Zootaxa 5257 (1): 049–081
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5257.1.6
http://zoobank.org/urn:lsid:zoobank.org:pub:E18CE51E-CCD2-4E12-B480-930C79D8B745

The millipedes (Diplopoda) in Yintiaoling National Natural Reserve, Southwest China

HUI-MING CHEN[1, 2], CHANG-BIN ZHENG[3, 4] & XUAN-KONG JIANG[1, 5 *]
[1] *Institute of Biology, Guizhou Academy of Sciences, Guiyang 550009, China*
[2] *mei0601@126.com; https://orcid.org/0000-0002-2449-3036*
[3] *Management Center of Yintiaoling National Nature Reserve, Chongqing 405800, China*
[4] *552151709@qq.com; https://orcid.org/ 0000-0002-2044-5096*
[5] *antoma93@gmail.com; https://orcid.org/0000-0003-3506-5894*
[*] *Corresponding author.*

Abstract

The millipedes of Yintiaoling National Natural Reserve, Southwest China, were investigated. In total, thirteen species from five orders (Sphaerotheriida, Spirobolida, Callipodida, Chordeumatida and Polydesmida) and eight families were discovered. Among them, six species are new to science: *Zephronia linkouzi* **sp. nov.**, *Paracortina inflata* **sp. nov.**, *Orthomorpha laminata* **sp. nov.**, *Polylobosoma corollifera* **sp. nov.**, *Epanerchodus wuxi* **sp. nov.** and *Riukiaria spina* **sp. nov.** As usual, the polydesmidan family Paradoxosomatidae is the most diverse group, containing five species. All new species are described and illustrated, and photographs of the habitus and the gonopods of all species are also provided.

Key words: new species, taxonomy, diversity, morphology, fauna

Introduction

Millipedes (Class Diplopoda) are a common and speciose group of soil arthropods, with more than 11,000 known species worldwide, distributed in all continents of the world except Antarctica (Enghoff *et al*. 2015). Millipedes are general detritivores, feeding on a variety of decaying organic debris, and living in dark, moist environments, such as under rocks, decayed wood, leaf litter, and bark. Millipedes show extremely high diversity and biomass in tropical and subtropical forests, where they form an important part of the soil ecosystem and play a positive role in the material cycle (Sierwald & Bond 2007; Wang *et al*. 2018). At the same time, their weak dispersal ability and the ability of some species to survive in extreme environments, such as caves, deserts, tundra, and even underwater (Golovatch & Kime 2009), show that they are good materials for evolutionary and biogeographic studies. However, the systematics of millipedes remain relatively weak, especially the Chinese fauna (Shelley 2007). Currently, there are only about 460 known millipede species recorded in China (Species 2000 China Node), which is far from the actual number. Although the discovery and description of new species in China have been increasing rapidly in recent years, most of these studies have been sporadic reports of species, lacking revisionary works on particular groups or regions, which are essential for a better understanding of the fauna of China.

Yintiaoling Nature Reserve is located in the northeast edge of Chongqing, Southwest China, covering an area of 224.23 km^2, with a large altitude range (1135–2797 m), rich vegetation types, good protection status, and high biodiversity (Wang *et al*. 2017). In biogeography, it lies on the border between the Oriental realm and the Holarctic realm. This region has a large number of niche habitats suitable for millipedes, such as deciduous forests, karst caves, etc. However, there are no records of any millipedes in the reserve. To understand the species composition of millipedes in this region, we explored this area under the survey program of diversity of Yintiaoling Nature Reserve on 10–20 August 2022. A total of thirteen species were discovered and identified, six of which are new to science and are described below.

Accepted by Z.-S. Zhang: 23 Dec. 2022; published: 24 Mar. 2023

Materials and methods

The specimens were collected by tweezers from thirteen sites in Yintiaoling Nature Reserve, China, including five caves (Yanzi Cave, Gangkou Cave, Longtan Cave, Rengong Cave (an artificial tunnel) and Zengjiayan Cave). Live animals were first observed and photographed with a Canon EOS 5D Mark III camera with a Canon EF 100 mm macro lens. Most of the specimens were preserved in 75% ethanol for morphological studies, and the rest were preserved in absolute ethanol and stored at -40℃ for molecular research. All specimens are deposited in the Institute of Biology, Guizhou Academy of Sciences, Guiyang, China (IBGAS).

Specimens were examined, photographed and measured using a Leica M205A stereomicroscope equipped with a Leica DFC450 camera and LAS software (Version 4.1). All images were edited with Photoshop CC 2019 software.

Terminology used in this paper follows Stoev & Geoffroy (2004), Korsós *et al*. (2011), Likhitrakarn *et al*. (2011), Liu & Golovatch (2018) and Wesener (2019).

Taxonomy

Order Sphaerotheriida Brandt, 1833

Family Zephroniidae Gray, 1843

Zephronia linkouzi sp. nov.

Figs 1–4

Type materials. Holotype male: China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Linkouzi, 31°28’19.47” N, 109°52’58.34” E, alt. 1680 m, 17 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes**: 6 males and 2 females, same data as holotype; 1 female, same locality, 18 August 2022, X.K. Jiang & H.M. Chen leg.

Diagnosis. This species is very similar to *Zephronia hui* Liu & Wesener, 2022 from Jiangkou County, Guizhou Province, China (Zhao *et al*. 2022), but it differs from the latter by the antennae slender (Fig. 2A) (short and stout in *Z. hui*), the process of telopoditomere 2 of the anterior telopod obviously shorter than the length of telopoditomeres 3 and 4 (Figs 3C, 4C) (subequal in *Z. hui*).

Etymology. This species is named after the type locality, Linkouzi, noun in apposition.

Description. Male body length ca. 19–31 mm. Width of thoracic shield = 8.0–11.0 mm, of tergite 8 = 8.8–12.0 mm. Height of thoracic shield = 4.3–6.0 mm, of tergite 8 = 6.0–8.2. Holotype 31 mm long, 11.0 mm (thoracic shield) wide, 6.0 mm (thoracic shield) high, 12.0 (tergite 8) wide, 8.2 (tergite 8) high. Female body length ca. 32–34 mm long. Width, of thoracic shield = 10.8–11.0 mm, of tergite 8 = 11.9–12.0 mm. Height, of thoracic shield = 6.4–6.9 mm, of tergite 8 = 8.3–8.9 mm. Body generally brown with irregular dark marks scattered on body surface (Fig. 1).

Eyes with ca. 55 ocelli. Antennae short and thick. Last antennomere obviously longer than other antennomeres, lengths of antennomeres: 1=2=3=4=5<<6 (Fig. 2A). Apical disc with 39–55 apical cones (male), 24–27 (female) (Fig. 2B, C). Organ of Tömösváry located inside antennal groove. Palpi sensory cones located in a single field. Head surface setose. Structure of gnathochilarium typical. Sensory cones of palpi all located in single field. Mandibles not examined. First stigmatic plate widely rounded, apex slightly curved anteriorly. Posterior-lateral margin of laterotergite 1 strongly projecting into a sharp tip. Laterotergite 2 with a broad, stout, much shorter projection. Collum glabrous except for marginal setae. Thoracic shield grooves deep, anterior margin thickened. Surface glabrous like tergites, setae only in grooves. Tergites surface glabrous. Tips of paratergites of midbody tergites projecting posteriorly. Inner section of endotergum lacking any spines or setae. Middle area with a single row of small, elliptical, cuticular impressions. Distance between impressions twice as wide as their diameter. Apically, 2 dense rows of short marginal bristles, tips of longest setae barely protruding beyond midpoint towards tergal margin. Anal shield massive, well-rounded, shiny and glabrous. Locking carina weakly developed. Leg 1 and 2 with 3 or 4 ventral spines. Leg pairs 4–21 (Fig. 2D) with 8–10 ventral spines and single apical spine. Coxal process weakly developed and well-rounded (Fig. 2D), absent from leg pairs 1 and 2. Tarsus 3.3 times longer than wide. Femur with toothed ridge of medium length.

FIGURE 1. Live specimen of *Zephronia linkouzi* **sp. nov.**

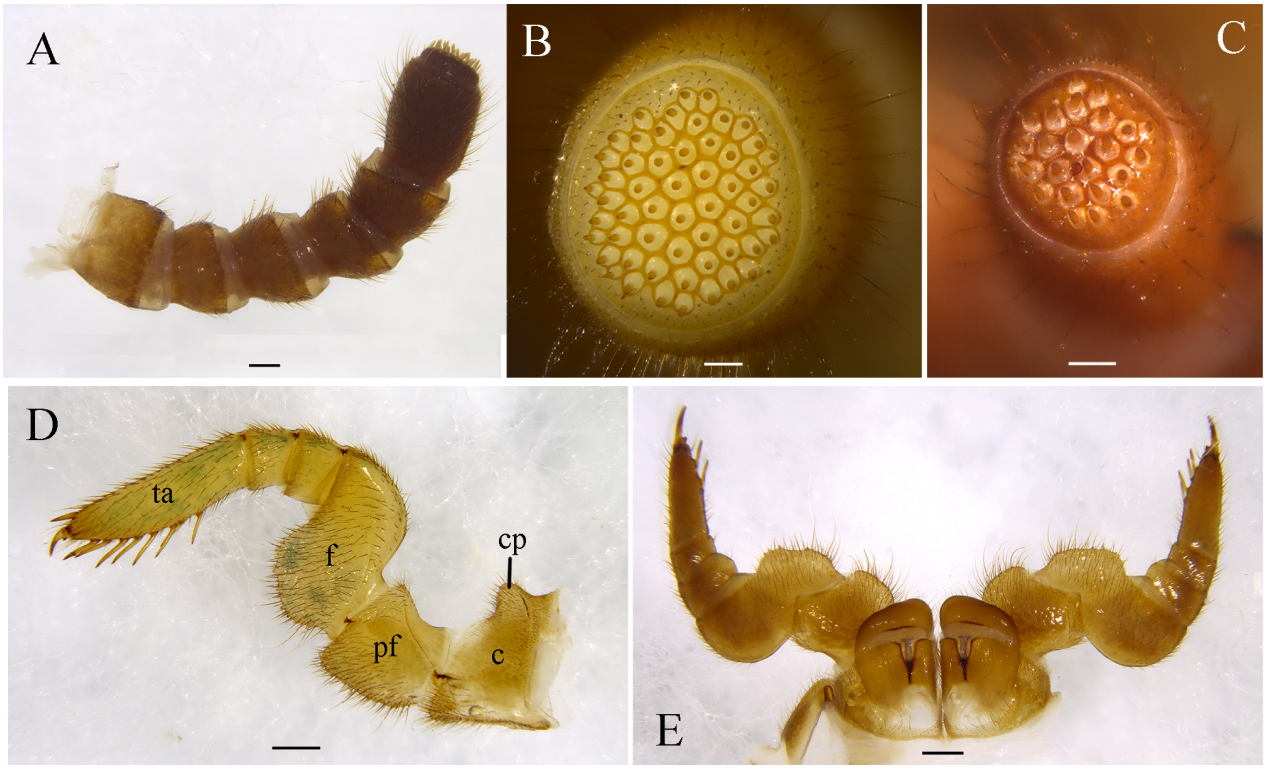

FIGURE 2. *Zephronia linkouzi* **sp. nov. A.** Left antenna, lateral view; **B.** Apical disc with sensory cones of male holotype; **C.** Apical disc with sensory cones of female paratype; **D.** 9th left leg of male holotype; **E.** Second leg with stigmatic plate and vulva, posterior view. **Scale bars:** A = 0.2 mm; B, C = 0.1 mm; D, E = 0.5 mm. **Abbreviations:** c, coxa; cp, coxal process; pf, prefemur; f, femur; ta, tarsus.

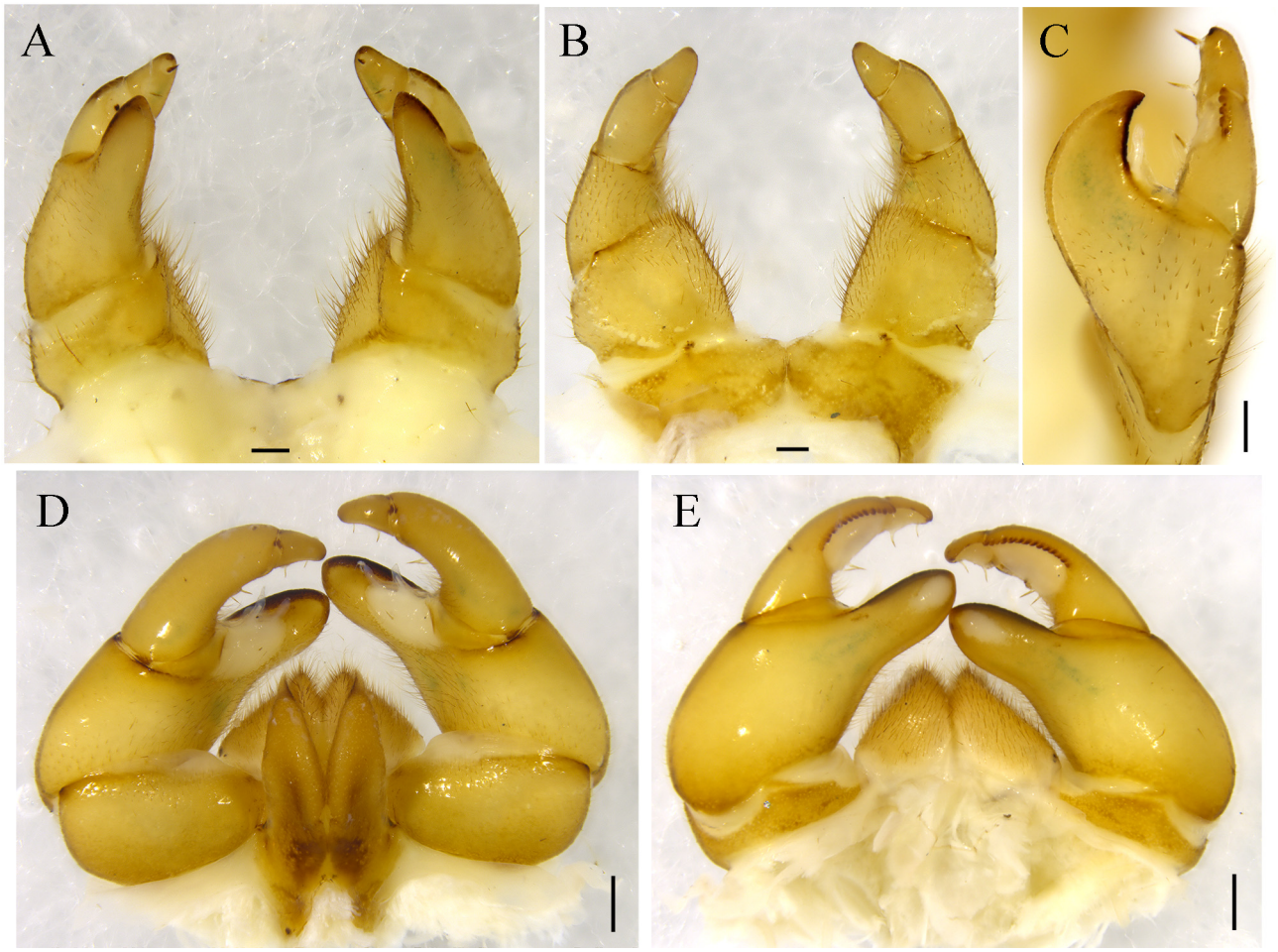

FIGURE 3. Telopods of male holotype of *Zephronia linkouzi* **sp. nov. A.** Anterior telopods, posterior view; **B.** Anterior telopods, anterior view; **C.** Telopoditomeres 2–4 of anterior telopods, lateral view; **D.** Posterior telopods, anterior view; **E.** Posterior telopods, posterior view. **Scale bars:** A–C = 0.2 mm; D, E =0.5 mm.

Male gonopore covered with a small, inconspicuous plate. Telopoditomere 1 of anterior telopods (Figs 3A, B; 4A, B) stout, slightly wider than long. Telopoditomere 2 as long as telopoditomere 3 in anterior view. Process of telopoditomere 2 originated posteriorly, broader than telopoditomere 3, tapering apically, curved, and protruding as high as basal part of telopoditomere 4. Inner margin towards movable finger with one large, membranous lobe. Posterior surface with a row of 5 crenulate and sclerotized teeth (Figs 3C, 4C). Telopoditomere 4 short, with at inner margin two long spines (Figs 3A–C, 4A–C). Mesial and lateral parts of telopoditomere 1 and anterior and lateral parts of telopoditomere 2 covered by setae. Other parts glabrous. Telopoditomere 1 of posterior telopods cylindrical, twice as long as wide. telopoditomere 2 stout (Figs 3D, E; 4D, E). Immovable finger (process of telopoditomere 2) slightly shorter than movable finger, consisting of telopoditomeres 3 and 4. Margin towards movable finger with two large, membranous lobes. Tip of immovable finger with a white spot in posterior view. Telopoditomere 3 elongated, 3 times longer than telopoditomere 4. Margin near immovable finger with a large membranous lobe and two slender spine, posterior surface with a row of 15 crenulate and sclerotized teeth. Telopoditomere 4 with at inner margin two long spines and a single membranous lobe. Entire telopod with few setae, mostly at anterior margins of telopoditomere 1 and inner margins of telopoditomere 2 (Figs 3D, E; 4D, E).

Female vulva (Fig. 2E) large, covering 2/3 of coxa, located at mesal margin, extending mesally to basal third of prefemur length. Operculum rounded. Subanal plate large and wide, not subdivided.

Distribution. Known only from the type locality.

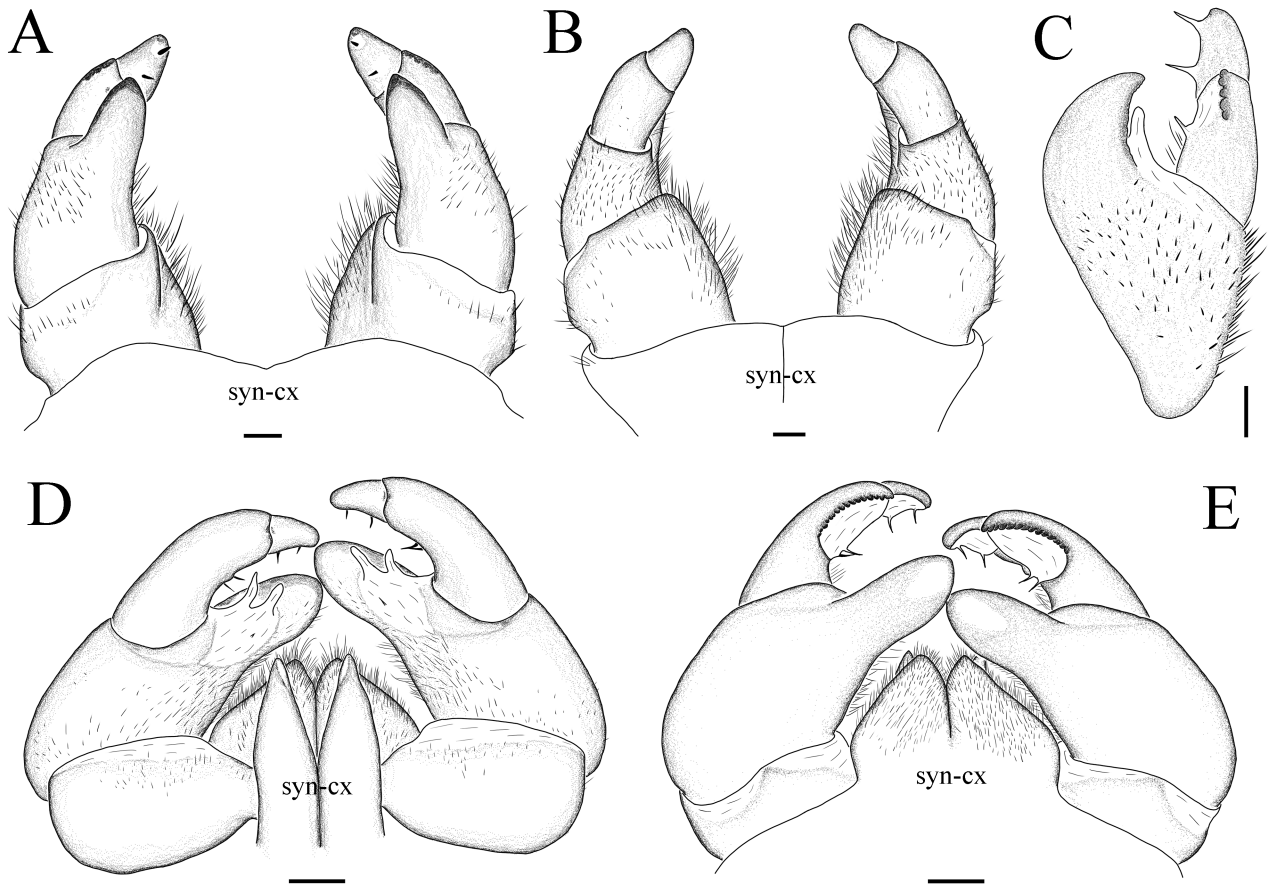

FIGURE 4. Telopods of male holotype of *Zephronia linkouzi* **sp. nov. A.** Anterior telopods, posterior view; **B.** Anterior telopods, anterior view; **C.** Telopoditomeres 2–4 of anterior telopods, lateral view; **D.** Posterior telopods, anterior view; **E.** Posterior telopods, posterior view. **Scale bars:** A–C = 0.2 mm; D, E =0.5 mm. **Abbreviation:** syn-cx = syncoxite.

FIGURE 5. Live specimen of *Spirobolus grahami* Keeton, 1960.

Order Spirobolida Bollman, 1893

Family Spirobolidae Bollman, 1893

Spirobolus grahami Keeton, 1960

Figs 5, 6

Materials examined: 1 male, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Linkouzi, 31°28’19.47” N, 109°52’58.34” E, alt. 1680 m, 17 August 2022, X.K. Jiang & H.M. Chen leg; 1 female and 3 juveniles, same locality, 18 August 2022, X.K. Jiang & H.M. Chen leg.

Distribution. This species was reported from Sichuan, Guizhou and Hubei Provinces. This is the first record of this species from Chongqing.

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 5–6. All the collected locations of this species from China are near the Yangtze River, implying the species may disperse through the water flow.

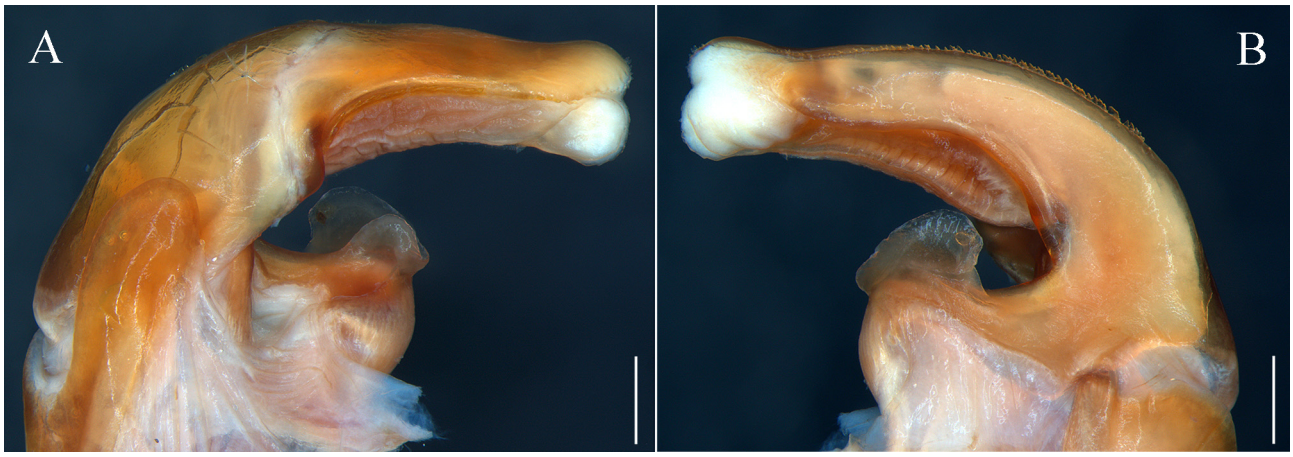

FIGURE 6. Distal portion of anterior gonopods of *Spirobolus grahami* Keeton, 1960. **A.** Anterior view; **B.** Posterior view. **Scale bars:** A, B = 0.5 mm.

Order Callipodida Pocock, 1894

Family Paracortinidae Wang & Zhang, 1993

Paracortina inflata sp. nov.

Figs 7–10

Type materials. Holotype male: China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Hongqi, Longtan Cave, 31°30’40.73” N, 109°49’40.93” E, alt. 1677 m, 14 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes:** 5 males and 9 females, same data as holotype; 1 male and 2 females, Yintiaoling National Nature Reserve, Hongqi, a manual tunnel under the Shuangtong Dam, 31°31’16.83” N, 109°49’51.84” E, alt. 1458 m, 14 August 2022, X.K. Jiang & H.M. Chen leg.

Etymology. This specific name is an adjective Latin word, meaning ‘inflated’ and refers to the shape of the prefemoroidal lateral processes of the gonopod.

Diagnosis. This species can be distinguished from other congeneric species by the large and inflated prefemoroidal lateral processes of the gonopod (Figs 9A, C; 10A, C) (*vs.* clavate or stick-like in other species) and the particular shape of the apex of the gonopod (Figs 9D, 10D).

Description. Adult males body length 46–50 mm, width 2.8–3.0 mm, 56–58 pleurotergites + telson. Adult females body length 48–52 mm, width 3.1–3.4 mm, 57–60 pleurotergites + telson. Body coloration uniformly light brownish (Figs 7, 8).

FIGURE 7. Live specimen of *Paracortina inflata* **sp. nov.**

FIGURE 8. Habitus of *Paracortina inflata* **sp. nov. A.** Anterior part of body, ventral view; **B.** Midbody segments, dorsal view; **C.** Posterior part of body, ventral view. **Scale bars:** A, B = 1 mm; C = 0.5 mm.

Head convex, as broad as pleurotergite 5, covered with minute setae. Eyes with ca. 55 pigmented ocelli in 8 or 9 horizontal rows (Fig. 8A). Organ of Tömösváry small, about 2–3 times larger than an ocellus, situated close to anteroventral side of eye. Antennae slender, reaching the posterior edge of PT6; length of antennomeres: 2=3>4=5>6>7>1; tip of antennomere 7 with four cones (Fig. 8A). Collum much narrower than head (Fig. 7). pleurotergites 6 and 7 in males strongly enlarged (Fig. 8A). Crests on collum and metazona moderately developed, 5+5 primary crests distinct, some secondary crests inconspicuous, 5–8 +5–8 (Figs 7, 8B), and ca. 12 small crests down to ventral pleurotergal edge. 3rd primary crest strongly enlarged (Fig. 8B). Ozopores starting with pleurotergite 6, present until penultimate pleurotergite, placed on tip of 3rd primary crest. Setal pattern as in Table 1. Axial line rather distinct (Fig. 8B). Epiproct simple, rear part with ca. 30 long setae in 3–4 transverse rows. Anal valves smooth, each divided into a small triangle and a large sclerite, both with a pair of macrosetae. Spinnerets comparatively thin and long, ending with a long macroseta. Hypoproct tripartite, medial sclerite largest, subrectangular, bearing two paramedian macrosetae; each lateral sclerite with a single macroseta (Fig. 8C). Male leg-pairs 1 and 2 evidently shorter, leg-pair 3 slightly shorter than midbody legs. Midbody legs about twice as long as pleurotergite height. Coxal sacs present from 3rd at least to leg-pair 18, but most abraded. Coxae 2 with a gonopore posteriorly, opening from a small cone. Coxae 7 normal without mesal spine; prefemora slightly incrassate. Tarsal pads small, present from 3rd to about leg pair 21.

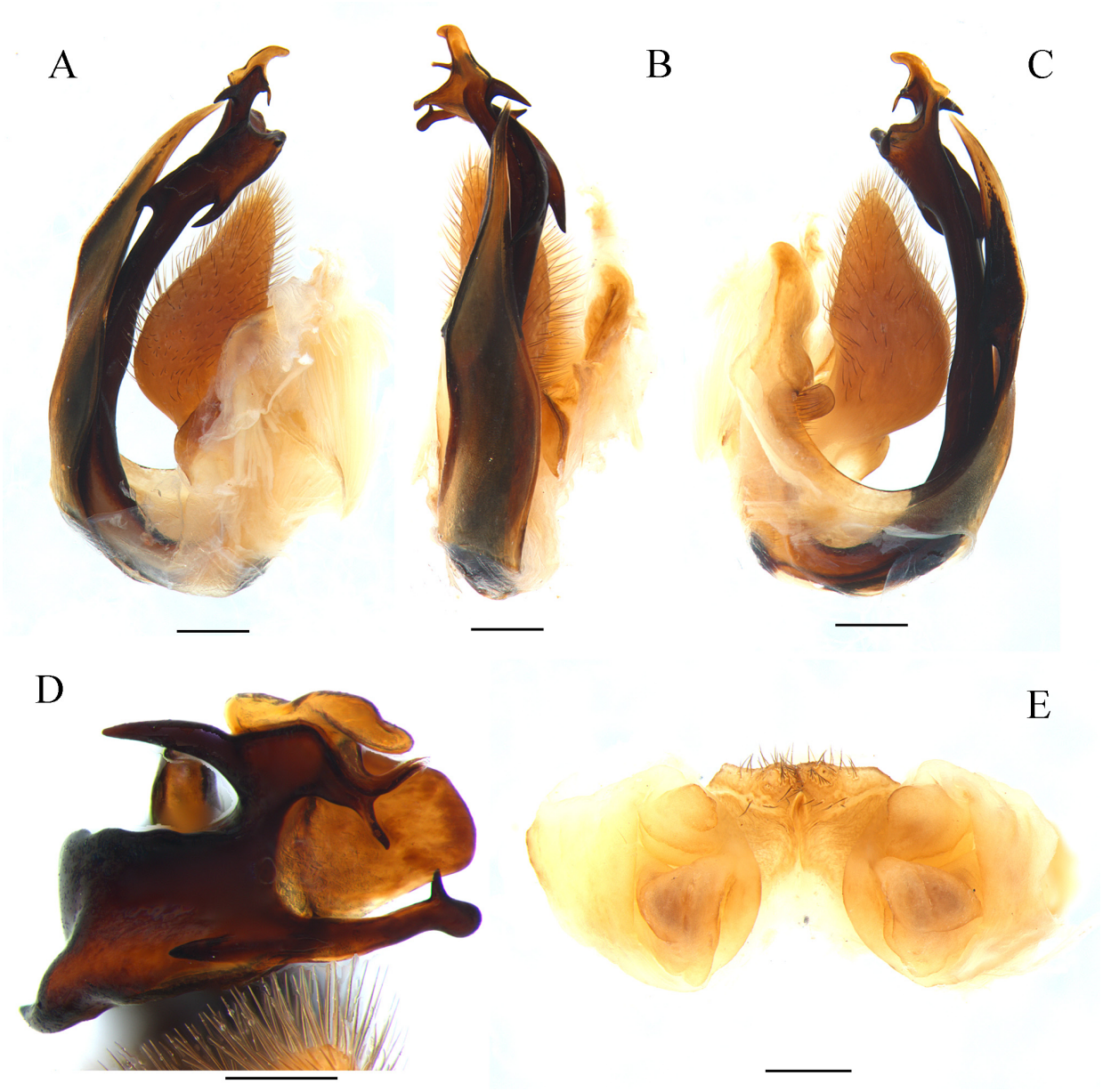

FIGURE 9. Gonopod and vulva of *Paracortina inflata* **sp. nov. A.** Left gonopod, lateral view; **B.** Left gonopod, ventral view; **C.** Left gonopod, mesal view; **D.** Tip of left gonopod, anterior view; **E.** Vulva, posterior view. **Scale bars:** 0.5 mm.

TABLE 1. Chaetotaxy of *Paracortina inflata* **sp. nov.**

	Anterior setae	**Posterior setae**
Collum	5 + 5	-
Pleurotergites 2 to 4	5 + 5	-
Pleurotergite 5	d, a + a, d	e, c, b + b, c, e
Pleurotergite 6 to penultimate	-	5 + 5

Gonopod coxae freely connected through a medial membranous lamina. Coxa strongly broadened, bearing a large, broad anterior process, tapering apically, near the length of telopodite (Figs 9A–C, 10A–C). Prefemur with two processes. Lateral process inflated and drop-shaped, densely setose, about half the length of telopodite (Figs 9A, C; 10A, C). Inner process small, base with several setae (Figs 9C, 10C). Femoroidal stem long, slender, directed cephalad. Subterminal part of femoroidal stem broadened, forming a complex tip with ten apices (Figs 9A–C, 10A–C). One dorsal and one ventral process located subterminal part directed basally. Terminal part trifid (Figs 9D, 10D). Dorsal branch with two apices, basal one short and straight, directed mesally and distal one strongly bent,

with a sharp tip. Ventral branch with three tips and a small apical lobe. A broad and rounded lobe located below the two branches. Seminal groove ending on the ventral branch.

Female. Slightly larger than males, pleurotergites 2 and 3 strongly enlarged. Leg pairs 1 and 3 with tarsal pads. Leg pair 1 strongly reduced in size. Leg pair 2 normal. All legs with unmodified coxae. Cyphopods small, densely setose (Fig. 9E).

Distribution. Known only from the type locality.

Remarks. The family Paracortinidae contains two genera and 14 species, distributed in Southwest China (Yunnan and Sichuan) and Vietnam (Liu & Tian 2015). The new species described here is the most northeast one on record, significantly expanding the distribution range of this family.

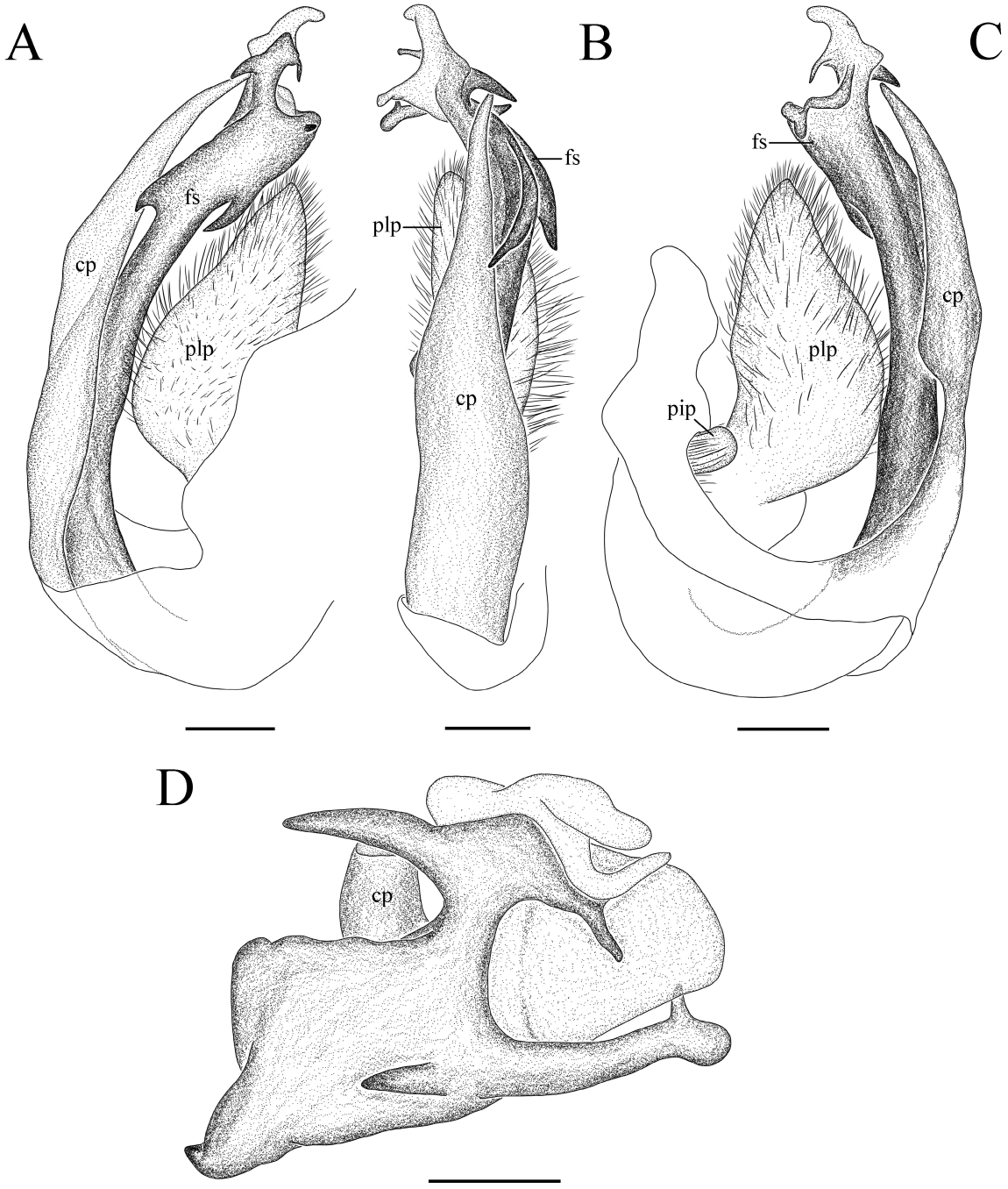

FIGURE 10. Gonopod of *Paracortina inflata* **sp. nov. A.** Left gonopod, lateral view; **B.** Left gonopod, ventral view; **C.** Left gonopod, mesal view; **D.** Tip of left gonopod, anterior view. **Scale bars:** 0.5 mm. **Abbreviations:** cp, coxal process; fs, femoroidal stem; pip, prefemoroidal lateral process; plp, prefemoroidal inner process.

Order Chordeumatida Pocock, 1894

Family Kashmireumatidae Mauriès, 1982

***Vieteuma hubeiensis* Mauriès & Nguyen Duy-Jacquemin, 1997**
Figs 11, 12

Materials examined: 20 males and 38 females, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Guanshan, Yanzi Cave, 31°28'52.67" N, 109°43'59.70" E, alt. 2230 m, 12 August 2022, X.K. Jiang & H.M. Chen leg; 1 male and 4 females, Yintiaoling National Nature Reserve, Guanshan, Gangkou Cave, 31°30'32.22" N, 109°41'33.65" E, alt. 2070 m, 13 August 2022, X.K. Jiang & H.M. Chen leg.

FIGURE 11. Live specimen of *Vieteuma hubeiensis* Mauriès & Nguyen Duy-Jacquemin, 1997.

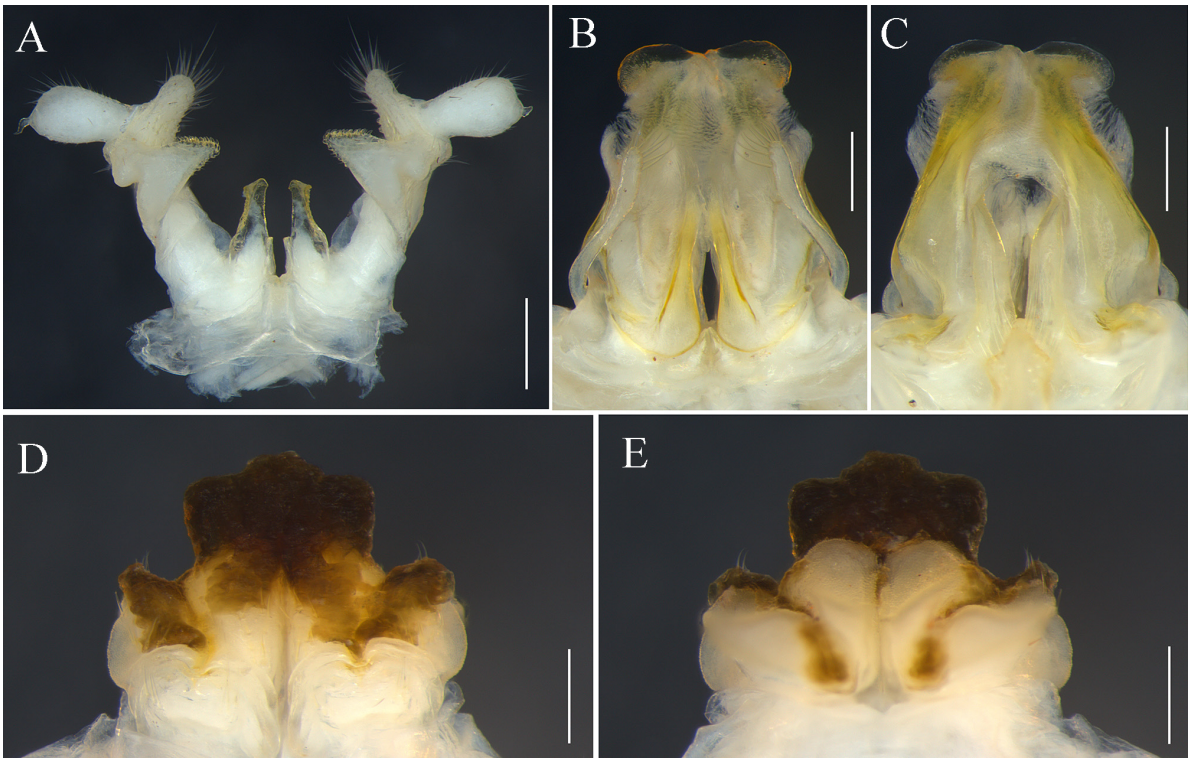

FIGURE 12. Gonopods and vulva of *Vieteuma hubeiensis* Mauriès & Nguyen Duy-Jacquemin, 1997. **A.** Posterior gonopods, anterior view; **B.** Anterior gonopods, posterior view; **C.** Anterior gonopods, anterior view; **D.** Vulva, anterior view; **E.** Vulva, posterior view. **Scale bars:** A = 0.75 mm; B–E = 0.5 mm.

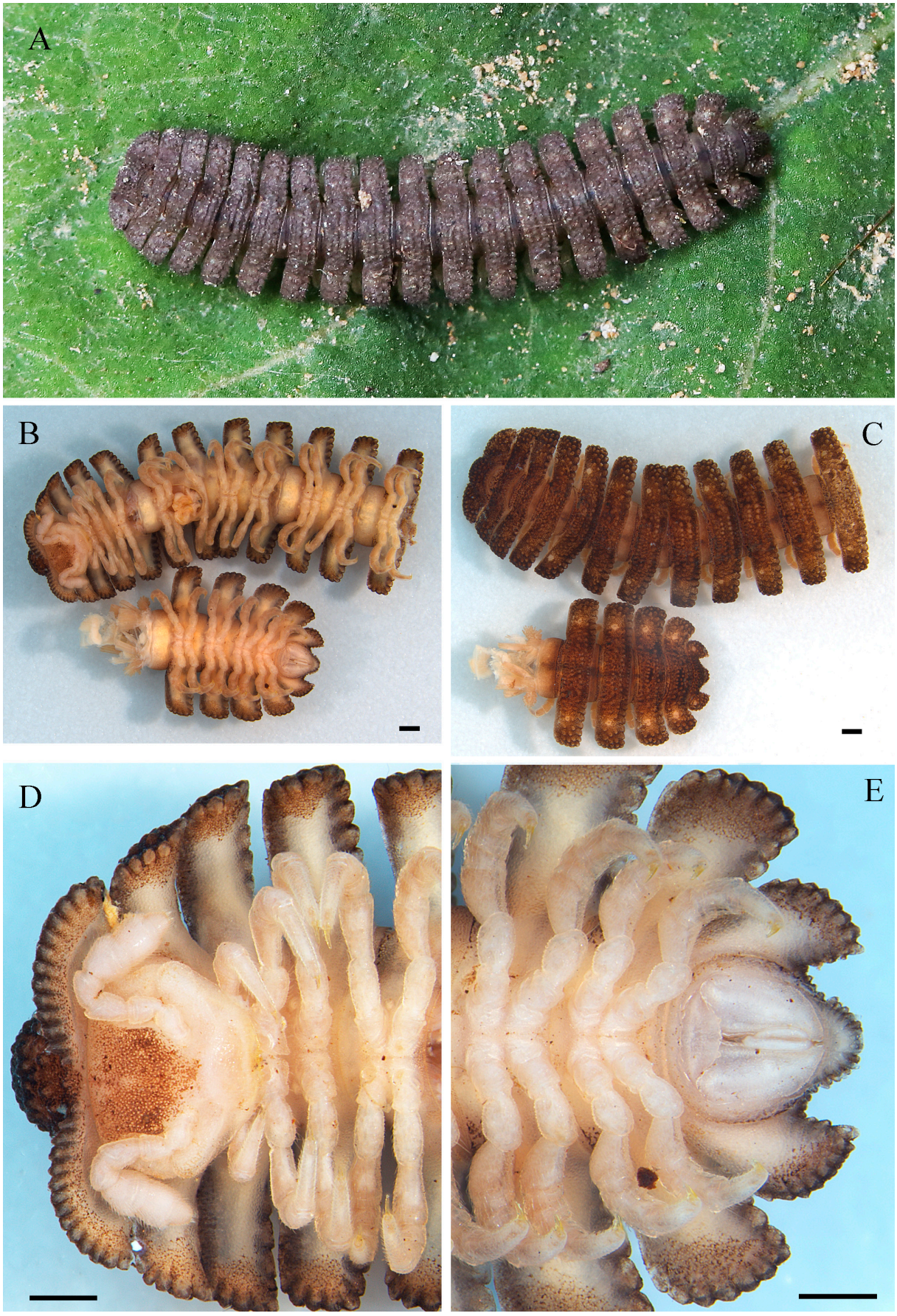

FIGURE 13. *Niponia nodulosa* Verhoeff, 1931. **A.** Living example; **B.** Habitus, ventral view; **C.** Habitus, dorsal view; **D.** Head, collum and segments 2–4, ventral view; **E.** Segments 17–19 and telson, ventral view. **Scale bars:** 1 mm.

Distribution. Shennongjia (Hubei) and Yintiaoling (Chongqing).

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 11–12. The type locality of this species is in Shennongjia National Natural Reserve, Hubei Province (Mauriès & Nguyen Duy-Jacquemin, 1997), bordering on Yintiaoling. It is not surprising to collect this species in the region.

Order Polydesmida Leach, 1815

Family Cryptodesmidae Karsch, 1880

Niponia nodulosa Verhoeff, 1931

Figs 13–15

Material examined. 1 male, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Linkouzi, 31°28′30.0″N, 109°52′40.8″E, alt. 1213 m, 17 August 2022, X.K. Jiang & H.M. Chen leg.

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 13–15. This species is easily distinguished by the coxite with two strong setae ventrolaterally, the prefemoral part less than half as long as the acropodite, and the latter distinctly excavate, forming a mesal cavity surrounded by fringed or microspiculate lamellae. It has hitherto been throughout Taiwan and Jiangsu, China, as well as in Japan and Vietnam (Golovatch *et al*. 2018). The above samples thus represent the first formal record of *N. nodulosa* in Chongqing, China.

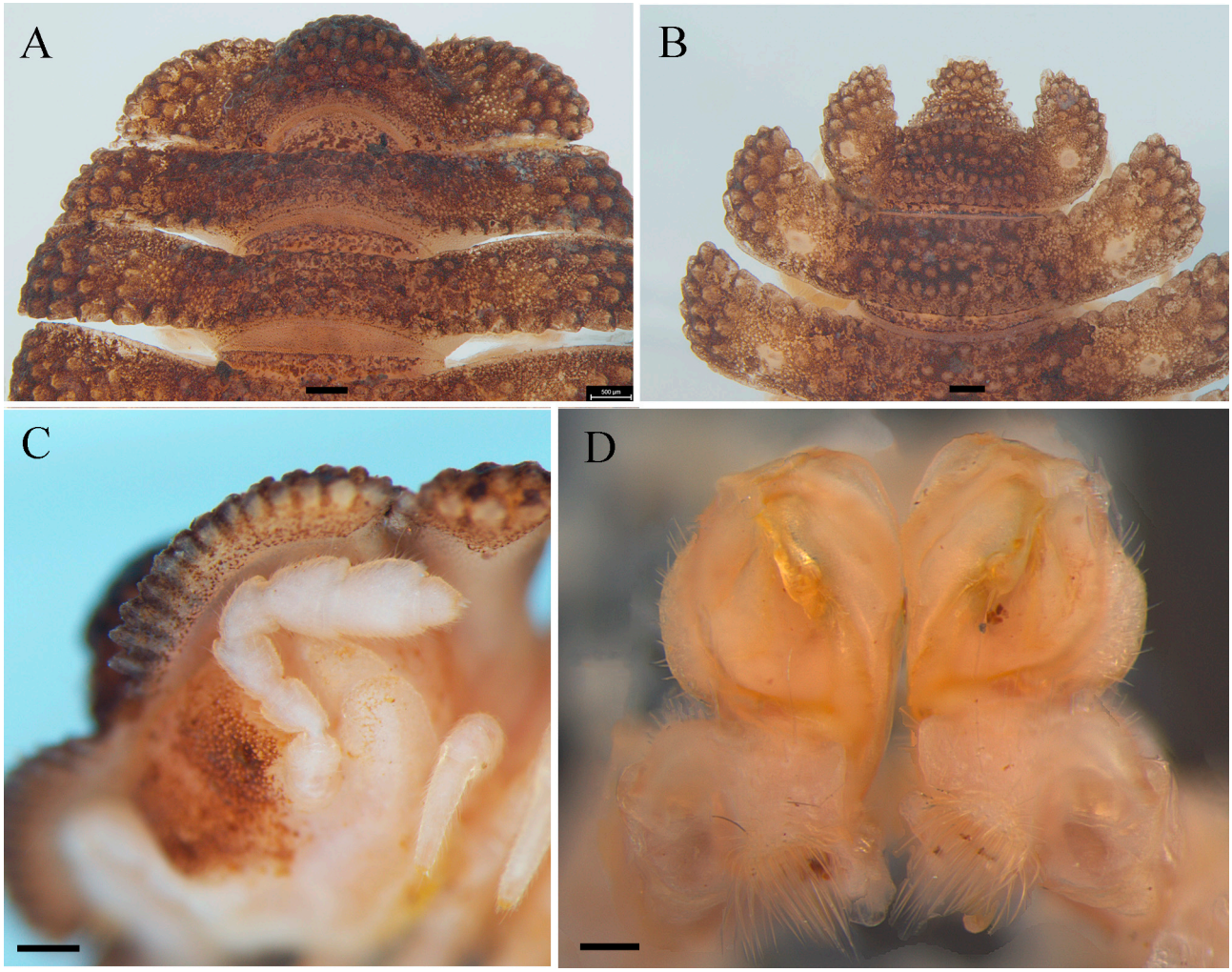

FIGURE 14. *Niponia nodulosa* Verhoeff, 1931. **A.** Head, collum and segments 2–4, dorsal view; **B.** Segments 17–19 and telson, dorsal view; **C.** Antenna, anterior view; **D.** Gonopods, ventral view. **Scale bars:** A–C = 0.5 mm; D = 0.2 mm.

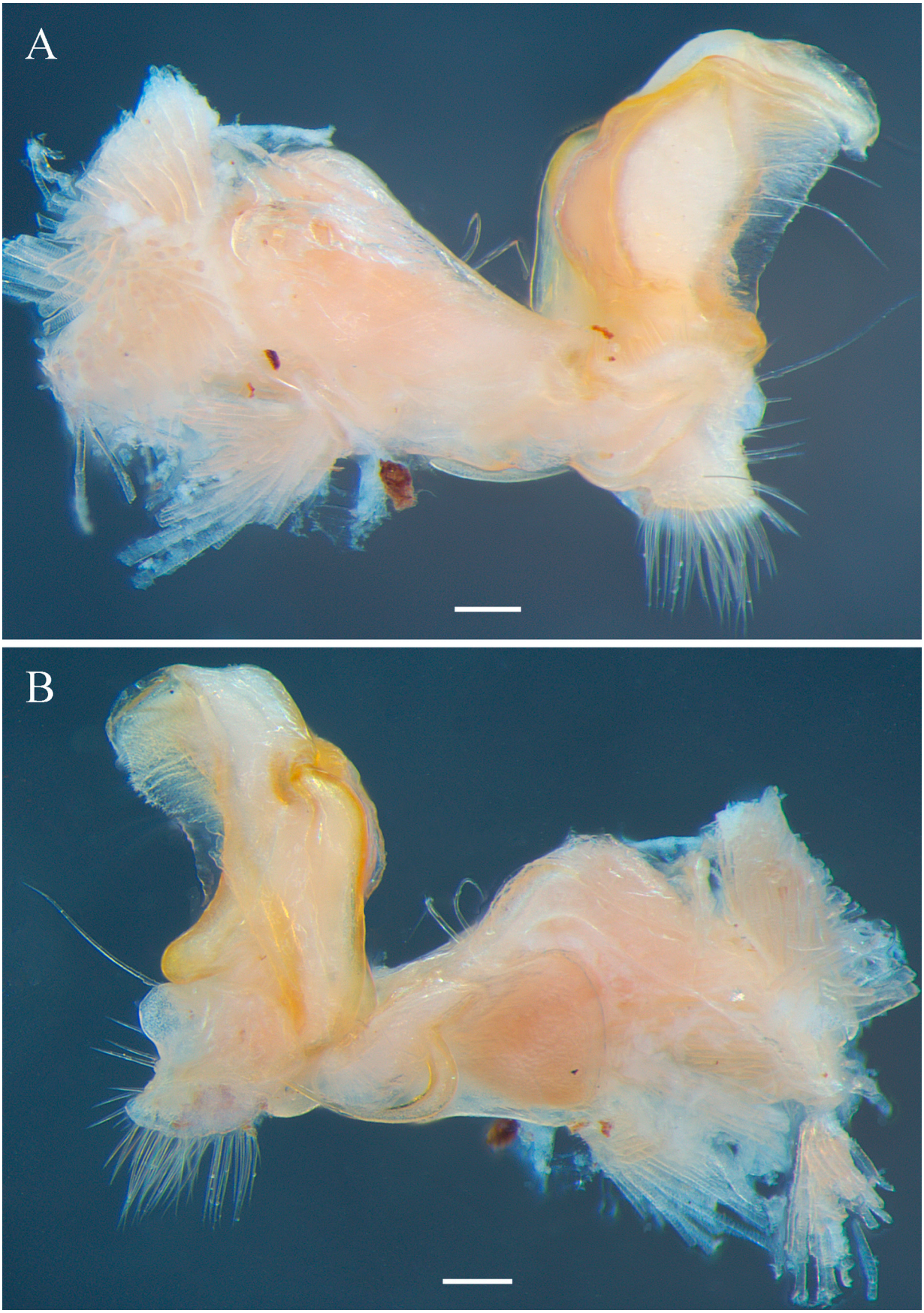

FIGURE 15. *Niponia nodulosa* Verhoeff, 1931. **A.** Right gonopod, mesal view; **B.** Right gonopod, lateral view. **Scale bars:** 0.2 mm.

Family Paradoxosomatidae Daday, 1889

***Kronopolites swinhoei* (Pocock, 1895)**
Figs 16, 17

Materials examined. 5 males and 7 females, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Hongqi, 31°30'25.43" N, 109°49'28.42" E, alt. 1166 m, 13 August 2022, X.K. Jiang & H.M. Chen leg; 13 males and 11 females, Yintiaoling National Nature Reserve, Linkouzi, 31°28'19.47" N, 109°52'58.34" E, alt. 1680 m, 16 August 2022, X.K. Jiang & H.M. Chen leg.; 6 males and 8 females, same locality, 17 August 2022, X.K. Jiang & H.M. Chen leg; 2 males and 4 females, Yintiaoling National Nature Reserve, Guanshan, Yanzi Cave, 31°28'52.67" N, 109°43'59.70" E, alt. 2230 m, 12 August 2022, X.K. Jiang & H.M. Chen leg; 1 female, Yintiaoling National Nature Reserve, Shizhuzi, 31°32'4.68" N, 109°42'16.26" E, alt. 2210 m, 11 August 2022, X.K. Jiang & H.M. Chen leg.

FIGURE 16. Live specimen of *Kronopolites swinhoei* (Pocock, 1895).

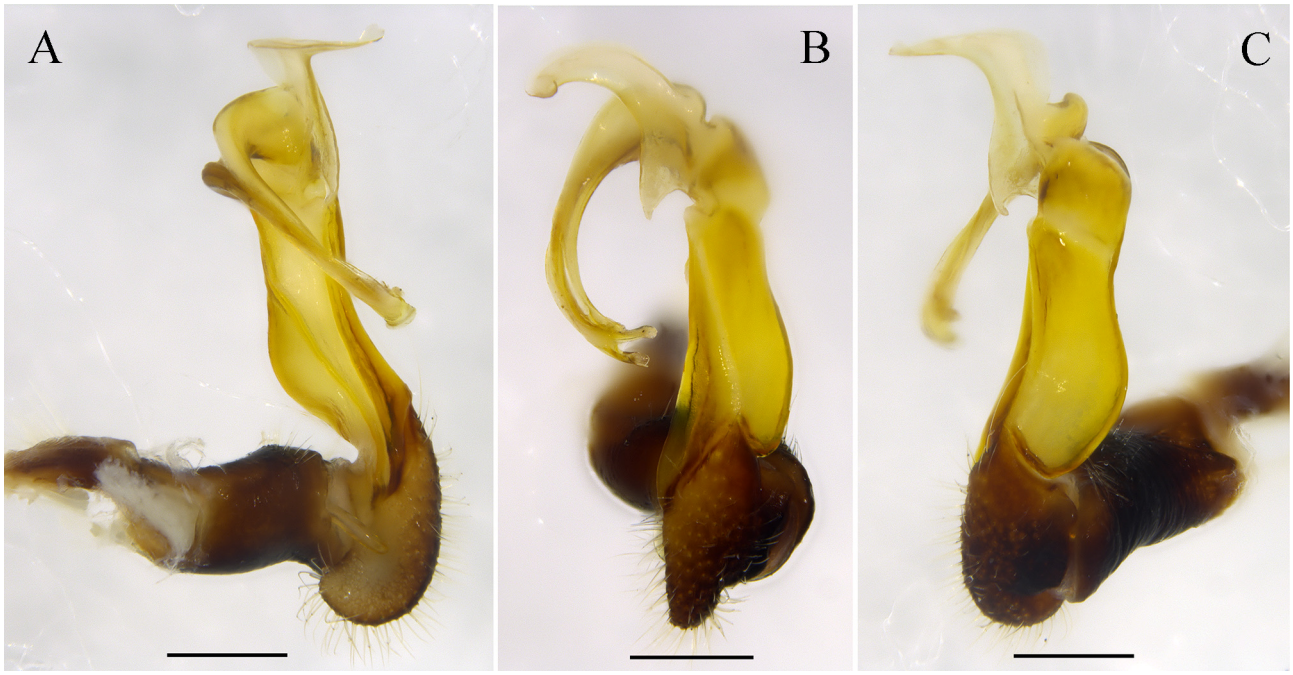

FIGURE 17. Left gonopods of *Kronopolites swinhoei* (Pocock, 1895). **A.** Mesal view; **B.** Ventral view; **C.** Lateral view. **Scale bars:** 0.5 mm.

Distribution. This species is widespread in central and southern China (Qinghai, Gansu, Shaanxi, Sichuan, Guizhou, Yunnan and Zhejiang) (Golovatch 2019).

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 16–17.

***Orthomorpha laminata* sp. nov.**

Figs 18–20

Type materials. Holotype male: China, Chongqing, Wuxi County, Tongcheng Town, Zengjiayan Cave, 31°22'30.23" N, 109°46'11.59" E, alt. 1301 m, 15 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes:** 3 males, same data as holotype; 2 males and 2 females, Yintiaoling National Nature Reserve, Hongqi, Longtan Cave, 31°30'40.73" N, 109°49'40.93" E, alt. 1677 m, 14 August 2022, X.K. Jiang & H.M. Chen leg.

Diagnosis. This species can be distinguished from other species in this genus by the femorite of the gonopods extremely bent, lamellar processes present apically, and without an oblique lateral sulcus (Figs 19, 20).

Etymology. This species is named by the lamellar processes of the tip of femorite of the gonopods, adjective.

Description. Length ca. 43–50 mm (male), 45–48 mm (female), width of midbody pro- and metazona 3.7–3.8 and 5.2–5.3 mm (male), 3.9–4.7 and 5.2–6.0 mm (female), respectively. Head and dorsum of the body black, paraterga light yellow, venter and legs reddish brown (Fig. 18A).

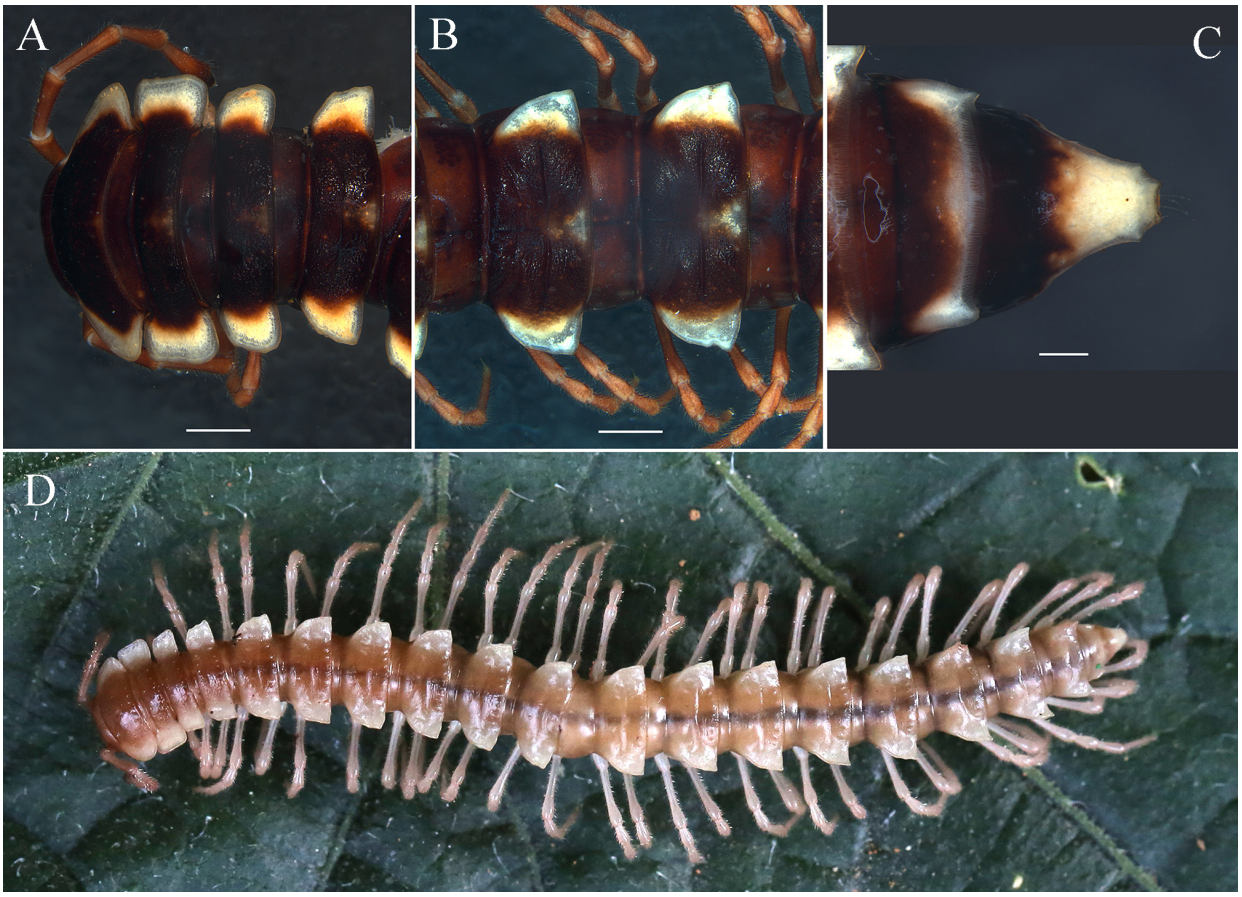

FIGURE 18. Habitus of *Orthomorpha laminata* **sp. nov. A.** Anterior part of body, dorsal view; **B.** Midbody segments, dorsal view; **C.** Posterior part of body, dorsal view; **D.** Live specimen with pale coloration from Zengjiayan Cave. **Scale bars:** A, B = 2.5 mm; C = 1 mm.

Clypeolabral region sparsely setose, vertex bare, epicranial suture distinct. Antennae slender, antennomeres 2–7 clavate. Lengths of antennomeres: 3≈2≈4≈5≈6>1>7. Collum glabrous (Fig. 18A). Paraterga only slightly declivous, broadly rounded, and narrowly bordered. Postcollum constriction obvious. Tegument of metaterga shining, rugulose, prozona and metazona below paraterga smooth. Axial line barely visible both on pro- and metazona. Paraterga strongly developed, broad, subhorizontal, always lying below dorsum, thick in lateral view (Fig. 18A, B). Ozopores

evident, lateral, lying in an ovoid groove at about 1/3 in front of caudal corner. Pore formula normal. Transverse sulcus evident, narrow, rather shallow and only slightly incomplete on metaterga 2 and 3, reaching base of paraterga on metaterga 4–18. Stricture between pro- and metazona narrow and shallow, evidently beaded at bottom down to base of paraterga. Sterna sparsely setose, without modifications, but with a small, rounded cone between male coxae 4. No conspicuous ridge in front of gonopod aperture. Legs long and slender, obviously longer than body height. Prefemora without modifications. Epiproct conical, flattened dorsoventrally, apical papillae well-developed (Fig. 18C). Hypoproct arch shaped.

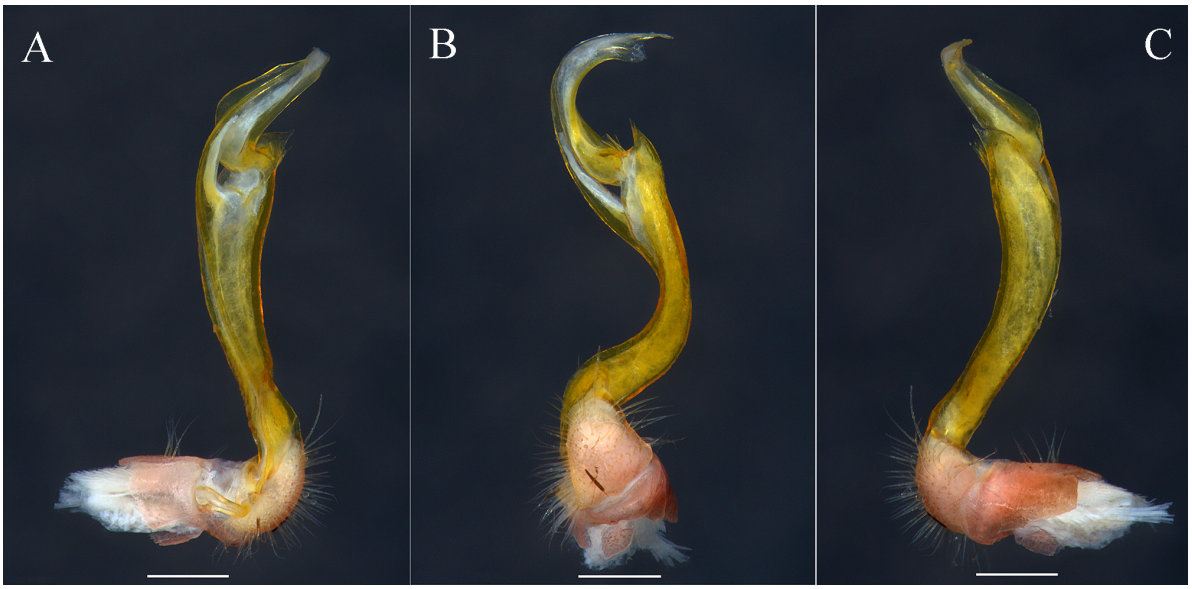

FIGURE 19. Left gonopod of *Orthomorpha laminata* **sp. nov.**, holotype. **A.** Mesal view; **B.** Ventral view; **C.** Lateral view. **Scale bars:** A–C = 0.5 mm.

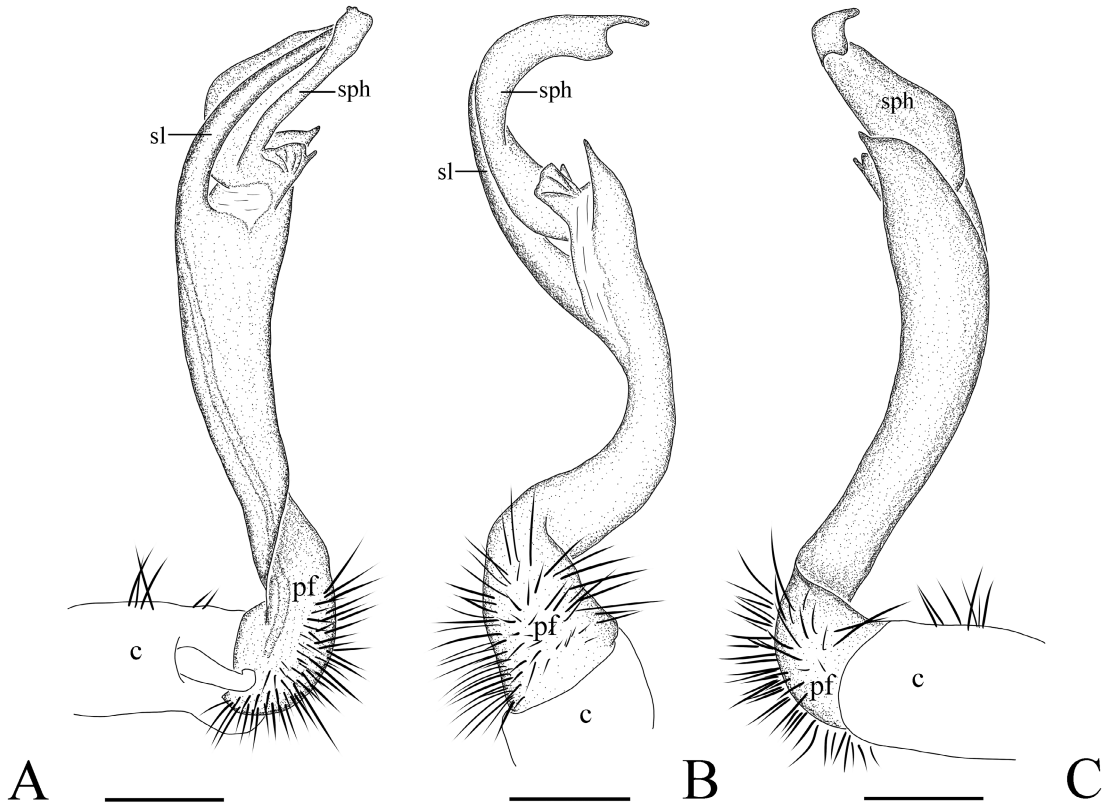

FIGURE 20. Left gonopod of *Orthomorpha laminata* **sp. nov.**, holotype. **A.** Mesal view; **B.** Ventral view; **C.** Lateral view. **Scale bars:** A–C = 0.5 mm. **Abbreviations:** c, coxa; pf, prefemur; sl, solenomere; sph, solenophore.

Gonopods (Figs 19, 20) simple. Coxa long and slender, with several setae distodorsally (Figs 19, 20). Prefemora densely setose, about 1/3 as long as acropodite (Figs 19, 20). Femorite slender, evidently curved and not enlarged distad, without a lateral sulcus (Figs 19, 20). Tip of femorite present two lamellar processes (Figs 19B, 20B). One situated at the inner margin, with a sharp tip. Another one situated at the base of solenophore. Solenophore bent as semicircle. Tip of solenophore slightly bifid, upper denticle slender and longer than lower lobule. Lower lobule broad (Figs 19B, 20B). Solenomere about as long as solenophore, flagelliform (Figs 19A, B; 20A, B).

Distribution. Known only from the type locality.

Remarks. *Orthomorpha* is distributed in southeast Asia and it is very similar to the sympatric genus *Antheromorpha* (Likhitrakarn *et al*. 2011, 2016). Their taxonomic boundary is vague. *Orthomorpha* can only be distinguished from the latter by the poorly differentiated gonopod tip, usually feebly bi- or trifid, whereas *Antheromorpha* shows a deeply bifid gonopod tip (Likhitrakarn *et al*. 2011, 2016). Considering the structure of the gonopod tip of the new species, we chose to place it in *Orthomorpha*.

Orthomorpha is a large genus comprising 50 species, and has been reviewed recently (Likhitrakarn *et al*. 2011; Nguyen & Sierwald 2013). However, no species of this genus have been reported from China. Therefore, the new species described here is the first *Orthomorpha* recorded in this country.

Two individuals from deep inside Zengjiayan Cave show the distinct pale coloration of the body (Fig. 18B), but their gonopods are identical to the epigean congeners indicating that they belong to the same species.

Oxidus gracilis (C.L. Koch, 1847)

Figs 21, 22

Materials examined: 2 males, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Hongqi, 31°30’25.43” N, 109°49’28.42” E, alt. 1166 m, 16 August 2022, X.K. Jiang & H.M. Chen leg; 11 males and 15 females, Yintiaoling National Nature Reserve, Guanshan, 31°31’0.78” N, 109°43’18.33” E, alt. 2034 m, 12 August 2022, X.K. Jiang & H.M. Chen leg.

Distribution. Cosmopolitan.

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 21–22. This species is distributed nearly world-wide in tropical and temperate environments and closely relates to human activities.

FIGURE 21. Live specimen of *Oxidus gracilis* (C.L. Koch, 1847).

FIGURE 22. Left gonopod of *Oxidus gracilis* (C.L. Koch, 1847), mesal view. **Scale bar:** 0.25 mm.

***Polylobosoma corollifera* sp. nov.**
Figs 23–25

Type materials. Holotype male: China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Huangcaoping, 31°25'7.20" N, 109°55'59.33" E, alt. 2098 m, 20 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes:** 2 females, same data as holotype; 1 male, Yintiaoling National Nature Reserve, Linkouzi, 31°28'19.47" N, 109°52'58.34" E, alt. 1680 m, 17 August 2022, X.K. Jiang & H.M. Chen leg; 2 females, Yintiaoling National Nature Reserve, Shizhuzi, 31°32'4.68" N, 109°42'16.26" E, alt. 2210 m, 11 August 2022, X.K. Jiang & H.M. Chen leg.

Diagnosis. This species is very similar to *Polylobosoma panda* (Golovtach, 2009) from Foping Nature Reserve, Shaanxi Province, China. It can be distinguished from the latter by the tips of the solenomere and the solenophore pointed laterally (Figs 24, 25), not caudally as in *P. panda*.

Etymology. This specific name is an adjective Latin word, meaning 'coronal' and refers to the shape of the solenophore of the gonopod.

Description. Length ca. 43–46 mm (male), 44–45 mm (female), width of midbody pro- and metazona 4.0–4.1 mm and 5.8–6.1 mm (male), 5.0–5.2 mm and 6.1–6.3 mm (female), respectively. Head and dorsum of the body black, paraterga whitish or light yellow, venter and legs reddish brown (Fig. 23).

Clypeolabral region poorly setose, vertex glabrous, epicranial suture distinct. Antennae slender, antennomeres 2–7 clavate. Lengths of antennomeres: 3≥2≥4≥5≥6>1>7. Collum glabrous (Fig. 23A). Paraterga only slightly declivous, broadly rounded, and narrowly bordered (Fig. 23A, B). Postcollum constriction moderate (Fig. 23A). Tegument of metaterga shining, rough, and leather-like; prozona and metazona below paraterga smooth. Axial line barely visible both on pro- and metazona. Paraterga strongly developed, broad, subhorizontal, located in the middle of body segment in lateral view (Fig. 23A, B). Ozopores evident, lateral, lying in an ovoid groove at about 1/3 in front of caudal corner. Pore formula normal. Transverse sulcus evident reaching base of paraterga on metaterga 5–17, absent in metaterga 2–4. Stricture between pro- and metazona narrow and shallow, evidently beaded at bottom down to base of paraterga. Sterna sparsely setose, without modifications, but with a small, rounded cone between male coxae 4 (Fig. 23C). No conspicuous ridge in front of gonopod aperture. Legs long and slender, obviously longer than body height. Prefemora without modifications. Epiproct conical, flattened dorsoventrally, apical papillae well-developed (Fig. 23D). Hypoproct arch shaped.

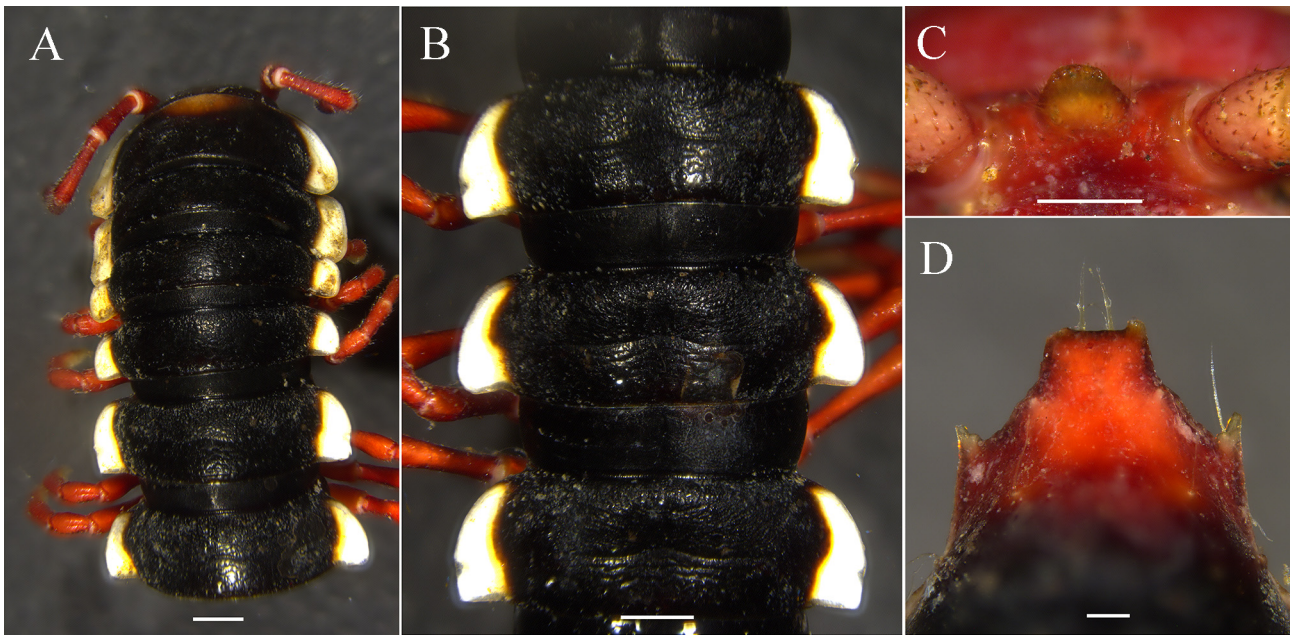

FIGURE 23. *Polylobosoma corollifera* **sp. nov.** holotype. **A.** Anterior part of body, dorsal view; **B.** midbody segments, dorsal view; **C.** Sternal cones between coxae 4, ventral view; **D.** Posterior part of body, dorsal view. **Scale bars:** A, B = 1 mm; C = 0.5 mm; D = 0.2 mm.

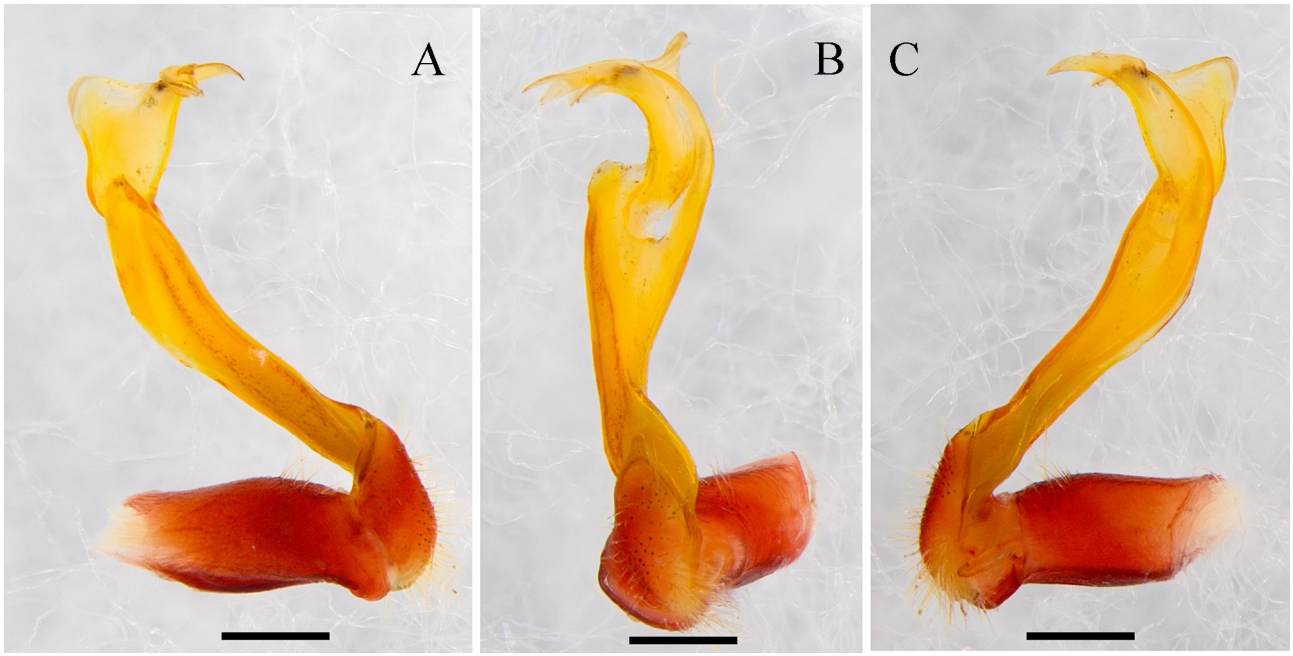

FIGURE 24. Right gonopod of *Polylobosoma corollifera* **sp. nov.**, holotype. **A.** Lateral view; **B.** Ventral view; **C.** Mesal view. **Scale bars:** A–C = 0.25 mm.

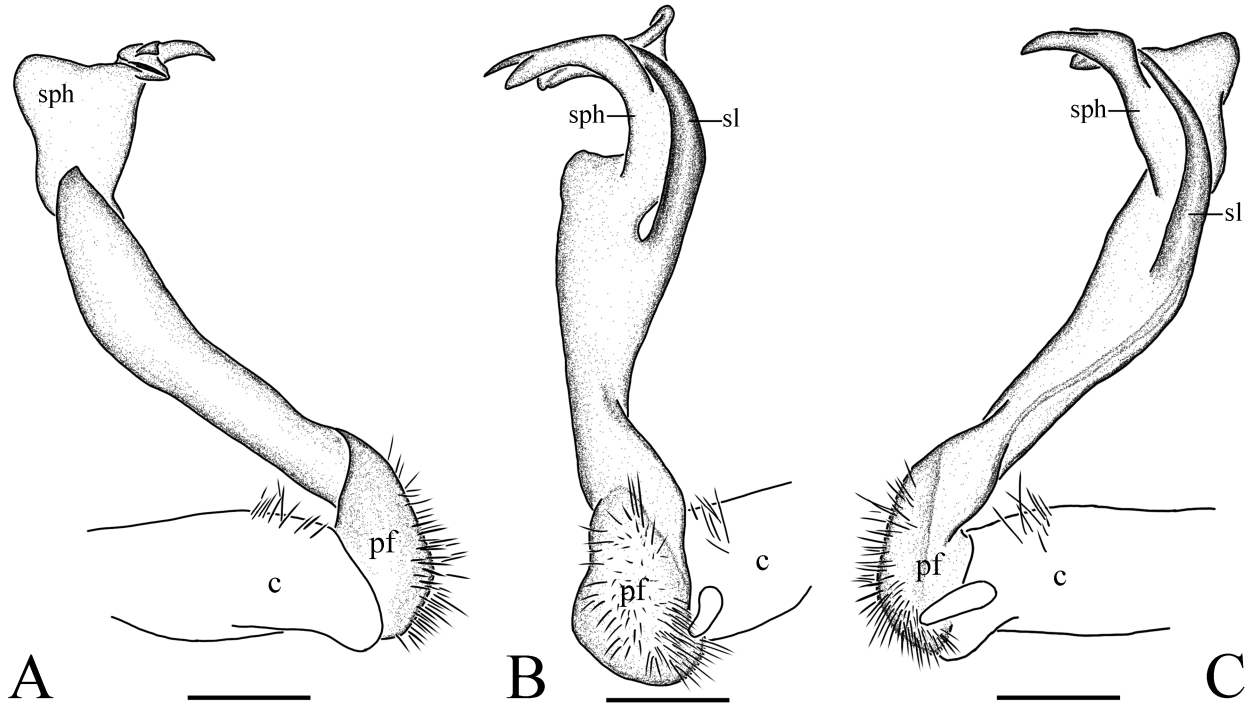

FIGURE 25. Right gonopod of *Polylobosoma corollifera* **sp. nov.**, holotype. **A.** Lateral view; **B.** Ventral view; **C.** Mesal view. **Scale bars:** A–C = 0.25 mm. **Abbreviations:** c, coxa; pf, prefemur; sl, solenomere; sph, solenophore.

Gonopods simple (Figs 24, 25). Coxa subcylindrical, poorly setose distodorsally (Figs 24A, C; 25A, C). Prefemora densely setose, about 1/3 as long as acropodite (Figs 24, 25). Femorite slender, slightly curved and not enlarged distad, without a lateral sulcus (Figs 24, 25). Tip of femorite present one small lobe (Figs 24A, B; 25A, B). Solenophore obviously bent. Anterior margin of solenophore expanded anteriorly, corona-shaped (Figs 24, 25). Tip of solenophore deeply trifid, all branches with a sharp tip. Solenomere about as long as solenophore, flagelliform (Figs 24B, C; 25B, C).

Distribution. Known only from the type locality.

***Sellanucheza jaegeri* Golovatch, 2013**
Figs 26, 27

Materials examined: 2 males and 1 female, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Shizhuzi, 31°32'4.68" N, 109°42'16.26" E, alt. 2210 m, 11 August 2022, X.K. Jiang & H.M. Chen leg.

Remarks. The characters of the habitus and the gonopods of this species are shown in Figs 26–27. *Sellanucheza* is a small genus containing six species distributed in China (three species in Sichuan, Chongqing and Shaanxi) and northern Vietnam. The generic name has been changed from *Szechuanella* Hoffman, 1961 to the anagram *Sellanucheza* because of preoccupation (Enghoff *et al*. 2004), and the original name refers to Sichuan Province, China. The type locality of *S. jaegeri* is in Houzhenzi, Shaanxi, about 400 km from Yintiaoling. Further investigation of the actual distribution range of this species is needed, especially on some areas of south slope of Qinling Mountains.

FIGURE 26. Live specimen of *Sellanucheza jaegeri* Golovatch, 2013.

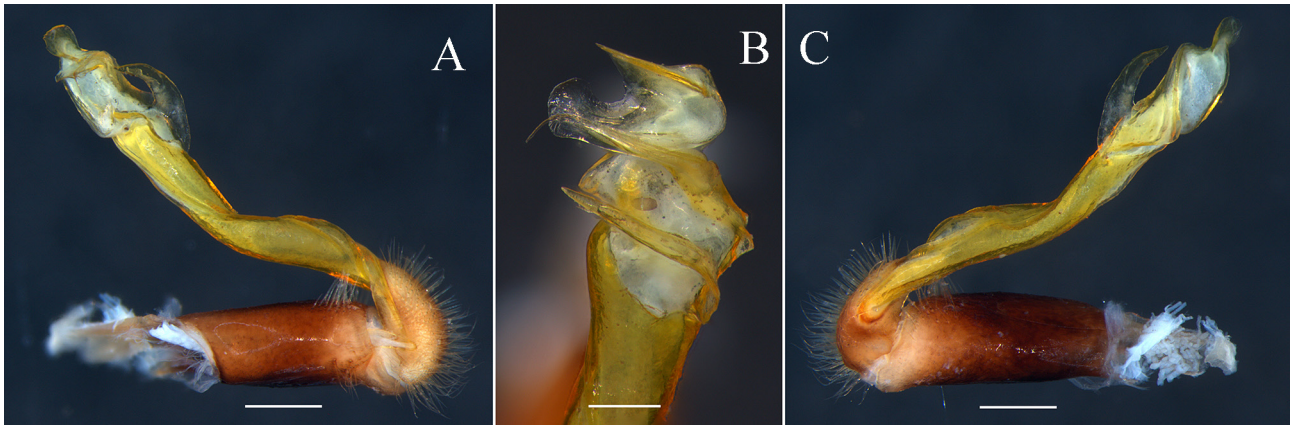

FIGURE 27. Left gonopods of *Sellanucheza jaegeri* Golovatch, 2013. **A.** Mesal view; **B.** Tip of acropodite, ventral view; **C.** Lateral view. **Scale bars:** A, C = 0.5 mm; B = 0.25 mm.

Family Polydesmidae Leach, 1815

***Epanerchodus potanini* Golovatch, 1991**
Figs 28–31

Materials examined. 1 Male and 1 female, China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Yanping, 31°31′9.1″N, 109°43′1.2″E, alt. 1802 m, 11 August 2022, X.K. Jiang & H.M. Chen leg.

Remarks. This species is very common in southern China, and has been recorded from Gansu, Sichuan and Yunnan Provinces. The new samples almost fully agree with the original description. The habitus and gonopodal structures are illustrated here (Figs 28–31).

FIGURE 28. *Epanerchodus potanini* Golovatch, 1991. **A.** Living specimen, male; **B.** Living specimen, female.

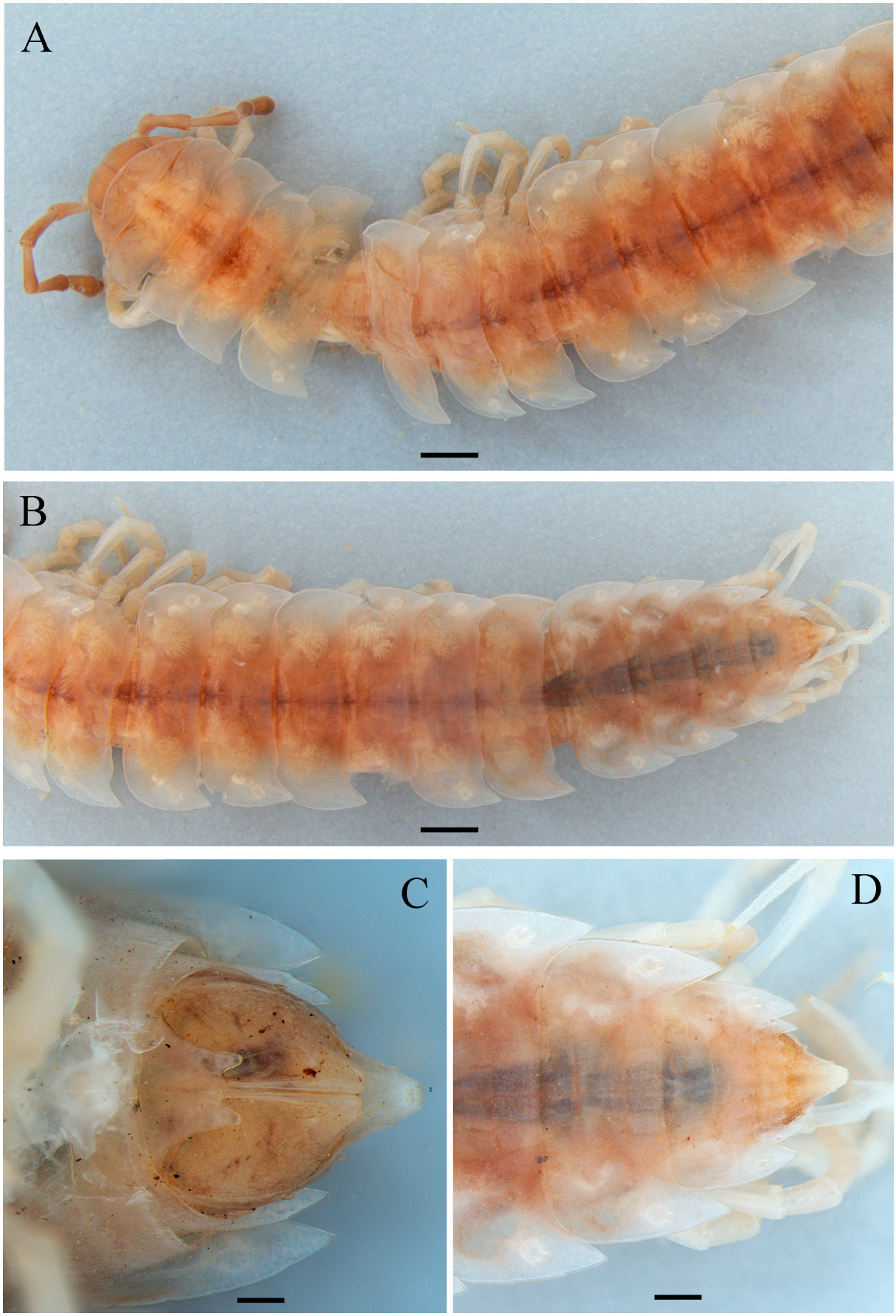

FIGURE 29. *Epanerchodus potanini* Golovatch, 1991. **A.** Anterior part of habitus, dorsal view; **B.** Posterior part of habitus, dorsal view; **C.** Telson, ventral view; **D.** Segments 17–19 and telson, dorsal view. **Scale bars:** A, B = 1 mm; C, D = 0.2 mm.

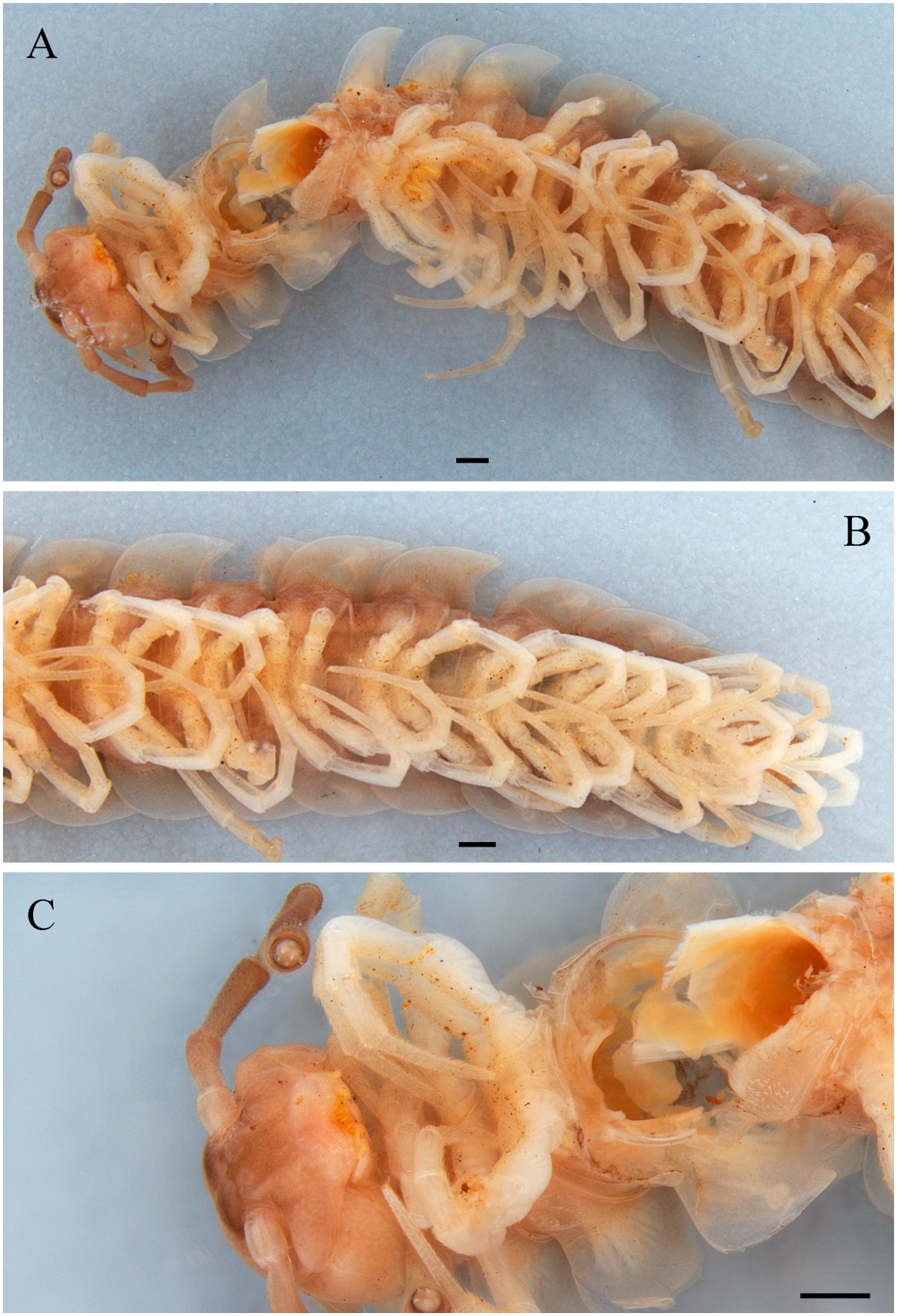

FIGURE 30. *Epanerchodus potanini* Golovatch, 1991. **A.** Anterior part of habitus, ventral view; **B.** Posterior part of habitus, ventral view; **C.** Head, collum and segments 2–4, ventral view. **Scale bars:** 0.5 mm.

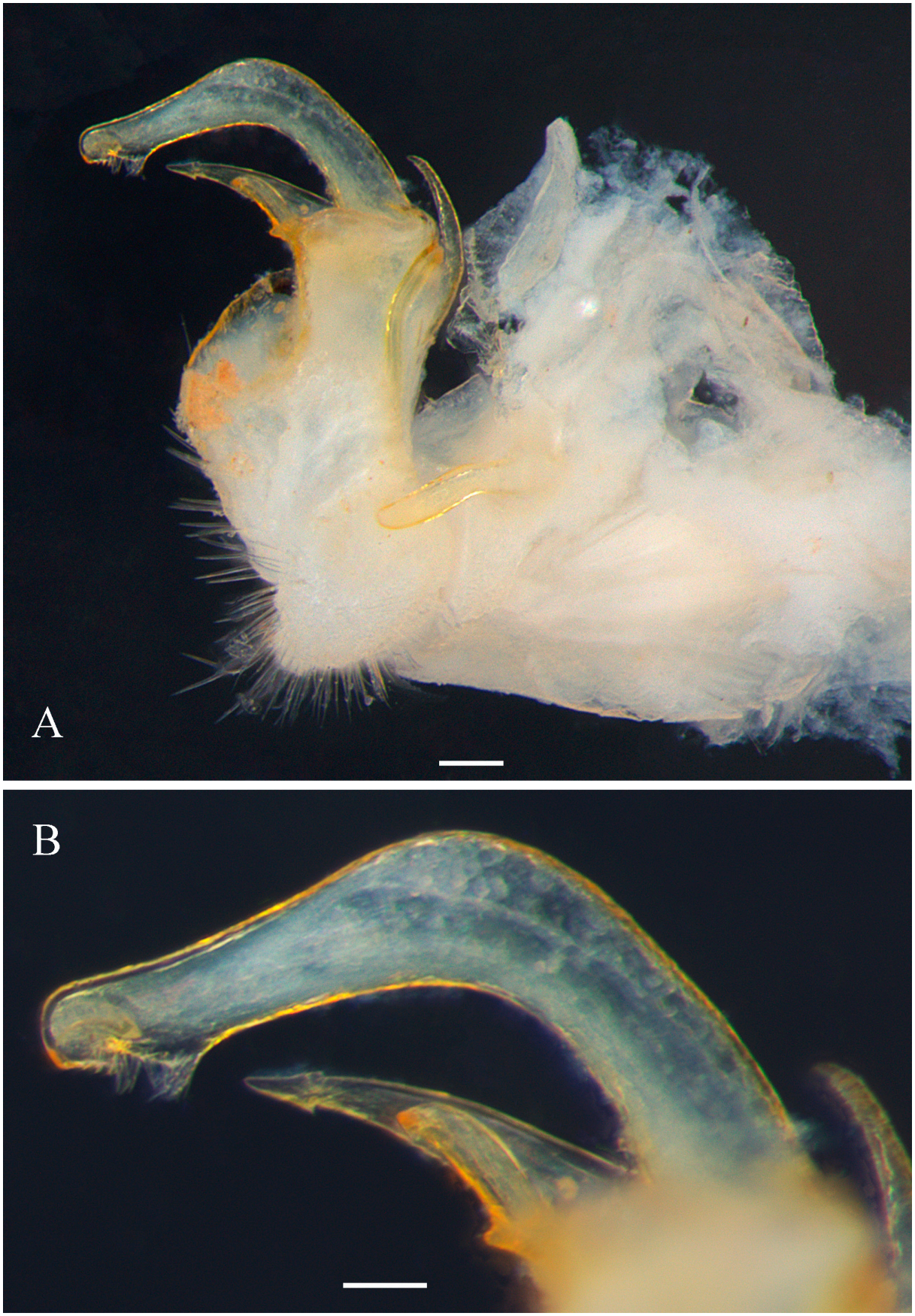

FIGURE 31. *Epanerchodus potanini* Golovatch, 1991. **A.** Right gonopod, mesal view; **B.** Right gonopod, lateral view. **Scale bars:** 0.1 mm.

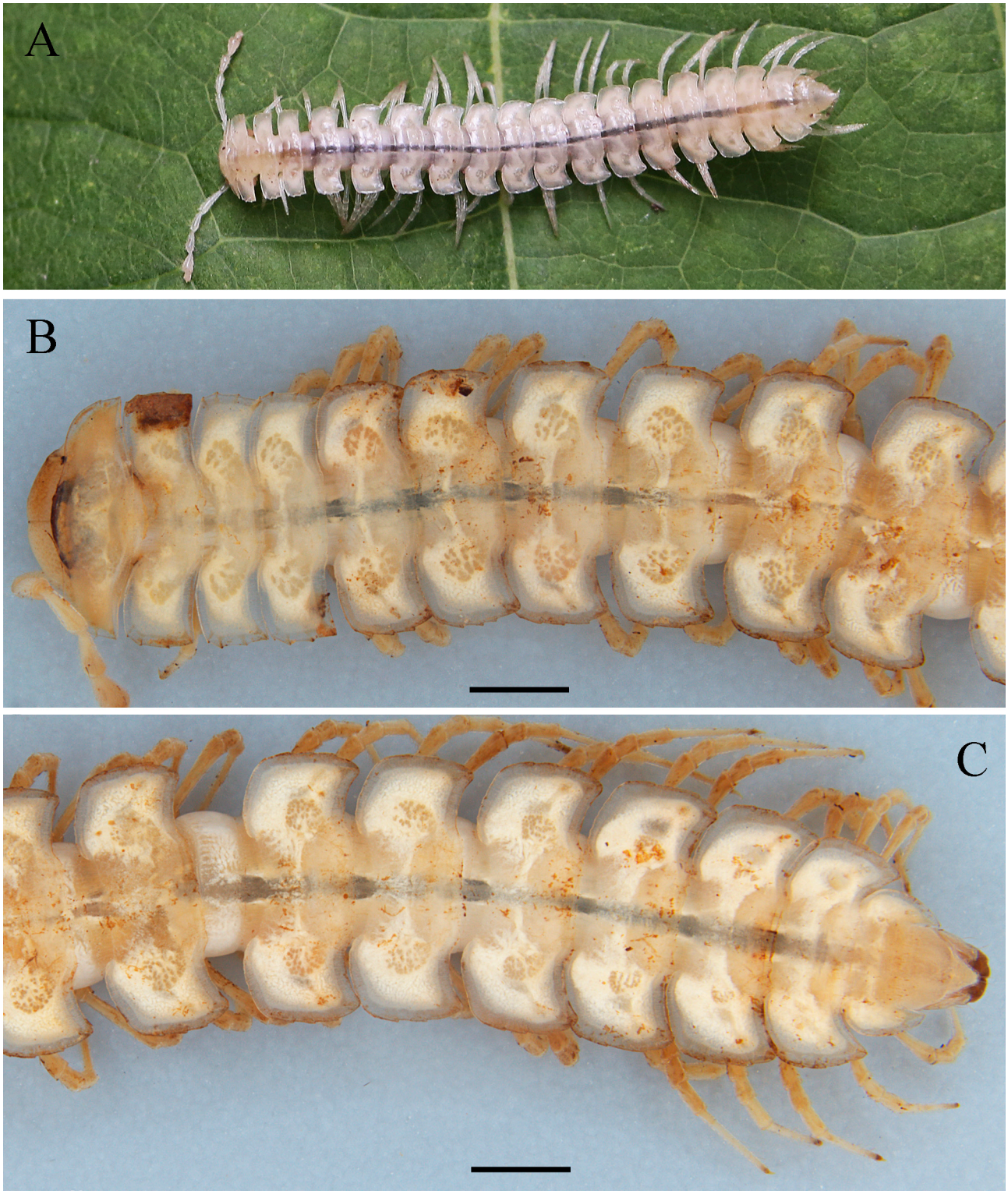

FIGURE 32. *Epanerchodus wuxi* **sp. nov.**, holotype. **A.** Living specimen; **B.** Anterior part of body, dorsal view; **C.** Posterior part of body, dorsal view. **Scale bars:** 1 mm.

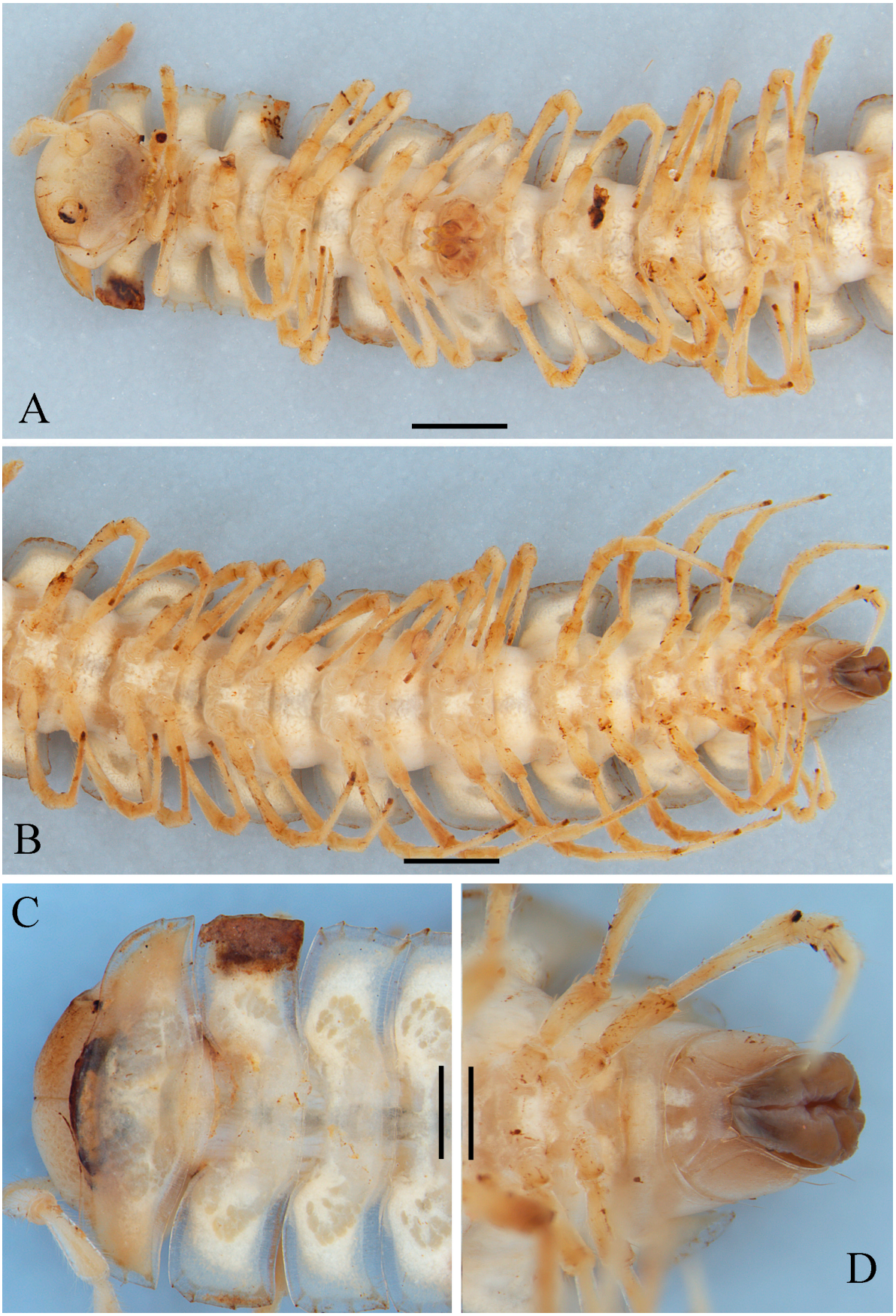

FIGURE 33. *Epanerchodus wuxi* **sp. nov.**, holotype. **A.** Anterior part of body, ventral view; **B.** Posterior part of body, ventral view; **C.** Head, collum and segments 2–4, dorsal view; **D.** Telson, ventral view. **Scale bars:** A, B = 1 mm; C, D = 0.5 mm.

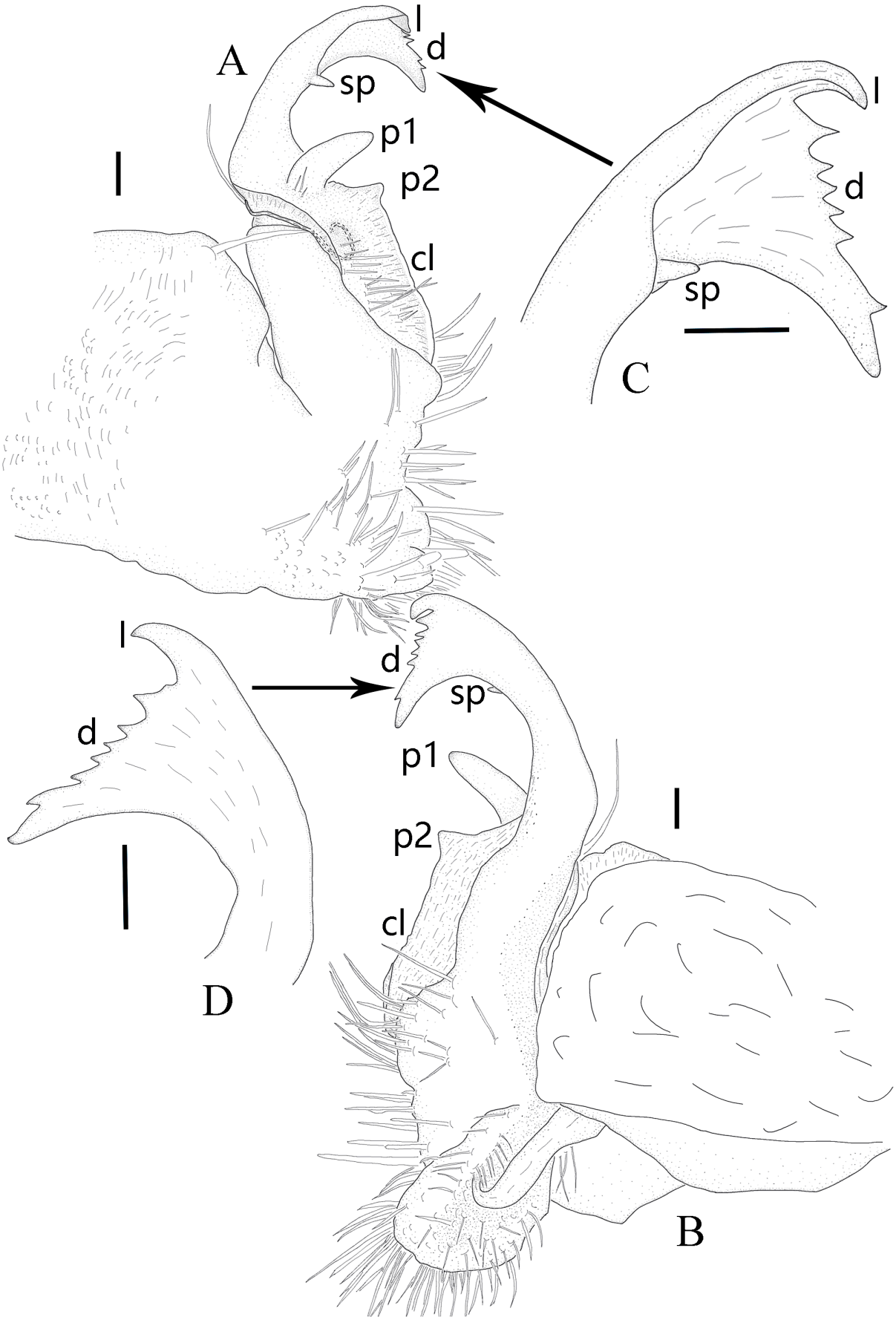

FIGURE 34. *Epanerchodus wuxi* **sp. nov.**, holotype. **A.** Right gonopod, mesal view; **B.** Right gonopod, lateral view; **C.** Subapical part of endomere, sub-medial view; **D.** Apical part of endomere, top view. **Scale bars:** 0.1 mm.

***Epanerchodus wuxi* sp. nov.**
Figs 32–34

Type materials. Holotype Male: China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Hongqi, Longtan Cave, 31°30'40.73" N, 109°49'40.93" E, alt. 1677 m, 14 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes:** 12 females, same data as holotype; 1 male, a manual tunnel near the Longtandong Cave, 31°31'16.83" N, 109°49'51.84" E, alt. 1458 m, same time and collectors as holotype; 1 female, same cave as holotype, 11 August 2022, Q.D. Zhu leg.

Etymology. The specific name is a noun in apposition, derived from the type locality, Wuxi County.

Diagnosis. The new species is similar to *Epanerchodus latus* Liu & Golovatch, 2018 in having the gonopodal femorite with a finger-shaped process distally and a process medially, the endomere carrying a subapical lobe, but distinguished by the broad subapical endomere with a spiny process and a row of apical denticles (Fig. 34).

Description: Length of holotype 22 mm, male paratypes 22 mm, female paratypes 20–37 mm; width of midbody pro- and metazona in holotype 1.6 mm and 3.1 mm, respectively, another male paratype 1.5 mm and 3.0 mm, in female paratypes up to 1.2–1.9 mm and 2.4–3.5 mm. Live specimens whitish to light yellow and semitransparent (Fig. 32A), in alcohol light yellow to light brown (Figs 32B, C, 33).

Adults with 20 segments. Width of holotype: head (1.8) << collum (2.7) < segment 2 (2.8) = 3 = 4 = 5 < 6 (2.9)–8 < 9 (3.1) –16, thereafter segments 17 (2.9)–19 (1.7). Body gradually tapering posteriorly towards telson (Figs 32, 33). Head covered with sparse pubescence throughout, vertigial sulcus apparent (Figs 32A, B; 33A, C). Antennae long and slender, clavate, *in situ* reaching behind segment 4. Collum fan-shaped, with irregular sparse setae, and a faint lateral incision/denticle on each side (Figs 32A, B; 33C). Paraterga distinct and broad (Figs 32, 33), midbody metaterga about 1.9 times as wide as prozonae. All paraterga slightly upturned dorsally above a faintly convex dorsum (Fig. 32). Anterior edge of metaterga forming a shoulder (Figs 32, 33). Caudolateral corners of paraterga from rings 2 protruded toward back-inner past tergal margin, subsequent ones acuminate, especially on rings 18–19 (Figs 32, 33). Integument shining, translucent, prozonae very delicately alveolate (Figs 32, 33C). Three or four notches at lateral margins of paraterga (Figs 32, 33). Constriction between pro- and metazonae narrow, shallow and smooth (Fig. 32). Metatergal sculpture faint, with three irregular transverse rows of setigerous polygonal bosses (Fig. 32). Sulcus between front and middle rows of setae a little deeper than that between middle and caudal rows (Fig. 32). Tergal setae very short, sparse.

Pore formula normal: 5, 7, 9, 10, 12, 13, 15–19. Ozopores large and evident, located between last and penultimate marginal incisions. Epiproct short, conical, slightly surpassing paraprocts caudally, pre-apical lateral papillae small, with two long setae (Fig. 32C). Hypoproct lunate, with two setigerous conical papillae at caudal margin (Fig. 33B, C). Sterna sparsely setose, cross-shaped impressions shallow (Fig. 33A, B). Legs long and slender, about 2.0 times as long as body ring height.

Coxa of gonopod (Fig. 34) large and squarish, as usual. Prefemur densely setose and nearly half the length of telopodite. Femorite with a clivus (**cl**), a process (**p2**) medially and a finger-shaped process (**p1**) distally. Endomere (**en**) strongly curved, broad subapical, with a small subapical curved lobe (**l**), a row of apical denticles (**d**) and a spiny protuberance medially (**sp**). Seminal groove starting mesally, distally recurved laterad near base of **p1**, then run into an accessory seminal chamber, the latter opening on a hairy pulvillus, which makes a clear-cut distolateral loop. Exomere absent.

Distribution. Known only from the type locality, Wuxi, Chongqing, China.

Family Xystodesmidae Cook, 1895

***Riukiaria spina* sp. nov.**
Figs 35–37

Type materials. Holotype male: China, Chongqing, Wuxi County, Yintiaoling National Nature Reserve, Linkouzi, 31°28'19.47" N, 109°52'58.34" E, alt. 1680 m, 17 August 2022, X.K. Jiang & H.M. Chen leg. **Paratypes:** 2 males and 1 female, same data as holotype.

Diagnosis. This species is very similar to *R. davidiani* Golovatch, 2014 from Sichuan in the slender and bent

prefemoral process and solenomere of the gonopods, but differs from the latter by the prefemoral process of the gonopods only slightly bending mesially (Figs 36A–C, 37A–C) not forming semicircle as in *R. davidiani*.

Etymology. The species name is derived from the shape of the prefemoral process of the gonopods, meaning 'spine', noun.

Description. Length ca. 48–52 mm, midbody paranotal width 9.7–10.6 mm, metatergal length 4.1–4.8 mm, collum width 8.3–8.5 mm, length 3.3–3.6 mm. Body uniformly light yellow (Fig. 35A). Fluorescence in UV light strong (Fig. 35B).

FIGURE 35. Live specimen of *Riukiaria spina* **sp. nov. A.** In visible light; **B.** In UV-light.

Head smooth, epicranial suture distinct, several setae scattered above clypeus, with 2 dense rows at its margin and on labrum. Antennae slender. Antennomeres 1 and 7 short and small, slightly longer than wide. Antennomeres 2–6 clavate. Lengths of antennomeres: 6>5≈4≈3≈2>1>7. Gnathochilarium densely setose. Collum convex, smooth, shiny, without marginal ridge, tapering laterally. Pro- and metaterga smooth without any traces of tubercles or punctuation, not even wrinkles (Fig. 35A). Posteriolateral edge of paranota strongly pointed caudad. Pore formula normal, pores on paranota 5,7,9,10,12,13,15,16,17, and 18, in median excavation of paranota (in lateral view). Epiproct in dorsal view subtriangular, in lateral view protruding over paraprocts, parallel-sided, slightly curved ventrad, with 7+7 setae, 3+3 of them sitting on knobs. Paraprocts strongly marginate with 2+2 setae, hypoproct with 1+1 setae on knobs. Midbody legs well separated, sterna wide and smooth. Postgonopodal legs (Fig. 36E) with moderately developed ventral spine on prefemur, increasingly stronger towards body end. Femur as long as tarsus. Postfemur stout, about half-length of femur. Tibia straight, both subequal in length of postfemur. Tarsus slender. Claw curved.

Male 2nd leg pair coxa with strong median projections about half as long as length of coxa, densely setose, without membraneous tubules apically (Fig. 36D). Male gonopodal aperture on segment 7 wide, elliptical, about twice as wide as long, gonopods in situ usually deeply embedded, with acropodites crossing each other.

Coxa of gonopod (Figs 36A–C, 37) stout, approximately as long as wide, glabrous, without proximal apophysis. Cannula normal, situated on mesal side (Figs 36B, C; 37B, C). Telopodite consists of two slender and simple processes, prefemoral process and acropodite (solenomere), typical for *Riukiaria*. Prefemur densely covered with long hairs. Base of prefemoral process developed, originated from the base of prefemur. Prefemoral process ex-

tremely slender, spine-like bending mesially, as long as acropodite, with no setae, hairs, or processes. Acropodite long, scythe-shaped with a sharp tip, arched proximally towards prefemoral process. Prostatic groove running along mesal side, and ending on the pointed tip (Fig. 37B).

Distribution. Known only from the type locality.

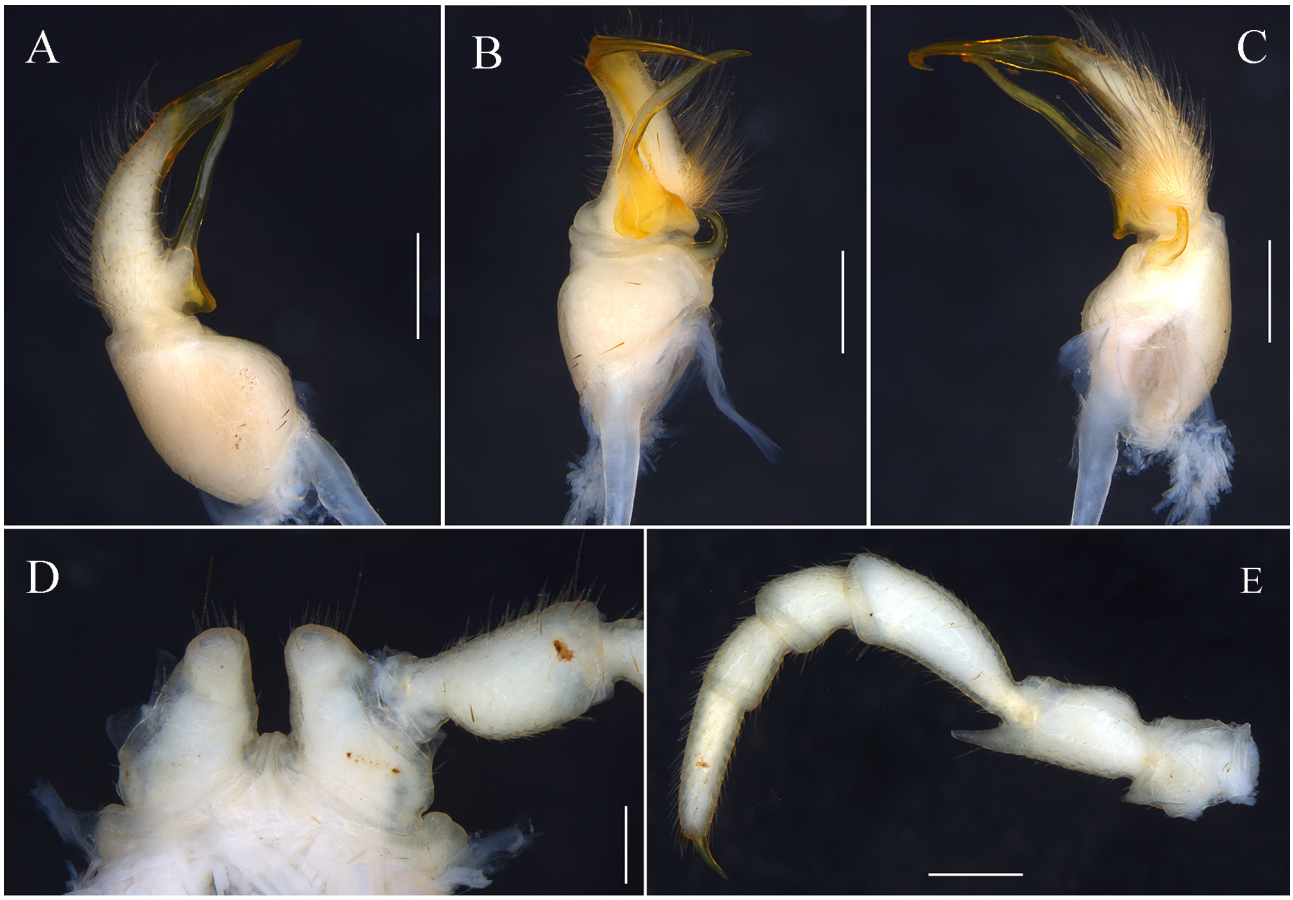

FIGURE 36. *Riukiaria spina* **sp. nov.**, holotype. **A.** Left gonopod, lateral view; **B.** Left gonopod, ventral view; **C.** Left gonopod, mesal view; **D.** Sternum, coxa, and prefemur of 2nd legpair, posterior view; **E.** Midbody leg, anterior view. **Scale bars:** A–C = 0.75 mm; D = 0.5 mm; E = 1 mm.

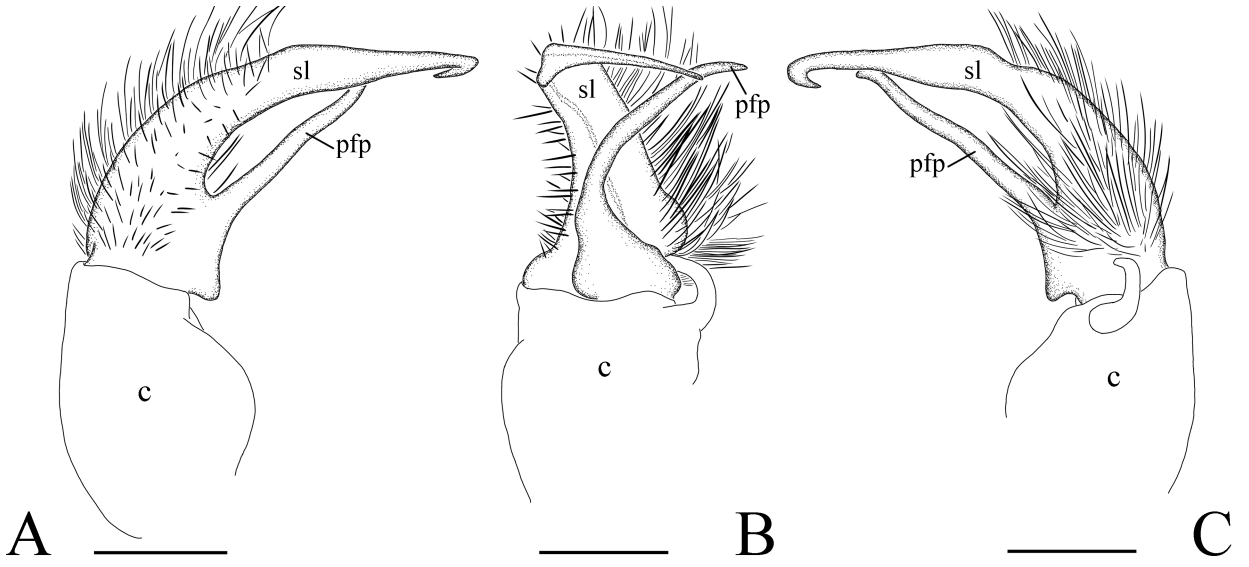

FIGURE 37. *Riukiaria spina* **sp. nov.**, holotype. **A.** Left gonopod, lateral view; **B.** Left gonopod, ventral view; **C.** Left gonopod, mesal view; **D.** Sternum, coxa, and prefemur of 2nd legpair, posterior view; **E.** Midbody leg, anterior view. **Scale bars:** A–C = 0.75 mm; D = 0.5 mm; E = 1 mm. **Abbreviations:** c, coxa; pfp, prefemoral process; sl, solenomere.

Remarks. *Riukiaria* contains 36 species distributed in China and Japan (Marek *et al*. 2014). In China, thirteen species have been reported from Shaanxi (1 species), Sichuan (2 species), Zhejiang (2 species), Fujian (1 species) and Taiwan (7 species). *Riukiaria spina* **sp. nov.** is the first species of *Riukiaria* reported from Chongqing.

Discussion

The Chinese Diplopoda fauna has been overlooked for a long time, and the vast majority of areas have never been investigated for millipede diversity. Our brief survey of the Yintiaoling Nature Reserve caught thirteen millipede species, and nearly half of which are new to science. However, our investigation on Yintiaoling is obviously inadequate, and there are certainly numerous taxa still remaining to be discovered. This result also indicates that the current knowledge of the Chinese millipede fauna is only the tip of the iceberg.

Acknowledgements

We sincerely thank Prof. William A. Shear, Dr. Huiqing Ma and Dr. Natdanai Likhitrakarn for reviewing the manuscript and offering critical comments. We are grateful to Prof. Zhi-Sheng Zhang, Dr. Lu-Yu Wang of Southwest University and the forest rangers of Yintiaoling National Natural Reserve for their help during the field work. This research is supported by grants from the National Natural Science Foundation of China (32100365), the Science and Technology Project of Guizhou Province ([2020]1Y079), the Talents Platform Construction Program of Guizhou Province (2017571903), and the Doctoral Foundation of Guizhou Academy of Sciences (R[2021]1).

References

Astrin, J.J. & Stüben, P.E. (2008) Phylogeny in cryptic weevils: molecules, morphology and new genera of western Palaearctic Cryptorhynchinae (Coleoptera: Curculionidae). *Invertebrate Systematics*, 22 (5), 503–522. https://doi.org/10.1071/IS07057

Koch, C.L. (1847). System der Myriapoden mit den Verzeichnissen und Berichtigungen zu Deutschlands Crustaceen, Myriapoden und Arachniden. *In*: Panzer & Herrich-Schäffer, A. (Eds.), *Kritische Revision der Insectenfaune Deutschlands, III*. Bändchen, Regensburg, pp.1−196. https://doi.org/10.5962/bhl.title.49866

Enghoff, H., Golovatch, S.I. & Nguyen Duc, A. (2004) A review of the millipede fauna of Vietnam (Diplopoda). *Arthropoda Selecta*, 13 (1–2), 29–43.

Enghoff, H., Golovatch, S.I., Short, M., Stoev, P. & Wesener, T. (2015) Diplopoda—taxonomic overview. *In*: Minelli, A. (Ed.), *Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda. Vol. 2*. Brill, Leiden-Boston, pp. 363–453. https://doi.org/10.1163/9789004188273_017

Golovatch, S.I. & Kime, R.D. (2009) Millipede (Diplopoda) distributions: A review. *Soil Organisms*, 81 (3), 565–597.

Golovatch, S.I. (1991) The millipede family Polydesmidae in Southeast Asia, with notes on phylogeny (Diplopoda: Polydesmida). *Steenstrupia*, 17 (4), 141–159.

Golovatch, S.I. (2009) On several new or poorly-known Oriental Paradoxosomatidae (Diplopoda: Polydesmida), VIII. *Arthropoda Selecta*, 18 (1/2), 1–7.

Golovatch, S.I. (2013) On several new or poorly-known Oriental Paradoxosomatidae (Diplopoda: Polydesmida) XIII. *Arthropoda Selecta*, 22 (1), 1–31. https://doi.org/10.15298/arthsel.22.1.01

Golovatch, S.I. (2014) The millipede genus *Riukiaria* Attems, 1938 in continental China, with descriptions of new species (Diplopoda: Polydesmida: Xystodesmidae). *Zootaxa*, 3793 (1), 188–200. https://doi.org/10.11646/zootaxa.3793.1.9

Golovatch, S.I. (2019) On several new or poorly-known Oriental Paradoxosomatidae (Diplopoda: Polydesmida), XXVI. *Arthropoda Selecta*, 28 (3), 347–367.

Golovatch, S.I., Mikhaljova, E.V. & Chang, H.W. (2018) The millipede families Cryptodesmidae, Pyrgodesmidae, Opisotretidae and Xystodesmidae in Taiwan (Diplopoda, Polydesmida). *Tropical Natural History*, 11 (2), 119–134.

Hoffman, R.L. (1961) Two new diplopod genera from western China (Polydesmida: Strongylosomatidae). *Annals and Magazine of Natural History*, 13(3), 533–543. https://doi.org/10.1080/00222936008651054

Jiang, X.K., Zhang Z.X., Chen, H.M. & Xie, Z.C. (2021) Description of *Hypocambala zizhongi* sp. nov. and the new combina-

tion, *Glyphiulus polytricha* (Golovatch *et al*., 2011) comb. nov., based on morphological and molecular data (Spirostreptida: Cambalidea: Cambalopsidae). *Zootaxa*, 4903 (3), 405–418.
https://doi.org/10.11646/zootaxa.4903.3.6

Keeton, W.T. (1960) A taxonomic study of the milliped family Spirobolidae (Diplopoda: Spirobolida). *Memoirs of the American Entomological Society*, 17, 1–146.

Korsós, Z., Nakamura, Y. & Tanabe, T. (2011) Two new millipede species of the genus *Riukiaria* (Diplopoda, Polydesmida, Xystodesmidae) endemic to the Ryukyu Archipelago, Japan. *Zootaxa*, 2877, 55–68.
https://doi.org/10.11646/zootaxa.2877.1.3

Likhitrakarn, N., Golovatch, S.I. & Panha, S. (2011) Revision of the Southeast Asian millipede genus *Orthomorpha* Bollman, 1893, with the proposal of a new genus (Diplopoda, Polydesmida, Paradoxosomatidae). *ZooKeys*, 131, 1–161.

Likhitrakarn, N., Golovatch, S.I. & Panha, S. (2016) Review of the Southeast Asian millipede genus *Antheromorpha* Jeekel, 1968 (Diplopoda, Polydesmida, Paradoxosomatidae). *ZooKeys*, 571, 21–57.
https://doi.org/10.3897/zookeys.571.7566

Liu, W.X. & Golovatch, S.I. (2018) The millipede genus *Epanerchodus* Attems, 1901 in continental China, with descriptions of seven new cavernicolous species (Diplopoda, Polydesmida, Polydesmidae). *Zootaxa*, 4459 (1), 053–084.
https://doi.org/10.11646/zootaxa.4459.1.2

Liu, W.X. & Huo, Q.B. (2020) Two new species and a new record of polydesmoid millipedes from Jiangsu and Zhejiang provinces, eastern China (Diplopoda, Polydesmida). *Zootaxa*, 4722 (1), 041–049.
https://doi.org/10.11646/zootaxa.4722.1.3

Liu, W.X. & Tian, M.Y. (2015) Two new cave-dwelling species of the millipede genus *Paracortina* Wang & Zhang, 1993 from southern China (Diplopoda, Callipodida, Paracortinidae). *ZooKeys*, 517, 123–140.
https://doi.org/10.3897/zookeys.517.9949

Marek, P.E., Tanabe, T. & Sierwald, P. (2014) A species catalog of the millipede family Xystodesmidae. *Virginia Museum of Natural History Publications*, 17, 1–117.

Mauriès, J.-P. & Nguyen Duy-Jacquemin, M. (1997) Nouveaux craspedosomides et glyphiulides cavernicoles de Chine (Diplopoda). *Mémoires de Biospéologie*, 24, 49–62.

Nguyen, A.D & Sierwald, P. (2013) A worldwide catalog of the family Paradoxosomatidae Daday, 1889 (Diplopoda: Polydesmida). *CheckList*, 9 (6), 1132–1353.
https://doi.org/10.15560/9.6.1132

Pocock, R.I. (1895) Report upon the Chilopoda and Diplopoda obtained by P.W. Bassett-Smith, Esq., Surgeon R.N., and J. J. Walker, Esq., R.N., during the cruise in the Chinese Seas of H.M.S.'Penguin', Commander W.U. Moore commanding. *Annals and Magazine of Natural History, ser. 6*, 15 (88), 346–372.
https://doi.org/10.1080/00222939508677895

Saussure, H.L.F.de. (1860) Essai d'une faune des Myriapodes du Mexique avec la description de quelques espèces des autres parties de l'Amérique. *Mémoires de la Société de Physiques et d'Histoire naturelle de Genève*. 15 (2), 259–394.
https://doi.org/10.5962/bhl.title.60509

Shelley, R.M. (2007) Taxonomy of extant Diplopoda (Millipeds) in the modern era: Perspectives for future advancements and observations on the global diplopod community (Arthropoda: Diplopoda). *Zootaxa*, 1668, 343–362.
https://doi.org/10.11646/zootaxa.1668.1.18

Sierwald, P. & Bond, J.E. (2007) Current status of the Myriapod class Diplopoda (millipedes): taxonomic diversity and phylogeny. *Annual Review of Entomology*, 52, 401–420.
https://doi.org/10.1146/annurev.ento.52.111805.090210

Species 2000 China Node (2022) Available from: http://sp2000.org.cn/browse/browse_taxa (accessed 15 November 2022)

Stoev, P. & Geoffroy, J.-J. (2004) Review of the millipede family Paracortinidae Wang & Zhang, 1993 (Diplopoda, Callipodida). *Acta Arachnologica*, 53 (2), 93–103.
https://doi.org/10.2476/asjaa.53.93

Wang, X.F., Liu, X.S., Niu, Q.C., Li, B.S. & Qi, D.H. (2017) Preliminary Analysis on Vegetation of Yintiaoling Nature Reserve in Chongqing City. *Forest Inventory and Planning*, 42 (6), 104–107.

Wang, M.R., Fu, S.L., Xu, H.X., Wang, M.N. & Shi, L.L. (2018) Ecological functions of millipedes in the terrestrial ecosystem. *Biodiversity Science*, 26 (10), 1051–1059.
https://doi.org/10.17520/biods.2018086

Wesener, T. (2019) First records of giant pill-millipedes from Laos (Diplopoda, Sphaerotheriida, Zephroniidae). *Zootaxa*, 4563 (2), 201–248.
https://doi.org/10.11646/zootaxa.4563.2.1

Zhao, Y., Hu, L.L., Wesener, T. & Liu, W.X. (2022) Five new species of the giant pill-millipedes of the genera *Zephronia* and *Sphaerobelum*, from China (Diplopoda: Sphaerotheriida: Zephroniidae). *Annales de la Société entomologique de France* (New Series), 58:6, 499–524.
https://doi.org/10.1080/00379271.2022.2137059