

A new species of the genus *Spiritiops* Lugo-Ortiz & McCafferty (Ephemeroptera, Baetidae) from the Pantepui biogeographical province

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Abstract

The genus *Spiritiops* was described by Lugo-Ortiz & McCafferty in 1998. Since then, only the type species, *S. silvudus*, was reported from different countries, such as Brazil, French Guiana, Surinam and Venezuela. In the last years, various international speleological expedition explored summits of some table mountains called tepuis in Guyana region in south-eastern Venezuela. Here we describe a new species of the genus *Spiritiops*, found at three tepuis (Auyán-tepui, Churí-tepui and Mt. Roraima) during above mentioned speleological expeditions.

Key words: Venezuela, tepui, taxonomy, systematic, *Baetodes* complex

Resumen

El género *Spiritiops* fue descrito por Lugo-Ortiz & McCafferty en 1998. Desde su descripción solo la especie tipo, *S. silvudus*, fue reportada para diferentes países, tales como Brasil, Guayana Francesa, Surinam y Venezuela. En los últimos años, varias expediciones espeleológicas internacionales exploraron las cimas aplanadas de las mesetas llamadas Tepuyes en la región de las Guyanas en el sur este de Venezuela. En este trabajo describimos una especie nueva del género *Spiritiops*, colectadas en 3 tepuyes (Auyán-tepui, Churí-tepui y Mt. Roraima) durante las mencionadas expediciones espeleológicas.

Palabras claves: Venezuela, tepui, taxonomía, sistemática, complejo *Baetodes*

Introduction

The genus *Spiritiops* was described by Lugo-Ortiz & McCafferty in 1998 based on nymphs from Brazil and French Guiana. Later, Salles & Nieto (2008) described the adults from Brazil. Since then, only the type species, *S. silvudus* Lugo-Ortiz & McCafferty, was reported from other countries, such as Surinam (Salles & Nieto 2008) and Venezuela (Nieto *et al.* 2011). Nieto placed this genus into the *Baetodes* complex by the presence of strong subapical setae in the tarsal claws (Node B, Fig. 73: Nieto 2010). *Spiritiops* was recovered at the base of the complex which includes: *Baetodes* Needham & Murphy, *Lugoiops* McCafferty & Baumgardner, *Mayobaetis* Waltz & McCafferty, *Moribaetis* Waltz & MacCafferty and *Prebaetodes* Lugo-Ortiz & McCafferty.

In last years, various international speleological expedition explored summits of some table mountains called tepuis in Guyana region in south-eastern Venezuela (Fig. 1) (Šmída *et al.* 2003, 2010; Aubrech *et al.* 2011). The ecological community of summits of tepuis is considered a distinct and discontinuous biogeographical province called Pantepui (Mayr & Phelps 1967). The Pantepui ranges from 1,500 to 3,000 m a.s.l. covering an area of about 5,000 km² (Berry *et al.* 1995; Huber 1995). Flat summits are known for high levels of endemism (Huber 2005; Rull 2005; Rull & Nogué 2007). It is true also for the fauna of water streams (Spangler & Faitoute 1991; Čiampor & Kodada 1999; Issa & Jaffe 1999; Derka & Fedor 2010). Black water streams with bedrock bottoms, cascades and

waterfalls, long and deep pools the most common type of running waters. The total absence of hyporheic environment is a typical attribute of Pantepui streams (pers. observ) with small streams, only locally and with thin depositions of sand and gravel. Another important factor is very low water retention capacity of watersheds responsible for violent discharge fluctuations (pers. observ.). Moreover, the streams are extremely oligotrophic, low in minerals (conductivity usually ranging between 10 and 20 $\mu\text{S}\cdot\text{cm}^{-2}$), acid (pH 3.5–5.5) and may contain high concentrations of organic compounds leached from vegetation (Aubrecht *et al.* 2011). Although mayfly nymphs are common component of benthic invertebrate communities of Pantepui streams, only few mayfly species have been reported (Derka *et al.* 2009; Nieto & Derka 2011). Here we describe a new species of the genus *Spiritiops*, found at three tepuis (Auyán-tepui, Churí-tepui and Mt. Roraima) during above mentioned speleological expeditions.

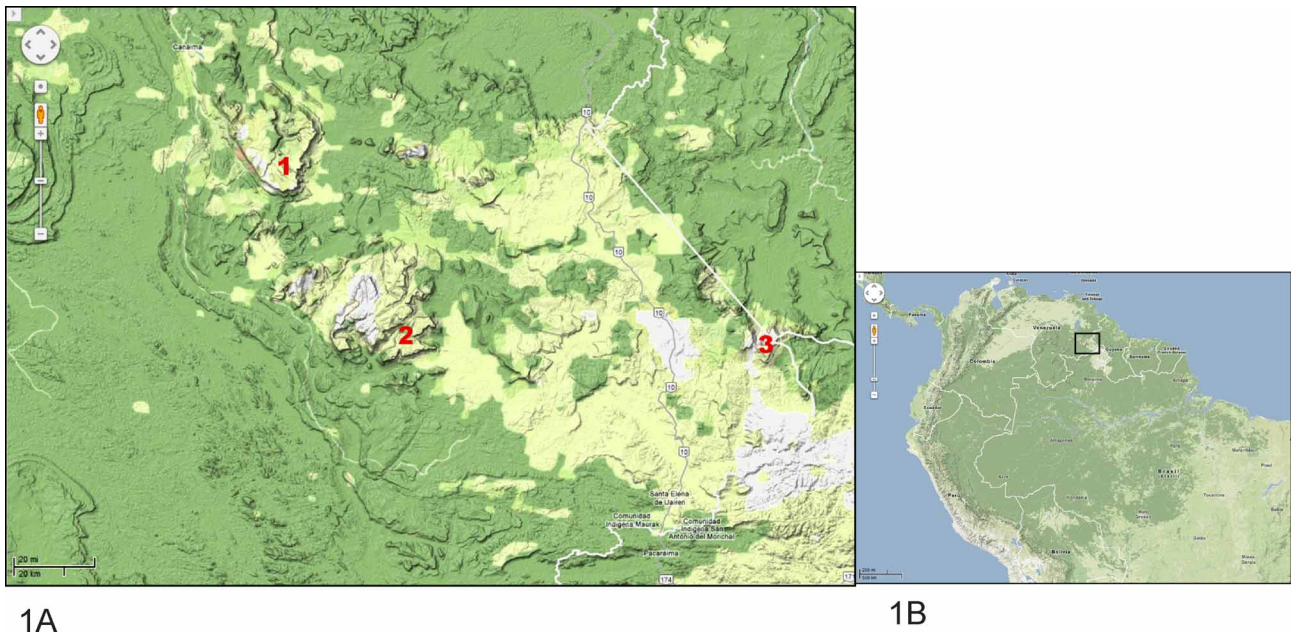


FIGURE 1. Maps. 1A: Sampling Sites, 1, Auyan Tepui; 2, Churi Tepui; 3, Roraima Tepui. 1B: Global location.

Material and methods

Nymphs were collected from all submerged substrates or microhabitats by manually picking the specimens or using a hydrobiological net. Adults were collected by entomological hand net. Some subimagines were captured and reared. Material was preserved in ethyl alcohol 96°. Dissected parts of the specimens studied were mounted on microscope slides using Canada balsam as mounting media. All the material is preserved in ethyl alcohol 96°. Line drawings were done using a camera lucida attached to a microscope. The pictures of adult and nymph were taken using a NIKON SMZ-10 stereomicroscope or an OLYMPUS BX-51 microscope, with a Nikon D5000 digital camera. For some of the pictures a series of partially focused images were processed with the program Combine ZP to produce final images with enhanced quality.

The material are housed at Instituto Miguel Lillo, Tucumán, Argentina (IML); Museo del Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay, Venezuela (MIZA); and Department of Ecology, Faculty of Natural Sciences, Comenius University, Mlynská dolina, Bratislava, Slovakia (FNS).

Results

Spiritiops Lugo-Ortiz & McCafferty, 1998

Spiritiops Domínguez *et al.* 2006; Salles & Nieto 2008; Nieto *et al.* 2011.

Diagnosis. This genus can be distinguished from the other genera of the family by the following combination of characters. In the nymph, 1) labrum, anterior margin with bifid bipectinate setae; 2) mandibles with incisors fused apically, prosthecae robust; 3) right mandible with setae between prostheca and mola, prostheca with transverse bipectinate seta; 4) maxillae with palpi two-segmented, segment II with a constriction; 5) labium with glossae subequal to paraglossae, glossae with a row and paraglossae with 3 rows of spine-like setae, segment II of palpi with slight distomedial projection, segment III small and conical; 6) legs robust, dorsal edge of femora with a row of spine-like setae; 7) tarsal claws with two rows of denticles and with a strong subapical seta; 8) hind wing pads present; 9) posterior margin of paraprocts with spines. In the adults, 1) fore wings with paired long marginal intercalary veins; 2) hind wings with two complete longitudinal veins, and a single marginal vein; 3) costal projection of the hind wings broadly pointed, broad at base and placed in the basal third of anterior margin; 4) forceps three-segmented, second segment basally constricted and third segment elongate and narrow.

Key to mature nymphs of *Spiritiops*

- 1 Nymphs bigger (more than 8 mm); labrum (Fig. 6a) dorsally with a row of subapical long setae; abdominal color pattern (Fig. 3) with segments II–VII with a pair of reddish spot laterally *S. tepuiensis* sp. nov.
Nymphs smaller (less than 5 mm); labrum (Nieto *et al.* 2011, Fig. 57a) dorsally with 2 pairs of subapical long setae; abdominal color pattern with segments III–IV, VI–VII brownish with faint small spots anteriorly in midregion (Nieto *et al.* 2011, Fig. 7).
..... *S. silvudus*

Spiritiops tepuiensis sp. nov.

(Figs. 2–17)

Female imago (Figs. 2, 4–5). Length: body: 10.0–10.7 mm; fore wings: 11.5–11.7 mm; hind wings: 1.5–1.7 mm. Head pale pink, compound eyes and ocelli blackish. Antennae yellowish brown. Thorax (Fig. 2): pronotum pinkish, meso and metanoto yellowish brown, anteronotal protuberance small and rounded. Pleurae and sterna pale yellow. Legs yellowish brown. Wings (Figs. 4–5) hyaline, costal and subcostal spaces of fore wings translucent, veins pigmented with brown. Abdomen pinkish, segment II–VII with a pair of reddish spots near lateral margins. Caudal filaments broken.

Nymphs (Figs. 3, 6–17). Length: body: 8.2–9.5. Antennae: 2.3–2.5 mm. Cerci: 9.5 mm, terminal filament: 4.5 mm. Head yellowish-brown, compound eye orange-brown, ocelli blackish. Antennae yellowish brown. Mouthparts: Labrum (Figs. 6 a–b) wider than long, dorsally with a row of subapical long setae, anterior margin with bipectinate setae and bifid pectinate setae. Left mandible (Fig. 7) without setae between prostheca and mola, tuft of spine-like setae at base of mola absent, prostheca robust with 6–7 denticles. Right mandible (Fig. 8) with setae between prostheca and mola, prostheca robust with four denticles and with a transverse bipectinate setae. Hypopharynx (Fig. 9) with lingua rounded subequal in length to superlinguae. Maxillae (Fig. 10) with double row of pectinated setae on outer margin and two denti-setae, palpi shorter or scarcely subequal in length to galea-lacinia, segment II with a constriction. Labium (Fig. 11) with glossae subequal in length to paraglossae, palpi with segment II with a weak rounded projection.

Thorax, pro, meso and metanoto yellowish brown with no distinct color pattern. Pleurae yellowish brown, sterna pale yellow. Legs (Fig. 12) yellowish brown, femora with a pale spot basally, tibiopatellar suture present more than half the length of tibiae. Tarsal claws with two rows of 7–8 denticles (Fig. 13).

Abdomen (Fig. 3) yellowish-brown. Segment II–VII with a pair of reddish spot laterally, segments II–III and V with a reddish spot along midline, segments II–IX with two small brownish spot in the midline. Posterior margin of each tergum with spines (Fig. 14). Sterna yellowish. Gills (Fig. 15) oblong, translucent, 1.5 times the length of each tergum, well tracheated and dark pigmented. Paraprocts (Fig. 16) with 13–14 spines posteriorly. Caudal filament yellowish brown. Cerci with spines near lateral margin on each segment or every two segments (Fig. 17).

Discussion. This species can be distinguished from the other species of the genus by the following combination of characters: 1) labrum dorsally with a row of subapical long setae (Fig. 6); 2) nymphs bigger, more than 8 mm; 3) abdominal color pattern with segments II–VII with a pair of reddish spot laterally, segments II–III and V with a reddish spot along midline (Fig. 3).



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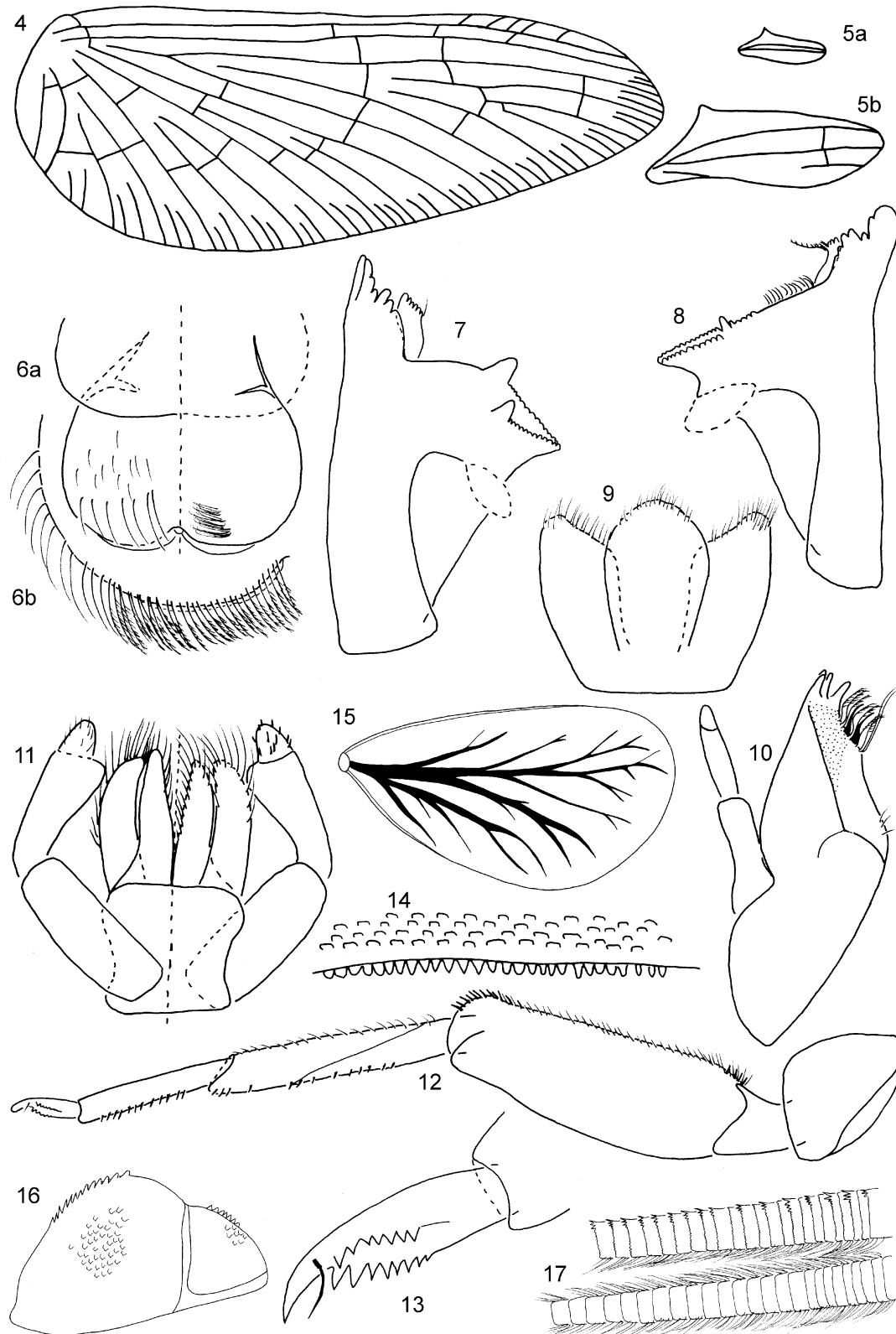
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FIGURES 2–3. *Spiritiops tepuiensis* sp. nov., dorsal habitus. 2, female imago; 3, nymph.

Biology. Nymphs inhabit streams where they prefer sections with stronger currents. They were observed even in a splash zone of small waterfall. They were very abundant in bedrock bottom streams at Churí-tepui and Auyán-tepui. Only one nymphal exuvia was found in one unnamed stream at Mt. Roraima plateau. All material from Mt. Roraima was sampled in spring streams below the plateau.

Etymology. A tepui or tepuy, is a table-top mountain or mesa found in the Guyana Highlands of South America, especially in southern Venezuela. The word tepui means "house of the gods" in the native tongue of the Pemon, the indigenous people who inhabit the Gran Sabana region where the species was found.

Material. Holotype female nymph: **VENEZUELA**, Bolívar Province, NP Canaima; a stream below, Salto Angel, 21.3 °C. 24/ 11/ 2008, T. Derka. Paratypes: three nymphs same locality and collector. 26 nymphs: **Auyán-tepui** massive, Quebrada El Peñón in camp El Peñón, Loc. Ven/ 5/ 2010. N 5° 44' 40.4''; W 62° 32' 29.7'', 1,832 m a.s.l. 8/ 1/ 2010, T. Derka & M. Svitok. 21 nymphs: Tuná Terciopelo (unnamed spring stream) cca 20 min. Below El Peñón camp. Loc. Ven/ 4/ 2010. N 5° 44' 23.3''; W 62° 32' 18.5'', 1,733 m a.s.l. 7/ 1/ 2010, T. Derka & M. Svitok. 35 nymphs: Headwaters of Río Churún cca. 30 min from El Oso camp, Loc. Ven/ 8/ 2010. 9/ 1/ 2010, T. Derka & M. Svitok. Two nymphs: Churún river below Salto Angel (Isla Ratón), 5/ 4/ 2009, T. Derka. 124 nymphs: Río Churún close El Lecho camp, 1,740 m a.s.l., N 5° 49' 34.6''; W 62° 32' 27.9''. Loc. Ven/ 9/ 2010. 10/ 1/ 2010, T. Derka & M. Svitok. 238 nymphs and 1 female imago: Río Oso in El Oso camp, N 5° 47' 1.4''; W 62° 32' 12.5'', 1,733 m a.s.l., Loc. Ven/ 7/ 2010. 9/ 1/ 2010, T. Derka & M. Svitok. Nine nymphs: springs of Río Churún, N 5° 46' 15.6''; W 62° 32' 7.9'', Loc. Ven/ 6/ 2010. 1,851 m a.s.l., 8/ 1/ 2010, T. Derka & M. Svitok. Six nymphs: **Mt.**



FIGURES 4–17. *Spiritiops tepuiensis* sp. nov. Figs. 4–5, female imago. 4, fore wing; 5a, hind wing; 5b, hind wing detail. Figs. 6–17, nymph. Mouthparts (Figs. 6–11): 6a, labrum, left d.v., right v.v.; 6b, labrum anterior margin; 7, left mandible; 8, right mandible; 9, hypopharynx; 10, maxilla; 11, labium, left v.v., right d.v. 12, leg I; 13, tarsal claw. 14, posterior margin of tergum IV. 15, gill IV. 16, paraproct. 17, cerci.

Roraima, spring stream at the La Rampa cca. 100 m below the entrance to the plateau. Loc. R1. cca. 2,600 m a.s.l. 7/ 11/ 2009, T. Derka. 76 nymphs: Roraima base camp, 1,500 m a.s.l. 3/ 2/ 1999. 12 nymphs: **Churí-tepui**, Chim-

antá massive, spring stream below waterfall at Río Olinka, originating in the Cueva Juliana, 2,300 m a.s.l. Loc. 8. 20/ 1/ 2009, T. Derka. 18 female imagos: Quebrada Lila above cueva Charles Brewer. Loc. 6. 21/ 1/ 2009. 30 nymphs: Quebrada Lila a stream at the plateau above cueva Charles Brewer. Loc. 6. cca. 2,400 m a.s.l. 26/ 1/ 2009, T. Derka. Five nymphs: middle reach of Western river. Loc. 14. 2,400 m a.s.l. 24/ 1/ 2009, T. Derka. 74 nymphs: stream above pozo Capuchino, cca. 2,300 m a.s.l. Loc. 7. 16/ 1/ 2009, T. Derka. 39 nymphs and 1 female imago: Río Olinka, stream above waterfall, above Cueva Juliana. Loc. 11. cca. 2,300 m a.s.l. 19/ 1/ 2009. Five nymphs: Gran Sabana, Salto Yuruani. 28/ 1/ 2005. 20 paratypes nymphs and 10 paratype female imago from Quebrada Lila, Loc. 6, housed at MIZA; holotype and 95 paratype nymphs and 4 paratype female imagos from different localities housed at IML; other paratypes at FNS.

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