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Description of three new Chinese species of the genus *Mesonemoura* (Plecoptera: Nemouridae)

Yu-Zhou Du[1,], Xiao-Yu Ji[1] and Zhi-Jie Wang[1,2]*

Abstract

Three new Chinese species of the genus *Mesonemoura* (Plecoptera: Nemouridae), *Mesonemoura dilatata* Du & Ji, **sp. nov.**, *M. sichuanensis* Du & Ji, **sp. nov.** and *M. sinistracurva* Du & Wang, **sp. nov.**, are described and illustrated. *Mesonemoura dilatata* is characterized by the flagellum of the epiproct being long and curved, forming a swollen membranous apex. *Mesonemoura sichuanensis* is characterized by tergum 9 forming a pair of obtuse angles mid-posteriorly, and by the ventral sclerite of the epiproct being basally broad, 2 × the width of the dorsal sclerite. *Mesonemoura sinistracurva* is characterized by the presence of a long stylus that curves abruptly to the left as it leaves the tip of the epiproct. A key to the Chinese species of this genus is presented.

Key Words: Plecoptera; Nemouridae; *Mesonemoura*; new species; China

Resumen

Se describen e ilustran tres nuevas especies del género *Mesonemoura* (Plecoptera: Nemouridae) de China, *Mesonemoura dilatata* Du &y Ji, **sp. nov**., *M. sichuanensis* Du & Ji, **sp. nov**. y *M. sinestracurva* Du & Wang, **sp. nov.**. Se caracteriza *M. dilatata* por el flagelo del epiprocto largo y curvado, formando un ápice membranoso hinchado. Se caracteriza *M. sichuanensis* por tener el tergo 9 formando un par de ángulos obtusos mediados-posteriores, y por el esclerito ventral del epiprocto basal amplio, 2 × la anchura del esclerito dorsal. Se caracteriza *M. sinestracurva* por la presencia de un largo estilus que se curva bruscamente a la izquierda al salir de la punta de la epiprocto. También se presenta una clave para las especies de este género en China.

Palabras Clave: Plecoptera; Nemouridae; *Mesonemoura*; nuevas especies; China

Baumann (1975) proposed the genus *Mesonemoura* and designated *Nemoura vaillanti* Navás, 1922 collected from Nan Shan, China, as its type species. He also transferred 15 additional species from *Nemoura*, *Protonemura* and *Amphinemura* into this genus, and 5 of these species occur in China. Zwick & Sivec (1980) later transferred *Protonemura funicula* Harper, 1974 and *P. mastigophora* Harper, 1974 to *Mesonemoura*. *Nemoura longicercia* (Okamoto 1922) has had a complex nomenclatural history, having been originally described as *Nemoura* (*Protonemura*), elevated to *Protonemura* (Illies, 1966), moved to *Mesonemoura* by Baumann (1975) and then transferred back to *Nemoura* by Shimizu (1994). Shimizu & Sivec (2001) erected the new genus *Sphaeronemura* and transferred *M. hamistyla* (Wu 1962) and *M. paraproctalis* (Aubert 1967) into this genus. One additional species was described by Fochetti & Sezzi (2000), 2 by Zhu et al. (2003), 2 by Du et al. (2007), 3 by Li & Yang (2007, 2009).Currently, the genus *Mesonemoura* includes 22 species occurring only in the Oriental and Palaearctic regions (DeWalt et al. 2014), 12 of which occur in China: *M. vaillanti* (Navás 1922), *M. flagellata* (Wu 1935), *M. multispira* (Wu 1973), *M. spiroflagellata* (Wu 1973), *M. sbordonii* (Fochetti & Sezzi 2000), *M. lii* (Zhu & Yang 2003), *M. tibetensis* (Zhu & Yang 2003), *M. aberransterga* (Du & Zhou 2007), *M. membranosa* (Du & Zhou 2007), *M. nielamuensis* (Li & Yang 2007), *M. tritaenia* (Li & Yang 2007), and *M. yulongana* (Li & Yang 2009). In the present paper, 3 new *Mesonemoura* species in China are described and illustrated, and a key to the Chinese species of this genus is presented. The types of the new species are in the Insect Collection of Yangzhou University.

Material and Methods

All type specimens were preserved in 75% or 99% ethanol and deposited in the Insect Collection of Yangzhou University, China. The abdomens of the specimen were cut from the bodies, then treated in 5% NaOH, slowly heated to 40-50 for 1-3 min, and then the specimens were cleared rinsing in clean water. The specimens were examined and illustrated using Leica stereomicroscope model MZAPO. The morphological terminology follows that of Baumann (1975).

Results

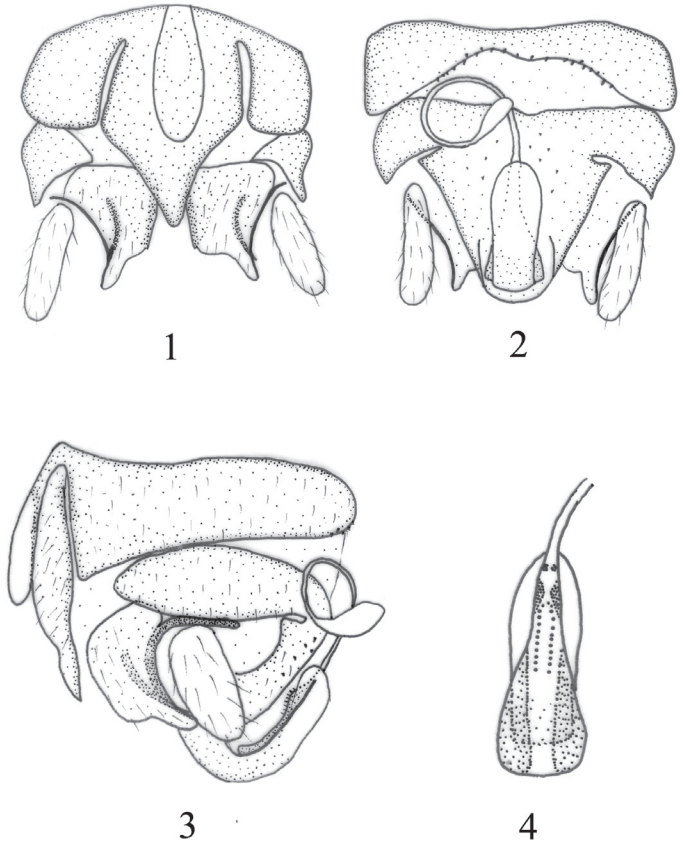
Mesonemoura dilatata Du & Ji, **sp. nov.** (Figs. 1–4)

MATERIAL EXAMINED

HOLOTYPE ♂, CHINA, Tibet, Leiwuqi county, Jiasangka township, 25-VI-2009, N 31° 52.494' E 96° 17.573', 3,722 m asl, Leg. Qian Yu-Han. PARATYPES, 2 ♂♂, the same data as holotype.

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Figs. 1–4. *Mesonemoura dilatata* Du & Ji, sp. nov. 1. Male terminalia, ventral; 2. Male terminalia, dorsal; 3. Male terminalia, lateral; 4. Male epiproct, ventral.

MALE

Head and antennae dark brown; pronotum dark brown, transverse oblong, with rugosities. Wings hyaline, veins brown. Legs brown, the middle of femora slightly brown.

Forewing length 6.3-6.5 mm, hind wing length 5.3-5.4 mm. Tergum 9 (Fig. 2) slightly sclerotized, with a small, asymmetrical notch mid-posteriorly, bearing several spinules posteriorly. Tergum 10 sclerotized, with several spinules each side of middle line. Hypoproct (Fig. 1) broad basally, abruptly tapering toward the apex; vesicle long, more than half length of hypoproct, length 3 × width, ventral membranous, but slightly sclerotized dorsally, sclerotized laterally. Paraprocts (Figs. 1, 3) divided into 3 lobes; inner lobe small, slightly sclerotized, fused with middle lobe; median lobe broad basally, slightly sclerotized, branched into 2 portions, inside portion of median lobe membranous, bearing many hairs, fused with outer lobe, another portion sclerotized, slender, shorter than membranous portion; outer lobe slender, sclerotized, basal part recurved along basal of cerci, other part fused with membranous portion of median lobe. Epiproct (Figs. 2, 4) long and narrow; dorsal sclerite mostly slightly sclerotized, apical portion membranous, extending over onto ventral sclerite; lateral sclerite slender, sclerotized; ventral sclerite slightly sclerotized, broad basally, tapering towards apex, apical portion inserted between folds of dorsal sclerite, the apex extended distally forming a long flagellum; the flagelliform projection sclerotized, slender, with a swollen membranous apex, length of the flagellum about 1.5 × length of the epiproct; epiproct ventral sclerite with 2 rows of spinules.

FEMALE

Unknown.

DISTRIBUTION

CHINA (Tibet Autonomous Region).

ETYMOLOGY

The Latin "*dilatata*" refers to the flagelliform projection with a swollen membranous apex.

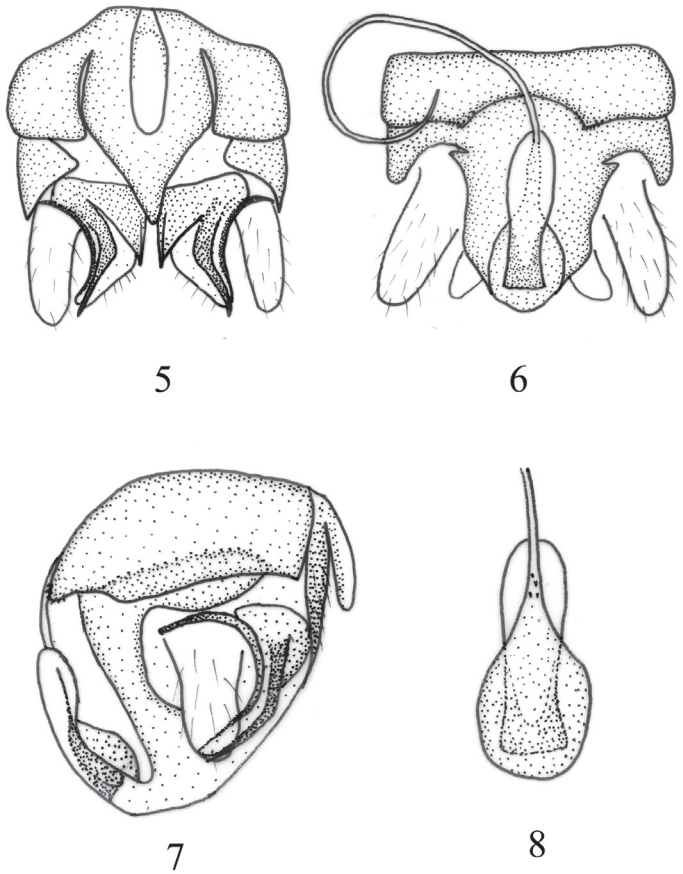
REMARKS

This species is characterized by the flagellum of the epiproct being long and curved, forming a swollen membranous apex. The new species is close to *M. spiroflagellata* (Wu 1973) in having the median lobe branched into 2 portions. But in *M. spiroflagellata*, the sclerotized portion is equal to the membranous portion, ventral sclerite of epiproct without spines, and the apex of flagellum narrow.

Mesonemoura sichuanensis Du & Ji, **sp. nov.** (Figs. 5–8)

MATERIAL EXAMINED

HOLOTYPE ♂, CHINA, Sichuan province, Litang county, 25-VI-2009, N 30° 011' E 100° 317', 4,300 m asl, Leg. Qian Yu-Han. PARATYPES, 1♂, the same data as holotype; 2♂♂, Sichuan province, Luding county, Hailuogou, 3-VII-2009, ', N 29° 60.3' E 102° 076 E, 2,200m, Leg. Qian Yu-Han; 66 ♂♂, Sichuan province, Luding county, Yangjiageng river,



Figs. 5–8. *Mesonemoura sichuanensis* Du & Ji, sp. nov. 5. Male terminalia, ventral; 6. Male terminalia, dorsal; 7. Male terminalia, lateral; 8. Male epiproct, ventral.

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4-VII-2009, N 29° 52.877' E 102° 1.193' E, 3,646 m asl, Leg. Qian Yu-Han; 1♂, Tibet, Bomi county, 21-VI-2009, N 29° 48.380' E 95° 41.956', 3,522 m asl, Leg. Qian Yu-Han.

MALE

Head and antennae dark brown; pronotum brown, angles blunt rounded. Wings hyaline, veins brown. Legs brown, the middle of femora slightly brown. Forewing length 6.2-6.7 mm, hind wing length 5.2-5.6 mm. Tergum 1-8 sclerotized at anterior margin laterally. Tergum 9 (Fig. 6) sclerotized, with a small notch mid-posteriorly, both sides of the notch forming an obtuse angle with several short spines. Tergum 10 sclerotized. Hypoproct (Fig. 5) broad basally, abruptly tapering towards the apex; vesicle slender, length 3 × width. Paraprocts (Figs. 5, 7) divided into 3 lobes; inner lobe sclerotized, large, triangular; median lobe branched into 2 portions, inside portion of median lobe membranous, bearing many hairs, fused with outer lobe, another portion sclerotized, slender, slightly longer than membranous portion; outer lobe slender, sclerotized, basal part recurved along basal of cerci, other part fused with membranous portion of median lobe. Epiproct (Figs. 6, 8) dorsal sclerite sclerotized basally, apical portion membranous; lateral sclerite sclerotized; ventral sclerite slightly sclerotized, basal broad, 2 × width of dorsal sclerite, apex narrowed distinctly, apical portion inserted between folds of dorsal sclerite, apex extended distally, forming a long slightly sclerotized flagellum; the flagellum broad basally, tapering towards the apex, with a pointed tip; epiproct ventral sclerite with several spines.

FEMALE

Unknown.

DISTRIBUTION

CHINA (Sichuan province; Tibet Autonomous Region).

ETYMOLOGY

The new species is named for the type locality, Sichuan.

REMARKS

This species is characterized by tergum 9 forming a pair of obtuse angle mid-posteriorly, and by the ventral sclerite of epiproct basal broad, 2 × width of dorsal sclerite. The new species is close to *M. spiroflagellata* (Wu 1973). But in the new species, basal of ventral sclerite 2 × width of dorsal sclerite, while ventral sclerite is not much wider than basal of dorsal sclerite in *M. spiroflagellata*. In *M. spiroflagellata*, tergum 9 does not form angles.

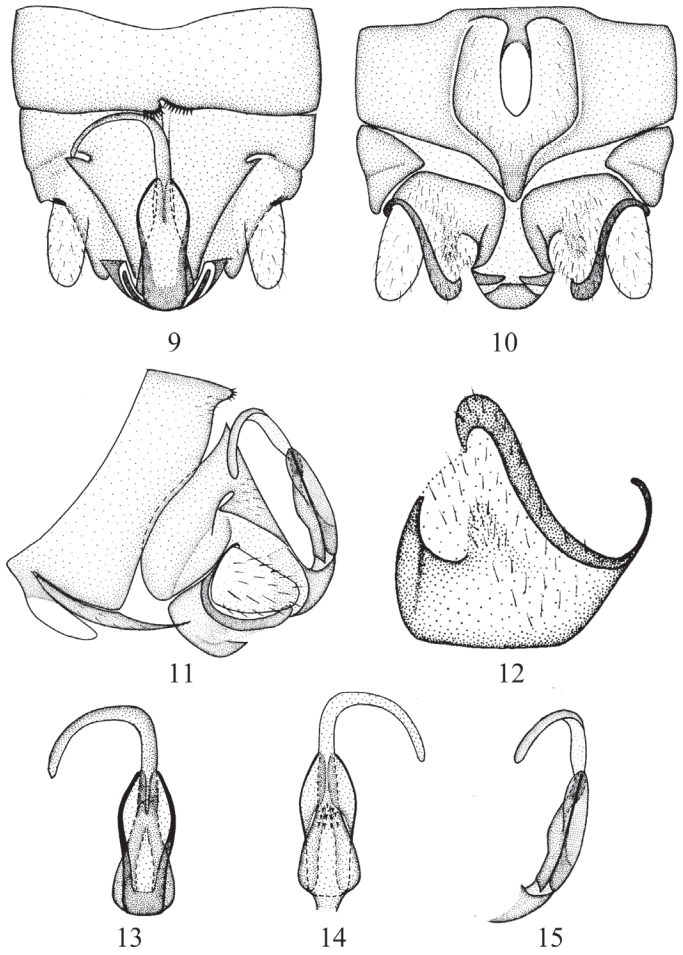
Mesonemoura sinistracurva Du & Wang, **sp. nov.** (Figs. 9–15)

MATERIAL EXAMINED

HOLOTYPE ♂, CHINA, Zhejiang province, Tianmu Mountain, Laodian to Xianrending, 6-V-1999, Leg. Zhou Pei.

MALE

Head and antennae dark brown; pronotum transverse oblong, brown, with rugosities. Cervical gills single, short and oval, each one is located outside of lateral cervical sclerite. Wings subhyaline, slightly brown, veins brown. Legs brown. Abdomen pale except for terminalia darker. Forewing length 8.9 mm, hind wing length 7.6 mm. Tergum 9 (Fig. 9) slightly sclerotized, with a small, asymmetrical notch mid-posteriorly, left side of the notch forming an acute angle, and right side of the notch forming an obtuse angle, each lobe of the notch bearing a row of short, stout spinules. Tergum 10 with a median, thin concavity running the length of the tergum. Hypoproct (Fig. 10) broad basally, tapering towards a small blunt rounded apex; vesicle slender, 2 × width. Paraprocts (Figs. 11-13) divided into 3 lobes; inner lobe small, slightly sclerotized, with an acute tip directed outward; median lobe membranous, broad basally, with a rounded apical portion, bearing many hairs, middle part slightly sclerotized, forming a small projection, equal length of inner lobe, bearing many hairs; outer lobe narrow and long, sclerotized, with the apex curving inward to a large hook, bearing several hairs, basal part elongated and recurved dorsally alongside cerci. Epiproct (Figs. 9, 13-15) narrowed basally, enlarged near apex; dorsal sclerite extending dorsolaterally towards apex, apical portion enlarged and extending over onto ventral sclerite, lateral margins of dorsal sclerite darkly sclerotized; ventral sclerite broad basally and becoming narrower towards apex, apical portion inserted between folds of dorsal sclerite, the apex extended distally forming a long flagelliform, sclerotized structure that curves strongly to the left side; the flagelliform projection broad basally, and tapering to apex, having a slightly sclerotized dorsal and membranous ventral surface, length of the projection equal to the epiproct; epiproct ventral sclerite with spines (Fig. 14).



Figs. 9–15. *Mesonemoura sinistracurva* Du & Wang, sp. nov. 9. Male terminalia, dorsal; 10. Male terminalia, ventral; 11. Male terminalia, lateral; 12. Male paraproct (left); 13. Male epiproct, dorsal; 14. Male epiproct, ventral; 15. Male epiproct, lateral.

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FEMALE

Unknown.

DISTRIBUTION

CHINA (Zhejiang province).

ETYMOLOGY

The name "*sinistracurva*" is derived from Latin, meaning that the epiproct terminal process curves abruptly to the left.

REMARKS

This species is characterized by the presence of a long stylus that curves abruptly to the left as it leave the tip of the epiproct. The new species is close to *M. sbordonii* Fochetti & Sezzi in the shape of the epiproct. The apical style of the new species is long and curved to the left, whereas in *M. sbordonii*, the style is longer still and only barely curved to the left. *M. sbordonii* also lacks the notch and spines on the posterior margin of tergum 9 found in the new species.

Key to the males of the Chinese species of *Mesonemoura* Baumann

1. Tergum 9 not produced at posterior margin 2
—. Tergum 9 produced at posterior margin 6
2. Flagellum with entire apex 3
—. Flagellum with bifurcate apex . . . . . *M. sbordonii*
3. Flagellum with acute apex 4
—. Flagellum with swollen apex . . . . . *M. dilatata*, **sp. nov**.
4. Median of tergum 9 extending acutely backward . . . . . *M. aberransterga*
—. Median part of tergum 9 not extending acutely backward 5
5. Inner lobe of paraproct with bifurcate tip . . . . . *M. vaillanti*
—. Inner lobe of paraproct with pointed tip . . . . . *M. spiroflagellata*
6. Tergum 9 with finger-like produced lobes . . . . . *M. lii*
—. Tergum 9 without finger-like produced lobes 7
7. Apex of flagellum furcate and greatly enlarged . . . . . *M. yulongana*
—. Apex of flagellum entire and not enlarged 8
8. Flagellum with acute apex 9
—. Flagellum with blunt apex. 10
9. Paraproct outer lobe shorter than median lobe . . . . . *M. tibetensis*
—. Paraproct outer lobe longer than median lobe, ventral sclerite of epiproct basal broad, 2 × width of dorsal sclerite . . . . . *M. sichuanensis*, **sp. nov.**
10. Flagellum with truncate apex 11
—. Apex of flagellum not truncate. 12
11. Median lobe of paraproct with apical spine . . . . . *M. multispira*
—. Median lobe of paraproct without apical spine . . . . . *M. nielamuensis*
12. Tergum 9 weakly produced at posterior margin 13
—. Tergum 9 distinctly produced at posterior margin 14
13. Tergum 9 with 3 small rounded lobes mid-posteriorly, covered with spiny hairs . . . . . *M. flagellata*
—. Tergum 9 with a small, asymmetrial notch mid-posteriorly, bearing several spinules posteriorly . . . . . *sinistracurva*, **sp. nov**.
14. Paraproct outer lobe broad, flagellum with small notch . . . . . *M. membranosa*
—. Paraproct outer lobe bulbous, flagellum not notch . . . . . *M. tritaenia*

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