New records of Ephemeroptera (Insecta) from Roraima State, Northern Brazil


Keywords: Aquatic insects; Faunal inventory; Geographic distribution; Neotropical region; Taxonomy.

Novos registros de Ephemeroptera (Insecta) do Estado de Roraima, norte do Brasil


Palavras-Chave: Distribuição geográfica; Insetos aquáticos; Inventário de fauna; Região Neotropical; Taxonomia.

Ephemeroptera comprise an abundant and diverse order of hemimetabolous aquatic insects with approximately 375 genera and 3,200 species grouped in 37 families worldwide (Barber-James et al. 2013). There are about 80 genera and 351 species of Ephemeroptera in Brazil, representing 10 families (Santos 2017).

Roraima is the northernmost state in Brazil and its Ephemeroptera fauna is poorly known due to the paucity of studies on this taxonomic group in the state. The first and most significant Ephemeroptera inventory for Roraima state was conducted by Falcão et al. (2011), where they recorded 32 species of Baetidae. After that study, only a few taxonomic studies on Ephemeroptera were made in Roraima, providing new records and describing species (Gama Neto & Hamada 2013, 2014; Boldrini & Barbosa 2015; Gama Neto & Passos 2016, 2017; Boldrini & Lima 2017; Molineri & Salles 2017; Ramunni et al. 2017). At present, Roraima states has 74 mayfly species belonging the families Baetidae, Caenidae, Leptohyphidae, Leptophlebiidae, Oligoneuriidae and Polycentrictidae. Baetidae and Leptophlebiidae are the most species-rich families including approximately 78% of the mayfly species in Roraima (Santos 2017).

The aim of the present study is to provide new records and distributional notes for mayflies from Brazil and Roraima state, northern Brazil, based in collections made in the Alto Alegre, Mucajai and Normalia municipalities.

MATERIAL AND METHODS

Mayflies were collected from September/2014 to December/2015 in three municipalities of the Roraima state, Brazil (Figure 1). Adult mayflies were collected with light-traps and nymphs were captured with aquatic entomological net. Specimens were preserved in 70% ethanol. For species identification, wings and male genital structures were examined under stereomicroscope. Nymphs’ mouthparts, legs and gills were mounted on glass...
slides with Berlese liquid using a modified version of the Young & Duncan (1994) temporary mounting technique. Whenever necessary, the genitalia also was removed and mounted on slides containing Berlese liquid and examined with a microscope for better visualization of its morphology.

Photographs of the species were taken using a Fuji FinePix s-4000 digital camera coupled to stereomicroscope Olympus SZ51 or to microscope Nikon Eclipse E-200. A series of digital images of different focal depths from each subject was stacked using the software CombineZP to produce enhanced quality final images. All collected specimens are deposited in the entomology collection of the Museu Integrado de Roraima (MIRR).

RESULTS

The new records of mayfly species from Roraima are proved below, together species’ diagnosis and geographical distribution data.

Species list

Family Baetidae Leach, 1815

Callibaetis cruentus Cruz, Salles & Hamada, 2014

Callibaetis cruentus Cruz et al. 2014: 13

Male imago. 1) Dorsal portion of turbinate eyes oval; 2) forewing hyaline with black bands transversally, medially with transverse band complete; 3) marginal intercalary veins paired, except between veins ICu2 and A; 4) hind wing hyaline with brown marks basally, medially and apically; 5) costal process of hind wing compound; 6) abdominal sterna with many reddish spots, laterally with reddish brown spot, medially one brown mark and submedially with two light black marks; 7) forceps segment I cylindrical.

Previous distribution. Brazil: Amazonas state (Cruz et al. 2014).

Callibaetis gelidus Cruz, Salles & Hamada, 2014

Callibaetis gelidus Cruz et al. 2014: 23

Diagnosis. Male imago. 1) Dorsal portion of turbinate eyes circular, apical third with constriction, base is wider than apex in lateral view; 2) forewing hyaline, except C, Sc, R1 areas; 3) marginal intercalary veins paired, except between veins MP and A; 4) hind wing hyaline, sometimes with one brown mark near costal process; 5) hind wing with costal process compound; 6) abdominal sterna with one brown mark submedially; 7) forceps segment I cylindrical.

Previous distribution. Brazil: Amazonas and Rondônia state (Cruz et al. 2014).

Remarks. Its find in this study represents the first record of this species in Roraima state.

**Family Coryphoridae Molineri, Peters & Cardoso, 2001**

*Coryphorus aequalis* Peters, 1981 (Figure 2)

Diagnosis. 1) Absence of intercalaries in the cubital field of forewings; 2) setae present on posterior margin of forewing; 3) male with large, fused, distally broadened penes and short desclerotized forceps; 4) Styliger plate produced distally, about as long as wide; 5) eyes undivided, separated, greatly enlarged.

Previous distribution. Colombia, Brazil (Amapá, Amazonas, Mato Grosso and Pará states), French Guyana and Venezuela (Peters 1981; McCafferty & Wang 2000; Molineri et al. 2001; Molineri & Peters 2002; Domínguez et al. 2006; Molineri et al. 2011; Shimano et al. 2011; Belmont et al. 2015).

Examined Material: 02 male imago (MIRR-EPH 0013), Brazil, Mucajá municipality, Vínculo Embra, 02°24’78” N, 060°58’41.8” W, 31.X.2015, J.A. Cruz col.

Remarks. Its find in this study represents the first record of this species from Brazil.

**Family Euthyplocidae Lestage, 1921**

*Campyloma demoulini* Gonçalves & Salles, 2017 (Figures 3 and 4)


Diagnosis. Imago: 1) Forewings usually with one ICu vein; 2) Abdominal colour pattern with two pairs of dropshaped spots, one on mediaspical region on terga II-IX and one on medial region, narrower and more subtle, on terga II-VIII; 3) Styliger plate semi-rounded; 4) Penes wide with distal half strongly curved outwards.

Previous distribution. Brazil (Amazonas, Pará, Distrito Federal, Mato Grosso, and Tocantins states), Ecuador and Surinam (Boldrini & Kroslow 2017; Gonçalves et al. 2017).

Examined material. 25 males and 10 females imagos (MIRR-EPH 0014), Brazil, Roraima state, Mucajá municipality, Vínculo Sem Terra, 02°19’11.9” N, 060°55’25.8” W, 17.X.2015, J.L. Gama Neto, M.A.B. Passos and J.A. Cruz col.

Remarks. Its find in this study represents the first record of this species from Roraima states.

**Family Leptophlebiidae Banks, 1900**

*Farrodes maculatus* Domínguez, Molineri & Peters, 1996 (Figures 5 and 6)

*Thraulus maculatus* Needham & Murphy 1924: 45; Ulmer 1943: 28; Traver 1947: 149.


Diagnosis. 1) Forewings with dark pigments, including a dark macula at fork of vein MA; 2) vein MP of fore wings forked asymetrically to vein MP2 attached to MP1 by a crossvein; 3) Apex of hind wing obtuse, broadly rounded; 4) Mesonotum with heavy brownish black wash forming marks on anterolateral margins, anterolateral sutures dark brown but not healy with brownish black; 5) lateral subposterior margins just anterior to lateral subposterior humps washed lightly to healy with brownish black; 6) terga 3-5 with small median dark marks.

Previous distribution. Argentina (Domínguez 1999).

Examined material. 06 males imago (MIRR-EPH 0015), Brazil, Mucajá municipality, Vínculo Embra, 02°24’08.7” N, 060°58’41.8” W, 31.X.2015, J.A. Cruz col.

Remarks. Its find in this study represents the first record of this species from Brazil.

**Fittkaulus cururuensis** Savage, 1986 (Figures 7-9)


Diagnosis. Nymphs: 1) labrum with anteromedian emargination without denticles; 2) apex of galea-lacinia with one large, pectinate setae and one large, nonpectinate, curved setae; 3) coxae II and III with brown mark; 4) tegrum yellow washed with brown, terga II-VII with sublateral yellow mark, terga VIII with median area yellow, posterior 2/3 of terga IX yellow. Female imagos: 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 posteroerlarnd brownish black marks.


Examined material. 04 female imagos (01 reared) and 03 nymphs (MIRR-EPH 0016), Brazil, Mucajá municipality, Vínculo Tamandaré, 02°28’51.6” N, 060°55’33.8” W, 18.IX.2015, J.L. Gama Neto, M.A.B. Passos and J.A. Cruz col.

Remarks. Its find in this study represents the first record of this species from Roraima states.

**Fittkaulus maculatus** Savage & Peters, 1978 (Figure 10)


Diagnosis. 1) Nymphs: anteromedian emargination of labrum well developed with 6 very small apically flattened denticles; 2) Abdominal terga with brownish black markings as Fig. xx; 3) Metanotum with a median longitudinal mark that widens anteriorly, mark often appears as a distinct triangle.

Previous distribution. Brazil (Pará and Bahia states), Surinam (Savage & Peters 1978; Da-Silva 1992).

Examined material. 02 nymphs (MIRR-EPH 0017), Brazil, Mucajá municipality, Vínculo Tamandaré, 02°28’51.6” N, 060°55’33.8” W, 18.IX.2015, J.L. Gama Neto, M.A.B. Passos and J.A. Cruz col.

Remarks. Its find in this study represents the first record of this species from Roraima states.

**Hermanellopsis incertans** (Spieth, 1943) (Figures 11 and 12)

*Hermanella incertans* Spieth, 1943: 9; Traver, 1947: 159; Demoulin, 1966: 11.


Diagnosis. 1) Upper portion of male eyes with 25-31 facets in longest row; and 2) vein MP2 of fore wings joined at base to veins MP1 and CuA by cross veins; 3) Posteromedian margin of male styliger plate gently rounded with a median notch and submedian projections; and (5) Penes long and narrow.

Previous distribution. Guyana and Surinam (Domínguez et al. 2006).

Examined material: 10 male imago (MIRR-EPH 0018), Brazil, Normandia municipality, Maú River, 03°57’07.6” N, 059°31’23.2” W, 05.X.2015, N.T. Souza col.

Remarks. Its find in this study represents the first record of this species from Brazil.

_Miroculus (Miroculus) fittkaui_ Savage & Peters, 1983 (Figures 13 and 14)

_Miroculus (Miroculus) fittkaui_ Savage 1983: 130; Savage 1987: 103.

Diagnosis. 1) Membrane of wings hyaline to very light brown, fore wings with darker brown clouds around cros veins; 2) ratio of femora to tibiae of male prothoracic legs 0.56-0.61; length of male prothoracic tibiae 1.9-2.2mm; 3) median area of abdominal tergum VI with a brownish-black V-shaped mark, with open end of V directed posteriorly; 4) basal 1/3-1/2 of inner margin of forceps segment I abruptly narrows apically, distal 1/4 of inner margin developed; 5) styliger plate posteromedian margin gently rounded with a shallow median identation; and 6) penes tubular, scavated apically, 0.9-1.3 length of forceps segment I.
Previous distribution. Brazil (Espírito Santo, Pará, and Pernambuco states), Surinam and Venezuela (Savage & Peters 1983; Domínguez et al. 2006; Lima et al. 2012).

Examined material: 01 male imago (MIRR-EPH 0019), Brazil, Mucajai municipality, Vicinal Rufina, 02°25’49.8” N, 60°52’15.5” W, 02.X.2015, J.A. Cruz coll.

Remarks. Its find in this study represents the first record of this species from Roraima.

Simothraulopsis (Maculognathus) sabalo Kluge, 2007 (Figures 15 and 16)

Simothraulopsis (Maculognathus) sabalo KLUGE 2007: 389


Diagnosis. 1) thorax orangish yellow, abdomen orangish brown; 2) forewing with two costal cross veins basal to bulla; 3) hind wing with costal projection forming an acute angle, located approximately 2/3 distance from base to apex of wing; 4) abdominal segments I-V with translucent white basal bands;

Figures 11-18. Figures on left showing Ephemeroptera male imago habitus (left lateral view) and figures on right showing the species genitalia (ventral view): 11 and 12. Hermanellopsis incertans. 13 and 14. Miroculis fittkaui. 15 and 16. Simothraulopsis sabalo. 17 and 18. Thraulodes marreroi (Scales: Figures 11, 13, 15 and 17 = 1 mm; Figures 12, 14, 16 and 18 = 0.1 mm).
We observed variations in the *Thraulodes marreroi* species from Roraima states. In general, specimens collected in Roraima have forceps segments III clearly shorter than forceps segments II, and penes apicolateral area apparently not forming an “ear”, while *T. marreroi* specimens from Venezuela have subequal forceps segments II and III, and penes apicolateral area forming a pronounced “ear”. We consider it as populational variation because no more relevant differences were found.

The species *Calibates cruentus*, *Calibates gelidus*, *Campylodia demoulini*, *Coryphorus aquilus*, *Fittkaulus cururuensis*, *Fittkaulus maculatus* and *Miroculus fittkau*, previously recorded only in Amazonas (*C. cruentus*, *C. gelidus*, *C. demoulini*, and *C. aquilus*), Amapá (*C. aquilus*), Bahia (*F. maculatus*), Distrito Federal (*C. demoulini*), Espírito Santo (*F. cururuensis* and *M. fittkau*), Mato Grosso (*C. demoulini, C. aquilus, and F. cururuensis*), Pará (*C. demoulini, C. aquilus, F. cururuensis, F. maculatus, and *M. fittkau*), Pernambuco (*F. maculatus, M. fittkau*), Rondônia (*C. gelidus*) and Tocantins states (*C. demoulini*) (Savage & Peters 1978, 1983; Savage 1986; Da-Silva 1992; Boldrini et al. 2009, Lima et al. 2012; Cruz et al. 2014; Gonçalves et al. 2017; Santos et al. 2017) have their known distributions extended to the far north in Brazil. In addition, the species *Coryphorus aquilus*, *Miroculus fittkau* and *Thraulodes marreroi* are filling the existing gap in their species’ distributions, showing continuity between Brazil and Venezuela.

After our study, the number of known Ephemeroptera species in Roraima has increased from 74 to 86.

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**REFERENCES**


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Suggestion citation: