

CANADIAN TRANSLATION OF FISHERIES AND AQUATIC SCIENCES

No. 4872

Revision of the genus Monopylephorus Levinsen, 1883  
(Oligochaeta, Tubificidae)

by

N.P. Finogenova

**Original Title:** Reviziya roda Monopylephorus Levinsen, 1883  
(Oligochaeta, Tubificidae)

**From:** Zool. Zh. 61: 5-17, 1982.

Translated by the Translation Bureau (NDE)  
Multilingual Services Division  
Department of the Secretary of State of Canada

Department of Fisheries and Oceans  
Institute of Ocean Sciences  
Sidney, BC

1982

25 pages typescript

DEPARTMENT OF THE SECRETARY OF STATE  
TRANSLATION BUREAU  
MULTILINGUAL SERVICES  
DIVISION



SECRETARIAT D'ÉTAT  
BUREAU DES TRADUCTIONS  
DIVISION DES SERVICES  
MULTILINGUES

4

TRANSLATED FROM - TRADUCTION DE  
Russian

INTO - EN  
English

AUTHOR - AUTEUR  
N.P. Finogenova

TITLE IN ENGLISH - TITRE ANGLAIS  
Revision of the genus Monopylephorus Levinsen, 1883  
(Oligochaeta, Tubificidae)

TITLE IN FOREIGN LANGUAGE (TRANSLITERATE FOREIGN CHARACTERS)  
TITRE EN LANGUE ÉTRANGÈRE (TRANSCRIRE EN CARACTÈRES ROMAINS)  
Reviziya roda Monopylephorus Levinsen, 1883  
(Oligochaeta, Tubificidae)

REFERENCE IN FOREIGN LANGUAGE (NAME OF BOOK OR PUBLICATION) IN FULL. TRANSLITERATE FOREIGN CHARACTERS.  
RÉFÉRENCE EN LANGUE ÉTRANGÈRE (NOM DU LIVRE OU PUBLICATION), AU COMPLET, TRANSCRIRE EN CARACTÈRES ROMAINS.

Zoologicheskii zhurnal

REFERENCE IN ENGLISH - RÉFÉRENCE EN ANGLAIS

Zoological Journal

| PUBLISHER - ÉDITEUR                         | DATE OF PUBLICATION<br>DATE DE PUBLICATION |        |                     | PAGE NUMBERS IN ORIGINAL<br>NUMÉROS DES PAGES DANS<br>L'ORIGINAL |
|---|--|--------|---------------------|--|
|   | YEAR<br>ANNÉE                              | VOLUME | ISSUE NO.<br>NUMÉRO | NUMBER OF TYPED PAGES<br>NOMBRE DE PAGES<br>DACTYLOGRAPHIÉES     |
| "Nauka" publishing house                    |  |        |                     | 5-17   |
| PLACE OF PUBLICATION<br>LIEU DE PUBLICATION |  |        |                     |  |
| Moscow, USSR                                | 1982                                       | 61     | 1                   | 25   |

REQUESTING DEPARTMENT  
MINISTÈRE-CLIENT DFO

TRANSLATION BUREAU NO.  
NOTRE DOSSIER N° 1035834

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| Client's No.—N° du client          | Department — Ministère<br><br>D F O | Division/Branch — Division/Direction<br><br>S.I.P.B.     | City — Ville<br><br>Sidney, B.C. |
| Bureau No.—N° du bureau<br>1035834 | Language — Langue<br>Russian        | Translator (Initials) — Traducteur (Initiales)<br>N. De. | 'AUG<br>AOUT 13 1982             |

Zoologicheskii zhurnal, 1982, v. 61, No. 1, p. 5-17

(5)\*

UDC 595.142.3(262.781)

Revision of the genus *Monopylephorus* Levinsen, 1883

(*Oligochaeta*, *Tubificidae*)

by N.P. Finogenova

The genus *Monopylephorus* Levinsen, 1883 is divided into the following three: *Monopylephorus* Levinsen, 1883, *Rhizodrilus* Smith 1900 and *Peristerodrilus* gen. n. This paper presents diagnoses of the genera, their size and diagnoses of the species. The genus *Monopylephorus* consists of four species, i.e. *M. rubroniveus* Levinsen (with the subspecies *rubroniveus*, *glaber*, *kermadecensis*, *ponticus*, *corderoi*, *iturupi* subsp. n.), *M. irroratus* (Verrill, 1883) (with the subspecies *irroratus*, *trichochaetus*, *aucklandicus*, *orientalis* subsp. n.), *M. limosus* (Hatai, 1898), *M. parvus* Ditlevsen, 1904; the genus *Rhizodrilus* consists of three species, *Rh. lacteus* Smith, 1900, *Rh. africanus* (Mich., 1913), *Rh. pacificus* (Brinkhurst and Baker, 1979) (with subspecies *pacificus* and *kurilensis* subsp. n.), and the genus *Peristerodrilus* consists of a single species, *P. montanus* (Hrabě, 1962).

In the material from the Kurile Islands, I discovered species which should have been assigned to the genus *Monopylephorus*. However, a study of their morphology and extensive data on *Monopylephorus* prompted me to revise this genus.

The synonymy of *Monopylephorus* is complicated and involved, and so the opinions regarding the use of this name differ. Levinsen, who first introduced this name for the brackish-water species *M. rubroniveus* found off the shores of Denmark (Levinsen, 1883), gave a description which

\*The numbers in the right-hand margin are the pages of the Russian text - translator

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was too laconic and inaccurate. The name *Vermiculus*, which had been given to a species morphologically similar to Levinsen's (Goodrich, 1892), was already taken. Therefore, Michaelsen (1900), who did not recognize the existence of *Monopylephorus rubroniveus* Levinsen, suggested that this genus be named *Rhizodrilus*, for he considered that *Rh. lacteus*, which had been described by Smith (1900), belonged to this genus. In the years that followed, some authors preferred to use Levinsen's name *Monopylephorus*, while others preferred the name *Rhizodrilus*. At the same time, numerous researchers expressed an assumption regarding the heterogeneity of this genus, as well as doubts regarding the validity of certain species. For instance, in contrast to Michaelsen, Nomura (1915) suggested that *Monopylephorus* and *Rhizodrilus* be regarded as separate genera. Chen (1940) said that it was necessary to revise the genus (11 species were known by then); he doubted that *Rh. lacteus* and *Rh. aucklandicus* Benham belonged to the genus *Monopylephorus*, and considered that *M. glaber* was a possible synonym of *M. pilosus* (Goodrich), *M. fluvialtilis* (Ferr.) was a synonym of *M. rubroniveus*, and *M. trichochaetus* (Ditl.) a synonym of *M. glotini* (Ferr.). Marcus (1949) did not agree that species with hairlike setae (*M. irroratus*, *M. trichochaetus*, etc.) or *M. africanus* Mich. and *M. aucklandicus* should be placed in the genus *Monopylephorus*. Hrabě (1962) compiled a synoptic table for this genus, in which he included all the known species with the exception of *M. rubroniveus* which he did not recognize. Chekanovskaya (1972) augmented this list with *M. ponticus* (Hr.) which was described later, and provisionally included in *Monopylephorus* the genus *Jolydrilus* with its only species *J. jaulus* Marcus, 1965.

At the same time, she wrote that *Monopylephorus* represented a collection of several related genera, and that further investigations would perhaps provide grounds for dividing it into *Monopylephorus*, (6)  
*Rhizodrilus* and *Jolydrilus*. After revising this genus, Brinkhurst (Brinkhurst, 1963; Brinkhurst, Jamieson, 1971) left only six species in it, making all the others synonyms of the species recognized by him and classifying *M. africanus* as sp. inquirendae. The most recently described species are *M. frigidus* (Brinkhurst, Jamieson, 1971), *M. pacificus* and *M. longisetosus* (Brinkhurst, Baker, 1979).

I think it would be advisable to divide this genus into three, i.e. *Monopylephorus* proper, *Rhizodrilus* and *Peristerodrilus* gen. n. Furthermore, having no additional data on *Jolydrilus jaulus*, I have left this species in its initial status, i.e. a separate genus. I do not regard *M. frigidus* and *M. longisetosus* as sp. inquirenda. Their description is very brief and does not take in the complex of characters of any of these genera. In addition, an unusual type of hairlike penial setae which are very rare in oligochaetes and a different form of the male gonoduct (an expansion in the form of a chamber in the distal part) are noted for *M. longisetosus*, and no prostatic cells are depicted in the fairly detailed drawing of the male gonoduct of *M. frigidus* (only epithelial cells are shown).

The three genera which I have indicated belong to the subfamily Rhyacodrilinae Hrabě, and so they are characterized by the presence of large coelomocytes in the body cavity and the absence of spermatozeugmata.

*Monopylephorus* Levinsen, 1883

Levinsen, 1883: 9; Goodrich, 1892: 474 (*Vermiculus*); Michaelsen, 1900: 523; 1927: 14 (*Rhizodrilus*); Stephenson, 1930: 752 (*Rhizodrilus*); Chekanovskaya, 1962: 286; Hrabě, 1962: 335 (*Rhizodrilus*); Brinkhurst, Jamieson, 1971: 555.

The setae are bifid, in some segments monodont, may be hairlike in dorsal bundles. There are no penial setae. The circular vessels in the preclitellar segments branch, forming an integumentary flexus. The nephridia have a saccular, **enchytraeid**-type postseptale. The vasa deferentia are rudimentary or very short. The atria are long, tubular and consist of three parts, i.e. an ental ciliated one covered with prostatic cells (the longest part), a middle part which is also ciliated but without prostatic cells, and a voluminous, cylindrical ectal part which forms the pseudopenis. The male genital apertures are observed as two individual pores in segment XI; in the majority of species, they open into an unpaired copulatory sac which occupies a median position on the ventral side of the body. The atria in the terminal part sometimes coalesce and open in a single aperture. The oviducts and female genital apertures are paired, and are found in the intersegmental furrow of dissepiment 11/12. Two (rarely one) spermathecae open behind dissepiment 9/10 in segment X in the form of two pores, frequently into a common cavity of the body wall; their ducts sometimes coalesce and form a single excretory pore.

The species of this genus are distinguished by a high degree of variability. Furthermore, the morphological characters of the reproductive organs depend on the degree of sexual maturity. For instance, immature specimens of *Vermiculus pilosus* do not have a

well-defined copulatory sac; the spermathecae open separately from each other, and only later do the pores come together in a single pore (Goodrich, 1895). We also observe very significant changes in such parameters as the height and degree of development of the prostatic cells, the length and width of the different parts of the atrium, and the nature of the flexures of the atrial tube. I am not discussing here the position in the genus *Monopylephorus* of the two old species *Vermiculus glotini* and *V. fluviatilis* which were described at the end of the past century (Ferronniere, 1899). This question can be solved only by a more detailed study of type material. *V. glotini* may prove to be identical to *M. rubroniveus*, as believed by Brinkhurst and Jamieson (1971).

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*Monopylephorus rubroniveus* Levinsen, 1883

Levinsen, 1883: 9; Goodrich, 1892: 474, fig. 1-2; 1895: 253, pl. 26, fig. I-II; pl. 27, fig. 12-24; pl. 28, fig. 25-32 (*Vermiculus pilosus*); Michaelsen, 1900: 523; 1927: 14, fig. 15-16 (*Rhizodrilus pilosus*); Moore, 1905: 378, pl. 32, fig. 1-6 (*M. glaber*); Benham, 1915: 180, fig. 8-10 (*Rhizodrilus kermadecensis*); Chen, 1940: 86; Marcus, 1949: 1, fig. 1-6 (*M. corderoi*); Chekanovskaya, 1962: 287; 1972: 11; Brinkhurst, 1965: 147, fig. 9, A-D; Hrabě, 1967: 332, fig. 1-12 (*Rhizodrilus ponticus*); Brinkhurst, Jamieson, 1971: 556, fig. 8.35.E.

The setae are bifid, the upper tooth is thinner and slightly longer than the lower one, sometimes the teeth are equal. There are 3-6 setae in a preclitellar bundle, and 1-3 setae in the posterior segments. The chloragogue tissue begins from segments IV-VI. The coelomocytes are  $8-12 \mu^1$  in diameter. The vasa deferentia are rudimentary. The atria open into an unpaired copulatory sac. The spermathecae open into a common sulcus, in the form of two closely spaced pores or a single median pore. The copulatory sac and the

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<sup>1</sup>All the measurements in this paper (except for body length) are given in micrometers.

sulcus containing the spermathecal pores are not developed in immature specimens. The body is 10-60 mm long and consists of 48-86 segments.

I regard this species as consisting of several subspecies; *M. r. rubroniveus* Levinsen - Denmark, Great Britain; *M. r. glaber* Moore - North America; *M. r. kermadecensis* Benham - Australia; *M. r. ponticus* Hrabě - Black Sea; *M. r. corderoi* Marcus - Montevideo Bay; *M. r. iturupi* subsp. n. - Iturup Island. The differences between them are shown in table 1. I must say that I have never encountered in our material or in the literature any mention of a cuticular process in the penial part of the atrial tube, which has been depicted for this species by Brinkhurst and Jamieson (1971). The sensory cuticular hairs which have been noted for some subspecies are apparently noticeable in live material, and are possibly retained with certain fixation techniques.

*Monopylephorus rubroniveus iturupi* Finogenova, subsp. n.  
(Fig. 1, A)

**M a t e r i a l.** Holotype No. 1/45289 (a series of anatomical sections)<sup>2</sup>, paratypes No. 2/45290-4/45292 (fragments) - Kurile Islands, Iturup Island, Bay of Whales\*, profile 10, sample 6, middle horizon of littoral, under boulders on pebble, 7 July 1967. Four specimens (fragments) also from the Bay of Whales, profile 1, sample 2, upper horizon of littoral, pebbly bottom, 29 June 1967 (V.N. Ivanova).

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<sup>2</sup>All the type specimens are stored at the Zoological Institute of the USSR Academy of Sciences.

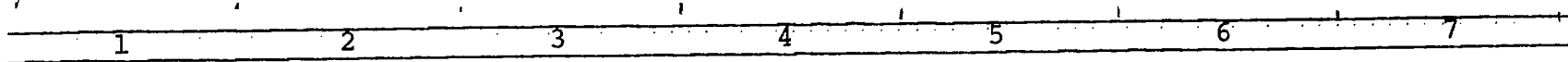
\*Zaliv kitovyi can also be translated as Whale Sound - translator

Table 1

Comparison of the subspecies of *Monopylephorus rubroniveus*

| Characters                                    | <i>M. r. rubroniveus</i>                      | <i>M. r. glaber</i>            | <i>M. r. kerma-<br/>madecensis</i>       | <i>M. r. pon-<br/>ticus</i>    | <i>M. r. cor-<br/>deroi</i>                  | <i>M. r. itu-<br/>rupi</i>                                    |
|---|---|--------------------------------|--|--------------------------------|--|---|
| Body length                                   | 40-60 mm                                      | 25-40 mm                       | 40 mm                                    | 12 mm                          | 10-11 mm                                     | 11 mm   |
| No. of seg-<br>ments                          | ?   | 67-74                          | ?  | 86                             | 48-67  | ?   |
| Form of setae                                 | Upper tooth longer and thinner than lower one |                                |  |                                | Teeth equal                                  | Upper tooth longer and thinner than lower one, or teeth equal |
| No. of setae<br>in bundle                     | 2-5, usually 3                                | 4-6, in posterior segments 1-3 | 4-6, in posterior segments 2-3           | 2-4, in posterior segments 1-3 | 4-6, in posterior segments 2-3               | 3-5, in posterior segments 2-3                                |
| Sensory hairs                                 | Cover entire body                             | In middle of each segment      | none                                     | none                           | none   | none  |
| Chloragogue tissue                            | From segment V                                | From segment IV or V           | ?  | From segment VI                | From segment V                               | From segment VI   |
| Form of efferent duct of nephridium           | Same width throughout                         | Same width throughout          | ?  | Narrows distally               | ?  | Narrows distally  |
| Length of atrium covered with prostatic cells | ~1/2 of entire length of atrium               | ?                              | Possibly >1/2 of entire length of atrium | ?                              | 400 $\mu$ or ~1/2 of entire length of atrium | ~275-300 $\mu$ or 1/2 of entire length of atrium              |
| Length of penial part of atrium               | ?   | ?                              | Possibly smaller than in other species   | 250 $\mu$                      | 250 $\mu$                                    | 250 $\mu$   |

(continued on next page)



|   |   |                    |                      |                      |                                      |  |
|---|---|--------------------|----------------------|----------------------|--------------------------------------|--|
| Narrowing of atrium at point where it passes into penial part | absent  | absent             | absent               | absent               | present                              | present  |
| Wall of penial part of atrium                                 | Epithelial cells of varying height form an uneven surface |                    |                      |                      | Smooth surface (Marcus, 1949)        | Epithelial cells of varying height form an uneven surface                                    |
| Spermathecal pores  | 2, in more mature specimens 1 common pore                 | 2 or 1 common pore | 2 in a common recess | 2 in a common recess | 2 spaced 50-60 $\mu$ from each other | 2 spaced 50-60 $\mu$ from each other, in more mature specimens in a barely noticeable sulcus |

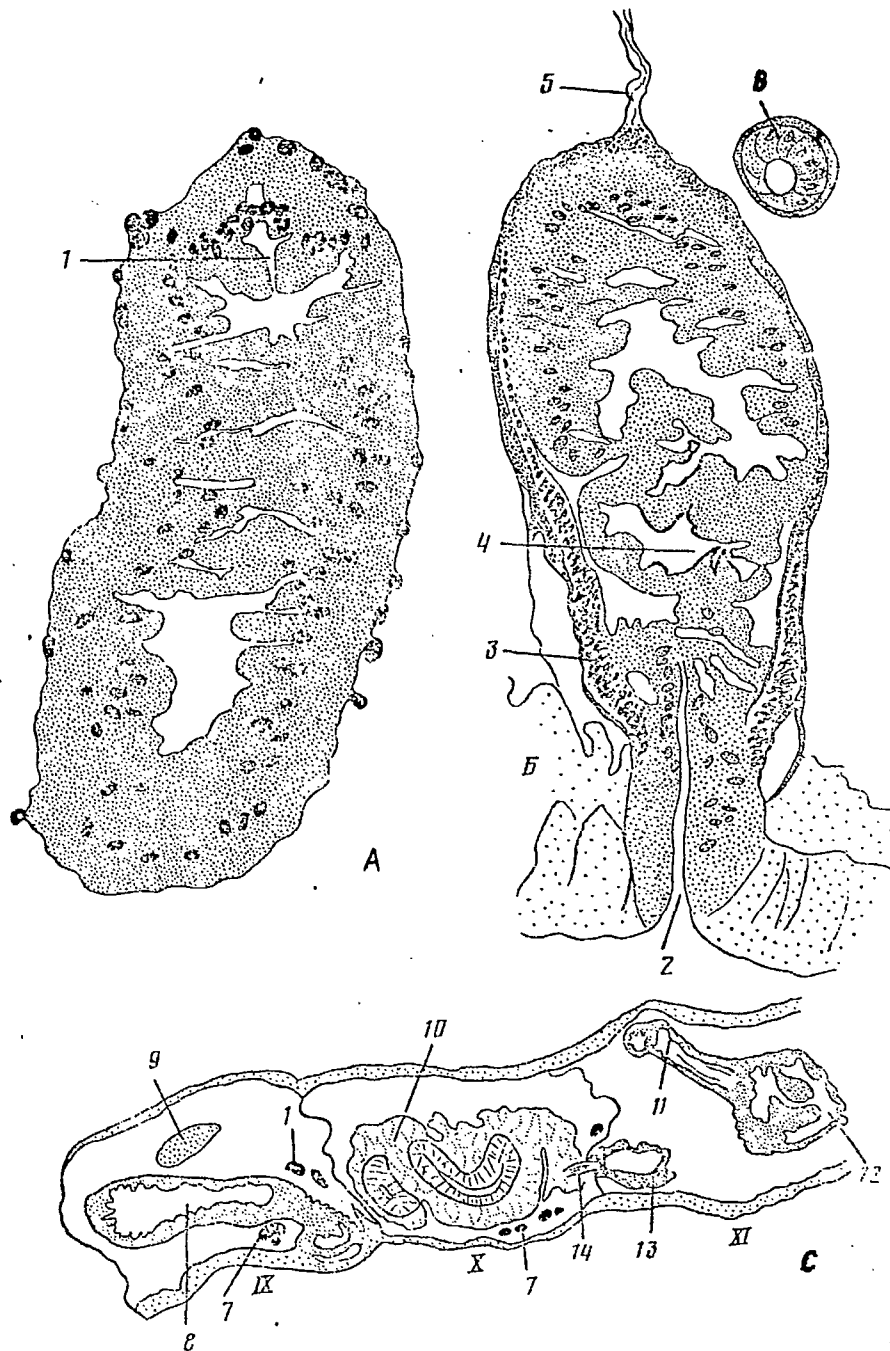


Fig. 1. Structural details of the reproductive organs of *Monopylephorus rubroniveus iturupi* subsp. n. (A), *M. irroratus orientalis* subsp. n. (B) and *Rhizodrillus pacificus kurilensis* subsp. n. (C): A, B - sections in region of pseudopenis; C - section in region of genital segments; 1 - ental part, narrowing of lumen; 2 - male genital aperture; 3 - muscles; 4 - spine-like chitinous processes; 5 - muscular band; 6 - section through ectal part of atrial tube; 7 - vessels; 8 - spermatheca; 9 - setal tubular gland; 10 - ental part of atrium with prostatic tissue; 11 - ectal part of atrium; 12 - pseudopenis; 13 - ovary; 14 - vas deferens; Roman numerals - segment numbers

**D e s c r i p t i o n.** There are 3-5 setae in the preclitellar bundles, and 2-3 setae in the postclitellar bundles. The upper tooth of the setae is slightly longer than the lower one or equal to it. The pharyngeal glands are found in segments IV-VI, and the chloragogue cells begin from segment VI. The wall of the coelom is covered with peritoneal tissue. The nephridia are found in segments VII, IX, XII and the ones after that, frequently on one side. The efferent duct of the nephridia is not contorted; it narrows distally (25  $\mu$  wide in its proximal part and 10  $\mu$  wide in its distal part), and has a perceptible lumen (2.5  $\mu$  in diameter). The clitellum occupies segments 1/2:IX - XII. Dimensions of male gonoduct: diameter of vas deferens - 15  $\mu$ , ental part of atrium - 20-23  $\mu$  wide (without prostatic cells), 80  $\mu$  wide with poststatic cells,  $\sim$ 275-300 long; middle part of atrium - 35  $\mu$  wide, 100  $\mu$  long; penial part of atrium - 60  $\mu$  wide,  $\sim$ 200  $\mu$  long. The atrial tube narrows at the point where it passes into the penial part (Fig. 1, A). The distance between the spermathecal pores is 55  $\mu$ . In fairly mature worms, there is a weakly perceptible sulcus in the body wall at the site of the spermathecal pores. The body length of an almost whole worm is 11 mm.

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*Monopylephorus irroratus* (Verrill, 1873)

Verrill, 1873: 324 (*Clitellio irrorata*); Ditlevsen, 1904: 421, fig. 21-23 (*M. trichochaetus*); Moore, 1905: 384, pl. 32, fig. 7-11 (*Tubifex irroratus*); Benham, 1909: 258, pl. 10, fig. 2-7 (*Rhizodrilus aucklandicus*); Boldt, 1926: 177, fig. 1-3 (*Postiodrilus sonderi*); Chen, 1940: 96 (*Littodrilus aucklandicus*); Hrabe, 1962: 343 (*Rhizodrilus irroratus*); *Rh. sonderi*, *Rh. aucklandicus*, *Rh. trichochaetus*, Brinkhurst, 1965: 147, fig. 9F.1; Brinkhurst, Jamieson, 1971: 559, fig. 8.34; Chekanovskaya, 1972: 11 (*M. trichchaetus*, *M. irroratus*, *M. aucklandicus*, *M. sonderi*).

The setae in the dorsal bundles are hairlike, of a distinctive form (with a vibrating end) and bifid; the upper<sup>t</sup> tooth is longer than the lower one, but sometimes equal to it; the upper tooth of the bifid setae in the ventral bundles is longer than the lower one, or sometimes equal to it. There are 0-3 hairlike setae in a pre-clitellare bundle, and 0-1 in the posterior segments; there are 2-4 forked setae in the dorsal preclitellar bundles, and 1-3 in the posterior segments. There are 3-5 setae in the ventral preclitellar bundles, and 1-3 in the posterior segments. The vasa deferentia are very short. The degree of development of the atria and prostatic cells depends on the stage of sexual maturity. The pseudopenises have a thin chitinous sheath, sometimes with spine-like processes; the sheath is not always developed. The male genital apertures and the spermathecal pores are paired. This species has no copulatory sac. The body is 15-30 (up to 60) mm long and consists of 70-90 segments.

I distinguish the following subspecies in this species: *M. i. irroratus* (Verrill) - Atlantic coast of North America; *M. i. trichochaetus* Ditlevsen (including *M. trichochaetus* and *P. sonderi*) - Denmark, Central Europe; *M. i. aucklandicus* Benham - Subantarctic Region; *M. i. orientalis* subsp. n. - Alaska (*M. irroratus* according to Brinkhurst, Jamieson, 1971), Kurile Islands, Iturup Island. The differences between the subspecies are given in table 2. There was no mention of hairlike setae in the first description of *Rh. aucklandicus* (now *M. i. aucklandicus*), but they were later detected during a revision of type material (Brinkhurst, Jamieson, 1971).

Table 2

A comparison of the subspecies of *Monopylephorus irroratus*

| Characters                           | <i>M. i. irroratus</i>          |                       | <i>M. i. orientalis</i>               |                      | <i>M. i. aucklandicus</i><br>Benham,<br>1909 | <i>M. i. trichochaetus</i> |                    |
|--------------------------------------|---------------------------------|-----------------------|---------------------------------------|----------------------|--|----------------------------|--------------------|
|                                      | Moore,<br>1905                  | Brinkhurst,<br>1965   | Brinkhurst,<br>Jamieson,<br>1971      | our data             |  | Boldt,<br>1926             | Ditlevsen,<br>1904 |
| Body length                          | 30 mm                           | 15-17 (30)<br>mm      | 15-35 mm                              | 14-15 mm             | 29 mm  | 35 mm                      | ?                  |
| No. of segments                      | 90                              | 70-90                 | 70-90                                 | 74                   | 80   | ?                          | ?                  |
| No. of hairlike setae                | 1-2,<br>rarely 3,<br>1 behind   | 1-2(3),<br>1 behind   | 1-2                                   | 0-1                  | ?  | 1-2                        | 2                  |
| No. of bifid setae in dorsal bundles | 2-3,<br>rarely 4,<br>1-2 behind | 2-3(4),<br>1-2 behind | Up to 4                               | 2-4,<br>3 behind     | 3, 4, 1-2<br>behind<br>(teeth equal)         | 2-3                        | 2-3                |
| No. of setae in ventral bundles      | 3, 1-2 behind                   |                       | 3, rarely<br>up to 7,<br>fewer behind | 3-5, 3<br>behind     | 3-4(5),<br>1-2 behind                        | 4-5,<br>2 behind           | 3-4                |
| Chitinous sheath of pseudopenis      | Thin,<br>distinct               | Thin                  | Thin, with<br>spines                  | Thin, with<br>spines | Not indicated                                |                            |                    |

For *P. sonderi* (now *M. i. trichochaetus*), Boldt (1926) indicated two penial setae (in form similar to ordinary setae) in segment XI. In all probability, the author was dealing with not quite mature specimens, and therefore the clitellum, as he noted, was poorly developed. Apparently, this is why the layer of prostatic cells is so thin (as depicted by Boldt in Fig. 3), and the ventral setae of segment XI are not penial, but have the form of an ordinary bundle.

*Monopylephorus irrotatus orientalis* Finogenova, subsp. n.  
(Fig. 1, B)

**M a t e r i a l.** Holotype No. 1/45293 (a series of anatomical sections), paratypes No. 2/45294-8/45300, Kurile Islands, Iturup Island, Kasatka Bay, Burevestnik settlement, boulder and pebble littoral, middle horizon, July 1969. Also 49 specimens from Iturup Island, Bay of Whales, profile I, sample 2, upper horizon of littoral, pebbly bottom, 29 June 1967, 2 specimens - profile 10, sample 6, middle horizon of littoral, under boulders on pebble, 7 July 1967 (Ivanova).

**D e s c r i p t i o n.** There are 0-1 hairlike and 2-4 bifid setae in the dorsal preclitellar bundles, and 0-1 hairlike and 3 bifid setae in the postclitellar bundles. The ventral preclitellar bundles consist of 3-5 (mostly 4) bifid setae, and the postclitellar ones consist of 3 bifid setae. The upper tooth of the forked setae is longer than the lower one. The pharyngeal glands are found in segments IV-VI, and the chloragogue tissue begins from segment VI. Nephridia are found in segments VII, VIII, XIV and the ones after that, or in the form of an individual variation in segments VIII,

IX, XIII and the ones following. The efferent duct of the nephridium has the same thickness throughout. The clitellum occupies segments X - 1/2 XIII. The atrium of fully mature specimens has deep N-shaped flexures (atrium weakly flexed in immature specimens).<sup>(12)</sup> The middle and distal part of the pseudopenis are covered with a chitinous sheath with spine-like processes (Fig. 1, B). Dimensions of male gonoduct: length of vas deferens - 40-50  $\mu$ ; ental part of atrium (with prostatic cells) - 150  $\mu$  wide, 350  $\mu$  long; middle part of atrium - 40  $\mu$  wide,  $\sim$ 150  $\mu$  long; penial part - 130  $\mu$  wide, 275  $\mu$  long. The body is 14-15 mm long and consists of 74 segments.

We should also mention that this species has been encountered in Africa (Brinkhurst, 1966), but the description of this form is too brief; true, it has been noted that the pseudopenis is covered with a very weakly developed, thin cuticular sheath, or has no sheath at all.

*Monopylephorus parvus* Ditlevsen, 1904

Ditlevsen, 1904: 427, pl. 16, fig. 25-26; Moore, 1905: 383, pl. 33, fig. 29-34; Stephenson, 1917: 485, fig. 1; Brinkhurst, 1965: 147, fig. 9e; 1966: 149; Brinkhurst, Jamieson, 1971: 557; Marcus, 1965: 75, fig. 25, 26; Chekanovskaya, 1972: 11.

The setae in the anterior segments are bifid, the upper tooth is slightly longer than the lower one or equal to it; the upper tooth is reduced in the postclitellar bundles; the setae are monodont in the posterior and sometimes middle parts of the body. There are 3-5 setae in the preclitellar bundles, and 2-4 setae in the postclitellar ones. The coelomocytes measure 5-12  $\mu$  in diameter. The nephridia have a very long and narrow nephrostomal lip. The vas deferens is rudimentary. The atria coalesce in the terminal part, forming a single opening, or they do not coalesce and

open in the form of two pores into a copulatory sac. One spermatheca opens medially in segment X behind dissepiment 9/10. The body is 8-15 mm long and consists of 38-64 segments.

In specimens described from different places, we observe variations in the form and ratio of forked and monodont setae, as well as the place where the bundles containing monodont setae begin. The specimens from North America (Moore, 1905), India (Stephenson, 1917) and Africa (Brinkhurst, 1966) are characterized by the coalescence of the atrial tubes into a single one; the atria do not coalesce in the specimens described from Denmark (Ditlevsen, 1904) and Brazil (Marchus, 1965). As we have already mentioned, this character may depend on the degree of sexual maturity.

*Monopylephorus limosus* (Hatai, 1898)

Hatai, 1898: 103, fig. 1-5 (*Vermiculus*); Nomura, 1915: I, fig. 1-30; Chen, 1940: 83, fig. 25, 26; Chekanovskaya, 1962: 288, fig. 182; 1972: 11; Hrabě, 1962: 344 (*Rhizodrilus*); Brinkhurst, Jamieson, 1971: 558, fig. 8.34.H.

The setae in the ventral bundles are monodont in segment II, and bifid in all the other segments; the upper tooth is shorter than the lower one. There are 3-5 (rarely 6) setae in the preclitellar bundles, and 1-3 setae in the postclitellar ones. The coelomocytes measure 5-6  $\mu$  in diameter. The efferent duct of the nephridium extends from the anterior part of the nephridium. The vas deferens is short (170  $\mu$ ); the atria open into an unpaired copulatory sac. The efferent ducts of the spermathecae coalesce into a single tube. The body is 15-70 mm long and consists of 68-150 segments.

This species is known from Japan and China. The specimens from China are distinguished from the Japanese ones by a smaller size (body length 15-40 mm, number of segments 68-96) and by a

somewhat smaller number of setae in a bundle (not more than 5, usually 3-4). Among the Japanese specimens, the chloragogue tissue begins from either the 5th or 6th segment.

(13)

*Rhizodrilus* Smith, 1900

Smith, 1900: 444, pl. 39, fig. 4, 5; pl. 40, fig. 6-8.

The setae are bifid. Modified genital setae are present, i.e. spermathecal setae in segments IX or IX, X (sometimes absent), and penial setae in segment XI. The circular vessels in the anterior segments connect the dorsal and ventral vessels without forming an integumentary flexus. The nephridia are tubificid in type (according to the description, possibly enchytraeid). The vasa deferentia are comparatively long (but usually shorter than the atria) and narrow, and they fall into the atria subapically (apically in *Rh. lacteus*). The atria are tubular, without cilia and much wider than the vasa deferentia, especially in the ental part where they have thickened walls and a thick sheath consisting of groups of prostatic cells. In the ectal, narrow part, the atria without prostatic cells end in pseudopenises which open into a large unpaired copulatory sac in segment XI. Large male gonoducts usually occupy not only segment XI, but segment X as well (except in *Rh. lacteus*). The spermathecae open in the form of 2 pores at dissepiment 9/10 in segment IX or X. Some species have large tubular glands which are connected with the spermathecal setae.

*Rhizodrilus lacteus* Smith, 1900

Smith, 1900: 444, pl. 39, fig. 4, 5; pl. 40, fig. 6-8; Michaelsen, 1900: 523; Hrabě, 1962: 343; Brinkhurst, 1965: 148, fig. 9 J-K (*Monopylephorus*); Brinkhurst, Jamieson, 1971: 559 (*Monopylephorus*); Chekanovskaya, 1972: 11 (*Monopylephorus*).

There are 5-6 preclitellar setae, 4 postclitellar ones and 1-3 in the posterior segments. Spermathecal setae are found in segments IX or IX, X, and 4-6 spatulate penial setae are found in segment XI. Septal glands are present in segments IV-V. The nephridia begin from segment VIII, frequently on one side in the anterior segments. The vasa deferentia are much shorter than the atria. The spermathecae open in segment X. Large tubular glands connected with spermathecal setae are present. The body is 70-100 mm long and consists of 215-305 segments.

*Rhizodrilus africanus* (Michaelsen, 1913)

Michaelsen, 1913: 143, fig. 1 (*Monopylephorus*); Hrabě, 1962: 343; Brinkhurst, 1966: 149 (*Monopylephorus*); Brinkhurst, Jamieson, 1971: 561 (*Monopylephorus*, sp. inquirendae); Chekanovskaya, 1972: 11 (*Monopylephorus*).

The setae have teeth of equal length; there are up to 4 setae in the dorsal and ventral bundles. The ventral bundles in segment XI contain 4-5 penial setae which are twice as large as the ordinary ones. Septal glands are present in segments IV-V. Chloragogue cells begin from segment V. The vasa deferentia are approximately as long as the part of the atria covered with prostatic tissue. The spermathecal apertures are found in segment IX. There are no spermathecal setae or large tubular glands. The body is 16 mm long and consists of 84 segments.

*Rhizodrilus pacificus* (Brinkhurst et Baker, 1979)

Brinkhurst and Baker, 1979: 1561, fig. 10 (*Monopylephorus*).

The upper tooth of the setae is longer and thinner than the lower one. The preclitellar bundles consist of 1-4 setae, and the postclitellar ones contain 1-2 setae. Spermathecal setae of the

*Potamothrix hammoniensis* type are found in segment IX, and up to 9 penial setae are found in segment XI. The chloragogue cells begin from segment V. The vasa deferentia are approximately as long as the part of the atria covered with prostatic tissue. The pseudopenises have a slightly thickened cuticle. The spermathecal apertures are found in segment IX. Large tubular glands connected with the spermathecal setae are present. The body is 15-25 mm long and consists of up to 100 segments. (14)

A new subspecies was found in our material from the Kurile Islands. Since Brinkhurst and Baker (1979) touched upon only some of the structural characters of the setal and reproductive organs in the original description of this species, I have given here the complete description of the new subspecies.

*Rhizodrilus pacificus kurilensis* Finogenova, subsp. n.  
(Fig. 1, C; fig. 2)

**M a t e r i a l:** holotype No. 1/45301 (a series of anatomical sections), paratypes No. 2/45302-4/45301, Kurile Islands, Iturup Is., Bay of Whales, middle horizon of littoral, under boulders, profile 10, sample 6, 7 July 1967, collected by Ivanova.

**D e s c r i p t i o n.** The upper tooth of the setae is much longer and frequently thinner than the lower one (fig. 2, A, B). Many of the setae have blunt denticles. The setae in fixed material are deeply embedded in the body wall, projecting above the surface by 1/4 of their length. The preclitellar bundles contain 3 (rarely 2 or 4) setae, and the postclitellar ones 2 (rarely 1) setae. Segment IX bears spermathecal setae (fig. 2, D, F), and segment XI 3-4 penial setae which are shaped like ordinary ones, but are approximately twice as long. The ordinary setae are 70-100  $\mu$  long. (15)

and 4-5  $\mu$  wide; the spermathecal setae are 165  $\mu$  long and 7  $\mu$  wide, and the penial setae are 175  $\mu$  long. The nodulus is distal. The spermathecal apertures are found in the line of ventral setae in segment IX at dissepiment 9/10 (fig. 1, C). The male genital apertures are found in a gigantic copulatory sac in segment XI. The apertures of the oviducts are found in segment XII at dissepiment 11/12, in the line of ventral setae, and they are quite distinct.

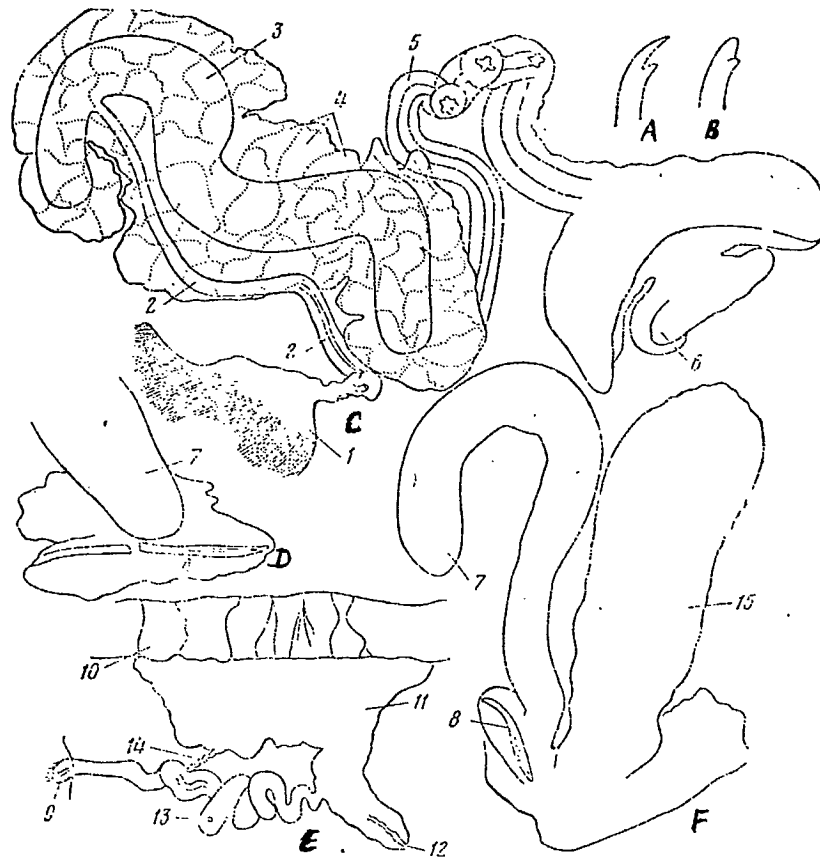


Fig. 2. Structural details of *Rhizodrilus pacificus kurilensis* subsp. n.: A, B - setae, C - male gonoduct (prepared specimen); D - spermathecal seta; E - nephridium (prepared specimen); F - spermatheca, spermathecal seta and tubular gland (prepared specimens): 1 - sperm funnel, 2 - vas deferens, 3 - ental part of atrium, 4 - groups of prostatic cells, 5 - ectal part of atrium, 6 - pseudopenis, 7 - tubular gland, 8 - spermathecal seta, 9 - funnel of nephridium, 10 - ventral vessel, 11 - distal region of postseptal part of nephridium, 12 - pore of nephridium, 13 - proximal region of postseptal part of nephridium, 14 - muscular band, 15 - spermatheca

The clitellum occupies segments 1/2 X - XII. The oesophageal glands are found in the posterior third of segment IV and segment V. The chloragogue tissue begins from segment V. The body cavity contains many large (10-15  $\mu$  in diameter) round coelomocytes with nuclei which are quite pronounced in stained specimens, with a small number of granules or with none at all. The hearts are found in segments VIII-IX. The nephridia begin from segment VII or segment VIII. The funnel of the nephridium is small. Right behind the dissepiment, the nephridium has the form of a contorted tubule with a canal inside. The distal region of the postseptal part of the nephridium consists of a ball of tubules which are very closely adjacent to the ventral vessel and, apparently, do not coalesce, but are of a tubificid type. The efferent part of the nephridium is quite wide and ends in a small pore in front of a bundle of setae. The proximal and distal regions of the postseptale are connected by a muscular band (fig. 2, E). At the base of the setal bundles, we find a setal gland which is clearly visible in stained sections. The brain is lobed, incised anteriorly. The testes are found in segment X, and the ovaries in segment XI. The sperm funnels are large, with uneven edges, attached to dissepiment 10/11 and turned into the cavity of segment X. The vasa deferentia have a narrow lumen (3-5  $\mu$ ), are quite long, are confined almost completely to segment X with only a small loop extending into segment XI, and fall into the atria at some distance from the apical end (fig. 2, C). The atria are tubular, proximally with a narrow lumen (10  $\mu$  wide) without cilia and with thickened walls consisting of an external thin layer of muscles (2.5  $\mu$  thick) and an

internal prismatic epithelium (30-35  $\mu$  thick), and covered with a layer of glandular tissue consisting of groups of prostatic cells which form ~~obovately~~ adjacent lobules. The distal part of the atria is much narrower than the proximal part, has no prostatic cells, and the surface of its canal is plicate. The atria are found in segments X and XI, and end in voluminous pseudopenises (fig. 2, C; 1, C), the external part of which has a slightly thickened cuticle. Dimensions of parts of the gonoduct: vas deferens - 900  $\mu$  long, 12-25  $\mu$  wide; proximal part of atrium - 1040  $\mu$  long, 125  $\mu$  wide in middle, 80-85  $\mu$  wide in the marginal parts; distal part of atrium - 930  $\mu$  long, 45-75  $\mu$  wide. The spermathecae have muscular ampullae and wide efferent ducts. Dimensions of spermatheca: ampulla - 600  $\mu$  long, 170-210  $\mu$  wide; efferent duct - 150  $\mu$  long, 25-30  $\mu$  thick, width of lumen - 25  $\mu$  (fig. 2, F; 1, C). Large tubular glands open in the region of the spermathecal setae. They are 770  $\mu$  long, 50-80  $\mu$  thick, and the lumen is 5-7  $\mu$  wide (fig. 2, F). There is a posterior seminal vesicle (extends up to segment XXI) and an anterior one (in segments VIII-IX). Fairly large egg funnels are attached to dissepiment 11/12. Mature specimens are 20-25 mm long, 500-550  $\mu$  thick in the region of the clitellum, and consist of 70-84 segments.

The differences between the subspecies are given in table 3.

It is possible that the spermathecal setae and spermathecal apertures of *Rh. p. pacificus* are also found in segment IX. If Brinkhurst and Baker (1979) examined only dissected worms, an error could have resulted; otherwise, it can be said that these characters are variable. This species is similar to *Rh. africanus* as to the form of the male gonoduct.

Table 3

Comparison of the subspecies of *Rhizodrilus pacificus*

| Characteristics                                     | <i>Rh. p. pacificus</i> | <i>Rh. p. kurilensis</i>                       |
|---|-------------------------|--|
| Length of body                                      | Up to 15 mm             | 20-25 mm                                       |
| Number of segments                                  | Up to 100               | 70-84  |
| Number of setae in a bundle<br>in anterior segments | 1-3                     | 2-4  |
| Number of penial setae                              | Up to 9                 | 3-4  |
| Form of penial setae                                | With short<br>denticles | Identical to<br>ordinary ones,<br>but longer   |
| Male genital apertures                              | Closely spaced          | Separate, but<br>in the same<br>copulatory sac |
| Spermathecal setae                                  | In segment X            | In segment IX                                  |
| Spermathecal pores                                  | In segment X            | In segment IX                                  |

*Peristerodrilus* Finogenova, gen. n.

The setae are forked, pectinate and hairlike. Modified penial setae are present in segment XI. The circular vessels in the anterior segments branch, forming an integumentary flexus. The nephridia have a sacciform postseptale (of the enchytraeid type). The vasa deferentia are long (occupy segments XI-XII) and narrow. The atria are cylindrical, very long (about 4 times as long as the vasa deferentia), with a narrow ciliated ental part and a wide unciliated ectal part which are completely covered with groups of prostatic cells, and they end in penises (or pseudopenises?) which are enclosed in penial chambers. The male genital apertures are found in segment XI, and are paired. One pair of oviducts open into intersegmental furrow 11/12. The spermathecal pores are paired, and are located in segment X right behind dissepiment 9/10.

The type species is *P. montanus* (Hrabe, 1962).

*Peristerodrilus montanus* (Hrabe, 1962)

*Rhizodrilus* - Hrabe, 1962: 339, fig. 1-13. †

The dorsal bundles of the anterior segments contain 2-5 pectinate and 2-5 hairlike setae, those in the middle part of the body contain 2-3 forked and 1 (rarely 2) hairlike setae, and the posterior bundles contain 1-2 forked setae. The ventral bundles of the anterior segments consist of 3-6 forked setae and the posterior ones contain 2 setae. The upper tooth of the forked setae is longer than the lower one in the preclitellar segments, and the teeth are equal in the postclitellar segments. The chloragogue tissue begins from segment VI. The coelomocytes measure 12-22  $\mu$  in diameter. The nephridia begin from segment VIII. The spermathecae consist of a long sacciform ampulla and a short narrow duct. The body is 14 mm long and consists of 86 segments.

Amendment during revision . The paper by R.O. Brinkhurst and H.R. Baker in *Canad. J. Zool.*, 1981, No. 6 (v. 59, pp. 939-965) describes the genus *Peristodrilus* which is identical to *Peristerodrilus*, and so the latter has been revoked.

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REVISION OF THE GENUS *MONOPYLEPHORUS* (OLIGOCHAETA, TUBIFICIDAE)

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Summary

Three genera (*Monopylephorus* Levinsen, 1883; *Rhizodrilus* Smith, 1900 and *Peristerodrilus* gen. n.) were established after the revision of the genus *Monopylephorus*. Diagnoses of these genera and composite species are provided. The genus *Monopylephorus* includes four species: *M. rubroniveus* Levinsen (with subspecies *rubroniveus*, *glaber*, *kermadecensis*, *ponticus*, *corderoi*, *iturupi* subsp. n.); *M. irroratus* (Verrill) (with subspecies *irroratus*, *trichochaetus*, *aucklandicus*, *orientalis* subsp. n.); *M. limosus* (Hatai, 1898); *M. parvus* Ditlevsen, 1904. The genus *Rhizodrilus* includes three species: *Rh. lacteus* Smith, 1900; *Rh. africanus* (Mich., 1913); *Rh. pacificus* (Brinkhurst et Baker, 1979) (with subspecies *pacificus* and *kurilensis* subsp. n.). The genus *Peristerodrilus* includes one species: *P. montanus* (Hrabe, 1962).