

Limnodrilus simplex sp. nov. (Oligochaeta: Naididae: Tubificinae) from Changjiang River, China

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Limnodrilus simplex sp. nov. (Oligochaeta: Naididae: Tubificinae) is described based on a single specimen from the mainstream of the Changjiang River near Anqing City, Anhui Province, China. The new species is assigned to *Limnodrilus* by the presence of long vasa deferentia, spindle-shaped atria with long ejaculatory ducts, large prostate glands, and thick cylindrical penial sheaths. It differs from its congeners in having simple-pointed chaetae and cuticularized penial sheaths without hoods. *Limnodrilus simplex* is closer to *L. paramblysetus* and *L. amblysetus* in possessing penial sheaths with relatively low length/maximum width ratio.

Key words: *Limnodrilus simplex*, Tubificinae, Oligochaeta, new species, Changjiang River, China

INTRODUCTION

The Changjiang (the Yangtze) River, the longest river in China, is known to have a high faunal diversity with rich endemic species (Wu, 1998; Fu et al., 2003). However, previous studies focusing on the river were carried out mainly in shallow lakes distributed around its vast basin (Brinkhurst et al., 1990; Xie et al., 2000; Wang and Liang, 2001). Studies in the mainstream of the river were limited (Xie et al., 1999) and, hence, our zoological knowledge there is still insufficient, especially with regard to benthic invertebrates. Liang (1987) for the first time dealt with aquatic oligochaetes from the mainstream. Thereafter, an increasing number of species were reported by several investigations concerning macrobenthos in river trunk. To date, 38 species have been recorded from the mainstream of the river (Liang, 1987; Brinkhurst et al., 1990; Wang and Liang, 1997; Liang et al., 1998; Xie et al., 1999; Xie et al., 2000; Wang and Liang, 2001; Wang et al., 2007). The present paper describes a new species belonging to the genus *Limnodrilus* based on a single specimen collected from the mainstream.

MATERIAL AND METHODS

From October 2005 to June 2007, a total of 141 sediment samples were taken with a Petersen grab (1/16 m²) from 11 sections along middle and lower reaches of the river. Samples were cleaned with a 250 µm sieve. Large worms were sorted manually in a white porcelain dish, and smaller ones were sorted under a dissecting microscope. Specimens were preserved in 10% formalin. Each preserved specimen was examined first in temporary glycerine mount, then stained with borax carmine, dehydrated in an alcohol series, cleared in xylene and mounted in Canada balsam. Measurements of the body and chaetae were made from the glycerine mount. Other dimensions were measured after the fixing procedures. Draw-

ings were made with a camera lucida. The holotype is deposited in the Institute of Hydrobiology (IHB), Chinese Academy of Sciences, Wuhan, China.

TAXONOMY

Limnodrilus simplex sp. nov. (Fig. 1A–E)

Holotype. Mature, whole-mounted specimen, IHB CJR2007001a.

Type locality. Sandy bottom without vegetation in the mainstream of Changjiang River, southwestern Anqing City (30°29'27.1"N, 117°01'04.2"E), Anhui Province, China; depth 2 m, surface water temperature 23.5°C, velocity 0.2 m/s, pH 8.1, surface water conductivity 283 µm/cm, Secchi depth 0.4 m, total nitrogen in surface water 0.695 mg/L, total phosphorus in surface water 0.089 mg/L, 22 May 2007, coll. by X. He and W. Zhao.

Etymology. The specific name "*simplex*" is Latin for "simple", and refers to this worm's simple penial sheath and simple-pointed chaetae.

Description. Length 2.9 cm, diameter at XI 0.73 mm, segments 83. Prostomium conical. Clitellum over 1/2X–XII.

Chaetae (Fig. 1A, B) all simple-pointed, nodulus distal, 3–5 per bundle, 75–90 µm long, 2.5–3.0 µm wide. Ventral chaetae in X unmodified, 3 per bundle. Ventral chaetae of XI absent. Male pores paired in line with ventral chaetae, anterior to middle XI. Spermathecal pores paired in line with ventral chaetae, anterior to middle X.

Chloragogen cells from XI onwards. No coelomocytes. Male genitalia paired. Vas deferens (Fig. 1D, vd) very long and irregularly coiled, 20–25 µm wide, entering atrium apically. Atrium (Fig. 1D, at) spindle-shaped, 375–505 µm long, 40–72 µm wide. Prostate gland (Fig. 1D, pr) large, entering atrium entally. Ejaculatory duct (Fig. 1D, ed) 713–950 µm long, 50–75 µm wide, with wall 13–32 µm thick. Soft part of penis (Fig. 1D, pe) conical, 28 µm wide, 145 µm long, penis surrounded by cuticularized, cylindrical penial sheath (Fig. 1D, ps), 135 µm long, 52 µm wide ectally, and 112 µm wide

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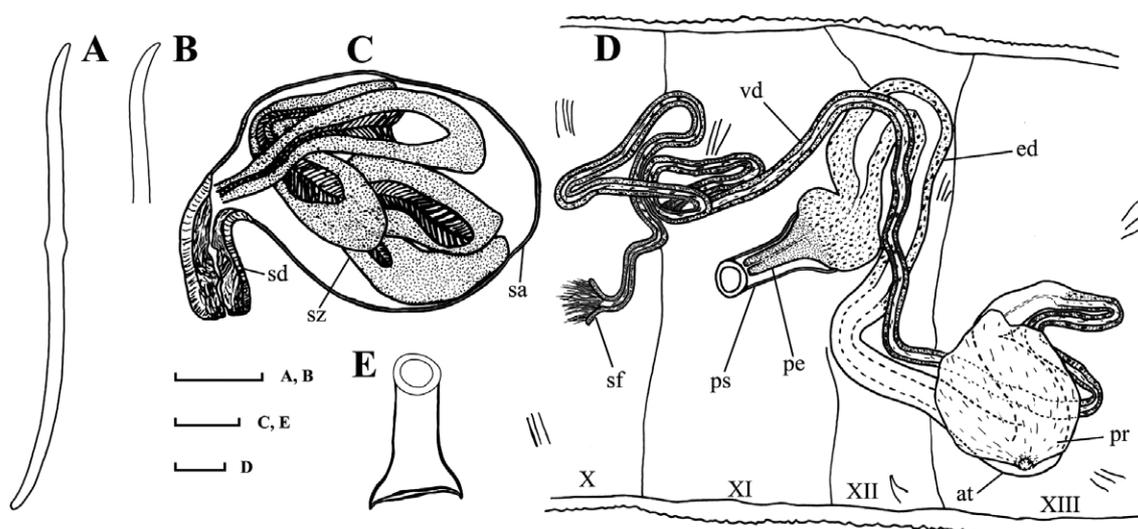


Fig. 1. *Limnodrilus simplex* sp. nov. (A) ventral chaeta from VI; (B) distal end of dorsal chaeta from posterior segment; (C) spermatheca; (D) lateral view of male duct in segments X-XIII; (E) cuticularized penial sheath. Scale bars: A, B. 16 µm; C, D, E. 80 µm. Abbreviations: at, atrium; ed, ejaculatory duct; pe, penis; pr, prostate gland; ps, penial sheath; sa, spermathecal ampulla; sd, spermathecal duct; sf, sperm funnel; sz, spermatozeugmata; vd, vas deferens

Table 1. Comparison of *Limnodrilus simplex* sp. nov. and congeners.

	<i>L. simplex</i> sp. nov	<i>L. paramblysetus</i>	<i>L. amblysetus</i>	<i>L. dybowskii</i>	<i>L. tendens</i>
Chaetae	Simple-pointed	Bifid, with blunt or subequal teeth or upper teeth reduced	Bifid to bluntly simple-pointed	Simple-pointed, with enlarged hooked chaetae	Simple-pointed, rudimentary teeth and hooked chaetae,
Penial sheaths					
Length of penial sheaths (µm)	135	103	328	240	320
Length/Maximum width of penial sheaths	1.2	1.4	1.8	6	4.5
Atrium					
Spermathecae	Ampullae pear-shaped, duct short	Ampullae oblong, ducts spindle-shaped, with vestibules	Ampullae oval to elongate, duct short	Ampullae oval, duct the same length of ampullae	Ampullae saccular or roundish, duct short and wide, with strong musculature
Distribution	Changjiang River, China	Changjiang River, China	Changjiang River, Xiang River, China; Japan	Lake Baikal	Lake Baikal
Reference	Present study	Wang and Liang (2001)	Brinkhurst et al. (1990); Ohtaka and Nishino (1999)	Semernoy (2004)	Semernoy (2004)

at the base, wall 3.0–4.5 µm thick. Sheath simple, without a hood, more or less thickened at ectal margin (Fig. 1E).

Spermathecal duct (Fig. 1C, sd) short, 45–50 µm wide, ampulla (Fig. 1C, sa) pear-shaped, 350 µm long, 275 µm

wide. Spermatozeugmata (Fig. 1C, sz) 6 in each lumen, about 175–360 µm long.

Distribution and habitat. Known only from the type locality, Anqing City, Changjiang River.

DISCUSSION

Although only one individual of the present species was found in Changjiang River, it is very characteristic and fully mature. We are hence of the opinion that it can be described as new to science. The very long and coiled vasa deferentia, the spindle shaped atria with large prostate glands, the long and thick ejaculatory ducts, and cylindrical penial sheaths indicate that this new species fits more closely the definition of *Limnodrilus* Claparède, 1862 than that of other described genera (Brinkhurst and Jamieson, 1971). About twenty species were previously known in the genus, among which seven species are distributed in the Holarctic region (Brinkhurst and Jamieson, 1971; Loden, 1977; Wetzels, 1987; Wang and Liang, 2001), three in the Neotropical region (Brinkhurst and Jamieson, 1971; Block and Goodnight, 1972; Brinkhurst, 1979), three in Lake Baikal (Semernoy, 2004), one in the Oriental region (Wang and Cui, 2007), and two distributed both in Holarctic and Oriental regions (Kennedy, 1965; Ohtaka and Nishino, 1999; Wang and Cui, 2007). Only four species are cosmopolitan (Brinkhurst and Jamieson, 1971; Wang and Cui, 2007).

Among the known members of *Limnodrilus*, three species, viz. *L. amblysetus*, *L. dybowskii*, *L. tendens*, possess simple-pointed chaetae (Brinkhurst et al., 1990; Semernoy, 2004). However, they differ from the new species in that *L. amblysetus* has both bifid and simple-pointed chaeta, and *L. dybowskii* and *L. tendens* have hook-like grand chaetae ventrally. With regard to length/width ratio of the penial sheaths, the new species shows some affinity to *L. paramblysetus* and *L. amblysetus* (Brinkhurst et al., 1990; Ohtaka and Nishino, 1999; Wang and Liang, 2001). However, *L. simplex* sp. nov. is easily distinguishable from those species by having simple-pointed chaetae throughout the body. The penial sheath without a hood is also a prominent character of the new species (Table 1).

Seven species of *Limnodrilus*, including the present new form, have been recorded from the Changjiang River Basin. Among them, *L. amblysetus* and *L. paramblysetus* were recorded only in the mainstream of the Changjiang River, while *L. claparedeianus*, *L. grandisetosus*, *L. udekemianus* and *L. hoffmeisteri* are common in Changjiang River Basin (Liang, 1987; Brinkhurst et al., 1990; Xie et al., 1999; Wang and Liang, 2001; Wang and Cui, 2007).

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