LARVA OF THE DRAGONFLY, *OPHIOGOMPHUS ARIZONICUS* (ODONATA: GOMPHIDAE)

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ABSTRACT

The larva of *Ophiogomphus arizonicus* Kennedy is described and figured from New Mexico. It is extremely similar to the larvae of *O. severus* Hagen and *O. morrisoni* Selys. The dorsal hooks on segments 2-9 of the abdomen are higher than those of *O. severus* but shorter and more robust than those of *O. morrisoni*. The ante-apical tubercles of male *O. arizonicus* larvae are positioned at mid length on the epiproct. The placement of these tubercles is similar in *O. severus* but 2/3 out from the base of the epiproct in *O. morrisoni*. Notes on the habitat and emergence of adult *O. arizonicus* are given.

I found a habitat of *Ophiogomphus arizonicus* Kennedy on the San Francisco River 6 km W of Luna, Catron Co., New Mexico (Dunkle, 1975). On 9 June 1974 my wife and I discovered an emerging male, 34 last instar exuviae, and 8 larvae. The San Francisco River, when we visited it during an exceptional drought, was a clear stream 2 to 3 m wide with many exposed rocks and silt bottomed pools. Most of the exuviae were floating in the stream, while others were on rocks a few cm above the water line or at the water line. Attached exuviae were seen along slow-flowing pools and gentle rapids.

Eight *Ophiogomphus* larvae were obtained from silt (but not sand or gravel) bottom areas in the stream. Three measured 20 mm in length, 1 was 13 mm long, and 4 were 7-8 mm long. The 20 mm larvae are essentially like the exuviae except that there are no ante-apical tubercles on the epiproct of the males, the extreme tips of the epiproct and cerci are decurved, and the dorsal hooks on segments 2-4 of the abdomen are a little lower in proportion to body size. The smaller larvae have more divergent lateral spines on the abdomen, much taller, more pointed, and more erect dorsal hooks on segments 2-9 of the abdomen, and a more acuminate epiproct. These larvae can not be said to be *O. arizonicus* with certainty because other *Ophiogomphus* species are so similar even in the last larval instar, as described below.

The emerging male was first seen at 10:25 AM several cm above water level on a boulder in mid stream. The larva was brown with the thorax and sides of the abdomen pale green. There was a darker brown mid-dorsal stripe edged with yellow on the abdomen. After 23 minutes and falling off the rock twice, the adult began to emerge while the larva had the tip and underside of the rear half of the abdomen under water. In 10 more minutes the eyes were emerging and in 2 more minutes the adult was supported upright by his abdomen with the legs folded. In 6 additional minutes the adult pulled his abdomen free of the exuvia. In 12 more minutes or a total of 30 minutes after beginning emergence, the wings were full size and the abdomen was nearly full size.

DESCRIPTION: Larva of *O. arizonicus* very similar to larvae of other species in its genus. Exuviae grey when dry or yellow-brown in alcohol (35 exuviae sample contained 19 females and 16 males). Females slightly greater total length (range 25.7-30.0, mean 28.1 mm) than males (range 25.0-29.0, mean 27.4 mm). Width of abdominal segment 5 ranges from 7.0-9.3 mm in females and 8.0-9.2 mm in males. Mean width of both males and females 8.4 mm.

In the description following, measurements of the transforming specimen are given first and those of 10 typical exuviae including the transforming specimen are given in parentheses. Segment 4 of antenna usual nipple-like projection in this genus (Fig. 1b). Segment 3 of antennae 2.6× (2.0-2.6, mean 2.2) longer than wide, fringed with long hairs on sides, and with medial edge slightly concave. Labium not different in any definable way from those of related species (Fig. 1a). Lateral spines on abdominal segments 7-9 (Fig. 1c), but no trace of spine on segment 6. Lateral spines point straight rearward or may be slightly divergent, especially on 7. Length of lateral spine on 7 0.20 (0.13-0.20, mean 0.18) length of lateral margin of 7 including length of spine. Similarly, spines of 8 and 9 0.21 (0.16-0.28, mean 0.22) and 0.12 (0.12-0.28, mean 0.19) length of lateral margins of those segments respectively. Relative lengths of lateral spines were variable. Emerging specimen had $7=8>9$, but of other 9 exuviae measured, 4 had $7=8=9$, 3 had $7<8=9$, 1 had $7=8<9$, and 1 had $7<8>9$.) Dorsal hooks (Fig. 1d) on abdominal segments 2-9, tallest on 2, and gradually becoming reduced in height to near flatness on 9. All dorsal hooks slant rearward, and taller hooks on 2-3 or 4 excavated on rear edge in lateral view. Epiproct usually

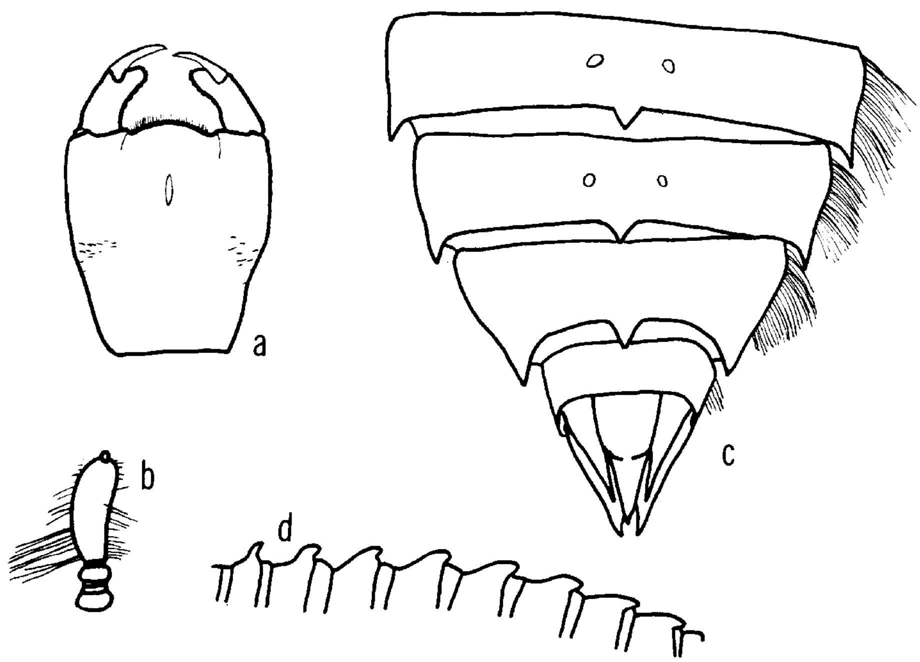

Fig. 1. Camera lucida drawings made from exuvia of emerged male *O. arizonicus*. a) prementum and palps of labium, dorsal view; b) left antenna, dorsal view; c) segments 7-10 of abdomen, dorsal view; d) dorsal hooks on the abdomen, lateral view.

slightly shorter than paraprocts (equal in 3 males and 2 females of all 35 exuviae). Ante-apical tubercles in all 16 male exuviae located very close to midpoint of epiproct and project slightly laterally. Epiproct basal width 0.60 (0.48-0.60, mean 0.53) of its length. Cerci 0.89 (0.76-0.89, mean 0.85) as long as epiproct with basal width 0.36 (0.23-0.41, mean 0.32) of their length. Width of abdominal segment 5 0.98 (0.86-1.04, mean 0.94) of mid-dorsal length of last 4 segments together with anal pyramid. Anal pyramid 0.84 (0.66-1.02, mean 0.87) of length of segments 9 and 10 combined. Segments 2-10 of abdomen have fringe of long white hairs laterally as shown in Fig. 1.

COMPARISON WITH OTHER SPECIES: The larva of *O. arizonicus* would key out with *O. severus* Hagen and *O. morrisoni* Selys in Needham and Westfall (1955). However, couplet 6 which differentiates the latter 2 species is reversed. In comparing the exuvia of an emerged female *severus* from Idaho with *arizonicus*, the only significant difference noted was the lower dorsal hooks in *severus*. The drawings of the dorsal hooks of *severus* in Walker (1933) and Kennedy (1917) also showed the hooks to be lower than in *arizonicus*. The hooks are variable, for Kennedy (1917) showed the hook on 2 blunt and the hooks on 3 and 4 smaller than Walker (1933). According to the drawings of *O. m. morrisoni* Selys and *O. m. nevadensis* Kennedy in Kennedy (1917) the dorsal hooks are taller, more slender, and less robust than in *arizonicus*.

Kennedy (1917) stated that *O.m. nevadensis* is "hardly as hairy" as *O. m. morrisoni* and may lack the lateral fringe of hairs on the abdomen. The photograph of *O. morrisoni* in Needham and Westfall (1955) shows that males have ante-apical tubercles 2/3 out from the base of the epiproct. Walker (1933) shows the ante-apical tubercles of *O. severus* positioned as in *O. arizonicus*. The first member of couplet 3 of the key in Walker (1958) reads "apex of epiproct of male extending not more than one-third of its length beyond the ante-apical tubercles" but apparently should read "apex of epiproct of male extending one-third or more of its length beyond the ante-apical tubercles". This change in the key would be necessary to properly lead to the other species further down the key, including *O. severus*.

In summary, it may be possible to tell male larvae of *O. arizonicus* from *O. morrisoni* by the position of the ante-apical tubercles. *O. m. nevadensis* can be differentiated by the reduced lateral abdominal fringe. Differentiation among the 3 species by the shape of the dorsal hooks is difficult and may not be reliable until more information is obtained on different populations.

Specimens of *O. arizonicus* including the emerged male, the 8 larvae, and several exuviae have been deposited in the Florida State Collection of Arthropods at Gainesville.

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Literature Cited

DUNKLE, S. W. 1975. New records of North American Anisopterous dragonflies. Fla. Ent. 58:117-9.

KENNEDY C. H. 1917. Notes on the life history and ecology of the dragonflies (Odonata) of central California and Nevada. Proc. U. S. Nat. Mus. 52:483-635.

NEEDHAM, J. G., AND M. J. WESTFALL, JR. 1955. A manual of the dragonflies of North America. Univ. of California Press, Loss Angeles. 615 p.

WALKER, E. M. 1933. The nymphs of the Canadian species of *Ophiogomphus*, Odonata, Gomphidae. Canad. Ent. 65:217-29. 1958. The Odonata of Canada and Alaska Vol. 2.

WALKER, E. M. 1958. The Odonata of Canada and Alaska. Vol. 2. Univ. Toronto Press, Toronto. XI + 318 p.

BOOK REVIEW

MECHANICAL DESIGN IN ORGANISMS. S. A. Wainwright, W. D. Biggs, J. D. Currey, J. M. Gosline. 1976. Halsted Press, N. Y., N. Y., $19.50. This book attempts to present an interface between mechanical engineering and biology by looking at mechanical function in organisms and their components and then correlating function with measurable mechanical properties and observed structure. The authors state in their preface that "the book is frankly evangelical" and that "we wish to modify biologist's view of the world and to impress upon them the importance of mechanical design in all aspects of biology". Unfortunately, their approach is about as successful as convincing Ralph Nader that the large business corporations have the safety of the American consumer as their prime concern.

This book has a number of useful and provocative concepts to present but was written for the individual trained in biophysics rather than the general or field biologist. For one thing, there are very few of us who have a working knowledge of mechanical engineering terminology, and so a good glossary at the back of the book would have been a great aid. I, personally, would have preferred a simple and more gradual introduction to the concepts of strength of materials than covering the subject as the authors did in 2 chapters. This can be very "heady" material for the non-engineer. The examples and discussions of biological organisms are interesting and very detailed with vertebrates where much more physical information is available. The authors do discuss the mechanical and structural properties of arthropod silks, resilin, chitin, and arthropod cuticle. I found chapter 7, "Support in Organisms" and chapter 8, "Ecological Mechanics" to be the best sections in the book primarily because they blended general principles with specific examples very well and presented a fine overview of the material. Chapter 8 points out the general ignorance on sensitivity and response of plants and animals to mechanical information in their environment and the requirements for extensive research in this area. The one major entomological mistake in the text is the use of the terms tendon and apodeme (p. 107-9) to mean the same thing.

This is not a text for the general entomologist, but the morphologist and physiologist may gain some sharp insights from the concepts presented.

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