



New species and new records of *Miroculis* Edmunds (Ephemeroptera: Leptophlebiidae) from Southeastern Brazil

F.F. SALLES¹ & M.M. LIMA²

¹Depto. de Ciências da Saúde, Biológicas e Agrárias, Centro Universitário Norte do Espírito Santo, Universidade Federal do Espírito Santo, CEP 29.933-415, São Mateus, ES, Brazil. E-mail: ffsalles@gmail.com

²Programa de Pós-graduação em Entomologia, Depto. De Biologia Animal, Universidade Federal de Viçosa, CEP 36.570-000, Viçosa, MG, Brazil

Abstract

In the present work, based mainly on material from environmental protection areas in the State of Espírito Santo, we describe a new species of *Miroculis* (*Miroculis*). The male imago of *M. (M.) caparaoensis*, **sp. nov.** can be distinguished from other members of the subgenus by the following combination of characteristics: 1) dorsal portion of eyes on a short stalk, dorsal upper portion circular with 12–18 large-sized facets in longest row; 2) forewings with membrane translucent, longitudinal and crossveins brown; 3) abdominal color pattern; 4) posteromedian margin of styliger plate with small concavity; 5) penes length approximately 0.70 length of forceps segment 1. *Miroculis (Ommaethus) mourei* and *M. (M.) fittkai* are reported for the first time from the region.

Key words: Taxonomy, Neotropics, mayfly, Caparaó, Atlantic Forest

Introduction

The genus *Miroculis* Edmunds (Ephemeroptera: Leptophlebiidae) is currently composed of 14 described species, ranging from Northeastern Argentina to Trinidad (Domínguez 2007, Peters *et al.* 2008). In Brazil *Miroculis* is one of the most species rich genera of Leptophlebiidae, with eight species recorded until now (Domínguez *et al.* 2006). In spite of this, we can consider that the genus has been poorly studied in the country, since most of these records are based on the original description and no other species has been described since the revision of the genus by Savage & Peters (1983).

In the present paper, as part of an effort to study the mayfly fauna of the State of Espírito Santo, we describe a new species of *Miroculis* (*Miroculis*), and extend the distributional range of two species, *Miroculis (Ommaethus) mourei* Savage & Peters, and *M. (M.) fittkai* Savage & Peters.

The material examined is housed in the following institutions: Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil; Entomological Collection of the Universidade Federal do Espírito Santo (UFES), Vitória, Brazil; and Collection of the Laboratório de Diversidade de Insetos Aquáticos of the Universidade Federal do Espírito Santo (CEUNES), São Mateus, Brazil.

Results

Miroculis (Miroculis) caparaoensis, **sp. nov.**

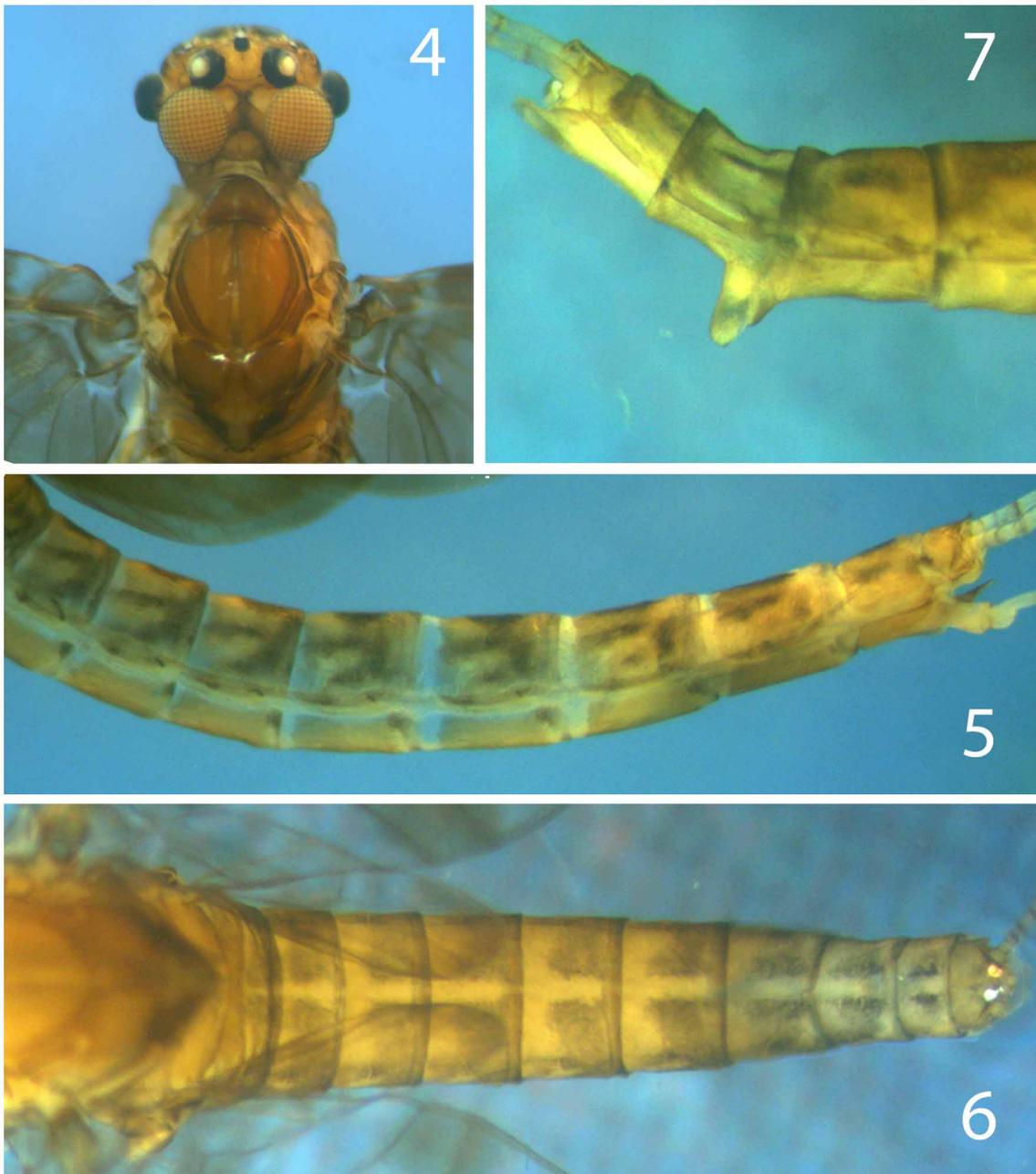
Description. *Nymph.* Unknown.

Male imago (Figs. 1–2).

Maximal length: Body 5.75–7.1 mm; Cerci broken; Forewing 5.9–6.4 mm; Hind wing 1.6–1.8 mm; Prothoracic legs, 5.40–5.75 mm.



FIGURES 1–3. *M. (M.) caparaoensis*, **sp. nov.**, imagos. 1. Lateral view of male imago; 2. Dorsolateral view of male imago and nymphal exuvia; 3. Dorsolateral view of female subimago.



FIGURES 4–7. *M. (M.) caparaoensis*, **sp. nov.**, imagos. 4. Dorsal view of head and thorax of male imago; 5. Lateral view of abdomen of male imago; 6. Dorsal view of abdomen of female; 7. Lateral view of abdominal segments VI–X of female.

Head (Figs. 1, 2, 4). Orangish-brown at base of eyes, darker anteriorly, pale between ocelli. *Eyes*: Lower portion black; apex of upper portion separated on meson of head by a length 0.4–0.6 width of an upper portion; dorsal portion of eyes on a short stalk; dorsal upper portion circular with 12–18 large-sized facets in longest row, facets orange with dark brown grooves. Ocelli white surrounded with dark brown. *Antenna*: scape translucent yellow, pedicel brown washed with grey and flagellum brownish.

Thorax (Figs. 1, 2, 4). Pronotum orangish-brown heavily washed with black on lateral margins. Mesonotum and metanotum orangish-brown. Pleura and sterna light-brown with margins dark brown. *Wings* (Figs. 8–11): Membrane translucent with longitudinal and crossveins brown. Base of Sc and R paler. Crossveins between C, Sc and R dark brown. Bulla prominent on Sc and major branches of RS. Base of forewings with unpigmented patches, apical half hyaline with crossveins surrounded with brown. Hind wings brown with few light-brown areas. *Legs*: ratio of segments in prothoracic legs, 0.50–0.51: 1.00 (2.15–2.20 mm): 0.01–0.01: 0.29–0.31: 0.23–0.24: 0.17–0.20: 0.07–0.08. Coxae brown, femora, tibiae and tarsi whitish to light brown with subapical blackish bands on femora and tibiae. Fore femora with apical brownish band.

Abdomen (Fig. 5). Terga brown. Tergum I completely washed with black; terga II–VI translucent with three longitudinal blackish marks; one submedian, one sublateral and one lateral. Basal half of terga II–VI washed with black except between submedian marks. All terga with narrow posterior blackish bands. Sterna brown. Sterna I–VI translucent. Sterna II–VIII with dark mark on posterolateral corners. *Caudal filaments*: light brown with dark brown bands at apex of each segment (broken off apically and missing).

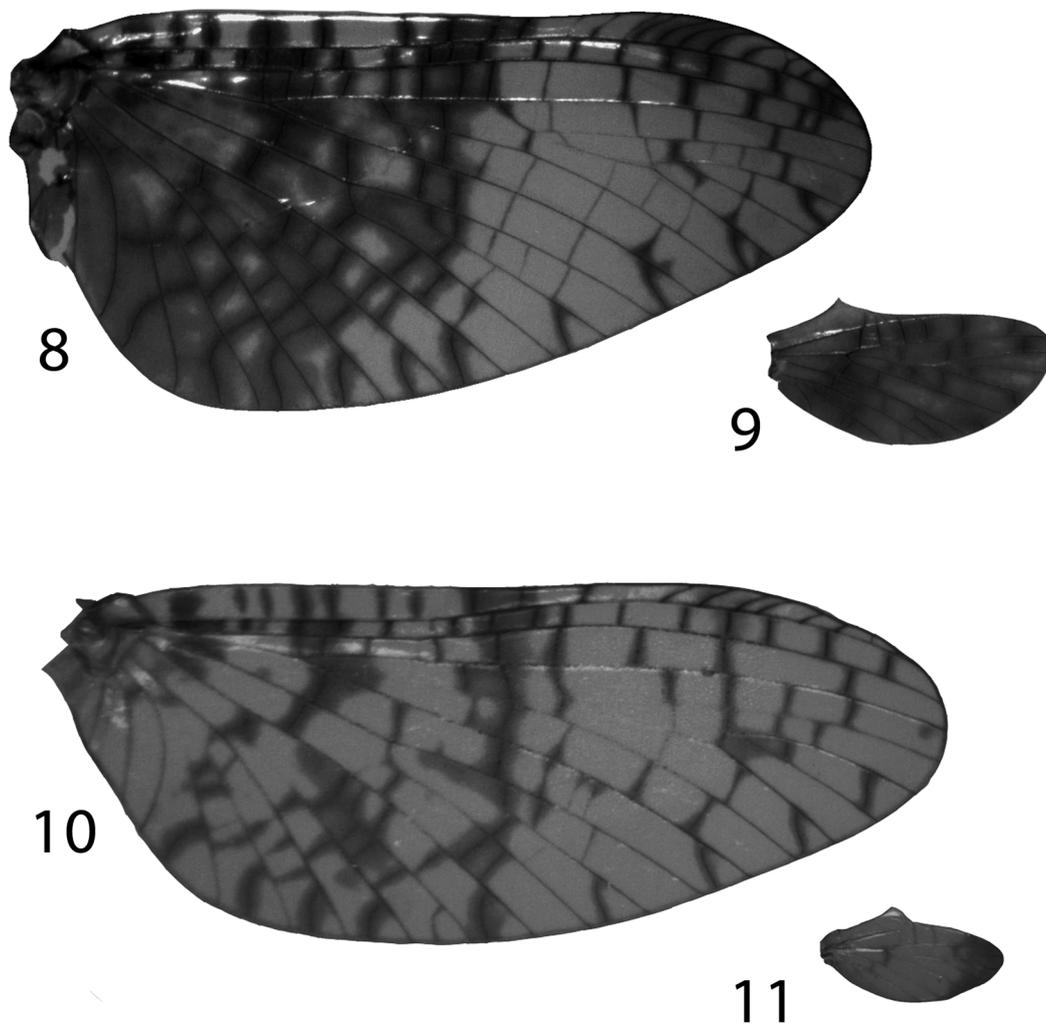
Genitalia (Figs. 12–13). *Forceps*: segment 3 from 0.80 length of segment 2. Segment 2 from 0.45 length of segment 1; Styliger plate: maximum length approximately 0.65 maximum width; posteromedian margin brown with small concavity. *Penes*: length approximately 0.70 length of forceps segment 1, apex as in Fig. 13; dark brown.

Female imago (Fig. 3).

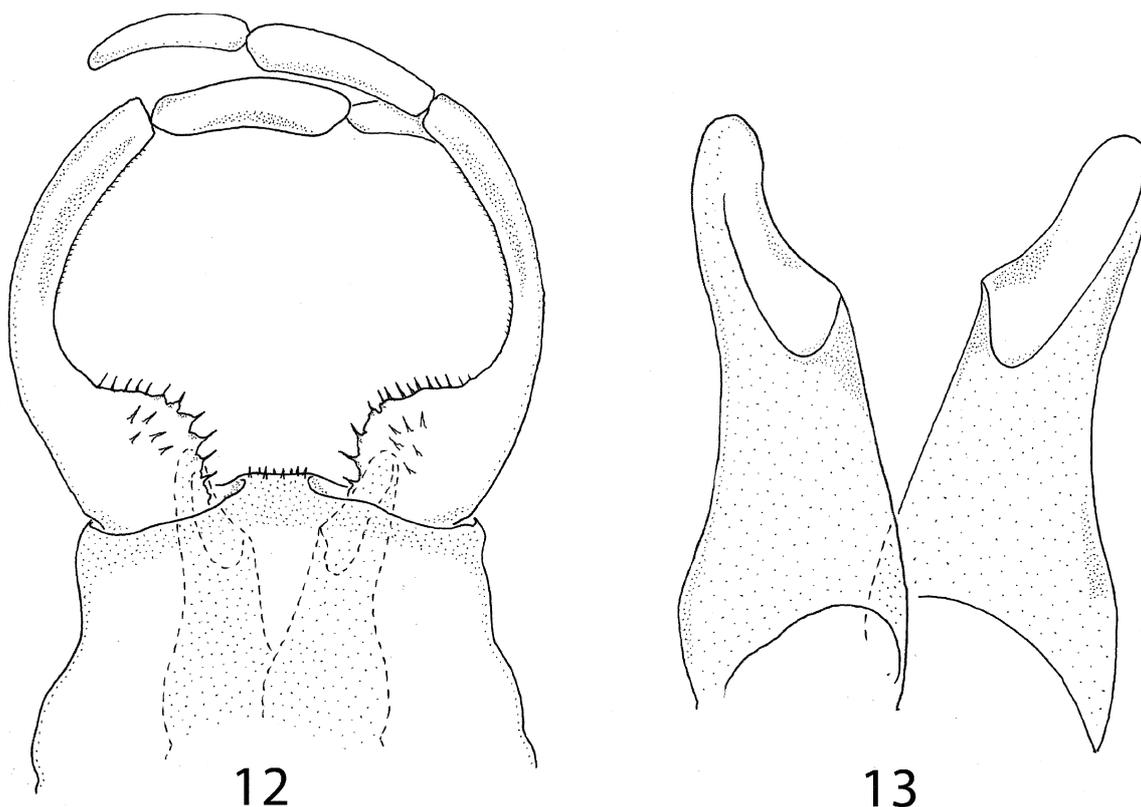
Maximal length: Body 4.9–5.8 mm; Cerci broken; Forewing 5.3–6.1 mm; Hind wing 1.0–1.1 mm.

Head: yellowish-brown washed with grey and with submedian blackish mark near posterior margin. *Eyes*: black. Ocelli white surrounded with black. *Antenna*: scape translucent yellow, pedicel yellowish-brown washed with grey and flagellum yellowish-brown.

Thorax: pronotum yellowish washed with grey with blackish lateral margins and a submedian blackish mark; meso and metanotum as in male, except for yellowish background. *Wings* (Figs. 10–11): Forewings hyaline with cross veins surrounded with brown, often forming two bands. Hind wings hyaline with cross veins and apical third washed with brown. *Legs*: coloration as in male except for absence of apical mark on fore femora.



FIGURES 8–11. *M. (M.) caparaensis*, sp. nov., imagos. 8. Male forewing; 9. Male hind wing; 10. Female forewing; 11. Female hind wing.



FIGURES 12–13. *M. (M.) caparaoensis*, **sp. nov.**, male imago. 12. Genitalia, ventral view; 13. Detail of penes.

Abdomen (Figs. 6–7): Abdominal color pattern as in male except that segments II–VI are not translucent; posterior margin of sternum 7 and anterior margin of sternum 8 forming a relatively long genital extension, nearly one half of sternum 8 (Fig. 7); sternum 9 with apical cleft.

Etymology. After Caparaó National Park, type locality of the new species.

Distribution. BRAZIL: Espírito Santo and Minas Gerais states.

Material examined. HOLOTYPE: Male imago, BRAZIL, Espírito Santo State, Parque Nacional do Caparaó, Pedra Roxa, afluyente do Rio Pedra Roxa, 20° 23' 48,1" S / 41° 44' 08,1" W, 1063 m, 20/iv/2008, F.F. Salles and M.M. Lima cols (UFES); **PARATYPES:** nine male imagos, same data as holotype (four at CEUNES, five at INPA); six female imagos, same data as holotype (three at CEUNES, three at INPA).

Additional examined material: Two male imagos, BRAZIL, Minas Gerais State, Araponga, Camping Vale das Luas, 21–23/x/2005, F.F. Salles and M.M. Lima cols. (CEUNES).

Discussion. *Miroculis (M.) caparaoensis* **sp. nov.** is distinguished by the following combination of characteristics:

In the male: 1) dorsal portion of eyes on a short stalk, dorsal upper portion circular with 12–18 large-sized facets in longest row; 2) forewings with membrane translucent, longitudinal and crossveins brown; 3) abdominal color pattern as in Figs. 5–6; 4) posteromedian margin of styliger plate with small concavity; 5) penes length approximately 0.70 length of forceps segment 1, apex as in Fig. 13.

In the female: 1) Wings hyaline with cross veins surrounded with brown, often forming two bands; 2) abdominal color pattern as in Figs. 5–6; 3) posterior margin of sternum 7 and anterior margin of sternum 8 forming a relatively long genital extension.

Using the key to male imagos proposed by Domínguez *et al.* (2006), *M. (M.) caparaoensis*, **sp. nov.**, would key out in couplet 6(5), which includes *M. (M.) fittkai* and *M. (M.) nebulosus*. The new species differs from *M. (M.) fittkai* in that the wing marks are broader, the penes are small and not apically hooked, as well as the number of facets in male compound eyes (12–18 in the new species, 5–8 in *M. (M.) fittkai*). Regarding *M. (M.) nebulosus*, the size of the penis (0.70 length of forceps segment 1 in the new species, 1.5 in *M. (M.) nebulosus*) clearly distinguishes them.

Miroculis (Ommaethus) mourei Savage & Peters 1983

Savage & Peters, 1983: 561 (male, female, nymph); Domínguez *et al.*, 2006: 448.

Comments. This species has been reported exclusively from its type-locality, in the State of Paraná; the new record represents a northward extension of its distribution. The specimens examined fit well with the description given by Savage & Peters (1983), except for the coloration of the male forceps. According to them the distal 1/3 of the first segment, the second and the third segment are washed with black, whereas in the material we have examined this pigmentation is restricted to the distal 1/3 of the first segment.

Material examined. BRAZIL, Espírito Santo State, Santa Teresa. Three male imagos, Capitel de Santo Antônio, 19° 31' 47.3" S / 40° 31' 47.3" W, 705 m, 20/iv/2008, F.F. Salles and M.M. Lima cols (CEUNES). Four male imagos, same data except, Pinguela, 19° 52' 16.0" S / 40° 31' 43.3" W, 718 m, 26/x/2008 (CEUNES). Four male imagos, Reserva Biológica Augusto Ruschi, 19° 55' 20.7" S / 40° 33' 12.2" W, 825 m, 20/ii/2009, F.F. Salles, F.B. Massariol, J.A. Rúdio, cols (CEUNES).

Miroculis (Miroculis) fittkaui Savage & Peters 1983

Savage & Peters, 1983: 529 (male, female, nymph); Savage, 1983: 130; Savage, 1987: 103 (male); Domínguez *et al.*, 2006: 445; Lopes *et al.* 2007: 142.

Comments. This species has been reported from its type-locality, Pará State, Brazil, besides Surinam and Venezuela (Savage & Peters 1983, Savage 1987); the new record represents a significant southeastern extension of its distribution. The specimens examined fit well with the descriptions given by Savage & Peters (1983) and Savage (1987).

Material examined. Three male imagos, BRAZIL, Espírito Santo State, Reserva Biológica de Sooretama, Rio Quirininho (dentro da reserva), 19° 02' 72.2" S / 19° 02' 72.2" W, 69 m, 18/ii/2008, F.F. Salles col. (CEUNES).

Acknowledgements

The authors wish to express their gratitude to Angela Brunner da Rocha, for logistic support and for allowing our team to work on her property in Santa Teresa; the staff from Reserva Biológica Augusto Ruschi, Parque Nacional do Caparaó and Reserva Biológica de Sooretama for logistic support; ICMBio (Instituto Chico Mendes de Conservação da Biodiversidade) and IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) for collection permission (number 16719-1); and FAPES (Fundação de Apoio à Ciência e Tecnologia do Espírito Santo (process number 36327263/2007) for financial support.

References

- Domínguez, E. (2007) A new species of *Miroculis* (Ephemeroptera: Leptophlebiidae) from NE Argentina. *Revista de la Sociedad Entomológica Argentina*, 66 (3–4), 99–102.
- Domínguez, E., Molineri, C., Pescador, M.L., Hubbard, D.M. & Nieto, C. (2006) *Ephemeroptera of South America, Aquatic Biodiversity of Latin America (ABLA Series)*. Sofia-Moscow, 646 pp.
- Peters, J.G., Domínguez, E. & Currea Dereser, A. (2008) Species of *Miroculis* from the Serranía de Chiribiquete in Colombia. (Ephemeroptera: Leptophlebiidae: Atalophlebiinae). In Hauer F.R., Stanford, J.A. & Newell, R.L. (Eds.), *International advances in Ecology, Zoogeography and Systematics of mayflies and stoneflies*. University of California Publications in Entomology, vol. 128, pp. 295–305.
- Savage, H.M. (1987) Two new species of *Miroculis* from Cerro de la Neblina, Venezuela with new distribution records for *Miroculis fittkaui* and *Microphlebia surinamensis* (Ephemeroptera: Leptophlebiidae). *Aquatic Insects*, 9, 97–108.
- Savage, H.M. & Peters, W.L. (1983) Systematics of *Miroculis* and related genera from Northern South America (Ephemeroptera: Leptophlebiidae). *Transactions of the American Entomological Society*, 108, 491–600.