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Research article

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Two new species of *Indonemoura* (Plecoptera, Nemouridae) from Yunnan Province, China

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Abstract. Two new species of the family Nemouridae of the genus *Indonemoura* Baumann, 1975, *Indonemoura yingjiangensis* Bai & Qian sp. nov. and *Indonemoura longihamata* Bai & Qian sp. nov. are described from Yunnan Province, southwest of China. The morphological characteristics of the two new species are compared to related taxa.

Keywords. Stonefly, Amphinemurinae, morphological, taxonomy, new taxon.

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Introduction

The genus *Indonemoura* Baumann, 1975, a member of the subfamily Amphinemurinae Baumann, 1975, currently contains 59 species worldwide (DeWalt *et al.* 2021) and is mainly distributed in the Oriental Region, but with a few species also in the Eastern Palaearctic. Presently 29 species are known from China (Wu 1935, 1949; Yang & Yang 1991; Zhu *et al.* 2002; Li *et al.* 2005, 2017a, 2017b, 2020; Li & Yang 2005, 2006, 2008a, 2008b, 2008c; Wang *et al.* 2006; Wang & Du 2009; Yang *et al.* 2015; Mo *et al.* 2019a, 2019b, 2020), among them, three known species *In. trichotoma* Li & Yang, 2008, *In. curvispina* Li, Wu & Yang, 2017, *In. spirocornua* Li, Wu & Yang, 2017 are distributed in Yunnan Province of China.

In the present paper, two new species are described from western Yunnan Province of China.

Material and methods

Specimens were collected by hand or using a sweep net and are stored in 75% ethanol. The terminalia were removed and treated with 5% NaOH. The holotype of two new species is deposited in the Southwest Forestry University (SWFU). Specimens were examined using a SOPTOP SZ stereo microscope (Sunny Group Co., Ltd., China). Illustrations were taken using a Liyang Super Resolution System LY-WN-YH (Chengdu Liyang Precision Machinery Co., Ltd., China). Stacking was done using the software Zerene Stacker (Zerene Systems LLC, USA, <https://www.zerenesystems.com/>). The morphological terminology follows that of Baumann (1975).

Results

Class Insecta Linnaeus, 1758
Order Plecoptera Burmeister, 1839
Family Nemouridae Billberg, 1820
Subfamily Amphinemourinae Baumann, 1975
Genus *Indonemoura* Baumann, 1975

Indonemoura yingjiangensis Bai & Qian sp. nov.

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Fig. 1

Diagnosis

The new species is very special and can be distinguished from all other *Indonemoura* species by the platy median lobe of paraproct that twisted at middle portion and apex truncatus with some tiny spines. This new species appears similar to *In. spirocornua* in having a similar epiproct and a twisted median lobe. However, the new species can be separated from *In. spirocornua* by the characteristic of median lobe and outer lobe of paraproct with a black spine located at ca ¼ of apex. In *In. spirocornua*, the median lobe forming an evenly out-curved, spine-like structure, apex bifurcate with two hooks of different size, the larger one spiral; and the outer lobe with a tiny ventroapical spine (Li *et al.* 2017: figs 6–7, 10). The similar long outer paraproctal lobe occur in *In. trichotoma*. However, in *In. trichotoma*, outer lobe forming a large hook with sharp tip, without spines at ca ¼ of apex; median lobe well developed, prolonged with two darkly sclerotized spines curved outward, and the hypoproct has spines apically (Li & Yang 2008: figs 6–7, 10).

Etymology

The new species is named after the type locality, Yingjiang County.

Material examined

Holotype

CHINA • ♂; Yunnan Province, Dehong Dai and Jingpo Autonomous Prefecture, Yingjiang County, Tongbiguan Township; 24°37'14" N, 97°38'19" E; 1351 m a.s.l.; 10 Jan. 2019; Chong-Xin Xie, Yu-Han Qian, Jin-Hong Xiang and Li Fu leg.; SWFU.

Paratype

CHINA • 1 ♂; same collection data as for holotype; SWFU.

Description

Male

MEASUREMENTS. Holotype: body length 9.8 mm; forewing length 10.9 mm; hindwing length 9.0 mm.

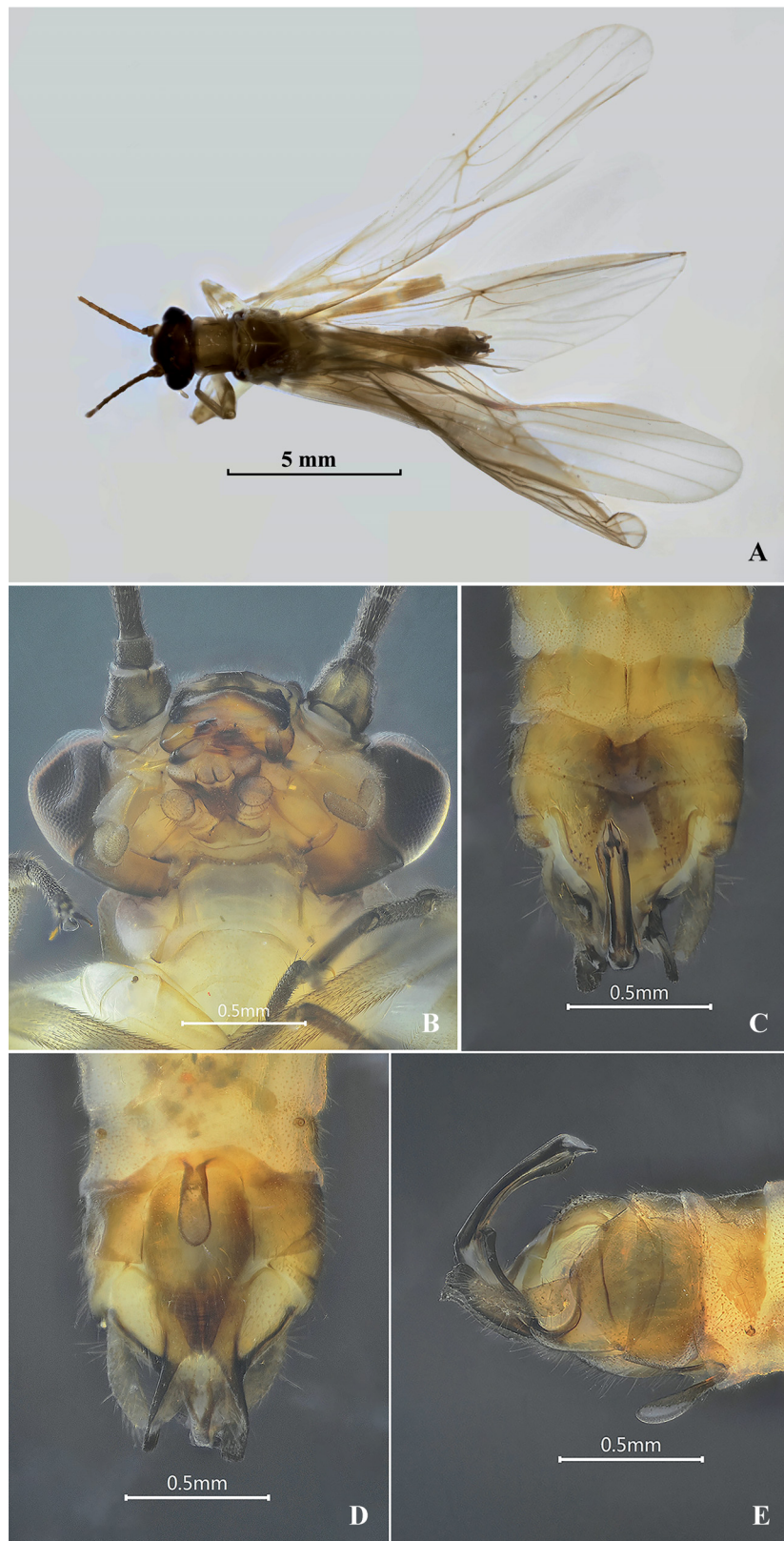


Fig. 1. *Indonemoura yingjiangensis* Bai & Qian sp. nov., holotype, ♂ (SWFU). **A.** Habitus, dorsal view. **B.** Head and prothorax, ventral view. **C.** Terminalia, dorsal view. **D.** Terminalia, ventral view. **E.** Terminalia, lateral view.

HEAD (Fig. 1A). Head dark brown; three ocelli; compound eyes black and protruded; antennae slender and dark brown, with abundant decumbent pubescence; head slightly wider than pronotum; mouthparts light brown.

THORAX (Fig. 1A–B). Weak sclerotized; pronotum slightly brown with rugosities; obvious nodules in cervical gills pale; Legs light brown and with a dark brown band on the middle and anterior of femora.

WINGS (Fig. 1A). Macropterous; wings light brown and membrane translucent, veins brown.

ABDOMEN (Fig. 1A, C). Abdominal segments weakly sclerotized, slightly brown. Tergum 9 weakly sclerotized, median slightly concaved and more sclerotized, mid-posterior membranous and with sparse tiny spines. Tergum 10 weakly sclerotized, median membranous and concaved below epiproct along with some tiny spines on both sides. Cerci with abundant long hairs, cylindrical and membranous, without spines.

GENITALIA (Fig. 1C–E). Vesicle of sternum 9 mostly membranous, claviform and slightly constricted basally. Hypoproct exceptionally long and broad, apex gradually narrowed and with rugosities, apex rounded. Epiproct long, basal and lateral sclerites sclerotized, centre and apex membranous in dorsal view, apex gradually narrowed, a triangular ventral sclerite in the median portion of apex; epiproct upward, basal ventral membranous, apex beak-shaped in lateral view, ventral sclerite convex and forming a carina, with sparse tiny spines on the apex of keel. Paraproct divided into three lobes; inner lobe covered by hypoproct, long triangular sclerite; median lobe platy and long, length 3 × inner lobe, slightly twisted at middle portion, basal weakly sclerotized, gradually strong sclerotized to terminal, apex truncation with some tiny spines; outer lobe basal part elongated and recurved dorsally alongside cerci, terminal part slender and strong sclerotized, longer than median lobe in lateral view, apex rounded and with a black spine, another black spine located at near the ¼ of apex.

Female

Unknown.

Distribution

China: Western Yunnan Province.

Indonemoura longihamata Bai & Qian sp. nov.

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Fig. 2

Diagnosis

The new species is somewhat similar to *In. trilogispina* Du & Wang, 2006 from Guizhou in having a similar epiproct and long spines on the paraproct, and also seems related to *In. curvispina* and *In. bilateralia* Du & Wang, 2009 in having a similar epiproct and hypoproct. However, the new species can be separated by the median lobe extending a long hamulus sclerotized bars, apex pointed, without other spines; outer lobe shorter than median lobe obviously and apex blunt rounded, with a tiny subapical spine; tip of hypoproct rounded. In *In. trilogispina*, median lobe with a long sclerotized bar and bearing a subapical spine and slightly inwardly directed acute apex; outer lobe without spines and denticles; tip of hypoproct pointed (Wang *et al.* 2006: figs 8–9, 11); in *In. curvispina*, apex of median lobe spine-like and bilobed, outer lobe with a larger apical spine at outer margin and a small, dorsal, subapical spine at proximal margin (Li *et al.* 2017: figs 1–2, 5); in *In. bilateralia*, median lobe branched to two portions, inner portion membranous, outer portion forming a long, thin sclerotized bar with 3 or 4 prongs at tip;

outer lobe much longer than median lobe, apex with a strong prong and a small lateral spine subapically (Wang & Du 2009: figs 1–4).

Etymology

The name refers to the median lobe of paraproct with a long hamulus shape. The Latin ‘*longi*’ and ‘*hamata*’ mean ‘long’ and ‘hamulus’.

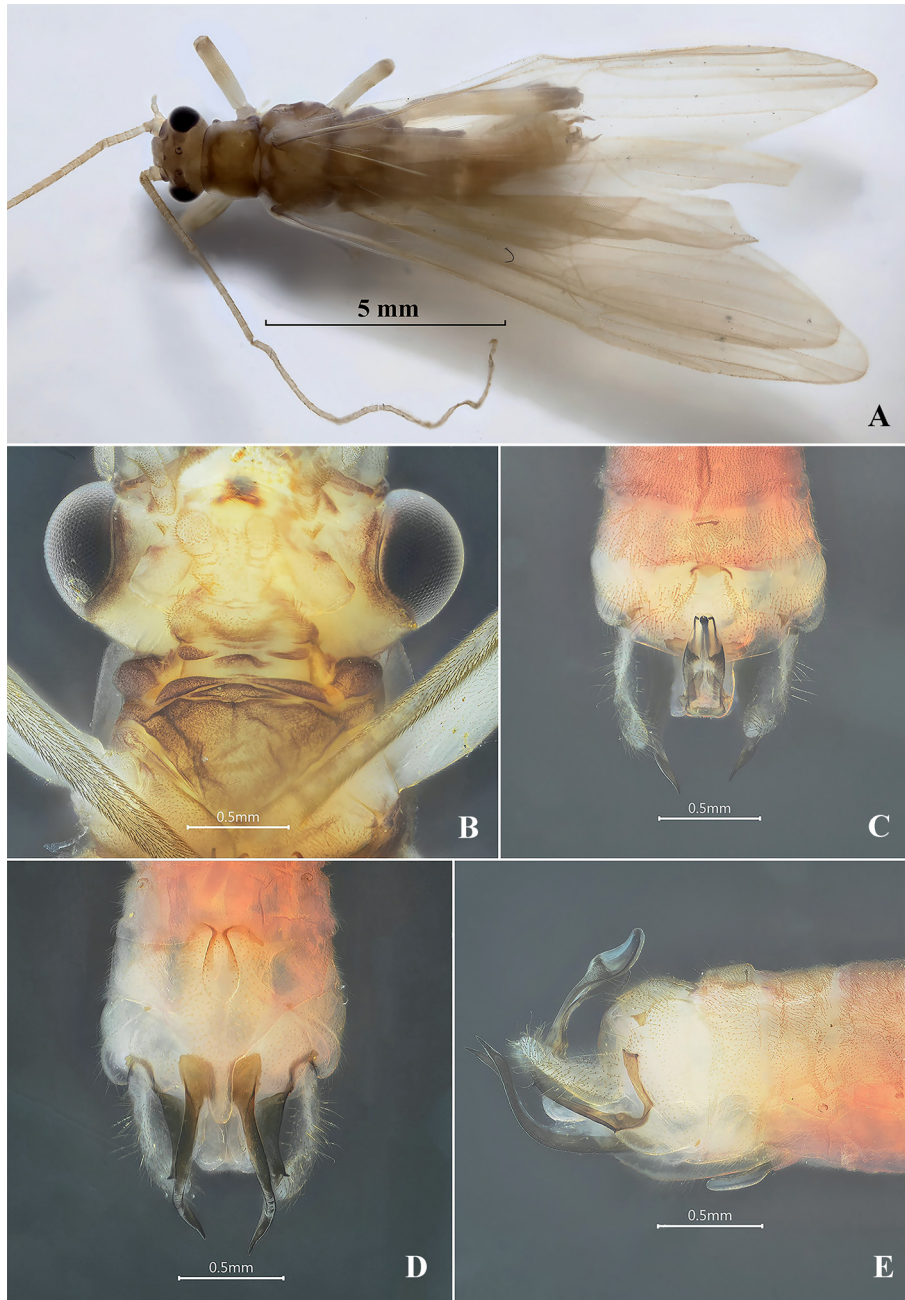


Fig. 2. *Indonemoura longihamata* Bai & Qian sp. nov., holotype, ♂ (SWFU). **A.** Habitus, dorsal view. **B.** Head and prothorax, ventral view. **C.** Terminalia, dorsal view. **D.** Terminalia, ventral view. **E.** Terminalia, lateral view.

Material examined

Holotype

CHINA • ♂; Yunnan Province, Dehong Dai and Jingpo Autonomous Prefecture, Yingjiang County, Tongbiguan Township; 24°37'14" N, 97°38'19" E; 1351 m a.s.l.; 10 Jan. 2019; Chong-Xin Xie, Yu-Han Qian, Jin-Hong Xiang and Li Fu leg.; SWFU.

Description

Male

MEASUREMENTS. Holotype: body length 9.4 mm; forewing length 12.3 mm; hindwing length 10.4 mm.

HEAD (Fig. 2A). Head light brown, three ocelli; compound eyes black and protruded; antennae light brown with abundant decumbent pubescence; mouthparts yellowish.

THORAX (Fig. 2A–B). Weak sclerotized. Pronotum slightly brown with rugosities; obvious nodules in cervical gills; legs lightly brown and with a brown narrowly band on the anterior of femora.

WINGS (Fig. 2A). Macropterous; wings brownish-yellow and membrane translucent, veins brown.

ABDOMEN (Fig. 2A, C). Abdominal segments generally brownish-yellow and weakly sclerotized. Tergum 9 weakly sclerotized with a thin and transverse sclerite on mid-anterior margin. Tergum 10 weakly sclerotized, median concaved below epiproct, a transverse arc-shaped sclerite anteriorly, two irregular



Fig. 3. Habitat of *Indonemoura yingjiangensis* Bai & Qian sp. nov. and *In. longihamata* Bai & Qian sp. nov. in Tongbiguan Provincial Nature Reserve. **A.** The upper reaches of unknown streams. **B.** The lower reaches of unknown streams.

sclerites posteriorly and a triangular sclerites on the both sides. Cerci long, cylindrical and membranous, without spines.

GENITALIA (Fig. 2C–E). Vesicle of sternum 9 mostly membranous, oval-shaped, apex rounded. Hypoproct exceptionally long and broad, apex gradually narrowed, forming a linguiform shaped sclerite. Epiproct narrowed, lightly enlarged in median portion, dorsal sclerites mostly membranous, with two triangular sclerites in the middle extending ventral surface, apex with a small notch mid-anteriorly; basal of epiproct narrowed and slightly sclerotized in lateral view, elevated at $\frac{1}{3}$ of terminal, apex weakly upward; ventral sclerites expanded into a large arched-shaped and strong sclerotized ridges, fringed with some tiny spines. Paraproct divided into three lobes in ventral view, inner lobe short and covered by hypoproct, closely connected to the median lobe; median lobe broad basally in ventral view, and extending a long hamulus sclerotized bars, apex pointed in lateral view; outer lobe basal part elongated and recurved dorsally alongside cerci, terminal part slenderly sclerotized bar and apex blunt rounded in lateral view, shorter than median lobe, with a subapical tiny spine.

Female

Unknown.

Distribution

China: Western Yunnan Province.

Discussion

Western Yunnan Province of China is dominated by high mountains and valleys. In this paper, *In. yingjiangensis* Bai & Qian sp. nov. and *In. longihamata* Bai & Qian sp. nov. were collected in the upper and lower reaches of a stream (Fig. 3) in Tongbiguan Provincial Nature Reserve. The Tongbiguan Provincial Nature Reserve is located at the transitional sector from the sloping area at the west side of South Hengduan Mountains to the Irawaddi River flatlands of Burma, and the great elevation difference has led to the variations of temperature, rainfall and of vertical bio-climate, which has helped to form habitats beneficial for species dissociation. The nature reserves have abundant biological resources, it is expected that more new species of stonefly may be discovered in the western Yunnan Province of China in the future with additional specimen collection and biodiversity surveys.

Acknowledgements

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