Ann. Limnol. - Int. J. Lim. 53 (2017) 79–88
© EDP Sciences, 2017
DOI: 10.1051/limn/2016036

Available online at:
www.limnology-journal.org

Tapajobaetis, a remarkable new genus of Baetidae with spatulate claws (Ephemeroptera)

R. Boldrini[1]*, A.M. Pes[2] and F.F. Salles[3]

[1] Universidade Federal de Roraima (UFRR), Campus Paricarana, Centro de Estudos da Biodiversidade (CBio), CEP 69310-000, Boa Vista, RR, Brazil
[2] Coordenação de Pesquisa em Biodiversidade (CBio), Instituto Nacional de Pesquisas da Amazônia (INPA), CEP 69060-001, Manaus, AM, Brazil
[3] Laboratório de Sistemática e Ecologia de Insetos, Depto. de Ciências Agrárias e Biológicas, Universidade Federal do Espírito Santo, CEP 29.933-415, São Mateus, ES, Brazil

Received 15 August 2016; Accepted 15 November 2016

Abstract – The Baetidae family is represented by 32 genera from the Neotropics. A new genus, *Tapajobaetis*, and a new species, *T. labiosus*, are described based on nymphs and adults from the Brazilian Amazon region. The nymph, with highly modified head and mouth parts is readily distinguished from other genera of this family by the following combination of characters: presence of fine, simple setae on scape and pedicel, labial and maxillary palpi elongated, hind wing pads vestigial, and claws spatulate, with about 140 denticles. Adults, on the other hand, are more similar to other Baetidae and are characterized by the absence of hind wings, anteronotal protuberance slightly truncate and genitalia with posterior margin of subgenital plate convex, forceps segment III elongate. The nymphs were found exclusively over leaves of *Thurnia sphaerocephala* (Thurniaceae), in areas with moderate currents, and possess modification in the labial palp, which seems to be adapted to collect fine material.

Key words: Taxonomy / *Camelobaetidius* / *Corinnella* / Macroinvertebrate / South America

Baetidae is the most diverse family of mayflies (Ephemeroptera) in terms of species and the second regarding the number of genera (Barber-James *et al.*, 2013). Of the approximately 100 genera worldwide, 32 are reported from the Neotropics (Nieto and Derka, 2011; Barber-James *et al.,* 2013; Cruz *et al.*, 2013).

Among the Neotropical representatives of the Baetidae family, there is a peculiar group in which the nymphal claws are conspicuously modified: truncate at apex and with few to several denticles, giving it a comb or rake-like appearance. These so-called spatulate-clawed baetids (Traver and Edmunds, 1968) were first described by Demoulin (1966), based on nymphs from Surinam, in the new genus *Camelobaetidius* and its single species, *C. leentvaari* Demoulin, 1966. Soon after, Traver & Edmunds (1968) revised the group; they described a new species of *Camelobaetidius* and the new genus *Dactylobaetis*. This new genus was described to accommodate several new species from the Neotropics and Nearctics that shared with *Camelobaetidius* the presence of spatulate claws, but that were different from that genus given the length of the median terminal filament (almost as long as cerci, instead of reduced) and the absence, on forelegs, of an inner projection at the femur base.

McCafferty and Waltz (1990) placed *Dactylobaetis* in synonymy with *Camelobaetidius*, transferring all the 17 species of the former to the later genus. Since then, several new species have been described, from South (Nieto, 2003; Salles and Serrão, 2005; Boldrini and Pes, 2014; Boldrini *et al.*, 2012), Central and North America (McCafferty and Klubertanz, 1994; Lugo-Ortiz and McCafferty, 1995). To date, *Camelobaetidius* comprises 43 species and is one of the most diverse genera of Baetidae from the Western Hemisphere. According to Nieto (2010), the sister group of *Camelobaetidius* is *Corinnella* Thomas & Dominique 2006, a rare South American genus. *Corinnella* is currently composed of two species from Northern Brazil and French Guiana, nymphs of both species also possess spatulate claws (Boldrini *et al.*, 2013).

Recently, during a field trip to a poorly sampled area in the state of Pará, Brazilian Amazon, a remarkable nymph with spatulate claws was collected and reared to the adult

*Corresponding author: rafaelboldrini.2@gmail.com

stage. Besides the unusual claws, nymphs of this taxon present highly modified mouthparts and the body is completely transparent. The objective of this paper, therefore, is to describe and illustrate a new genus and a new species related to *Camelobaetidius* and *Corinnella*.

Methods

Nymphs were collected with an aquatic entomological net, and some of them were reared in the field following Boldrini and Cruz (2013).

Pictures of dead specimens were taken using a Leica (M165C) stereomicroscope with a DFC420 digital camera; a series of partially focused images was processed with the program Leica Application Suite V3.4.1. (Version 2009) to produce final images with enhanced quality. Pictures of living specimens were made in the field, in a small acrylic aquarium, with a Nikon D800, a 105 mm objective and a Nikon macro flash. Line drawings were made with the aid of a camera lucida, photographs, or both. Posterior margin of terga was visualized using a microscope with phase contrast. Final illustrations were prepared according to the method of Coleman (2003, 2006). Whole nymphs or dissected parts were dehydrated in a graded ethanol series, dried by the critical point-method, before mounting on scanning electron microscope (SEM) stubs and sputter-coated with gold, and then observed and imaged with a JSM 6610 LV SEM. The slides were prepared with Euparal®, except for wings that were dry mounted. Each slide of nymph contained mouth parts, legs (I, II and III), tergum IV, terminal filament and paraproct.

The material examined is housed in the following institutions: Coleção Zoológica Norte Capixaba of the Universidade Federal do Espírito Santo (CZNC), São Mateus, Brazil; Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil; and in the Zoological Collection of the Universidade Federal de Roraima (UFRR), Boa Vista, Brazil.

Results

***Tapajobaetis* Boldrini & Salles, gen. nov.**

Figures 1–10.

Diagnosis:

Nymph. (1) Outer margin of scape and pedicel covered by fine simple setae (Fig. 6(A)); (2) superlingua expanded laterally (Fig. 4(B)); (3) incisors of mandibles fused (Figs. 4(D) and (E)); (4) mandibles without setae between prostheca and mola; (5) maxillary palp two-segmented (Fig. 4(C)); (6) labial palp with 2nd and 3rd segments fused (Figs. 5 and 6(E)); (7) patella-tibial suture present on all legs and much shorter than half the length of tibia (Fig. 7(A)); (8) hind wing pad vestigial; (9) gills present on abdominal segments I–VII (Figs. 1(A) and (B), 2(A)); (10) claws spatulate (Fig. 8(C) and (D)); (11) subimaginal

Fig. 1. (A, B) *Tapajobaetis labiosus* sp. nov., nymph, *in vivo*. (A) lateral view. (B) dorsal view.

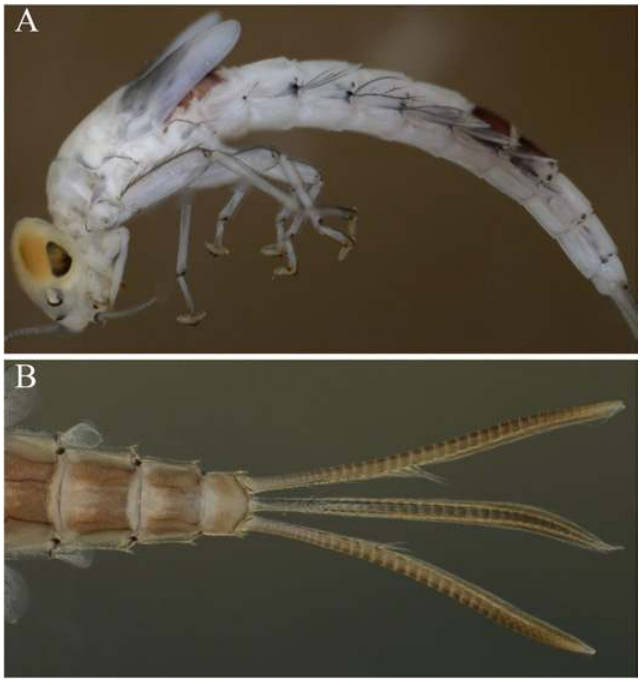

Fig. 2. (A, B) *Tapajobaetis labiosus* sp. nov., nymph, in alcohol. (A) (lateral view). (B) detail of abdomen and terminal filament (dorsal view).

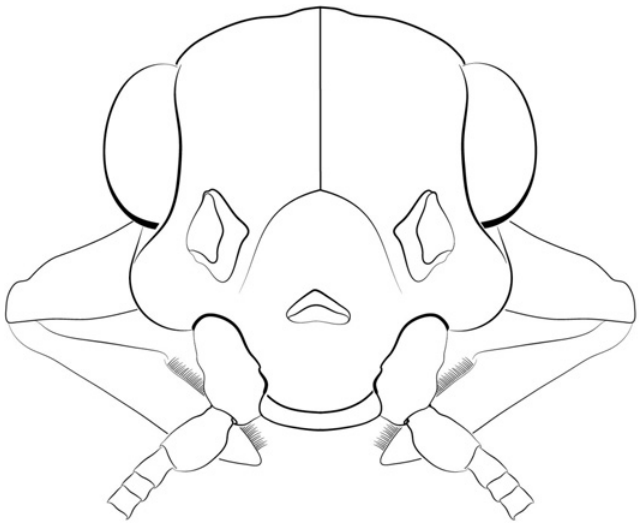

Fig. 3. *Tapajobaetis labiosus* sp. nov., nymph. Head (frontal view).

forceps under nymphal cuticle of Labiobaetis-type; (12) median terminal filament as long as cerci (Fig. 1(A)).

Male imago. (1) Hind wing absent; (2) anteronotal protuberance slightly truncate (Fig. 9(A)); (3) forceps segment II narrow submedially; forceps segment III elongate (Fig. 9(D)); (4) Gonovects not deeply situated on sternum IX, at base of forceps.

Female imago. (1) Hind wing absent; (2) anteronotal protuberance slightly truncate; (3) marginal intercalary veins of forewing paired.

Description:

Nymph. *Head* (Fig. 3): Gena protruded. Scape and pedicel subcylindrical, with dense short, fine, simple setae on outer margin (Fig. 6(A)); lateral branch of epicranial suture slightly sinuous.

Labrum (Figs. 4(A) and 6(B)). Rectangular, broader than long. Dorsolateral arc of setae present.

Hypopharynx (Fig. 4(B)). Superlingua expanded laterally.

Left mandible (Fig. 4(D)). Incisors fused. Prostheca robust, apically denticulate. Margin between prostheca and mola straight, without row of setae; tuft of setae at apex of mola absent.

Right mandible (Fig. 4(E)). Incisors fused. Prostheca slender, apically denticulate. Margin between prostheca and mola without setae; crown of setae at base of mola present; tuft of setae at apex of mola present.

Maxilla (Figs. 4(C) and 6(C)). Canines tapered at apex. Maxillary palp two-segmented, much longer than galea-lacinia.

Labium (Figs. 5 and 6(E)). Glossa narrower and shorter than paraglossa. Paraglossa subrectangular, curved inward. Labial palp: elongated; segments II and III fused; apical-inner margin with a row of long, pectinate setae; dorsal surface with a row of spine-like setae; ventral surface with a row of short, fine, simple setae near inner margin.

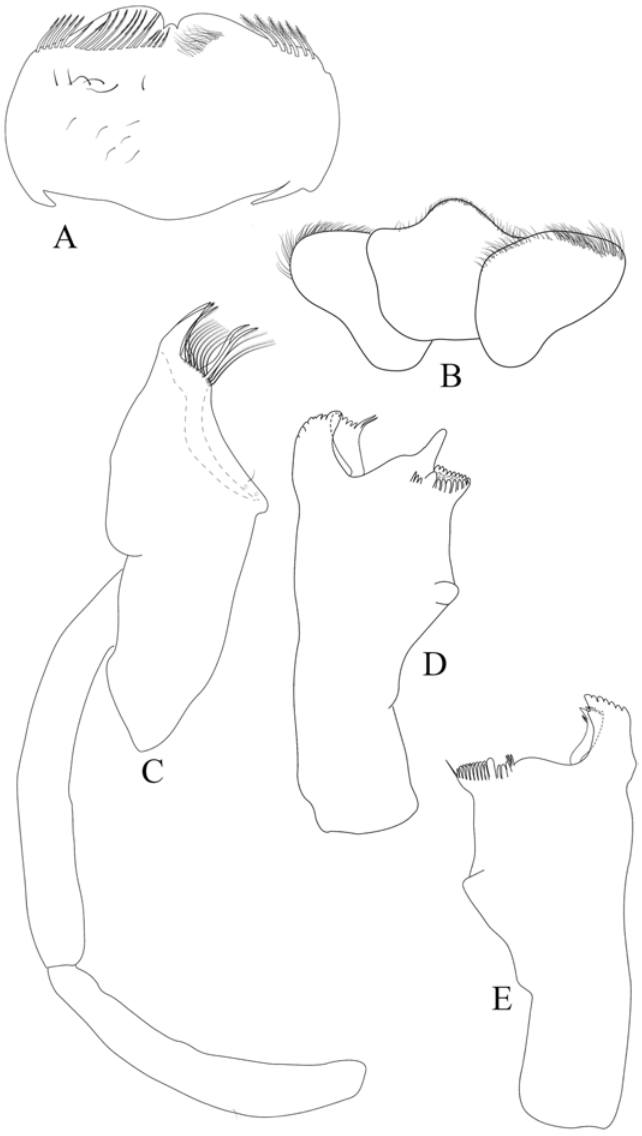

Fig. 4. (A–E) *Tapajobaetis labiosus* sp. nov., nymph. (A) labrum (left dorsal view, right ventral view). (B) hypopharynx and superlingua. (C) maxilla (palp with unusual orientation on nymphs). (D) left mandible. (E) right mandible.

Thorax (Figs. 1(B) and 2(A)): Hind wing pad vestigial. Foreleg: Femur (Fig. 8(A) and (B)). Dorsally with two rows of setae, one row of long, spine-like setae and one row of short, spine-like setae. Patella-tibial suture much shorter than half of tibia. Claw spatulate (Fig. 8(C) and (D)). Mid and hind leg similar to foreleg, except for femur without a row of short setae dorsally.

Abdomen (Figs. 1(A) and (B), 2(A)): Tergal surface creased. Gills on segments I–VII. Median terminal filament as long as cerci. Subimaginal forceps under nymphal cuticle of Labiobaetis-type.

Male imago (Fig. 9(A–D)).

Dorsal portion of turbinate eyes oval. Anteronotal protuberance slightly truncate. Metascutellar protuberance posteriorly rounded. Forewing with marginal intercalary veins paired. Hind wing absent. Posterior margin of

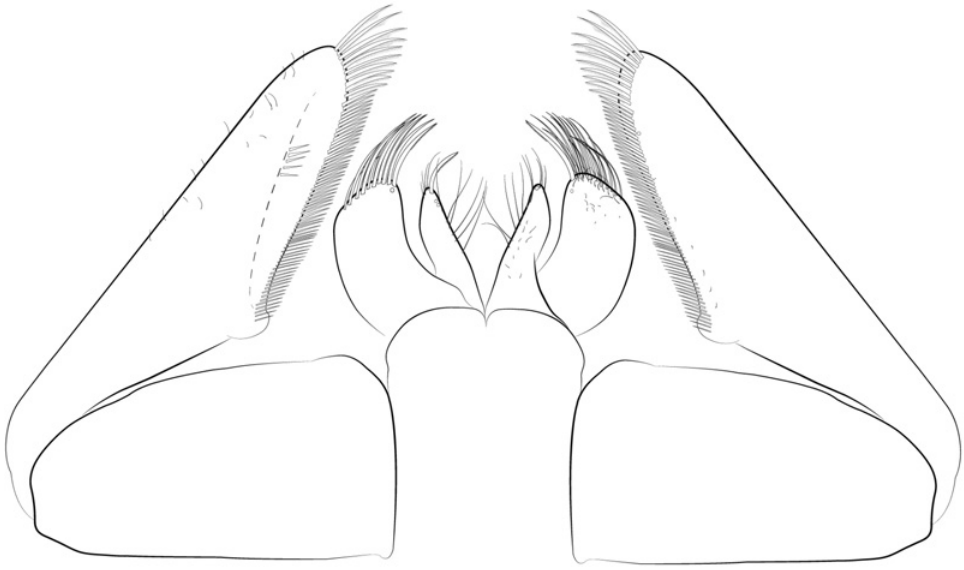

Fig. 5. *Tapajobaetis labiosus* sp. nov., nymph. Labium (left dorsal view and right ventral view).

subgenital plate convex. Forceps segment II narrow submedially; forceps segment III elongate.

Female imago (Figs. 9E, 10).

Thorax and wings as in male.

Etymology: Combination of the words Tapajós and Baetis. Tapajós is one of Brazil's largest rivers and a tributary of the Amazon River. The Igarapé Branco, where the species was found, is the main tributary of the Tapajós river. Baetis is in reference to the family. The gender is masculine.

Distribution: Pará State, Northern Brazil. Known from a single locality (Fig. 11).

Type-species: *Tapajobaetis labiosus*, new species.

***Tapajobaetis labiosus* sp. nov. Boldrini & Salles** (Figures 1–10).

Diagnosis:

As the genus is monotypic, it is difficult to ascertain at this time the characteristics that will distinguish it from its congeners.

Description:

Nymph. Transparent *in vivo* (Fig. 1(A) and (B)), whitish in alcohol (Fig. 2(A)).

Lengths. Body: 4.5–5.6 mm; antennae: 0.9–1.1 mm; cerci: 1.7–2.1 mm; median terminal filament: 1.6–1.8 mm; tibia I: 0.8 mm; tibia II: 0.5 mm; tibia III: 0.4–0.5 mm.

Head (Fig. 2(A)): Whitish washed with light brown.

Labrum (Figs. 4(A) and 6(B)). Length about 0.6 × maximum width. Distal margin with shallow medial emargination and small process. Ventrally with short, fine, simple setae scattered over area; anterolateral margin with long, pectinate setae. Dorsally with few long, fine, simple setae over basal area; dorsolateral arc of setae with a row of c.a. five long, fine and apically pointed setae; submarginal row of c.a. 20 long, pectinate setae. Hypopharynx and superlingua (Fig. 4(B)): Lingua with apex rounded, with tuft of short, fine, simple setae. Superlingua with fine, simple setae scattered over lateral and distal margin.

Left (Fig. 4(D)) and right mandibles (Fig. 4(E)). Incisors with eight denticles. Basal half without setae.

Maxilla (Fig. 4(C)). With inner dorsal row with three pectinate dentisetae, proximal dentisetae at the same orientation of canines; setae on inner ventral row pectinate. Medial protuberance of galea with 1 + 2 fine, simple setae. Maxillary palp 2.5 × length of galea-lacinia; posteriorly oriented, segment II circumventing segment I of labial palp.

Labium (Figs. 5 and 6(E)). Glossa. Inner margin with eight long, fine, simple setae; apex with three long, fine simple setae and one long, robust, pectinate seta; ventral surface with ten short, fine, simple setae. Paraglossa. Apex with two rows of long, fine, pectinate setae and one row of short, fine simple setae; ventral surface with nine short, simple setae. Labial palp (Fig. 6(D)). Inner margin of fused segments II and III with a row of c.a. 60 long, pectinate setae; dorsal surface with scarce fine, simple setae and a row of five, fine, spine-like setae; ventral surface with a row of seven short, fine, simple setae near inner margin.

Thorax (Figs. 1(A) and (B), 2(A)): Pro-, meso- and metanotum whitish, metanotum washed with reddish brown. Tibia I 1.1 × length of respective femur, tibia II and III 0.8 × length of respective femur, tarsus I 0.5 × length of respective femur, tarsus II and III 0.3 × length of respective femur.

Foreleg (Fig. 7(A)). Femur. Length about 3.0 × maximum width; dorsally with two rows of setae (Fig. 8(A) and (B)), one row with c.a. 50 long, spine-like setae and one row of ten short spine-like setae; dorsal surface with short, spine-like setae near inner margin, ventrally with five short, spine-like setae. Tibia. Dorsally with few, short, fine, simple setae; ventrally with short, spine-like setae; ventral surface with short, spine-like setae

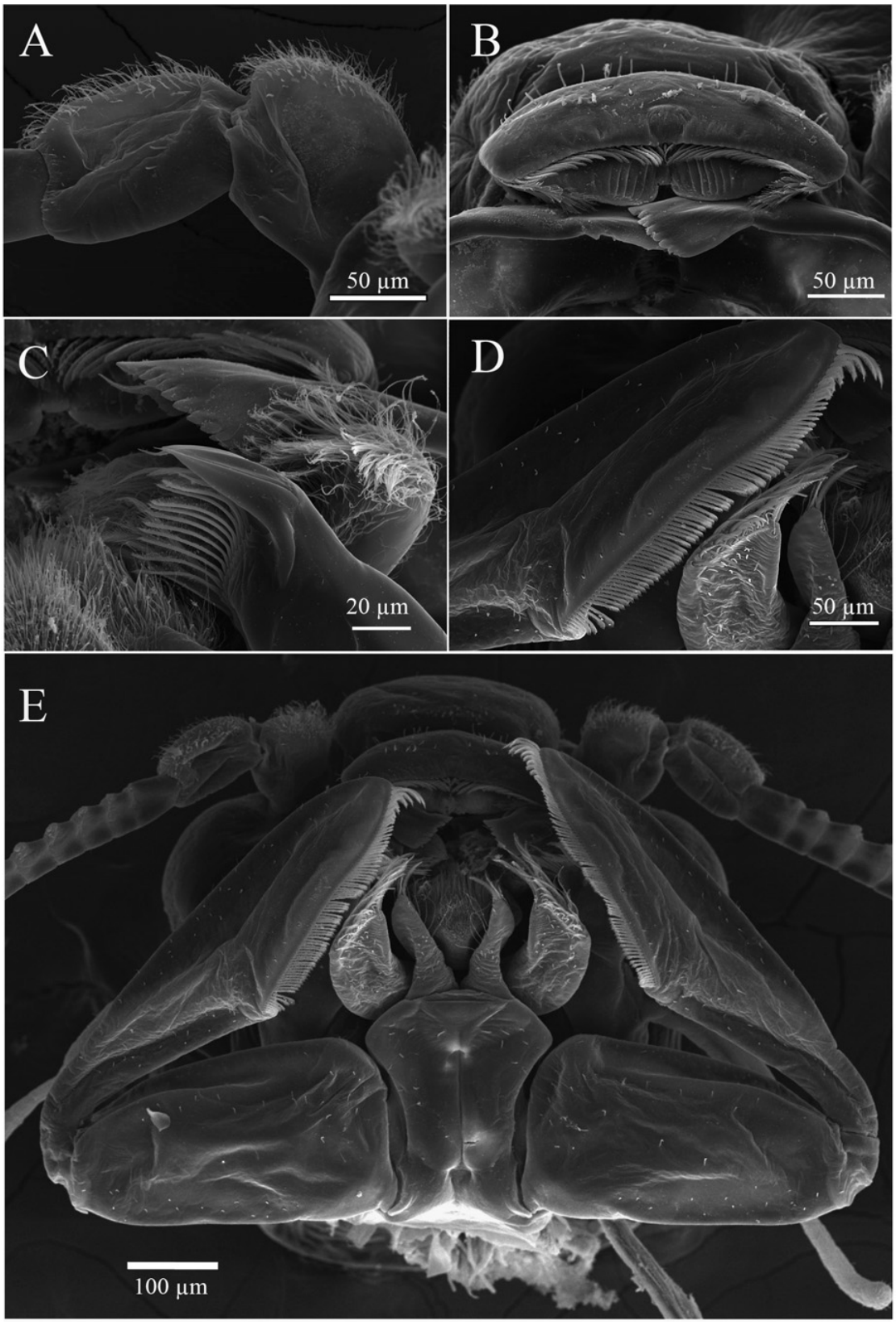

Fig. 6. (A–E) *Tapajobaetis labiosus* sp. nov., nymph. (A) detail of antenna (ventral view). (B) labrum (frontal view). (C) apex of maxilla. (D) apex of labial palp (ventral view). (E) labium (ventral view).

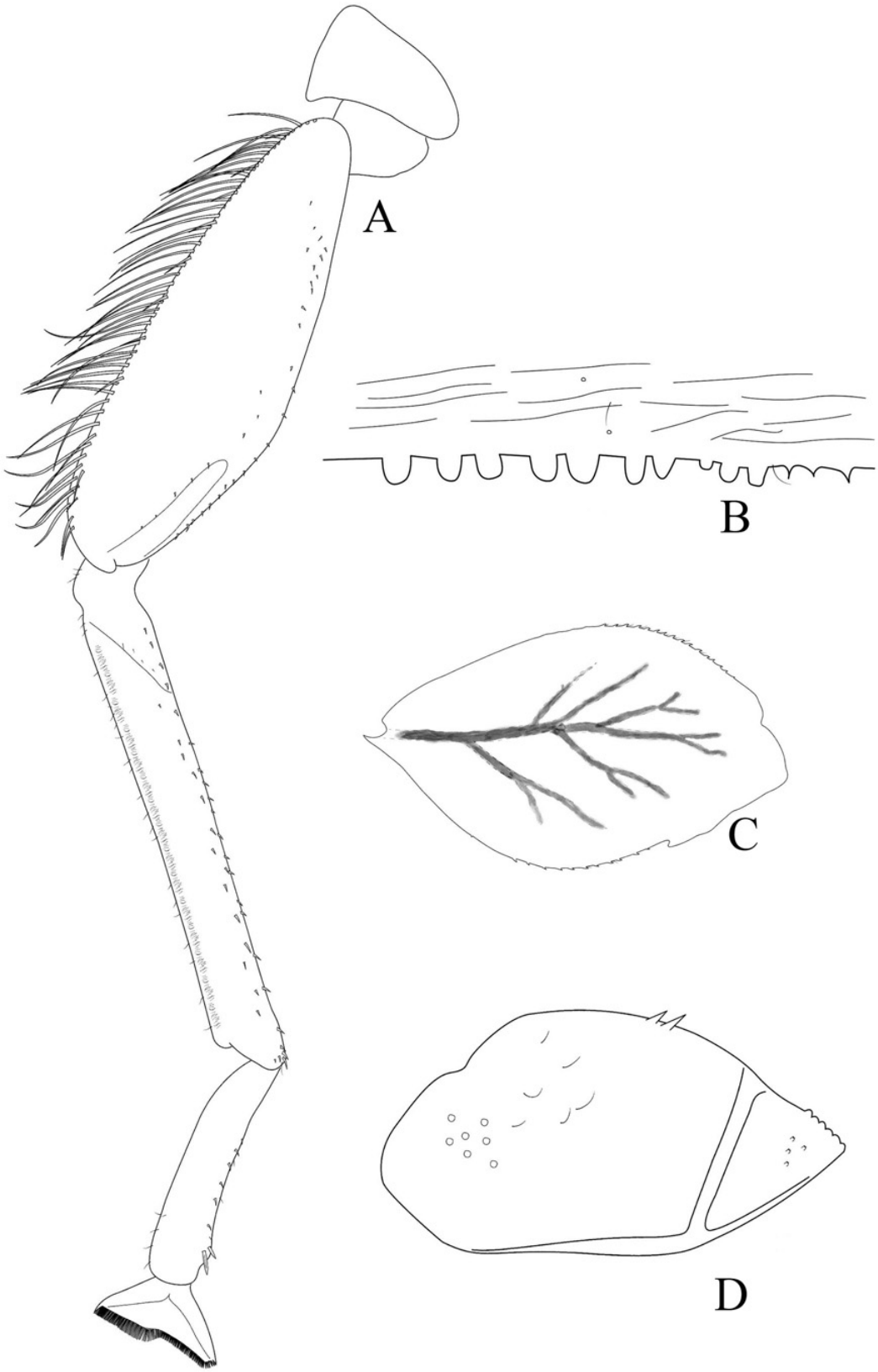

Fig. 7. (A–D) *Tapajobaetis labiosus* sp. nov., nymph. (A) foreleg. (B) posterior margin of abdominal tergum IV. (C) gill IV. (D) paraproct.

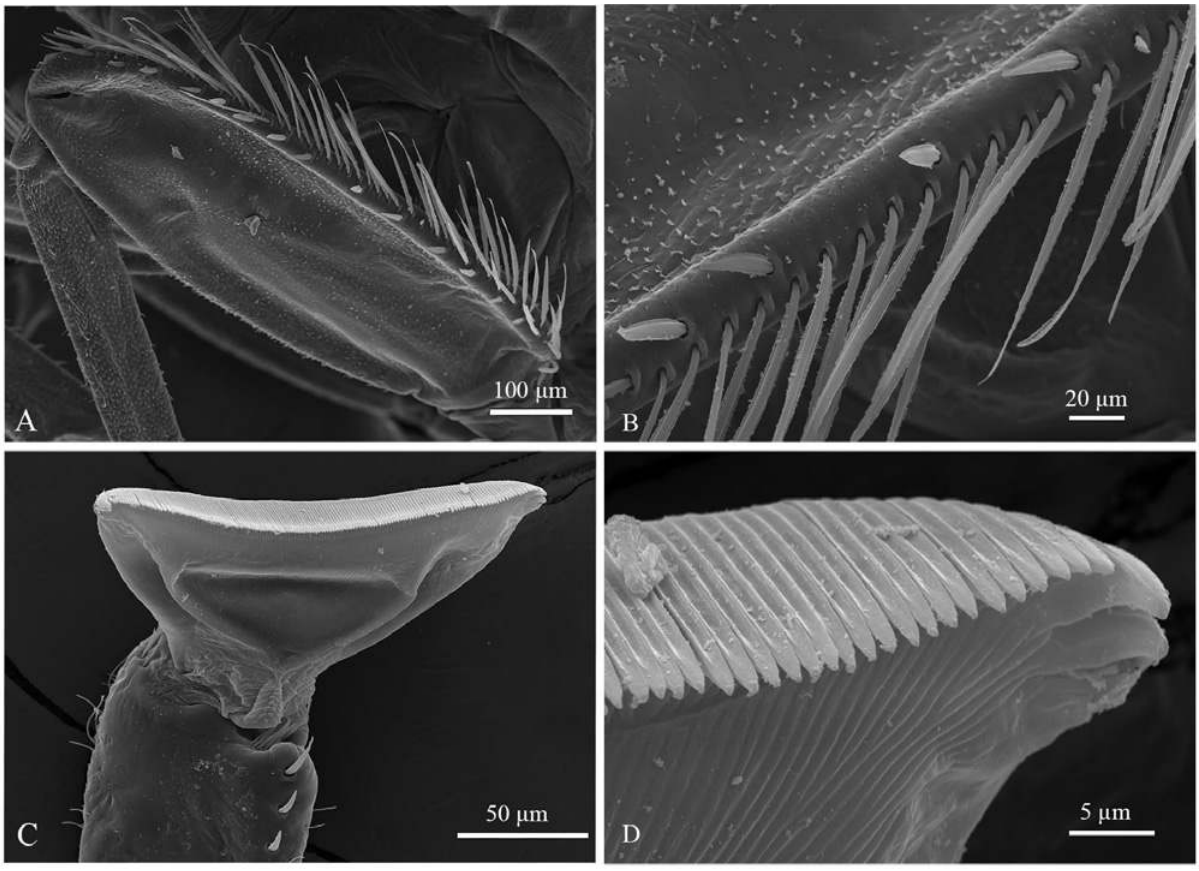

Fig. 8. (A–D) *Tapajobaetis labiosus* sp. nov., nymph. (A) forefemur (dorsal view). (B) detail of forefemur (dorsal view). (C) claw (ventral view). (D) detail of the claw (ventral view).

near inner margin; dorsal surface with a row of short, fine, simple setae near outer margin; patella-tibial suture present, 0.3 × in length of tibia. Tarsus. Dorsally with short, fine, simple setae; ventrally with short, spine-like setae. Claw (Fig. 8(C) and (D)) with around 140 denticles.

Abdomen (Figs. 1 and 2): Terga whitish, segments I, VI and VII washed with reddish brown. Posterolateral corners of segments VII–X with single, minute, sclerotized spine (Fig. 2(B)). Surface of terga without scales, with fine, simple setae over area; posterior margin with rounded spines (Fig. 7(B)). Gills IV light brown; margins with narrow spines intercalating short, fine, simple setae; tracheae pigmented (Fig. 7(C)); gills II–VII with costal and anal marginal ribs, apex without marginal ribs.

Paraproct (Fig. 7(D)). With two spines near inner margin; surface with fine, simple setae; postero-lateral extension with rounded spines, with shagreened area. Cerci light brown, distal half darker; outer margins of median terminal filament and inner margins of cerci with tufts of long, simple swimming setae.

Male imago. Whitish in alcohol. Lengths. Antenna: 0.8 mm; body: 4.3 mm; forewing: 3.9 mm; tibia II: 0.7 mm; tibia III: 0.7 mm.

Head (Fig. 9(A) and (B)): Brown; compound eyes brownish, turbinate portion reddish. Antenna with scape and pedicel light brown, flagellum lighter.

Thorax (Fig. 9(A) and (B)): Pronotum light brown; mesonotum brown; metanotum dark reddish brown. Pro-, meso- and metasternum whitish. Legs whitish. Leg II: tibia 1.3 × length of femur; tarsus 0.2 × length of femur. Leg III: tibia 1.2 × length of femur; tarsus 0.2 × length of femur. Forewing hyaline. Veins light brown, stigmatic area with one cross vein not touching and five cross veins touching subcostal vein; length of forewing about 2.6 × width.

Abdomen (Fig. 9(A) and (C)): Terga white washed with brown, terga I, VI and VII reddish, terga VIII, IX and X brown. Tracheation black. Sterna whitish. Genitalia (Fig. 9(D)). Forceps whitish washed with brown. Base of forceps 0.3 × length of segment II. Forceps segment III 2.0 × as long as wide; 0.2 × length of segment II. Posterior margin of subgenital plate convex. Gonovects not deeply situated on sternum IX, at base of forceps.

Female subimago. Yellowish brown.

Length. Antenna: 0.7 mm; body: 5.0 mm; forewing: 4.3 mm; tibia I: 0.7 mm; tibia II: 0.9 mm; tibia III: 0.8 mm.

Head (Fig. 9(E)): Yellowish brown; compound eyes yellowish black. Antenna with scape, pedicel yellowish brown and flagellum whitish.

Thorax (Fig. 9(E)): Pro-, meso- and metanotum yellowish brown; pro-, meso- and metasternum whitish. Legs. Yellowish brown. Leg I: tibia 1.1 × length of femur;

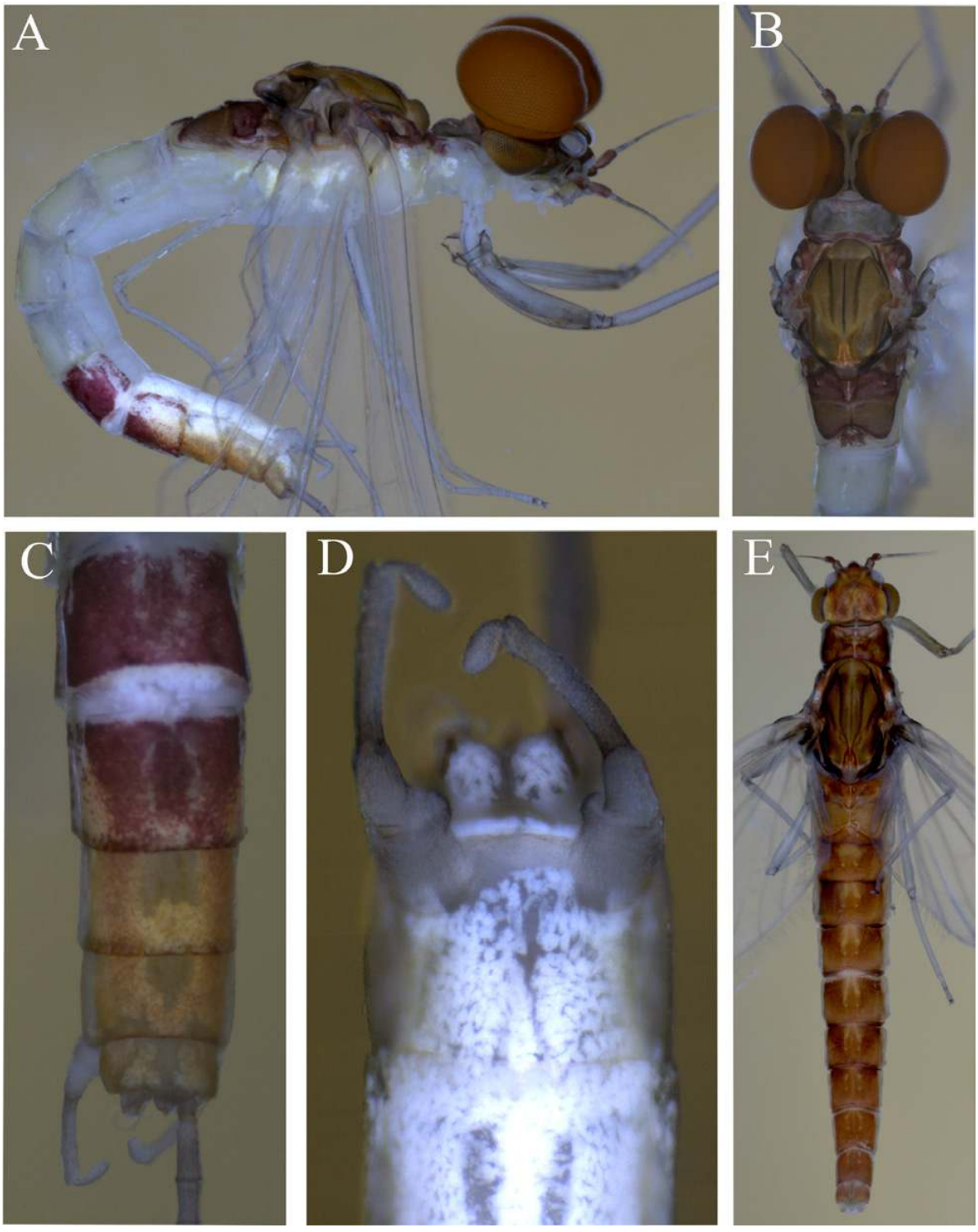

Fig. 9. (A–E) *Tapajobaetis labiosus* sp. nov., adults. (A–D) male imago; (E) female subimago. (A) lateral view. (B) head and thorax (dorsal view). (C) detail of abdomen (dorsal view). (D) genitalia (ventral view). (E) dorsal view.

tarsus 0.2 × length of femur. Leg II tibia 1.3 × length of femur; tarsus 0.2 × length of femur. Leg III tibia 1.2 × length of femur; tarsus 0.2 × length of femur. Forewing opaque (Fig. 10). Veins light brown, stigmatic area with seven cross veins, four of them not touching subcostal vein; length of forewing about 2.6 × width.

Abdomen (Fig. 9(E)): Terga brown. Sterna yellowish brown.

Biology: Despite collections in other streams close to the type-locality, and in many habitats at the Igarapé Branco, nymphs of *Tapajobaetis labiosus* sp. nov. were found in this single stream and exclusively over leaves of

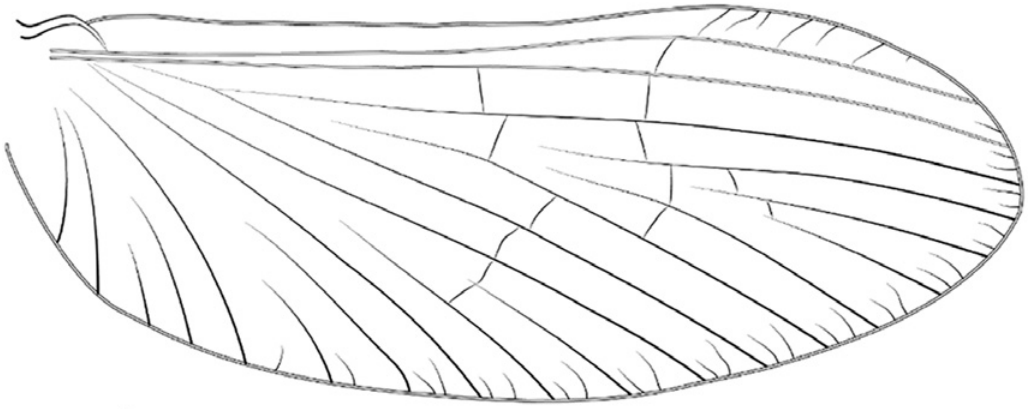

Fig. 10. *Tapajobaetis labiosus* sp. nov., female subimago. Forewing.

Fig. 11. (A) Habitat of *Tapajobaetis labiosus* sp. n. (B) *Thurnia sphaerocephala* (Thurniaceae).

Thurnia sphaerocephala (Thurniaceae), in areas with fast to moderate currents (Fig. 11(A) and (B)). Nymphs of another species of Baetidae, *Tomedontus primus* Lugo-Ortiz & McCafferty, were also found on the same leaves. Usually, however, nymphs of *T. primus* were more abundant in areas with slower current. Mouthparts of the nymphs of *Tapajobaetis labiosus* are extremely modified, especially maxillary and labial palpi. The maxillary palp is posteriorly directed and so long that segment II is curved and circumvents the base of the labial palp. The labial palp is also very long, segment I is robust, segment II and III are fused, distally expanded and with a row of pectinate setae. On the basis of the habitat where the nymphs were found, and the presence of a row of pectinate setae on labial palp, we expect that nymphs are grazers, feeding on the epiphyton that colonizes the leaves of *Thurnia* (*e.g.*, Baptista *et al.*, 2006). Another striking characteristic of the nymphs is their transparent body (Fig. 1), similar to the larvae of the phantom midge (Diptera: Chaoboridae). As hypothesized for their larva (Giguère and Dunbrack, 1990), the transparency must reduce the visibility of the nymphs of *Tapajobaetis labiosus* to predators.

Etymology: The specific epithet is a Latin word meaning "large-lipped". It is in reference to the distinctly elongate and robust labium of the nymph.

Distribution: Brazil: Pará.

Material examined: *Holotype*: Nearly mature male nymph, BRAZIL, **Pará**, Santarem, BR 163, ramal da Galiléia, Igarapé Branco, 03°28′55.5″S, 54°50′25.0″W, 24.xi.2012, Boldrini, R. and Salles, F.F. leg. (INPA). *Paratypes*: Three nymphs mounted on slides, same data as holotype (INPA). Two nymphs, same data as holotype (one in UFRR, one in INPA). One male imago (foreleg broken and wing damaged, reared) and one female subimago (reared), exuviae mounted on slides, same data as holotype (UFRR). One nymph mounted on slides, same data as holotype, except, 02.x.2012, Nascimento, J.M.C. and Fernandes, A.S. Leg (UFRR). Eight nymphs, same data as holotype (CZNC).

Comments

The spatulate nymphal claws clearly indicate a close relationship among *Tapajobaetis*, *Camelobaetidius* and *Corinnella*, but it is difficult to ascertain at this time whether the new genus is more related to one or another. Some important characteristics are shared between *Tapajobaetis* and *Corinnella*, such as the shape and length of the outer incisors (slightly curved at apex and increasing in length toward inner margin), as well as the length and shape of the maxillary canines (long and apically pointed). A few species of *Camelobaetidius*, such as *C. ortizi* Dominique & Thomas 2001, *C. cruzi* Boldrini 2014, *C. carolinae* Boldrini 2014, and *C. matilei* Thomas & Peru 2003, also possess such characteristics. However, without a formal cladistic analysis, we cannot anticipate whether they represent synapomorphies of all these taxa, thus making *Camelobaetidius* paraphyletic, or homoplasies shared by *Tapajobaetis*, *Corinnella* and the aforementioned species of *Camelobaetidius*.

Acknowledgements. We would like to express our gratitude to CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for a productivity grant to FFS, to CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) for financial support of the Pro-Equipamentos CAPES, to FAPEAM (Fundação de Apoio a Pesquisa do Estado do Amazonas), the project Taxonomy and Biology of Trichoptera (Insecta) in Central Amazônia (CNPq process: 558776/2008-6) for financial support and FAPES (Fundação de Amparo à Pesquisa do Estado do Espírito Santo (processes #54689627/2011, 59145277/2012, 61938408/2013). The authors would like to thank Dr. Neusa Hamada and Jeane Nascimento (Instituto Nacional de Pesquisas da Amazônia) for logistic support and for collecting and donating the first specimen; Dr. Marco Guimarães and Jairo Oliveira from the Laboratório de Ultraestrutura Celular Carlos Alberto Redins (LUCCAR), CCS/UFES, as well as edital MCT/FINEP/CT-INFRA – PROINFRA 01/2006 for the SEM images and Dr Anderson Alves Araújo (Universidade Federal do Espírito Santo) for the identification of *Thurnia sphaerocephala*. A previous version of this manuscript benefited greatly from revisions by Carlos Molineri, Luke M. Jacobus, and Nikita J. Kluge.

References

Barber-James H., Sartori M., Gattolliat J-L. and Webb J., 2013. World checklist of freshwater Ephemeroptera species. Available online at: http://fada.biodiversity.be/group/show/35

Baptista D.F., Buss D.F., Dias L.G., Nessimian J.L., Da-Silva E.R., De Moraes Neto A.H.A., De Carvalho S.N., De Oliveira M.A. and Rade L.R., 2006. Functional feeding groups of Brazilian Ephemeroptera nymphs: ultrastructure of mouthparts. *Ann. Limnol. - Int. J. Lim.*, *42*, 87–96.

Boldrini R. and Cruz P.V., 2013. Criação e transporte de ninfas de Ephemeroptera (Insecta) em campo. *EntomoBrasilis*, *6*, 168–170.

Boldrini R. and Pes A.M.O., 2014. Five new species of Camelobaetidius Demoulin, 1966 (Ephemeroptera: Baetidae), and redescription of *Camelobaetidius mexicanus* (Traver & Edmunds, 1968). *Zootaxa*, *3796*, 545–567.

Boldrini R., Pes A.M.O., Francischetti C.N. and Salles F.F., 2012. New species and new records of *Camelobaetidius* Demoulin, 1966 (Ephemeroptera: Baetidae) from Southeastern Brazil. *Zootaxa*, *3526*, 17–30.

Boldrini R., Salles F.F. and Pes A.M.O., 2013. A new species of *Corinnella* Thomas e Dominique, 2006 (Ephemeroptera: Baetidae). *Zootaxa*, *3608*, 75–80.

Coleman C.O., 2003. "Digital inking": How to make perfect line drawings on computers. Organism, Diversity and Evolution, Electronic Supplement. Available online at: http://senckenberg.de/odes/03-14. htm

Coleman C.O., 2006. Substituting time-consuming pencil drawings in arthropod taxonomy using stacks of digital photographs. *Zootaxa*, *1360*, 61–68.

Cruz P.V., Salles F.F. and Hamada N., 2013. A new genus and species of Baetidae (Insecta: Ephemeroptera) from Brazil. *Ann. Limnol. - Int. J. Lim.*, *49*, 1–12.

Demoulin G., 1966. Contribution à l'étude des Ephéméroptères du Surinam. *Bull. Inst. R. Sci. Nat. Belg.*, *42*, 1–22.

Giguère L.A. and Dunbrack R.L., 1990. Thin layer interference may reduce the visibility of transparent phantom midge larvae (*Chaoborus trivittatus*) to predators. *Can. J. Fish Aquat. Sci.*, *47*, 1043–1046.

Lugo-Ortiz C.R. and McCafferty W.P., 1995. Taxonomy of the North and Central America Species of *Camelobaetidius* (Ephemeroptera: Baetidae). *Entomol. News*, *106*, 178–192.

McCafferty W.P. and Klubertanz T.H., 1994. Camelobaetidius (Ephemeroptera: Baetidae) in Indiana and Iowa: new species and range extension. *Proc. Entomol. Soc. Washington*, *96*, 37–43.

McCafferty W.P. and Waltz R.D., 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. *Trans. Am. Entomol. Soc.*, *116*, 769–799.

Nieto C., 2003. El género *Camelobaetidius* (Ephemeroptera: Baetidae) en la Argentina. *Acta Zool. Mex.* (*Nueva Série*), *88*, 233–255.

Nieto C., 2010. Cladistic analysis of the family Baetidae (Insecta: Ephemeroptera) in South America. *Syst. Entomol.*, 1–14.

Nieto C. and Derka T., 2011. *Parakari* a New Genus of the Family Baetidae (Insecta: Ephemeroptera) from Guyana Highlands. *Zootaxa*, *3032*, 47–59.

Salles F.F. and Serrão J.E., 2005. The nymphs of the genus *Camelobaetidius* Demoulin (Ephemeroptera: Baetidae) in Brazil: new species, new records, and key for the identification of the species. *Ann. Limnol. - Int. J. Lim.*, *41*, 267–279.

Traver J.R. and Edmunds G.F. Jr., 1968. A revision of the Baetidae with spatulate-clawed nymphs (Ephemeroptera). *Pacific Insects*, *10*, 629–677.