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A New Terrestrial Species of *Bothrioneurum* (Tubificidae, Oligochaeta) from Hunan Province, China

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A new terrestrial tubificid oligochaete, *Bothrioneurum grandisetosum* sp. n., is described. It is unique in the possession of giant ventral setae in segments V-VI, sudden stomachal dilatation, thickened septa in posterior segments, and the absence of paratrial glands.

Key Words: Tubificidae, terrestrial oligochaete, *Bothrioneurum*, new species.

It is generally believed that almost all species of Tubificidae are aquatic. Only one species, *Rhyacodrilus stephensoni* Černosvitov, 1942, has been previously reported in China from a terrestrial habitat, on Mt. Tianmushan in Zhejiang Province (Liang and Xie 1992). In 1991 a tubificid species belonging to the genus *Bothrioneurum* was collected from forest soil in Hunan Province of China. It is considered to be new to science and described below.

The worms were extracted from soil samples by the wet-funnel method, accompanied by many enchytraeids belonging to *Achaeta*, *Enchytraeus*, *Fridericia*, *Hemienchytraeus*, *Marionina*, or *Mesenchytraeus*. Whole-mounted specimens were stained with alum cochineal. Serial sections were stained by Hansen's haematoxylin and eosin (HE). Some specimens were examined under an AMRAY-1830 scanning electron microscope (SEM). The types of the new species are deposited in the Specimen Room of Invertebrates, Institute of Hydrobiology, Chinese Academy of Sciences (CAS).

Bothrioneurum grandisetosum sp. n.

(Figs 1-3)

Holotype. A mature specimen, whole mount in Canada balsam, collected from Tiefosi (April 29, 1991) (ca. 840 m above sea-level), Mt. Heng Shan (27.3°N, 112.7°E), Hunan Province.

Paratypes. 25 specimens: 6 mature ones in whole mounts (2 dissected), 2 mature ones used for serial sections, the rest in 10% formalin; from the type locality and its vicinity [Banshanting (April 26, 1991) (ca. 620 m), Yehoushuyuan (April 28, 1991) (ca. 750 m)], and from Yuelu Shan Hill (28.2°N, 112.9°E) (April 17, 1991) (<296 m) in Hunan Province. Habitats were of yellow-red or yellow soil, with Pinaceae, Taxodiaceae, Fagaceae, or Babusoideae as the dominant plants. Soil temperature was 13-15°C, with a water content of 25-36% at the time of sampling.

Other material. 2 individuals used for SEM, 2 in glycerine mounts; from same

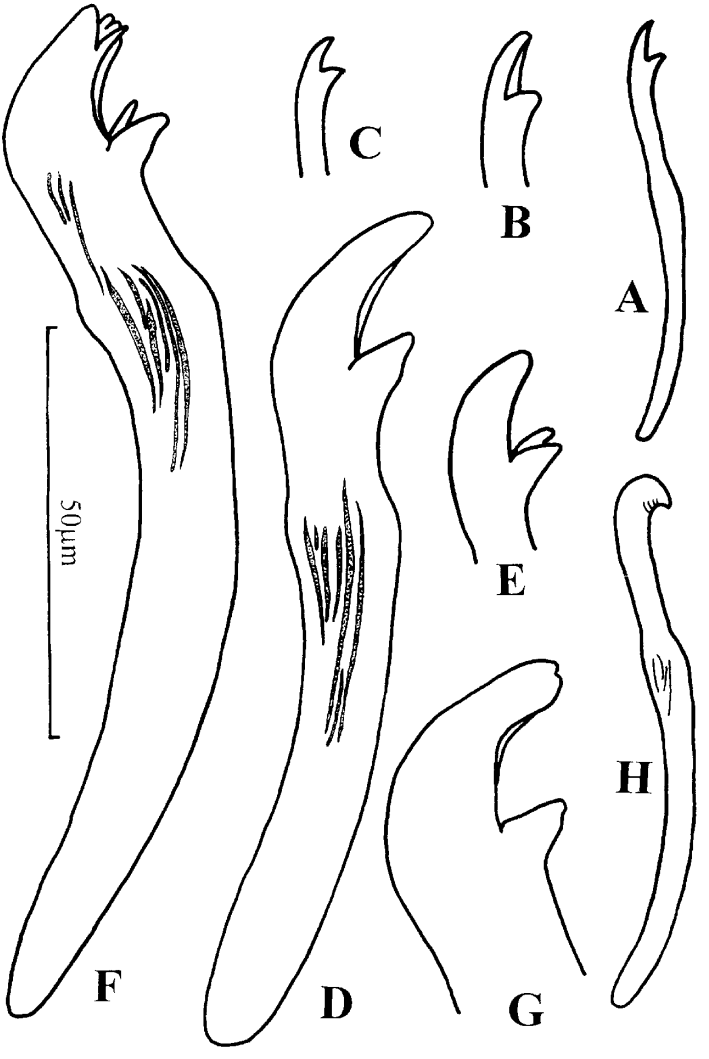

Fig. 1. Setae in *Bothrioneurum grandisetosum* sp. n. A-C, setae (II, IV, posterior); D, E, ventral setae (V); F, G, ventral setae (VI); H, penial seta.

localities as paratypes.

Etymology. Named *grandisetosum* for the giant ventral setae in segments V-VI.

Description. Length 3-7.5 mm (holotype: 5.5 mm) when preserved, 8-9 mm when living. Segments 25-48 (holotype: 48).

Body reddish when living. Prostomium round. Head pore (Fig. 3A) in middle of prostomium dorsally, large with thick margin. Setae from II onwards, all double-pronged crotchets, consisting of 3 sorts: (1) Normal setae (Fig. 1A-C), 45.9-69.0 μm long, 2.4-4.0 μm thick, nodulus distal, distal prong 1.6-1.9 times as long as proximal;

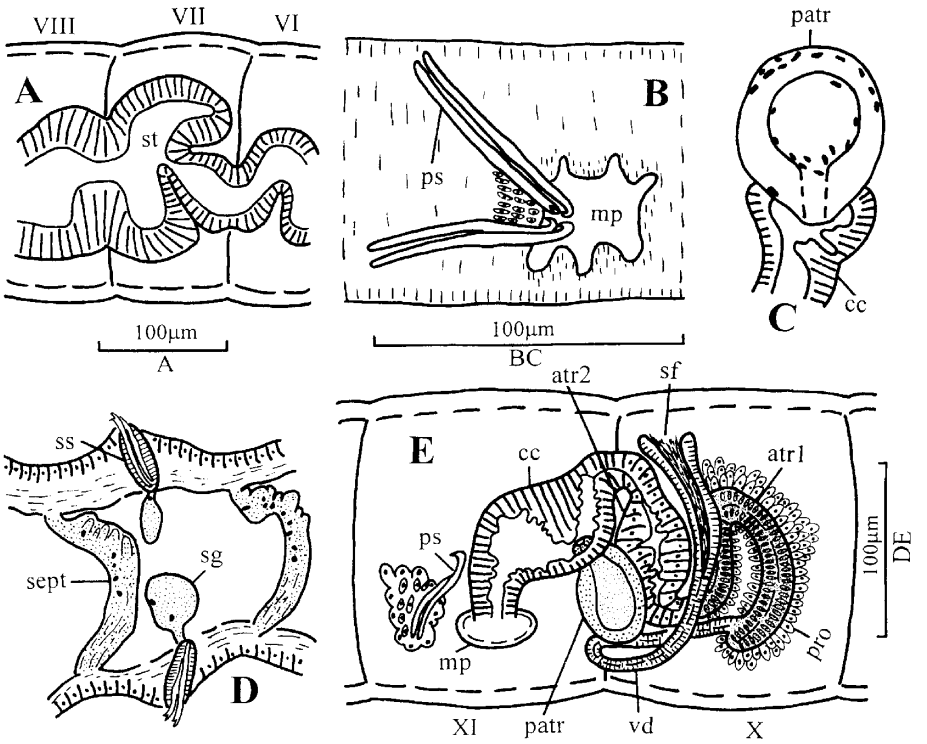

Fig. 2. Internal characters and male pore of *Bothrioneurum grandisetosum* sp. n. A, lateral view of VI-VIII; B, ventral view of male pore; C, ventral view of paratrium; D, lateral view of one posterior segment; E, lateral view of X-XI. atr1, first atrium; atr2, second atrium; cc, copulatory chamber; mp, male pore; patr, paratrium; pro, prostate; ps, penial setae; sept, septum; sf, sperm funnel; sg, setal gland; ss, setal sac; st, stomachal dilatation; vd, vas deferens.

preclitellar segments with 3-8 (usually 5-7) setae per bundle, postclitellar segments with 2-5 (usually 2-4) per bundle. (2) Thick setae, usually 1-3 per bundle in each ventral bundle of V-VI of immature worms, setal shaft as long as but 1.3 times as thick as normal setae in same bundle. (3) Giant setae (Figs 1D-G, 3B), in ventral bundle of V-VI of mature worms, 2-3 (usually 2) per bundle, occasionally with normal setae; giant setae 91.8-128.5 μm long, 7.6-13.1 μm thick, with numerous "ribs" on shaft, intermediate tooth sometimes present between two prongs, or distal prong secondarily branched with a few small intermediate teeth. Setal glands (Figs 2D, 3D) present, simple, at base of setal sac, usually 2 per sac for giant setae, 1 for other setae.

Pharyngeal glands in IV-VI. Stomachal dilatation (Fig. 2A) sudden, without diverticulum. Transverse blood vessels conspicuous in VIII-IX. Septa thicker (10-22 μm) in 6-10 segments of posterior end (Figs 2D, 3D). Coelomocytes abundant, disk-like, biconcave, each with a small nucleus.

Clitellum in X-XII, not very conspicuous, with setae; gland cells arranged irregular anteriorly and in transverse rows posteriorly. Sperm funnel long and trumpet-shaped, ca. 66 μm long, 15-40 μm wide, facing upward in front of X/XI (Figs

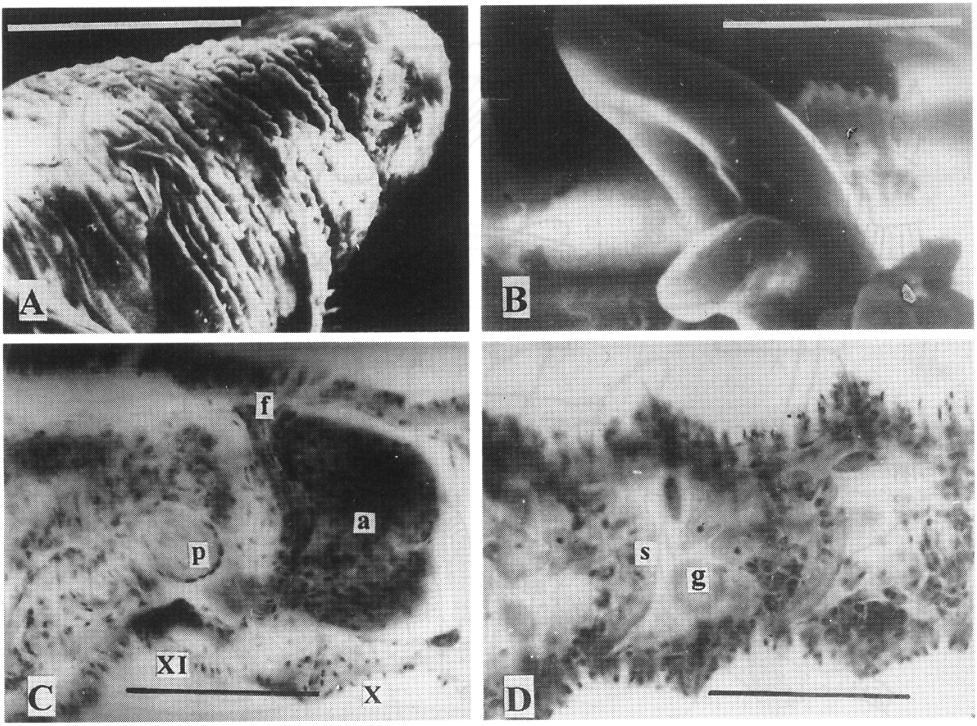

Fig. 3. SEM (A, B) and optical (C, D) photomicrographs of *Bothrioneurum grandisetosum* sp. n. A, head pore; B, giant ventral setae (VI); C, sagittal section of X-XI showing male duct; D, sagittal section of posterior end. a, atrium; f, sperm funnel; g, setal gland; p, paratrium; s, septum. Scales: A, C, D, 100 μm; B, 10 μm.

2E, 3C). Vas deferens ca. 180 μm long, ca. 12 μm wide. First atrium slender, coiled in X, ca. 200 μm long, ca. 20 μm wide, surrounding with prostate cells. Second atrium oval and wider, ca. 80 μm in length, ca. 44 μm in maximum width, without prostate cells (Figs 2E, 3C). Copulatory chamber spindle-shaped, ca. 120 μm long, ca. 76 μm wide (Fig. 2E). Paratrium opening into copulatory chamber ventrally, 30-32 μm in diameter, with a few nuclei but no accessory glands (Figs 2C, E, 3C). Male pore single, located ventrally at mid-XI, ca. 38 μm long, ca. 22 μm wide, with wavy margin. Penial setae modified, distal end hooked, 2 per bundle (Figs 1H, 2B, E).

Spermatheca absent. External spermatophores not found.

Remarks. In the present species, no collected specimen bore an external spermatophore. It is unclear whether the absence of the spermatophore is an intrinsic character of this species or just due to sampling contingency. To clarify the matter, a second sampling was made on Yuelu Shan Hill in November, 1994, but no specimen was further found. Although no spermatophore was observed, the main characters of the present specimens, such as the presence of a sensory pit and the structure of the male ducts, are in conformity with the diagnosis of *Bothrioneurum*. Therefore, it is reasonable to assign the present species to this genus.

There are 6 previously described species of *Bothrioneurum*, viz. *B. vej-*

Table 1. Comparison of *Bothrioneurum grandisetosum* sp. n. with allied species

	B. grandisetosum sp. n.	*B. vejdovskyanum* Štolc, 1886	*B. schiemeri* Timm, 1997
length (mm)	3-7.5	10-28	16-22
segments	25-48	53-78	100-110
anterior setae/bundle	3-8	4-6	4-8
posterior setae/bundle	2-5	2	2-3
giant setae	ventrally in V-VI	absent	absent
teeth of posterior setae	distal tooth longer	equally long	distal tooth longer
penial setae/bundle	2	4-5	5-7
setal glands	present in each setal sac	absent	sometimes present
pharyngeal glands	IV-VI	IV-V	III-VI(VII)
stomachal dilatation	sudden	gradual	gradual
septa	thickened posteriorly	normal	normal
paratrial glands	absent	present	present
male pore	single	single	single
spermatophores	not found	present	present
habitat	soil	freshwater	freshwater
distribution	Hunan Province, China	Europe, Asia, N. America, Africa	East Africa
reference(s)	present paper	characters (Chen 1940; Wang 1995), distribution (Brinkhurst and Jamieson 1971)	Timm 1997

dovskyanum Štolc, 1886, *B. iris* Beddard, 1901, *B. americanum* Beddard, 1894, *B. brauni* Marcus, 1949, *B. pyrrhum* Marcus, 1942, and *B. schiemeri* Timm, 1997. All are aquatic forms. According to Brinkhurst and Jamieson (1971), the differences among them are trifling and they are likely to be only one variable species in reality. *Bothrioneurum grandisetosum* sp. n. is a terrestrial form. In addition to the habitat, the new species differs from all known species by having giant ventral setae, a sudden stomachal dilatation, and thickened septa in the posterior segments. It also differs from the other species in the absence of paratrial glands (Table 1).

Acknowledgments

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