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A New Species of Earthworm Belonging to the Genus *Metaphire* Sims and Easton 1972 (Oligochaeta: Megascolecidae) from Southern Taiwan

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ABSTRACT: This paper described a new species of earthworm from southern Taiwan *Metaphire feijani*. This species belongs to the octothecate *stephensoni*-species group within the genus *Metaphire*. The morphological comparison of species within this group revealed the identity of this new species.

KEY WORDS: Earthworms, New species, *Metaphire feijani*, Taiwan.

INTRODUCTION

Most earthworm species in Taiwan belong to the genus *Amynthas* or *Metaphire* in the family Megascolecidae. Within the 23 new species described from Taiwan between 1999 and 2004 (Shen and Tsai, 2002; Shen *et al.*, 2002, 2003; Tsai *et al.*, 1999, 2000a, b, 2001, 2002, 2003, 2004), *Pithemera lanyuensis* (Shen and Tsai, 2002) is the only species which was not belong to the two genera. On the other hand, most of the recently described species were collected from central Taiwan. *Metaphire paiwanna* and *M. yeni* are the only two new species which were found from southern Taiwan recently (Tsai *et al.*, 2000a, b). Due to limited survey in southern Taiwan, these results might evoke a bias image which shows the species richness of earthworm in southern Taiwan is lower than that in central Taiwan. This paper described a new species from southern Taiwan. This species belongs to the *stephensoni*-species group within *Metaphire*. The differences among all taxa within this group are also compared.

MATERIALS AND METHODS

Earthworm samples collected from the mountain areas in southern Taiwan were anaesthetized in 10% ethanol solution, fixed in 5% formalin solution, and preserved in 70% ethanol solution. The type specimens and other materials examined are deposited at Institute of Zoology, National Taiwan University, Taipei, Taiwan.

TREATMENT

Metaphire feijani C.-H. Chang and J.-H. Chen, sp. nov. 飛棧腔環蚓 Fig. 1

Holotype: a mature (clitellate) specimen (dissected) collected 10 February 2004 from

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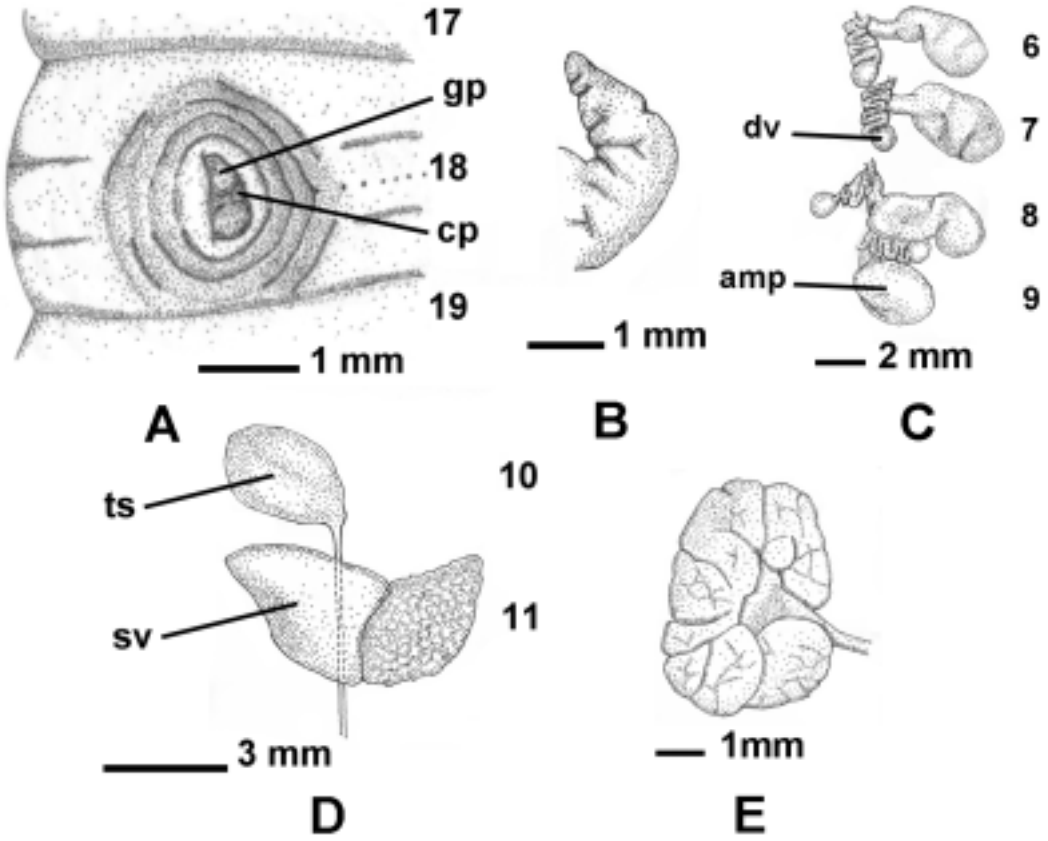

Fig. 1. *Metaphire feijani*. A: Right male pore, ventral view (gp, genital pad; cp, copulatory pouch). B: Right caecum, dorsal view. C: Right spermathecae, dorsal view (dv, diverticulum; amp, ampulla). D: Left testis sac and seminal vesicle, dorsal view (ts, testis sac; sv, seminal vesicle). E: Left prostate gland, dorsal view.

Majia, Pingtung County in southern Taiwan (22°41´N, 120°41´E) by C.-H. Chang (Cat. No. 14-07095).

Paratype: a mature (clitellate) specimen (dissected) collected 10 February 2004 from Wutai, Pingtung County in southern Taiwan (22°45´N, 120°43´E) by C.-H. Chang (Cat. No. 14-07099).

Other materials

Two immature specimens collected 10 February 2004 from Majia, Pingtung County (22°41´N, 120°41´E) by C.-H. Chang (Cat. No. 14-07096, 14-07097); and an immature specimen collected 10 February 2004 from Wutai, Pingtung County (22°45´N, 120°43´E) by C.-H. Chang (Cat. No. 14-07098).

External characters

Length (mature) 226-254 mm, clitellum width 8.0-10.7 mm, segment number 95-130. Number of annulets (secondary segmentation) per segment three in 6-9, five in 10-13, and three in body segments behind 17. Prostomium prolobous. Setae 76-92 in 7, 101-104 in 20, 21-22 between male pores. First dorsal pore in 12/13. Clitellum 14-16, smooth, length 10.2-11.0 mm, dorsal pore absent, setae absent. Spermathecal pores four pairs in 5/6-8/9, invisible from outside, ventral, distance between the paired pores about 0.27-0.35 body

circumference ventrally apart. No genital papillae in the spermathecal pore region. Female pore single, situated on the medio-ventral in 14. Male pores (opening of copulatory pouch) small, paired, situated on setal line close to lateral border of 18. Each copulatory pouch is compressed to the outer body wall, surrounded by 2-6 circular folds, laterally bordered by a thick skin lip. The opening of copulatory pouch is a split parallel to the body axis, facing the medio-ventral line. Male aperture is embedded in the copulatory pouch and is inconspicuous. A small genital pad resides in the front of the opening of the copulatory pouch. Genital papillae absent in the male pore area.

Live specimens bluish brown with metallic luster on dorsum, light reddish brown on ventral. Preserved specimens purplish brown on dorsum, light brown on ventral.

Internal characters

Septa 5/6-7/8 thickened, 8/9 thin, 9/10 absent, 10/11-13/14 greatly thickened. Gizzard in 8-10. Intestine enlarged from 15. Intestinal caeca paired in 27, simple, extending anteriorly to 26. Lateral hearts enlarged in 10-13.

Spermathecae four pairs in 6-9. Ampulla large, about 2.8-4.2 mm in length, with a stalk about 1.4-2.4 mm in length. The spermathecal diverticulum short, around the middle of spermathecae, with a small oval seminal chamber on the tip. diverticulum stalk long, tightly coiled, forming a short and thick appearance. Nephridia tufted, attached to the post-segmental septa, surrounding the segmental chambers anterior to the 6/7 septum. Ovaries paired in 13, medio-ventral, close to the 12/13 septum.

Testis sacs paired in 10, oval-shaped, smooth, medio-ventral in front of 10/11. Seminal vesicles paired in 11, large, each one with a folliculate dorsal lobe. Prostate glands paired in 18, large, lobular, extending to 17 and 19.

Localities and Habitats

This species lives in the mountain areas around the altitude of 600 meters, where the main vegetation is broadleaf forest, either virgin forest or secondary forest. This species is an anecic species, having permanent vertical burrows. The collection site in Majia is a shallow ditch by the road, near the entrance of Majia Village. The circumstance nearby the ditch is secondary forest. The ditch is about 10 cm in depth, covered with soil mixed with gravel. The collection site in Wutai is also a ditch by the road, near Shenshan, but the nearby circumstance is virgin forest mixed with small patches of secondary forest. The ditch is about 40 cm in depth. Soil presents only near the edge of the ditch bottom.

Remarks

Metaphire feijani is octothecate and protandric (with one pair of testes in 10), and therefore belongs to the *stephensoni*-species group (Sims and Easton, 1972; Tsai *et al.*, 2004) within *Metaphire*. This species group includes other four species (Tsai *et al.*, 2004). They are *M. paiwanna*, *M. bununa*, and *M. taiwanensis* of Taiwan and *M. stephensoni* of southern Indochina. Regarding Taiwanese species, the spermathecal diverticulum stalks of *M. paiwanna*, *M. bununa*, and *M. taiwanensis* are not tightly coiled; the male pores of the latter three species are C-shaped, and a large genital pad instead of a small one presents in the male pore area of these three species (Tsai *et al.*, 2000a, 2004). Besides, *M. taiwanensis* is a gigantic earthworm, with length longer than 50 cm, and distributes in central Taiwan (Tsai *et al.*, 2004). Generally, it is easy to distinguish *M. feijani* from the other three species by morphology. So far, only five specimens of *M. feijani* were found from two separated sites.

Due to *M. paiwanna* is abundant in the neighbouring regions including these two described sites and *M. feijani* is restricted in the two small areas only, the habitats of these two species seem ecologically different. Regarding *M. stephensoni*, it has smaller body size than *M. feijani* and has transverse-oval male pores (Michaelsen, 1934) with genital papillae. Hence, these two species are remarkably different. The comparison of *stephensoni*-species group is listed in Table 1.

The species epithet '*feijani*' is given in memory of the Taiwanese evolutionary biologist Dr. Fei-Jan Lin, who made a significant contribution during the early study period of Taiwanese earthworms.

Table 1. The comparison of *stephensoni*-species group of the genus *Metaphire*.

Character	*M. paiwanna*	*M. bununa*	*M. taiwanensis*	*M. feijani*	*M. stephensoni*
Locality	Southern Taiwan	Central Taiwan	Central Taiwan	Southern Taiwan	Indochina
Length (mm)	292-293	255-352	637-655	226-254	65
Clitellum width (mm)	6.8-7.4	10.6	16.1-17.2	10.2-11.0	-
Segment number	132-140	189-221	185-228	95-130	100
Annulet number per segment	1-5	1-7	1-3	1-5	-
Prostomium	Prolobous	Prolobous	Prolobous	Prolobous	Epilobous
Setae between male pores	22-26	19-29	24	21-22	-
Male pores	C-shaped	C-shaped	C-shaped	Oval	Transverse-oval
Genital pads in male pore area	large	large	large	small	absent
Reference	Tsai *et al.*, 2000a	Tsai *et al.*, 2000a	Tsai *et al.*, 2004	This study	Michaelsen, 1934

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一種產於台灣南部的新種腔環蚓

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摘　　要

本文描述一種發現於台灣南部的新種蚯蚓。這種蚯蚓屬於腔環蚓屬中具有八個受精囊的 *stephensoni* 種群。在與此種群中的各物種比較形態特徵，顯示這個新種的存在。

關鍵詞：蚯蚓、新種、飛棧腔環蚓、台灣。

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