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A NEW SPECIES OF RHYNCHELMIS IN NORTH AMERICA*

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The worms described in this paper are part of a series of Oligochaeta obtained by Miss Bessie R. Green from the vicinity of Flathead Lake in Montana during the summer of 1914, while at the Biological Station maintained by the University of Montana. The *Rhynchelmis* specimens were collected in July by A. G. Vestal and M. J. Elrod, for whom the species is named, from a creek near the Station, and included several mature specimens and a number of immature ones.

But two species and a variety of *Rhynchelmis* have previously been known. *R. limosella* Hoffmeister is a common European species, and the Asiatic species *R. brachycephala* and its variety *bythia* have been somewhat recently made known by Michaelsen (1901 and 1905). We now describe a distinct but somewhat closely related species from North America.

A modification of the definition of the genus in a few characters is necessary, and a still closer relationship between *Rhynchelmis* and the North American genera *Sutroa* and *Eclipidrilus* becomes apparent.

RHYNCHELMIS HOFFMEISTER

Setae simple. Spermiducal pores paired on 10.† Oviducal pores paired in intersegmental groove 11/12. Spermathecal pores paired on 8. Longitudinal muscle layer completely separated into eight longitudinal bands. Transverse blood vessels, two pairs, in each of most somites. Spermaries and spermiducal funnels paired in 10, or two pairs in 9 and 10; sperm ducts, one or two pair, opening into a pair of long atria. Ovaries paired, in 11. Spermathecae paired, in 8, without diverticula opening into the spermathecal ducts, ampullae communicating with the alimentary tract.

* Contributions from the Zoological Laboratory of the University of Illinois, No. 106.

† Arabic numerals are used to designate the somites, counted from the anterior end.

RHYNCHELMIS ELRODI SP. NOV.

Length, 47-65 mm. Somites, 133-177. Proboscis long and slender. Setae closely paired. Clitellum on 9-17. Spermiducal, oviducal, and spermathecal pores nearly in seta line *ab*. Longitudinal muscle bands not spirally rolled at edges. Ventral vessel forked in 7, and connected with dorsal vessel in 1. First nephridia in 13. Spermaries paired, in 10. Spermiducal funnels, one pair; sperm ducts, one pair, imbedded in the walls of the atria. Albumen glands lacking. Spermathecae, one pair in 8; communicating by ducts with the alimentary tract.

From the mucky banks of a creek near the Biological Station at Flat-head Lake in western Montana.

Holotype and paratypes in the collection of the senior author (Cat. No. 1058).

The more important facts of structure were gained from the study of a series of sagittal sections of the 33 anterior somites of one specimen, and of two series of transverse sections from the anterior 18 somites of each of two other specimens, of which one is the type.

EXTERNAL CHARACTERS

Alcoholic specimens, apparently sexually mature, are 47-65 mm. in length, and 0.9-1.25 mm. in diameter in the region of the clitellum, where the diameter is greatest. In the anterior half of the worm the body is nearly circular in cross section, unlike other described species of *Rhynchelmis*, and elsewhere it is not decidedly quadrilateral. In one apparently complete specimen, the number of somites is but 133, while in another it is 177. The number of somites in other specimens varies between these extremes and approximates 150. The anterior part of the prostomium is prolonged into a slender tentacle-like proboscis. The setae are closely paired and the distances between the pairs are approximately indicated by the formula; $a\bar{a}^*:bc:dd = 3:5:5$. The setae are sigmoid, slightly more curved at the distal end, slender, and simple. The average length is about 0.27 mm., and the diameter at the nodulus is about 0.01 mm. The nodulus is at about one-third of the length of the seta from the distal end.

The clitellum is developed on 9-17 and encroaches slightly on the adjacent somites. It is most strongly thickened on 10-16, and is devel-

* Letters are used to designate the setae of either side of a somite, beginning with *a* for the most ventral one and proceeding in order to *d* for the most dorsal one.

oped ventrally as well as dorsally. The spermiducal pores are paired on 10, slightly anterior to 10/11, and nearly in line with the ventral setae. The oviducal pores are small, in 11/12, and in line with the ventral setae. The spermathecal pores are paired on 8, posterior to the ventral setae.

INTERNAL CHARACTERS

The brain lies dorsad of the mouth, in the first somite, and is similar in form to that of *R. limosella*, as figured by Vejdovský (1876). The ventral nerve cord is closely adherent to the body wall throughout its length. The layer of longitudinal muscle fibers is in eight distinct bands, as in other species of the genus, but the edges of these bands are not rolled as in *R. limosella* (Vejdovský, 1884, pl. 16, figs. 1 and 2), and in *R. brachycephala* and its variety, as described by Michaelsen (1905:62-63). The alimentary tract is simple in character, like that of the other species.

The ventral vessel forks in 7 and the two anterior branches unite near the brain with the dorsal vessel. A pair of transverse vessels in the posterior part of each of somites 2-6, connect the dorsal vessel with the branches of the ventral; and similar transverse vessels in 7-12, connect the dorsal and ventral vessels. In one specimen there is a similar vessel on one side of 13. The paired posterior transverse vessels of somites posterior to 12 are connected with the dorsal vessel only. They have a few caecal branches and often extend only part way down the sides of the body. There is a pair of transverse vessels in the anterior part of each of most somites posterior to 7. The first pair are somewhat shorter and more simple, but those of somites posterior to 8 extend to the ventral side and have several caecal branches. In the somites that have been examined, posterior to 12, each of these vessels is connected with the ventro-lateral wall of the intestine by a branch which extends obliquely dorsad and mesad from that part of the vessel lying in the ventro-lateral part of the body cavity. Ventro-intestinal vessels connect the ventral vessel with the ventro-median wall of the intestine (fig. 1). In somites 10 or 11 to 18 or 19 inclusive, these vessels, usually three in number, enter peculiar glandular bodies which are closely associated with the ventro-median wall of the intestine and correspond to the blutdrüsen described by Michaelsen (1901:178) in *R. brachycephala*. These blood glands (fig. 1) are more intimately united with the wall of the intestine in *R. elrodi* than are those of the other species.

In the specimens examined, the most anterior nephridia are in 13 or 14, and they are more or less irregularly distributed posteriorly. There are sometimes a pair in a somite, sometimes a single one, and often none at all. Just posterior to the septum which supports the nephridial funnel, there is an enlargement similar to that found in a considerable number of other species of lumbriculids. The nephridiopores are in the line of the ventral seta bundles and a short distance anterior to them.

There is but one pair of spermaries and they project freely into 10 from their attachment to the posterior face of 9/10. A pair of sperm sacs extend posteriorly on either side of the alimentary tract, from their openings in septum 10/11, at least as far as to somite 30, in some specimens. The spermiducal organs are similar in their main features to those of other species of the genus; but there is no trace of more than one pair of sperm ducts or spermiducal funnels, and those present belong to somite 10. The funnels are on 10/11, below and laterad of the openings of the sperm sacs, and the dorsal edges of the funnels extend into the sacs, along their ventral wall for a short distance. In tracing each sperm duct from the funnel towards the external pore, we have a relatively slender duct which extends posteriorly through several somites in the cavity of the corresponding sperm sac, to a position at which it enters the posterior end of a much larger and tubular atrium which extends anteriorly into 10 and then, bending ventrally, joins the body wall, posterior to the ventral setae, and opens to the exterior at the spermiducal pore. There is a general correspondence between the main features of the spermiducal organs, as outlined above, and those of the other species of the genus; but a more detailed study yields distinct differences, as will appear later. From the funnel the sperm duct first extends ventrad along the septum and then antieriad to the atrium which it follows closely to the place of their union. The duct and atrium are merely in contact in somite 10, but in the anterior part of the sperm sac the duct becomes more strongly flattened against the atrial wall, and about opposite 11/12, in the type specimen, it enters the tissue of the atrial wall (fig. 2, *sd*) and follows it to a point near the posterior end of the atrium, where duct and atrium merge and their cavities become continuous. This intimate relation of duct and atrium is more like the condition found in certain species of *Eclipidrilus* than it is like that of the other species of *Rhynchelmis*. In the type specimen the atrium extends posteriorly to 15, and in the other sectioned specimens not so far. Numerous small glandular masses

or prostate glands which are much like those of other species of the genus, are attached to the outer surface of the atrium (fig. 2, *pr*). The ectal ends of the atria are apparently protrusible and may function as penial organs. In somite 9, in other species of *Rhynchelmis*, there are organs, either one or a pair, which are known by various names: albumen glands, Kopulationsdrüsen, etc. There are no recognizable traces of such organs in *R. elrodi*.

There is but one pair of ovaries and these are in 11 and are attached to the septum 10/11. The paired ovisacs extend posteriorly from 11/12 and closely invest the corresponding sperm sacs except where ova prevent. They extend through several somites posteriad of the sperm sacs. Paired oviducal funnels are on the anterior face of the septum 11/12, and the very short oviducts open to the exterior in the segmental groove 11/12 in line with the ventral setae. Paired spermathecae in 8, correspond closely with those of the other species of the genus. They open to the exterior posteriad of the ventral seta bundles of 8; the ducts are without diverticula; and the ampullae open through narrowed duct-like portions into the alimentary tract. In one specimen the spermathecae have no connection with the alimentary tract and the diameter of the lumen is much less than normal. This is probably due to degeneration, since the spermaries are small and apparently at a stage of inactivity and yet the sperm sacs are well distended with sperm cells.

SYSTEMATIC RELATIONSHIPS

The new species has important characters that ally it closely with the Eurasian species of *Rhynchelmis*, and others in which it is nearly related to *Sutroa* (Beddard, 1892; Eisen, 1888, 1891) and *Eclipidrilus*. The simple pointed setae, and much elongated atria are characters shared by all of them. In having an intervening somite between the spermathecal and atrial somites; in the communication between the spermathecae and the alimentary tract; and in the lack of differentiation of each atrium into a "sperm reservoir" or "storage chamber" and a penial organ with narrowed connecting duct; it resembles the species of *Rhynchelmis* and *Sutroa* and differs from those of *Eclipidrilus* (Michaelsen, 1901:150; Smith, 1900:473). It is nearer to *Rhynchelmis* than to *Sutroa*, in having the spermathecae paired and without diverticula; but resembles the latter rather than the previously known species of the former, in having no atrial remnants (albumen glands) in somite 9. To the writers the rela-

tionships to *Rhynchelmis* seem more significant and they include it in that genus. One important difference between *Rhynchelmis* and *Sutroa* disappears when we find simple, paired spermathecae, and absence of atrial remnants in 9, characterizing the same species. It is interesting to note that the possibility of the existence of such a species of *Rhynchelmis* as *R. elrodi* has already been forecast by Michaelsen (1908:163).

“Ich bin in meinen Betrachtungen dieser Reduktionsverhältnisse dann noch einen Schritt weiter gegangen. Von *Rhynchelmis brachycephala* ausgehend, sagte ich mir, dass es kein morphologisch sehr bedeutsamer Vorgang sei, wenn nun die rudimentären, Samentrichterlosen Samenleiter des vorderen Paares und die verlassenen, ihrer Hauptfunktion enthobenen Atrien des vorderen Paares ganz schwänden. Es würde dann ein Zustand des männlichen Geschlechtsapparates eintreten, der mit dem ursprünglich einfachpaarigen Apparat durchaus übereinstimmte.”

In *R. limosella* (fig. 3) there are two pair of spermaries and spermiducal funnels in 9 and 10, and two pair of sperm ducts joining the paired atria of 10. In 9 there are paired organs resembling atria but without the atrial function since no sperm ducts are connected with them. They are the “albumen glands” and presumably represent an additional pair of atria which in ancestors were joined by the sperm ducts connected with the spermiducal funnels of 9. In *R. brachycephala* (fig. 4) and its variety *bythia*, the spermaries and spermiducal funnels of 9 have disappeared and there is a partial disappearance of the related pair of sperm ducts, while the atrial organs of 9 are still represented. In *R. elrodi* (fig. 5) there is a complete disappearance of the reproductive organs of 9, and we have simply the single pairs of spermaries, spermiducal funnels, sperm ducts, and atria in 10. We also have a single pair of ovaries and of oviducts which are in 11. The location of the single pair of spermathecae in *R. elrodi*, two somites anterior to the one containing the male organs, which would otherwise seem rather peculiar, is easily understood on the assumption that this species has been derived from ancestors similar to *R. limosella*. In accordance with the views of Michaelsen, these in turn were presumably derived from *Lamprodrilus*-like ancestors in which each pair of sperm ducts had its own pair of atria independent of others.

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EXPLANATION OF PLATE XVI

Fig. 1. *Rhynchelmis elrodi*. Transverse section through the posterior part of somite 17: int, intestine; bg, blood gland; vi, ventro-intestinal vessel; vv, ventral vessel; ss, sperm sacs.

Fig. 2. The same. Transverse section through the atrium near the place of entrance of the sperm duct: at, atrium; sd, sperm duct; pr, prostate glands; s, developing sperm cells. Semi-diagrammatic.

Fig. 3. *Rhynchelmis limosella*. Diagram showing relations of the reproductive organs of one side: sy, spermary; sd, sperm duct; at, atrium; al, albumen gland; oy, ovary; od, oviduct; st, spermatheca.

Fig. 4. *Rhynchelmis brachycephala*. Similar diagram: adapted from figure of Michaelsen (1901:179).

Fig. 5. *Rhynchelmis elrodi*. Similar diagram.



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