

NOTES ON THE IMMATURE STAGES OF DELTOMETOPUS RUFIPES MELS. (Coleoptera, Eucnemidæ).*

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Larvæ of the family Eucnemidæ have been somewhat of a puzzle to entomologists since the first description of a larva of Fornax by Coquerel in 1856. The first American species were described by Osten Sacken, from larvæ collected by Dr. Horn and an unnamed species from his own collection. The larvæ are found in dead wood, some of them where it is still very firm, others, including the species under discussion, prefer wood which is more decayed. Although living in the wood, they differ very materially from the ordinary type of wood-boring insects for they have no powerful mandibles such as these insects are provided with. Instead the head strongly resembles that of the leaf-mining larvæ without having even as efficient mandibles as they. Schiodte quotes Coquerel as saying that they are "without perceptible organs of the mouth—nay without a buccal orifice." It has been doubted by some authors, including Schiodte, that they were able to make their own burrows and were suspected of living in burrows made by other insects. The same authors also differed as to the food of such larvæ, considering their lack of mouthparts, and Schiodte seemed certain that they must feed on xylophagous larvæ and pupæ, since it was quite evident they could not feed on wood. Some have thought they lived on the sap or "juices of the wood." Little has been added to our knowledge of the larvæ or pupæ since Osten Sacken's paper was written. Since these larvæ seemed to be such an entomological puzzle, I have been much interested in collecting them from time to time in the last five years. Altogether three species have been collected, but only one or two specimens each time, and all my attempts at rearing them have been unsuccessful. Mr. H. G. Crawford, however, found one of these species very abundant at Guelph, Ontario and succeeded in rearing a number of adults. I am greatly indebted to him for placing all of his material at my disposal, and also to Mr. Charles Dury, of Cincinnati, who identified the species for me as *Deltometopus rufipes* Mels.

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LARVA: The larva is depressed, somewhat moniliform, pale yellow in color, with dark brown on the head, prothorax and ninth abdominal segment. When full-grown it averages 14–16 mm. in length, or when fully expanded, as much as 18 mm. The head is subtriangular in outline, heavily chitinized and nearly all dark brown as shown by the stippled portions in Figs. 1 and 2. The pale lines seen on either side of the head capsule (Figs. 1, 2, 3, 4) may indicate sutures, as the head capsule will break along these lines when softened. If they are sutures, their homology is doubtful; but as they are furrows on the ectal surface and ridges on the ental they are perhaps for the attachment of muscles. The head is much thinner cephalad and laterad of these lines. Along the cephalic margin of the head capsule are two small triangular projections and four similar, but larger ones, along the lateral margin, making it serrate. The lateral margin also has a prominent blunt projection caudad of the serrations. The head is inserted into the prothorax and may move laterad until this blunt projection strikes the dark brown protuberance on the prothorax. The head may also be moved dorsad and ventrad, and a prominent projection like a condyle on the meson of each caudal margin seems to facilitate these various movements and also prevents the head from being shoved farther back into the prothorax. The very dark line extending caudad from each cephalic projection (Figs. 3 and 4, t) marks the attachment of a strongly chitinized bar to each surface, which is probably the tentorium. Between these two bars at the cephalic end of the head is an opening, the entrance into the buccal cavity. There are no ocelli present. The head capsule is sparsely covered with very minute setæ. The appendages of the head are all retractile. Their location is indicated in Fig. 3, where they are shown extruded. Normally only the extreme tips of the mandibles are visible and then only under high power, as all of these structures are exceedingly minute. What I have considered the antenna (Fig. 5) looks very like a maxilla but does not seem to be in any way connected with the buccal cavity. Its median projection at the distal end seems to be covered with sensory structures and the lateral projection ends in at least three finger-like projections. The structures articulated to the tentorial bar are certainly the mandibles (Figs. 6 and 7, md). Each moves in a horizontal plane and has one very long tendon.

Mesad of these are a group of structures which seem to be maxillæ and labium but these can only be seen distinctly under the oil immersion lens. The median portion, which is pointed at the end (Figs. 3 and 8, 1b) has a longer, sharp projection on either side which appears to be two-segmented. The dorsal surface of this structure (Fig. 8) shows a long tube connected with the median projection which I have traced back into the prothorax and may be the alimentary canal, although it is very small and the salivary duct should open here. The tube seems to have a chitinous lining, however. Laterad of these structures and slightly dorsad of them are what appear to be maxillæ. The distal end bears a cluster of projections which appear to be arranged in a circle. These structures are only a little less strongly chitinized than the mandibles. There has been so little morphological work done on this type of head that one is rather at a loss to account for their peculiar structure and extremely doubtful as to the homology of parts.

The entire surface of the thorax and abdomen is very finely striate, except when otherwise indicated, and all the body segments are very similar, except that the thoracic segments are shorter in proportion to their width than those of the abdomen. There are no traces of legs or prolegs. Each segment except the caudal one has some very distinct areas which appear velvety under a low power lens as if densely covered with fine setæ. On the dorsal surface of the prothorax this area is triangular and located near the caudal part of the segment but on the other thoracic segments it is cephalic and somewhat triradiate. The areas are ovate on the abdominal segments and located near the cephalic margin. The areas are the same shape on the ventral surface except that the median projection is lacking on the mesothorax and metathorax. These areas are really covered with scales as shown much enlarged in Fig. 11, and a few fine setæ are also present. Caudad of these velvety areas on the mesothorax and metathorax, on both surfaces, are much coarser striations than on the remainder of the segment. Near the caudal margin of each body segment except the prothorax and the last abdominal segment on both surfaces, and the eighth segment on the dorsal surface, is a clear, smooth area clearly outlined by a fine, slightly elevated, brown, chitinous ring. These are almost semicircular in outline on all segments except the ventral surface of the eighth abdominal, where it is much

smaller. The ninth abdominal segment is apparently the last one, although the portion surrounding the anal opening probably represents the tenth segment. It is outlined and almost covered with coarse, triangular spines. The remainder of the ninth segment is sparsely covered with very minute setæ. On both surfaces the heavily chitinized caudal portion is punctate. At the caudal end of this segment are two minute spines. The spiracles are easily visible on the lateral part of the mesothorax and first eight abdominal segments (Fig. 9). In the spiracular region are a number of structures which seem to be olfactory pores. The arrangement is shown on one segment in Fig. 9 and several very much enlarged in Fig. 10. These seem to be all of the simple type as shown in McIndoo's Fig. 19. A few sensory pores were also located on the head, and what appeared to be a compound one with several openings was found on each side of the ventral surface of the prothorax. These show as a round white spot on the large, brown area on each side of the meson. Nearly all of the body segments have a small, lateral projection which seems to aid in locomotion, as the larva moves on either side as well as on either dorsal or ventral surface.

PUPA: The pupa (Figs. 12 and 13) is very much like that of an elaterid and does not differ in essential details from any other coleopterous pupa. The entire body, including appendages, is densely covered with very fine pubescence. In dorsal view (Fig. 12) a small portion of the head is visible and the thoracic and nine abdominal segments clearly defined. A deep furrow between the thorax and abdomen allows for considerable movement. The caudo-lateral angles of the prothorax are produced for at least one-fourth the total length of the segment. The first eight abdominal segments bear spiracles but those of the first, and sometimes those of the eighth, are concealed. The lateral margin of each abdominal segment is more flattened than the remainder and separated from it by a slight furrow as indicated by dotted lines. There are many long, soft setæ on the various body segments as indicated in the figure, the row on the base of the mesothoracic wings being quite prominent. In ventral view (Fig. 13) it will be seen that none of the head sutures are visible, the antennæ are closely approximated and mandibles, maxillæ and labial palpi are easily distinguished. The prosternal spine and its groove on the mesothorax are easily seen and all of the appendages are quite normal in

arrangement. A portion of the seventh segment is elevated and extends as a flap over a portion of the eighth when the body is curved. The elevated portion containing the anal opening is probably the tenth segment. Figs. 12 and 13 show a female pupa. The arrangement of the caudal segments is somewhat different in the male as shown in Fig. 14. The length of the female averages 8 mm., the male 6 mm. The color is white until the color of the developing beetle begins to show when it appears to be a dull brown.

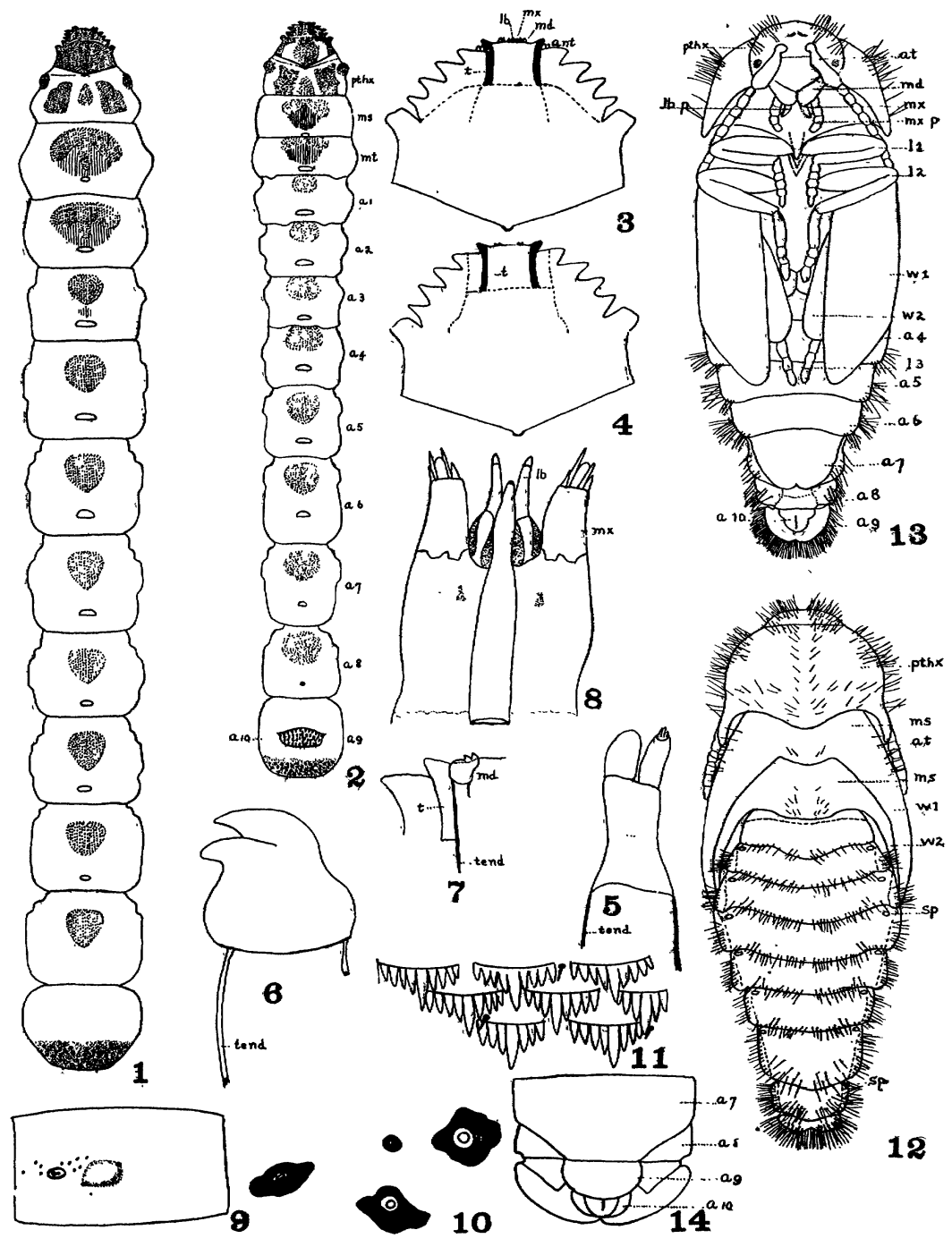
This species apparently takes three years to mature, as larvæ of three different sizes have been taken in the same log in autumn. The larvæ are certainly able to bore into wood. They seem to use the serrate margin of the head to assist progress and probably hold themselves firmly in a partially-formed burrow by the lateral protuberances on the segments, especially the strongly chitinized one on the prothorax. The burrows are very small and not easily detected, but some of the wood where they were found did not need much boring as the larvæ could almost push their way along. As to their food, I cannot state positively, but they have always refused any insect larvæ placed in the cages, and have lived for at least eight consecutive months on nothing but wood. In the case of larvæ feeding in very firm wood there never seems to be any "sawdust" or frass about, but very frequently a clear liquid is seen to be expelled from the anus. Even such facts as have been discovered about the mouth-parts will not entirely solve the problem.

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EXPLANATION OF PLATE IV.

- Fig. 1. Dorsal view of larva with all the segments extended to their full length, as when the larva is in motion.
- Fig. 2. Ventral view of larva, with some of the segments retracted as they appear when the larva is inactive and in most alcoholic specimens, (drawn to slightly smaller scale).
- Fig. 3. Dorsal view of head showing mouth-parts extruded.
- Fig. 4. Ventral view of head showing mouth-parts retracted.
- Fig. 5. Dorsal view of antenna and tendons.
- Fig. 6. Mandible and tendons.
- Fig. 7. Showing articulation of mandible.
- Fig. 8. Dorsal view of labium and maxillæ.
- Fig. 9. Lateral view of fourth abdominal segment showing location of spiracle and sensory pores.
- Fig. 10. Several sensory pores greatly enlarged.
- Fig. 11. Arrangement of scales on "velvety" areas.
- Fig. 12. Dorsal view of female pupa.
- Fig. 13. Ventral view of female pupa.
- Fig. 14. Ventral view of caudal segments of male pupa (without setae).



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