

AN UNUSUAL MALE ANTENNAL SENSE ORGAN
IN THE ISOTOMIDAE¹DAVID L. WRAY²

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ABSTRACT

Complex antennal sense organs of males in the Collembola suborder Arthropleona are illustrated and described for the first time. In addition the species *Hydroisotoma schaefferi* (Krausbauer) is redescribed.

Literature on the insect order Collembola has long illustrated the presence of complex male antennal sense organs in the genus *Sminthurides* Börner. This genus belongs to the suborder Symphypleona Börner in which the body is globular in form and with indefinite body segmentation. Very little has been published concerning complex antennal sense organs in the suborder Arthropleona Börner in which the body is more or less elongated, as in the family Isotomidae. The purpose of this paper is to describe and illustrate the presence of male antennal sense organs in the species *Hydroisotoma schaefferi* (Krausbauer). This species occurs widely in Europe and in several localities in North America. Several years ago I examined a large population of *H. schaefferi* which was collected along a small stream in Oklahoma, and in which the male antennal sense organs were well developed on the 3rd and 4th antennal segments. Also, a redescription of *Hydroisotoma schaefferi* (Krausbauer) is given, and some of the important specific and generic characters are noted.

Stach (1947) described the genus *Hydroisotoma* based on the presence of a pair of dorsal bothriotrichae on the 4th abdominal segment, the dens being subcylindrical or about equal width throughout and without crenulations or tuberculations. The bothriotrichae are not ciliated or fringed in this genus, thereby separating it from the genus *Isotomurus*.

Hydroisotoma schaefferi (Krausbauer) Stach

Isotoma schaefferi Krausbauer, 1898; Schaeffer, 1900; Carl, 1901; Börner 1901; Krausbauer, 1902; *Isotoma rivularis* Latzel, 1921; *Archisotoma dimorpha* Denis, 1922; *Proisotoma schaefferi aculata* Stach, 1929; *Proisotoma* (*Proisotoma schaefferi* (Krausbauer) Folsom, 1937; *Hydroisotoma schaefferi* (Krausbauer) Stach, 1947; *Isotoma* (*Isotoma*) *schaefferi* (Krausbauer) Maynard, 1951.

DESCRIPTION

Color variable, with overall color greenish brown. Head lighter with a yellowish-green cast and with a large brownish green triangular area be-

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tween the eyespots and posterior to the antennal bases. Smaller brownish spots laterally. Antennae purplish green throughout. Broad dorsal, dark brownish-green stripe beginning on prothorax and extending over thorax and abdomen; stripe ends narrowly at posterior margin of 4th abdominal segment. Legs brownish-green. Furcula with greenish base, manubrium, and dens. Venter lighter greenish-yellow.

Length up to 2.3 mm. Antennae about 1.5 times length of head. Relative lengths of antennal segments 30:90:90:80. Antennal segments more or less cylindrical. Relative lengths of manubrium, dens, and mucro 140:150:35. Post-antennal organ $\frac{3}{4}$ diameter of adjacent eye, thick-walled, elliptical, situated very close to eye spot, which is dark in color. Third abdominal dorsum equal to length of 4th abdominal segment; sometimes 4th segment a little longer. Eight eyes on each side of head, in dark patches, subequal in size. Sometimes the 2 anterior eyes a little larger. Mouthparts mandibulate, with well developed molar surfaces (Fig. 11). Maxilla head toothed (Fig. 10). Labrum with 3 rows of heavy hairs, in rows as: 5, 5, 4 (Fig. 13). On the distal end of the 4th antennal segment is a somewhat bilobed sense organ and a submarginal bulb surrounded by many enlarged sensory hairs.

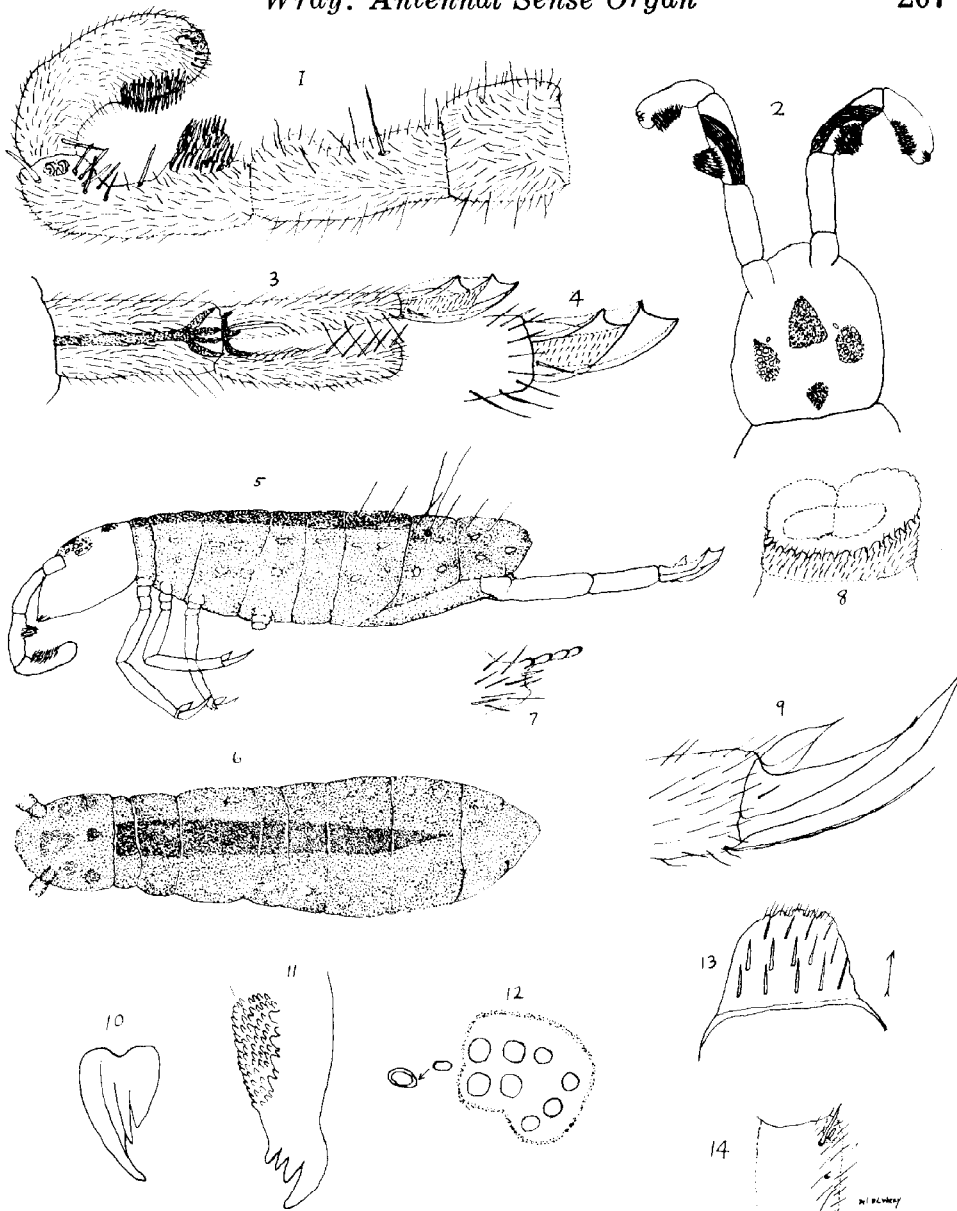
Legs greenish-purple and somewhat stout. End of tibia somewhat subcylindrical, not subsegmented. Abdomen gradually enlarged posteriorly. Genital and anal segments not fully ankylosed; except ventrolaterally, a slight demarcation is noted on each side. Furcula appended to 5th abdominal segment and reaches ventral tube. Furcula greenish in color, manubrium with numerous ventral, short setae, more so distally. Dentes stout, not tapering, and subcylindrical, apically rounded, dorsally not tuberculate or crenulate; with short, curved setae all over; mesally and distally with long setae which overlap (Fig. 3). Mucro stout, 3-toothed, and with 4 complex lamellae (Fig. 4). (See Folsom 1937, for complete description of the 4 complex lamellae).

Unguis long, thin, and slightly curved with a basal hair. Inner tooth (when present) is $\frac{3}{4}$ length of unguis on inner side (Fig. 9). Unguiculus broadly lamellate at base, ending spinately. One long unknobbed slender hair $\frac{3}{4}$ length of unguis represents the tenent hair. Rami of tenaculum 4-toothed and with 10-12 stout setae on corpus (Fig. 7). Ventral tube well developed with somewhat of a tuberculate area all around the end where many short hairs arise (Fig. 8).

Hairs on body stout, curved, numerous, intermingled with many long outstanding hairs which are more numerous posteriorly. On dorsum of 4th abdominal segment are a pair of long, thin, thread-like, unciliated bothriothrichae (Fig. 5) with smooth integument.

MALE ANTENNAL SENSE ORGANS

On the 3rd antennal segment is an enlarged sensory knob covered by 8 rows of enlarged sensory hairs. This sensory knob is near the proximal end of the antennal segment and is about $\frac{2}{3}$ as long as the width of the antennal segment. The enlarged sensory hairs cover the knob on all sides and up to apex (Fig. 1). On the 4th antennal segment there is a much wider field of sensory hairs which are constructed as those on 3rd segment, so that when the antenna is compressed the 2 areas meet. The sensory field on the 4th segment is situated only on 1 side of the antennal segment and always



EXPLANATION OF FIGURES

Fig. 1-14. *Hydroisotoma schaefferi* (Krausbauer). Fig. 1, whole antenna showing 3rd and 4th antennal sense organs; Fig. 2, head and antennae showing relative lengths of antennal segments to length of head; position of eye spots, and dark-colored spots on head; Fig. 3 & 4, furcula with relative lengths of joints, and enlarged view of mucro; Fig. 5, lateral view of entire body showing position of pair of unciliated bothriotrichae and outstanding long hairs on body; Fig. 6, dark dorsal stripe on body; Fig. 7, quadridentate tenaculum and basal hairs on corpus; Fig. 8, terminal end of ventral tube with corrugated appearance and surrounding hairs; Fig. 9, unguis, unguiculus, and long knobbed hair representing tenent hair; Fig. 10, maxilla head dentation; Fig. 11, mandible showing terminal teeth and mandibular chewing area; Fig. 12, eyes and post-antennal organ; Fig. 13, dorsal labral spines; Fig. 14, 3rd antennal ventral sensory peg.

is aligned with 3rd sensory knob (Fig. 1). Cleared specimens show a strongly developed strip of muscles on the outer side of the antennal segments to indicate that both 4th and 3rd antennal segments may be used to clasp the female when copulation is in progress (Fig. 2). Males with these sensory organs show antennal segments 3 and 4 bent nearly together. One can identify males by this characteristic pose in a vial, and discern them easily from females (Fig. 2). The bent antennal segments (3 and 4), and sensory fields show a complex development in the Isotomidae, which is significant inasmuch as such development has not been shown before in this suborder. The genus *Sminthurides* shows a highly complex development of antennal sense organs in the males. Figures 1 and 2 show the structures as seen in cleared specimens.

The sense organ of the 3rd antennal segment consists of 2 bent rods situated behind an integumental fold and an adjacent long sense hair (Fig. 1). There is a sense rod ventrally located on the 2nd antennal segment. The antennae are thickly covered with numerous bent hairs and some outstanding long sensory hairs (Fig. 1).

This species occurs in moist areas in debris, trash, under logs, along and at edges of streams and ponds. It has been noted during very cold temperatures when ice and snow cover most of the earth along wet areas. Specimens for these illustrations were collected by Bill Stark from leaf litter along a stream, Oklahoma, LeFlore County, 22-XII-1971, 5 miles west of Wister; also from Hurd Creek, Oklahoma, Pushmataha County, 14-II-1971. Other specimens showing male antennal sense organs are from Pennsylvania; Indiana, Wayne County, collected by John Hart, 25-X-; and North Carolina, Mitchell County, 3-I-1967, by A. H. Maxwell. They occurred in extremely large numbers (so-called swarming) along a small, cold mountain stream.

LITERATURE CITED

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