

NOTES ON THE ORDER LEPIDOPTERA
From Lectures Presented by HAHN W. CAPPS

April 24-26, 1963

Chaetotaxy of Lepidopterous Larvae:

1884 Muller
1894 Dyar
Gerasimov
1914-1950 Heinrich
1948 Hinton

115 to 190 Families in World
105 to 120 Families in Western Hemisphere
73 families represented by larval stage

U. S. National Museum Collections on Lepidoptera:

- a) alcoholic
- b) inflated--Old World, Indo-Australian
- c) slides

2,000 species represented by inflated larvae
500 species on microscope slide mounts
100,000 specimens - 850 genera - 2,000 species

Less than 3% of the described species are represented by larvae in the U. S. National Museum.

Rearing:

- 1) preserve a few larvae
- 2) save cast larval skin
- 3) pupal case
- 4) perfect adult (not teneral)

It is only recently that people have become interested in lepidopterous larvae--their collection, rearing, and association with adults.

There are several instars--characters not apparent until mature or nearly mature, viz. tooth on mandible; prolegs on A_1 and A_2 in early instars.

Cataloguers keep specialists supplied with references on species recently described, revisions of groups, etc.

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Crambidae

13a

LITERATURE

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- Spuler, A. Die Raupen der Schmetterlingen. 1904. Color pictures
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*Avail in English
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- Werner, Kurt Die Larvalsystematik einiger kleinschmetterlings
familien. Abhandlungen zur larvalsystematik der
insekten. Nr. 2. 1958. (Hyponomeutidae, Orthotalidae,
Acrolepiidae, Tineidae, Incurvariidae, Adelidae)

Inflated larvae better for Lasiocampids, Arctiids, Notodontids, Saturniids, etc.

Technique for Slide Preparation:

When necessary use compound scope.

1st instar larvae of Pectinophora gossypiella:

1st - oversaturated solution of KOH; 5 cc. water plus several sticks KOH
Leave until no more dissolves - about 10 cc.
10 cc. plus 90 cc. water = 10% solution by volume
Used for larvae and genitalia.

Cold Caustic - put specimen for 12 hours or so. Larger specimen
takes more time. To speed up, put over alcohol
lamp for 10-15 min.

Setal groups VII and VIII becoming more and more important for
species recognition and family diagnostics.

Capps likes one skin split down dorsum for anal end study (cut about
1/4 length) and one split down venter for cephalic end study purposes
(cut about 1/4 length).

For study of setal arrangement or crochets, take needle and cut up to
lateral side between A₂ and A₃, and cut head ventrally until the mater-
ial can be pressed out.

Notodontids have at least 1 crochet on anal proleg but leg must be distend-
ed to see it.

Dissection:

Soften in caustic
Cut in water.

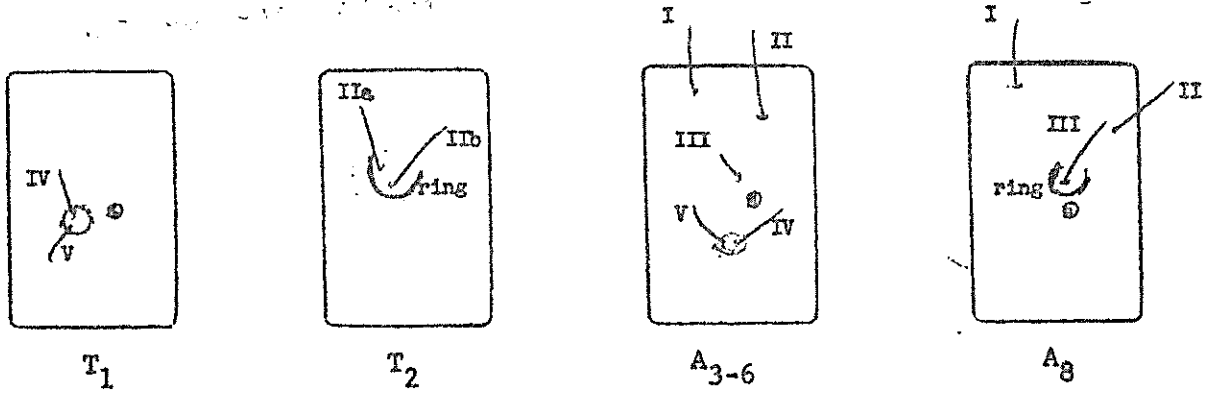
> Diatraea larvae have to be cleared to identify to species. Remove
fat, muscle, etc.
Stain in mercurochrome (taba) water solution
95% alcohol, 20-30 minutes - dehydrate
Oil of cloves to clear - dehydrate. 1 hour or overnite (punctures
show up better)
Xylene - 2 to 3 minutes. Wash off oil of cloves.
Absorb excess xylene on towel
Mount on slide, balsam, cover slip.
Head - concave slide or plastic chips or moulder's pellets clay
Pelt - flat slide.

How to Tell 1st stage larva:

Presence (later than 1st instar) or absence of seta VI on proleg-
bearing segments - 1st stage

Primary setae (only) 1-7, or know index of head capsule measurements.

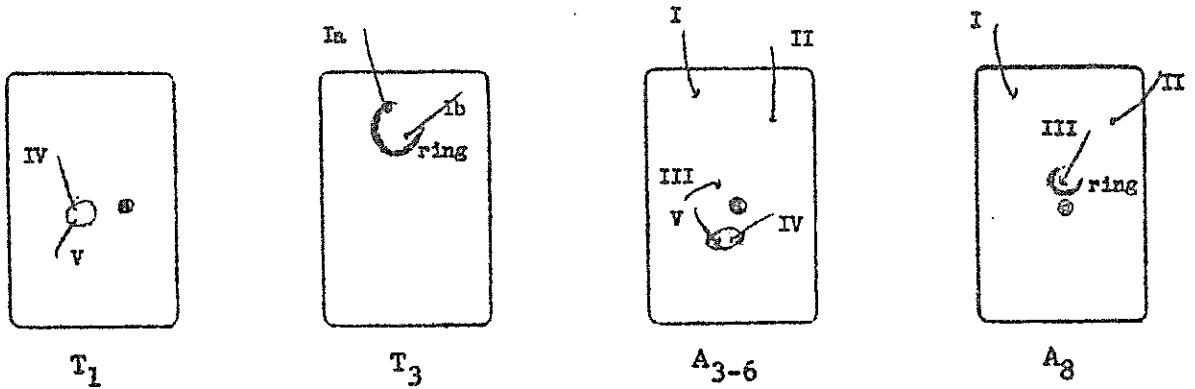
PHYCITIDAE (all have these characters):



A₉ at least 3 setae
 have ...
 1-2 ...
 3-4 ...
 pinaculum ② 3

usually ...

CHRYSAUGIDAE (most, not all have these characters):



1. T₃₋₄
2. A₁₋₈

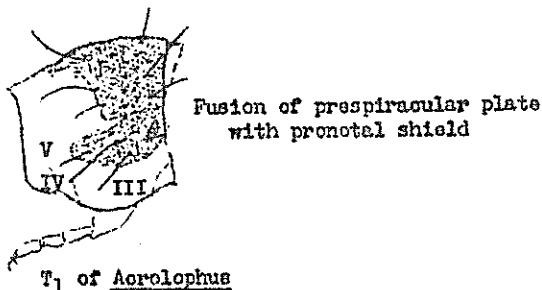
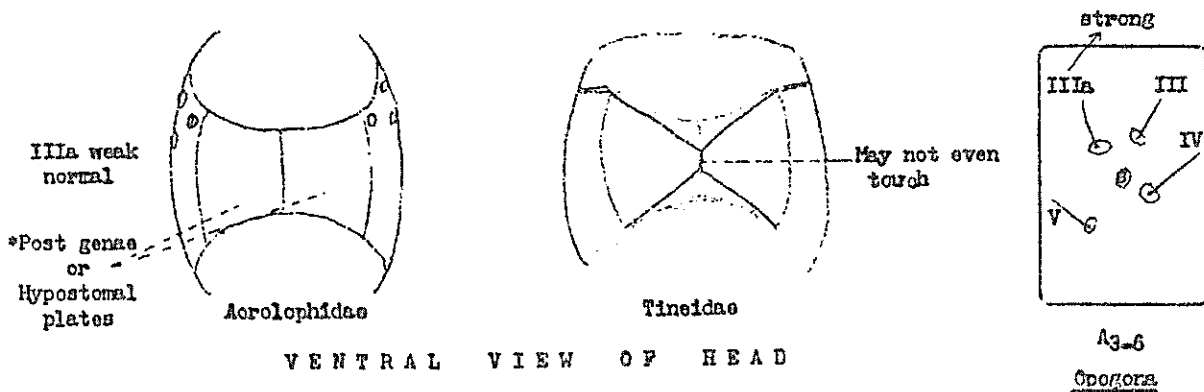
Leaf feeder and on moist material.

3. ...
 4. ...
 5. ...

Hinton's Key to Tineidae (Subfamilies):

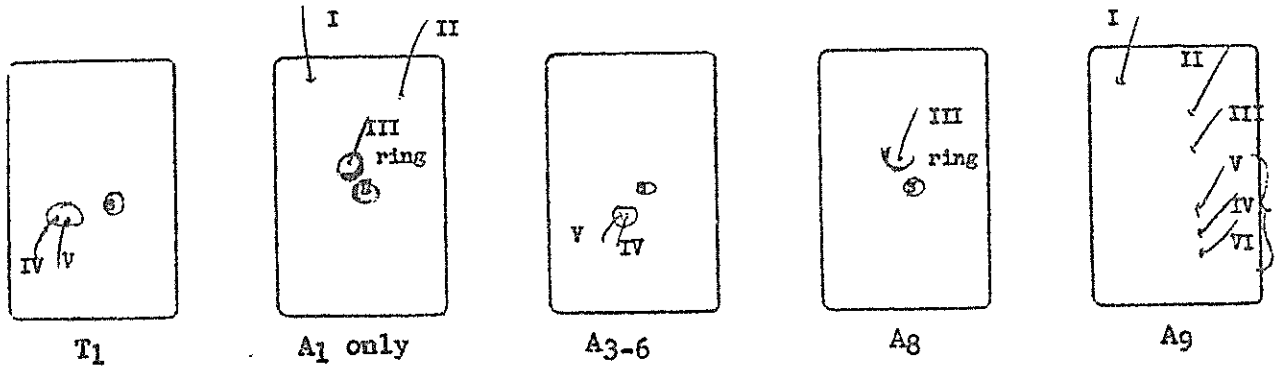
1. Head with post genae* nearly fused together on a broad front along median line. A3-6 and A10 prolegs each with a broad band of recurved spines or smaller crochets above the usual crochets, (multiserial). Subventral setal group (Group VI) of meso and metathorax unisetose or bisetose ----- Acrolophinae (Acrolophus spp.)
- 1a. Head with post genae nearer each other on a very narrow front. Prolegs without recurved spines above crochets except in Lindera and Setomorpha in which such spines are present above area of crochets on prolegs A1-A6 but not above those of prolegs on A10 ----- 2
2. T1 with 2 setae in prespiracular group; seta 1 of A1-8 more widely separated than seta II--Scardinae (Scardia and Morophaga)
- 2a. T1 with 3 setae in prespiracular group; seta 1 of A1-8 less widely separated than seta II ----- 3
3. 1 seta, group VI of T2 and T3; head with 5 or 6 convex ocellar lenses on each side (sometimes with less than 5 or none) ----- Nemapogoninae (In mushrooms from Europe - Nemapogon, Lindera, Setomorpha)
- 3a. 2 setae, group VI of T2 and T3; head never with more than a single convex ocellar lens ----- Tineinae (Tinea, Acedes, Tineola, Amydria, Monopis, Trichophaga)

Recognition of Acrolophid larva. Hypostomal plate (post genae):



Mr. Capps considers Tineidae and Acrolophidae separate families.

GALLERIIDAE (Alpheias - pineapple - Mexico)



PYRALIDAE (proper spelling)

Primary setae; T1 has 2 setae in prespiracular group, VI unisetose, VII trisetose; T2 and T3 ~~2 setae in group VI~~; A3-6 - IV and V close and on same pinaculum, VI is unisetose, VII is trisetose; crochets - uniserial, in complete ring and biordinal or triordinal in length; A9 - IV, V, VI all present, seta I approximately equidistant from setae II and III, I never closely associated with III; group VII of A1 trisetose.

Pigmented ring-like sclerotizations bordering membranous area at base of seta III on A8.

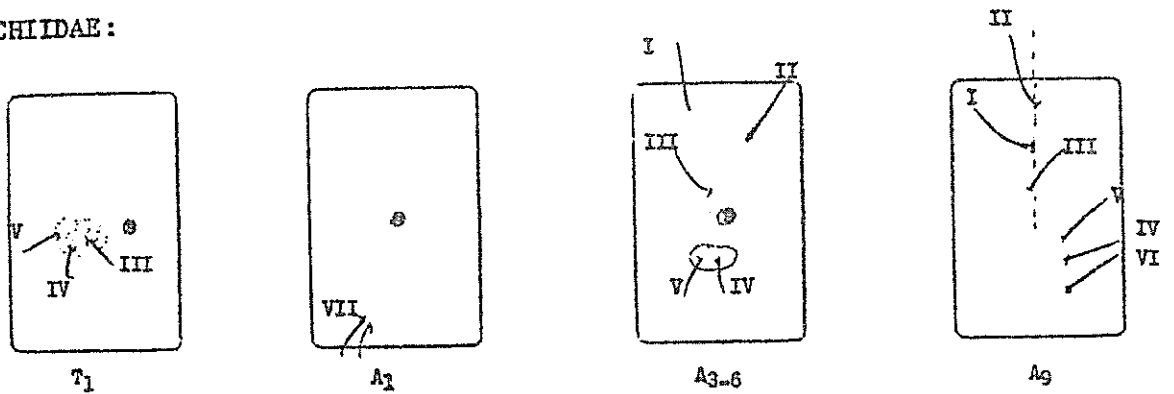
Ocelli 6, except Pyralis with 3 or 4.

Body and head without conspicuous stripes or mottling except Omphalocera (feeds in pawpaw fruit)

EPIPASCHIIDAE (Tetralopha etc.)

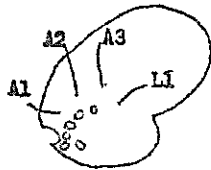
Primary setae. T1 with prespiracular group bisetose; T2 and T3 with seta VI unisetose; proleg segments with seta IV close to V below spiracle, usually on same pinaculum, VI unisetose, crochets uniserial, in complete ring, biordinal in length; A9 with IV, V, VI all present, seta I equidistant to II and III, I never close to II and III; on A1 group VII trisetose; pigmented ring-like sclerotization at base of seta III on A8; body usually with distinct longitudinal stripes or pale spots; head capsule definitely reticulate, mottled or with irregular color pattern, ocelli 6 in number.

GELECHIIDAE:

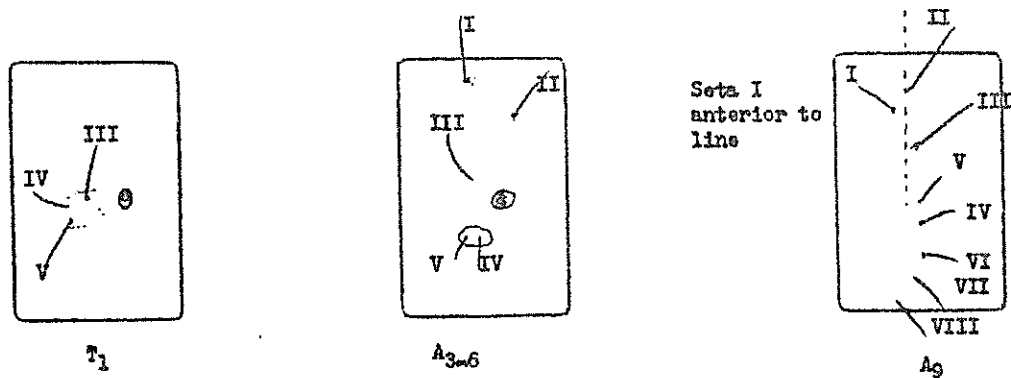


On A9 paired setae II not on same pinaculum, I on same line as II and III; A1 - VII bisetose, crochets in complete ring, penellipse, or transverse bands; anal leg - crochets interrupted at middle or continuous, anal fork may or may not be present.

Head - A3 approximately equidistant from L1 and A2.

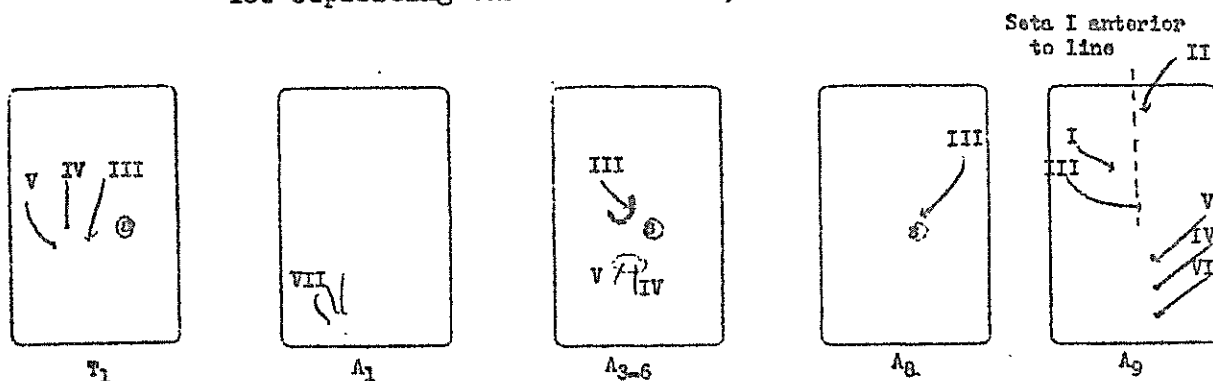


OECOPHORIDAE (Hofmannophila, Endrosis, etc.)



On A9 - I, II, III not in straight line, I and II close; crochets uniserial, complete ring, uniordinal, biordinal, or triordinal; A1 - group VII trisetose, submentum without pit in Hofmannophila, A1 - group VII bisetose, submentum with pit in Endrosis; A3-6 - seta III never sclerotized at base; on Head, seta A3 closer to L1 than to A2; anal legs - crochets series never interrupted; never have anal fork.

BLASTOBASIDAE (Identified to family as there are few reliable characters for separating the larval forms):



Seta III on A8 not a key character; A1 - VII always trisetose; crochets - complete ring, uni, bi, or irregular triordinal; crochets on anal proleg not interrupted; never an anal fork; always a submental pit; head - A3 is closer to L1 than to A2; A3-6 - sclerotized ring at base of seta III; ocellar arrangements in Fracker do not hold.

Mostly scavengers; classification of adults in bad shape.
Auximobasis coffeaella Busck - in coffee from Brazil and Central America.

HEPIALIDAE (Good sized larvae):

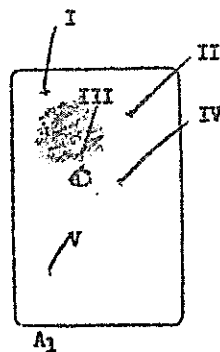
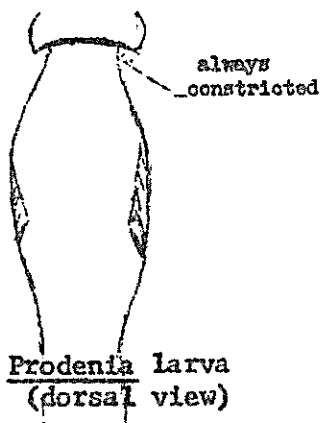
Sclerotized band between antennal socket and base of mandible (only larva Mr. Capps knows which has this character). Boring in root crops. Europe or West Africa only.

NOCTUIDAE:

Prodenia spp.

- P. ornithogalli Guenée
- P. eridania Cram.
- P. dolichos F.

- P. litura (F.)
- P. praefica Grt.
- P. latifascia Wlk.



Fuscous patch between I and III on A1 is diagnostic for genus Prodenia. It is stronger on A1 than on other abdominal segments

A1 Skin smooth

Handwritten notes:
 A1 - 1st abdominal segment
 Prodenia litura
 in yellowish...

NOCTUIDAE (Continued):

Spodoptera exigua Hb. } - fuscous patch at seta IIb on T2, no fuscous
Spodoptera exempta Walk. } patch on A1 between seta I and seta III;
not conspicuously narrowing toward head.

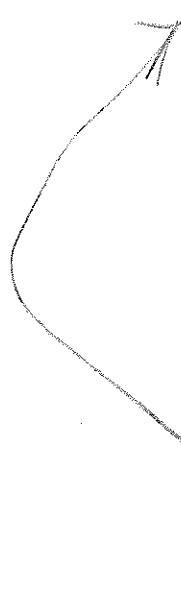
Earias (Old World only. Spotted or spiny bollworm)

Prespiracular group of T1 with 2 setae, seta V minute, directly under seta IV; setae Ic and IIc on separate pinacula well below lower margin of prothoracic shield. Abdominal segments A3-6 with seta IV posterior to spiracle, seta V remote from IV and under spiracle; A9 - seta I anterior to line joining bases of II and III, each on separate pinaculum, only VI of lateral group present. Seta IV above spiracle on A1, on level with or slightly below spiracle on A2-8. On A8, seta IV closer to V than on A7, also farther below spiracle. Group VII setal pattern: $\frac{1}{A1} \frac{2}{A2} \frac{3}{A3} \frac{1}{A6} \frac{1}{A7} \frac{1}{A8} \frac{1}{A9}$; Crochets unioordinal homoideous mesoseries, all with hooks.

Setae Ia, II and IV usually borne apically from soft projections which may be long and slender or short and round, according to species; projections always conspicuous on T2 and T3 and A8. Seta VI may be on smaller projection; setae I and III not raised basally. Body skin densely covered with minute spinules, longer and stronger on projections. Head brown or blackish reticulations with transverse whitish band. Mandible with 3 distinct teeth and/or angulations. Spinneret slender. Spiracles oval, black, that of A8 but little larger than that of A7. Larvae all malvaceous except one (luteolaria) which feeds in Grewia hirsuta, Tiliaceae. Feed in buds of fruits. Found in Africa and Asia Minor.

Key to species of Earias:

1. Seta IIa on T2 and T3 on a rounded projection, projection's height = width on A2-6, seta II weakly or not raised basally 2
 - Seta IIa on T2 and T3 and on most abdominal segments is elongate, more or less finger shaped projection 3
2. Mandible without internal tooth. 2nd segment of antenna less than twice as long as width fabia (Stoll)
- Mandible with a small internal tooth. 2nd segment of antenna more than twice as long as wide luteolaria Hampson



*From
Gardner*

(Key continued on next page)

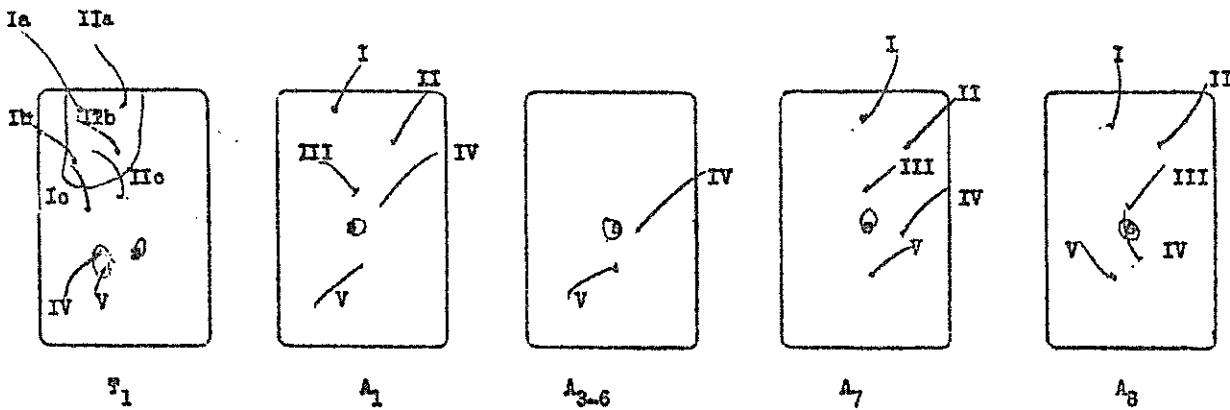
NOCTUIDAE (Key to species of Earias continued):

3. Mandible without internal tooth. Projection at base of seta II on A8 rather short and stout, only slightly longer than wide insulana Bdv.

Mandible with internal tooth. Projection at base of seta II on A8 distinctly longer than wide 4

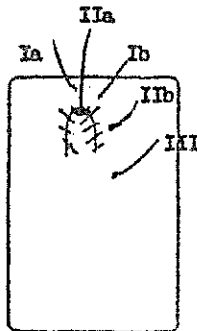
4. Projection of seta IIa on T2 and T3 blackish. Frons mostly dark; transverse pale band of head angulate above it..... cupreoviridis Walker

Projections of seta IIa on T2 and T3 pale. Frons pale, not breaking regularity of pale transverse band across head sp. near luteolaria (undet.)



Earias fabia (Stoll)

In Earias insulana , projections are much more pronounced:



T2 & T3

NOCTUIDAE (Continued):

Mamestra brassicae (L.) - Species recognition.

Has setal pattern of typical noctuid. Prothoracic shield and body above spiracles reticulate, pinacula absent, spiracles black rims, pale centers; body setae whitish, moderate size, seta IIIa about level of dorsal margin of spiracle on A1, about level of middle of spiracle A2-8. Coxae of thoracic legs T1-3 contiguous or nearly so; tarsal claw but slightly angulate. Head coloration reticulate; frons about 1/2 height of head; P1, P2, Adfl and Fl almost in straight line; spinneret slender and pointed, long, extending beyond labial palpi; mandible with strong plate-like projection on oral surface; distal margin of plate distinctly concave. Food plants: cabbage, cauliflower, lettuce - Europe.

Sesamia 17 spp. cretica and nonagriodes Europe
(calamistis larvae not described)

1. Head pale amber, weakly reticulate. Pinacula of body setae minute, indistinct. Seta III on A8 on or slightly above dorsal margin of spiracle. On A9, seta I but little closer to seta III than to seta II; seta I much shorter than seta III; seta III normal; on T1 there is only 1 seta in the prespiracular group ... S. cretica Led.

Head brownish, reticulation distinct. Pinacula at bases of body setae distinct. On A8, seta III distinctly below dorsal margin of spiracle. On A9, seta I much closer to seta III than to seta II and often on same pinaculum with seta III; seta I longer than seta III, seta III modified S. nonagriodes (Lef.)

Busseola fusca (One of main pests in Africa)

Prespiracular shield of T1 with only 1 seta discernible. Seta V small or obsolescent. Head pale amber, weakly reticulate. Body pinacula conspicuous, strongly pigmented; seta IIIa above level of spiracle on A1-7. A9 with seta I approximately equidistant from II and III; seta III modified, much shorter than seta I.

Gortyna (possibly genus Hydroecia) From Italy, France, Greece, England
Algeria

Noctuid setal pattern. Head pale amber, body pinacula dark fuscous, large, the pinacula larger than spiracles; seta IV minute on prespiracular shield of T1; pinacula of setae I, II, III on A9 contiguous or fused; body setae whitish.

NOCTUIDAE (Continued):

Plusia (Autographa group). Refer to J. McDunnough Check List of the Lepidoptera for the North American species

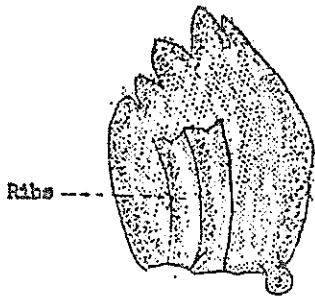
Mandibles separate the following:

Chrysoidea Plusia chalcites ^(ESP) - ribs on oral surface of mandible end before they get to the cutting edge or margin of teeth. - old world + Hawaii

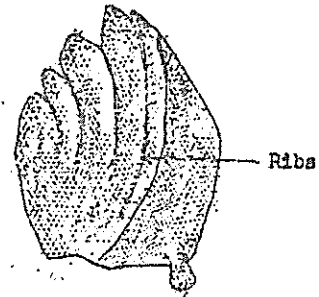
Trichoplusia ni - ribs continue to margin of mandibular teeth. old world + Hawaii, U.S.

Pseudoplusia includens (Walker) - Mandibles similar to P. chalcites, but limited to the Western Hemisphere. P. chalcites not in Western Hemisphere.

For Genus Pseudoplusia (Walker) use keys in E. Crumb, Larvae of the Phalaenidae, page 252.

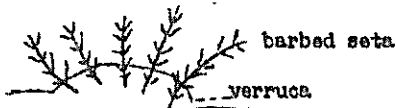


Chrysoidea
Plusia chalcites



Trichoplusia ni

Simyra henrici Grote - cattails, sometimes wheat, rye. Looks like Arctiid larva. Arctiids have barbed setae on verruca. Noctuids have plain setae on verruca.



Simyra albovenosa Goetze - Phragmites, Carex, Typha (European genera)

13a

CRAMBINAE

T1 with 2 setae in the prespiracula group. T2 and T3 with group vi unisetose or bisetose, unisetose in Crambus, bisetose in Diatraea, unisetose or bisetose in Chilo. A1-9 with setae iv and v adjacent. A1 with group vii trisetose. A9 with seta i approximate to seta iii and usually on the same pinaculum. A9 with only 1 seta in the lateral group (iv, v and vi), except in Crambus rarellus which has 2 setae. Crochets biordinal or triordinal in a complete circle. Crambines are restricted to grasses and a few other genera of monocots.

Diatraea saccharalis (Fab.)

T2 and T3 with group vi bisetose. Color creamy white, head light brown. On A3-6, pinacula of seta iii barely extends below level of top of the spiracle in front of the spiracle. On A3-6, seta iiii is at the level of the middle of the spiracle. Sugarcane. North and South America, West Indies.

Diatraea conspurcator Hair.

T2 and T3 with group vi bisetose. Color creamy white with diffuse purple coloring along the sides and with transverse bands of purple coloring on some segments. On A3-6, pinacula of seta iii barely extends below level of top of the spiracle in front of the spiracle. On A3-6, seta iiii is at the level of the middle of the spiracle. Sugarcane. Northwestern Mexico.

Diatraea grandiosella Dyar

T2 and T3 with group vi bisetose. Color creamy white, head light brown with darker freckles. On A3-6, pinacula of seta iii extends to level of the middle of the spiracle in front of the spiracle. On A3-6, seta iiii is at the level of the bottom of the spiracle or lower. Corn, sorghum. Southwestern U.S. and Mexico.

Chilo suppressalis (Wlk.)

T2 and T3 with group vi bisetose. Body with 5 pale longitudinal stripes. Crochets in a complete circle. Rice. India to Japan.

Chilo phragmitellus Hon.

T2 and T3 with group vi bisetose. Body with 5 broad purple irregular stripes. Crochets in a mesonellipise. Phragmites. Europe.

Chilo loftini Dyar

T2 and T3 with group vi unisetose. Body with 5 pale longitudinal stripes. Crochets in a complete circle. Corn and sugarcane. Southwestern U.S. and Mexico.

PYRALOIDEA

PYRAUSTIDAE (Family Diagnostics):

Prespiracular group of T1 is bisetose; on A3-A6, seta IV is approximate to seta V and usually on same pinaculum; on A9 only 1 seta of lateral group present, seta VI; group VII is trisetose on A3-A6; crochets usually in penellipse, triordinal in length; group VI of T2 and T3 is unisetose, or, if bisetose, P2 not mesad of P1 or seta I of A9 is approximate to seta II.

Dichocrocis punctiferalis (Guenée)-castor bean, catalpa, peach, cherry, and Pinus spp. are some hosts. Found in Japan, Korea, India, Formosa

Typical Pyraustid pattern and quite distinctive. Pair of non-seta bearing plates on dorsum T2 and T3 (as in Maruca) and postero-laterad of pinaculum bearing setae IV and V on T2 and T3 and on abdominal segments A1-7. Prespiracular shield extending under and posterior to spiracle on T1. Group VII: $\frac{A1}{3} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{1} \frac{A9}{1}$.* On A9, seta III modified,

thread-like, posterior to seta I, but slightly lower and on same pinaculum. Body pinacula large, elongate, transverse, pale brown with pinaculum of seta I broader than seta II on A1-8.

Evergestis rimosalis Guenée

Head pale amber; ocellus 2 closer to ocellus 1 than to ocellus 3 with typical Pyraustid pattern. Tubercles of setae I, II, and III distinctly conical on A1-9. On A9, seta III modified, threadlike, long, about equal in length to seta I. A conspicuous lateral stripe through spiracular area; dorsum marked with conspicuous transverse bands, creamy white and pink. On cauliflower and cabbage. In U. S. A.

Evergestis straminalis (Hubn.) (Syn. of pallidata?)

Similar to above E. rimosalis, but with seta III on A9 well below level of seta I and lacking dorsal transverse banding. Area above spiracle bluish and occasionally somewhat paler in middorsal area. On cauliflower in U.S. and Europe.

Evergestis forficalis (Fab.) (= Mesographe)

On T2 and T3 group VI is bisetose. Other characters are typical of Pyraustidae. Found in Europe on Cruciferae.

Hedylepta - See Zimmerman, pp. 52 and 72. 15 species in Hawaii

H. accepta (Butler) - sugarcane leaf roller

H. blackburni (Butler) - coconut and banana

Larvae can be recognized by conspicuous, short frons, its height about one-half that of head or longitudinal ridge. Two types of larvae; those

* This formula for the Group VII setal pattern will be indicated throughout these notes in the format shown above, but should also be recognized when described simply by numbers such as: Group VII - 3-3-3-2-1-1.

PYRAUSTIDAE (Continued):

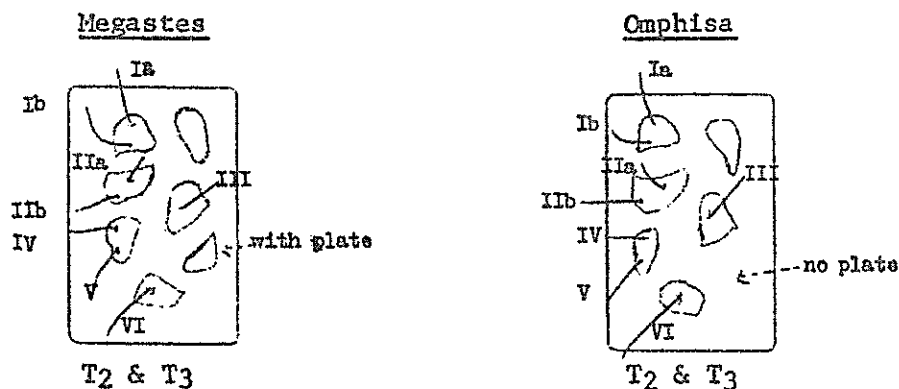
with a conspicuously fuscous spot slightly anterior to base of seta PI on head, and those without such spots. Both types are represented in leguminous species and the following key separates legume feeders.

1. Head pale amber, unicolorous or with single spot and it is weak 2
 Head with conspicuous spots monogona (Meyrick)
2. Mandible with 3 or 4 small teeth indicata F.
 Mandible with 1 or 2 small teeth diemanalis Guenée
 (found in Guam)

Megastes (plusialis and grandalis) - In sweetpotato from the West Indies and South America

Typical Pyraustids in regard to setae and crochets. Dorsum of T2 and T3 has pair of non-seta-bearing pinacula (as in Maruca), also another non-seta-bearing plate between setae III and VI on T2 and T3; on abdominal segments 1-7, there are two non-setae-bearing pinacula posterior to spiracle and another posterior to pinaculum of setae IV and V. Group VII is: $\frac{A1}{2}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{1}$ $\frac{A9}{1}$. Megastes is somewhat similar to Omphisa

anastomosalis in Hawaii, India, Ceylon, Malaya, Java, Formosa, and New Guinea (both feed on sweetpotatoes in Hawaii) but O. anastomosalis lacks non-seta plate between setae III and VI, and on T2 and T3; only 1 seta-bearing plate is posterior to spiracle on A1-7 and none is posterior to pinaculum of setae IV and V.



Neoleucinodes (makes nailhead or window on side of tomato when ready to come out; attacks young fruit; tropical only). In the Western Hemisphere there are five species, one species of which is of economic importance - N. elegantalis (Guenée):

Body setae are those of a typical Pyraustid. Body robust, conspicuously tapered posteriorly (the 9th and 10th segments greatly reduced in size). Body color white or pinkish. Body setae without conspicuously sclerotized, pigmented, pinacula at their bases, the pinacula concolorous with adjacent

PYRAUSTIDAE (Continued):

body area and slightly raised (blister-like), particularly on T2 and T3. Prothoracic shield pale yellow, markings light brown, and without a conspicuous, blackish reniform spot posterior to seta Ib. Head wider than high, pale yellow, reticulation indistinct; in lateral view slightly rounded, not appreciably flattened and with a short, rather broad dark fuscous pigmentation along incision from the hind margin. Ocellus 2 much closer to ocellus 1 than to ocellus 3; a dark fuscous pigmentation along the ocellar arc, the intensity of the pigmentation distinctly weaker in the area between ocellus 3 and ocellus 2. (The next character is an important one in distinguishing N. elegantalis (Guenée) from another species) Seta O1 is tangent to or anterior to a line joining the centers of ocelli 2 and 3. Mandible with lower ventral rib smooth, except for minute tooth-like projection from near base of the lower tooth. Group VII is normally: $\frac{A1}{2}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{1}$ $\frac{A9}{1}$ but on A1 is unstable and frequently only 1 seta is present. Crochets on abdominal prolegs A3-A6 are of irregular or triordinal length, often in a complete circle but usually weaker or interrupted outwardly (at least on some of the prolegs).

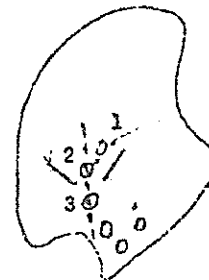
Leucinodes orbonalis Guenée

Eggplant - Pakistan
 Potato - Congo
 Tomato
 Physalis
 Africa + S. Asia

There are about ten species in the genus Leucinodes and these are Oriental and Ethiopian in distribution. But so far as we know only one -

orbonalis Guenée - is of economic importance. Similar to N. elegantalis but differs in having body pinacula rather strongly sclerotized and with a distinct ochreous or brownish pigmentation; seta O1 is distinctly posterior to a line joining the centers of ocelli 2 and 3. These species are found in eggplant and tomatoes--both species--one New World and one from India, Africa, Australia. - Leucinodes

Group VII is: $\frac{A1}{1}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{1}$ $\frac{A9}{1}$. Crochets are arranged in a mesal penellipse.



Position of ocelli in Leucinodes orbonalis

SCHOENOBIIDAE:

Schoenobius spp. and the species Tryporyza incertulas (Walker) described by family characteristics:

You won't find the setal pattern very helpful in recognizing the Schoenobiid larvae. The Schoenobiid larvae are usually recognizable by habitus. They are somewhat slender, with the setae very minute, often not discernible except when treated with caustic; only 1 seta of the laterad group present on A9; and often only 2 setae in group VII on A3-6 discernible. The abdominal prolegs are very short with the crochets in a complete ring, of biordinal or triordinal length and with the anterior series stronger than the posterior series. Anal legs somewhat modified and produced posteriorly. This species is always associated with rice - Tryporyza incertulas (Walker). There are several other species that feed in rice but due to their biology we don't deal with them in quantity. There is a mid-ventral gland between head and prothorax as seen in treated specimens.

PHYCITIDAE:

Cryptoblabes

With characters of a typical Phycitid. Later stage larvae easily recognized by the fusion of prespiracular shield with prothoracic shield. Height of frons about one-half that of the head. Proleg-bearing segments with seta II on a level with seta I. A line connecting seta III and seta V is anterior to or tangent to the anterior margin of the spiracle. On A9, seta I is closer to seta III than to seta II but on a separate pinaculum. Group VII is: $\frac{A1}{3}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{2}$ $\frac{A9}{1}$. Coloration of body above

spiracles reticulate, dorsal area paler. You will note in Zimmerman's Hawaiian paper that he treats species C. aliena Swezey but there are no differences between the larvae of the Swezey species and C. gnidiella (Mill.) It also has similar feeding habits and is probably the same species but has not been published as such yet. All the material that you deal with you can call it gnidiella. Found in Europe, West Indies, Florida, Bermuda, and I believe Brazil. See Heinrich for distribution. Is chiefly semi-scavenger but feeds on different sorts of flowers, and citrus (causes natural drop of fruit). In the earlier stages, on T1 of gnidiella the prespiracular shield is not fused with the prothoracic shield but by noting the body pattern above the spiracles and the other characters already given you'll be able to recognize it as just the earlier stage of the same species.

Spiracle + k group fused



Ribua spp.

Has typical Phycitid characters with body skin (on medium to high power) distinctly granulose and the brownish pigmentation with a group of conspicuous non-pigmented muscle attachments about midway between seta III and setae I and II on the dorsum of A1-A8. Three species are assigned to this genus: innoxia Hein., on pineapple from Cuba; contigua Hein., from Puerto Rico but with food plants unknown; and patricella Dyar from Cuba and with food plants unknown. We have authentic larvae of only innoxia and determination to species should be restricted to pineapples from Cuba; and to genus - material associated with pineapple from other localities in the West Indies and Central America. Ribua larvae are sometimes confused with Ephestia but the darker pigmentation and more granulose skin with the presence of conspicuous, non-pigmented muscle attachments will separate Ribua larvae from those of Ephestia.

(So far as Mr. Capps knows, Ephestia does not feed on pineapple--mostly on stored products. Ribua are also semi-scavengers. A species may be in Mexico).

PTEROPHORIDAE (Greatly diversified; some have primary setae only, some look like coleopterous larvae; some have numerous secondary setae):

Stenoptilia

We have only one species that has been intercepted in Quarantine material so far and that is *S. stigmatodactyla* Zeller. These characters will separate this species from all others seen by Mr. Capps. Head with ocellus 3 and ocellus 4 larger than rest of ocelli. Prespiracular group of prothorax trisetose. Seta IV approximate to V and on the same pinaculum, remote from and directly under the spiracle on A1-A7. On A9 with 2 setae on dorsal pinaculum; seta I approximate to seta III and on the same pinaculum; only 2 setae in laterad group (VI absent). Group VI on T1, T2, and T3 is bisetose. Group VII: $\frac{A1}{2}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{1}$ $\frac{A9}{1}$.

Abdominal prolegs long, slender, with crochets of unioordinal length and arranged in a penellipse. Body skin granulose, with rather sparse secondary, short, modified setae (enlarged at tip). This species is associated with Gentian flowers from Switzerland and Austria. There are about 20 species in Europe and 10 in North America but we have only this one encountered in Quarantine.

Platyptilia - somewhat similar to Stenoptilia

Ocellus 3 and ocellus 4 not larger than the other ocelli and the secondary setae are slender, not, or slightly, enlarged at the tip.

Sphenarches

Differs from Platyptilia and Stenoptilia in that setae I, II, and III are modified, being distinctly spatulate distally. The species most frequently found is *S. caffer*. Chiefly in Pigeon Peas from Puerto Rico and Africa.

TINEIDAE

Opogona spp. (It is regarded by Mr. Capps and Mr. Heinrich as a Tineid but some people place it in the Lyonetiidae; can be confused with Acrolophidae)

Head with number of ocelli reduced, usually only 1 or 2 present. Frons extending almost to vertical angle; adfrontals extending to the vertical angle. Median margins of hypostomal plates triangular, not broadly contiguous. Prespiracular shield of prothorax trisetose, the shield elongate and enclosing the spiracle (occasionally partially fused with the prothoracic shield.) Body skin scobinate (very fine spinules--may be very dense or sparse but skin is not smooth). On A1 to A8, seta V remote from seta IV, seta IV behind and slightly below level of the spiracles, seta V directly below seta IIIa; seta IIIa more strongly developed than usual, remote from and directly anterior to seta III. On 9th abdominal segment seta I but slightly lower than seta II; seta IIIa well developed, between seta III and the lateral group; lateral group with all 3 setae present (IV, V, and VI). Prolegs normal, group VII: $\frac{A1}{3}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{2}$ $\frac{A9}{1}$. Crochets are multiserial.

TINEIDAE (Continued):

There is a large number of species in the genus Opogona but we have larvae of only one determined to species and this is O. sacchari Bojer. This species may have been previously determined as Tinea subcervinella Walk. which has been made a synonym of O. sacchari. Larvae of Opogona are usually associated with damp or moist material such as banana, yam, potatoes, bromeliads, sugarcane.

Ereunetis spp.

With similar habits but with 5 to 6 ocelli, and the prespiracular shield incised or with a conspicuous pale area and seta IIIa minute.

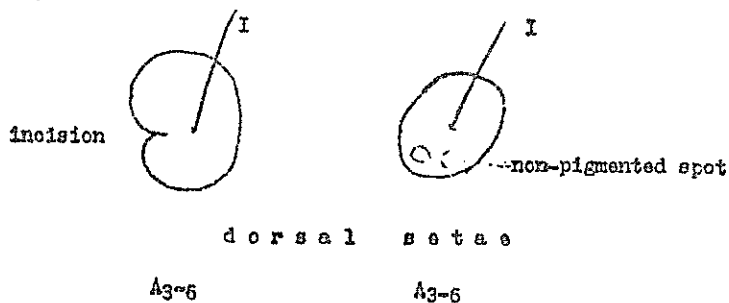
E. minuscula Walsm. and E. flavistriata most frequently intercepted.

OLETHREUTIDAE

Cryptophlebia

The species of Cryptophlebia have the typical Olethreutid characters. Body rather stout; pinacula at the base of seta I at least on proleg-bearing segments with a conspicuous incision on anterior margin, or a pale, non-pigmented spot but slightly posterior to the margin. (When only 2 setae are present in group VII, VIIb and VIIc are always present and it is VIIa that is missing). Spiracle of the 8th abdominal segment is usually conspicuously dorsad.

Note: Larvae of the genus Gymnandrosoma will also fit the above characters but it is of New World distribution. In G. aurantium Costa Lima, group VII of proleg-bearing segments A3-6 is composed of 3 setae. A related undetermined species from the West Indies in guava, has 4 setae in group VII and setae IV, V, and VI on A9 are on separate pinacula. This guava feeding species is only from Puerto Rico. G. aurantium is found in cocoa, cacao, or citrus from Mexico, Central and South America, Cuba, and Santa Domingo.



OLETHREUTIDAE (Continued):

Key to Species of Cryptophlebia

- 1. Anal comb present and well developed leucotreta (Meyrick)
 (= Argyroploce in Collection)
 (in oranges, Old World)
- Anal comb absent, or if present, weakly developed 2
- 2. Group VII of A9 has 2 setae 3
- Group VII of A9 has 1 seta 4
- 3. Setae III and IIIa on the same pinaculum A2-8 .. schistaceana (Snell.)
 (sugarcane)
- Setae III and IIIa on separate pinacula A2-8 peltastica Meyrick
- 4. Distribution Mauritius and Madagascar williamsi Bradley
- Elsewhere 5
- 5. Lateral group of 3 setae on A9; seta VI on the
 same pinaculum with IV and V ombrodelta (Lower)
- Lateral group of 2 setae on A9 illepida (Butler)

Laspeyresia - the species that are found in chestnuts from Europe and also the species that feeds in spruce--most commonly intercepted:

Group VII on A9 unisetose; also unisetose on 8th abdominal segment, or if bisetose, then setae II of the 9th abdominal segment, that is, paired setae II of the 9th abdominal segment are on separate pinacula or setae II and IIIa on T2 and T3 are on separate pinacula; anal fork absent.

L. splendana - associated with chestnuts from Europe. Head is pale amber, unicolorous.

Laspeyresia sp. - we determine only to genus the early stage larvae of L. splendana and the larvae of L. dorsana or L. grossana since they all have the following character: head has dark fuscous pigmentation at incision of the hind margin. All are associated with chestnuts and may even be found in the same shipment.

L. strobilella - in spruce cones from Germany

L. fabivora Meyrick - in beans from Mexico and Central and South America (Can be separated from Epinotia by anal fork. Epinotia has anal fork and Laspeyresia does not). There are differences in the pinacula and spiracles and general habitus.

L. amplana - from Italy; a good species. A9 is important for recognition. Associated with chestnuts.

OLETHREUTIDAE (Continued):

Hemimene

✓ Typical Olethreutid characters. Body color white or whitish, with rather large brownish pinacula. On segments A1-8, seta V is about one-half the length of seta IV. Prolegs normal, crochets usually of irregular or biordinal length, but occasionally uniordinal.

Group VII is: $\frac{A1}{3}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{2}$ $\frac{A9}{1}$.

About 14 species in the genus but only one, H. juliana (Curtis) is intercepted in Quarantine material and this rather infrequently. According to the literature, its larvae feed on oak, beech, chestnut, and maple; but with Quarantine material it is associated with acorns and chestnuts.

It has the characteristic color pattern of the prothoracic and anal shields; with setae IV, V, VI on the same pinaculum of the 9th abdominal segment and the presence of the anal fork will separate this species from all the other Olethreutids associated with acorns and chestnuts.

The next two species that we are going to discuss used to be in the genus Polychrosis, but now have been changed to Lobesia and Paralobesia. The first one we will take up is Lobesia.

Lobesia

Typical Olethreutid characters. Coronal suture longer than adfrontals, at apex of the frons. On abdominal segments 1-8, seta V is but slightly shorter than seta IV. Group VII is: $\frac{A1}{3}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{3}$ $\frac{A8}{2}$ $\frac{A9}{2}$.

On anal segment, ventral side of caudal plate with 4 setae. Crochets on A3-6 in complete circle, of biordinal length.

L. botrana (Schiff.) is found in grapes from Europe. It has the characters noted for the genus and the head pale amber with dark fuscous pigmentation in ocellar area and at incision of the hind margin. Prothoracic shield pale amber, there is some fuscous suffusion along the lateral and posterior margin. Pinacula weakly sclerotized, concolorous with body area. With well developed anal fork. Crochets on prolegs of equal strength on anterior and posterior margins. Some of the species we will deal with later have either the anterior or the posterior margin weaker or stronger developed than other. In mature larvae about 35 crochets in the series on the abdominal prolegs.

Paralobesia viteana (Clemens) - In United States

Similar to botrana except in L. botrana the spiracles on A2-7 are little, if any, larger than the setal insertion of seta III; skin weakly scobinate. In viteana the spiracles are distinctly larger than the insertion place on seta III on A2-7 and the scobinations of the skin stronger. It is found in grapes in the U. S.

TORTRICIDAE:

Adoxophyes reticulana (Hbn.) - Most material in Plant Quarantine under name orana (F.)

With characters of typical Tortricid. Ocellus 2 closer to ocellus 3 than to ocellus 1. Group VII is: $\frac{A1}{3} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{3} \frac{A8}{2} \frac{A9}{2}$. Setae VIII (ventral view) on A9 further apart than setae VIII on A8. Spiracles on A1-7 small, approximately same size as ring at the base of seta III. Seta III on A8 in front of spiracle. On A9 seta I approximately equidistant to seta II and seta III. Crochets on anterior margin A3-6 essentially of same length, but smaller than those on the posterior margin which are distinctly biordinal. In Plant Quarantine it is intercepted chiefly in Lilacs from Holland. It is found in Europe. Well developed Anal Fork *Another Y...*

all name Cacaecia
Cacaecimorpha pronubana (Hbn.)

Contains a single species pronubana. Use to be in the genus Capua. Characters of a typical Tortricid. With ocellus 2 equidistant from ocelli 1 and 3. Spiracle of A2 distinctly larger than the ring at base of seta III. Lower margin of pinaculum at base of seta III on A1-8 contiguous with the spiracle or almost so. Seta III on A8 anterior to and on level of the spiracle. Group VII is: $\frac{A1}{3} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{3} \frac{A8}{2} \frac{A9}{2}$. On A9, setae VIII farther apart than on A8. Anal fork well-developed. Body color ashy gray, pinacula pale, concolorous with body. Head brownish or amber-like, reticulate, fuscous pigmentation in ocellar area and incision of hind margin, extending about half way to a line joining the bases of setae O2 and O3. Prothoracic shield sunny yellow, with a conspicuous, rather large dark patch from lateral posterior margin. Anal shield brownish. Body skin strongly granulate. Head coloration has considerable variation. Found chiefly on Lilac but feeds on a variety of things in Europe (apple, fruit) but is chiefly a leaf feeder.

Epichorista - (One species ionephala Meyrick)

Recorded in the literature on pear, pumpkin, apple, Cryptostemma, Rhaphanus, Rhapanistrum, Rumex, etc. Called Carnationworm. All the Quarantine material that it has been intercepted on is in the Chinkeriebe flowers in South Africa and Madagascar.

With characters of the typical Tortricid. Head brown, reticulate, dark fuscous pigmentation in ocellar area and at incision on hind margin; ocellus 2 equidistant from ocelli 1 and 3; ocelli 3 and 4 somewhat larger than the other ocelli. Spiracle on A1-7 small, but spiracle little larger than the ring at base of seta III; pinacula of seta III contiguous with the spiracle or nearly so on A1-8; seta IIIa on the same pinaculum with seta III on A1-8. Sometimes the location of IIIa as to whether it is above or below the spiracle is sometimes important. Seta V about one-half the length of seta IV on A1-8. Crochets biordinal or irregularly triordinal on posterior margin. Group VII is: $\frac{A1}{3} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{3} \frac{A8}{2} \frac{A9}{2}$.

On A3-6, setae VII in a straight line or nearly so; anal fork well developed. Prothoracic shield pale brown with a darker brownish suffusion along posterior margin and lateral margin. Anal shield pale brown with slightly darker margins. Body pinacula of moderate size, pale brown; thoracic legs and coxae also brown. Dorsal area body with 3 pale whitish longitudinal lines, mid-dorsal and sub-dorsal.

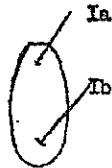
TORTRICIDAE:

Sparganothis sp.

With typically Tortricid characters. Ocellus 2 closer to ocellus 3 than to ocellus 1; ocelli 3 and 4 somewhat enlarged and ringed with a dark pigmentation, the pigmentation sometimes extending to ocellus 5. Spiracle of A8 as large as the pinaculum of seta III; on A2 the spiracle is larger than the ring at the base of seta III. Crochets of abdominal prolegs equally developed on anterior and posterior margins.

Group VII is: $\frac{A1}{3}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{3}$ $\frac{A8}{2}$ $\frac{A9}{2}$.

The species of this genus are divided into 2 groups and those encountered in Quarantine are of group 2. The one species we deal with in the Plant Quarantine material is S. sulphurana F. (= S. sulfureana Clemens). This species has the characters of the genus. Head brownish yellow with dark pigmentation in ocellar area, more intense from ocellus 2 to ocellus 5. Lateral band from incision of hind margin weak. Prothoracic shield pale yellowish brown with a pale fuscous suffusion along lateral margins. Thoracic legs pale, tarsi brownish. Anal shield yellowish. Body color is a pale sordid white; pinacula of moderate size and concolorous with the body; pinacula of setae Ia and Ib on T2 are distinctly elongate and less so on T3 and on abdominal segments 1-8 the pinacula are round. *Anal fork present.*



never like this on thorax



elongate means longitudinally



round

Setae VIII on A9 farther apart than on A8. Species widely distributed in the U. S. but found also on cut flowers (lily buds) from Bermuda.

S. pilleriana Schiff.

Characters of the genus. Head, thorax and legs dark brown to black; prothoracic shield with darker suffusion along lateral margin. Setae VIII on A9 are not farther apart than on A8. Has similar feeding habits to our American species. It feeds on Iris, Clementis, Sedum, etc. but Mr. Capps has never seen this in Quarantine material. Comes from Europe.

" Eulia "

According to Obraztsov, Eulia contains but a single species, ministrana L., an Old World species, which feeds on the leaves of Ulmus, Sorbus, Quercus, Rosa, etc. (deciduous trees) but as far as Mr. Capps knows the species has never been taken in Quarantine. The species heretofore placed in Eulia will have to be placed elsewhere. The things it feeds on must be items not heretofore shipped. Since the Eulia group is not a homogeneous group, no generic diagnosis is possible at this time. Two types of larvae are represented in the Eulia in the sens. lat. (broad sense). Intercepted in plums, apricots, cherries, peaches, almonds, and grapes from South America, chiefly from Chile in nectarine but also from Argentina and Uruguay, we find Eulia sp.

TORTRICIDAE (Continued):

We can't do very much about giving restrictive characters for this group at the present time. We can only go on the fact that all of the Tortricid or Olethreutid larvae that have been reared from the material from Chile have been in this Eulia group. We have two types of larvae in that. We have another species, Eulia sphaleropa Meyrick that were reared from apricot or apple from Uruguay. We will have to go on the assumption that the Tortricoid material in grapes, nectarines and plums are Eulia in the broad sense, from South America. The material which has the Olethreutid-like character on the ninth abdominal segment, that is, with seta I on the same pinaculum with III, contains E. auraria Clarke. That was reared on material from New York. However, it is difficult to get enough larvae to rear many.

The other group has the Tortricid-like arrangement on the 9th abdominal segment, that is, with seta I on a pinaculum separate from III and approximately equidistant setae II and III, and whether or not these larvae represent more than one species, or only one, we don't know, so, if the material is in grape or nectarine or plum from South America, why, we have to at present assume that it is in the Eulia complex. The characters that separate the Tortricidae and the Olethreutidae in the larval stages have exceptions and all larvae that have seta I separate from II and III are not Tortricids and all that have I and III on the same pinaculum are not necessarily Olethreutids.

Eulia sp

... probably is ...

Note: Mr. Capps suggests not boiling Tortricids but placing them in alcohol.

PHALONIIDAE:

Family characters: Prespiracular group trisetose. On A3-6, seta IV approximate to seta V and on same pinaculum. A9 with paired setae II on the same pinaculum; seta I approximate to seta III and on same pinaculum; only two setae of lateral group present except in hysterosia. Setae VIII farther apart on A9 than on A8 or Adf 1 is closer to Adf 2 than to Fl. Coronal suture usually not longer than width of adfrontals at apex of front. In the American species the crochets are uniordinal or triordinal in a complete ring and the skin granulate. In the Palearctic species, the crochets are uniordinal and the skin not always granulate.

(Clysia) or Eupoecilia ambiguella (Hbn.) = (Clysia, Clysiana)

With typical Phalonid characters but with a pair of non-setal-bearing plates on dorsum of T2 and on A9 the pinaculum bearing setae I and III fused with that of paired setae II or at least partially so. Anal fork well developed. Group VII is: $\frac{A1}{3} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{2} \frac{A9}{2}$. Crochets

uniordinal and in complete circle. There are 2 generations per year of this species. The first generation feeds in the flowers and the buds and those of the second in the fruit. Often a serious pest of grapes in Europe. Also feeds in Hedera, Helix and Cornus mascula, Syringa persica, Viburnum, Osier, Ligustrum, and Lonicera.

PHALONIIDAE (Continued):

Aethes williana (Brahm) = (Phalonia zephyrana (Treit.))

With typical Phaloniid characters. Spiracle on A1 distinctly larger than on A2-7, approximately the same size as on T1 and A8. Prolegs short, crochets on A3-6 uniordinal, in a complete ring.

Group VII is: $\frac{A1}{2(3)} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{3} \frac{A8}{2} \frac{A9}{1}$. Anal fork absent. Granulation

of body skin subconical on anterior body segments but granulate on A8 and A9. Pinaculum of seta III on A1-8 contiguous with the spiracle. In Quarantine material this species is always associated with carrots, but it also feeds in the roots and stems of Eryngium campestri and Gnaphalium arenarium. It is found in Europe.

CARPOSINIDAE:

Diagnostic characters for the family are these: Prespiracular shield on T1 with but 2 setae. A1-8, seta IV approximate to V and on the same pinaculum, remote from and under the spiracle. A9 with only one seta in the lateral group (seta VI), setae IV and V are absent. Spiracles on A8 more dorsad than usual. Group VII of A3-6 composed of 4 setae instead of three. Crochets uniordinal on abdominal prolegs and in a complete circle. Body skin distinctly scobinate. This is primarily a tropical group and only a few encountered in Quarantine material which are chiefly Oriental or European in origin.

Key to Species of Carposina

- 1. Number of crochets on anal legs 8; on abdominal legs 15 (no specimen--from literature). In ripe fruits of Berberis from Europe Carposina berberis (H.-S.)

Number of crochets on anal legs 11-14; and on abdominal legs 16-18 2

- 2. A9 with setae I, II, and III approximately in a straight line; seta I approximately equidistant setae II and III and on a separate pinaculum C. niponensis Wlsm. (sasakii) in apple

On A9, seta I distinctly anterior to a line joining bases of setae II and III, much closer to seta II than to seta III and the pinaculum of seta I fused with that of seta II (in fruits of Myrica faya from Madeira C. atlanticella Rebel

COSSIDAE:

Cossids can be recognized by the mandible--very large, and labrum is small. They have the tortricoid setal arrangement. Most are wood borers. Some feed in roots of plants. Spines on shield of T1. In some, spiracle on A8 modified. The armature on the prothoracic shield is quite useful for identifying purposes.

Dyspessa will be the only genus that we will deal with. Prespiracular group on T1 is trisetose. There may be an extra seta in our specimens, but 3 is the normal. On A3-6, seta IV approximate to seta V on the same pinaculum. On A9, setae I, II, and III sometimes on the same pinaculum; setae IV, V, and VI present. On A3-6 three setae usually present in Group VII. Crochets in a complete circle or occasionally they appear as 2 transverse bands, the circle being slightly broken at the outside and also at the inner sides.

D. ulua (Bkh.) Spiracle of T1 and A8 little, if any, larger than on A1 to 7. Prespiracular group on T1 trisetose. On A1-8 the seta IV approximate to V and on the same pinaculum; seta V short, less than one-half the length of IV; has 3 to 5 extra setae between the spiracle and seta II. Spiracle of A8 normal. On A9 paired setae II widely separated and not on same pinaculum; seta I approximate to III but on a separate pinaculum; seta IV, V, and VI all present. Group VII unstable on A8 and A9 and the arrangement is usually: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{3} \frac{A8}{2} \frac{A9}{2(i)}$.

Crochets in 2 transverse bands. The anterior band much weaker.

Dyspessa species intercepted all the time from Italy in garlic. In onion from Greece is another species. Also found in garlic and onion in Turkey is another species which has characters similar to ulua but it usually has only one extra seta above the spiracle in the area between the spiracle and seta III instead of the 3 to 5 which you find in the ulua and this Dyspessa species in onion from Greece; and the body skin of this species from Turkey is more granulate than the one that is in Italy or Greece.

BLASTODACNIDAE:

Two genera: Blastodacna and Chaetocampa. Chaetocampa spp. - not seen Quarantine.

Characters for family and the genus Blastodacna. Body with numerous, short secondary setae; some of the primary setae often indistinguishable. Prespiracular group of T1 with 3 setae. On A1-7 setae I, II, and III indistinguishable; seta V approximate to seta IV, on same pinaculum and directly anterior to seta IV. On posterior margin of A8, a narrow sclerotized plate bearing numerous setae; a similar sclerotization but much broader on dorsum of A9; on A9 setae IV, V, and VI all present. Group VII composed of 3 setae on A3-6. Crochets in a penellipse, uni-ordinal. Anal plate with numerous secondary setae. No anal fork. This will enable one to recognize the larvae of B. atra (Haw.). Early stage larvae lack the secondary setae and the sclerotized plate-like structure on A8 and A9. Found under the hibernaculum on scions of apple from Europe.

BLASTOBASIDAE (See page 9):

Except for Valentinia glanduella which we get in acorns from Mexico and the United States and Auximobasis coffeaella Busck restricted to coffee from Brazil and Central America, we can't do anything more with it. The host association and country of origin are the determining factors between these two species. Holococera is another genus.

STENOMIDAE

Head with 6 ocelli. ^{with seta} No submental pit. Prespiracular shield with 3 setae. Proleg-bearing segments A3-6 with seta IV approximate to seta V and on the same pinaculum. A8 with seta VI postero-laterad of pinaculum bearing setae IV and V or the anterior portion of segment 8 much larger than the posterior portion, with the spiracles directed dorsad. On A9 seta III strong, never thread-like or closely associated with the lateral group. Anal fork absent. Crochets in a complete circle, uniserial on A3-6, on anal legs in a transverse unbroken mesoseries.

^{W(S m).}
S. catenifer Walsingham

With characters of the family and seta VI on A8 postero-laterad of setae IV and V. Body skin granulose. Pinacula dark brown. On A1-8, seta IIIa close to seta III and on the same pinaculum with it. On A9 seta I approximate to seta II and on the same pinaculum; setae IV, V, and VI all present. Group VII is: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{2} \frac{A9}{1}$. Crochets on A3-6 in a complete circle and irregularly triordinal. This is the species that is in Avocado seed from Central and South America, and Mexico.

Cerconota anonella (Sepp)

With characters of the family but on A8, seta VI is ventrad of the pinaculum bearing setae IV and V. Body skin weakly granulate (under high magnification). On T2, two pairs of non-setal plates on the dorsum. On A1-8 seta IIIa is close to seta III and on the same pinaculum. On A9 seta I approximately equidistant setae II and III and on a separate pinaculum. Setae IV, V, and VI all present. Group VII is: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{2} \frac{A9}{1}$, or the last item may be 2 or more.

Crochets on A3-6 in a complete circle, irregularly triordinal in length and on the anal legs in a transverse mesoseries unbroken. In Annona, Cherimoya, etc. from the West Indies and Central America.

HYPONOMEUTIDAE (Now spelled: YPONOMEUTIDAE)

This family contains such a large diversification of larvae it would be impossible for one to define the family as an entity. It is necessary to get the different categories of it. The Prays genus is encountered more frequently than any other in Quarantine work.

HYPONOMEUTIDAE (Continued):

Prays oleellus (Fab.)

Head with 6 ocelli; ocellus 2 closer to ocellus 1 than to ocellus 3. Prespiracular group of prothorax composed of 3 setae, the arrangement triangular. Prothoracic shield with a large brownish pigmented area below setae Ia and IIa. On A3-6 setae IV and V not on the same pinaculum. On A8 seta V cephalad and on level of seta IV. Seta VI directly ventrad seta IV, approximately the same distance from seta IV as from seta V. On A9 paired setae II on separate pinacula; seta I anterior to line joining bases of setae II and III, closer to seta II than to seta III; setae IV, V, and VI all present and on separate pinacula, seta VI closely associated with VII. Group VII is: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{1} \frac{A9}{1}$.

Crochets biserial and on A3-6 uniordinal and in a complete ring, the series stronger on the posterior margin. This is in olives from Europe and Asia Minor.

Prays sp. (endocarpa complex)

Head with 6 ocelli; ocellus 2 closer to 1 than to 3. Prespiracular group of prothorax composed of 3 setae, arrangement triangular. Prothoracic shield with a conspicuous brownish pigmented patch at anterolateral margin surrounding setae Ic and IIc; pinaculum of Ia-Ib, IIa-IIb, IV and V, on T2 and T3 rather large and of similar pigmentation. On proleg-bearing segments A3-6, setae IV and V on separate pinacula. On A8 seta V on level with and anterior to seta IV; seta VI directly ventrad of seta IV and about the same distance from seta IV as from V. A9 has paired setae II on separate pinacula, seta I anterior to a line joining bases of setae II and III but closer to seta II than to seta III; setae IV, V, and VI all present, but with seta VI closely associated with VII. Group VII is: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{1} \frac{A9}{1}$.

Crochets on A3-6 in a complete circle, uniserial on some, but biserial on others. This is the species that feeds in citrus in Indo-Australia area.

Prays citri (Mill.)

Head with 6 ocelli; ocellus 2 closer to 1 than to 3. Prespiracular group composed of 3 setae, arrangement triangular. Prothoracic shield pale amber, without dark fuscous markings. Pinacula of body weakly sclerotized and pale, about same color as adjacent body area. On proleg-bearing segments A3-6, setae IV and V not on same pinaculum, setae IV and V on about the same level. On A8 seta V on the level with and anterior to seta IV, on separate pinacula; seta VI directly ventrad of seta IV and distinctly closer to seta IV than to seta V. On A9 paired setae II on separate pinacula; seta I anterior to a line joining bases of setae II and III, close to and on the same pinaculum with seta II; setae IV, V, and VI all present; seta VI closely associated with VII.

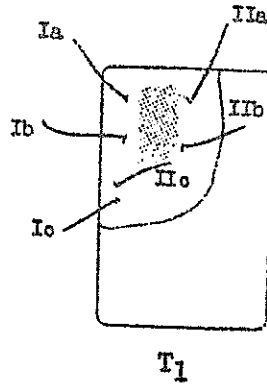
Group VII is: $\frac{A1}{2} \frac{A2}{3} \frac{A3-6}{3} \frac{A7}{2} \frac{A8}{1} \frac{A9}{1}$. Crochets on A3-6 in a complete

circle, biserial, uniordinal. This is from citrus fruit in the Mediterranean region.

HYPONOMEUTIDAE:

Prays fulvocanellus Wlsm.

Head with 6 ocelli; ocellus 2 slightly closer to ocellus 1 than to ocellus 3. Prespiracular group of T1 composed of 3 setae, arrangement triangular. Prothoracic shield pale amber, with a conspicuous subdorsal fuscous patch between setae Ia and Ib and IIa and IIb terminating before the level of IIc; seta IIc close to and directly above Ic.



Body pinacula moderately sclerotized and pigmentation slightly darker than adjacent body area. On A3-6 seta IV not on the same pinaculum as seta V, setae IV and V on about the same level. On A8, seta V on level with and anterior to seta IV and on a separate pinaculum; seta VI directly ventrad to seta IV, pinaculum of VI fused with that of IV. On A9 seta I anterior to a line joining bases of setae II and III and closer to seta II than seta III and on the same pinaculum with seta II; pinaculum of seta III contiguous or fused with pinaculum bearing setae I and II. Setae IV and V on the same pinaculum, seta VI closely associated with VII, pinaculum of setae VI and VII fused. Group VII is: $\frac{A1}{2}$ $\frac{A2}{3}$ $\frac{A3-6}{3}$ $\frac{A7}{2}$ $\frac{A8}{1}$ $\frac{A9}{1}$. Crochets on A3-6 biserial, uniordinal, in a complete ring. Feeds in the pods of Pelea anisata in Hawaii.

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Plant Quarantine Division
Division Training Center

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IN ENTOMOLOGY AND RELATED TECHNICAL DISCIPLINES

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LEPIDOPTERA

Pyralidae P

TWO SETAE IN PRESEG. CAR GROUP

SETAE 4 AND 5 ON PROLEG. BEARING SEGMENTS MESOTHORACIC AUPRICIAL ABDOMINAL SEGMENT 9 CROCHETS REMARKS
 SCLEROTIZED RINGS SCLEROTIZED RINGS

Family	Setae 4 & 5 on proleg. bearing segments	Mesothoracic sclerotized rings	Aupricial sclerotized rings	Abdominal segment 9	Crochets	Remarks
GEOMETRIDAE	SETAE 4 & 5 NOT ON SAME PIVOTUM--DISTANT FROM EACH OTHER	NONE	NONE	-----	USUALLY CONTINUOUS BIORDINAL MESOSERIES IF BROKEN, INTERRUPTED BY FLESHY LOBE	ONLY 2 PAIRS OF FULLY DEVELOPED PROLEGS PRESENT-- 1 PAIR ON 6TH ABD. SEGMENT & ANTL PAIR ON LAST SEG.
NOCTUIDAE *	SETA 4 BEHIND AND SETA 5 BELOW SPIRACLE	NONE	NONE	ONLY 1 SETA PRESENT OF GROUP 4, 5, 6	USUALLY BIORDINAL MESOSERIES	-----
CARPOSIDAE	SETAE 4 & 5 ADJACENT AND BELOW SPIRACLE	NONE	NONE	-----	BIORDINAL CIRCLE	SPIRACLES ON THE 8TH ABD. SEGMENT ARE CONSPICUOUS, PROJECT CAUDALLY AND ARE NEARER THE DORSUM THAN SETA 4 OF THE 7TH ABD. SEGMENT.
PHYCITIDAE *	SETAE 4 & 5 ADJACENT & BELOW SPIRACLE	RING AT BASE OF SETA 2B; MAY BE DARK OR LIGHT	RING AT BASE OF SETA 3 ON 8TH	3 (OR 2) SETAE PRESENT OF GROUP 4, 5, 6	UNIORDINAL OR BIORDINAL CIRCLE	NO RINGS ON ETIOLA SP. AND EUMYSIA SP. BUT 3 SETAE PRESENT
GALLERIIDAE *	SETAE 4 & 5 ADJACENT & BELOW SPIRACLE	NONE	RING AT BASE OF SETA 3 ON 1ST AND 8TH SEGMENTS	3 SETAE PRESENT OF GROUP 4, 5, 6	USUALLY BIORDINAL CIRCLE	-----
PYRALIDAE *	SETAE 4 & 5 ADJACENT & BELOW SPIRACLE	NONE	RING AT BASE OF SETA 3 ON 8TH	3 (OR 2) SETAE PRESENT OF GROUP 4, 5, 6	UNIORDINAL OR BIORDINAL CIRCLE	-----
PYRAUSTIDAE *	SETAE 4 & 5 ADJACENT & BELOW SPIRACLE	NONE	NONE	ONLY 1 SETA PRESENT OF GROUP 4, 5, 6	PENELLIPSE, USUALLY TRIORDINAL	-----
GRAMBIDAE	SETAE 4 & 5 ADJACENT & BELOW SPIRACLE	NONE	NONE	ONLY 1 SETA PRESENT OF GROUP 4, 5, 6	CIRCLE, BIORDINAL OR TRIORDINAL	-----

Arctiidae
 Anom. doer
 1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th
 13th 14th 15th 16th 17th 18th 19th 20th
 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th
 31st 32nd 33rd 34th 35th 36th 37th 38th 39th 40th
 41st 42nd 43rd 44th 45th 46th 47th 48th 49th 50th
 51st 52nd 53rd 54th 55th 56th 57th 58th 59th 60th
 61st 62nd 63rd 64th 65th 66th 67th 68th 69th 70th
 71st 72nd 73rd 74th 75th 76th 77th 78th 79th 80th
 81st 82nd 83rd 84th 85th 86th 87th 88th 89th 90th
 91st 92nd 93rd 94th 95th 96th 97th 98th 99th 100th

Diagnostic Characters for Some Families
of Lepidopterous Larvae

* - Denotes family characteristics as based on species indicated in "Keys for Identification of Some Lepidopterous Larvae Frequently Intercepted at Quarantine", by Hahn W. Capps, and are not diagnostic for entire family.

** - Denotes family characteristics as based on species indicated and are not diagnostic for the entire family.

A. Characters other than setal arrangements.

1. Gracilariidae, 2. Pieridae.

B. Two setae in prespiracular group.

1. Phalaenidae, 2. Phycitidae, 3. Galleriidae,
4. Pyralididae, 5. Crambidae, 6. Schoenobiidae,
7. Pyraustidae.

C. Three setae in prespiracular group.

1. Hyponomeutidae, 2. Tortricidae, 3. Olethreutidae,
4. Phaloniidae, 5. Aegeridae, 6. Cossidae, 7. Stenomidae,
8. Gelechiidae, 9. Blastobasidae, 10. Cosmopterygidae,
11. Blastodacnidae.

**Gracilariidae

Distinctive feature of later instar larvae is the presence of but three pairs of ventral prolegs located on segments 3, 4, and 5. Prolegs are very short and often not represented by swellings at all, location indicated by suckers or variously arranged crochets.

Group I - Gracilaria consimilella, G. violacella
Ornix geminatella.

1. Setae minute and position cannot be determined satisfactorily.
2. Thoracic legs present.
3. Crochets of prolegs arranged in a lateral penelipse enclosing a transverse series, all unior-dinal.

Group II - Lithocolletis hamadryadella, L. ostensackenella,
Marmara salictella, M. falgidella.

1. Setae as above.
2. Thoracic legs present or absent.
3. Ventral prolegs reduced, either bearing transverse rows of crochets or modified into suckers.

- * Pieridae
 1. Fleshy protuberances on anterior ventral margin of first thoracic segment.
 2. Body with numerous secondary setae.

- * Phalaenidae
 1. Two setae in prespiracular group.
 2. Setae IV and V on proleg segments with seta IV behind and V below the spiracle.
 3. Crochets in a longitudinal mesoseries.

Pyralidoidea

- * Phycitidae
 1. Two setae in prespiracular group.
 2. Setae IV and V adjacent and below the spiracle.
 3. On 9th abdominal segment at least two and usually three setae of group IV, V, VI present.
 4. Dark, pigmented, sclerotized ring or semi-ring surrounding seta IIb of mesothorax and similar structure at base of seta III on 8th abdominal segment (except for Etiella and Eumysia).
 5. Crochets in a circle, uniordinal or biordinal.

- * Gelleriidae
 1. Two setae in prespiracular group.
 2. Setae IV and V adjacent and below the spiracle on proleg bearing segments.
 3. On 9th abdominal segment all setae of group IV, V, and VI present.
 4. A small pigmented ring around base of seta III of 1st and 8th abdominal segments.
 5. Crochets in a complete circle.

- * Pyralididae

As for Phycitidae except #4, pigmented ring at base of seta III on 8th abdominal segment but such ring absent on seta IIb of mesothorax.

- * Crambidae
 1. Two setae in prespiracular group.
 2. Setae IV and V of abdominal segments adjacent and below the spiracle.
 3. On 9th abdominal segment only one seta of group IV, V, and VI present.
 4. Crochets in a complete circle, usually biordinal or triordinal.

- **Schoenobiidae

Close to Crambids, structure of larvae not well known.

- * Pyraustidae
 1. Two setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments adjacent and below the spiracle.
 3. On 9th abdominal segment only one seta of group IV, V, and VI present.
 4. Crochets in a penellipse, usually triordinal.

- * Hyponomeutidae
 1. Three setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments distant from each other and below spiracle.
 3. Crochets of abdominal prolegs in a complete ring enclosing a short longitudinal series or in a pseudocircle, or
 2. Setae IV and V of proleg bearing segments adjacent below the spiracles.
 3. 9th abdominal segment bearing 9 setae, setae I, II, III on a single plate or with seta I slightly posterior to margin of plate.
 4. Crochets in a complete ring. Argyresthia spp.
- * Tortricidae
 1. Three setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
 3. On 9th abdominal segment paired setae II on a sclerotized plate, seta I on a separate plate approximately equidistant from setae II and III.
- * Olethreutidae
 1. Three setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
 3. On 9th abdominal segment, paired setae II on a sclerotized plate, seta I closely associated with seta III on a sclerotized plate, seta VI present.
 4. Crochets in a circle.
- * Phaloniidae
 1. Three setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
 3. On 9th abdominal segment, paired setae II on a sclerotized plate, seta I closely associated with seta III on a sclerotized plate, seta VI absent.
 4. Flat, granulate skin under high power.
- **Aegeridae
 - For species indicated by Fracker, 1929
 1. Three setae in prespiracular group.
 2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
 3. Ocelli 1-4 in form of a trapezoid.
 4. Crochets of prolegs in two uniserial bands, crochets of anal prolegs in a single transverse row.

**Cossidae

Dyspessa ulula (Bkh), Zeuzera pyrina?

1. Three setae in prespiracular group.
2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
3. Mandibles large and conspicuous extending beyond margins of labrum.
4. Six or seven large setae above level of abdominal spiracles.
5. Skin coarsely granulate.
6. Crochets in two (indefinite) transverse rows; anal prolegs in a single row; spiracles on a line Dyspessa ulula (Bkh); or, crochets in a circle; spiracle of segment 8 higher than those of segments 1-7. Zeuzera pyrina.

**Stenomidae

Stenoma catenifer Wlsm., S. anonella Sepp.

1. Three setae in prespiracular group.
2. Setae IV and V of proleg bearing segments adjacent and below the spiracles.
3. On 8th abdominal segment seta VI behind setae IV and V. S. catenifer or, setae II closer together than setae I and spiracles directed dorsally and distinctly more dorsal than on 7th abdominal segment. S. anonella.
4. Crochets in a complete circle.

* Gelechiidae

1. Three setae in prespiracular group.
2. Setae IV and V of proleg bearing segments adjacent and below the spiracle.
3. On 9th abdominal segment paired setae II not on a sclerotized plate; seta I not closely associated with seta III, approximately equidistant from setae II and III and not on a plate.
4. Crochets in a circle, penellipse or transverse bands.
5. Submentum without a pit.

* Blastobasidae

1. Three setae in prespiracular group.
2. Setae IV and V of proleg bearing segments approximately adjacent and below the spiracles.
3. On 9th abdominal segment paired setae II not on the same plate; seta I on separate plate and approximately equidistant from setae II and III; all setae of group IV, V, VI present.
4. Group VII on first abdominal segment trisetose.

Blastobasidae Cont'd.

5. Crochets in a complete circle.
6. Submentum with a pit.
7. Group VII on abdominal proleg segments with only three setae.

* Cosmopterygidae Pyroderces spp.

1. Three setae in prespiracular group arranged in a triangle.
2. Setae IV and V of proleg bearing segments adjacent and below spiracles.
3. On 9th abdominal segment; paired setae II not on the same plate; seta I much closer to seta III than to seta II often on the same plate; all setae of group IV, V, and VI present.
4. Group VII on first abdominal segment trisetose.
5. Crochets in a complete circle.
6. Submentum without a pit.

**Blastodacnidae Blastodacna hellerella (Dup.)

1. Three setae in prespiracular group.
2. Setae IV and V of proleg bearing segments adjacent and below spiracle.
3. On 9th abdominal segment paired setae II not on a sclerotized plate, seta I approximate to seta III but not on same plate.
4. Crochets uniserial and unioordinal.
5. Body with numerous secondary setae.