



Short communication

A remarkable caddisfly with bipectinate antennae in Cretaceous Burmese amber (Insecta, Trichoptera)



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ABSTRACT

A new caddisfly (Trichoptera), *Palaeopsilotreta xiai* gen. et sp. nov. is described based on three well-preserved male specimens from mid-Cretaceous Burmese amber. It is assigned to the extant family Odontoceridae. *Palaeopsilotreta* is similar to the extant genus *Psilotreta* but differs from the latter by partially bipectinate antennae which are unknown among living Trichoptera. Our fossils are not only the only Mesozoic Odontoceridae, but also hitherto the earliest record of this family.

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1. Introduction

Burmese amber (from northern Myanmar) contains the most diverse biota in amber from the mid-Cretaceous and more than 250 families of arthropods have been reported from this deposit (Ross et al., 2010; Grimaldi and Ross, in press). The caddisflies in Burmese amber are represented to date by four extant families: Hydroptilidae, Philopotamidae, Polycentropodidae and Psychomyiidae (Botosaneanu, 1981; Wichard and Poinar, 2005; Wichard et al., 2011; Wichard and Wang, 2016). Our recent investigation reveals a potentially high diversity of this lineage in Burmese amber. Mesozoic caddisflies are mainly described based on compression fossils which commonly preserve often only wing characters. Some of compression fossils have discernible body parts and enable detailed descriptions (e.g., Gao et al., 2013; Zhang et al., 2016). The new caddisflies from Burmese amber show exquisite details of body structure, especially genitalia, thus providing

insights into the evolution of this lineage. In this paper, we describe a new extinct genus and species placed in the family Odontoceridae: *Palaeopsilotreta xiai* gen. et sp. nov., based on three well-preserved male specimens. It exhibits partially bipectinate antennae which are unknown among living Trichoptera.

2. Material and methods

The specimens are from an amber mine located near Noiye Bum Village, Tanaing Town, Myanmar (Kania et al., 2015). The age given by U–Pb dating of zircons from the volcanoclastic matrix of the amber is early Cenomanian (98.8 ± 0.6 million years) (Shi et al., 2012), but the geological age of Burmese amber should be slightly older than the zircon date (Ross, 2015).

The fossil specimens are embedded in small amber blocks cut out from larger Burmese amber pieces. The adult insects are nearly completely preserved and clearly visible in ventral and dorsal view. The male genitalia are flattened. The hindwings are partly covered by the somewhat distorted forewings. Some legs or parts of legs are missing. The head, thorax and abdomen show signs of decomposition and maceration. Antennae are incomplete.

Photos were taken using a Leica stereomicroscope M 420 Apo-zoom in combination with a Canon EOS 600D, EOS utility software

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and the Zerene Stacker software or were taken by the digital microscope Keyence VHX-900F. All images and figures were prepared with CorelDraw X4 and Adobe Photoshop CS4. The wing venation terminology in general follows [Holzenthal et al. \(2007\)](#): I – apical fork I; II – apical fork II; V – apical fork V; R – radius, M – media, Cu1 – cubitus anterior, Cu2 – cubitus posterior, A – analis, DC – discoidal cell. All taxonomic acts established in the present work have been registered in ZooBank (see below), together with the electronic publication LSID: urn:lsid:zoobank.org:pub:668567C5-A47B-4866-ADA6-59D6C5B752AC.

3. Systematic palaeontology

Order Trichoptera [Kirby, 1815](#)

Suborder Integripalpia [Martynov, 1924](#)

Family Odontoceridae [Wallengren, 1891](#)

Palaeopsilotreta gen. nov.

(urn:lsid:zoobank.org:act:211F3FC8-0A53-4FBF-BD2F-0777F996CA15)

Diagnosis. Male antennae partially bipectinate, about as long as forewings. Maxillary palps 5-segmented, first segment without apicomeres nodule; terminal segment not flexible or annulated. Mesoscutum with a pair of ovoid setal warts, mesoscutellum covered by a single wart, large, dome-like and ovoid. In fore- and hindwings forks I, II and V present; media simple, unbranched running to apical margin; discoidal cells closed, median and thyridial cells lacking. Tibial spurs: 1/4/4.

Remarks. The new extinct genus can be assigned to the family Odontoceridae by the following combination of features: maxillary palps 5-segmented, terminal segment not flexible or unannulated; mesoscutellum covered by large single wart, dome-like and ovoid, sparsely covered with setae; at mesoscutum a pair of ovoid setose warts present. Tibial spurs: 0–2/0–4/2–4. In the forewings discoidal cell closed, median cell absent; the thyridial cell lacking in the males of the genera *Marilia* and *Psilotreta*; the M stem missing in *Pseudogoera* and simple and unbranched in *Psilotreta*. In order to distinguish odontocerids from other families, a combination of different morphological characters is essential ([Oláh and Johanson, 2010, 2011](#)).

The genus *Palaeopsilotreta* is closely related to the extant genus *Psilotreta* by the simple and unbranched media in forewings, but differs from the latter in having the partially bipectinate antennae and only one apical spurs of the fore legs, instead of the two apical spurs in *Psilotreta*. In forewing the vein combination of forks I and II, discoidal cell closed, M simple and unbranched and the median and thyridial cells absent, is only known from the odontocerid genera *Psilotreta* and the extinct new *Palaeopsilotreta*.

Etymology. The generic name refers to the extant genus *Psilotreta*, to which the new extinct genus is closely related.

Palaeopsilotreta xiai sp. nov.

[Figs. 1–4](#)

(urn:lsid:zoobank.org:act:400ACD13-B750-4FB6-9257-32ADD57C67EF)

Holotype. NIGP164781, deposited in the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences.

Paratype. Two specimens, BA16001 and BA16002, deposited in the Lingpoge Amber Museum (Shanghai).

Etymology. The specific name is in honour of Mr. Xia Fangyuan, Director of Lingpoge Amber Museum, for his contribution to the study of Burmese amber.

Diagnosis. As for the genus.

Description. Head, thorax and abdomen brown covered partly with small and light brown setae; laterally with prominent eyes. Antennae partially bipectinate, about as long as forewings, consisting of a strong scapus, approximately twice the length of the short pedicellus, then follow 15–20 sub-cylindrical flagellomeres: the basal 10 flagellomeres each bear distally bipectinate rami, the terminal 6–10 flagellomeres are simple, rami are lacking. Maxillary palps 5-segmented, sparsely covered with setae; terminal segment not flexible or annulated, apically rounded.

Head dorsal ocelli absent, with a pair of antennal (anterior) setal warts, small and ovoid and a pair of posterior setal warts, large and subtriangular. Pronotum transversally with two setal warts, small and rounded. Mesoscutum bearing a pair of small ovoid scutal warts, the scutellum with a single dome-shaped, large, ovoid wart.

Forewings light brown, 2.3–2.6 mm long, apically rounded. Vein R1 basally thickened, strong, running to wing margin. Forks I and II present and sessile; discoidal cell closed by crossveins. DC about as long as fork I, fork II a little longer. Media simple, running to apical margin, without branching into M1+2 and M3+4. Thyridial cell absent. Cu1 basally thickened, running straight, apically bifurcated into fork V; Cu2 simple, unforked. Anal vein complete and basally thickened.

Hindwings light brown, translucent, relatively narrow, smaller than forewings, about 2 mm long, so far as visible, venation probably similar to forewing venation. Radius R1 vein conspicuously strong and slightly thickened. Forks I (R2 + R3), II (R4 + R5) and V (Cu1a + Cu1b) visible, as well as the apical junctions of media (M) and Cu2 at apical wing margin.

Legs with apical tibial spurs, mid- and hindlegs with additional pre-apical tibial spurs, however, in forelegs pre-apical tibial spurs absent: Tibial spurs: 1/4/4.

Male genitalia are visible only in ventral view, so the description is preliminary and incomplete ([Fig. 3](#)). Inferior appendages (gonocoxites) 2-segmented. Coxopodites cone-shaped, bearing mesad scattered long setae; almost 2/3rd in length of the gonocoxites; the harpagoes originating probably from the apex of the coxopodites, elongate, pencil-shaped, about 1/3rd in length of the gonocoxites, each harpago ending in a small crown with few black spines. Preanal appendages membranous, dorsum slightly convex, inner side slightly hollowed, at apex triangular and pointed; the preanal appendages longer than the gonocoxites. Segment X and the genital apparatus unclear, therefore undefined. The positions of fore- and hindwings hinder a clear description of the flattened male genitalia, visible ventrally.

4. Discussion

The family Odontoceridae is relatively small and is known from all zoogeographical regions. It contains about 150 extant species in 15 genera ([Holzenthal et al., 2010](#)) and 7 fossil species: *Phenacopsyche vexans* [Cockerell, 1909](#) from the Eocene of Florissant, USA; *Marilia altrocki* [Wichard, 1986](#), *Marilia succinea* [Wichard, 2013](#), *Marilia ophthalmica* [Ulmer, 1912](#), *Electrocerum pedestre* [Ulmer, 1912](#) and *Electropsilotetes rara* [Ulmer, 1912](#) from Eocene Baltic amber ([Wichard, 2013](#)). Our fossils are not only the only Mesozoic Odontoceridae, but also hitherto the earliest record of this family.

Pectinate antennae have a single row of comb-like rami along the flagellum, one ramus for each flagellomere, forming all together a comb-like shape. Bipectinate antennae have two rows of comb-like rami along the flagella and a pair of rami at each flagellomere; they look often like flea combs. Pectinate and bipectinate antennae are well known in some insect orders, e.g. in Coleoptera and Lepidoptera ([Beutel et al., 2014](#); [Gao et al., 2016](#)). In some moths and beetles, males possess such distinct antennae for

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