

New records of mayflies (Ephemeroptera: Insecta) from Pernambuco state, Northeastern Brazil

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Abstract: The knowledge about the distribution of Ephemeroptera in Brazil has increased in recent years, contributing to reduce the gaps about its distribution in this country. This paper presents an updated checklist of the species of Ephemeroptera from Pernambuco state, Northeastern Brazil based on bibliography and collections from numerous rivers and streams of 27 counties and 74 localities. In this study, 18 species and 11 genera are recorded for the first time from Pernambuco state, increasing from 43 to 61 the number of known species. With these results, Pernambuco becomes the state with highest number of species in Northeastern Region of Brazil. Moreover, *Caenis chamie* is reported for the first time from Brazil.

Key words: mayflies, Neotropical, survey, taxonomy

INTRODUCTION

The knowledge about the distribution of Ephemeroptera in Brazil has increased in recent years. According to information provided in the list of species from Brazil from the website “Ephemeroptera do Brasil” (Salles et al. 2015), there are 319 species recorded in 10 families and 72 genera. Since the first survey for Brazil performed by Salles et al. (2004a) several local and regional inventories were made, mainly for Southeast and Northeastern Brazil (Boldrini et al. 2012; Cruz et al. 2011; Lima et al. 2010, 2012; Salles et al. 2004b, 2010; Shimano 2010). These surveys have contributed to reduce the gaps in the knowledge of distribution of Ephemeroptera in Brazil.

The first checklist about mayflies of Pernambuco state was made by Lima et al. (2012) that recorded 38 species, 28 genera, and five families. Later, five species were added: *Cloeodes maracatu* Lima, Pinheiro & Massariol, 2013; *Paracloeodes charrua* Nieto & Emmerich, 2009; *Thraulodes luizgonzagai* Lima, Mariano & Pinheiro, 2013;

Thraulodes sternimaculatus Lima, Mariano & Pinheiro, 2013 and *Miroculis (Miroculis) stenopterus* Lima, Raimundi, Pinheiro & Salles, 2014 (Massariol et al. 2013; Lima et al. 2013a, 2013b; Lima et al. 2014).

Based on bibliography and specimens collected in this work, we elaborated an updated checklist of mayflies from Pernambuco state, in order to add new records of species and correct erroneous records.

MATERIALS AND METHODS

Collections were made between March 2011 and April 2014 in 27 counties and 74 localities (Figures 1A–D). Nymphs were collected with an aquatic entomological net and, adults were captured with light traps. When possible, nymphs were reared to obtain the adult stage. Collected specimens were fixed in 80% ethanol. Permanent slides were made using Canada Balsam and Euparal® as the mounting medium. The identifications were based on Domínguez et al. (2006), Salles (2006) and other specific papers for each species when necessary. Information on the geographical distribution of species were consulted in Domínguez et al. (2006), the updated frequently website “Ephemeroptera do Brasil” (Salles et al. 2015), and specific papers for each species. In material examined, the symbols “I” and “N” mean “imago” and “nymph”, respectively. In Appendix 1, the asterisk (*) after the name refers to a new record of species to Pernambuco state and two asterisks (**) mean a new generic record. All specimens were collected under the scientific collector’s license issued to LRCL (number 34065-3) by the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBIO). The material examined is deposited in the following institutions: Instituto de Biodiversidad Neotropical, Tucumán, Argentina (IBN); Coleção Zoológica Norte Capixaba (CZNC), São Mateus, Brazil and Coleção Entomológica da Universidade Federal de Pernambuco (CEUFPE), Recife, Brazil.

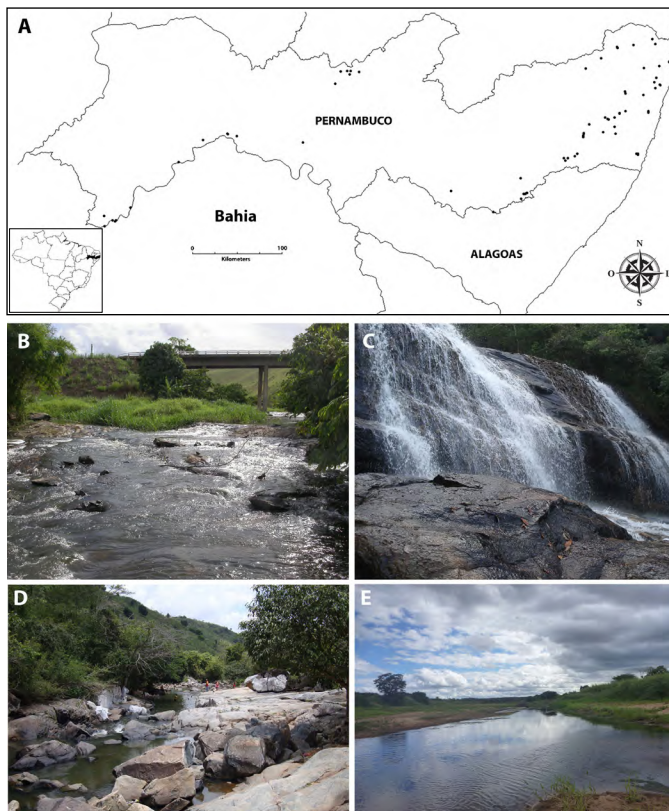


Figure 1. Studied area. **A**, Map with sampling sites in the Pernambuco state where mayflies specimens were collected. Collections localities: **B**, Rio Piranji, Jaqueira-PE. **C**, Cachoeira Barra Azul, Bonito-PE. **D**, Poço Verde, Orobó-PE. **E**, Rio Pajeú, Flores-PE.

RESULTS AND DISCUSSION

In this study were record 18 species and 11 genera for the first time from Pernambuco state, increasing from 43 to 61 the number of recorded species. With these results, Pernambuco becomes the state with highest number of known species of Northeastern region of Brazil, followed by the states of Bahia (40), Maranhão (22), and Piauí (9) (Salles et al. 2015). We provide below, a list of new records of mayfly species to Pernambuco state. For each species, we list data on geographical distribution, and comments are made when necessary.

Family Baetidae

Adebrotus lugo Salles, 2010

MATERIAL EXAMINED. Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49.0" W, 320 m, 1 N, 21.iv.2012, L.R.C. Lima coll. (CEUFPE).

DISTRIBUTION. Brazil: Espírito Santo.

REMARKS. Its presence in this study represents the first record of this genus from Northeastern region of Brazil.

Aturbina georgei Lugo-Ortiz & McCafferty, 1996 (Figure 2A)

MATERIAL EXAMINED: Cabrobó, Ilha de Assunção,

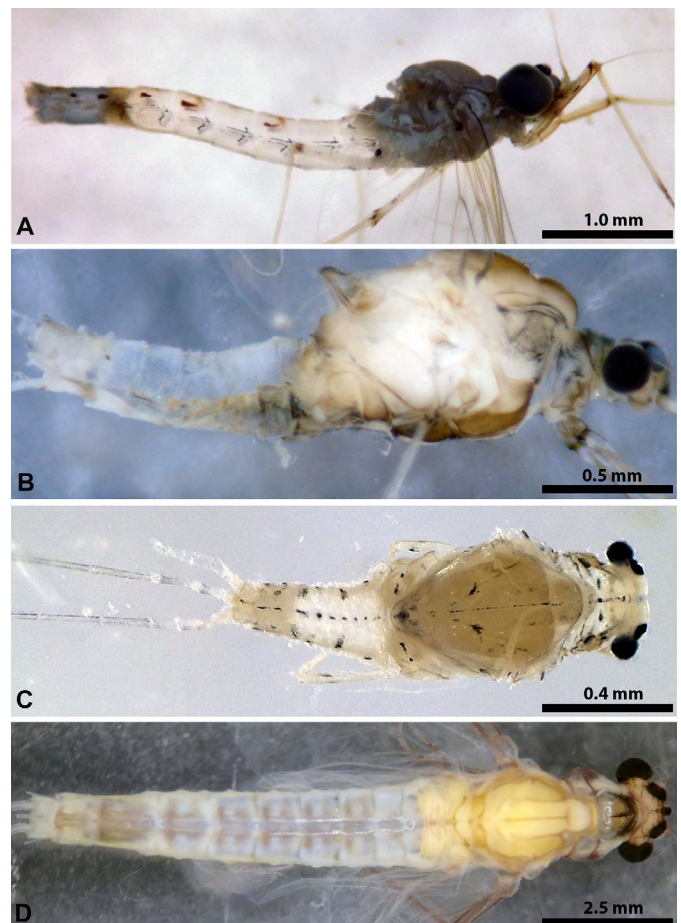


Figure 2. Male imagos of Ephemeroptera. **A**, *Aturbina georgei* (Baetidae), lateral view. **B**, *Tricorythodes bullus* (Leptoxyphidae), lateral view. **C**, *Tricorythopsis chiriguano* (Leptoxyphidae), dorsal view. **D**, *Campsurus truncatus* (Polymitarciidae), dorsal view.

near to the bridge (Point 2), 08°31'04.9" S, 039°19'53.3" W, 322 m, 2 I♂ (light trap), 07.x.2011, L.R.C. Lima coll. (CEUFPE); Petrolina, Balneário de Pedrinhas, São Francisco River, 009°16'29.2" S, 040°19'27" W, 355 m, 1 N, L.R.C. Lima coll. (CEUFPE).

DISTRIBUTION. Brazil: Acre, Amazonas, Bahia, Espírito Santo, Mato Grosso, Minas Gerais, Pará, Rio de Janeiro, Roraima and São Paulo. Colombia, French Guiana and Paraguay.

REMARKS. Its presence in this study represents the first record of this species to state of Pernambuco.

Paraclodes leptobranchus Lugo-Ortiz & McCafferty, 1996 (Figure 3A)

MATERIAL EXAMINED: Amaraji, Amaraji River, near to Campo Belo Plant 08°21'48.9" S, 035°28'49" W, 320 m, 1 N, 21.iv.2012, L.R.C. Lima coll. (CEUFPE).

DISTRIBUTION. Brazil: Paraná, Rio Grande do Sul, Roraima and Santa Catarina. Paraguay.

REMARKS. Its presence in this study represents the first record of this species from the state of Pernambuco.

Family Caenidae

Brasilocaenis septentrionalis Malzacher, 1990

MATERIAL EXAMINED. Tamandaré, Mamucabas stream P2, próximo à sede da Rebio Saltinho 08°43'52.7" S, 035°10'24.8" W, 38 m, 1I♂ (light trap), 28.iii.2014 Lima, LRC coll.; same data as preceding except 17.iv.2014, 1I♂.

DISTRIBUTION. Brazil: Pará.

REMARKS. So far, the species of the genus *Brasilocaenis* were restricted to the Amazonian basin. Its presence in Pernambuco extends the distribution of the genus outside the Amazonian basin and represents the first record of the genus in coastal basins in Brazil.

Caenis chamie Alba-Tercedor & Mosquera, 1999

(Figures 4A–E)

MATERIAL EXAMINED. Flores, Pajeú River near road to Véia stream, 07°52'35.7" S, 038°00'04" W, 473 m, 1 I♂ (reared) and 5N, 19.vii.2011, L.R.C. Lima, G. Nicácio, R.P. Salomão cols. (CEUFPE); Triunfo, waterfall near to Canaã, 07°54'20.9" S, 038°05'46" W, 464 m, 1 N, 19.vii.2011, L.R.C. Lima, G. Nicácio, R.P. Salomão cols. (CEUFPE); Petrolina, Vitória River, near airport, 09°21'43.7" S, 040°35'25" W, 380 m, 1 N, 06.x.2011, L.R.C. Lima, G. Nicácio cols. (CEUFPE); Vicência, Engenho Embú waterfall, 07°37'22.2" S, 035°22'51.3" W, 186 m, 93 I♂ and 60 I♀, 13.xi.2011, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE); Vitória de Santo Antão, Fazenda Boa Esperança, 08°5'59.5" S, 035°17'49.6" W, 1 N, 30.viii.2009, L.R.C. Lima, G. Nicácio, R.P. Salomão cols. (CEUFPE).

DISTRIBUTION. Colombia.

REMARKS. Its presence in this study represents the first record of this species from Brazil.

Caenis cuniana Froehlich, 1969

MATERIAL EXAMINED. Orocó, Brígida River, 08°34'54.4" S, 039°35'03.8" W, 338 m, 3 N, 08.x.2011, L.R.C. Lima, G. Nicácio cols. (CEUFPE); Vitória de Santo Antão, Fazenda Boa Esperança, 08°5'59.5" S, 035°17'49.6" W, 1 N, 30.viii.2009, L.R.C. Lima, G. Nicácio, R.P. Salomão cols. (CEUFPE).

DISTRIBUTION. Brazil: Espírito Santo, Mato Grosso, Rio de Janeiro and São Paulo.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

Caenis fittkai Malzacher, 1986

(Figure 3B)

MATERIAL EXAMINED. Araçoiaba, Campo Grande Dam, CIMNIC, 07°50'13.3" S, 035°6'39.6" W, 133 m, 2 I♀ (reared) and 3 N, 07.xi.2009, L.R.C. Lima coll. (CEUFPE).

DISTRIBUTION. Brazil: Espírito Santo and Pará.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

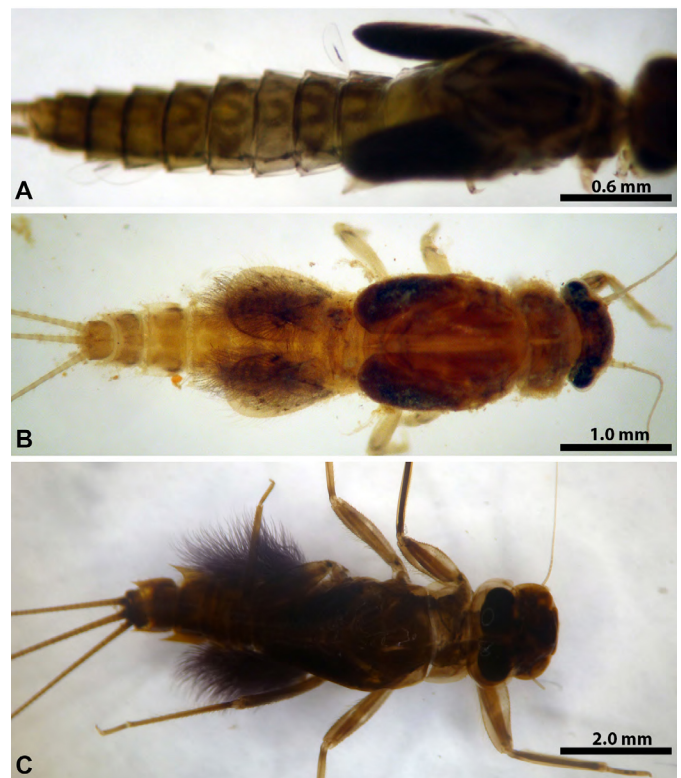


Figure 3. Nymphs of Ephemeroptera, dorsal view. **A**, *Paracloeodes leptobranchus* (Baetidae). **B**, *Caenis fittkai* (Caenidae). **C**, *Ulmeritoides flavopedes* (Leptophlebiidae).

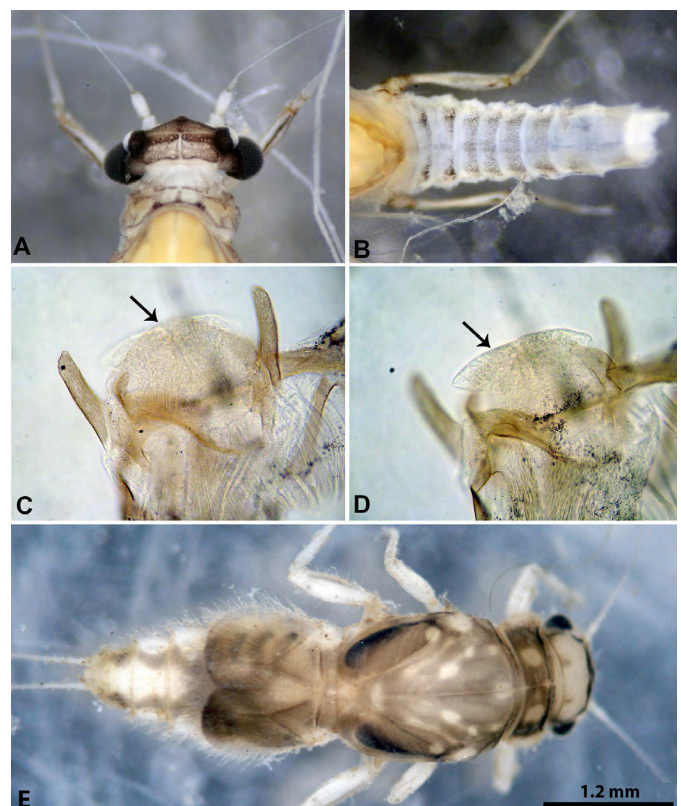


Figure 4. *Caenis chamie* Alba-Tercedor & Mosquera, 1999, **A–D** male imago, **E** nymph. **A**, detail of head. **B**, abdominal color pattern. **C**, genitalia (arrow indicating the styliger plate). **D**, genitalia (arrow indicating the penis). **E**, habitus.

Caenis sp.

MATERIAL EXAMINED. One nymph (slide CEUFPE 350113), Itamaracá, stream, estrada para a Lagoa Azul, 07°46'22.3" S, 034°51'4.6" W, 21 m, 24.v.2009, Lima, LRC coll. (CEUFPE). Six nymphs, Camaragibe, Besouro River, Estrada do Borralho, KM 07, PE-027, 07°59'06.4" S, 035°00'13.9" W, 16.vii.2009, 66 m, Lima, LRC coll. (CEUFPE). Seven nymphs (slide CEUFPE350111) and 18 females imagos, Recife, Açude do Prata, Parque Dois Irmãos, 08°00'28.5" S, 034°56'54.3" W, 22.viii.2009, 31 m, Lima, LRC coll. (CEUFPE); two males and three females imagos (reared) (slide CEUFPE350093), same data as preceding except 12.ix.2009 (CEUFPE); two nymphs and one male imago (reared), same data as preceding except 17.iii.2010 (CZNC). One nymph and three female imagos (reared), Recife, UFRPE stream, 08°00'57.4" S, 034°56'46.4" W, 17.iii.2010, 48 m, Lima, LRC coll. (CEUFPE); three nymphs and six female imagos (reared), same data as preceding except 06.iv.2010 (CEUFPE); three male imagos (slides CEUFPE350131#001 and CEUFPE350131#002), same data as preceding except 18.xii.2012 (CZNC); one nymph and four imagos (one male and three females) same data except 22.iii.2013 (CZNC); one nymph, four males and 11 females (reared) (slides p.674 and p.675) same data except 14.ii.2014 (IBN). Five nymphs, Igarassu, Jacocá stream, Refúgio Charles Darwin, 07°48'57.5" S, 034°57'19.1" W, 22.ii.2010, 37 m, Lima, LRC coll. (CEUFPE). One nymph, Goiana, Açude Santa Tereza, 07°35'33.2" S, 034°59'32.8" W, 12.xi.2011, 35 m, Lima, LRC, Souza, WRM cols. (CEUFPE). Two nymphs, São João, Inhumas Dam stream, 08°58'17.3" S, 036°21'48.5" W, 13.ii.2012, 686 m, Lima, LRC, Souza, WRM cols. Six males and two females (slides CEUFPE350136 #001 and CEUFPE350136 #002), Amaraji, Barragem Jaguarana, 08°21'01.6" S, 035°24'27.7" W, 05.xii.2012, 265m, Lima, LRC coll. (CEUFPE). One female imago (reared), Brazil, Tamandaré, Córrego da sede stream, Rebio Saltinho, 08°43'48.3" S, 035°10'35.3" W, 21.ix.2009, 46 m, Lima, LRC coll. (CEUFPE); one nymph, same data except 22.ix.2009 (CEUFPE); one female imago, same data except 08.viii.2010 (CEUFPE). One female imago, Rio Formoso, Fazenda São Manuel, 08°43'21.5" S, 035°10'12.6" W, 04.v.2010, 50 m, Lima, LRC coll. (CEUFPE). One female imago (reared), Rio Formoso, Gameleira stream, Rebio Saltinho, 08°43'12.3" S, 035°10'32.9" W, 22.xi.2012, 47 m, Lima LRC, Souza, WRM cols. (CEUFPE). One female imago (reared), Tamandaré, Mamucabas stream Point 1, near dam, 08°43'21.6" S, 035°11'14.0" W, 27.iii.2014, 90 m, Lima, LRC coll. (CEUFPE). 55 males and 15 females (light trap), Tamandaré, Mamucabas stream Point 2, próximo à sede da Rebio Saltinho, 08°43'52.7" S, 035°10'24.8" W, 28.iii.2014, 38 m, Lima, LRC coll. (IBN); 92 male and 63 females (slide CEUFPE350188), same data except 17.iv.2014 (CZNC).

REMARKS. *Caenis* sp. probably represents a new

species, however it presents some uncommon intermediate characteristics with the genus *Brasilocaenis* in the male imago. Thus, additional studies are necessary to confirm its generic status.

Family Leptohiphidae

Tricorythodes bullus (Allen, 1967)

(Figure 2B)

MATERIAL EXAMINED. Amaraji, Amaraji River, Cachoeira do Amor, 08°26'34.1" S, 035°24'22.1" W, 1 I♂ (light trap), 05.ii.2011, L.R.C. Lima, G. Nicacio cols. (DZRJ); Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49" W, 320 m, 2 I♂ (light trap), 21.iv.2012, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE); Amaraji, Poço do Carreiro, Amaraji River, 08°22'1.9" S, 035°28'8.7" W, 269 m, 2 I♂ (light trap), 21.iv.2012, L.R.C. Lima coll. (DZRJ).

DISTRIBUTION. Brazil: Maranhão. Bolivia.

REMARKS. The imago shows the penis with length almost equal to basal width (about 1.2×) and groove almost completely fused similar to *T. bullus*. However, the specimens analyzed here do not show peculiar spots on femur and tibia. This can be a populational variation, because no more relevant differences were found.

Tricorythopsis chiriguano Molineri, 2001

(Figure 2C)

MATERIAL EXAMINED. Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49" W, 320 m, 4 I♂ (light trap), 21.iv.2012, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE); same data as preceding except 1 I♂ (light trap), 28.iv.2012 (CEUFPE); Amaraji, Poço do Carreiro, Amaraji River, 08°22'1.9" S, 035°28'8.7" W, 269 m, 10 I♂ (light trap), 21.iv.2012, L.R.C. Lima coll. (DZRJ); Jaqueira, Pirangi River, PE-126 near to the bridge, 08°44'53" S, 035°48'51.1" W, 189 m, 685 I♂ (light trap), 23.v.2012, L.R.C. Lima, W.R.M. Souza cols. (647 CEUFPE and 38 DZRJ); Moreno, Jaboatão River, near to water treatment plant of COMPESA, 08°06'54.9" S, 035°07'00.2" W, 102 m, 17 I♂ (light trap), 21.xi.2013, L.R.C. Lima coll. (CEUFPE).

DISTRIBUTION. Brazil: Maranhão. Bolivia.

Tricorythopsis gibbus (Allen, 1967)

MATERIAL EXAMINED. Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49" W, 320 m, 6 I♂ (light trap), 21.iv.2012, L.R.C. Lima, W.R.M. Souza cols. (DZRJ).

DISTRIBUTION. Brazil: Espírito Santo, Rio de Janeiro and Santa Catarina. Argentina.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

Tricorythopsis sigillatus Molineri, 2009

MATERIAL EXAMINED. Correntes, Mundaú River (point 2), 009°07'57.4" S, 036°19'01.0" W, 380 m, 1 I♂ (light trap), 14.ii.2012, L.R.C. Lima, W.R.M. Souza cols. (DZRJ).

DISTRIBUTION. Brazil: state of Rio de Janeiro.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

Tricorythopsis yacutinga Molineri, 2001

MATERIAL EXAMINED. Amaraji, Amaraji River, Cachoeira do Amor, 08°26'34.1" S, 035°24'22.1" W, 9 I♂ (light trap), 05.ii.2011, L.R.C. Lima, G. Nicacio cols. (CEUFPE); Jaqueira, Pirangi River, PE-126 próximo a ponte, 08°44'53.0" S, 035°48'51.1" W, 189 m, 76 I♂ (light trap), 23.v.2012, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE); Amaraji, Poço do Carreiro, Amaraji River, 08°22'1.9" S, 35°28'8.7" W, 269 m, 65 I♂ (light trap), 28.iv.2012, L.R.C. Lima coll. (DZRJ). Amaraji, Amaraji River, near to Campo Belo Plant, 08°21'48.9" S, 035°28'49" W, 320 m, 6 I♂ (light trap), 28.iv.2012, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE).

DISTRIBUTION. Brazil: Rio Grande do Sul. Argentina.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

Tricorythopsis undulatus (Allen, 1967)

MATERIAL EXAMINED. Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49" W, 320 m, 17 I♂ (light trap), 21.iv.2012, L.R.C. Lima, W.R.M. Souza cols. (DZRJ).

DISTRIBUTION. Brazil: Espírito Santo and Paraná. Argentina.

REMARKS. Its presence in this study represents the first record of this species to Northeast region.

Family Leptophlebiidae

Simothraulopsis (Simothraulopsis) demerara (Traver, 1947)

MATERIAL EXAMINED. Amaraji, Amaraji River, near to Usina Campo Belo, 08°21'48.9" S, 035°28'49" W, 320 m, 2 I♂ (light trap), 21.iv.2012, L.R.C. Lima, W.R.M. Souza cols.; same data except 28.iv.2012, 9 I♂ (light trap); same data except 11.v.2013, 9 I♂ (light trap); Tamandaré, Biological Reserve of Saltinho, Mamucabas stream Point 1, próximo ao açude, 08°43'21.6" S, 035°11'14.0" W, 90 m, 16 I♂ (light trap), 09.viii.2012, L.R.C. Lima & W.R.M. Souza cols.; same data except 27.iii.2014, 6 I♂.

DISTRIBUTION. Brazil: Amapá, Espírito Santo and Pará. Colombia, French Guiana, Suriname and Venezuela.

REMARKS. This species had been misidentified as *Simothraulopsis (Maculognathus) sabalo* by Lima et al. (2012, Figures 13-18). Comparing our material with reared imagos of *S. (M.) sabalo* by Nascimento (2014)

we conclude that previous material belongs to *S. (S.) demerara*, due mainly to the abdominal color pattern and by the absence of a reentrancy on the base of forceps segment I in the imago. Its presence here represents the first record from Northeastern region of Brazil.

Ulmeritoides flavopedes (Spieth, 1943)

(Figure 3C)

MATERIAL EXAMINED. Moreno, Jaboaão River, near to water treatment plant of COMPESA, 08°06'54.9" S, 035°07'00.2" W, 102 m, 3 N, I. Arruda coll. (CEUFPE).

DISTRIBUTION. Brazil: Mato Grosso and Roraima. Suriname.

REMARKS. Its presence in this study represents the first record of this species from Northeastern region of Brazil.

Family Polymitarcyidae

***Asthenopus* sp.**

MATERIAL EXAMINED. Vicência, Engenho Embú waterfall, 07°37'22.2" S, 035°22'51.3" W, 186 m, 2 I♀ (light trap), 13.xi.2011, L.R.C. Lima, W.R.M. Souza cols. (CEUFPE).

REMARKS. Due to lack of male adult specimens, species identification cannot be done. Its presence represents the first record of the genus to Northeastern region of Brazil.

Campsurus truncatus Ulmer, 1920

(Figure 2D)

MATERIAL EXAMINED. Belo Jardim, Fazenda Boa Vista do Ipojuca, 2 I♀, 16.iv.2006, M.J.A. Medeiros coll. (CEUFPE); Tamandaré, Biological Reserve of Saltinho, Mamucabas stream, Point 1, near to pond, 08°43'21.6" S, 035°11'14.0" W, 90 m, 12 I♀ and 8 I♂ (light trap), 13.xi.2011, L.R.C. Lima & W.R.M. Souza cols. (CZNC).

DISTRIBUTION. Brazil: Espírito Santo. Bolivia.

REMARKS. Its presence in this study represents the first record of this species from Northeastern region of Brazil.

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LITERATURE CITED

- Boldrini R., P.V. Cruz, F.F. Salles, E.L. Belmont and N. Hamada. 2012. Baetidae (Insecta: Ephemeroptera) from northeastern Brazil. Check List 8(1): 88-94. <http://www.checklist.org.br/getpdf?SL105-11>
- Cruz P.V., E.L. Belmont, R. Boldrini and N. Hamada. 2011.

- Leptohiphidae (Insecta: Ephemeroptera) from Northeastern Brazil. *Neotropical Entomology* 40(6): 682–688. doi: [10.1590/S1519-566X2011000600008](https://doi.org/10.1590/S1519-566X2011000600008)
- Lima L.R.C., F.F. Salles, U.S. Pinheiro and E. Quinto. 2010. Espécies de Baetidae (Ephemeroptera) do Sul da Bahia, Brasil, com descrição de uma nova espécie de *Paracloeodes* Day. *Neotropical Entomology* 39(5): 725–731. doi: [10.1590/S1519-566X201000500009](https://doi.org/10.1590/S1519-566X201000500009)
- Lima L.R.C., F.F. Salles and U. Pinheiro. 2012. Ephemeroptera (Insecta) from Pernambuco state, Northeastern Brazil. *Revista Brasileira de Entomologia* 56(3): 304–314. doi: [10.1590/S0085-56262012005000043](https://doi.org/10.1590/S0085-56262012005000043)
- L.R.C. Lima, P.V. Cruz and U. Pinheiro. 2013a. The adult stage of *Paracloeodes charrua* Emmerich & Nieto, 2009 (Ephemeroptera: Baetidae). *Zootaxa* 3640(4): 597–600. doi: [10.11646/zootaxa.3640.4.8](https://doi.org/10.11646/zootaxa.3640.4.8)
- L.R.C. Lima, R. Mariano and Pinheiro U. 2013b. New species for *Thraulodes* Ulmer, 1920 (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) and the first key to adults from Brazil. *Zootaxa* 3709(3): 230–242. doi: [10.11646/zootaxa.3709.3.2](https://doi.org/10.11646/zootaxa.3709.3.2)
- Lima L.R.C., E.A. Raimundi, U. Pinheiro and F.F. Salles. 2014. A new species of *Miroculis* Edmunds, 1963 (Ephemeroptera: Leptophlebiidae) from Northeastern Brazil. *Zootaxa* 3795(4): 441–448. doi: [10.11646/zootaxa.3734.5.9](https://doi.org/10.11646/zootaxa.3734.5.9)
- Massariol F.C., L.R.C. Lima, U.S. Pinheiro, L.G.O. Queiroz and F.F. Salles. 2013. Two-winged *Cloeodes* in Brazil: new species, stage description, and key to South American species. *Journal of Insect Science* 13(60): 1–20. doi: [10.1673/031.013.6001](https://doi.org/10.1673/031.013.6001)
- Nascimento J.M.C. 2014. Sistemática de *Simothraulopsis* Demoulin, 1966 (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) [M. Sc. Dissertation pp]. Manaus: Instituto Nacional de Pesquisas da Amazônia. 176 pp.
- Salles F.F., E.R. Da-Silva, M. Hubbard and J.E. Serrão. 2004a. As espécies de Ephemeroptera (Insecta) registradas para o Brasil. *Biota Neotropica* 4(2): 1–34. doi: [10.1590/S1676-06032004000200011](https://doi.org/10.1590/S1676-06032004000200011)
- Salles F.F., E.R. Da-Silva, J.E. Serrão and C.N. Francischetti. 2004b. Baetidae (Ephemeroptera) na região sudeste do Brasil: novos registros e chave para os gêneros no estágio ninfal. *Neotropical Entomology* 33(6): 725–735. doi: [10.1590/S1519-566X2004000600010](https://doi.org/10.1590/S1519-566X2004000600010)
- Salles F.F., J.M.C. Nascimento, F.C. Massariol, K.B. Angeli, P.B. Silva, J.A. Rúdio and R. Boldrini. 2010. Primeiro levantamento da fauna de Ephemeroptera (Insecta) do Espírito Santo, sudeste do Brasil. *Biota Neotropica* 10(1): 293–307. <http://www.biotaneotropica.org.br/v10n1/pt/abstract?inventory+bno2610012010>
- Salles F.F., R. Boldrini, J.M.C. Nascimento, K.B. Angeli, F.C. Massariol and E. Raimundi. 2015. Ephemeroptera do Brasil. Accessed at <http://ephemeroptera.com.br/>. Date of access: 1 January 2015.
- Shimano Y., H.S.R. Cabette, F.F. Salles and L. Juen. 2010. Ephemeroptera (Insecta) ocorrentes no Leste do Estado do Mato Grosso, Brasil. *Iheringia, Série Zoologia* 100(4): 301–308. <http://www.biotaneotropica.org.br/v11n4/en/abstract?inventory+bno2011042011>
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- APPENDIX 1.** Species of mayflies (Ephemeroptera: Insecta) recorded to state of Pernambuco (*new records of species; ** new generic records).
- Baetidae**
Adebrotus Lugo-Ortiz & McCafferty, 1995
Adebrotus lugoi Salles, 2010 **
- Americabaetis* Kluge, 1992
Americabaetis alphas Lugo-Ortiz & McCafferty, 1996
Americabaetis labiosus Lugo-Ortiz & McCafferty, 1996
- Apobaetis* Day, 1955
Apobaetis fuizai Salles & Lugo-Ortiz, 2002
- Aturbina* Lugo-Ortiz & McCafferty, 1996
Aturbina beatrixae Gillies, 2001
Aturbina georgei Lugo-Ortiz & McCafferty, 1996 *
- Baetodes* Needham & Murphy, 1924
Baetodes santatereza Salles & Polegatto, 2008
- Callibaetis* Eaton, 1881
Callibaetis gonzalezi (Navás, 1934)
Callibaetis guttatus Navás, 1915
Callibaetis pollens Needham & Murphy, 1924
- Camelobaetidius* Demoulin, 1966
Camelobaetidius billi Thomas & Dominique, 2000
Camelobaetidius cayumba (Traver & Edmunds, 1968)
Camelobaetidius francischetti Salles, Andrade & Da-Silva, 2005
Camelobaetidius lassance Salles & Serrão, 2005
- Cloeodes* Traver, 1938
Cloeodes hydration McCafferty & Lugo-Ortiz, 1995
Cloeodes irvingi Waltz & McCafferty, 1987
Cloeodes maracatu Lima, Pinheiro & Massariol, 2013
- Cryptonympha* Lugo-Ortiz & McCafferty, 1998
Cryptonympha dasilvai Lugo-Ortiz & McCafferty, 1998
- Harpagobaetis* Mol, 1986
Harpagobaetis gulosus Mol, 1986
- Paracloeodes* Day, 1955
Paracloeodes charrua Emmerich & Nieto, 2009
Paracloeodes leptobranchnus Lugo-Ortiz & McCafferty, 1996 *
- Waltzoyphius* McCafferty & Lugo-Ortiz, 1995
Waltzoyphius fasciatus Lugo-Ortiz & McCafferty, 1995
- Zelus* Lugo-Ortiz & McCafferty, 1998
Zelusio principalis Lugo-Ortiz & McCafferty, 1998
- Caenidae**
Brasilocaenis Puthz, 1975
Brasilocaenis septentrionalis Malzacher, 1990**
- Caenis* Stephens, 1835
Caenis chamie Alba-Tercedor & Mosquera, 1999 *
Caenis cuniana Froehlich, 1969 *
Caenis fittkaui Malzacher, 1986 *
Caenis sp.
- Leptohiphidae**
Leptohiphes Eaton, 1882
Leptohiphes petersi Allen, 1967
- Traverhyphes* Molineri, 2001
Traverhyphes (Mocoihyphes) edmundsi (Allen, 1973)
Traverhyphes (Traverhyphes) frevo Lima, Salles & Pinheiro, 2011
Traverhyphes (Traverhyphes) pirai Molineri, 2001
- Tricorythodes* Ulmer, 1920
Tricorythodes mirca Molineri, 2002
Tricorythodes bullus (Allen, 1967) *
- Tricorythopsis* Traver, 1958
Tricorythopsis chiriguano Molineri, 2001 *
Tricorythopsis gibbus (Allen, 1967) *
Tricorythopsis sigillatus Molineri *
Tricorythopsis spongicola Lima, Salles & Pinheiro, 2011
Tricorythopsis yacutinga Molineri, 2001 *
Tricorythopsis undulatus (Allen, 1967) *
- Leptophlebiidae**
Farrodes Peters, 1971
Farrodes tepui Dominguez, Molineri & Peters, 1996
- Fittkaulus* Savage & Peters, 1978
Fittkaulus cururuensis Savage, 1986
- Hermanella* Needham & Murphy, 1924
Hermanella froehlichii Ferreira & Dominguez, 1992

Hermanella maculipennis (Ulmer, 1920)
Hydrosmilodon Flowers & Domínguez, 1992
Hydrosmilodon gilliesae Thomas & Péru, 2004
Hydrosmilodon plagatus Lima, Nascimento & Salles, 2012
Leentvaaria Demoulin, 1966
Leentvaaria palpalis Demoulin, 1966
Lisetta Thomas, Dominique & Orth, 2005
Lisetta ernsti Thomas & Dominique, 2005
Miroculis Edmunds, 1963
Miroculis fittkawi Savage & Peters, 1983
Miroculis stenopterus Lima, Raimundi, Pinheiro & Salles, 2014
Needhamella Domínguez & Flowers, 1989
Needhamella ehrhadi (Ulmer, 1920)
Simothraulopsis Demoulin, 1966
Simothraulopsis (Simothraulopsis) demerara (Traver, 1947) *

Simothraulopsis janae Mariano, 2010
Terpides Demoulin, 1966
Terpides sooretamae Boldrini & Salles, 2009
Thraulodes Ulmer, 1920
Thraulodes luizgonzagai Lima, Mariano & Pinheiro, 2013
Thraulodes sternimaculatus Lima, Mariano & Pinheiro, 2013
Ulmeritoides Traver, 1959
Ulmeritoides flavopedes (Spieth, 1943) **

Polymitarcyidae

Asthenopus Eaton, 1871
Asthenopus sp. **
Campsurus Eaton, 1868
Campsurus duplicatus Spieth, 1943
Campsurus truncatus (Ulmer, 1920)*