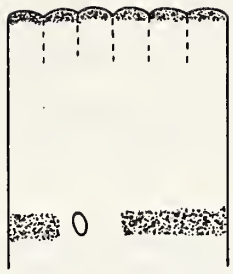
47

2(1). Body with yellow middorsal stripe and a broken stripe through the spiracles (fig. 48) . . . . Pieris rapae (Linnaeus)

Distribution: Europe and North America
Hosts: cabbage, cauliflower, and other crucifers

2'. Body without middorsal stripe, with yellowish area around abdominal spiracles (fig. 49) . . Pieris napi (Linnaeus)

Distribution: Europe and North America
Hosts: mustard and turnip



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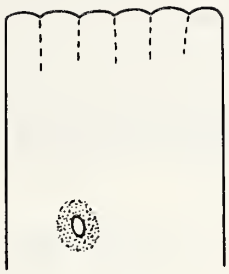

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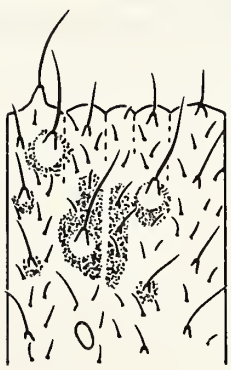
3(1'). Head black, except for gray front and light patch on each side; body with yellow middorsal and spiracular stripes, area between with patches of dark color (fig. 50); anal shield black with median yellow stripe . . Pieris brassicae (Linnaeus)

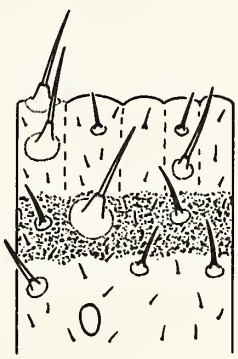
Distribution: Europe, Middle East, North Africa, and Chile
Hosts: cabbage, cauliflower, and other crucifers

3'. Head yellow except for black chalazae; body with yellow dorsal, subdorsal and spiracular stripes, area between latter two with longitudinal fuscous stripe (fig. 51); anal shield yellow except for black chalazae . . . . . Ascia monuste (Linnaeus)

Distribution: Mexico, West Indies, and United States
Hosts: cabbage and other crucifers



50



51

LYCAENIDAE

1. Secondary setae long, stout, and of variable length, borne on short, cylindrical chalazae (fig. 52) . . . . . Strymon melinus (Hübner)

Distribution: Mexico and United States
Hosts: beans and cotton

1'. Secondary setae of moderate, more uniform length, borne on short star-shaped chalazae (fig. 53) . . . . . Lampides boeticus (Linnaeus)

Distribution: Old World and Hawaii
Hosts: beans, peas, and other legumes

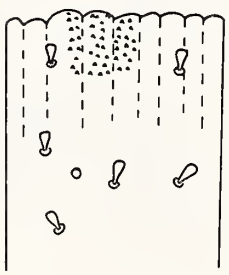
52

53

GEOMETRIDAE

Skin granulose; setae spatulate (fig. 54) . . . . . Idaea spp.

Distribution: Mexico and Europe
Hosts: cut flowers, heather, and chamomile



54

NOCTUIDAE

1. Prolegs absent on abdominal segments 3 and 4, present on segments 5 and 6 2

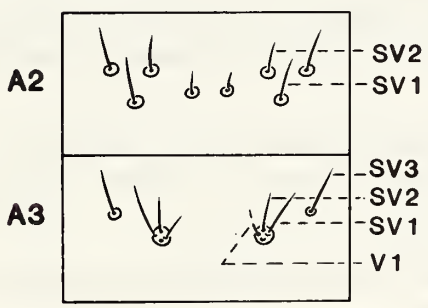
1'. Prolegs present on abdominal segments 3 to 6 . . . 3

2(1). Vestigial prolegs present on abdominal segments 3 and 4; setae SV1, SV2, and V1 grouped closely about vestigial proleg (fig. 55); pinacula of setae SV1 and SV2 well separated on abdominal segment 2 (fig. 55) . . . Trichoplusia ni (Hübner)

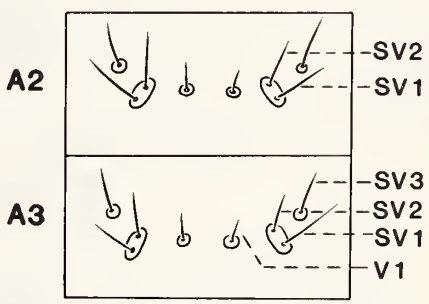
Distribution: North, Central, and South America and West Indies
Hosts: general feeder

2'. Vestigial prolegs absent on abdominal segments 3 and 4; seta V1 separated from setae SV1 and SV2 on all abdominal segments (fig. 56); pinacula of setae SV1 and SV2 fused on abdominal segments 2 to 4 (fig. 56) . . . . . Autographa gamma (Linnaeus)

Distribution: Europe, Asia, and North Africa
Hosts: general feeder



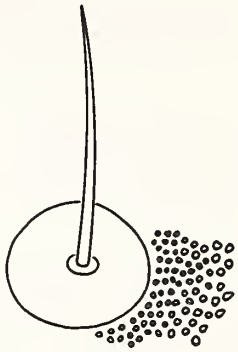
55



56

3(1'). Integument with short, sharp spines (fig. 57) . . . 4
3'. Integument smooth or with flat granules (fig. 58)
. 5

57



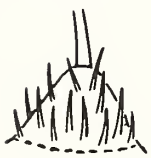
58

4(3). Chalazae D1 and D2 of abdominal segments with hair-like spinules (fig. 59); mandible with a broad basal process on the oral surface (fig. 60) . . Heliothis virescens (Fabricius)

Distribution: Mexico, West Indies, and United States
Hosts: cotton, tobacco, tomatoes, peppers, and many others

4'. Chalazae D1 and D2 of abdominal segments without spinules (fig. 61); mandible without basal process on the oral surface (fig. 62) . . . . . Helicoverpa zea (Boddie)

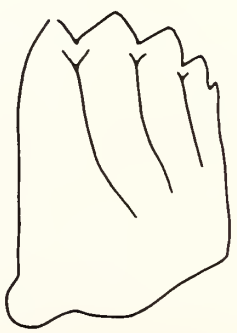
Distribution: North, Central, and South America, and West Indies
Hosts: corn, beans, cotton, tomatoes, and many others



59

60

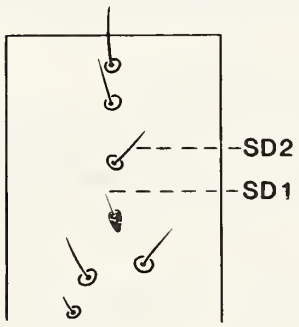
61



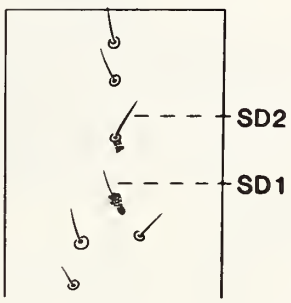
62

5(3'). Meso- and metathorax with dark bar connecting seta SD1 with adjacent ventral muscle attachment, no dark bar associated with seta SD2 on these segments (fig. 63) 6

5'. Meso- and metathorax with dark bars connecting both setae SD2 and SD1 with their adjacent ventral muscle attachments (fig. 64) 7



63



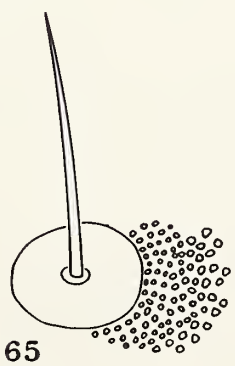
64

6(5). Integument with evident flat granules (fig. 65); setal pinacula of body large and brown (fig. 66); abdominal segments patterned as illustrated (fig. 66) . . . . . *Spodoptera frugiperda* (J. E. Smith)

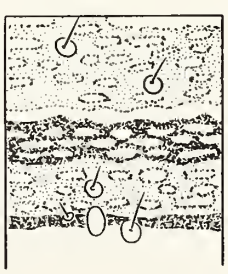
Distribution: North, Central, and South America, West Indies
Hosts: wide range of crop plants and vegetables

6' Integument smooth; setal pinacula of body minute (fig. 67); abdominal segments patterned as illustrated (fig. 67) . . . . . *Spodoptera exigua* (Hübner)

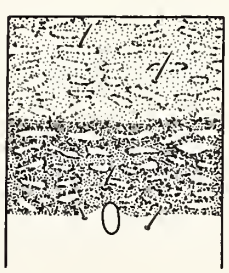
Distribution: Old World, Mexico, and United States
Hosts: wide range of vegetables



65



66

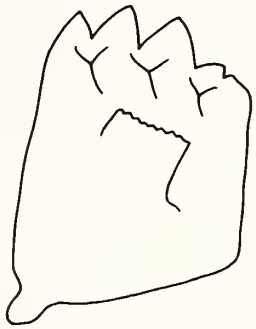


67

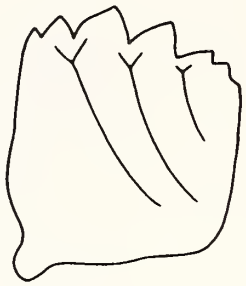
7(5'). Mandible with large molar-bearing basal process on oral surface (fig. 68) . . . . . Mamestra brassicae (Linnaeus)

Distribution: Europe and Asia
Hosts: crucifers and other leafy vegetables

7'. Mandible without large basal process (fig. 69) (a small tooth may be present at base of oral surface in Xestia) 8



68

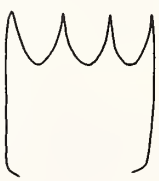


69

8(7'). Spinneret with apical spinules (fig. 70); spiracles black; yellow middorsal spots on metathorax and abdominal segments 1 to 4 . . . . . Peridroma saucia (Hübner)

Distribution: Europe, North, Central, and South America, and West Indies
Hosts: general feeder

8'. Spinneret without spinules; spiracles white or yellowish; no yellow middorsal spots 9



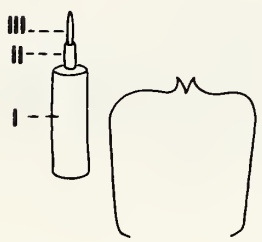
70

9(8'). Combined length of 2nd and 3rd segments of labial palpus one-half or more length of 1st segment (fig. 71); spinneret with 2 denticles on apical margin (fig. 71); head reticulated brown usually with black submedian arcs present . . . . . Xestia spp.

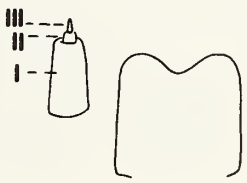
Distribution: Europe and North America
Hosts: general feeder

9' Combined length of 2nd and 3rd segments of labial palpus one-third or less length of 1st segment (fig. 72); spinneret without denticles, apical margin lobed (fig. 72); later instar head reticulated with light brown, no darker submedian arcs, head flecked with brown in early instars; . . . . . Copitarsia spp.

Distribution: Mexico, Central and South America
Hosts: cut flowers, potatoes, and other vegetables



71



72

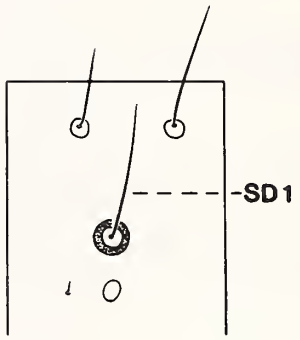
CARPOSINIDAE

This family never has more than one lateral seta on abdominal segment 9 . . . . . Carposina niponensis niponensis Walsingham

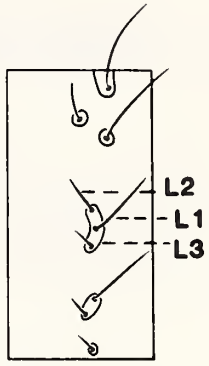
Distribution: Japan, Korea, and China
Hosts: apple, pear, plum, and peach

PYRALIDAE

1. Sclerotized ring around seta SD1 on abdominal segment 8 (missing in Etiella zinckenella) (fig. 73); 3 setae in the lateral group on abdominal segment 9 (fig. 74) 2

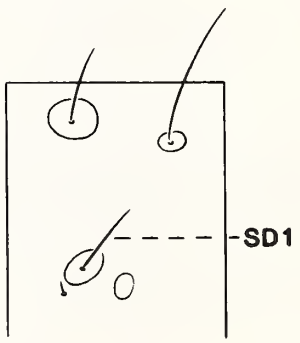


73

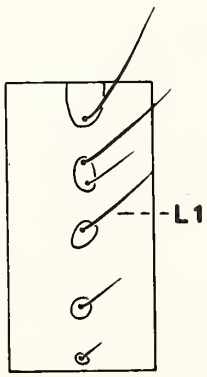


74

1'. No sclerotized ring around seta SD1 on abdominal segment 8 (fig. 75); one seta in the lateral group on abdominal segment 9 (fig. 76) . . . . . 20 (p. 30)



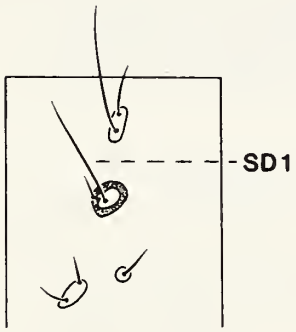
75



76

2(1). Sclerotized ring around seta SD1 on mesothorax (fig. 77) . . . . . Phycitinae . . . 3

2'. No sclerotized ring around seta SD1 on mesothorax 15

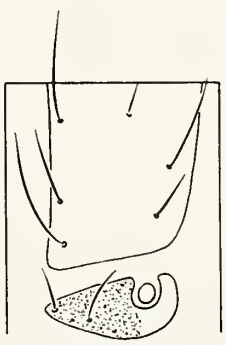


77

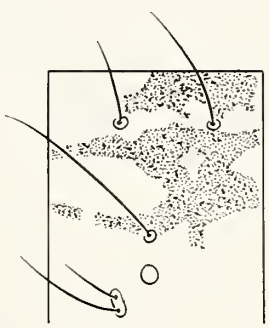
3(2). Prespiracular shield of prothorax extending below and behind the spiracle, posterior portion weakly pigmented (fig. 78); body pink with whitish discontinuous longitudinal bands on most segments (fig. 79) . . . Elasmopalpus lignosellus (Zeller)

Distribution: Mexico, West Indies, and United States
Hosts: corn, sugarcane, peas, and many others

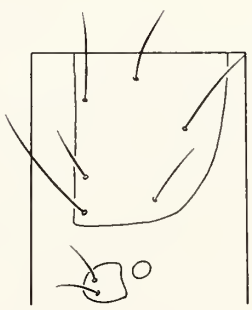
3'. Prespiracular shield of prothorax never extending below and behind spiracle (fig. 80); body white or if pinkish without white bands 4



78



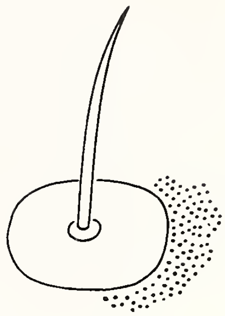
79



80

4(3'). Integument granulose under low magnification (30X) (fig. 81) 5

4'. Integument not granulose under low magnification 7

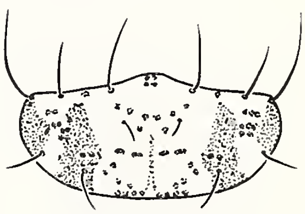


81

5(4). Prothoracic shield with black areas on lateral margins and longitudinal black areas on either side midway between center line and lateral margins (fig. 82) . . . . Ancylostomia stercorea (Zeller)

Distribution: West Indies
Hosts: pigeon peas

5'. Prothoracic shield not with the above color pattern 6



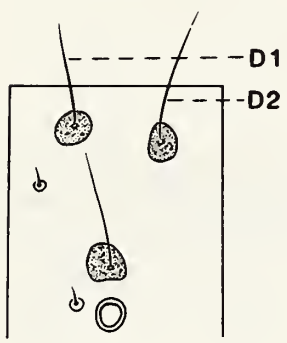
82

6(5'). Pinacula of body setae large and dark (fig. 83); seta D2 of abdominal segments 1 to 7 below level of seta D1 (fig. 83) . . . . . Hypsipyla grandella (Zeller)

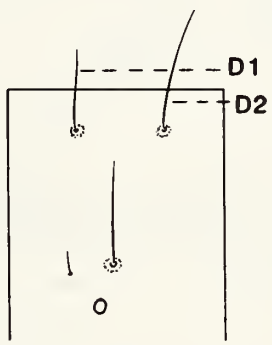
Distribution: Central and South America, West Indies, and southern Florida
Hosts: mahogany and Spanish cedar logs

6'. Pinacula of body setae very small and pale (fig. 84); seta D2 of abdominal segments 1 to 7 at level of seta D1 (fig. 84) . . . . . Moodna bisinuella Hampson

Distribution: Mexico
Host: corn



83



84

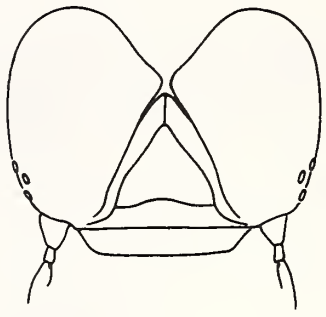
7(4'). Prothoracic shield yellow with pattern of dark marks as illustrated (fig. 85) . . . . . Fundella pellucens Zeller

Distribution: Mexico and West Indies
Hosts: beans and peas

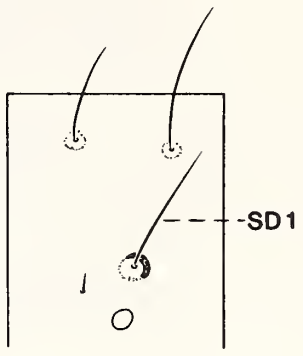
7'. Prothoracic shield yellowish without the pattern as above 8

85

8(7'). Coronal suture absent (fig. 86); abdominal segments 1 to 7 with a crescent-shaped patch above seta SD1 (usually reduced to a small smudge or missing in Amyelois transitella) (fig. 87) 9

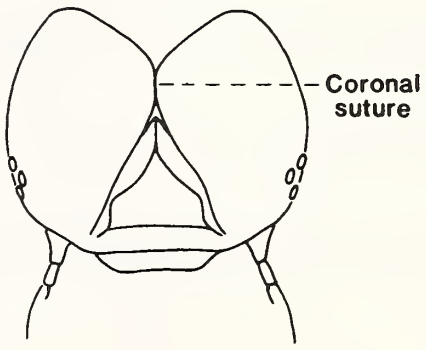


86

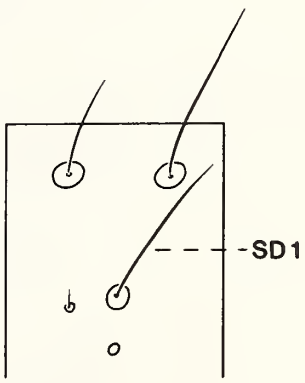


87

8'. Coronal suture present (fig. 88); abdominal segments 1 to 7 without crescent-shaped patch above seta SD1 (fig. 89) 10



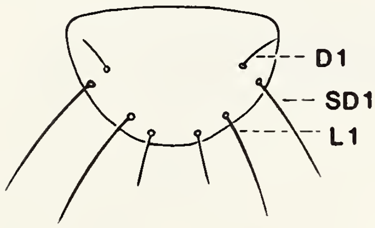
88



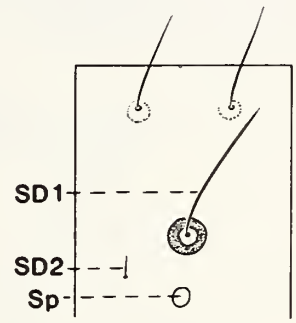
89

9(8). Anal plate with seta SD1 closer to seta D1 than to seta L1 (fig. 90); seta SD2 of abdominal segment 8 usually separated from the spiracle by 2 or more times the diameter of the spiracle (fig. 91); ring around seta SD1 on abdominal segment 8 usually complete (fig. 91) . . . . <u>Ectomyelois</u> <u>ceratoniae</u> (Zeller)

Distribution: Mediterranean, Africa, Argentina, West Indies, and Florida
Hosts: legumes, nuts, dates, tamarinds, carobs, and others



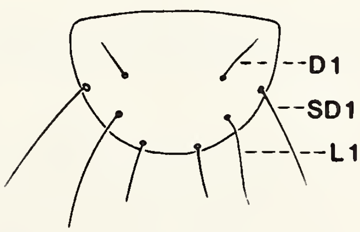
90



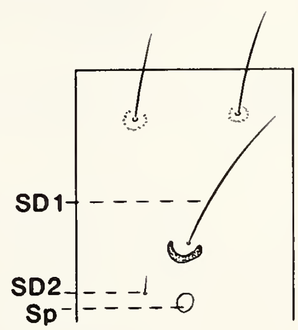
91

9'. Anal plate with seta SD1 equidistant from setae D1 and L1 (fig. 92); seta SD2 of abdominal segment 8 usually separated from the spiracle by one to 1.5 times the diameter of the spiracle (fig. 93); ring around seta SD1 on abdominal segment 8 incomplete (fig. 93) . . . . <u>Amyelois</u> <u>transitella</u> (Walker)

Distribution: North and South America, and West Indies
Hosts: oranges, walnuts, and other fruits and pods



92

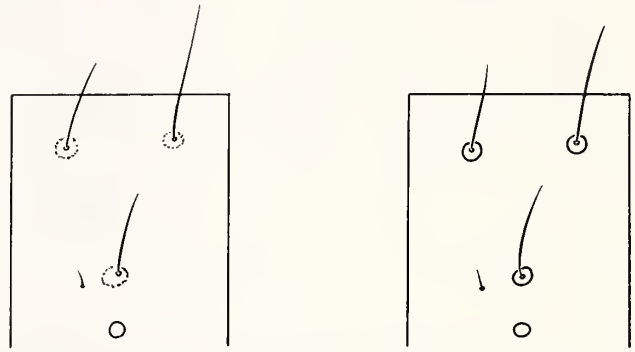


93

10(8'). Abdominal segments 1 to 8 apparently without pinacula (pinacula concolorous with body and not evident) (fig. 94) . . . . . Plodia interpunctella (Hübner)

Distribution: Cosmopolitan
Hosts: stored grain, vegetable and fruit products

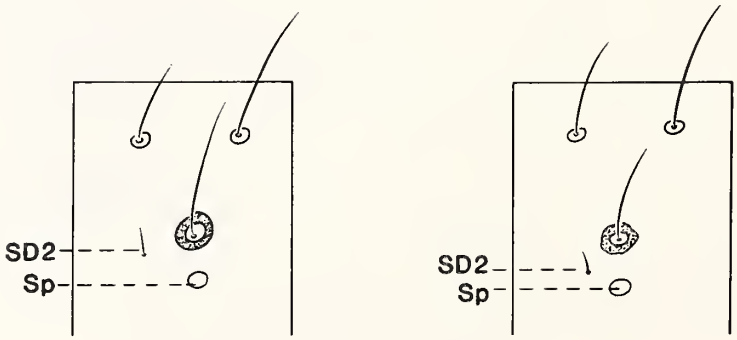
10'. Abdominal segments 1 to 8 with small pigmented pinacula (fig. 95) 11



94 95

11(10'). Abdominal segment 8 with seta SD2 separated from spiracle by 2 to 3 times the horizontal diameter of the spiracle (fig. 96) 12

11'. Abdominal segment 8 with seta SD2 separated from spiracle by a distance equal to the horizontal diameter of the spiracle (fig. 97) 13



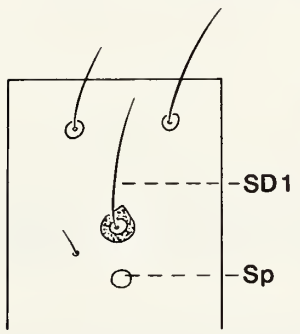
96 97

12(11). Spiracle of abdominal segment 8 as large as the area enclosed by the sclerotized ring around seta SD1 (fig. 98) . . . . . Anagasta kuehniella (Zeller)

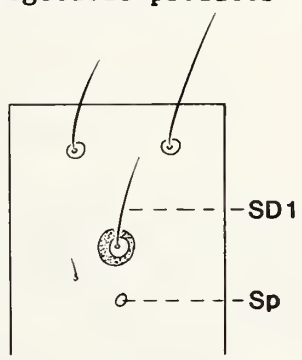
Distribution: Nearly cosmopolitan
Hosts: grain and other stored and dried vegetable products

12'. Spiracle of abdominal segment 8 two-thirds or less as broad as the area enclosed by the sclerotized ring around seta SD1 (fig. 99) . . . . . Ephestia elutella (Hübner)

Distribution: Nearly cosmopolitan
Hosts: stored and dried vegetable products



98

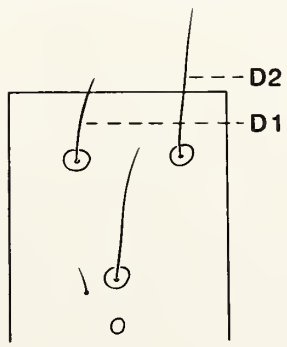


99

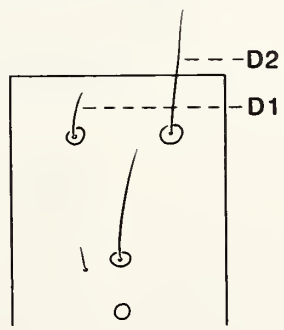
13(11'). Seta D2 of abdominal segments 1 to 8, two to two and one-half times the length of seta D1 (fig. 100) . . . . . Cadra cautella (Walker)

Distribution: Cosmopolitan
Hosts: stored and dried vegetable products

13'. Seta D2 of abdominal segments 1 to 8, three to five times the length of seta D1 (fig. 101) 14



100



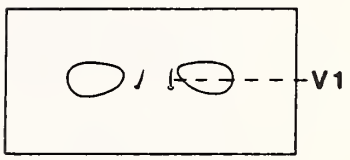
101

14(13'). Metathorax with the distance between setae V1 2 times or less than the distance between seta V1 and the coxa (fig. 102) . . . . . Cadra figulilella (Gregson)

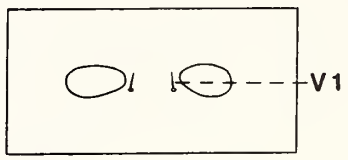
Distribution: Nearly cosmopolitan
Hosts: dried fruits, nuts, seeds, and beans

14'. Metathorax with the distance between setae V1 3 to 5 times the distance between seta V1 and the coxa (fig. 103) . . . . . Cadra calidella (Guenée)

Distribution: Mediterranean
Hosts: carobs, dried fruits, and nuts



102

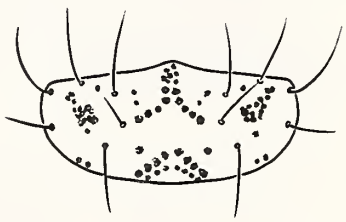


103

15(2'). Prothoracic shield with pattern of dark markings as illustrated (fig. 104) . . . . . Phycitinae . . . . . Etiella zinckenella (Treitschke)

Distribution: Nearly cosmopolitan
Hosts: lima beans, pigeon peas, and other legumes

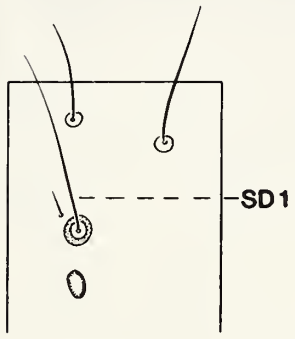
15'. Prothoracic shield not patterned as above 16



104

16(15'). Sclerotized ring around seta SD1 on abdominal segment 1 (fig. 105) . . . . . Galleriinae . . . 17

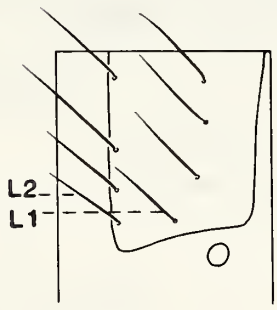
16'. No sclerotized ring around seta SD1 on abdominal segment 1 . . . . . Pyralinae . . . 19



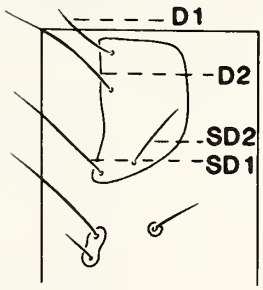
105

17(16). Prespiracular and prothoracic shields fused, setae L1 and L2 on lateral margin (fig. 106); dorsal and subdorsal setae of mesothorax on a single sclerotized plate (fig. 107) . . . . . Alpheias conspirata Heinrich

Distribution: Mexico
Hosts: pineapple

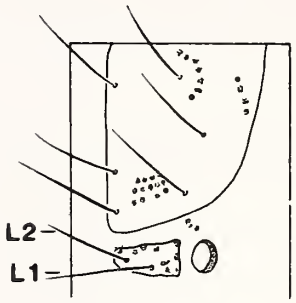


106

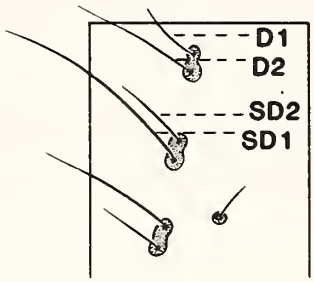


107

17'. Prespiracular and prothoracic shields not fused (fig. 108); dorsal and subdorsal setae of mesothorax on separate pinacula (fig. 109) 18



108



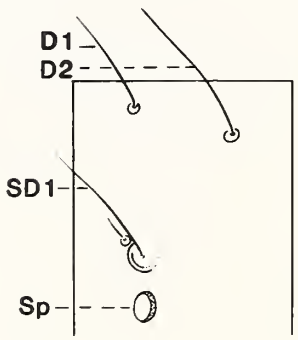
109

18(17'). Sclerotized rings around seta SD1 on abdominal segments 1 and 8 not complete (fig. 110); spiracular peritremes thicker on caudal margin (fig. 110); pinacula of setae D1 and D2 on abdominal segments not pigmented (fig. 110) . . . . . Corcyra cephalonica (Stainton)

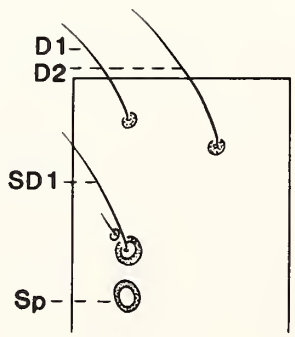
Distribution: Cosmopolitan
Hosts: stored vegetable products

18'. Sclerotized rings around seta SD1 on abdominal segments 1 and 8 complete (fig. 111); spiracular peritremes of uniform thickness (fig. 111); pinacula of setae D1 and D2 on abdominal segments pigmented (fig. 111) . . . . . Paralipsa gularis (Zeller)

Distribution: Nearly cosmopolitan
Hosts: stored vegetable products



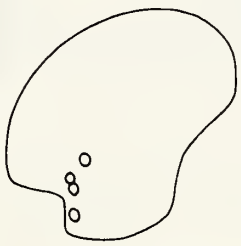
110



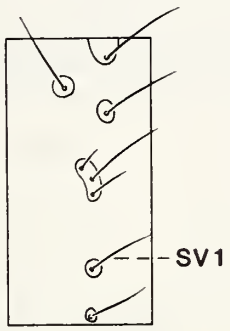
111

19(16'). Head with only 4 distinct ocelli present (ocelli I and II fused and ocellus VI usually missing) (fig. 112); abdominal segment 9 with one subventral seta (fig. 113) . . . . . Pyralis farinalis Linnaeus

Distribution: Cosmopolitan
Hosts: dried vegetable products



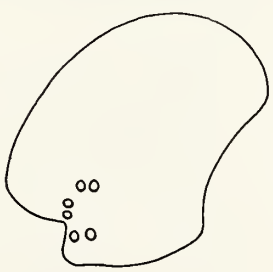
112



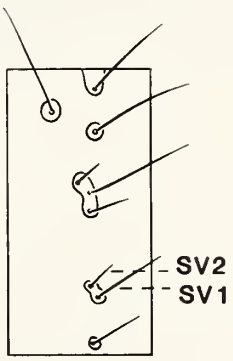
113

19'. Head with 6 ocelli present (fig. 114); abdominal segment 9 with two subventral setae (fig. 115) . . . . . Aglossa caprealis (Hübner)

Distribution: Nearly cosmopolitan
Hosts: damp grain and rotting vegetable matter (feeds on fungus)

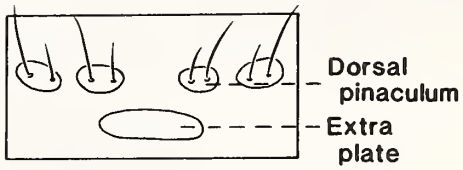


114



115

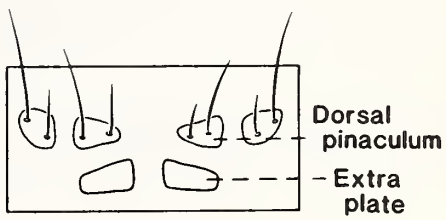
20(1'). A single transverse plate without setae posterior to dorsal pinacula on mesothorax (fig. 116); crochets in complete circle (fig. 117) . . . . . Crambinae . . . 21



116

117

20'. A pair of plates without setae posterior to dorsal pinacula on mesothorax (fig. 118) or such plates absent; crochets in a mesal penellipse (fig. 119) (or may be a circle weaker on lateral edge in Lineodes integra and Udea rubigalis) (figs. 144, 146) . . . . . Pyraustinae . . . 23



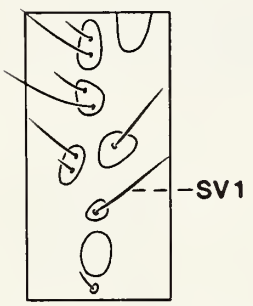
118

119

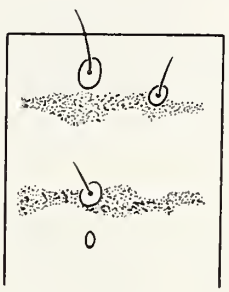
21(20). One subventral seta on meso- and metathorax (fig. 120); body with 2 pink longitudinal stripes on each side (fig. 121); pink-pigmented area around lateral setae on proleg-bearing segments . . . . . Eoreuma loftini (Dyar)

Distribution: Mexico and United States
Hosts: corn and sugarcane

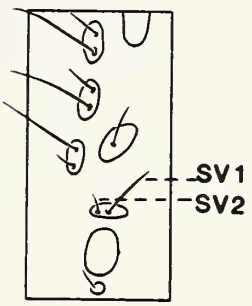
21'. Two subventral setae on meso- and metathorax (fig. 122); body with or without pigmented stripes; no pigmented area around lateral setae on proleg-bearing segments . . . 22



120



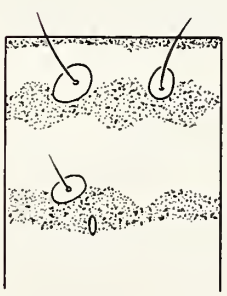
121



122

22(21'). Body with pinkish middorsal stripe and two lateral stripes on each side (fig. 123); setal pinacula concolorous with body . . . . . Chilo suppressalis (Walker)

Distribution: Japan, China, Southeast Asia to India
Host: rice straw



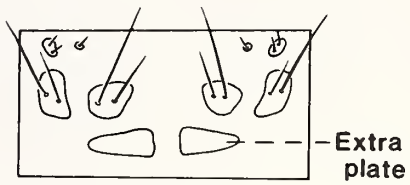
123

22'. Body without pinkish middorsal stripe; setal pinacula concolorous with body (winter form) or darkly pigmented (summer form) . . . . . Diatraea spp.

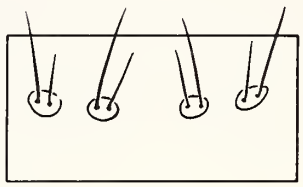
Distribution: North, Central, and South America, and West Indies
Hosts: corn, sugarcane, and sorghum

23(20'). Meso- and metathorax with a pair of nonsetal bearing plates posterior to dorsal pinacula, also small pinacula anterior to dorsal and subdorsal pinacula bearing microscopic setae (fig. 124) 24

23'. Meso- and metathorax without nonsetal bearing plates posterior to dorsal pinacula, no small pinacula anterior to dorsal and subdorsal pinacula (fig. 125) 25



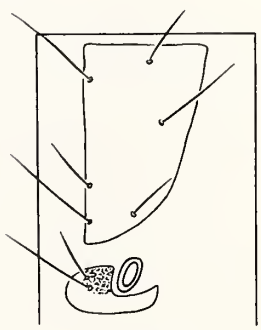
124



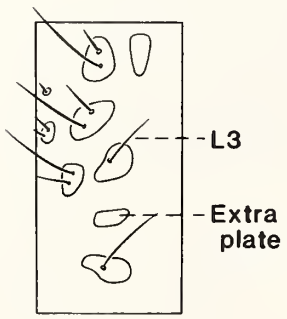
125

24(23). Prespiracular shield of prothorax extending below and beyond spiracle (fig. 126); an extra nonsetal bearing plate below seta L3 on meso- and metathorax (fig. 127) and behind L1 and L2 on abdominal segments 1 to 7 (fig. 128) . . . . . Dichocrocis punctiferalis (Guenée)

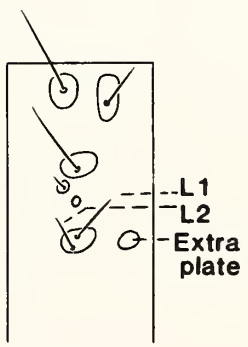
Distribution: Japan, Korea, Taiwan, and India
Hosts: pine, chestnut, peach, and others



126



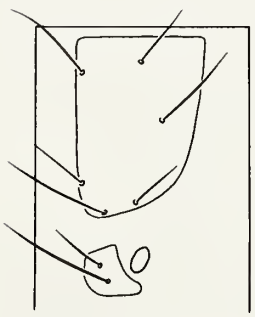
127



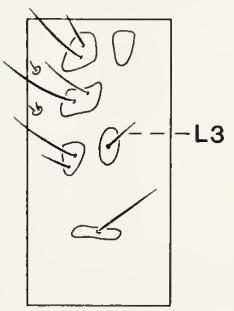
128

24'. Prespiracular shield of prothorax crescent shaped extending below spiracle (fig. 129); no extra nonsetal bearing plate below seta L3 on meso- and metathorax (fig. 130) and behind L1 and L2 on abdominal segments 1 to 7 (fig. 131) . . . . . Maruca testulalis (Geyer)

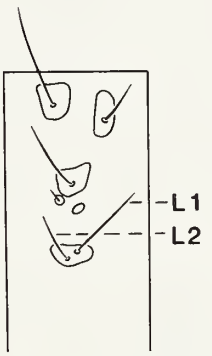
Distribution: Africa, Asia, Australia, Mexico, Central and South America, and Hawaii
Hosts: beans, pigeon peas, and other legumes



129



130

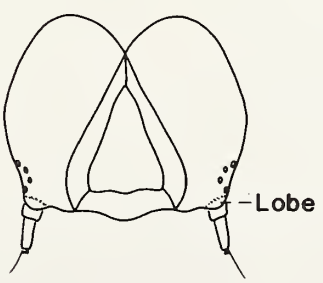


131

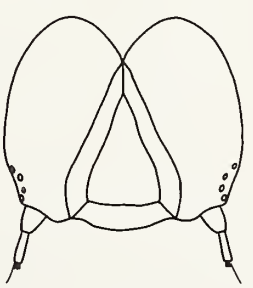
25(23'). Head capsule with a shieldlike extension over base of antenna (fig. 132) . . . . . Ostrinia nubilalis (Hübner)

Distribution: Europe and United States
Hosts: corn, beans, peas, and many others

25'. Head capsule without a shieldlike extension over base of antenna (fig. 133) 26



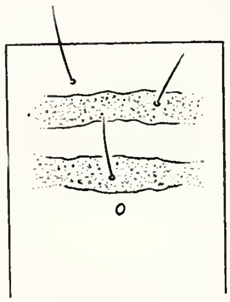
132



133

26(25'). Body with pinkish longitudinal stripes (fig. 134) 27

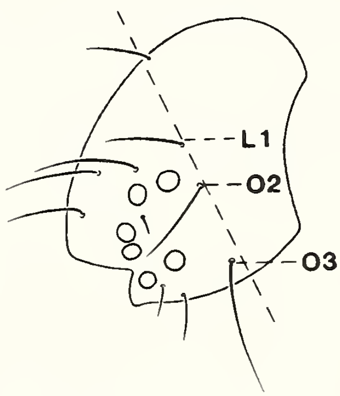
26'. Body without pinkish longitudinal stripes 28



134

27(26). Head blackish or brownish with whitish areas along adfrontal sutures extending to vertex, seta O3 anterior to a line joining setae L1 and O2 (fig. 135) . . . . *Hellula rogatalis* (Hulst)

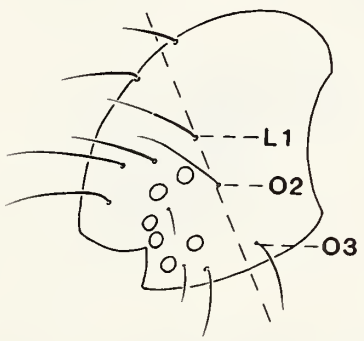
Distribution: Europe, North Africa, Asia, Pacific Islands, Mexico, West Indies, and United States
Hosts: cabbage, mustard, radish, and turnip



135

27'. Head pale, mottled, area along adfrontal sutures pale but not white, seta 03 posterior to a line joining setae L1 and 02 (fig. 136) . . . . . Hellula phidilealis (Walker)

Distribution: Mexico, Central and South America, West Indies, and United States
Hosts: cabbage, cauliflower, mustard, and other crucifers

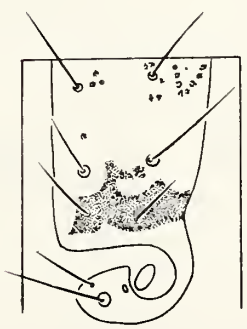


136

28(26'). Prothorax with sclerotization extending from posterolateral margin of prothoracic shield behind and below spiracle to prespiracular shield (fig. 137) . . . . . Achyra rantalis (Guenée)

Distribution: Mexico, West Indies, and United States
Hosts: alfalfa, beets, cotton, soybeans, and many others

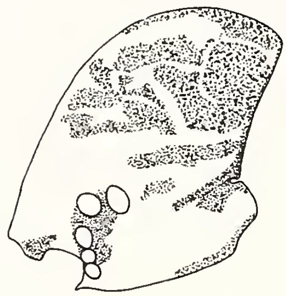
28'. Prothorax without sclerotization extending from posterolateral margin of prothoracic shield to prespiracular shield 29



137

29(28'). Prothoracic shield broadly shaded laterally (figs. 139, 141); head yellow with dark pattern (fig. 138) 30

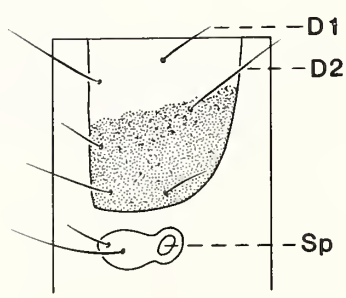
29'. Prothoracic shield without dark shading laterally, head not patterned 31



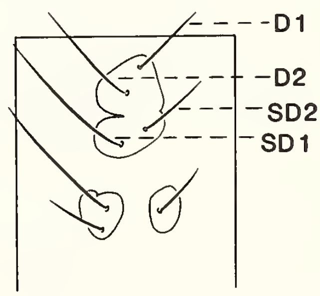
138

30(29). Prothoracic shield with dark lateral shading extending to seta D2 (fig. 139); prespiracular shield enclosing the spiracle (fig. 139); dorsal and subdorsal pinacula of mesothorax fused (fig. 140) . . . . <u>Herpetogramma</u> <u>bipunctalis</u> (Fabricius)

Distribution: West Indies and United States
Hosts: alfalfa, beets, cotton, soybeans, and many others



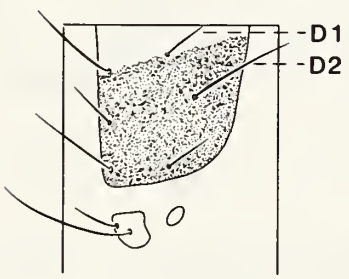
139



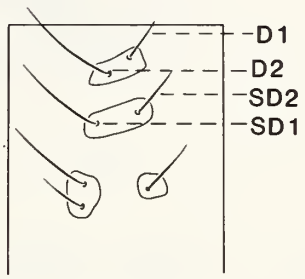
140

30'. Prothoracic shield with dark lateral shading extending to seta D1 (fig. 141); prespiracular shield not enclosing the spiracle (fig. 141); dorsal and subdorsal pinacula of mesothorax not fused (fig. 142) . . . . . Pilemia periusalis (Walker)

Distribution: West Indies and United States
Hosts: eggplant, potatoes, and tomatoes



141



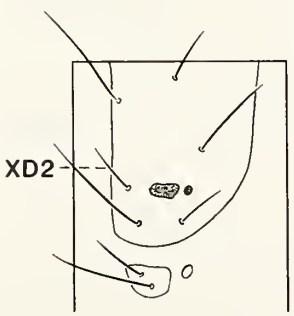
142

31(29'). Prothoracic shield with a dark reniform spot posterior to seta XD2 (figs. 143, 145) 32

31'. Prothoracic shield without dark reniform spot posterior to seta XD2 33

32(31). Prespiracular shield ovate (fig. 143); crochets triordinal on mesal aspect (fig. 144) . . . . . Udea rubigalis (Guenée)

Distribution: Mexico, West Indies, United States, and Canada
Hosts: celery, lettuce, spinach, and others

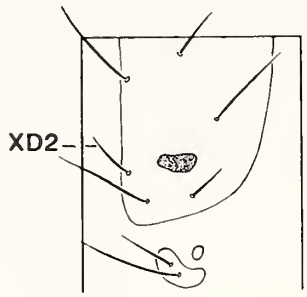


143

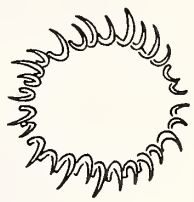
144

32'. Prespiracular shield crescent shaped extending below spiracle (fig. 145); crochets biordinal on mesal aspect (fig. 146) . . . . . Lineodes integra (Zeller)

Distribution: Mexico and West Indies
Hosts: eggplant and tomatoes



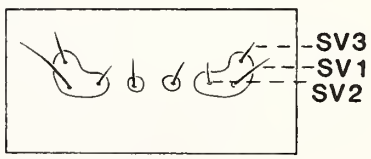
145



146

33(31'). Abdominal segment 1 with three subventral setae (fig. 147); prothorax with seta XD2 equidistant from setae SD1 and XD1 (fig. 148); crochets biordinal (fig. 149) . . . . . Hendecasis duplifascialis Hampson

Distribution: Philippines and Southeast Asia
Host: jasmine



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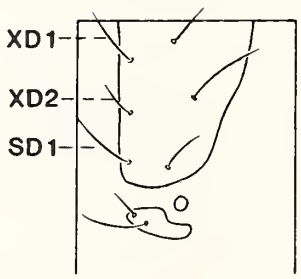
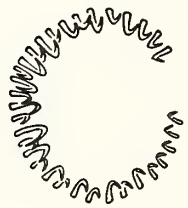
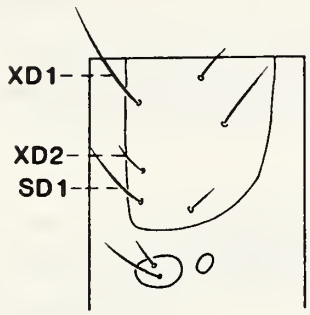


148



149

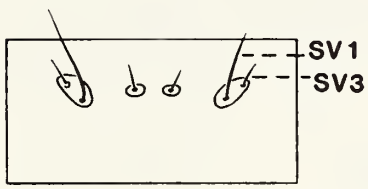
33'. Abdominal segment 1 with less than three subventral setae (figs. 152, 154); prothorax with seta XD2 closer to seta SD1 than to seta XD1 (fig. 150); crochets triordinal (fig. 151) 34



150

151

34(33'). Abdominal segment 1 with two subventral setae (fig. 152); prespiracular shield oblong (fig. 153) 35



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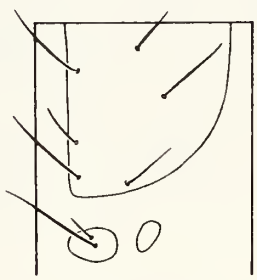
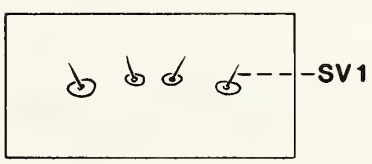
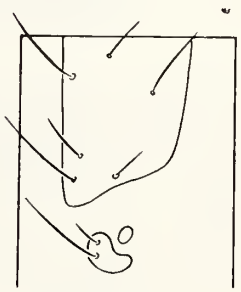


153

34'. Abdominal segment 1 with one subventral seta (fig. 154); prespiracular shield crescent shaped, may extend under spiracle (fig. 155) 36



154



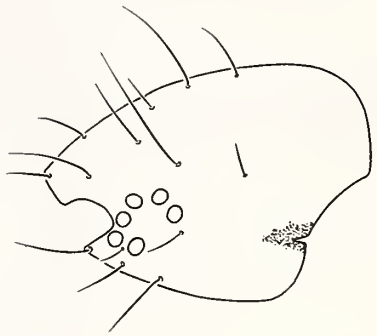
155

35(34). Head with a pigmented spot at genal angle (fig. 156); mandible without a projection on lateral margin (fig. 157); pinacula dark on early instars, pale in later instars . . . . . Diaphania nitidalis (Stoll)

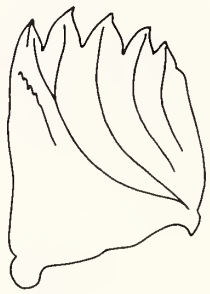
Distribution: Mexico, Central and South America, West Indies, United States, and Canada
Hosts: squash, cantaloupe, cucumbers, and gourds

35'. Head without pigmented spot at genal angle; mandible with a projection on lateral margin (fig. 158); pinacula concolorous with body in all instars . . . . . Diaphania hyalinata (Linnaeus)

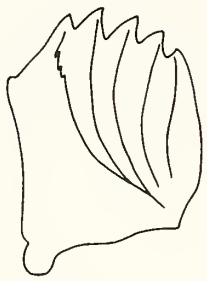
Distribution: Mexico, Central America, Northern South America, West Indies, and Eastern United States
Hosts: squash, cucumbers, cantaloupe, gourds, and pumpkins



156



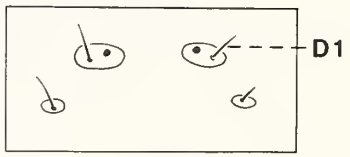
157



158

36(34'). Head, prothoracic shield, and body pinacula brownish yellow; pinaculum of seta D1 on abdominal segments 2 to 8 with dark spot on anterior margin (fig. 159) . . . . . Leucinodes orbonalis (Guenée)

Distribution: Africa and Southeast Asia
Hosts: eggplant, tomatoes, potatoes, and other solanaceous plants



159

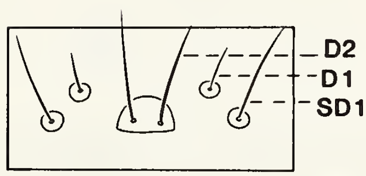
36'. Head and prothoracic shield pale yellow, pinacula concolorous with body; pinaculum of seta D1 on abdominal segments 2 to 8 without spots . . . . Neoleucinodes elegantalis (Guenée)

Distribution: Mexico, Central and South America, and West Indies
Hosts: eggplant, tomatoes, and other solanaceous plants

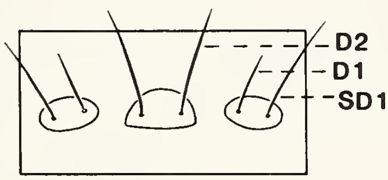
TORTRICIDAE

1. Seta D1 of abdominal segment 9 cephalad of and equidistant from setae D2 and SD1, setae D1 and SD1 on separate pinacula (fig. 160) . . . . Tortricinae . . . 2

1'. Seta D1 of abdominal segment 9 closely associated with seta SD1 on a single pinaculum (fig. 161), ... Olethreutinae . . . 3



160



161

2(1). Head, prothoracic shield, and prothoracic pinacula yellowish, shield may be edged laterally and posteriorly with brown . . . . Platynota stultana (Walsingham)

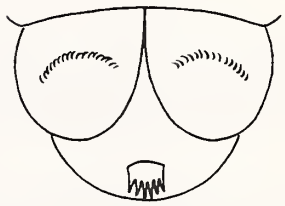
Distribution: Mexico and United States
Hosts: tomatoes, peppers, and many others

2'. Head, prothoracic shield, and prothoracic pinacula brown or blackish, shield and head may show faint pattern . . . . Platynota rostrana (Walker)

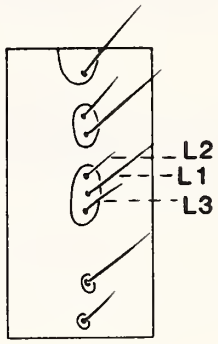
Distribution: Mexico, Central America, West Indies, and United States
Hosts: cotton, banana, and many others

3(1'). Anal fork present (fig. 162); three lateral setae of abdominal segment 9 on one pinaculum (fig. 163) 4

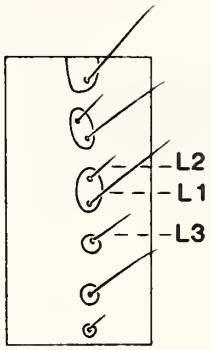
3'. Anal fork absent; seta L3 of abdominal segment 9 usually on its own pinaculum separate from that of setae L1 and L2 (fig. 164) 7



162



163

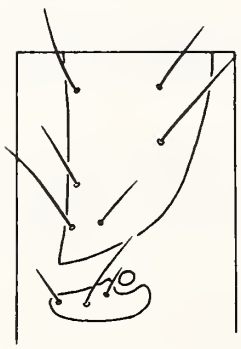


164

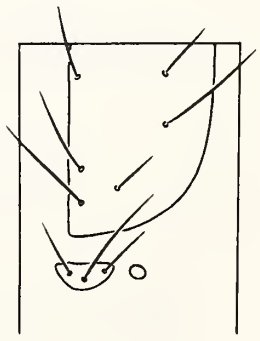
4(3). Prespiracular shield of prothorax elongated extending below and beyond spiracle (fig. 165) . . . . . Cryptophlebia leucotreta (Meyrick)

Distribution: Central and South Africa
Hosts: okra, orange, Capsicum sp., and many others

4'. Prespiracular shield of prothorax not extending below spiracle (fig. 166) 5



165

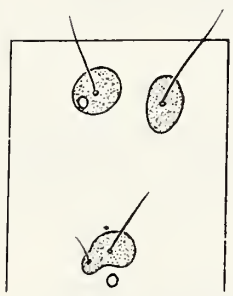


166

5(4'). Body pinacula large and brown (fig. 167); prothoracic shield (fig. 168) and anal shield (fig. 169) patterned as illustrated . . . . . Pammene fasciana (Linnaeus)

Distribution: Europe
Hosts: acorns and chestnuts

5'. Body pinacula smaller and pale; prothoracic and anal shields not patterned as above 6



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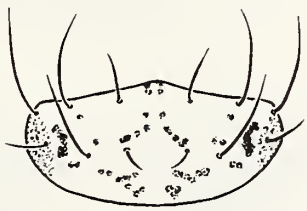
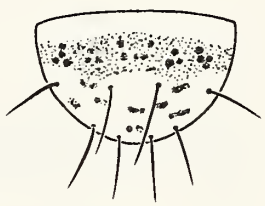


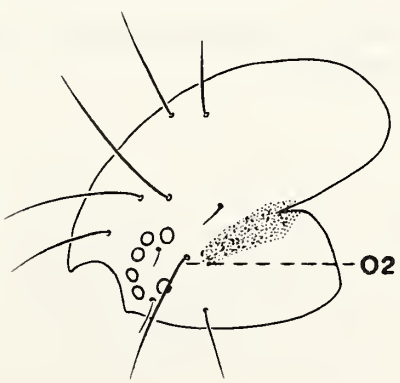
168



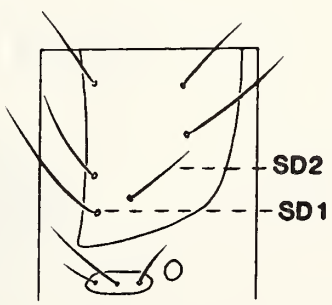
169

6(5'). Head with black band extending from postgenal juncture to seta O2 (fig. 170); prothorax with seta SD2 dorsocaudad of SD1, lateral setae almost in horizontal line (fig. 171) . . . . . Epinotia aporema (Walsingham)

Distribution: Mexico, Central and South America, West Indies, and United States
Hosts: string beans and other legumes



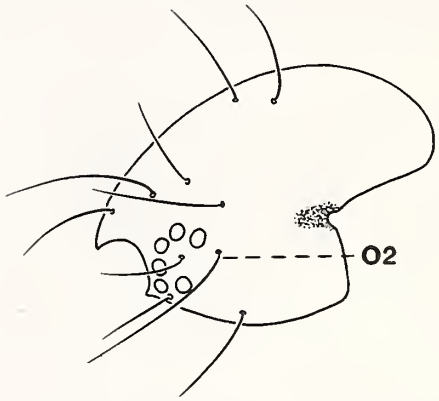
170



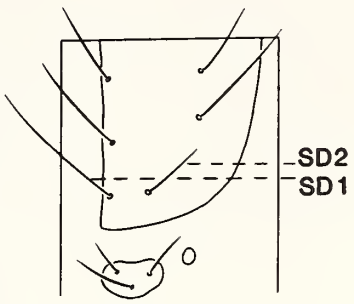
171

6'. Head with some dark color at postgenal juncture but not extending to seta O2 (fig. 172); prothorax with seta SD2 directly caudad of SD1, lateral setae in more triangular arrangement (fig. 173) . . . . . Grapholita spp.

Distribution: Europe, East Asia, Australia, Mexico, South America, and United States
Hosts: apple and other pomes, plums and other drupes, and berries



172



173

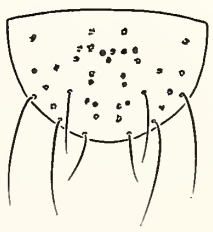
7(3'). Head yellowish brown, usually distinctly patterned with dark color (fig. 174), prothoracic shield (fig. 175) and anal shield (fig. 176) yellowish brown with dark patterns as illustrated . . . . . Cydia pomonella (Linnaeus)

Distribution: Nearly cosmopolitan
Hosts: apples, pears, quince, and walnut

7'. Head yellow, possibly faintly patterned; prothoracic and anal shields yellow 8

174

175



176

8(7'). Head clear yellow; body always white . . . . *Cydia splendana* (Hübner)

Distribution: Southern Europe
Host: chestnuts

8'. Head yellow with some indication of faint pattern or some dark color at postgenal juncture; body with pink pigment in fresh specimens . . . . *Cydia* spp.

Distribution: Europe and East Asia
Host: chestnuts

COCHYLIDAE

This family never has more than two lateral setae on abdominal segment 9. The ventral setae are always farther apart on the 9th abdominal segment than on the 8th . . . . *Lorita abornana chatka* Busck

Distribution: Mexico
Host: peppers

BLASTOBASIDAE

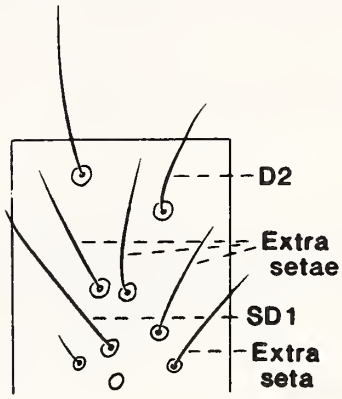
Many species in this family have rings around seta SD1 on abdominal segments 1 to 7. The subfamily Blastobasinae always has the submental pit (fig. 29) and always has three subventral setae on abdominal segment 1 . . . . . Species of Blastobasidae

Distribution: Worldwide
Hosts: garlic, coffee, acorns, and many others

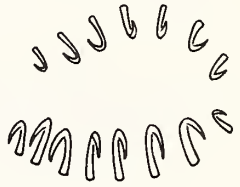
COSSIDAE

1. Proleg-bearing segments of abdomen (3-6) usually with three (number variable) extra unnamed setae between the dorsal and subdorsal setae (fig. 177); crochets in two uniordinal crossbands (fig. 178) . . . . . Dyspessa ululа (Borkhausen)

Distribution: Europe
Host: garlic



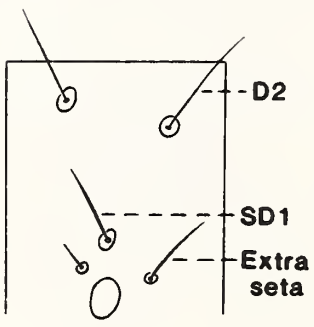
177



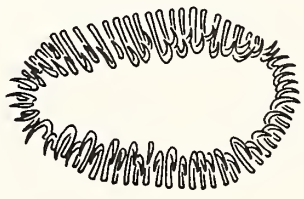
178

1'. Proleg-bearing segments of abdomen without three extra setae between the dorsal and subdorsal setae (fig. 179); crochets in a biordinal laterally elongated circle (fig. 180) . . . . . Cossus cossus (Linnaeus)

Distribution: Europe
Hosts: wood products



179



180

ARGYRESTHIIDAE

The character of setae SD2 being almost in line with setae XD2 and SD1 appears to be consistent for this family . . . . *Argyresthia conjugella* (Zeller)

Distribution: Europe
Hosts: apples and sorbus berries

COSMOPTERIGIDAE

Setae L1 and L2 on one pinaculum, and seta L3 separate on abdominal segment 9; three subventral setae on abdominal segment 1 . . . . *Pyroderces* spp.

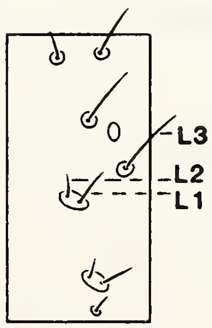
Distribution: Mexico, West Indies, and United States
Hosts: corn, cotton, and many rotting and dried fruits

OECOPHORIDAE

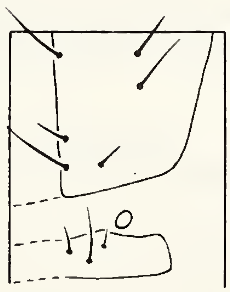
1. Abdominal segment 8 with seta L3 above the level of setae L1 and L2, spiracle toward back of segment (fig. 181); prothorax with large prespiracular shield extending below the spiracle (fig. 182) . . . . . . *Stenoma catenifer* Walsingham

Distribution: Mexico, Central and South America
Host: avocado

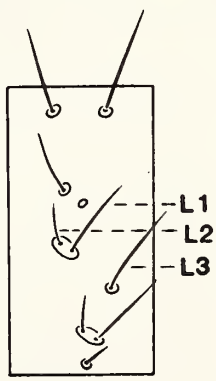
1'. Abdominal segment 8 with seta L3 below the level of setae L1 and L2, spiracle in usual position (fig. 183); prothorax without prespiracular shield extending below the spiracle 2



181



182



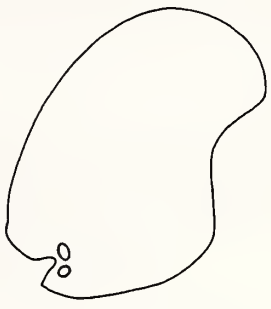
183

2(1'). Head with 2 ocelli present (fig. 184); submentum with large oval pit (fig. 185) . . . Endrosis sarcitrella (Linnaeus)

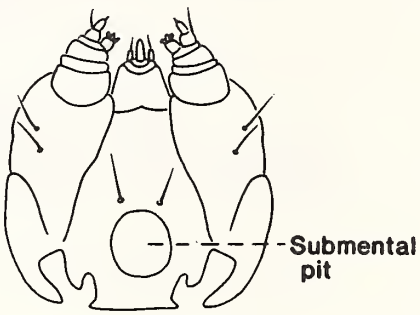
Distribution: Nearly cosmopolitan
Hosts: bulbs and decaying fruits

2'. Head with 4 ocelli apparent (ocelli I and II fused and ocelli III and IV fused) (fig. 186); submentum without large oval pit . . . Hofmannophila pseudospretella (Stainton)

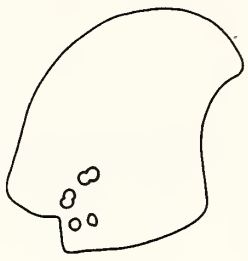
Distribution: Nearly cosmopolitan
Hosts: bulbs, stored vegetable products, and many others



184



185



186

GELECHIIDAE

1. Abdominal prolegs rudimentary, with only 2 to 4 crochets (fig. 187) . . . . . Sitotroga cerealella (Olivier)

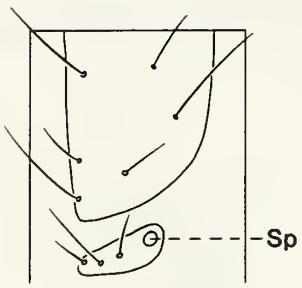
Distribution: Nearly cosmopolitan
Hosts: stored grain

1'. Abdominal prolegs normal, each proleg with more than 4 crochets 2

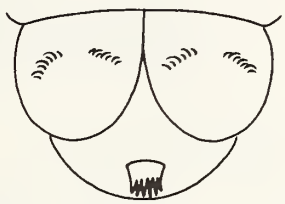
187

2(1'). Prothorax with prespiracular shield enclosing the spiracle, lateral setae in a linear arrangement (fig. 188); crochets of anal prolegs interrupted at center (fig. 189); anal fork present (fig. 189) . . . . . Anarsia lineatella Zeller

Distribution: Europe, Mexico, Central and South America, and United States
Hosts: peach, pear, almond, cherry, and other stone fruits

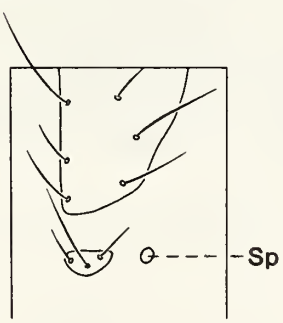


188

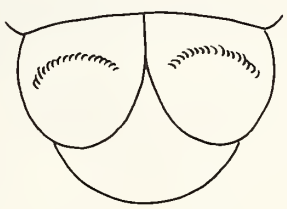


189

2'. Prothorax with prespiracular shield not enclosing the spiracle, lateral setae in a triangular arrangement (fig. 190); crochets of anal prolegs not interrupted at center (fig. 191); anal fork absent (fig. 191) 3



190

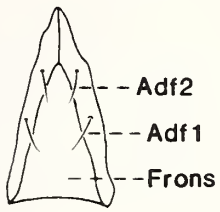


191

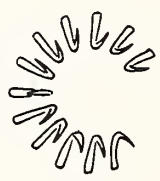
3(2'). Head with adfrontal setae widely separated, seta Adf2 at level of apex of front (fig. 192); abdominal prolegs with crochets in a uniordinal penellipse (fig. 193) . . . . . Pectinophora gossypiella (Saunders)

Distribution: India, Egypt, Mexico, Central and South America, West Indies, and United States
Hosts: cotton, okra, and other malvaceous plants

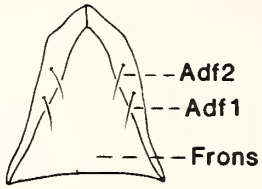
3'. Head with adfrontal setae close together, seta Adf2 well below apex of front (fig. 194); abdominal crochets in a complete circle 4



192



193

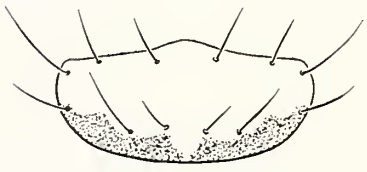


194

4(3'). Prothoracic shield pale, with dark shading along posterior margin (fig. 195) . . . . . Keiferia lycopersicella (Walsingham)

Distribution: Mexico, Central and South America, West Indies, Hawaii, and United States
Hosts: tomato, eggplant, potato, and other solanaceous plants

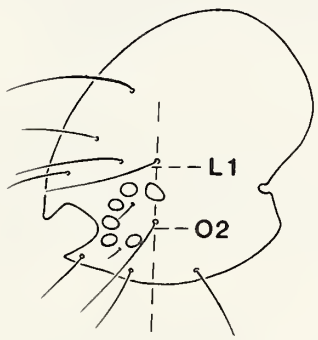
4'. Prothoracic shield uniformly brown or blackish . . 5



195

5(4'). Line joining setae L1 and O2 tangent to or passing through ocellus I (fig. 196); lateral setae of abdominal segment 9 in a nearly vertical line (fig. 197); legs pale . . . . . Symmetrischema capsicum (Bradley & Povolny)

Distribution: Mexico, Central and South America, West Indies, and United States
Hosts: pepper and tomato



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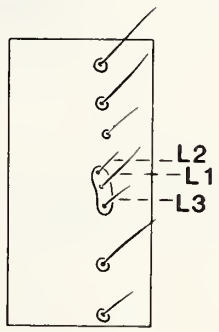
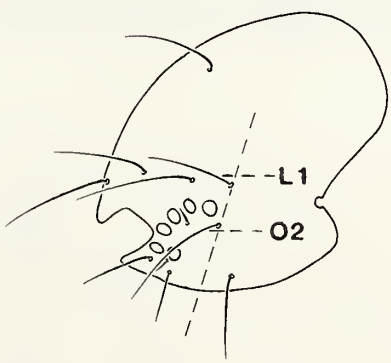


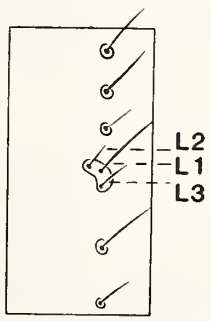
197

5'. Line joining setae L1 and O2 posterior to ocellus I (fig. 198); lateral setae of abdominal segment 9 in a triangular arrangement (fig. 199); legs dark . . . . . Phthorimaea operculella (Zeller)

Distribution: Nearly cosmopolitan
Hosts: potatoes, tomatoes, stored tobacco, and other solanaceous plants



198



199

ACROLEPIIDAE

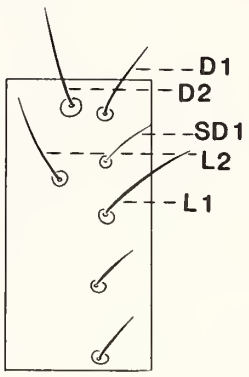
The pupae in this family are always enclosed in loose net; Europe and Hawaii; leeks . . . . Acrolepia assectella (Zeller)

PLUTELLIDAE

1. Anal prolegs longer than broad, few crochets (fig. 200); abdominal segment 9 with dorsal, subdorsal, and lateral setae all widely separated, seta SD1 distinctly thin and hairlike (fig. 201) . . . . . Plutella xylostella (Linnaeus)

Distribution: Nearly cosmopolitan
Hosts: cabbage and other crucifers

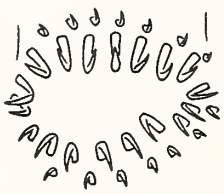
200



201

1'. Anal prolegs short, many crochets (fig. 202); abdominal segment 9 with dorsal and subdorsal setae on one continuous pinaculum and the lateral setae on another, seta SD1 not hairlike (fig. 203) . . . . . Prays spp.

Distribution: Europe, East Asia, and Hawaii
Hosts: citrus, olives, and pelea berries



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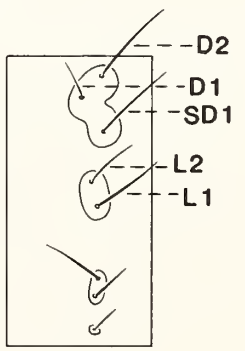
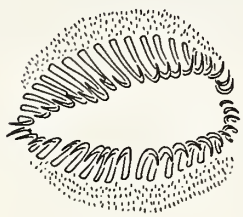


203

TINEIDAE

1. Abdominal prolegs with rows of minute recurved spinules anterior and posterior to the crochets (fig. 204) or on anterior aspect only (fig. 205); abdominal segment 1 with three subventral setae (fig. 206) 2



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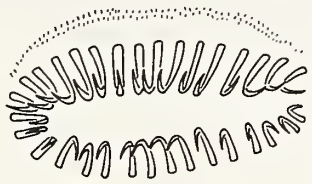
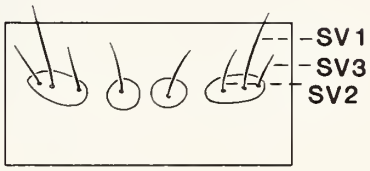
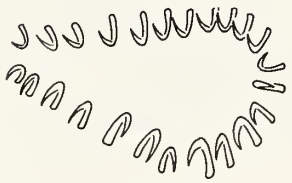


205



206

1'. Abdominal prolegs without minute spinules adjacent to the crochets (fig. 207); abdominal segment 1 with two subventral setae (fig. 208) 4



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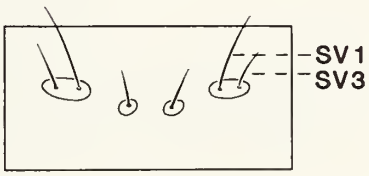
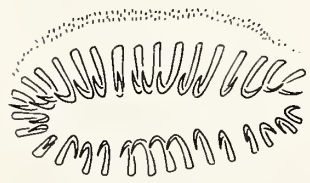


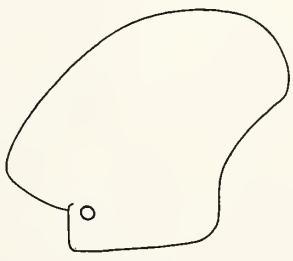
208

2(1). Abdominal prolegs with rows of spinules anterior to the crochets (fig. 209); head with only one ocellus (fig. 210) . . . . . Setomorpha rutella Zeller

Distribution: Nearly cosmopolitan
Hosts: dried tobacco, cottonseed, and many stored plant products



209

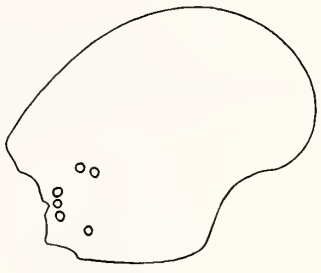


210

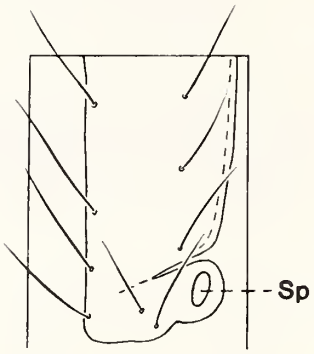
2'. Abdominal prolegs with rows of spinules both anterior and posterior to the crochets (figs. 213, 216); head with either two or six ocelli (figs. 211, 214) 3

3(2'). Head with 6 ocelli (fig. 211); prespiracular shield surrounds spiracle and is fused to prothoracic shield (fig. 212); abdominal prolegs with space between the spinules and crochets (fig. 213) . . . . . Acrolophus spp.

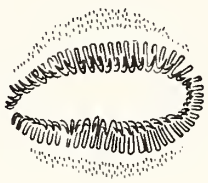
Distribution: Mexico, Central and South America
Hosts: bromeliads, orchids, and others



211



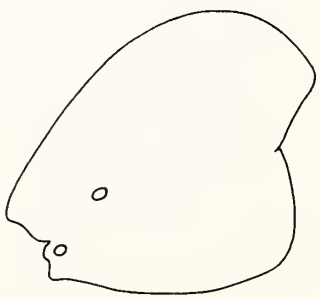
212



213

3'. Head with 2 ocelli (fig. 214); prespiracular shield surrounds spiracle but is not fused to prothoracic shield (fig. 215); abdominal prolegs without space between the spinules and crochets (fig. 216) . . . Opogona sacchari (Bojer)

Distribution: Southern Europe, Africa, Brazil, and West Indies
Hosts: sugarcane, banana, bulbs, and many others



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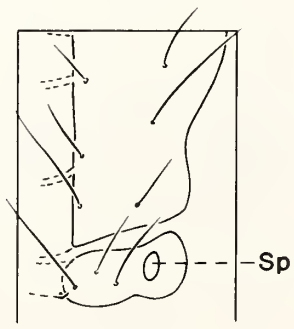
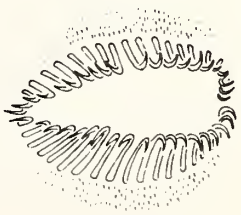


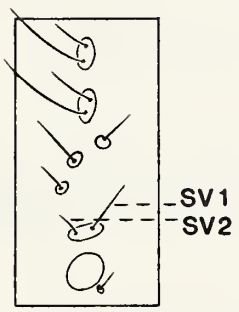
215



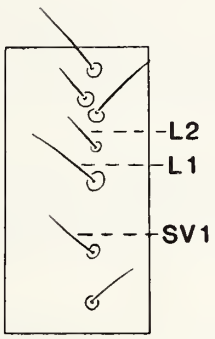
216

4(1'). Meso- and metathorax with two subventral setae (fig. 217); abdominal segment 9 with two lateral setae and one subventral seta (fig. 218); head with no ocelli present . . . . . Tineola bisselliella (Hummel)

Distribution: Cosmopolitan
Hosts: wool, hair, feathers, and other animal products

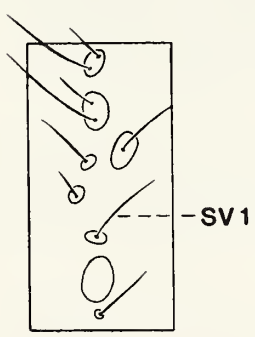


217

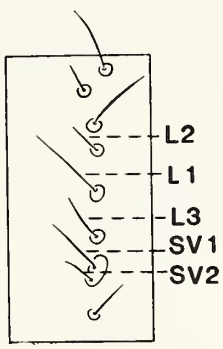


218

4'. Meso- and metathorax with one subventral seta (fig. 219); abdominal segment 9 with three lateral setae and two subventral setae (fig. 220); head with 5 or 6 ocelli present 5



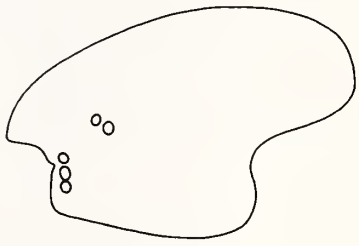
219



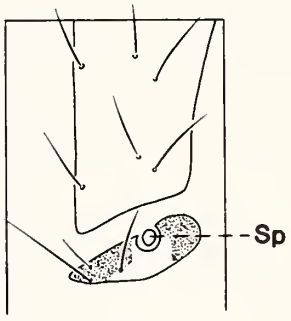
220

5(4'). Head with 5 ocelli (fig. 221); prespiracular shield extends behind spiracle (fig. 222) . . . . . Lepidobregma minuscula (Walsingham)

Distribution: West Indies, Hawaii, and United States
Hosts: pineapple, banana, and many others (scavenger)



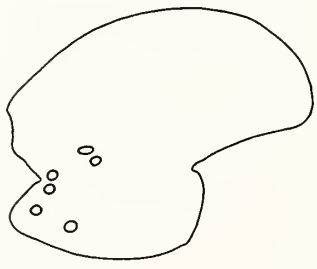
221



222

5'. Head with 6 ocelli (fig. 223); prespiracular shield does not extend behind spiracle . . . . . Nemapogon granella (Linnaeus)

Distribution: Nearly cosmopolitan
Hosts: mushrooms, stored grain, and dried fruits



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