



A New Species of the Genus *Neoephemera* McDunnough from China (Ephemeroptera: Neoephemeridae)

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Abstract

The mature larva of a new species, *Neoephemera projecta* sp. n., from China is described in detail. It represents a new country record of the genus for China. The discovery shows that the genus *Neoephemera* McDunnough has a more extensive Holarctic distribution than previously known. Ecological vicariance instead of geographic isolation is therefore favoured as presumed cause of the origin of the three neoephemerid genera.

Keywords: New species, *Neoephemera projecta* sp. n., Neoephemeridae, Ephemeroptera, China.

Introduction

There are five named species in the genus *Neoephemera* McDunnough, 1925, including *N. bicolor* McDunnough, 1925, *N. purpurea* (Traver, 1931), *N. youngi* Berner, 1953, *N. compressa* Berner, 1956 from the eastern Nearctic (Berner, 1956; Bae & McCafferty, 1998), and *N. maxima* (Joly, 1870) from the western Palearctic (Eaton, 1883–1888; Kazlauskas, 1959, 1963; Jazdzewska, 1975; Bae & McCafferty, 1998). In June, 1996 and August, 2000, larvae of a new species were collected in Sichuan and Yunnan Provinces of Southwest China and described herein. This is the first record of the genus *Neoephemera* from China.

The type specimens of the new species are deposited in several institutions: some in the Insects Collection, Department of Biology, Nankai University, some in the Department of Biology, Nanjing Normal University, and two paratypes in the Purdue Entomological Research Collection, Purdue University.

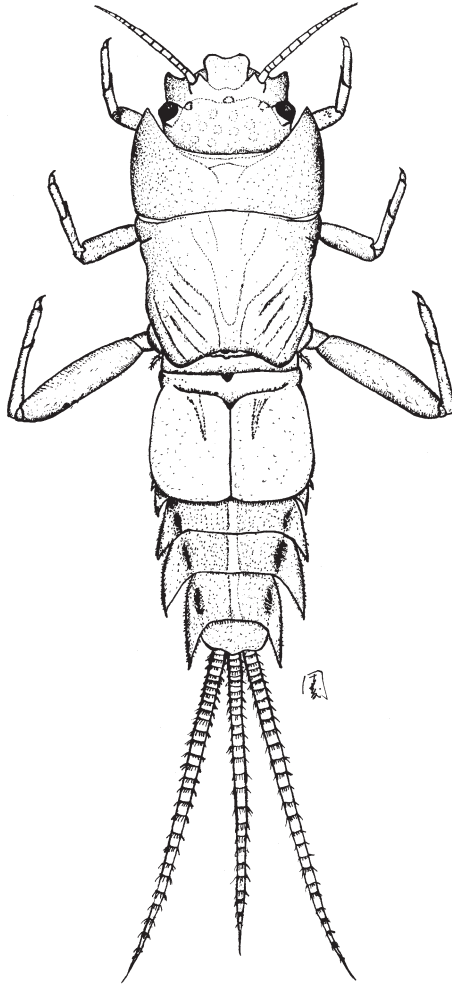
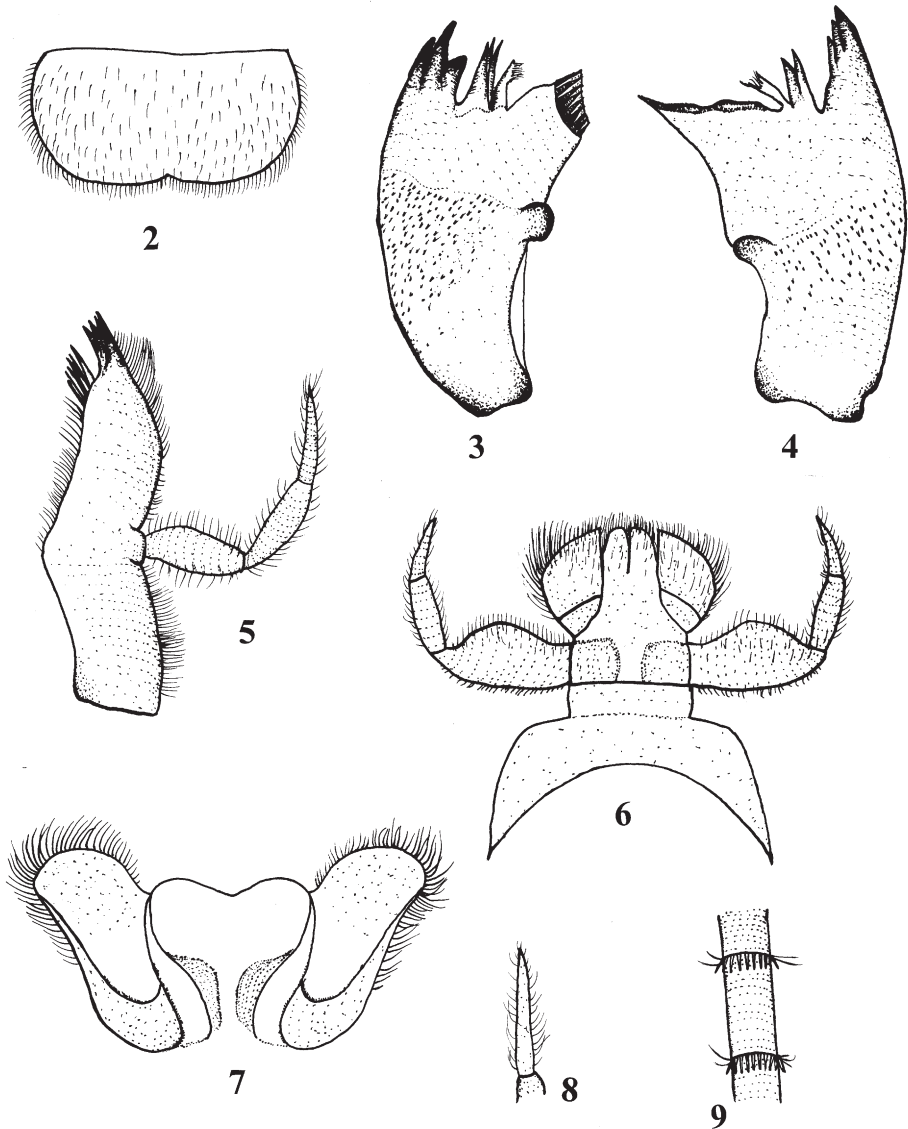


Figure 1. *Neophemera projecta* sp. n., larval habitus, dorsal view.

***Neophemera projecta* Zhou and Zheng, sp. n. (Figs. 1–9)**

Mature larva (in alcohol)

Body length 16.5 mm, caudal filament length 7.5 mm, body yellowish brown (Fig. 1). *Head.* Antennae pale, unicolorous, longer than head width. Frons expanded, somewhat bifurcated; one distinct projection present between antenna and compound eye. Eyes black; ocelli somewhat indistinct. Mouthparts: labrum lobe-like, upper surface and free margin with dense spines (Fig. 2), inner surface smooth. Mandible with well-developed lacinia and stout spines on dorsal surface; outer and inner incisor of right mandible trifurcate and bifurcate, respectively; outer and inner incisor of left mandible quadrifurcate and trifurcate, respectively (Figs. 3–4). Each galealacinia of maxillae



Figures 2-9. *Neoephemera projecta* sp. n., larva. (2) Labrum; (3) Left mandible; (4) Right mandible; (5) Maxilla; (6) Labium; (7) Hypopharynx; (8) Gill 1; (9) Detail of caudal filament.

with 5 distinguished bristles, their lateral margin with setae. Maxillary palpi 3-segmented, with setae (Fig. 5), the basal segment broader than the others and slightly longer than 2nd one; apical segment about 0.8 times length of 2nd one. Labium with dense setae and spines. Palpi of labium 3-segmented, basal segment broadest and longest, apical one thinnest and shortest. Paraglossae 2-segmented (Fig. 6); hypopharynx

rynix with three lobes, two tubercles on inner basal portion of lingua, superlinguae with long setae (Fig. 7).

Thorax. Notum yellowish brown; pronotum with well-developed anterolateral projections; mesonotum with rudimentary anterolateral expansions; with two pairs of wingpads, hindwing pads smaller, covered by forewing pads and invisible in dorsal view. Forelegs shortest of three pairs, length ratio of femur:tibia:tarsus = 1.0:0.6:0.8; length ratio of femur:tibia:tarsus of midleg = 1.2:0.9:0.9; hindleg longest, length ratio of femur:tibia:tarsus = 1.4:1.0:0.8. Each leg with acute claw and sparse spines on the surface and margins; claws simple, without denticles.

Abdomen. Terga yellow, with sparse spines on the surface and dense on margins; posterolateral projections of terga pale. Structure typical of genus: posterolateral projections of terga well developed, especially on tergum 9; the first two terga each with distinct median tubercle; terga 7–9 each with two dark spots, remainder pale. Gills 1–6 present. Gill 1 vestigial, with 2 segments, apical segments much longer than basal one, setaceous (Fig. 8). Dorsal lamellae of gill 2 quadrate, meeting and fused at midline, covering succeeding gill pairs; upper surface with indistinct ridge and sparse spines, free margin with dense stout spines (Fig. 1); ventral fringed lamella much smaller than dorsal one, also smaller than on gills 3–6. Gills 3–5 similar to each other, gills 3 largest, each with two lamellae; dorsal lamellae larger. Lamella plate with row of fringes on medial margin and row of tufts of fringes on lateral margin; ventral lamellae with row of marginal fringes too; gill 6 smallest, simple, single lamella with row of marginal fringes and turned inward. Terminal filament shorter than cerci, with whorls of short spines and sparse long setae at apex of each segment (Fig. 9).

Male and female adults. Unknown.

Material

Holotype: mature larva, VIII–18–2000, Chuan-Zhu-Shi (32.39°N, 103.35°E), Songpan County, Sichuan Province, ZHOU Chang-fa. *Paratypes:* 3 larvae, as the holotype; 8 larvae, VIII–11–2000, Chuan-Zhu-Shi, Songpan County, Sichuan Province, ZHOU Chang-fa; 2 larvae, VIII–12–2000, Shuanghe, Jiu-Zhai-Guo County (29.06°N, 106.59°E), Sichuan Province (deposited in Department of Biology, Nankai University, Tianjin, China). 15 larvae, VI–10 and VI–14–1996, collected at Yajiang stream, Yajiang County (30.02°N, 101.00°E); 3 larvae, Litang City (30.01°N, 100.17°E), Litang County, Sichuan Province; 1 larva, V–26–1996, Heping bridge, XiaoZhongdian, Zhongdian County (27.48°N, 99.42°E), Yunnan Province, China, by ZHOU Chang-fa and WANG Bei-xing (deposited in Department of Biology, Nanjing Normal University, Nanjing, China). 2 larvae, VIII–18–2000, Chuan-Zhu-Shi (32.39°N, 103.35°E), Songpan County, Sichuan Province, ZHOU Chang-fa (deposited in the Purdue Entomological Research Collection, Purdue University, USA).

Differential diagnosis

The larva of *Neophemera projecta* sp. n. has two pairs of wingpads and comparatively larger body size, and the dorsal lamellae of gills 2 meet and fuse at the midline, without overlapping each other and margin fringes distinctly show that this species belongs to the family Neophemeridae. Because it possesses anterolateral pronotal projections, mesonotum expansions and fused dorsal lamellae of gills 2, and because it has no longitudinal rows of setae on caudal filaments, and hindtibiae which are shorter than hindfemora, it is a species of the genus *Neophemera*.

Larvae of *Neoephemera projecta* sp. n. are unique in the genus *Neoephemera* because of 2 distinct projections on the head and longer foretarsi. They are similar to those of *Neoephemera purpurea* because both of them have well-developed anterolateral pronotal projections and a large body size. The new species can be distinguished easily from *N. purpurea* by having 2 large tubercles on the head and comparatively rudimentary anterolateral expansions of the mesonotum. Furthermore, larvae of *N. purpurea* have distinct tubercles on the nota, those of *N. projecta* sp. n. do not have any tubercles on the thorax.

Etymology

The species name is derived from the Latin adjective *projectus*, meaning prominent, and refers to two distinct projections on the head of the new species.

Discussion

There are three genera in the Neophemeridae. Genus *Potamanthellus* Lestage was recorded from the eastern Palearctic and Oriental regions (a Tertiary species was reported from the western Nearctic: Lewis, 1977, Bae & McCafferty, 1998), genus *Ochernova* Bae and McCafferty is found from the central Palearctic, and *Neoephemera* was previously reported from the western Palearctic and eastern Nearctic (Bae & McCafferty, 1998). The discovery of *N. projecta* in China reveals a more extensive Holarctic distribution of the genus.

Bae & McCafferty (1998) hypothesized three vicariance events to explain the distributional pattern, origin and evolution of the 3 neophemerid genera: Asiamerica was isolated from Euramerica, Euramerica from central Asia, and North America from Europe. This must be reconsidered in the light of the new discovery which leaves no obvious gap or barrier in the geographic distribution of the three genera of Neophemeridae. Differences between larvae of the three genera (larvae of *Potamanthellus* with more setaceous mouthparts and caudal filaments than both other genera; larvae of *Ochernova* with longer hindtibiae than *Neoephemera*) suggest they may move in different manners and may occupy different ecological niches which could have contributed to the origin and development of different genera.

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