

Larvae of Hawaiian Elaterid Beetles*

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According to Böving and Craighead,¹ the larvae of the true elaterids have the head capsule and mouthparts only slightly reduced, and possess distinct frontal sutures; the gular area is small and indistinct, or represented only by a median gular suture. The Throscidae and Melasidae, on the contrary, have the head capsule and mouthparts greatly reduced or extremely specialized. The latter two families may be separated by the fact that the throscids have the legs short, but with normal segments (fig. 1), while the melasids have vestigial, or no legs (fig. 2).

The key to the larvae of the elaterid beetles found in Hawaii, which follows, is based upon examination of full grown larvae or of final moult skins of local origin.² It should aid in identifying any of the eleven genera (*Melanoxanthus* and *Dacnitus* excepted) known to occur in these Islands. Larval characters in the family Elateridae are excellent for generic separation, and are usually easily distinguished. For specific identification, as in most other insect families, no adequate larval characters are known.

- A. More or less depressed forms with a terminal emargination on the 9th abdominal segment (fig. 3); stipes of maxillae contiguous posteriorly, or nearly so; submentum pointed caudad (fig. 4,A); mandibles not dentate B
 Cylindrical or subcylindrical forms without emargination at tip of 9th segment; stipes distantly separated by submentum, which, caudad, is broad, not triangular (fig. 5,A); mandibles with a distinct tooth on inner margin E
 B. Anal nipple armed with distinct hooks; spines or tubercles present on disc of 9th abdominal segment C
 Hooks absent or much reduced on anal nipple; disc of 9th segment without spines or tubercles; margin of the segment with 8 heavily sclerotized, sharp or blunt, upcurved teeth on either side of the emargination, the second on each side distinct, longer than the others, which, cephalad, become progressively reduced, the foremost sometimes obsolete *Drasterius*; *Conoderus*³

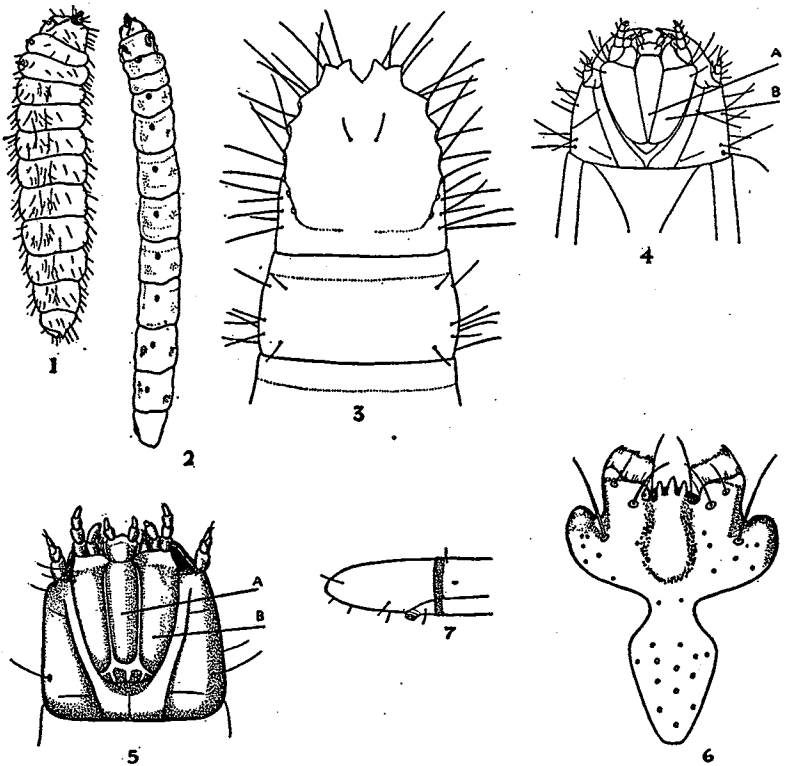
* The writer is grateful to Dr. Adam G. Böving of the U. S. Bureau of Entomology & Plant Quarantine for his criticism of the manuscript, and for his suggestions as to certain differentiating characters, particularly in the case of *Chalcolepidius* and *Pyrophorus*.

¹Böving, A. G., and Craighead, F. C. An illustrated synopsis of the principal larval forms of the order Coleoptera. Ent. Americana, xi (n.s.), 1, 350 pp., 125 pls., Brooklyn, 1930.

²J. A. Hyslop's paper (The phylogeny of the Elateridae based on larval characters. Ann. Ent. Soc. Amer., X, pp. 241-263, 10 figs., 1917) is invaluable to any study of elaterid larval structure.

³The following is from Dr. Böving:

"Several years ago I tried to discover separating characters between *Conoderus* and *Drasterius* larvae but did not succeed in finding truly reliable ones. This was to a great extent caused by lack of a sufficient material of larvae determined by rearing. . . . However, I shall be glad to mention these separating characters, which perhaps may prove of some systematic value.



- FIG. 1. *Throsacus* sp. Larva; lateral view. (From Böving & Craighead, 1930, pl. 81, fig. C.)
- FIG. 2. *Melasis rufipennis* Horn. Larva; lateral view. (From Böving & Craighead, 1930, pl. 81, fig. P.)
- FIG. 3. *Conoderus exsul* (Sharp). Dorsal view of terminal segments of larva.
- FIG. 4. *Conoderus exsul* (Sharp). Head of larva; ventral view; A-submentum; B-stipes.
- FIG. 5. *Agriotella bigeminatus* (Randall). Head of larva; ventral view; A-submentum; B-stipes. (After Böving & Craighead, 1930, pl. 86, fig. P.)
- FIG. 6. *Agriotes mancus* Say. Nasal plate and front (on dorsal part of head). (From Hyslop, 1917, fig. 7c.)
- FIG. 7. *Anchastus sweszei* Van Zwal. Right side of terminal abdominal segments of larva.

- C. Anal nipple with a single large hook on either side; disc of 9th abdominal segment tuberculate; 5 upcurved, acute teeth on either side of terminal emargination progressively reduced anteriorly⁴ . . . **Lacon (modestus)**
 Anal nipple with several hooks on either side D
- D. Respiratory tubes of spiracle closely adjacent, straight and parallel; disc of 9th abdominal segment with but two longitudinal furrows
 Respiratory tubes diverging, widely separated at base; disc of 9th segment with 4 longitudinal furrows, the inner pair the shorter
 **Pyrophorus (bellamyi)**
 **Chalcolepidius (erythroloma)**
- E. Nasal plate unidentate F
 Nasal plate tridentate (fig. 6) G
- F. Terminal armature of 9th abdominal segment complex, with 4 blunt tubercles, from between which a narrower prolongation projects backward, ending in 3 fairly acute tubercles
 **Simodactylus (cinnamomeus)**
 9th abdominal segment unarmored, elliptical (fig. 7); (not congeneric with *Anchastus* of America) **Anchastus (swezeyi)**
- G. 9th abdominal segment ending in 2 well-marked truncate projections, with an acute, longer spine between **Eopenthes**
 Projections and spine of 9th segment greatly reduced **Itodacnus**

Lacon modestus (Boisd.), an immigrant species widespread in the Pacific, is found commonly in the drier parts of Oahu, and was once taken near Kawaihae on Hawaii. J. S. Rosa found its larvae under stones on the slopes of Koko Head, Oahu, and was able to rear them to maturity on scarabaeid grubs; the pupal period lasted 52 days.

The larvae of *Chalcolepidius erythroloma* Dej. are found in rotton wood (Aleurites, etc.), in the forests where they are predacious on other insects. This large beetle, known since the seventies of last century from Oahu (and from none of the other islands in the group), is a native of Ecuador. It is common on the Koolau range, and has been taken on the western slopes of the Waianae mountains.

Simodactylus cinnamomeus (Boisd.) is another immigrant widely distributed throughout the Pacific islands. With *Conoderus exsul* it was implicated in damage to sugar cane some years ago, and although it is undoubtedly predacious as well, Vietch⁵ says of it

⁴First: The processes on either side of the anus are low or even absent in *Drasterius*, but plainly projecting or distinct in *Conoderus*.

⁵Second: There seems to be only a single transverse row of subnasal denticles and the subnasal region anterior to them is smooth and shiny in *Drasterius*, but there appear to be some or many extra denticles anterior to the transverse row of subnasal denticles, and the subnasal region in front is not smooth and shiny in *Conoderus*.

⁶Third: Tergum of ninth abdominal segment is provided with only one pair of distinct setae in or between a pair of longitudinal furrows in *Drasterius dorsalis* Say and *Drasterius amabilis* Lec., but there are often (not always) one anterior and one posterior pair of distinct setae between the longitudinal furrows in *Conoderus*. This third character may not be of any value for generic separation because the size, presence, and position of the setae appear much inclined to individual variation, and the character does not always fall in line with the two other characters mentioned.

⁷Dr. Böving points out the following difference between *Lacon* and *Adelocera* larvae, the latter a genus not so far known to occur in Hawaii:

Concavity of hooks facing toward each other and toward the longitudinal middle line of venter **Lacon**
 Concavity of hooks facing anteriorly **Adelocera**
⁸Vietch, R. The white grubs of the sugar cane soils of Fiji. Agr. Rpt. no. 5, Colonial Sugar Refining Co., Ltd., p. 8, Sydney, 1922.

“. . . any good it may do is completely outweighed by the tremendous damage it does to young cane plants.” Its present importance as a pest in Hawaii is insignificant and in no way comparable to its reported ravages in Fiji.

The two local species of *Conoderus* have both been accidentally introduced here. *C. exsul* (Sharp), a native of Australia or New Zealand, occurs on all the principal islands of the group, and has been known here since at least 1904. It is the commonest of the Hawaiian elaterids, and its predacious larvae are found in bare ground, in sodland, in decomposing filter-press cake, etc. Some years ago it caused economic losses by injuring the eyes of newly planted sugar cane in fields where germination was slow. More recently, partly due perhaps to the substitution of other varieties of cane, such damage has ceased to be important. All things considered, it now deserves the rating of a beneficial insect.

Conoderus eveillardii (Le Guillou) is another predacious immigrant from Australia. It was first taken here in 1931, and apparently is still confined to Oahu. It is fairly common along the coast from Honolulu to Lanikai, the adults coming to lights, and one specimen has been found at Waialua. Mr. Rosa has reared it from larvae found in sandy soil at Waimanalo beach.

A specimen of the North American *Drasterius mellilus* var. *comis* (Le Conte)⁶ was taken at Nanakuli, Oahu, in 1933, but has not been found since. It might easily be concealed in shipments of vegetables from the mainland, and its establishment here is doubtful. Its larva is unknown to me, but it will certainly prove to be smaller than either of the Hawaiian *Conoderus*, and the characters suggested by Dr. Böving (footnote 3) should distinguish it from that genus.

Of the endemic genus *Eopenthes* there are probably 32 distinct species. So far as they are known, their larvae all live in more or less decayed forest wood, and some of them are certainly predacious. The same is true of the nine species of the endemic genus *Itodacmus*.

Anchastus swezeyi Van Zwal. is an endemic species known so far only from the windward forest slopes of Haleakala above Nahiku, Maui. The larvae have been found in dead *Clermontia macrocarpa* Gaud., an endemic lobeliaceous shrub, but nothing is known concerning their food habits. Comparison of its larva with that of *Anchastus sericans* Candèze, both loaned me by Dr. Böving, makes it clear that *swezeyi* is not congeneric with the California-Arizona species. Whereas in *swezeyi* the ninth abdominal segment is unarmored and smoothly elliptical (fig. 7), in *sericans* this segment is heavily and complexly armored in a way suggestive of *Simodactylus*; so great a difference in larval structure makes it impossible

⁶ According to W. J. Brown, Studies of the Elateridae (Coleoptera)—I, Canad. Ent., lxx, p. 133, 1933, *Drasterius mellilus* (Say) is the correct name for the insect commonly known as *D. dorsalis* (Say).

that the two are members of the same genus. The single larva of *swezeyi* available for examination has the nasal plate partially obscured; it is definitely not tridentate, but appears to be unidentate, and is so placed in the dichotomous key. In any case, the larva of *swezeyi* cannot be confused with that of any other species now known in these Islands. The only adult difference discernible between *swezeyi* and its Pacific congeners on the one hand, and the North American species of *Anchastus* on the other, is that in the former the first segment of the hind tarsus is as long as, and usually decidedly longer than, the four following segments together, whereas in the several American species which I have seen, the first hind tarsal segment is usually markedly shorter than the four following. *A. swezeyi* certainly, and perhaps all the other *Anchastus* from the Pacific islands as well, should properly be placed in a new genus.

In 1934 large numbers of larvae of *Pyrophorus bellamyi* Van Zwail., reared from individuals introduced from the Pacific slope of Guatemala, were released in Anomala-infested sugar cane fields in the Pearl Harbor region of Oahu. Should it be recovered in the future, the characters given in the key will serve to distinguish it from the somewhat similar larva of *Chalcolepidius*.

The larvae of *Melanoxanthus* and of *Dacnitus* have not yet been recognized. The former genus is represented here by the widely distributed immigrant *M. melanocephalus* (Fabr.). Abundant as this species often is on all of the principal islands of the group except Kauai, occurring in the drier regions, its larva has not yet been found; whether it inhabits soil or decaying wood, or has another more specialized habit, is not known. Only two specimens of *Dacnitus* have ever been collected; these were adults of *currax* Sharp taken on muddy soil under stones and logs at Kokee, Kauai, in the mountain forest. The larva of this native species remains to be discovered.