



Hermanella complex on Northern Brazil (Ephemeroptera: Leptophlebiidae): New species and stage descriptions

Myllena Lima^{1,2*} , Leandro Schlemmer Brasil³ , Leandro Juen^{1,2,4} ,
Juan Mateo Rivera-Pérez^{1,4} , Karina Dias-Silva^{1,4} , Frederico Falcão Salles⁵ 

¹Universidade Federal do Pará, Instituto de Ciências Biológicas, Laboratório de Ecologia e Conservação (LABECO), Belém, PA, Brasil.

²Universidade Federal do Pará, Programa de Pós-Graduação em Zoologia, Belém, PA, Brasil.

³Universidade Federal do Mato Grosso (UFMT), Instituto de Ciências Biológicas e da Saúde (ICBS), Pontal do Araguaia, MT, Brasil.

⁴Universidade Federal do Pará, Programa de Pós-Graduação em Ecologia, Belém, PA, Brasil.

⁵Universidade Federal de Viçosa, Departamento de Entomologia, Museu de Entomologia, Viçosa, MG, Brasil.

urn:lsid:zoobank.org:pub:43246EE6-AAB1-4FB6-AD87-39A7576B5438

ARTICLE INFO

Article history:

Received 08 August 2023

Accepted 03 November 2023

Available online 15 December 2023

Associate Editor: Fabio Quinteiro

Keywords:

Aquatic insects

Hydromastodon

Paramaka

Taxonomy

Mayflies

Neotropical region

ABSTRACT

The male and female imago stage and a new species of the *Hermanella* complex are described based on material from Pará State, Northern Brazil: *Hydromastodon cf. mikei* (Thomas & Boutonnet, 2004) and *Paramaka froehlichii* **sp. nov.** The male imago of *Hydromastodon cf. mikei* can be distinguished from *Hydromastodon sallesi* by the following combination of characters: (1) body color pattern, especially abdominal terga translucent white with terga I to IV washed with black on posterior margin; (2) compound eyes anteriorly rounded; (3) medial projection of the styliiger plate short; and (4) penis lobes close to each other and with posterolateral projection as long as ½ of its length. The male imago of *Paramaka froehlichii* **sp. nov.** can be distinguished from the other species of the genus by the following combination of characters: (1) fore and hind wings with membrane brown; (2) legs uniformly yellowish-white, without distal band; (3) abdominal terga II to VI with marks more expanded laterally, median line absent; (4) medial projection of the styliiger plate broad; (5) base of telopenis arising at distal ⅓ of penis lobe; and (6): body size of 6.1 to 7.6 mm.

Introduction

The generic complex *Hermanella* proposed by Domínguez and Flowers (1989) is a large and distinct group of Hagenulinae (Ephemeroptera: Leptophlebiidae) widely distributed in the Neotropical region extending to the Nearctic region (Monjardim et al., 2020). The group is distinguished from other representatives of Leptophlebiidae by the conspicuous characteristics of the nymphs' mouthparts, with a wide labrum and maxillary palps developed with long rows of bristles (Domínguez and Flowers 1989; Domínguez et al., 2001).

The systematics of the *Hermanella* complex has been the subject of many studies over three decades based on morphological and molecular data (Domínguez and Flowers, 1989; Domínguez et al., 2001; Sartori and Brittain, 2015; Monjardim et al., 2020). However, despite such studies confirming the group monophyly, the evolutionary relationships within the complex are still discussed and poorly understood (Sartori,

2005). The limited knowledge regarding all semaphoronts (Haeckelian deficit) of the species may serve as a hindrance in identifying additional synapomorphies for more robust phylogenetic analyzes (Sartori, 2005; Lima et al., 2012; Nascimento and Salles, 2013; Faria et al., 2021).

So far, eight genera are recognized by most authors as members of the *Hermanella* complex: *Hermanella* Needham & Murphy, 1924; *Hydromastodon* Polegatto & Batista, 2007; *Hydrosmilodon* Flowers and Domínguez, 1992; *Hylister* Domínguez & Flowers, 1989; *Leentvaaria* Demoulin, 1966; *Needhamella* Domínguez & Flowers, 1989; *Paramaka* Savage & Domínguez, 1992; and *Traverella* Edmunds, 1948.

Hydromastodon was originally described by Polegatto and Batista (2007), based exclusively on nymphs collected in North and Central-Western Brazil. The genus was based on the new species *H. sallesi* Polegatto & Batista 2007, and a new combination of *Hydromastodon* (= *Hydrosmilodon*) *mikei* Thomas & Boutonnet (2004), a species known only from nymphs. More recently, Salles et al. (2016) described the

*Corresponding author.

E-mail: myllenalima.ml@gmail.com (M. Lima)

male imago of *H. sallesi* based on material collected in Roraima and Rondônia, Northern Brazil.

Paramaka was established for *Thraulux convexus* Spieth, 1943 by Savage and Domínguez (1992), based on imagos collected in Suriname. Later, Blanco-Belmonte et al. (2003) described the nymph of the type species, based on material from Venezuela, Suriname, and French Guiana. Then, three more new species were described for the genus: *P. antonii* Sartori, 2005 from Guyana, *P. pearljam* Mariano, 2011 from Brazil, and *P. incognita* Domínguez, Grillet, Nieto, Molineri and Guerrero, 2014 from Venezuela (Sartori, 2005; Mariano, 2011; Domínguez et al., 2014).

In this study, we provide a further contribution to the taxonomy of the group based on material collected in the Pará state, Northern Brazil. Specifically, we describe the male and female imago of *H. cf. miki* and a new species of *Paramaka*.

Materials and methods

Specimens were collected using light traps (Pennsylvania and white light sheet) in two tributaries of the two main watersheds in Northern Brazil: the Xingu River in the Amazon basin, and the Araguaia River in the Tocantins Araguaia basin. Both are located in Pará State, in areas of the Amazon biome and the Amazon/Cerrado transition, respectively (Fig. 1). The collected subimagos were kept alive in plastic microtubules until the emergence of the imago. All captured individuals were preserved in 96% alcohol.

The terminology used to describe the morphology of the genitalia follows Domínguez et al. (2006) and Kluge (2007), and the terms referring to the thorax of adults follow Kluge (1994). Images of the habitus of the specimens were taken using a Leica M165C stereomicroscope. The male genitalia were dissected and mounted on microscope slides and coverslips, using Euparal®, and the wings were dry mounted. The illustrations were made using Adobe-Illustrator CC® and the distribution map was created using QGIS version 3.28.3 free software.

The examined material is deposited at the Museum of Entomology (UFVB), Federal University of Viçosa, Viçosa, Minas Gerais, Brazil, and at the Entomological Collection of the Ecology and Conservation Laboratory (LABECO), Federal University of Pará (UFPA), Belém, Pará, Brazil.

Results

Hydromastodon cf. miki (Thomas & Boutonnet, 2004)

Hydrosmilodon miki Thomas et al. 2004: 72; Sartori 2005: 243; Domínguez et al. 2006: 407

Hydromastodon miki: Polegatto & Batista 2007: 54

Hermanella (Needhamella) miki: Kluge 2007: 398

Diagnosis. The male imago of *Hydromastodon cf. miki* can be distinguished from those of *H. sallesi* by the following combination of characteristics: a) body color pattern, especially abdominal terga, translucent white with terga I to IV washed with black on posterior margins (Fig. 2C, D); b) compound eyes anteriorly rounded (Fig. 2A, B); c) medial projection of styliger plate short; d) penis lobes close to each other and with posterolateral projection as long as ½ of its length (2E and 4D- F).

Description of male imago (in alcohol).

Lengths (in mm). Body 4.2–4.5; fore wings 5.6–5.7; hind wings 1.1.

Head (Fig. 2A, B): yellowish-white, tinged with orange between ocelli; upper portion of eyes orangish, lower portion black. Eyes meeting on meson of head; ocelli white, surrounded with black and orange. Antennae light yellowish-brown.

Thorax (Fig. 2A, B): pronotum yellowish-brown, with transversal median black line and with lateral margin tinged with black; mesonotum light orangish-brown, except for yellow sublateral scutum and outer margin of posterior scutellar protuberance. Metanotum light brown. Pleurae purplish-gray. Prosternum with wide, X-shaped median carina, with similar anterior and posterior arms. Mesosternum orangish-brown, except for white marks medially. Membranous areas between pro- and mesosternum purplish-gray. Metasternum orangish-brown anteriorly, yellowish-brown posteriorly.

Wings (Fig. 4A, B and C): membrane of fore and hind wings hyaline. Fore wing with costal arch, C, Sc, RA, RP and MA brown, lighter towards apex, remaining veins light yellowish-brown. Fork of MA and fork of MP asymmetrical. Legs: translucent white, except for coxae yellowish-brown, fore femur, apex of mid and hind femora and claws yellow.

Abdomen (Fig. 2C, D): Terga I–VII translucent, VIII–X yellowish-white; terga I–IV washed with black on posterior margins, pigmentation stronger and wider medially; tracheae of segments I–IX washed with black, restricted to a small area on segments III–VII, completely covering tracheae on remaining segments.; Sterna I–VII translucent white, sterna VIII–IX light yellowish-white.

Genitalia (Fig. 2E, 4D, E and F): yellowish-white, except for yellow telopenis; styliger plate with strong, dorsally curved, medial short projection; Penis lobes close to each other and with posterolateral projection as long as ½ of its length. Caudal filaments white, washed with brown except at base.

Description of female imago (Fig. 3A, B, C and D) (in alcohol).

Lengths. Body 4.9 mm; 5.9 mm fore wings; 1.0 mm hind wings. Head yellowish, except ocelli surrounded with black. Eyes black. Pronotum yellowish, with transversal median black line and with lateral margin tinged with black. Mesonotum light yellowish-brown with sutures yellowish-white. Metanotum yellowish-brown. Abdominal color pattern similar to male imago and sternum IX deeply and broadly cleft apically

Material examined. 162 ♂ imagos (Pennsylvania trap), Brazil, Pará State, Altamira, P01, Xingu River (03°28'55.4" S 51°40'55.5" W), 31.iii.2021, Gonçalves A and Lobato C, cols. (70 UFVB; 92 LABECO). One imago (Pennsylvania trap), Brazil, Pará State, Altamira P02, Xingu River, (3°11'35.0"S 51°26'45.1"W), 24.iv.2021, Prata EG, col. (LABECO). 4 ♂ imagos (Pennsylvania trap), Brazil, Pará State, Altamira, P03, Xingu River, (3°07'27.4"S 51°23'00.6"W), 28.iv.2021, Prata EG, col. (LABECO). 5 ♀ imagos (Pennsylvania trap), BRAZIL, Pará State, Altamira, P04, Xingu River (03°58'52.7" S 51°81'31.0" W), 28.iii.2021, Gonçalves A and Lobato C, cols. (2 UFVB; 3 LABECO).

Comments

The imago herein described fits well with the concept of *Hydromastodon* as proposed by Salles et al. (2016) while describing *H. sallesi*, but definitely represents a distinct species. For example, they both share similar forceps shape (relatively long and bent approximately at mid length) and the presence of a strong and dorsally curved, medial projection at the styliger plate. They also present a posterolateral projection at the penis lobe, which was not described for *H. sallesi*, but can be seen in Figs. 4D, E (Salles et al., 2016). As the adults of only two species of *Hydromastodon* have been described, the diagnosis herein present is enough to highlight the differences between *H. cf. miki* and *H. sallesi*. As we have not found nymphs of *H. miki* and could not associate them by rearing or any other technique, we do not discard the possibility that the material described here represents a third and new species of *Hydromastodon*. On the other hand, the length of the body of *H. miki* matches those of our specimens and, more importantly, the abdominal coloration described for mature nymphs of *H. miki* fits exactly the

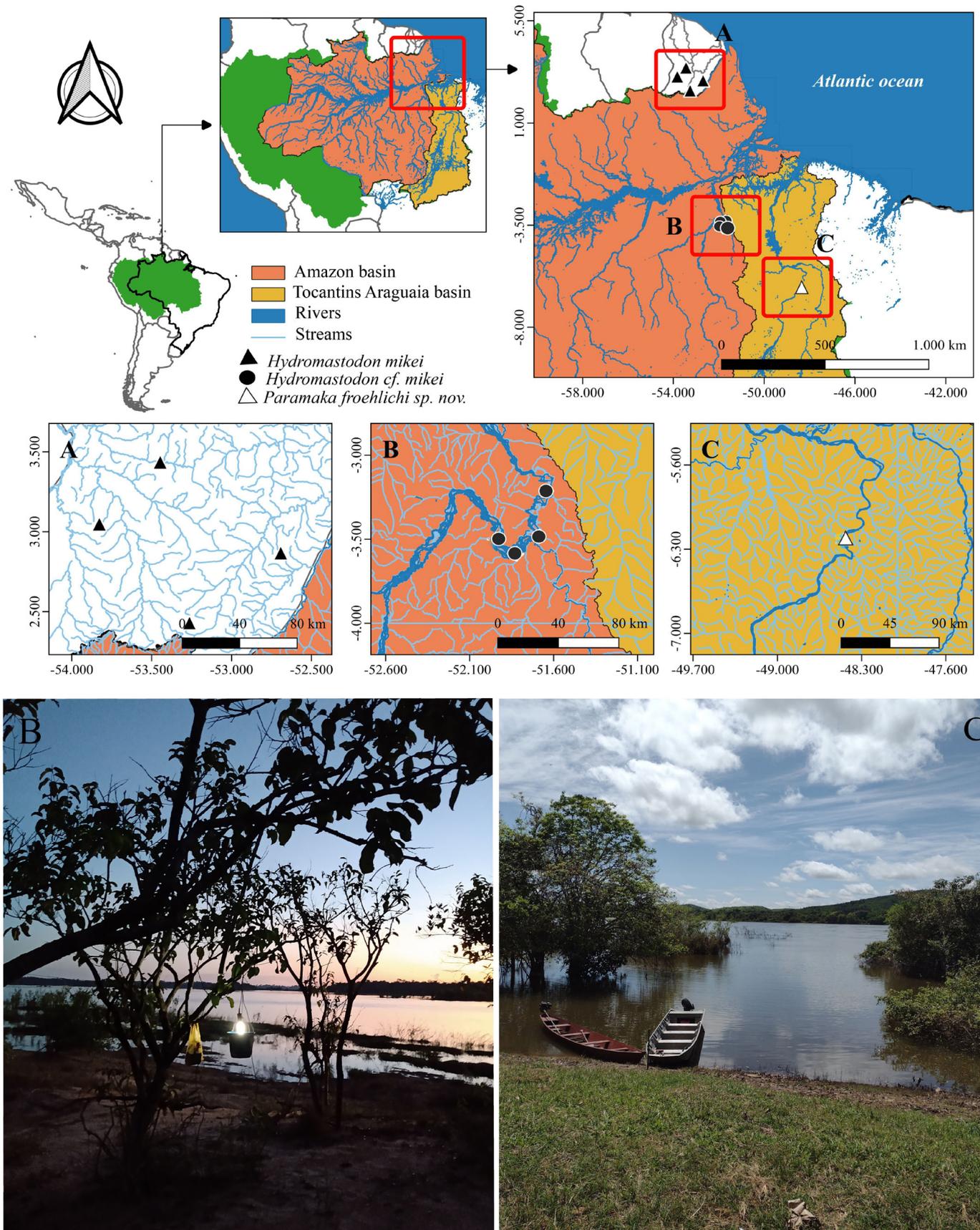


Figure 1 Distribution maps of the species. Black triangle: original distribution of *Hydromastodon mikei*, Black circle: new record of the *Hydromastodon cf. mikei* from Brazil, and white triangle: *Paramaka froehlichii* sp. nov. (A): original distribution of *Hydromastodon mikei* in French Guiana; (B – C): sampled locations of *Hydromastodon cf. mikei* and *Paramaka froehlichii* sp. nov. in Pará State, Brazil, respectively; (B): Altamira Municipality, Xingu River; (C): São Geraldo do Araguaia Municipality, Araguaia River.

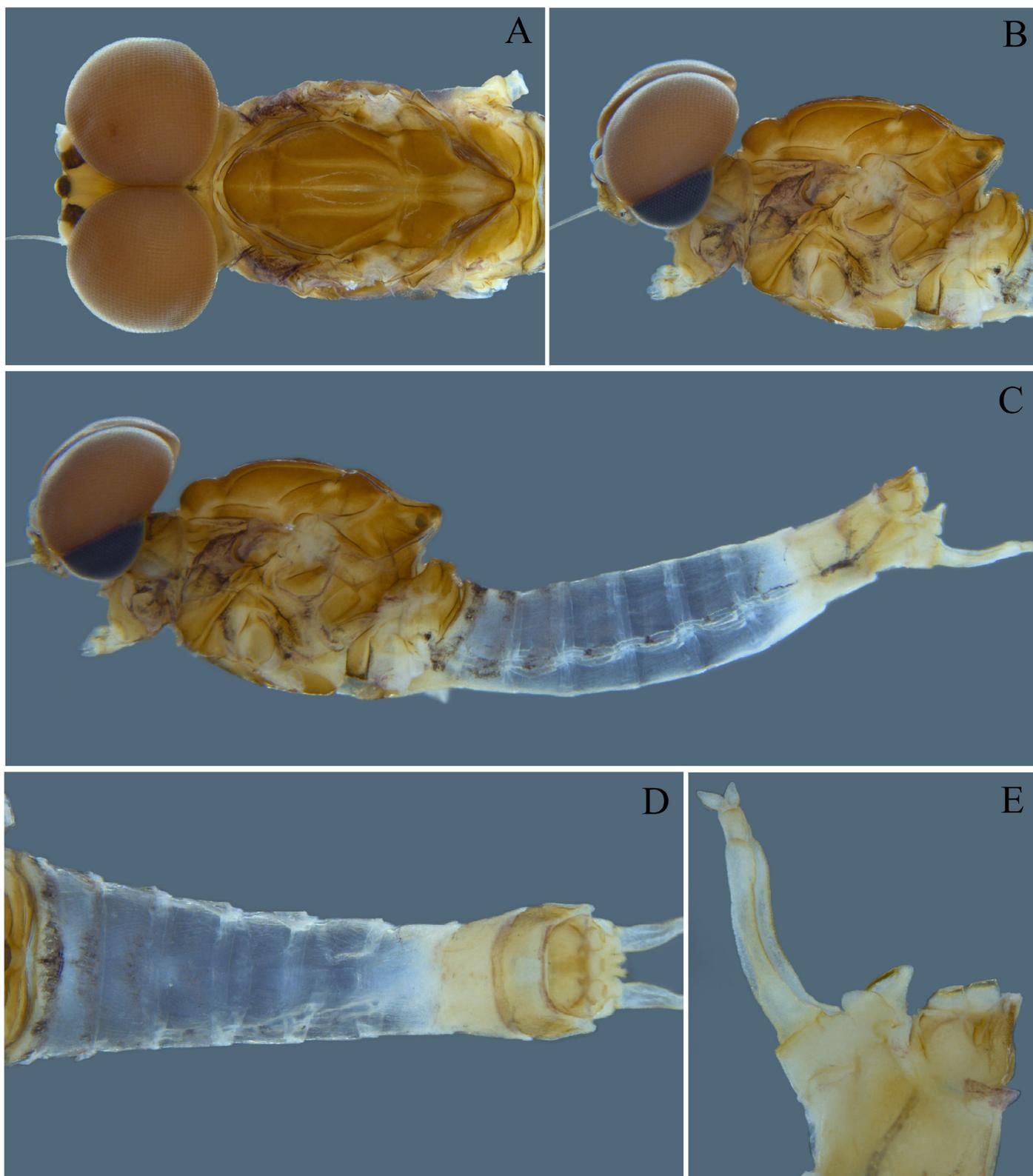


Figure 2 *Hydromastodon cf. miki*, male imago. A, head and thorax, dorsal view; B, head and thorax, lateral view; C, habitus, lateral view; D, abdomen, dorsal view; E, male genitalia, lateral view.

abdominal coloration of our material, as detailed in the original article by Thomas et al. (2004, p.77): “Coloration très différente de celle d’*H. gilliesae* par la présence d’une dominante pigmentaire sur une grande partie des tergites I à IV, ou même I à V; tergites V-X ou VI-X clairs, jaunes ou brun jaunâtre”. Since none of the alternatives is 100%

safe, we opted for a more conservative approach until we are able to find and associate nymphs with adults.

Distribution and Biology. Brazil (Pará State) (but if the specific determination is confirmed, it is also present in French Guiana). The specimens were collected in the Xingu River, with predominant

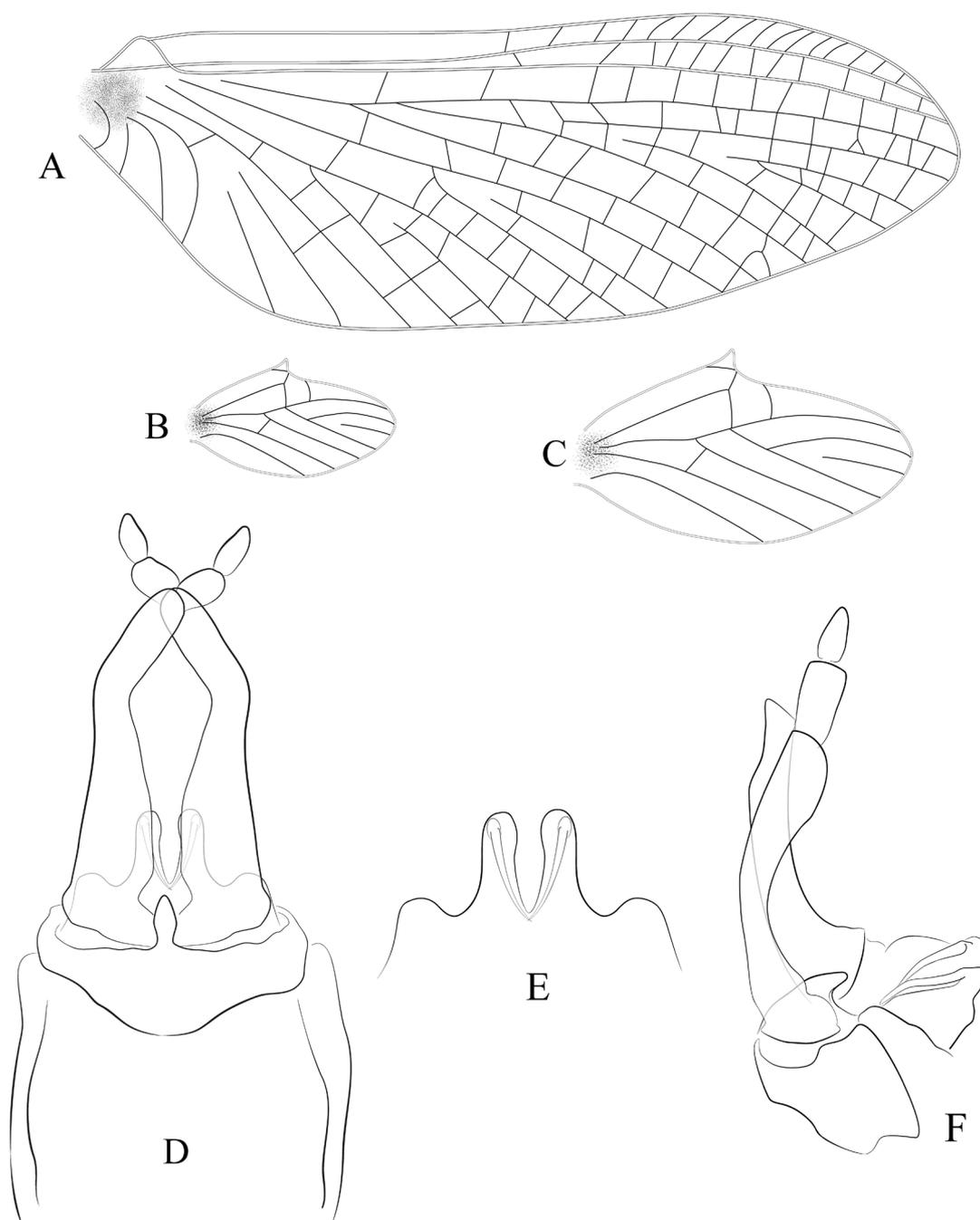


Figure 3 *Hydromastodon cf. miki*, female imago. A, head and thorax, dorsal view; B, abdomen, dorsal view; C, abdomen, lateral view; D, female sternum IX, ventral view.

vegetation in the Amazonian biome. The river stretch was large and presented open natural areas, with moderate to fast currents.

***Paramaka froehlich* Lima & Salles, sp.nov.**

urn:lsid:zoobank.org:act:D311562F-03A5-4609-B034-D58D1D41846C

Diagnosis.

The male imago of *P. froehlich* sp. nov. can be distinguished from the other male imagos of the genus by the following combination of characteristics: a) fore and hind wings with membrane brown

(Fig. 6A and 7A); b) legs uniformly yellowish-brown, without distal band (Fig. 5B and 7A); c) abdominal terga II to VI with marks more expanded laterally, medial line absent (Fig. 5A, B); d) medial projection of styliiger plate broad (Fig. 5D and 7A); e) base of telopenis arising at distal $\frac{2}{3}$ of penis lobe (Fig. 5D); f) body size of 6.1 to 7.6 mm.

Description of male imago (in alcohol).

Lengths (in mm): body, 6.1–7.6; fore wings: 6.8; hind wings: 1.3–1.4.

Head (Fig. 5A and C): yellowish-brown, upper portions of eyes orange-brown, lower portions blackish. Eyes meeting on meson of head. Ocelli white surrounded with black. Antennae: scape yellowish washed with black basally, pedicel and flagelum whitish.

Thorax (Fig. 5A- C): pronotum light yellowish-brown, oblique submedial black line and lateral margin tinged with black; mesonotum

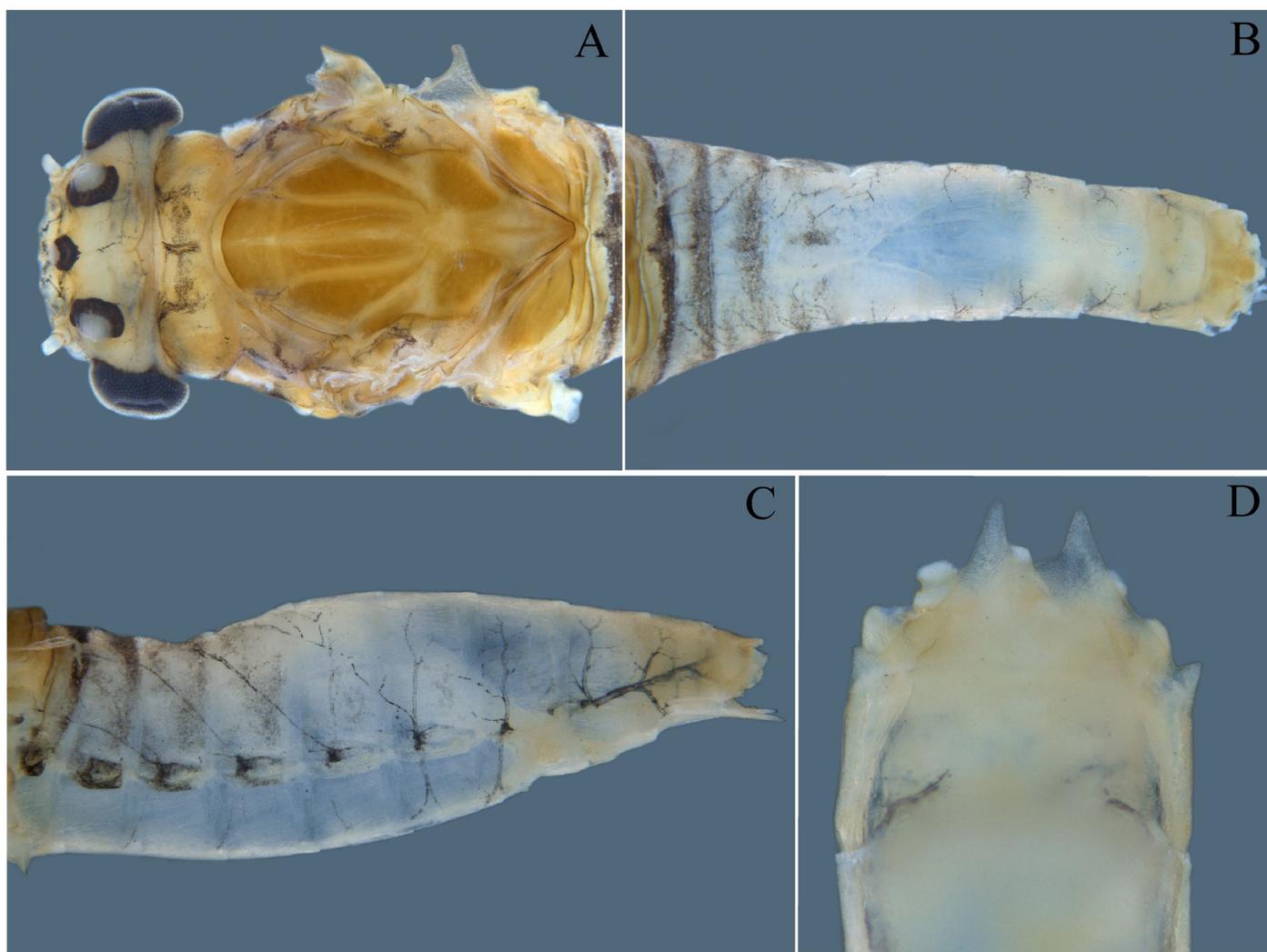


Figure 4 *Hydromastodon cf. miki*, male imago. A, fore wing; B, hind wing; C, hind wing, enlarged; D, genitalia, ventral view; E, penis, ventral view and F, genitalia, lateral view.

orangish-brown with sutures and scutellum yellow. Metanotum light yellowish-brown. Pleurae purplish-gray. Prosternum with straight, short and narrow medial carina, similar to *P. convexa*. Mesosternum orangish-brown, furcasternal protuberance brown. Membranous areas between pro- and mesosternum purplish-gray. Metasternum orangish-brown anteriorly, yellowish-brown posteriorly.

Wings (Fig. 6A): membrane of fore and hind wings brown, darker at base. Fore wing with C, Sc and RA brown, from RP to CuP brown at base, lighter towards apex. Fork of MA asymmetrical and fork of MP slightly asymmetrical (MP2 connected directly to MP1); crossvein above MA slanted; vein ICu₁ connected to CuA basally, vein ICu₂ attached at base to ICu₁ by a weak crossvein. Hind wing with C and Sc brown, remaining veins brown at base, lighter towards apex. Legs: uniformly yellowish-white.

Abdomen (Fig. 5A, B): terga I translucent and heavily washed with purplish-grey, terga II–VII translucent white and with posterior purple band which extends anteriorly on lateral areas (on several paratypes, these purple band and more extended laterally, almost reaching the anterior margins), terga VII–X orange, except on anterior margin of terga VII; sterna I–VII translucent white, sterna VIII–IX yellowish-white.

Genitalia (Fig. 5D and 6B): styliger plate yellowish-white; penes white, telopenis yellowish-brown; forceps white; styliger plate with

triangular broad medial projection; base of telopenis arising at distal 2/3 of penis lobe. Caudal filaments white, washed with brown except at base.

Material examined. Holotype: ♂ imago, BRAZIL, Pará State, Parque Estadual da Serra dos Martírios-Andorinhas (PESAM), São Geraldo do Araguaia, Araguaia River (6° 13'21.6" S 48° 27'53.2" W); 03.v. 2022; Rivera-Pérez, JM col. (UFVB). Paratypes: 4 ♂ imagos (same data as holotype) (UFVB); 12 ♂ imagos, 5 ♂ subimagos (same data as holotype) (LABECO/UFPA).

Nymph and female imago. Unknown.

Etymology. The specific epithet is in honour of Claudio Gilberto Froehlich, a great Brazilian researcher in ecology and taxonomy of aquatic insects.

Comments

Concerning the morphology of the genitalia, *P. froehlichii* **sp. nov.** is most similar to *P. convexa* and *P. incognita*. They both possess the penis lobe divided on apical 2/3, apically rounded and with a subapical and anteromedially directed telopenis, as well as a triangular medial projection on the styliger plate. The other characters listed above, however, clearly distinguishes them: the abdominal coloration of *P. incognita* and *P. convexa* is very conspicuous, with a strong contrasting pattern between terga II–V or II–VI and VI–X or VII–X, respectively. In the case

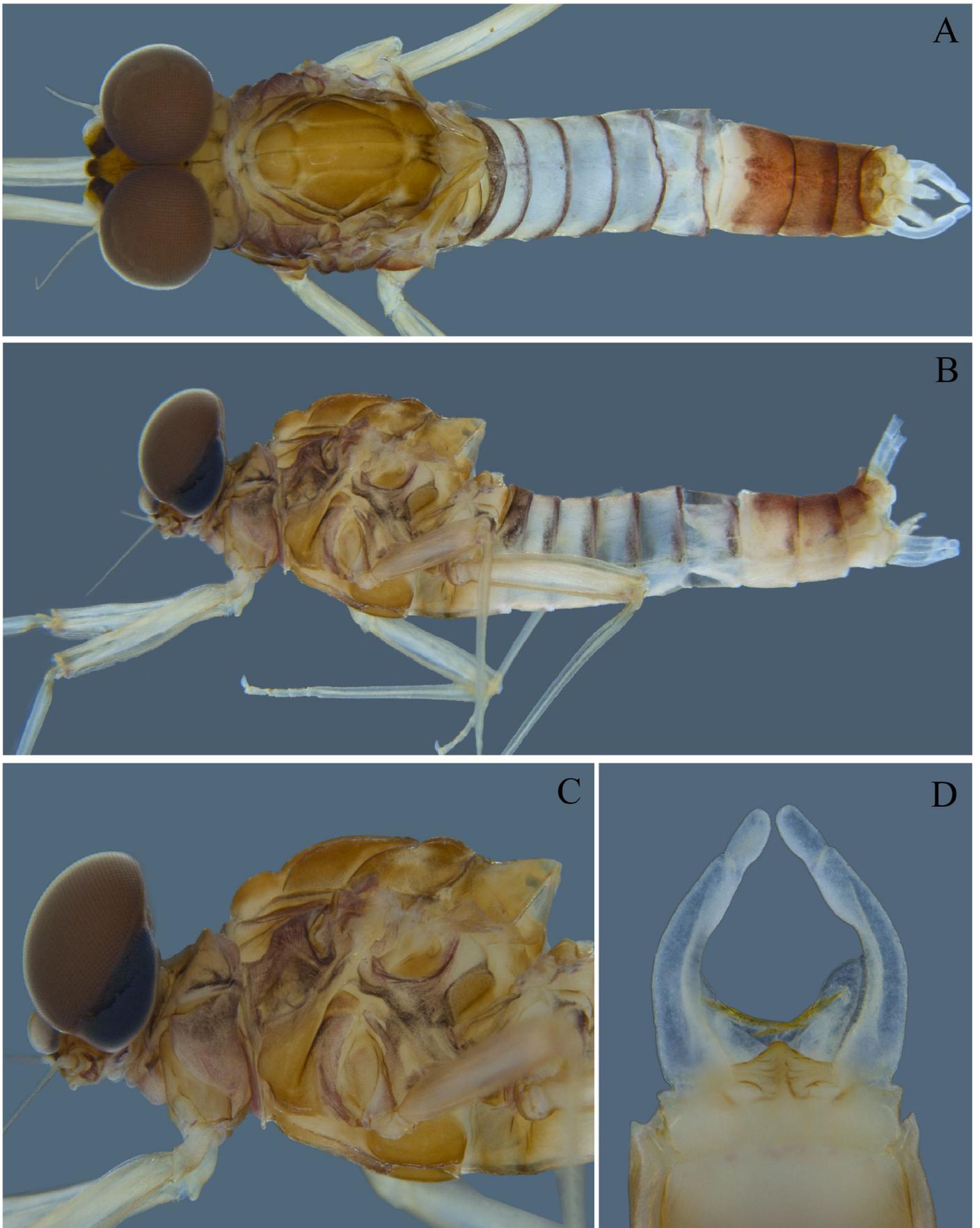


Figure 5 *Paramaka froehlichii* sp. nov., male imago. A, Habitus, dorsal view; B, Habitus, lateral view; C, head and thorax, lateral view, D, male genitalia, ventral view.

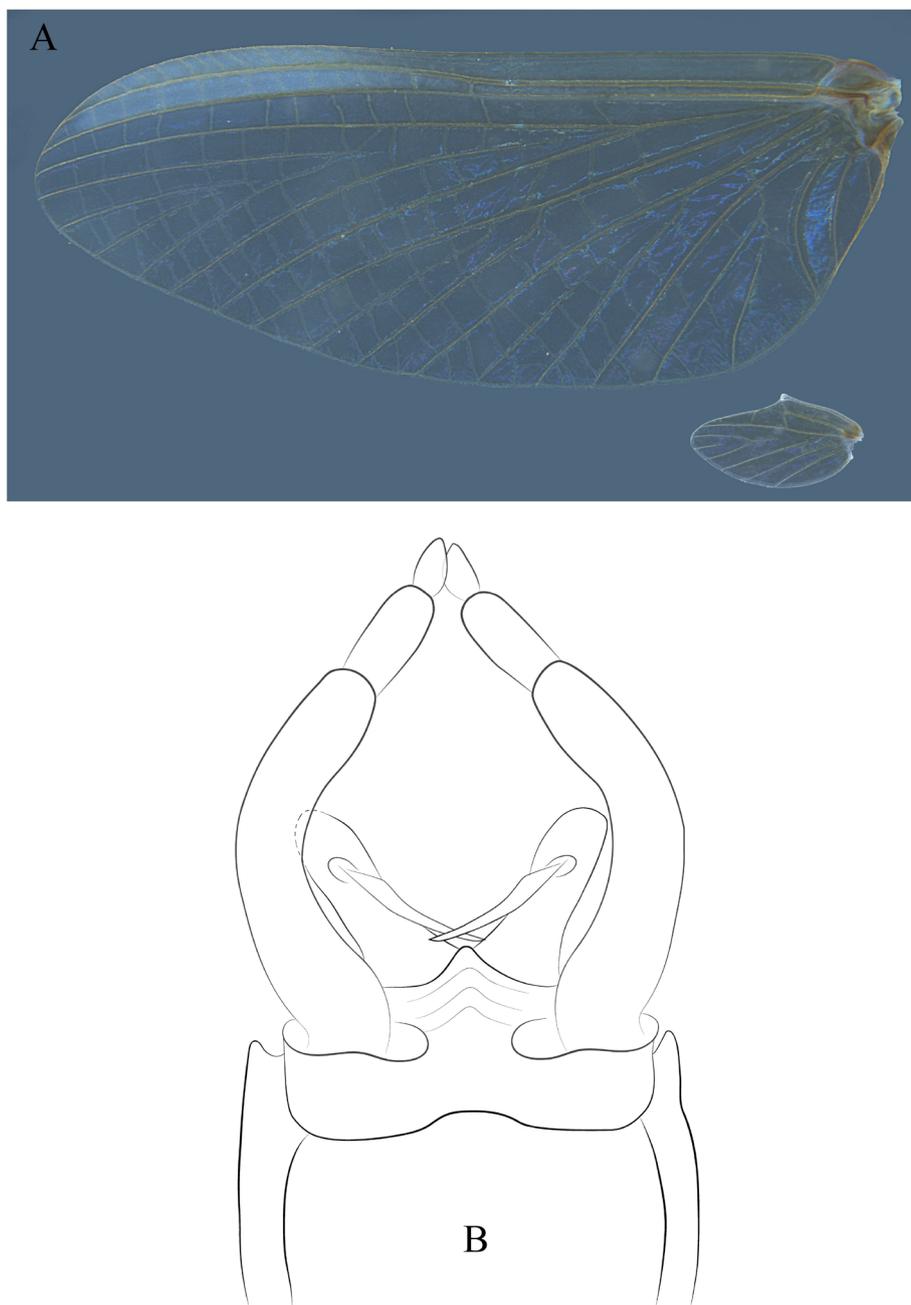


Figure 6 *Paramaka froehlichii* sp. nov., male imago. A, fore and hind wings. B, male genitalia, ventral view.

of *P. convexa*, a medial black line is also present on most terga, while in *P. incognita* sterna VII and VIII are heavily pigmented. Importantly, the medial black line in *P. convexa* is present on all specimens examined by us, even in faded material, and from several areas in Brazil, including Amazonas, Amapá, Pará, Piauí, Minas Gerais and Espírito Santo. On the other hand, besides the absence of the medial line, marks on terga II to VI are more extensive on most specimens of the new species, minimizing the contrast between anterior and posterior segments (Fig. 5A). The femora of *P. convexa* and *P. incognita* are heavily pigmented at apex, while in *P. froehlichii* sp. nov. they are uniformly yellowish-brown. The forewings of *P. froehlichii*, given the brown pigmentation of the membrane and main veins (Fig. 6A and 7A), resemble those of *P. incognita*. In contrast, the body length of the new species is more similar to that of *P. convexa* (Fig. 7D-F) (the body length of *P. incognita* exceeds 10,0 mm, while it is around 7,0 mm in *P. convexa* and in the new

species). Compared to *P. antonii*, the nymphs of this species exhibit a distinct pigmentation pattern on their legs, as described in the original article by Sartori (2005, p. 339) in figures 9-12: “yellowish-brown, each with a distinctive brownish color spot on the distal part of the dorsal margin of the femora; the apex of the femora are clouded with brown; a narrow transverse band on the proximal and subdistal parts of the tibiae, as well as on the third proximal parts of the tarsi.” In contrast, the imago of *P. froehlichii* sp. nov. displays uniformly yellowish-white legs without any mottled pattern.

Distribution and Biology. Brazil (Pará State). The specimens were collected in the Serra dos Martírios-Andorinhas, which is a region characterized predominantly by scrub forests and natural open areas. These habitats contain forest fragments that have been disturbed by livestock. Additionally, the river flowing in front of the collection area features sections with substantial rock formations.

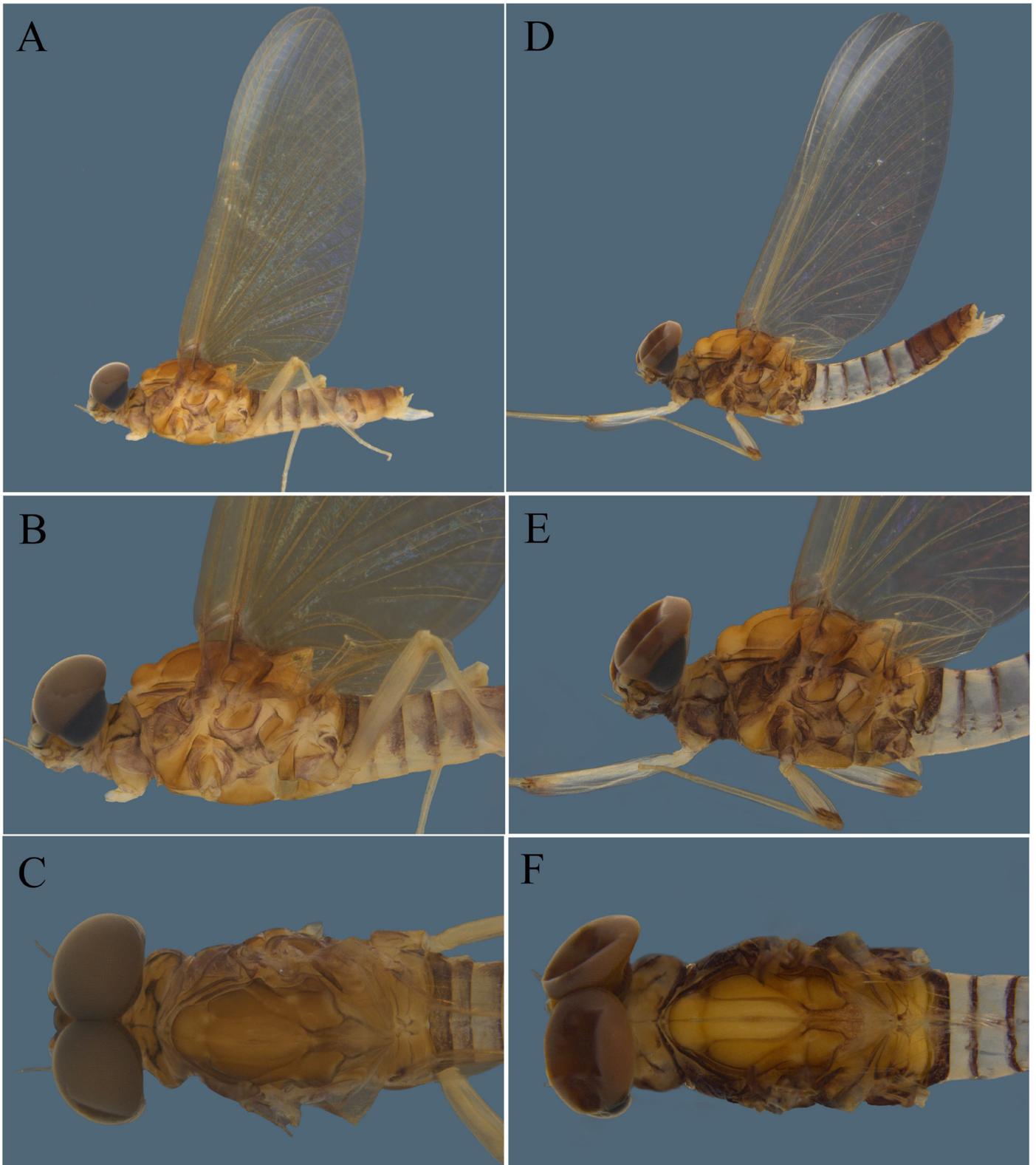


Figure 7 *Paramaka froehlichii*, **sp. nov.**, male imago. A, Habitus, lateral view; B, Thorax, lateral view; C, Thorax dorsal, view. *Paramaka convexa*, male imago. D, Habitus, lateral view; E, Thorax, lateral view; F, Thorax, dorsal view.

Acknowledgments

We would like to thank the Ecology and Conservation Laboratory (LABECO, UFPA), and the Museum of Entomology (UFV) for support and Luciano Montag, Cleonice Lobato, Alany Gonçalves and Erival Prata

who collected the material studied in this paper. JMRP thanks Fernando Carvalho Filho (MPEG) and Caroline Costa de Souza (UFPA/MPEG) for the invitation to participate in the field expedition to the Serra dos Martírios-Andorinhas. ML would like to thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES, process 88887.615447/2021-00)

for the doctoral scholarship and we are also grateful to the Conselho Nacional de Desenvolvimento Científico e Tecnológico do Brasil (CNPq) for a productivity grant for FFS (process 309666/2019-8), LJ (process 304710/2019-9) and LSB (process 305929/2022-4). Furthermore, we would like to thank Dr. Eduardo Domínguez and Dr. Lucas Lima for suggestions and reviewing the manuscript, as well as the other anonymous reviewer for their suggestions.

Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

ML and FFS wrote the initial version of the manuscript, including the preparation and identification of the material. The other authors, LSB, LJ, JMPP, and KDS, reviewed all versions of the article, providing contributions to both the writing and fieldwork. All authors read and critically reviewed the final version of the article.

References

- Blanco-Belmonte, L., Ruaise, V., Peters, J. G., 2003. The nymph of *Paramaka* Savage & Domínguez (Ephemeroptera: Leptophlebiidae: Atalophlebiinae). In: Gaino, E. (Ed.), Research Update on Ephemeroptera & Plecoptera. University of Perugia, Perugia, pp. 117-121.
- Domínguez, E., Ferreira, M. J., Nieto, C., 2001. Redescription and Phylogenetic Relationships of *Leentvaaria* Demoulin (Ephemeroptera: Leptophlebiidae). In: Domínguez, E. (Ed.), Trends in Research in Ephemeroptera and Plecoptera. Springer, Boston, pp. 313-320. http://dx.doi.org/10.1007/978-1-4615-1257-8_35.
- Domínguez, E., Flowers, R. W., 1989. A Revision of *Hermanella* and Related Genera (Ephemeroptera: Leptophlebiidae; Atalophlebiinae) from Subtropical South America. Ann. Entomol. Soc. Am. 82 (5), 555-573. <http://dx.doi.org/10.1093/aesa/82.5.555>.
- Domínguez, E., Grillet, M. E., Nieto, C., Molineri, C., Guerrero, E., 2014. Ephemeroptera from the Venezuelan Guayanas's Uplands: Families Leptophlebiidae, Euthyplociidae and Oligoneuridae. Zootaxa 3827 (3), 301-317. <http://dx.doi.org/10.11646/zootaxa.3827.3.1>.
- Domínguez, E., Molineri, C., Pescador, M. L., Hubbard, M. D., Nieto, C., 2006. Ephemeroptera of South America. Aquatic Biodiversity in Latin America (ABLA). Vol. 2. Pensoft, Sofia-Moscow, 646 pp.
- Faria, L. R. R., Pie, M. R., Salles, F. F., Della, G. S. E., 2021. The Haecklian shortfall or the tale missing semaphoronts. Zool. Syst. Evol. Res. 59 (2), 359-369. <http://dx.doi.org/10.1111/jzs.12435>.
- Flowers, R. W., Domínguez, E., 1992. New Genus of Leptophlebiidae (Ephemeroptera) from Central and South America. Ann. Entomol. Soc. Am. 85 (6), 655-661. <http://dx.doi.org/10.1093/aesa/85.6.655>.
- Kluge, N. J., 2007. A new taxon *Hermanellonota*, or subtribe Hermanellini subtr.n. (Ephemeroptera: Leptophlebiidae: Hagenulini), with description of three new species from Peruvian Amazonia. Russ. Entomol. J. 16, 385-400.
- Kluge, N. J., 1994. Pterothorax structure of mayflies (Ephemeroptera) and its use in systematics. Bull. Soc. Entomol. Fr. 99 (1), 41-61. <http://dx.doi.org/10.3406/bsef.1994.17037>.
- Lima, L. R. C., Nascimento, J. M. C., Mariano, R., Pinheiro, U. S., Salles, F. F., 2012. New species and new records of *Hermanella* complex (Ephemeroptera: Leptophlebiidae) from Eastern Brazilian Coast. Ann. Limnol. 48 (2), 201-213. <http://dx.doi.org/10.1051/limn/2012011>.
- Mariano, R., 2011. A new species of *Paramaka* Savage & Domínguez, 1992 (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) from Brazil. Zootaxa 3038 (1), 45-50. <http://dx.doi.org/10.11646/zootaxa.3038.1.3>.
- Monjardim, M., Paresque, R., Salles, F. F., 2020. Phylogeny and classification of Leptophlebiidae (Ephemeroptera) with an emphasis on Neotropical fauna. Syst. Entomol. 45 (2), 415-429. <http://dx.doi.org/10.1111/syen.12402>.
- Nascimento, J. M. C., Salles, F. F., 2013. New species of *Hermanella* complex (Ephemeroptera: Leptophlebiidae) from Brazilian Atlantic Forest. Zootaxa 3718 (1), 1-27. <http://dx.doi.org/10.11646/zootaxa.3718.1.1>.
- Polegatto, C. M., Batista, J. D., 2007. *Hydromastodon sallesi*, new genus and new species of Atalophlebiinae (Insecta: Ephemeroptera: Leptophlebiidae) from West and North of Brazil, and notes on systematics of *Hermanella* group. Zootaxa 1619 (1), 53-60. <http://dx.doi.org/10.11646/zootaxa.1619.1.3>.
- Salles, F. F., Domínguez, E., Mariano, R., Paresque, R., 2016. Then imagos of some enigmatic members of the *Hermanella* complex (Ephemeroptera, Leptophlebiidae). ZooKeys 625, 45-66. <http://dx.doi.org/10.3897/zookeys.625.9874>.
- Sartori, M., 2005. A new species of the genus *Paramaka* Savage & Domínguez, 1992 with some comments on related genera (Ephemeroptera, Leptophlebiidae, Atalophlebiinae). Stud. Neotrop. Fauna Environ. 40 (3), 237-245. <http://dx.doi.org/10.1080/01650520500208481>.
- Sartori, M., Brittain, J. E., 2015. Order Ephemeroptera. In: Rogers, D.C., Thorp, J.H. (Eds.), Thorp and Covich's Freshwater Invertebrates. Academic Press, Amsterdam, pp. 873-891. <http://dx.doi.org/10.1016/B978-0-12-385026-3.00034-6>.
- Savage, H. M., Domínguez, E., 1992. A new genus of Atalophlebiinae (Ephemeroptera, Leptophlebiidae) from Northern South America. Aquat. Insects 14 (4), 243-248. <http://dx.doi.org/10.1080/01650429209361489>.
- Spieth, H., 1943. Taxonomic studies on the Ephemeroptera. III. Some interesting Ephemeroptera from Surinam and other neotropical localities. Am. Mus. Novit. 1244, 1-13.
- Thomas, A., Boutonnet, J., Peru, N., Horeau, V., 2004. Les Ephemere's de la Guyane Française. 9. Descriptions d'*Hydrosmilodon gilliesae* n. sp. et d'*H. mikei* n. sp. (Ephemeroptera, Leptophlebiidae). Ephemera 4, 65-80.