Annls Limnol. 30 (2) 1994 : 95-100

Description of a new *Lumbriculus* species (Oligochaeta, Lumbriculidae) from the Russian Far-East

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Keywords : Far East, freshwater fauna, systematics, Oligochaeta, Lumbriculidae.

Lumbriculus illex sp.n. is described from the Komarovka Stream, north of Vladivostok. It differs from all other congeners in having single-pointed setae and very long spermathecal ampullae. *L. sachalinicus* Sokolskaya, 1967 is regarded as its closest relative.

Description d'une nouvelle espèces de *Lumbriculus* (Oligochaeta, Lumbriculidae) de l'Extrême-Orient russe

Mots Clés : Extrême-Orient, faune aquatique, systématique, Oligochaeta, Lumbriculidae.

Lumbriculus illex n.sp. de la rivière Komarovka au nord de Vladivostok est décrit. Il diffère de tous ses congénères par ses soies à pointe simple et une très longue ampoule de la spermathèque. *L. sachalinicus* Sokolskaya, 1967 est considérée comme l'espèce la plus proche.

1. Introduction

Several species of *Lumbriculus* Grube, 1844 are known from Russian Far-East, including the Holarctic *Lumbriculus variegatus* (Müller, 1774) from different regions (Michaelsen 1929 ; Sokolskaya 1958, 1980, 1983 ; Morev 1974, 1983, *etc.*) as well as four endemic species : two from the Sakhalin Island (*L. multiatriatus* Yamaguchi, 1937 and *L. sachalinicus* Sokolskaya, 1967), one from the Chukchi Peninsula (*L. olgae* Sokolskaya, 1976) and one from the northern Magadan Region (*L. kolymensis* Morev, 1982). Several species live also on the neighbouring of the Japan Islands (Yamaguchi 1936, 1937, 1953).

The genus *Lumbriculus* presents taxonomic difficulties due to the fact that the widely distributed type species *L. variegatus* reproduces asexually or perhaps also parthenogenetically (Brinkhurst & Wetzel 1984). This fact produced a huge number of variants being described (Mrázek 1906 ; Timm 1979 ; Rodriguez & Armas 1983 ; Rodriguez 1988). The discrimination among variants of *L. variegatus* and other species is not easy. Cook (1971) considered numerous described taxa as subspecies of the former, in regard to the frequency of individuals with male pores in different position and the number of pairs of testes and ovaries. In such a context, the description of a new species in the genus *Lumbriculus* can be considered as an extra problem to the existing ones, but this new species is supported by interesting taxonomic characters.

2. Material and methods

The material used in this description is a part of a collection from the Komarovka Stream (formerly Suputinka), a tributary of the River Razdolnaya (Suifun) flowing into the Sea of Japan, West of Vladivostok (Fig. 1). The sampling was made in the V.L. Komarov Ussuriisk State Nature Reserve by the staff of the Far-East Scientific Centre (Vladivostok). This material was sent to the first author who studied and published elsewhere some results on the oligochaete fauna of this collection (Timm 1987, 1990, 1991). Type material is maintained at the Võrtsjärv Limnological Station (*VLS*), Rannu, Estonia and in the Museo Nacional de Ciencias Naturales (*MNCN*), Madrid, Spain.

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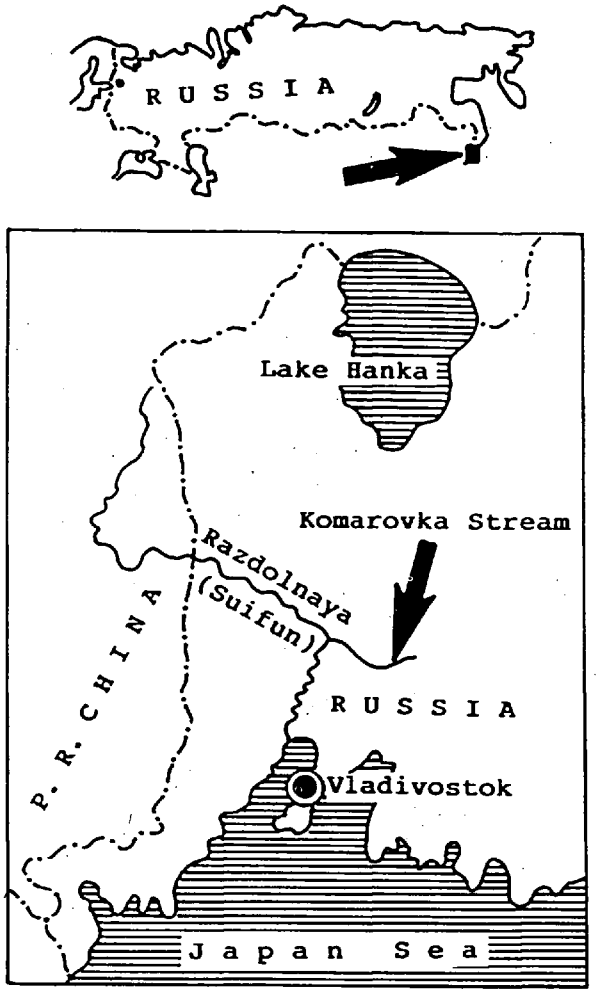


Fig. 1. Location of the sampling site.
Fig. 1. Situation du lieu de récolte.

3. *Lumbriculus illex* n.sp.

Lumbriculidae gen.sp. N° 2 (Timm 1987 : 134)

Holotype : VSL, N° 17-1 : whole mount in Canada balsam.

Paratypes : VLS, N° 17-1 : 2 whole-mounted specimens on the same slide with the holotype. VLS, N° 17-2 : serial sagittal sections of one specimen on two slides. VLS, N° 17-3 : serial sagittal sections of one specimen on three slides. MNCN, N° 16.03/3015 : 2 dissected specimens, stained in haematoxylin and mounted in Canada balsam. All from the type locality.

Type locality : Upper reaches of the Komarovka Stream, station 9 (sample 216), coordenates 43°39'N, 132°20'E. Collected 1st June 1984. 8 mature and 2 immature individuals.

Other material studied : 3 specimens, two being immature, from the type locality.

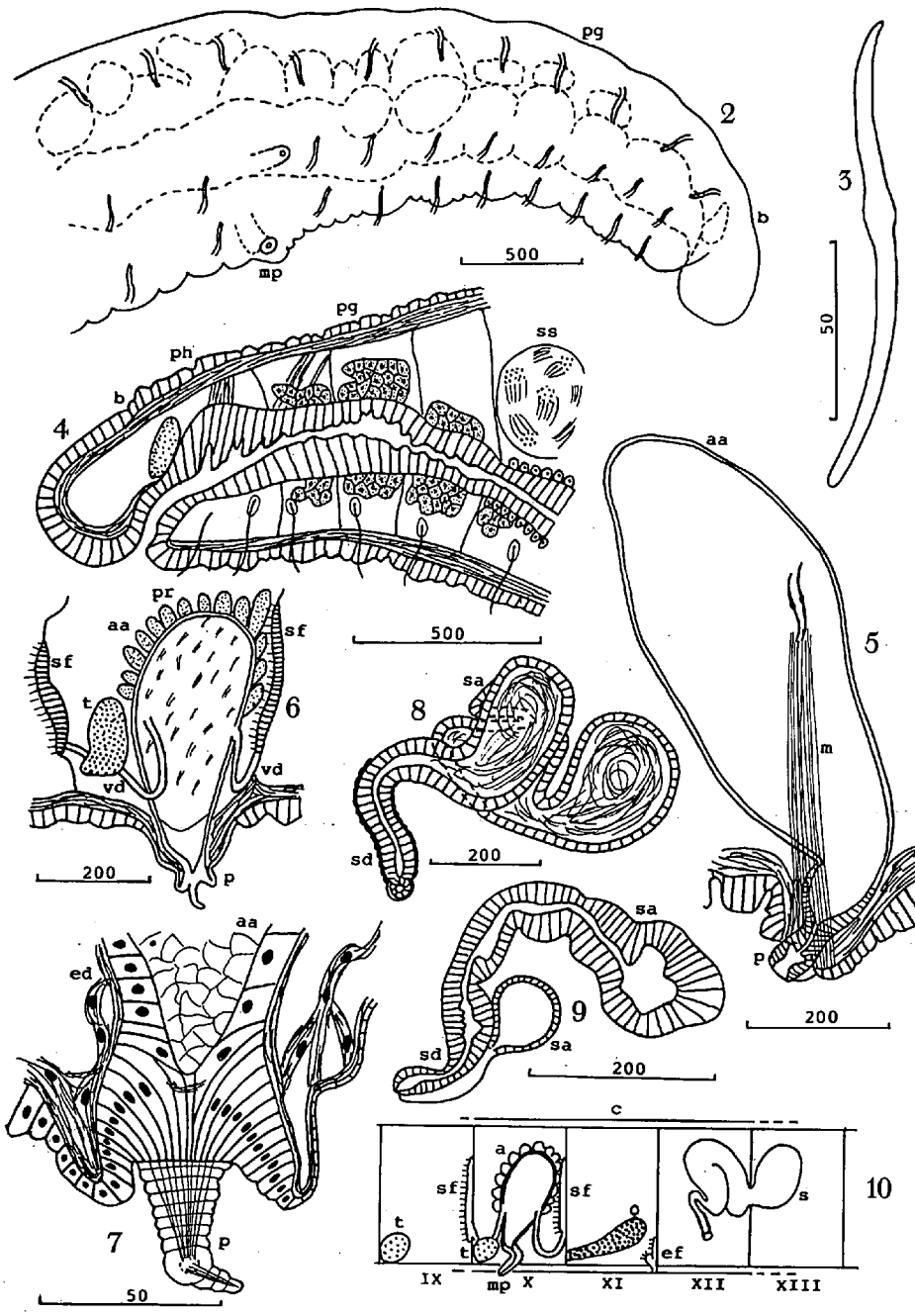
Etymology : *illex* means « illegal », « lawbreaker », or also « tempter » in Latin. The name refers to the tentative position of this taxon within the genus.

Description (Fig. 2-10).

Length up to 25 mm ; up to 93 segments (most specimens being incomplete). Width 0.5-0.7 mm in anteclitellar region, 0.9-1.0 mm at the clitellum ; the posterior region gradually tapering. Prostomium rounded, shorter than broad (1 : 279-341 μm, w : 353-496 μm). Anterior segments with 3-4 annuli ; secondary annulation in the sense of Cook (1967 : 356), affecting the anterior part of the segment only, present from IV. Setae two per bundle, sigmoid,

Fig. 2-10. *Lumbriculus illex* sp.n. 2. Anterior end and genital region of the holotype. 3. Seta. 4. Anterior segments of a dissected paratype. 5. Atrium with relaxed penis, from a whole-mounted paratype (prostatic tissue not drawn). 6. Reconstruction of male genital apparatus with protruded penis. 7. Reconstruction of the protruded penis under high magnification. 8. Reconstruction of spermatheca. 9. Developing spermatheca, with an abnormal supplementary spermatheca. 10. Diagrammatic scheme of reproductive apparatus, all elements paired.
Abbreviations : a : atrium, aa : atrial ampulla, b : brain, c : clitellum, ed : ejaculatory duct, ef : egg funnel, m : muscle fibers, mp : male pore, o : ovary, p : penis, pg : pharyngeal glands, ph : pharynx, pr : prostatic gland tissue, s : spermatheca, sa : spermathecal ampulla, sd : spermathecal duct. sf : sperm funnel, ss : sperm sac, t : testis, vd : vas deferens, IX-XIII : ordinal numbers of the segments. Scale bars in μm.

Fig. 2-10. *Lumbriculus illex* n.sp. 2. Extrémité antérieure et région génitale de l'holotype. 3. Soie. 4. Segments antérieurs du paratype disséqué. 5. Atrium avec pénis rétracté à partir d'un paratype monté in toto (prostate non dessinée). 6. Reconstitution de l'appareil génital ♂ avec pénis dévaginé. 7. Reconstitution du pénis dévaginé à fort grossissement. 8. Reconstitution de la spermathèque. 9. Spermathèque en cours de développement avec une spermathèque surnuméraire anormale. 10. Diagramme schématique de l'appareil reproducteur (tous les éléments sont paires).
Abréviations : a : atrium, aa : ampoule atriale, b : « cerveau », c : clitellum, ed : canal éjaculateur, ef : entonnoir ovarien, m : fibres musculaires, mp : pore male, o : ovaire, p : pénis, pg : glandes pharyngiennes, ph : pharynx, pr : cellules glandulaires prostatiques, s : spermathèque, sa : ampoule de la spermathèque, sd : canal de la spermathèque, sf : entonnoir spermatique, ss : vésicule séminale, t : testicule, vd : canal déférent, IX-XIII : numéros des segments, échelle en μm.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single-pointed (Fig. 3), anterior dorsals shorter than ventrals, and those of segment II smaller than the following ones. Anterior dorsal setae 95-151 μm long, 6.4 μm wide, ratio tip-nodulus/total length = 0.30-0.32 ; anterior ventral setae 111-183 μm long, 6.4 μm wide, ratio tip-nodulus/total length = 0.38 ; postclitellar setae 120-151 μm long, 4.8-6.4 μm wide, ratio tip-nodulus/total length = 0.34-0.38. Ventral setae of segment X absent. Clitellum extending from IX or X to XII-XV. One pair male pores in X, in the place of ventral setae. One pair spermathecal pores in XII, ventrolateral. Female pores indistinct, on the ventral setal line of XI/XII.

In anteclitellar segments, body wall epidermis 16-29 μm thick and longitudinal muscle layer 16-48 μm thick. Pharynx well developed, with dorsal wall thicker than ventral with gradual transition into the œsophagus. Pharyngeal glands in IV-VI and on the ventral side of VII. No clear difference between œsophagus and intestine ; chloragogen tissue begins in VII. Blind posterior lateral blood vessels present. First nephridia found in segment VII and the next ones found again from segment XII or XIII on.

Two pairs of testes present in IX and X. Anterior sperm sacs can reach up to VII, posterior ones up to XIX. Two pairs of flat sperm funnels in IX and X, on the anterior side of 9/10 and 10/11, about 180 μm high, the epithelium being 25-30 μm thick. Vasa deferentia very slender, 11-24 μm wide, descend to the ventral side of X, the posterior pair not penetrating the septum 10/11, and then ascend to join the middle portion of the atrial ampulla under a sharp angle. Atria paired in X. Atrial ampullae globular or pear-shaped, about 500 μm long and 250-290 μm wide, sparsely covered with 40-80 μm high prostatic cells. Atrial wall 5-10 μm (occasionally 15 μm) thick, consisting of very thin (up to 3 μm, sometimes imperceptible) inner epithelium and an outer muscular layer. The atrial lumen sparsely filled with spermatozoa. Ejaculatory duct about 80 μm long and 50 μm wide, its wall 15 μm thick, with well-developed circular musculature. Sometimes, the lumen of ejaculatory duct partially filled with loose transparent cellular mass somewhat similar to the prostatic cells (probably degenerating cells of the inner atrial epithelium). Penis in relaxed condition represented by a thickened portion of epithelium of the ejaculatory duct (Fig. 5). Tops of these epithelial cells can be protruded, forming a thin tubular penis, up to 100 μm long and 12-22 μm wide (Figs. 6 & 7). Male pore lies on a small porophore, associated with a dorso-ventral muscular bundle (Fig. 5).

One pair of ovaries in segment XI. Egg sacs reach up to XX. Egg funnels on 11/12, with bigger upper lip 70-100 μm high and 30-40 μm thick. They open immediately into female pores, oviducts not developed.

One pair of spermathecae ventrolaterally open in XII, the first postovarian segment. Ampullae very long, either partially protruding into following segments XIII-XV or folded up several times in XII (Figs. 8 & 10), filled with unorganized sperm, 100-200 μm wide, the 5-30 μm thick wall mostly epithelial, with a very thin muscular cover. Ampulla gradually tapering into short external duct, about 80 μm long, 50-60 μm wide, with very narrow lumen and triple wall (epithelium, circular and longitudinal musculature).

Anomalies

An uncompletely mature individual with a small extra spermatheca on one side of XII, clinging tightly to the ordinary spermatheca (Fig. 9).

Remarks

In the family Lumbriculidae, the general pattern of two pairs of testes and vasa deferentia, one pair of atria, and one pair of ovaries is found in many genera. Among them, only in *Trichodrilus* Claparède, 1862 and the majority of *Lumbriculus* species the distribution of spermathecae is limited to postatrial segments. The first or single pair of spermathecae always lies in the ovarian segment (GIII) in *Trichodrilus*, while different variants can occur in *Lumbriculus* species. In the new species, the single pair of spermathecae opening in the postovarian segment, distinguishes it from *Trichodrilus*.

Regarding to the structure of atrium and spermatheca, *L. sachalinicus* Sokolskaya, 1967 is the closest species to *L. illex* as it also has thin-walled though elongate atrium, and an unique pair of spermathecae in the postovarian segment with elongated ampullae extending in the following segment. The ventro-lateral position of spermathecal pores is also known in *L. inconstans* (Smith, 1895), *L. multiatriatus* Yamaguchi, 1937, *L. ambiguus* (Holmquist 1975) and *L. olgae* Sokolskaya, 1976. A slender tubular penis consisting of protruding cells were also described for *L. variegatus* by Vejdovsky (1895) and Hesse (1902). *L. illex* is clearly distinguished from all

congeners by having single-pointed setae and very long spermathecal ampulla. All other species have bifid setae and smaller spermathecae, usually restricted to one segment (except in *L. sachalinicus*), with short ducts and spherical to sacciform ampulla.

Distribution and ecology

Known only in the Komarovka Stream, in the Russian Far-East. The type locality is situated in an open, comparatively well-warmed part of the reaches studied, with a stony bottom, a 25-30 cm mean depth and a 0.5-1.2 m/sec current speed. The species was met only once ; even no suspicious immature worms were found in other seasons. No sign of asexual reproduction was either observed.

4. Discussion

The cladistic analysis performed by Brinkhurst (1989) clearly stated that *Lumbriculus* is different from *Stylodrilus* Claparède, 1862, its sister group, by the position of the spermathecae (beginning from the segment behind GIII), and the non penetration of the posterior vasa deferentia in the postatrial segment. By these characters, the new species may be classify as a member of the genus *Lumbriculus*. It belongs to a species assemblage within *Lumbriculus* characterized by a double pair of sperm funnels and vasa deferentia but only one pair of atria, which are considered as ancestral for the Lumbriculidae by Brinkhurst (1989). Holmquist (1975) treated this group as a separate genus *Thinodrilus* Smith, 1895. However, as these characters are subjected to intraspecific variations, e.g. in the Nearctic *L. ambiguus* (= *Thinodrilus ambiguus* Holmquist, 1975), the separation of *Thinodrilus* from *Lumbriculus* is unjustified.

Among the genus *Lumbriculus*, only the new species *L. illex* has single-pointed setae. However, the setal form alone is not sufficient for creating a new genus as other lumbriculid genera e.g. *Stylodrilus* (with *Bythonomus*), *Trichodrilus* Claparède, 1862 or *Rhynchelmis* Hoffmeister, 1843 gather together species with single-pointed or bifid setae. For including the new species in the genus *Lumbriculus* it is necessary to eliminate the bifid condition of setae from the generic definition reducing, even more the weak difference in the diagnoses of *Lumbriculus* and the two closed genera *Stylodrilus* and *Trichodrilus*.

The genus *Lumbriculus* shows a great variability in the number and position of the components of reproductive organs *L. genitosetosus* (Holmquist 1975) and *L. olgae*, Sokolskaya, 1976 clearly overlap with *Trichodrilus*. *L. variegatus* shows great degree of variation, but it is difficult to establish which species of the genus could be included in the *variegatus* complex or not. Some species have been erected only on the basis of a peculiar number and position or atria or/and spermathecae and the number or pairs of vasa deferentia and sperm funnels per atrium. These characters are subject to a great range of variation into *L. variegatus* (Mrázek 1906). In fact, many of the described species of the genus are probably synonyms of it. Our experience, however, demonstrate that populations of *L. variegatus* usually show individual patterns in the genitalia (Timm 1979 ; Rodriguez 1988). Thus, we should admit that the stability of the components and position of genitalia in a population is important for the specific status in this problematic genus.

The genus *Lumbriculus* is in need of a sound revision because of the great confusion originated by the variations of *L. variegatus*. This objective is outside the scope of the present contribution and the classification of the new species can be considered as tentative untill such a revision is made.

Acknowledgements

We are greatly indebted to Dr. T.S. Vshivkova (Vladivostok) for delivery the studied collection and to Ralph O. Brinkhurst for his comments on the manuscript.

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