EIGHT NEW SPECIES OF THE GENUS NEMOURA (PLECOPTERA: NEMOURIDAE) FROM THAILAND AND VIETNAM

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ABSTRACT

Eight new species of Nemoura are proposed from specimens collected in Thailand and Vietnam. New species include N. apicalis sp.n., N. clavaloba sp.n., N. magniseta sp.n. N. stylocerca sp.n. and N. tenuiloba sp.n. from Vietnam, and N. neospiniloba sp.n., N. raptoraloba sp.n. and N. spinaerca sp.n. from Thailand. A provisional key for male Nemoura from Thailand and Vietnam is presented.

Keywords: Nemoura, Plecoptera, Nemouridae, Thailand, Vietnam, New species

INTRODUCTION

Nemoura is a large, primarily Holarctic, stonefly genus with a significant Oriental component. Baumann (1975) provided the modern definition for the group and included a list of 91 species considered valid at that time. More recently, DeWalt et al. (2009) posted a list which includes 176 species; the great majority of these are western Palearctic, but 36 are reported for China. Mainland Chinese species include 10 proposed by Wu (1926, 1927, 1929, 1935, 1938, 1939, 1962, 1973), 13 described by Li & Yang (2006, 2007, 2008a, 2008b) and others described by various authors (Chu 1928; Du et al. 2008; Klapálek 1907; Sivec 1981; Ueno 1941; Wang et al. 2006; Zhu & Yang 2003). Currently none are recorded for Thailand or Vietnam.

The present study is based on a small sample of adult Nemoura collected primarily in Malaise traps by Professor Dr. P. Chantaramongkol and members of the Chiang Mai University team, or by Dr. H. Malicky, Dr. W. Mey or personnel of the Royal Ontario Museum. The material includes eight species which we regard as new. Specimens are deposited in the Slovenian Museum of Natural History, Ljubljana, Slovenia (PMSL), B.P. Stark collection, Clinton, Mississippi, U.S.A. (BPS), the Royal Ontario Museum, Toronto, Ontario, Canada (ROM) and the Zoological Museum der Universität-Humboldt, Berlin, Germany (ZMB) as indicated in the text. The following key will assist in identification of male specimens of Nemoura known for Thailand and Vietnam.

RESULTS AND DISCUSSION

Provisional Key to Males of Nemoura from Thailand and Vietnam

1 Paraprocts in ventral aspect bearing a long, slender, acute lobe projecting to tips of cerci (Figs. 6, 15); cerci usually simple ……………………… 2

1’ Paraprocts without projecting slender lobe (Figs. 3, 11); cerci modified with truncate or bilobed apices (Figs. 1, 11) …………………………………… 4

2 Paraproct outer lobe club-shaped in lateral aspect; epiproct apex serrate in lateral aspect (Fig. 5) ................................................................. *clavaloba*

2’ Paraproct outer lobe acute in lateral aspect (Fig. 14); epiproct apex not serrate (Figs. 13-14) ........ 3

3 Epiproct somewhat quadrangular in dorsal aspect (Fig. 24); tergum 10 without spiny armature ................................................................. *tenuiloba*

3’ Epiproct margins convergent in apical half (Fig. 13); tergum 10 bearing sensilla basiconica and a cluster of spines near epiproct (Fig. 13) ................................................................. *raptoraloba*

4 Cercal apices truncate in dorsal aspect (Fig. 1); tergum 9 with a mesal row of long setae .. *apicalis*

4’ Cercal apices variable but not truncate; tergum 9 without mesal row of long setae .................. 5

5 Posterior margin of tergum 9 bearing a pair of spiny lobes (Fig. 9) ............................... *neospiniloba*
Nemoura clavaloba  sp.n.  
(Figs. 4-6)

Material examined. Holotype ♂ and 8 ♀ paratypes from Tam Dao, 800-1000 m, Vinh Phu Province, Vietnam, 19 May-13 June 1995, H. Malicky (PMSL).

Adult habitus. General color brown. Basal antennal segment dark brown, next few segments pale and rest of antennal segments dark. Legs faintly banded.

Male. Forewing length 5 mm. Tergum 9 with a pair of long setae on each side of posterior margin; tergum 10 with a sparse median patch of short, thin setae (Fig. 4). Epiproct bearing a dorsoapical, blade-like process armed with tooth-like serrae (Fig. 5). Paraprocts bearing a sharply pointed, inwardly curved process in ventral aspect (Fig. 5), which appears club shaped in lateral aspect. Cerci simple.

Female. Unknown.

Larva. Unknown.

Etymology. The species name refers to the club shaped paraproct lobe.

Diagnosis. Nemoura clavaloba is similar in paraproct structure to N. raptoraloba and N. tenuiloba, both described below, and to N. rotundprojecta Du & Zhou (Du et al. 2008). However, the latter species has the acute process of the paraprocts curved strongly laterad and N. clavaloba is the only species of this group which has the extended paraproct lobe appearing clavate in lateral aspect, and also the only one in which the epiproct apex is strongly serrate on the dorsal margin (Fig. 5).

Nemoura magniseta  sp.n.  
(Figs. 7-8)


Male. Forewing length 6 mm. Terga 9-10 without conspicuous setation. Epiproct slightly longer than wide and bears two pairs of slender apical lobes (Fig. 7); slender, straight inner lobes extend beyond outwardly directed, and more heavily sclerotized.

Fig. 7-8. Nemoura magniseta. 7. Male terminalia dorsal. 8. Male terminalia, ventral.

lateral lobes. Outer paraproct lobe large, unarmed, but with a small mesoapical projection; inner lobes small and unarmed (Fig. 8). Cercal segments curved strongly inward; sclerotized outer margins bear a low knob in basolateral third; inner margins bear a single prominent seta at midlength. Vesicle of moderate length; greatest width near apex (Fig. 8).

**Female.** Unknown.

**Larva.** Unknown.

**Etymology.** The species name refers to the enlarged inner marginal cercal seta.

**Diagnosis.** This species appears distinct from others in the genus by virtue of the enlarged, spine-like seta projecting from the inner cercal margin and by the small rounded knob on the outer cercal margin (Fig. 7). The thick setal-like projection on the ventral cercal margin suggests this species is a member of the Cercispinosa Complex recognized by Baumann (1975).

**Nemoura neospiniloba** sp.n.  
(Figs. 9-12)

Adult habitus. General color brown to dark brown. First and second segment of antennae slightly darker than the rest of antennae. Head and pronotum uniformly brown. Legs faintly banded.

Male. Forewing length 6 mm. Posterior margin of tergum 9 bears a pair of rounded, spinulose lobes and tergum 10 bears a pair of small spines set on low knobs on either side of epiproct (Figs. 9-10). Epiproct short, wide, apically notched with a pair of minute processes set in the notch; apices of dorsal surface armed with small scale-like spines; ventral sclerite without obvious armature. Cerci bilobed in ventral aspect (Fig. 11); ventral lobe with a prominent, inwardly curved apical spine. Vesicle about twice as long as wide (Fig. 11). Paraprocts simple and without armature; inner lobes small, not shown in Fig. 11; outer lobes large and subtriangular with rounded apices.

Female. Forewing length 8 mm. Sternum 7 produced into a truncate lobe which covers about half of sternum 8 (Fig. 12). Sternum 8 mostly membranous and without posterior projection.

Larva. Unknown.

Etymology. The species name refers to the pair of...


spiny lobes on the mesoposterior margin of tergum 9. The prefix has been added to distinguish this name from that of N. spiniloba Jewett.

**Diagnosis.** *Nemoura neospiniloba* is similar in tergum 9 structure to *N. mucronata* Li & Yang and *N. furcocauda* Wu (Li & Yang 2008b). In the former species, the lobes on tergum 9 are acute and bear a single large apical spine and the paraprocts have a distinct, but small, club-shaped inner lobe. The lobes on tergum 9 are separated by about twice their width in *N. furcocauda* and the epiproct apex in that species is distinctly trilobed. The species is tentatively placed in the *Cercispinosa* Complex recognized by Baumann (1975).


*Nemoura raptoraloba* sp.n. (Figs. 13-16)

**Adult habitus.** General color pale brown. Head and pronotum without distinctive pigment pattern. Palpi and basal antennal segment pale. Femora with mesal and apical dark bands; tibiae with dark proximal marking. Forewings bearing scattered irregularly shaped pale areas against a slightly darker background.

**Male.** Forewing length 6.5 mm. Posterior margin of tergum 9 with a row of 5–8 long setae (Fig. 13); tergum 10 with a patch of sensilla basiconica on either side of epiproct tip, and a pair of prominent clusters of triangular spines set on sclerite adjacent to epiproct near apical third. Epiproct somewhat triangular in dorsal aspect, with a pair of thin, spine covered processes projecting at apex (Fig. 13). Paraproct outer lobe with a slender and strongly curved outer spine (Figs. 13-15). Cerci globular. Vesicle about twice as long as wide (Fig. 15).

**Female.** Forewing length 8.5 mm. Sternum 7 broadly rounded and overlapping basal half of sternum 8 (Fig. 16).

**Larva.** Unknown.

**Etymology.** The species name refers to the prominently curved, somewhat raptorial-like outer paraproct lobe.

**Diagnosis.** As indicated above under *N. clavaloba*, this species shares the enlarged, spine-like structure on the paraprocts. These paraproct lobes are acute and slender in lateral aspect for *N. raptoraloba* and *N. tenuiloba* (described below) but club shaped in *N. clavaloba*. *Nemoura raptoraloba* has a cluster of spines on tergum 10 adjacent to the epiproct which are absent in *N. tenuiloba* and the epiproct is more quadrangular in outline for the latter species.

*Nemoura spinacerca* sp. n.

(Figs. 17-20)


**Adult habitus.** General color brown. Antennae uniformly brown. Legs uniformly pale brown.

**Male.** Forewing length 7 mm. Tergum 9 with a pair of sparse patches of sensilla basiconica and tergum 10 with a few sensilla basiconica along anterior margin (Fig. 17). Epiproct short, wide, constricted apically and bearing an apical pair of large, sclerotized hooks that curve outward and a pair of short parallel median lobes that are closely appressed. Cerci wide, with a mesoventral spine and an apical finger-like process (Figs. 17-19). Vesicle about twice as long as wide (Fig. 18).

**Female.** Forewing length 9 mm. Sternum 7 produced into wide strongly sclerotized lobe reaching nearly the half of sternite 8 (Fig. 20); apex truncate.

**Larva.** Unknown.

**Etymology.** The species name refers to the prominent ventral cercal spine.

**Diagnosis.** See *N. stylocerca* below. This species is a member of the *Cercispinosa* Complex recognized by Baumann (1975).

*Nemoura stylocerca* sp. n.

(Figs. 21-23)

**Material examined.** Holotype ♀ from ca. 12 km along road from Sapa to Lai Chau, Lao Cai Province, Vietnam, 1950 m, 22° 20.583’ N, 103° 46.157’ E, 1-12 May 1999, B. Hubley, ROM 992002 (ROM).

**Adult habitus.** General color dark brown. Head, pronotum and antennae uniformly dark brown. Femora brown, but darker near knee. Wings dark brown but with a small transparent spot near cord.

**Male.** Forewing length 8 mm. Abdominal terga 1–7 poorly sclerotized, incomplete mesally; terga 8–10 with a complete sclerotized ring. Terga without
obvious sensilla basiconica. Epiproct with a dorsal constriction near midlength (Fig. 21); apex notched and bearing a pair of small finger-like processes in the notch and a pair of small, curved horns adjacent to notch and appressed to anterior margin of epiproct (Figs. 21-22); lateral aspect with a prominent raised knob near midlength (Fig. 22). Cerci consisting of a large dorsobasal lobe with apical hook and a smaller, stylus-like ventral lobe (Figs. 21-23). Inner lobe of paraprocts small, club shaped, outer lobe large and somewhat triangular in outline; vesicle typical.

**Female.** Unknown.

**Larva.** Unknown.

**Etymology.** The species name refers to the stylus-like ventral lobe of the cerci.

**Diagnosis.** This species is similar to *N. spinacerca* in cercal and epiproct structure, but the dorsolateral arms on the epiproct are larger in that species and tergum 9 of that species bears a conspicuous patch of sensilla basiconica. This species is a member of the *Cercispinosa* Complex recognized by Baumann (1975).

**Nemoura tenuiloba** sp. n.

(Figs. 24-26)

**Material examined.** Holotype ♂ from Muong Hoa Ho River, Lao Cai Province, Vietnam, 5-12 May 1995, D. Currie, B. Hubley, J. Swann, ROM 956007 (ROM).

**Adult habitus.** (Teneral specimen). Body color pale brown, wings milky, not fully pigmented. Legs, head and pronotum pale brown.

**Male.** Forewing length 5 mm. Abdominal tergum 9 poorly sclerotized and without sensilla basiconica, but bearing a row of fine hairs along posterior margin (Fig. 24); tergum 10 bearing a semicircular group of hairs near epiproct apex (Fig. 24), and strongly sclerotized beneath epiproct (Fig. 25). Epiproct poorly sclerotized and somewhat quadrangular in dorsal aspect but with a pair of short projecting apical processes; lateral aspect with a posteriorly directed dorsal lobe at midlength (Fig. 25). Paraprocts broad basally and strongly narrowed to a thin, acute lobe; inner angles of paraprocts bearing a thin spike-like structure, present on right side but apparently broken on left and added to Figure 26.

**Female.** Unknown.

**Larva.** Unknown.

**Etymology.** The species name refers to the thin paraproct lobe.

**Diagnosis.** This species is similar to *N. clavaloba* and *N. raptoraloba* in paraproct structure but the absence of tergal spines on segment 10 distinguishes it from the latter species and the absence of serrae on the epiproct distinguishes it from the former.

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**REFERENCES**


Zootaxa, 1511:65-68.


