Taxonomy

Contribution to the taxonomy of the Terpides lineage (Ephemeroptera: Leptophlebiidae)

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Abstract – In the present work, based on material from several localities in Brazil, we present a contribution to the taxonomy of the Terpides lineage, a monophyletic group of Neotropical mayflies that encompasses three genera: Terpides, Tikuna, and Fittkaulus. A new species of Terpides is described from the States of Espírito Santo and Mato Grosso, based on nymphs, male and female imagos. The male imago of the type species of Terpides, T. guyanensis, the nymph and male imago of Tikuna bilineata, and the nymph of Fittkaulus cururuensis are described for the first time.

Key words: New species / taxonomy / Neotropics / South America / macroinvertebrate

Introduction

The mayfly Terpides lineage (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) was first recognized by Savage (1986) and included the following described genera and species: Terpides Demoulin, represented by T. guyanensis Demoulin and T. jessiae Peters & Harrison; and Fittkaulus Savage & Peters, represented by F. maculatus Savage & Peters, F. cuibae Savage, and F. cururuensis Savage. Later, a new species of Terpides, T. diadema, was described by Lugo-Ortiz and McCafferty (1996), the morphology of the nymphs of T. jessiae and T. guyanensis was compared (Boutonnet et al., 2004), and a new genus, Tikuna Savage, Flowers & Porras, was described based on a single species, T. atramentum (Traver), and incorporated to the Terpides lineage (Savage et al., 2005). Peters et al. (2005) complemented the current knowledge of the Terpides lineage, transferring Choroterpes bilineata Needham & Murphy to Tikuna, and C. vinculan Traver to Terpides. To date nine species and three genera are recognized in the Terpides lineage.

Terpides is not only the most speciose genus in the lineage, but also presents the widest distribution, being known from Central America (T. diadema and T. vinculan, both from Costa Rica), West Indies (T. jessiae, from Martinique), and South America (T. guyanensis, from Surinam and French Guyana, as well as undescribed species mentioned by Dominguez et al. (2006) from Argentina, Bolivia, Brazil, Colombia and Ecuador) (Demoulin, 1966; Peters and Harrison, 1974; Lugo-Ortiz and McCafferty, 1996; Boutonnet et al., 2004); Fittkaulus is mainly known from Brazil (all described species), but undescribed species are also recorded from Surinam, French Guyana, Peru and Ecuador (Savage, 1986; Dominguez et al., 2006); whereas Tikuna is reported from Central and South America (T. atramentum from Costa Rica, and T. bilineata from Ecuador, Surinam, Venezuela, Colombia and Brazil) (Peters et al., 2005; Savage et al., 2005).

During the last years, we have collected material from the Terpides lineage from several and poorly documented areas of Brazil. Based on this material, and aiming to complement the current knowledge of this group of mayflies, in the present paper a new species of Terpides is described from the States of Espírito Santo and Mato Grosso, based on nymphs, male and female imagos. The male imago of the type species of Terpides, T. guyanensis, the nymph and male imago of Tikuna bilineata, and the nymph of Fittkaulus cururuensis are described for the first time.

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**Taxonomy**

*Fittkaulus cururuensis* Savage (1986) (Figs. 1–9 and 30–31)

Description

Nymph

Length: body: 5.8–6.3 mm, cerci: 4.0 mm.

Head (Fig. 30): brown, inner margin of eyes and triangular mark below ocelli yellow. Vertex with irregular yellow spots. Antennae whitish. Base of ocelli black, apex whitish.

Labrum (Fig. 1): length about 2.3x maximum width, anteromedial emargination without denticles; dorsally with one nearly marginal row of fine, simple setae, and one submarginal row of long, fine, simple setae, and long, fine, simple setae scattered on basal half; ventrally with long, fine, simple setae on antero-sublateral area and on anterolateral corner.

Left mandible (Fig. 2): outer margin relatively straight; basal set of incisors with three main denticles, distal set with four; prostheca with numerous long bristles.

Right mandible (Fig. 3): outer margin broadly curved; basal set of incisors with two main denticles, distal set with four; inner margin with distomedial row of long, simple setae.

Hypopharynx (as in Fig. 25): lingua rectangular without lateral processes, superlingua with inner margin with row of setae.

Maxilla (Fig. 4): apex of galea-lacinia with one large, pectinate setae and one long, non-pectinate, curved setae; inner lateral margin with row of long, simple setae; palp segment II 2.1x length of segment I; palp segment III 0.6x length of segment II; palp segment IV 1.5x length of segment III.

Labium (Fig. 5): palp segment II 0.6x length of segment I; palp segment III subequal length to segment II; segment I with fine, long, simple setae scattered on inner and outer margins; segment II with two fine, simple setae on outer margin; segment III conical with spine-like setae on inner margin, and fine, long, simple setae scattered on outer margin, dorsally with oblique row of large setae; paraglossa and glossa with scattered setae; glossa curved over ventrolaterally, large; paraglossa broadly rounded laterally.

Thorax (Fig. 31): brown. Pronotum with lateral margin yellow; mesonotum with yellow marks; metanotum with posterior margin yellow. Sternum yellow. Pleura yellowish white.

Legs (Fig. 6): femora yellowish white, subdistal area brown; coxae II and III with brown mark; tibiae and tarsi yellowish washed with brown; forefemora with marginal and submarginal inner rows of short, fine, simple setae, outer margin with scattered fine, simple setae; foretibiae with inner row of simple setae, and with four long, fine, simple setae near apex; foretarsi with two rows of fine, simple setae on inner margin, outer margin with scattered fine, simple setae; tarsal claw with nine denticles (Fig. 7).

Abdome (Fig. 31): tergum yellow washed with brown; tergum X yellow. Posterolateral projections present on terga II–VI and VIII–IX (shorter on segment II, regular on segments III–VI, larger on segments VIII–IX). Sternum yellow; sterna II and III with sublateral brown mark. Gills with tracheae blackish; ventral portions of gill I lanceolate, dorsal portions with narrow projection (Fig. 8); gill IV with dorsal and ventral portions dissimilar, dorsal portion large, distal margin with large inner lobe, ventral portion as in gill I (Fig. 9). Cerci yellow, basal area brown.

Adults

The female imago of this species was adequately characterized by Savage (1986), whereas the male imago remains unknown.

Diagnoses

Nymphs of *F. cururuensis* are distinguished from those of *F. maculatus*, the other species of the genus described in the nymphal stage, by the following combination of characteristics: (1) labrum with anteromedian emargination without denticles (Fig. 1); (2) apex of galea-lacinia with one large, pectinate setae and one long, non-pectinate, curved setae (Fig. 4); (3) coxae II and III with brown mark; (4) tergum yellow washed with brown, terga II–VII with sublateral yellow mark, terga VIII with median area yellow, posterior 2/3 of terga IX yellow (Fig. 31).

Female imagos of *F. cururuensis* are distinguished from other species of the genus by the following combination of characteristics: (1) fore wing without a dark macula at fork of vein MA; (2) coxae I and II, or II and III with brown mark; (3) abdominal sterna 1–2 with small posteromedian brownish black marks.

Distribution

Brazil: Mato Grosso, Pará, Espírito Santo.

Material examined

Terpides guyanensis Demoulin (1966) (Figs. 36–37, 41 and 44–45)


Description

Nymph

The nymph of this species, previously described by Demoulin (1966), was adequately characterized by Boutonnet et al. (2004).

Male imago

Length: body: 6.0 mm, fore wing: 5.2 mm, hind wing: 0.9 mm.

Head (Figs. 36 and 37): brown. Upper portion of eyes grayish brown, stalk brown. Scape and pedicel dark brown; flagellum whitish. Base of ocelli whitish, apex black.

Thorax (Figs. 36 and 37): pronotum light brown, margins brown; mesonotum dark brown, posterior scutal protuberance and scutellum darker; metanotum brown. Pleura brown washed with black. Sternum brown.

Wings (Figs. 44 and 45): longitudinal and cross veins of fore and hind wings light brown; membrane of fore and hind wings hyaline. Forefemora whitish washed with black; foretibiae whitish, apex black; mid and hind legs whitish. Tarsi and tarsal claws whitish.

Abdomen (Figs. 36 and 37): terga grayish black; terga II–VIII with anteromedial grayish white mark; Sternum grayish white; sterna I and II completely washed with grayish black; sterna III with anteromedian and median area washed grayish black. Styliger plate grayish.

Genitalia (Fig. 41): forceps and penes grayish; abruptly narrowing toward apex. Caudal filaments whitish, fading toward apex of filaments.

Female imago

Unknown.

Diagnoses

Nymphs of T. guyanensis are distinguished from other species of the genus by the following combination of characteristics: (1) labrum with six larger denticles; (2) gills with tracheae blackish only in part; (3) posterolateral projection on terga V–VI and VIII–IX.

Imagos of T. guyanensis are distinguished from other species of the genus by the following combination of characteristics: (1) upper portion of eyes grayish brown (Figs. 36 and 37); (2) fore wing hyaline (Fig. 44); (3) genitalia with penes abruptly narrowing toward apex (Fig. 41).

Distribution

Brazil: Roraima, Surinam, French Guyana.

Material examined

Brazil: Roraima, Igarapé do Pedral, Serra de Tepequém, N 3°37'14.43", W 61°38'15.34", 26.xi.2006, J.N. Falcão col. Two male imagos (one reared with corresponding exuvia mounted on slide), INPA.

Terpides sooretamae Boldrini and Salles, sp. n. (Figs. 10–21, 32–33, 38, 42 and 46–49)

Description

Nymph

Length: body: 5.1–7.4 mm, cerci: 6.8 mm.

Head (Fig. 32): brown. Vertex with irregular light brown marks; triangular light yellowish brown mark below ocelli. Antennae whitish. Inner margin of compound eye yellowish white. Upper portion of compound eye grayish black.

Labrum (Fig. 11): length about 2× maximum width; anteromedial emargination with six poorly defined denticles (Fig. 10); dorsally with one nearly marginal row of fine, simple setae, and one submarginal row of long, simple setae.

Maxilla (Fig. 14): apex of galea-lacinia with one large, pectinate setae and one long, non-pectinate, curved setae (Fig. 15), and row of five pectinate setae; inner lateral margin with row of long, simple setae; segment I with palp segment II 2.5× length of segment I; palp segment III subequal of segment II; palp segment IV 0.7× length of segment III.

Labium (Fig. 16): palp segment II 0.7× length of segment I; palp segment III 0.6× length of segment II; segment I with fine, long, simple setae scattered on inner and outer margin; segment II with row of fine, simple setae...
on outer margin; segment III conical with 16 spine-like setae on inner margin, and fine, long, simple setae scattered on outer margin, dorsally with a diagonal row of large setae; paraglossa and glossa with scattered setae; glossa curved over ventrolaterally, large, paraglossa rounded laterally.

Thorax (Fig. 33): pronotum light brown, anterior and posterior margins brown; mesonotum brown with yellow marks, posterior area dark brown; metanotum brown.

Legs (Fig. 17): yellow washed with brown; forefemora brown washed with black; apex of femora of mid and hind
legs brown; base of tibiae brown. Forefemora with row of 28 short, fine, simple setae on inner margin, and row of short, fine, pectinate setae on submarginal area, outer margin with scattered fine, simple setae; foretibialiae with an inner row of short, simple setae, and with two long, fine simple setae near apex; foretarsi with two rows of short, fine, simple setae; tarsal claw with a larger denticle in the middle, basal set with four denticles, distal set with six denticles (Fig. 18).

Abdome (Fig. 33): tergum yellowish brown, terga I–VI completely washed with black, terga VII–VIII washed with black on anterior margin; terga II–VIII with anteromedial light yellowish brown mark. Posterolateral projections present on terga III–VI and VIII–IX (shorter on segments III–IV, larger on segments VIII–IX). Gills relatively alike, dorsal and ventral lamella lanceolate, tracheae blackish; gill I with only main trunk of trachea pigmented (Fig. 19); gill IV with many tracheoles (Fig. 20); gill VII with four tracheoles (Fig. 21). Sternum yellowish brown; sternae I, II and VII completely washed with black, sternae III–VI washed with black only on posterior margin.

Male imago

Length: body: 5.2–6.1 mm, fore wings: 6.1 mm, hind wings: 1.0 mm.

Head (Fig. 38): brown. Upper portion of eyes orange, stalk dark brown. Scape and pedicel brown; flagellum light brown. Base of ocelli black, apex light brown.

Thorax: pronotum brown, posterior margin dark brown; mesonotum dark brown, scutellum darker; metasternum brown. Proand mesosternum light brown; mesosternum with basisternum and furcasternum dark brown; metasternum light brown. Pleura brown washed with black.

Wings (Figs. 48 and 49): longitudinal and cross veins of fore and hind wing brown; cross veins of fore wing surrounded with small brown clouds; membrane of fore and hind wings grayish brown. Forefemora brown; foretibialia brownish yellow; mid and hind legs brownish yellow. Tarsi and tarsal claws whitish.

Abdome: as in male imago, except for lighter coloration.

Diagnoses

Nymphs of T. sooretamae sp. n. are distinguished from other species of the genus by the following combination of characteristics: (1) labrum with six poorly defined denticles (Fig. 10); (2) segment III of labial palp with 16 spine-like setae on inner margin; (3) gills with tracheae completely black (Figs. 19–21); (4) posterolateral projections present on terga III–VI and VIII–IX (Fig. 33).

Imagos of T. sooretamae sp. n. are distinguished from other species of the genus by the following combination of characteristics: (1) upper portion of eyes orange (Fig. 38); (2) cross veins of fore wings surrounded with small brown clouds (Figs. 46 and 48); (3) genitalia with penes gradually narrowing toward apex (Fig. 42).

Etymology

After the Reserva Biológica de Sooretama, one of the most important areas of conservation in the State of Espírito Santo, and one of the localities where the new species was found.

Distribution

Brazil: Espírito Santo, Mato Grosso.

Material examined


Non type material

Brazil: Mato Grosso, Barra do Garça, Córrego da Mata, S 14°29′51.7″, W 52°28′42.6″, 12.i.2005, F.F. Salles col., fifteen nymphs. Five nymphs, same data, except, Y.F. Shimano and 1.viii.2007, UNEMAT.

\textit{Tikuna bilineata} (Needham and Murphy, 1924)
(Figs. 22–29, 34–35, 39–40, 43 and 50–51)

\textit{Choroterps bilineata} Needham and Murphy (1924); 48 (male, female); Traver (1947): 156 (male, female).


**Description**

**Nymph**

Length: body: 5.9 mm, cerci: 5.7 mm.
Head (Fig. 34): yellowish. Antennae whitish. Ocelli whitish, inner margin of ocelli black.

Labrum (Fig. 22): length about 2.2× maximum width, anteromedian emargination without denticles, dorsally with one nearly marginal row of fine, simple setae, and one submarginal row of long, fine, simple setae; ventrally with long, fine, simple setae on antero-sublateral area and on anterolateral corner.

Left mandible (Fig. 23): outer margin relatively straight; basal set of incisors with two main denticles, distal set with four to five denticles; prostheca with numerous long bristles.

Right mandible (Fig. 24): outer margin broadly curved; basal set of incisors with two main denticles, distal set with four; inner margin with distomedial row of long, simple setae.

Hypopharynx (Fig. 25): lingua rectangular without lateral processes, superlingua with inner margin with row of setae.

Maxilla (Fig. 26): apex of galea-lacinia with one large, pectinate setae and one short, non-pectinate, curved setae, and row of five pectinate setae; inner lateral margin with row of long, simple setae; palp segment II 1.6× length of segment I; palp segment IV subequal to segments III and II.

Labium (Fig. 27): palp segment II 0.7× length of segment I; palp segment III subequal to segment II; segment I with fine, long, simple setae scattered on inner and outer margin; segment II with fine, simple setae scattered on outer margin; segment III conical with spine-like setae on inner margin, and fine, long, simple setae scattered on outer margin, dorsally with a diagonal row of large setae; paraglossa and glossa with scattered setae; glossa curved over ventrolaterally, large; paraglossa rounded lateral.

Thorax (Fig. 35): pro-, meso- and metanotum yellow washed with brown; pronotum with longitudinal submedial black mark; mesonotum with longitudinal submedial black mark restricted to anterior half. Pro-, meso- and metasternum light yellow.

Legs light yellow (Fig. 28): forefemora with row of 24 short, fine, simple setae on inner margin, and row of short, fine, pectinate setae on submarginal area, outer margin with scattered fine, simple setae; foretibiae with an inner row of short, simple setae, and with six long, fine, pectinate setae near to apex; foretarsi with row of fine, simple setae; tarsal claw as in Figure 29.
Abdome (Fig. 35): terga yellow; segments I–VIII with longitudinal submedial black mark. Posterolateral projections present on terga VIII–IX. Sterna light yellow. Cerci yellow.

**Male imago**

Length: body: 5.4 mm, wings: broken and lost.

Head (Fig. 39): yellowish. Antennae light yellow. Upper portion of eyes grayish brown, basal half of stalk washed with black. Ocelli whitish, inner margin black.

Thorax (Fig. 39): yellowish. Pronotum with longitudinal submedial black mark; mesonotum darker, with longitudinal submedial black mark reaching posterior scutal protuberance, lateral area just bellow scutellum washed with black; metanotum yellow. Pro-, meso- and metasternum light yellow. Legs broken and lost.

Abdome: terga yellowish white, except segment X light yellow; segments I–VII with longitudinal submedial black mark. Sternum yellowish white. Genitalia (Fig. 43): yellowish; penes wanting apical spine. Caudal filaments broken-off and lost.

**Female imago**

Length: body: 6.2–7.1 mm, fore wing: 7.1 mm, hind wing: 1.1 mm.

Similar to male imago, except for head yellowish with black marks between lateral ocelli and on inner margin of compound eyes (Fig. 40). Wings (Figs. 50 and 51): longitudinal and cross veins of fore and hind wings yellowish brown; membrane of fore and hind wings hyaline; costal and posterior region of subcostal veins yellowish.

**Diagnoses**

*Tikuna bilineata* is distinguished from *T. atromentum*, the other described species of the genus, by the following combination of characteristics:

Nymphs: (1) terga yellow, segments I–VIII with longitudinal submedial black mark (Fig. 35); (2) apex of tibia with pectinate setae (Fig. 28); (3) apex of galea-lacinia with one large, pectinate setae, and one short, non-pectinate, curved setae (Fig. 26); (4) posterolateral projections present on terga VIII–IX (Fig. 35).
Male imagos: (1) terga segments I–VII with longitudinal submedial black mark (Fig. 40); (2) penes wanting apical spine (Fig. 43).

Female imagos: (1) costal and posterior region of subcostal veins yellowish (Fig. 50); (2) terga segments I–VII with longitudinal submedial black mark (Fig. 40).

**Distribution**

Brazil: Mato Grosso, Pará; Ecuador; Surinam; Venezuela; Colombia.

**Material examined**


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