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Artículos

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Primer registro de ninfas de Atopophlebia (Flowers, 1980) (Ephemeroptera: Leptophlebiidae: Atalophlebiinae) en arroyos venezolanos

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Abstract: In America, the genus *Atopophlebia* (Flowers, 1980) has been recorded in Argentina, Bolivia, Colombia, Costa Rica, Ecuador, Bolivia, Panamá and Perú. This mayfly is here reported for the first time in Venezuela. The nymphs were collected in two streams in the Capaz River Basin in the Venezuelan Andes. An updated description of this genus is also provided. The dark patterns in abdominal segments differ from those in the species reported before by other authors, so it is presumed that this Venezuelan nymph could be a new species.

Keywords: Aquatic insects, Distribution, Mayflies, Streams, Venezuela.

Resumen: En América, el género *Atopophlebia* (Flowers, 1980) ha sido registrado en Argentina, Bolivia, Colombia, Costa Rica, Ecuador, Panamá y Perú. Se reporta aquí por primera vez la presencia de esta mosca de mayo en Venezuela. Las ninfas fueron recolectadas en dos arroyos en la cuenca del río Capaz en los Andes venezolanos. También se proporciona una descripción actualizada de este género. Los patrones oscuros en los segmentos abdominales difieren de los de las especies reportadas anteriormente por otros autores, por lo que se presume que la ninfa hallada podría ser una nueva especie.

Palabras clave: Corrientes, Distribución, Insectos acuáticos, Moscas de mayo, Venezuela.

INTRODUCTION

Chacón et al. (2009) have pointed out that the knowledge about mayfly systematics in Venezuela is very poor. Only 33 species (Table I), of the 3,500 known species (Sartori & Brittain, 2015; Salles et al., 2018a), have been recorded in Venezuela, unlike countries like Brazil with 344 species (Salles et al., 2015). This does not necessarily correspond to the true richness of mayflies in Venezuela because sampling effort and taxonomic works are still limited.

Leptophlebiidae is one of the most diverse families of Neotropical mayflies. In South America 50 genera and 270 species have been described (Domínguez & Fernández, 2009; Salles et al., 2018a). In Venezuela, 18

species of Leptophlebiidae have been reported (Table I), which means that almost half of the mayfly species known from the country belongs to this family, confirming its great diversity. This family is distributed worldwide from sea level to heights upper than 3000 masl and can be found from rivers to small streams. However, a low number of species lives in lentic environments for at least part of their lives. Nymphs are generally considered detritivores or collectors-gatherers of fine organic matter, facultative scrapers and a few collectors-filterers (Merrit et al., 2008).

Atopophlebia Flowers has been reported from Costa Rica to northern Argentina (Flowers, 2012). To date, seven species have been reported: *A fortunensis* (Flowers, 1980), *A. obrienorum* (Flowers, 1987), *A. yarinacocha* (Flowers, 1987), *A. flowersi* (Domínguez & Molineri, 1996), *A. pitculya* (Flowers, 2012), *A. pacis* (Salles et al., 2018b) and *A. caldasi* (Salles et al., 2018b). Flowers (1980) described the genus and the species *A. fortunensis* in Panama based on a male imago. Later, he described both the female adult and nymph for the same species, as well as *A. obrienorum* and *A. yarinacocha* based on male imagines from the Ecuadorian and Peruvian Amazonia, respectively (Flowers, 1987) . Domínguez & Molineri (1996) described *A. flowersi* based on male and female imagines and nymphs, from the Bolivian Andes and northern Argentina. McCafferty & Lugo-Ortiz (1996) reported the genus for Costa Rica. Flowers (2012) described *A. pitculya* based on nymphs and adults for western Ecuador. Salles et al. (2018b) described *A. pacis* based on a male imago, and *A. caldasi* based on a male subimago, a female imago and eggs, both from Putumayo and Caldas in Colombia. After reviewing the most recent lists of Ephemeroptera species in Venezuela (Chacón et al., 2009) we find that this genus has not been reported previously, so this would be the first record of *Atopophlebia* in the country.

Family / species	Locality	Coordinates
BAETIDAE		
Baetodes arawak (Traver, 1943)	Antímano	10°27' N, 66°59' W
Baetodes peniculus (Mayo, 1973)	Apartaderos, Mérida	08°48' N, 70°50' W
Baetodes spinifer (Traver, 1943)	Antímano	10°27' N, 66°59' W
Camelobaetidius alcyoneus (Traver, 1943)	Antímano	10°27' N, 66°59' W
Cloeodes anduzei (Traver, 1943)	Antímano	10°27' N, 66°59' W
Cloeodes venezuelensis (Traver, 1943)	Antímano	10°27' N, 66°59' W
EUTHYPLOCIIDAE		
Campylocia anceps (Eaton, 1883)	Mt. Duida, Amazonas	03°35' N, 65°30' W
Euthyplocia hecuba (Hagen, 1861)	Caracas	10°29' N, 66°53' W
LEPTOHYPHIIDAE		
Allenhyphes flinti (Allen, 1973)	Río El Tucuco, Perijá, Zulia. Río Paují, Municipio Baralt, Zulia.	09°50' N, 72°48' W 09°46' N, 70°45' W
Leptohyphes nigripunctum (Traver, 1943)	Antímano	10°27' N, 66°59' W
Tricorythodes lichyi (Traver, 1943)	Antímano	10°27' N, 66°59' W
Tricorythopsis volsellus (Molineri, 1999)	Río Negro, San Carlos de Río Negro, Amazonas	01°55' N, 67°03' W

Table I. Checklist of Ephemeroptera species recorded in Venezuela (*Chacón et. al., 2009*)

Family / species	Locality	Coordinates
LEPTOPHLEBIIDAE		
Farrodes caribbianus (Traver, 1943)	Antímano	10°27' N, 66°59' W
Farrodes longispinus (Domínguez *et al.*, 1996)	Cerro La Neblina, Amazonas	00°50' N, 66°09' W
Farrodes savagei (Domínguez, 1999)	Río del Pelaya, Tucuco, Perijá, Zulia	09°50' N, 72°48' W
Farrodes tepui (Domínguez *et al.*, 1996)	Cerro La Neblina, Amazonas	00°50' N, 66°09' W
Hagenulopsis minuta (Spieth, 1943)	Cerro La Neblina, Amazonas	00°50' N, 66°10' W
Massartella devani Derka, 2002	Mt. Roraima, Bolívar	05°08' N, 60°46' W
Massartella venezuelensis (Pescador & Peters, 1990)	Río Cuyuní, Bolívar	06°01' N, 61°28' W
Microphlebia surinamensis (Savage & Peters, 1983)	Cerro La Neblina, Agua Blanca, Amazonas	00°48' N, 66°08' W
Miroculis (*Miroculis*) *bicoloratus* (Savage, 1987)	Cerro La Neblina, Amazonas	00°50' N, 65°58' W
Miroculis (*Miroculis*) *fittkaui* (Savage & Peters, 1983)	Cerro La Neblina, Río Mawarinuna, Amazonas	00°50' N, 66°09' W
Miroculis (*Miroculis*) *nebulosus* (Savage, 1987)	Cerro La Neblina, Río Mawarinuna, Amazonas	00°50' N, 66°09' W
Paramaka convexa (Spieth, 1943)	La Llovizna National Park, Caroni River Basin, Bolívar	08°18' N, 62°40' W
Simothraulopsis demerara (Traver, 1947)	Morichal Tauca, Río Caura, Bolívar	07°29' N, 65°00' W
Thraulodes guanare (Chacón *et al.*, 1999)	Río Guanare, Portuguesa	09°02' N, 69°49' W
Thraulodes marreroi (Chacón *et al.*, 1999)	Río Guanare, Portuguesa	09°02' N, 69°49' W
Thraulodes mucuy (Chacón *et al.*, 1999)	Río La Mucuy, Mérida	08°38' N, 71°03' W
Thraulodes venezuelana (Ulmer, 1943)	Not specified	Not specified
Tikuna bilineata (Needham & Murphy, 1924)	Río Socuy, Perijá, Zulia Río Tucuco, Perijá, Zulia	10°45' N, 72°28' W 09°50' N, 72°48' W
OLIGONEURIIDAE		
Fittkauneuria adusta (Pescador & Edmunds, 1994)	Río Cuyuní, Bolívar	06°01' N, 61°28' W
Fittkauneuria carina (Pescador & Edmunds, 1994)	Cerro La Neblina, Amazonas	01°33' N, 65°12' W

Tabla I (Cont.). Checklist of Ephemeroptera species recorded in Venezuela (Chacón et. al., 2009)

MATERIAL AND METHODS

Nymphs were collected in July, 2013, in two tributaries of the Capaz river basin (Merida state), which is located on the northern slope of the Sierra de La Culata (Andes) and drains into Lake Maracaibo. Capaz river has a length of 41.3 km, in which several permanent and torrential rivers and streams converge. Samplings were taken from Quebrada Zerpa and Quebrada Las Adjuntas, with a Surber net (0.1 m^2, 250 μm mesh size) and a D-type kicking net (250 μm mesh size). Immediately after collection, nymphs were preserved with formalin (5%) and then stored in ethanol (95%). Specimens were observed with a stereoscope and identified with taxonomic keys (Flowers, 1980, 1987, 2012; Domínguez et al., 2006; Domínguez & Fernández, 2009; Salles et al., 2018a). During sampling, water conductivity, temperature and pH were registered with a field multiprobe while dissolved and saturation oxygen were measured with YSI oxymeter.

RESULTS

Material examined

2 nymphs: Quebrada Las Adjuntas, Mérida state (8° 40' 16.4" N; 71° 28' 49.2" W, 1375 m, 07/29/2013). Collectors: Heberto Prieto, José Rincón, Luis Sibira, Patricia Ortega. 1 nymph: Quebrada Zerpa, Mérida state (8° 40' 54.6" N; 71° 25' 25.4" W, 1680 m, 07/28/2017) Collectors: Heberto Prieto, José Rincón, Luis Sibira, Patricia Ortega.

All specimens are housed in the Aquatic Macroinvertebrates Collection of the Biology Museum of the Zulia University (MBLUZ), Maracaibo, Zulia State, Venezuela.

Habitat Description

Collection sites habitats were characterized by shallow water courses (4.0-8.5 cm) having low flows (0.01-0.09 m^3/s). In general, stream bed was rocky with medium to large boulders, gravel and abundant leaf litter. Water temperature ranges between 16 and 18 °C with pH levels close to neutrality (7.19 - 7.25), good oxygen conditions (≥ 8mg / L, ≥ 90% saturation) and water conductivity from average to high (190 - 358 μS/cm). One of the sampled sites (Quebrada Las Adjuntas) showed evidence of contamination such as solid waste and possibly minor inputs of domestic wastewater.

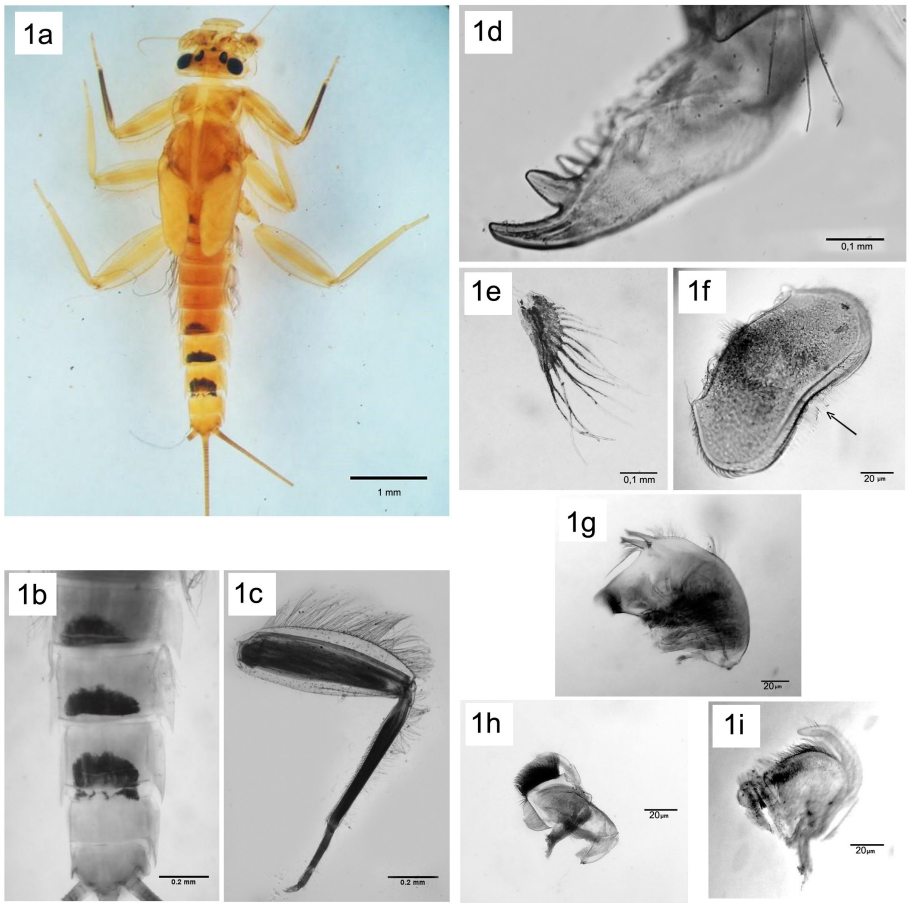

Fig. 1. *Atopophlebia* sp. 1a, mature nymph, dorsal view; 1b, posterolateral projections and dorsal black spots on abdomen; 1c, spatulate setae and spines on fore leg; 1d, tarsal claw; 1e, abdominal gill II; 1f, labrum (arrow shows broad apical denticles); 1g, left mandible; 1h, right maxilla; 1i, labium (left side broken and missing).

DISCUSSION

According to the first description of this genus made by Flowers (1987), nymphs of *Atopophlebia* can be distinguished from other leptophlebid nymphs from northern South America by the following combination of characters: 1) I–VI gills fringed in the apical margin, VII gill reduced to a filament; 2) external mandible curved and bordered with long setae, denser at apical bend; 3) labrum with broad-based denticles; 4) abdomen with postero-lateral projections on abdominal segments II to IX. Imagines and subimagines of *Atopophlebia* can be also distinguished from other neotropical leptophlebids because of their yellowish coloration, dark brown tibiae and black spots on first and last segments of the abdomen. Position and size of the spots are unique to each species. We provide a diagnosis below of the species we discovered.

Collected nymphs herein fit into description mentioned above. Additionally, the following characters were observed: General color yellowish brown (Fig. 1a). Head yellow, hypognathous, black ocelli, compound eyes and light-yellow antennae. Thorax yellowish brown

with light yellow wingpads. Abdomen with posterolateral projections in abdominal segments II to IX (Fig. 1b) and black spots present in abdominal segments I to II and VI to VIII, as bands that extend from lateral region and vanish in the center in segments I–II whereas in segments VI to VIII they show an irregular bell shape and appear in the center of the abdomen. Legs yellowish white, anterior tibiae dark (Fig. 1a). Both femora and tibiae with spatulate setae and spines on their inner margin and long setae on their posterior margin (Fig. 1c). Tarsal claws with denticles increasing in size toward apex (Fig. 1d). Gills grayish presents on segments I to VII, gills I to VI fringed in the apical margin, VII gill reduced to a pair of filaments (Fig. 1e).

Regarding mouthparts, the labrum is wide and somewhat angled laterally, dorsum with a subapical line of medium-long setae and short and broad apical denticles (Fig. 1f). Mandibles are strongly curved with lateral and apical setae (Fig. 1g). Maxillae broad, maxillary palps with a row of long setae on lateral region (Fig. 1h). Segment I and II of labial palpi are subequal while segment III is about 1/3 length of segment II (Fig. 1i).

The pattern of dark abdominal spots is one of the characters that allows species identification within this genus (Domínguez et al., 2006). In our study this pattern differs from the species reported before by other authors, so it is presumed that it could be a new species (Flowers, pers. comm.). However, to confirm it, it would be necessary to rearing the immature nymphs and describe the adults.

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