

*Microplitis* sp. has exposed cocoons like *Apanteles* and probably has many parasites but we have not reared any of them yet. *Apanteles rufocoxalis* may have the same parasites as *militaris* but we have not reared any of them from this species. It is possible that *Enicospilus purgatus*, *Rhogas atricornis*, *Ichneumon* sp., and the Tachinids may also have parasites but they pupate in the ground and are thus protected. We have reared no parasites from these species.

The primary parasites are controlled to some extent by the secondary parasites; but the most important factors in their control as well as in the control of *Heliophila* itself are changes in temperature and humidity. And the effect of these two factors should be worked out by a series of experiments conducted under such conditions that the various factors can be controlled. These experiments could easily be conducted with a couple of biological incubators such as are used for bacteriological work in the tropics.

## A KEY TO THE CUTWORMS AFFECTING TOBACCO

By S. E. CRUMB, U. S. Bureau of Entomology

The following key includes only the cutworms known to affect tobacco in the United States, but these include also the majority of the common species affecting other crops. For this reason it has been considered advisable to publish this table for the use of other workers in advance of a forthcoming publication of the Bureau of Entomology in which these species will be fully treated.

The characterizations of *Noctua clandestina* and of *Feltia malefida* are based upon inadequate material, and those of *Mamestra legitima* and *Peridroma incivis* as here presented might lead to some confusion, owing to the fact that it was originally intended that this key should be accompanied by descriptions and photographs of the larvæ. The larva of *Feltia ducens* (= *subgothica*) has been bred from egg to adult and no character has been found by which it may be distinguished from the larva of *Feltia jaculifera*. It seems probable that these quite similar forms are not specifically distinct. The examination of a single inflated larva of *Euxoa tessellata* has likewise revealed no character by which this species may be distinguished from *Euxoa messoria*.

In determining the character of the skin granules it should be borne in mind that the coarse granules mentioned in the key are not more than one-twentieth of a millimetre broad. A low power of the compound microscope is essential for obtaining an adequate idea of their appearance, although with a little practice the species can be determined readily with a good hand lens.

If the necessary coöperation can be secured, the writer wishes to undertake the preparation of a much more extensive cutworm key in which all our economic species might find a place. To this end material from all parts of the country, and especially live larvæ in considerable series, is very much desired; and determinations will be made when possible.

A KEY TO THE CUTWORMS AFFECTING TOBACCO

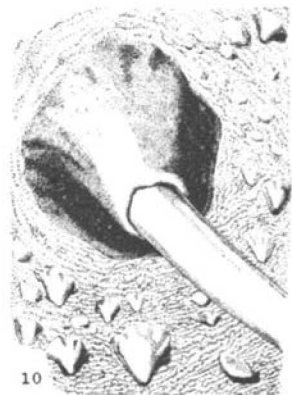
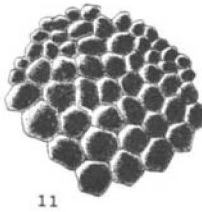
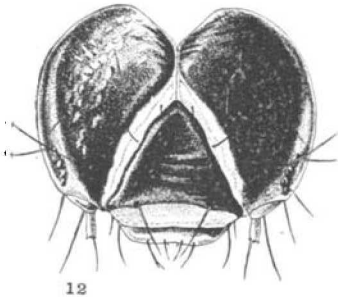
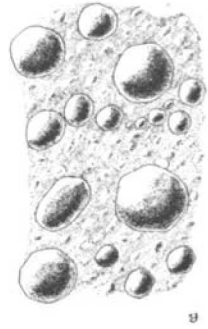
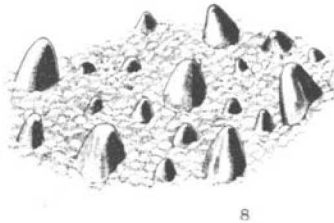
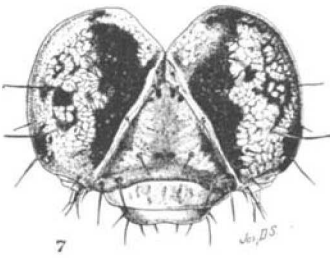
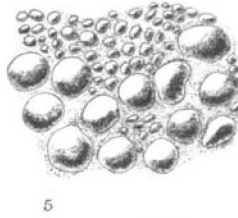
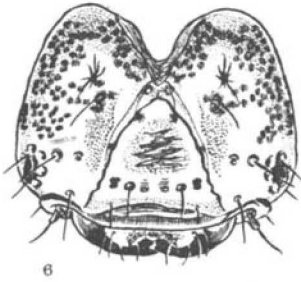
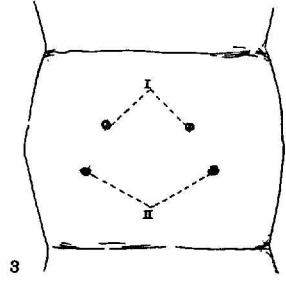
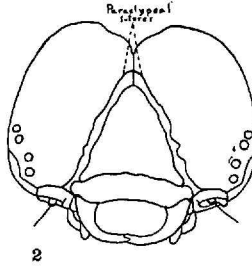
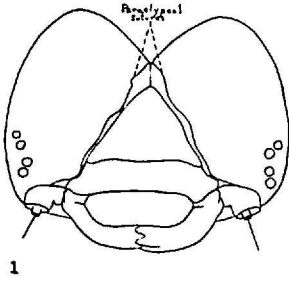
- 1 { Paraclypeal sutures not attaining apex of head shield (Plate 20, fig. 2). Skin smooth, excepting in *Mamestra renigera* (Pl. 20, fig. 10).....2
- 1 { Paraclypeal sutures attaining apex of head shield (Pl. 20, fig. 1). Setigerous tubercles rather large, distinct. Tubercle IV of abdominal segments very large (Pl. 20, fig. 4, IV). Skin granulose (Pl. 20, figs. 5, 8, 9, 11).....11
- 2 { Head shield clear brown with solid dark fuscous above. Paraclypeal region white (Pl. 20, fig. 12).....3
- 2 { Fuscous coloring of head shield limited to arcs and reticulation or absent (Pl. 20, figs. 6, 7). Paraclypeal region concolorous with remainder of head shield or merely pale, never white.....4
- 3 { Subdorsal black spots of mesothorax as large as those on seventh abdominal segment.....*Prodenia commelinæ* S. & A.
- 3 { Subdorsal black spots of mesothorax absent or smaller than those on seventh abdominal segment.....*Prodenia ornithogalli* Guenée
- 4 { Mandibles each with about 4 teeth.....5
- 4 { Mandibles with cutting margin straight, toothless or bearing about twelve minute teeth.....*Peridroma incisus* Guenée.
- 5 { Tubercle IV of abdominal segments distinctly larger than tubercles I, II and III. Spiracles black.....*Mamestra meditata* Grote.
- 5 { Tubercle IV of abdominal segments of about the same size as tubercles I, II, and III.....6
- 6 { Skin coarsely granulose dorsally. Tubercles I and II conical and bearing prominent bristles.(Pl. 20, fig. 10). Spiracles black.....*Mamestra renigera* Stephens.
- 6 { Skin smooth, neither shagreened nor granulose. Tubercles and their setæ minute.....7
- 7 { Body without spots but prominently striped. Ground color of head shield white, submedian arcs and stemmatal stripe united posteriorly and at maxillary palpi.....*Mamestra legitima* Grote.
- 7 { Body usually bearing black spots and never prominently striped.....8
- 8 { With triangular black subdorsal markings, at least posteriorly.....9
- 8 { Black subdorsal markings linear or absent. Spiracles black. With distinct yellow middorsal dots on abdominal segments, at least anteriorly.....*Peridroma saucia* Hübner.
- 9 { Without black spots above spiracles. Spiracles yellowish with dark rims. Ground color of head shield greyish or whitish. Dorsum drab.....*Noctua c-nigrum* Linnæus.
- 9 { With distinct black spots above spiracles.....10

10	}	Spiracles yellowish with dark rims. Ground color of head shield whitish . . . . . <i>Noctua clandestina</i> Harris.	
		Spiracles black. Ground color of head shield pale yellowish brown . . . . . <i>Noctua badinodis</i> Grote.	
11	}	Skin granules very small, flat or slightly convex, set pavement-like, without secondary granules (Pl. 20, fig. 11) . . . . .	12
		Skin granules coarse, isolated, strongly convex or bluntly conical, interspersed irregularly with many small secondary granules (Pl. 20, figs. 5, 8, 9) . . . . .	14
12	}	Reticulation of head shield replaced entirely by close-set fuscous freckles (Pl. 20, fig. 6). Subspiracular white band distinct . . . <i>Euxoa messoria</i> Harris.	
		Head shield more or less fuscous-, or ferruginous-reticulate. White subspi- racular band not distinct . . . . .	13
13	}	Tubercle I of abdominal segments nearly or quite as large as tubercle II . . . . . <i>Feltia malefida</i> Guenée.	
		Tubercle I of abdominal segments about one-half as large as tubercle II . . . . . <i>Feltia gladiaria</i> Morrison.	
14	}	Skin granules upright, conical, somewhat retrorse (Pl. 20, fig. 8). Tubercle I of abdominal segments about one-half as large as tubercle II . . . . . <i>Feltia annexa</i> Treitschke.	
		Skin granules strongly convex but scarcely subconical, not at all retrorse (Pl. 20, figs. 5, 9) . . . . .	15
15	}	Tubercle I of abdominal segments nearly or quite as large as tubercle II . . . . . <i>Feltia jaculifera</i> Guenée.	
		Tubercle I of abdominal segments about one-third as large as tubercle II . . . . . <i>Agrotis ypsilon</i> Rott.	

EXPLANATION OF PLATE 20<sup>1</sup>

- Fig. 1. Diagram of head shield of *Feltia annexa* larva showing the paraclypeal sutures attaining apex of head shield.
- Fig. 2. Diagram of head shield of *Peridroma saucia* larva showing the paraclypeal sutures not attaining apex of head shield.
- Fig. 3. Diagram of the dorsum of an abdominal segment of a cutworm showing tubercles I and II. Tubercle I is anterior.
- Fig. 4. Diagrammatic lateral view of an abdominal segment of a cutworm giving the notation of the setigerous tubercles. Tubercle IV is posterior to the spiracle.
- Fig. 5. Portion of the skin of *Feltia jaculifera* highly magnified showing the strongly convex, isolated, primary and secondary granules.
- Fig. 6. Head shield of *Euxoa messoria* showing the submedian fuscous arcs nearly absent and the reticulation reduced to close-set fuscous freckles.
- Fig. 7. Head shield of *Feltia jaculifera* showing the fuscous submedian arcs, the reticulation, and a portion of the stemmatal stripe. This is the usual coloration among cutworms.
- Fig. 8. Portion of the skin of *Feltia annexa* highly magnified showing the isolated, conical, retrorse, primary and secondary granules.

<sup>1</sup> Figures 1-4 were drawn by Mr. Harry Bradford. The remainder of the drawings are the work of Mr. Joseph D. Smith.



Cutworm Structures

- Fig. 9. Portion of the skin of *Agrotis ypsilon* highly magnified showing the strongly convex, isolated, primary and secondary granules.
- Fig. 10. Portion of the skin of *Mamestra renigera* highly magnified showing one of the conical dorsal tubercles, the base of its coarse bristle, and the isolated skin granules.
- Fig. 11. Portion of the skin of *Feltia gladiaria* highly magnified showing the skin granules set pavement-like without secondary granules.
- Fig. 12. Head shield of *Prodenia ornithogalli* showing the black dorsal area and the white paraclypeal areas.

## THE DRIED-FRUIT BEETLE

*Carpophilus hemipterus* (Linnaeus)

(*Scarabacus hemipterus* Linnaeus—Systema Naturæ, p. 351, 1758)

Order—*Coleoptera* Family—*Nitidulidæ*

By E. O. ESSIG, *University of California, Berkeley, California*

The dried-fruit beetle is very common throughout California and because of its attacks upon fresh ripe and dried fruits, it has become a source of some anxiety to fruit-growers and considerable worry to fruit-packers and grocers. The insect has been known to science for many years and is found in nearly all parts of the world, being a cosmopolitan species thought to have originated in Europe<sup>1</sup> and carried to other places in products of trade. Its fondness for dried fruits has also been known for many years, but the small number of published records concerning its work indicate that it is not generally considered to be a pest of any great importance, excepting in a few localities.

### DESCRIPTION

*Larvæ* (Figure 17).—The first hatched young are exceedingly small and are white or transparently yellowish in color. The mature forms attain an average length of about one-fourth inch and are white or yellowish with the head and tip of the tail rich amber-brown. The body is quite slender, sparsely clothed with quite long spine-like hairs, and with two large tubercles at the extreme posterior end of the abdomen and two smaller tubercles just in front of the larger ones as shown in Figures 17 and 19. All stages of the larvæ are quite active, move quickly and disappear in a surprisingly short time when disturbed.

*Pupæ* (Figure 18).—The pupæ are short, oval or somewhat robust and about one-eighth inch long. There are many formidable looking spines on the body as shown in the drawing. The color is white or pale yellow until they are nearly mature when the dark shades of the adult are gradually assumed.

*Adults* (Figure 20).—The beetles are small, averaging about one-eighth inch in length and half as much in width. They are oval or robust and dull or shining black in color with two conspicuous amber-brown spots at the posterior tips and two smaller more obscure spots of the same color at the lateral marginal bases of the wing covers

<sup>1</sup> French, C., Jr. Dept. Agric. Victoria, IX, pp. 640-641, 1911.