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Description of two new species of *Oecetis* (Trichoptera, Leptoceridae) from Borneo

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Abstract. Two new species of *Oecetis* from Maliau Basin, Malaysian Borneo, are described for the first time, *O. mesospina* sp. nov. and *O. apelqvisti* sp. nov. These two new species bring the total number of *Oecetis* found on the island of Borneo up to 16.

Keywords. Taxonomy, caddisflies, Oriental, Leptocerini, Malaysia.

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Introduction

With almost 2000 known species (Morse 2020) the family Leptoceridae Leach, 1815 represents about 12% of the species diversity in the Trichoptera and constitute one of the largest families in the order. Within the family, the subfamily Leptocerinae Leach, 1815 holds the majority of the species and also has the widest distribution, with species recorded from all continents except Antarctica. Around 600 species are recognized in the leptocerine genus *Oecetis* McLachlan, 1877 (Morse 2020; Johanson *et al.* 2020a, 2020b), the largest genus in the entire family. A few attempts based on morphological characteristics have been made to cluster its species into more heuristic groups. Chen (1993) presented a phylogenetic hypothesis based on morphological characters and revealed four main clades; these were erected as subgenera of *Oecetis*. The Eurasian members of the genus were subsequently divided into species groups by Malicky (2005), but without any critical examinations of the characters used of or phylogenetic context.

About 270 species have been described from the Oriental Biogeographical Region, and of these, 14 are recorded from the island of Borneo (Malicky 2010). Of these, the following four species have been recorded from the Malaysian states: from Sabah, *O. paris* Malicky, 2006 and *O. lynkeus* Malicky, 2005; from Sarawak, *O. koyana* Kimmins, 1955 and *O. maron* Malicky & Chantaramongkol, 2005. The latter

is also known from Indonesian Borneo (Kalimantan). In total, eight species are known from Indonesian Borneo, and three are recorded from Brunei. Here we describe two new species from Sabah, bringing to 16 the total for the island.

Material and methods

Caddisfly adults were collected from 22W circular UV lamps and in Malaise traps situated closely to the river during December 9–14 2007. The material was preserved in 80% ethanol. Sorting and determinations were executed in the laboratory at the Swedish Museum of Natural History. Individual specimens were initially grouped based on genital morphology, after which the abdomen was separated from the rest of the body. Extraction of DNA was carried out on the abdomen with QIAamp® DNA Micro kit (QIAGEN), which also macerated the abdomen. The abdomen was dehydrated in absolute alcohol and temporarily suspended in Euparal on a microscope slide. Illustrations of genitalia were drawn using a Laborlux compound microscope with a drawing tube. The illustrations were subsequently scanned and finalized in Adobe® Illustrator® 15.1 and Photoshop® 12.1. After examination and illustration, the abdomens were transferred back to 80% ethanol together with the rest of the specimen. In situations where the description is based on a single specimen, species are confirmed to be distinct from other Bornean and Oriental species based on a combination of DNA sequences and morphology. All material is deposited in the Swedish Museum of Natural History (NHRS). The terminology applied to genitalia follows that of Nielsen (1957).

Results

Phylum Arthropoda von Siebold, 1848
Class Insecta Linneaus, 1758
Order Trichoptera Kirby, 1813
Family Leptoceridae Leach, 1815
Genus *Oecetis* McLachlan, 1877

Oecetis mesospina sp. nov.
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Figs 1–5, 11

Diagnosis

The species is distinguished from many of the Oriental and Palearctic species by the absence of modified tergites on segment VI–VIII. It resembles the Bornean *Oecetis peleus* Malicky, 2005 and *Oecetis halirrhotios* Malicky, 2005 in genitalic features, particularly in the shape of tergum X, the inferior appendages of the inferior appendages and the superior appendages. However, it is distinguished from both species by the presence of a row of short megasetae forming a comb along the mesal margin of the inferior appendages and by the phallus bearing a pair of sharply triangular lateral processes on the posterior part of the ventral side compared to rounded processes in *O. peleus* and *O. halirrhotios*. It is also distinguished from *O. peleus* by the more strongly curved tergum X in lateral view.

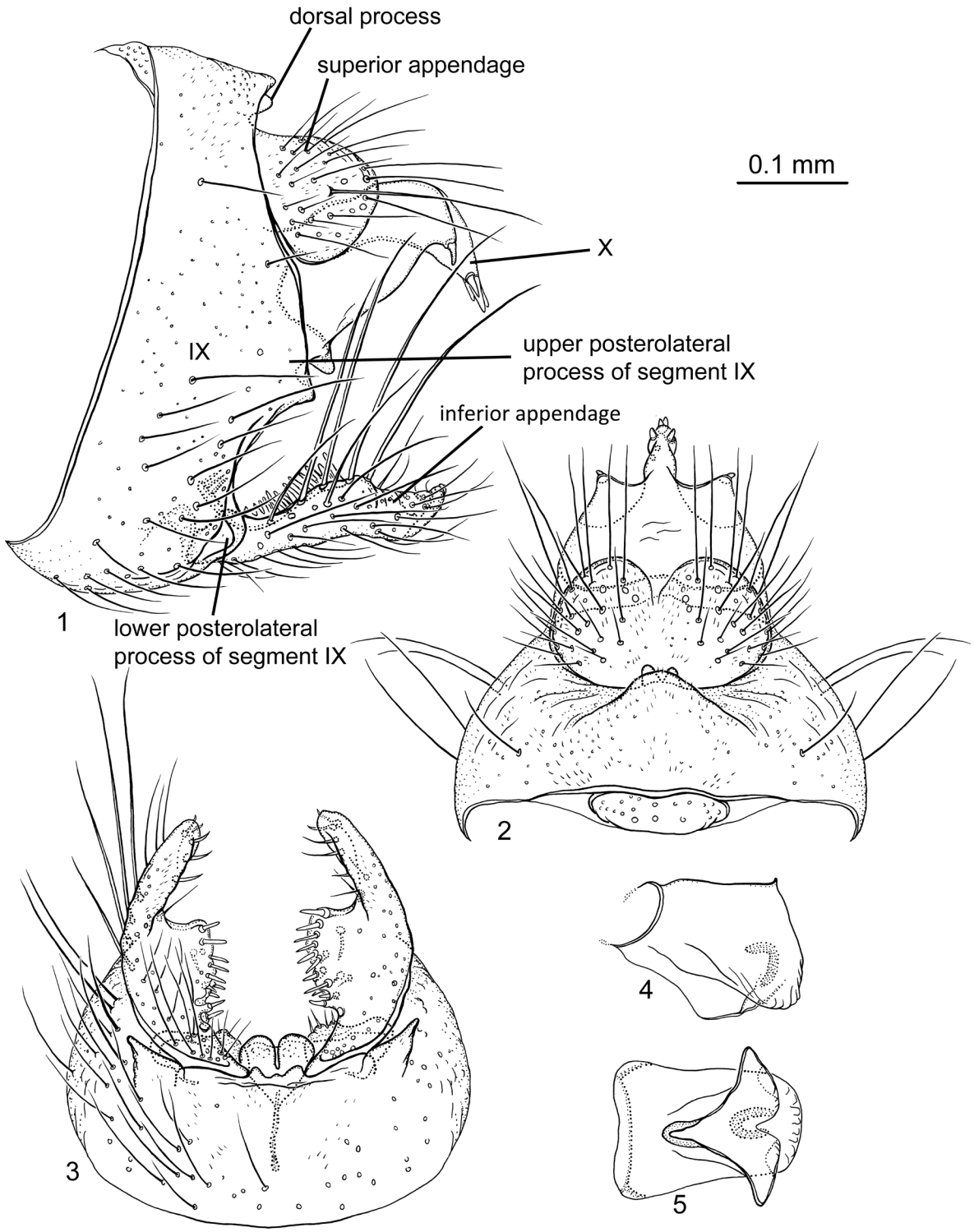
Etymology

Mesospina, referring to the row of spine-like megasetae along the mesal margin of the coxopodites.

Type material

Holotype

MALAYSIA • ♂ (in alcohol); Sabah, Tawau, Maliau Basin, Nepenthes Camp, crossing stream; 4°43′58.9″ N, 116°52′40.7″ E; 994 m a.s.l.; 9–14 Dec. 2007; B. Viklund and N. Jönsson leg.; 6 m Malaise trap, loc# VKBS-2007-27; DNA voucher JL5; NHRS.



Figs 1–5. *Oecetis mesospina* sp. nov., holotype, ♂ (NHRS). **1**. Genitalia, lateral view. **2**. Genitalia, dorsal view. **3**. Genitalia, ventral view. **4**. Phallus, lateral view. **5**. Phallus, ventral. Scale bar = 0.1 mm.

Paratype

MALAYSIA • 1 ♂ (in alcohol); same collection data as for holotype; DNA voucher JO7; NHRS.

Description of male

Body. Forewing: 5.6–6.4 mm (N = 2). Tergites VI–VIII without reticulate pattern.

Genitalia (Figs 1–5). Higher than long in lateral view. In lateral view segment IX with almost straight anterior margin, dorsal and ventral parts slightly produced anteriorly and posteriorly. Acrotergite of segment IX well developed, forming single transverse wart-like aggregation of setal bases, more than three times wider than long. Pair of dorsal processes of segment IX minute, wart-like. In lateral view lower posterolateral plate of segment IX short, posteriorly rounded, situated at same level as base of inferior appendages; upper posterolateral plate of segment IX short, sharply triangular, located medially between superior appendages and inferior appendages. Longitudinal apodemes absent. Tergum X reaching as far posteriorly as inferior appendages, about twice as long as superior appendages; divided into long central and two shorter lateral processes; in lateral view, central process longer than lateral processes, curving posteroventrally, with apical megasetae, narrow in dorsal view; lateral processes curving posteroventrally, each with single, apical megaseta; in dorsal view forming triangular plates. In lateral view, superior appendages almost circular, about half as long as tergum X; in dorsal view situated closely to each other, mesally fused, almost circular. In lateral view, each inferior appendage slender along their, slightly sigmoid, parallel-sided, except narrowing apically; four very long dorsally oriented setae located at mid-length of each inferior appendage; in ventral view inferior appendages well separated after basal plate and pair of small rounded processes; each mesal plate with comb of short megasetae along mesal margin. Phallus about as long as tergum X. In lateral view almost as high as long; in ventral view anterior margin almost straight, widest anteriorly and weakly narrowing posteriorly; sharply triangular pair of lateral processes after mid-length; internal sclerite horse-shoe shaped.

Distribution

The species is only known from the type locality (Fig. 11).

Oecetis apelqvisti sp. nov.

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Figs 6–11

Diagnosis

The species is distinguished from many of the Oriental and Palearctic species by the absence of modified tergites on segment VI–VIII. It resembles *O. idas* Malicky, 2005 in genitalic features, particularly the long and slightly curving superior appendages, long and strongly ventrally curving tergum X, with right branch longer than left branch, and long pair of dorsal processes. *Oecetis apelqvisti* sp. nov. can be distinguished from *O. idas* in lateral view by the clearly bifid inferior appendages, and the apical part of phallus with a single hook-shaped sclerotized process.

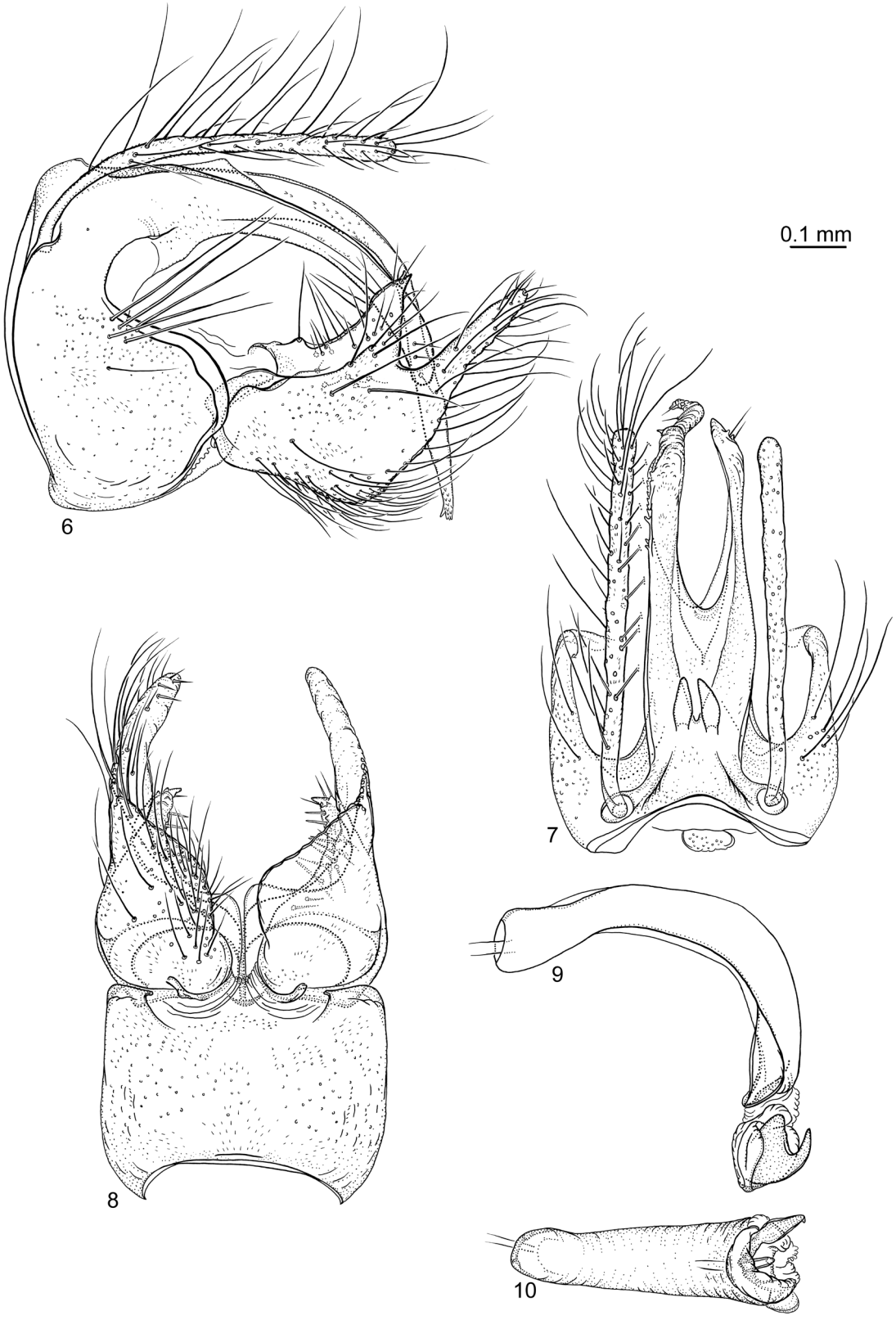
Etymology

Apelqvisti, named after one of the collectors, Niklas Apelqvist (formerly Niklas Jönsson).

Type material

Holotype

MALAYSIA • ♂ (in alcohol); Sabah, Tawau, Maliau Basin, Nepenthes Camp, 150 m from Jalan Babi; 4°43′56.1″ N, 116°52′52.0″ E; 1031 m a.s.l.; 13 Dec. 2007; N. Jönsson, T. Malm and B. Viklund; light trap, loc#VKBS-2007-47; DNA voucher JQ1; NHRS.



Figs 6–10. *Oecetis apelqvisti* sp. nov., holotype, ♂ (NHRS). **6**. Genitalia, lateral view. **7**. Genitalia, dorsal view. **8**. Genitalia, ventral view. **9**. Phallus, lateral view. **10**. Phallus, ventral view. Scale bar = 0.1 mm.

Description of male

Body. Forewing: 6.7 mm (N = 1). Tergites VI–VIII unmodified.

Genitalia (Figs 6–10). Longer than high in lateral view. Segment IX oriented almost vertically, anterior margin uniformly convex along its height; ventral part almost circularly expanded posteriorly; dorsal part reduced. Acrotergite of segment IX well developed, forming single oval aggregation of setal bases about width of dorsal processes combined. Pair of dorsal processes of segment IX elongate, tube-like; segment lacking membranous area. Lower posterolateral plate of segment IX short, high, located from basis of inferior appendages to mid-height of segment; upper posterolateral plate of segment IX lacking. Longitudinal apodeme absent. Tergum X in lateral view twice length of superior appendages, curving ventrally along its length to pointed apex; in dorsal view bilobed from half length, both lobes tapering. Superior appendages very long, tubular, originating at anterior margin of segment IX at junction between dorsal and ventral parts; oriented dorsally before curving posteriorly over segment IX. Each inferior appendage high and wide, about as long as superior appendages, all setae shorter than length of inferior appendages; in lateral view 2-branched, basal two-thirds widening from base, sharply triangular dorsal branch, ventral margin expanded around mid-length; apical branch digitate, narrow, oriented posterodorsally; in ventral view, each inferior appendage with basimesal expansions, sharply narrowing after basal one-third, apical one-third narrow, digitate. Phallus about as long as tergum X in lateral view, uniformly slender, oriented posteriorly before curving ventrally at mid-length, apex with single hook-shaped sclerotized process; in ventral view about length of inferior appendages, tubular, slightly widening apically, hook-shaped sclerotized process located on left side.

Distribution

The species is only known from the type locality (Fig. 11).

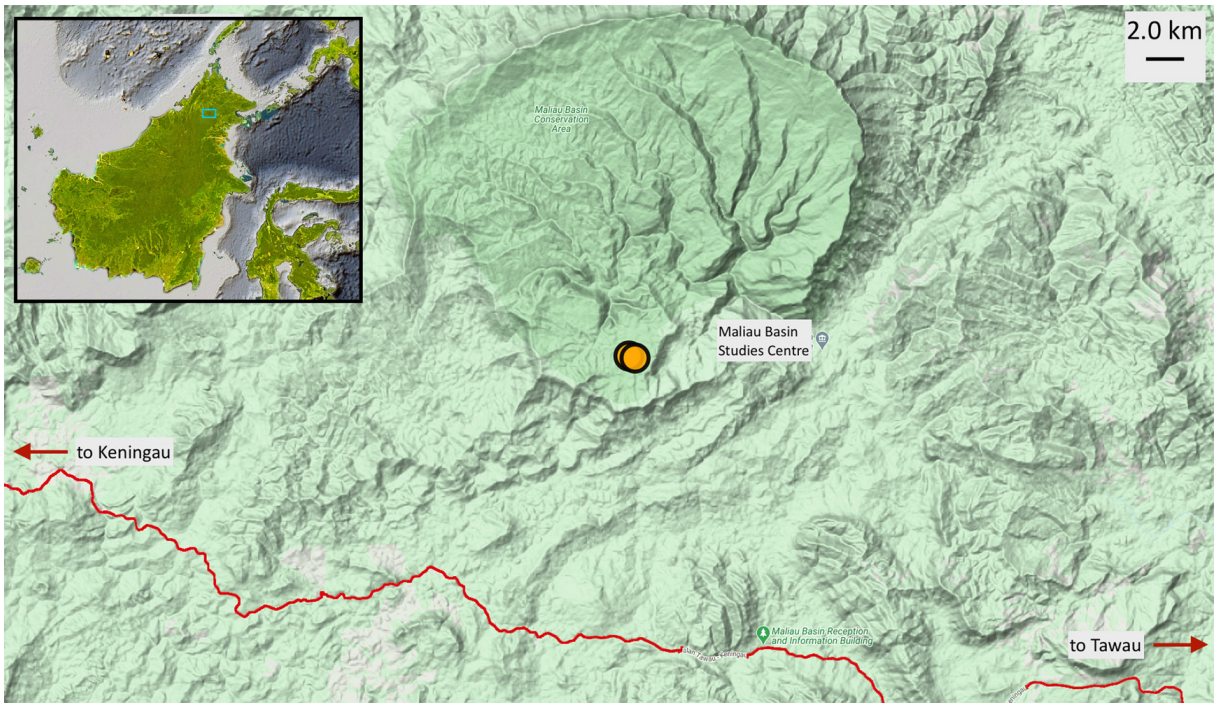


Fig. 11. Map with the position of the two sampling sites in Maliau Basin shown as orange dots. The position of the Maliau Basin area on Borneo is indicated with a blue rectangular in the upper-left map.

Discussion

The study is based on only three specimens. Both specimens of *O. mesospina* sp. nov. were collected in a Malaise trap and the single specimen of *O. apelqvisti* sp. nov. was taken from a light trap. No specimens of previously described species were collected from the visited sites. This could indicate that species of *Oecetis* are rarely collected in the area or that they are seasonal. It is possible that the diversity might be much higher than indicated by the known species number. With around 270 species described, the diversity of *Oecetis* in the Oriental region represents about 45% of the world fauna of *Oecetis*. A recent paper by Quinteiro & Almeida (2021) on the Neotropical diversity of *Oecetis* gave the number of Neotropical species as 73 and of these, 49 were assigned to six evolutionary groups based on phylogenetic analyses of morphological characters. To fully understand the evolutionary success of *Oecetis* in the Oriental Region, a phylogenetic analysis involving DNA characters is needed, involving as many species and representatives of different biogeographical regions as possible.

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