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The male imago of *Fittkaulus cururuensis* Savage, 1986 (Leptophlebiidae: Ephemeroptera)

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Abstract. The Leptophlebiidae family of mayflies is diverse, with over 640 species and 140 genera worldwide. One of its subfamilies, Terpidinae, is restricted to the Neotropical region and consists of three genera, including *Fittkaulus*, which have four South American species. This paper describes the male imago of *F. cururuensis*, which was previously unknown, based on specimens collected in streams in the Caatinga and Amazon Forest regions of northern and northeastern Brazil. It can be differentiated by having the following combination of characteristics: upper portions of eyes on short stalk; forewing with reddish brown macula; abdominal terga I–VIII with posterior and lateral margins washed with black; penes with proximal half fused, distal half with a globose lateral lobe, and with a long, apically pointed and tubular medial lobe.

Key words: Taxonomy, Insect, Paleoptera, Neotropical. Terpidinae.

Introduction

The Family Leptophlebiidae is one of the most diversified groups of mayflies (Ephemeroptera), both taxonomically and ecologically, with more than 640 species and 140 genera distributed worldwide (Sartori and Brittain 2015). Recently, Leptophlebiidae was divided into eight subfamilies, including Terpidinae, composed of the genera *Terpides*, *Fittkaulus* and *Tikuna*, and with occurrence restricted to the Neotropical region (Kluge 2009; Godunko et al. 2015; Monjardim et al. 2020). Terpidinae genera have particular morphological characteristics, such as fusiform body, hypognated mouthpieces and the presence of swimming bristles in caudal filaments (Kluge 2009). The genus *Fittkaulus* Savage & Peters is found only in South America and consists of four species: *Fittkaulus cuiabae* Savage, 1986; *F. cururuensis* Savage, 1986; *F. maculatus* Savage & Peters, 1978; and *Fittkaulus amazonicus* (Salles et al. 2022). The genus occurs in Brazil, Colombia, French Guiana, and Peru (Savage and Peters 1978; Orth 2001; Kluge 2009, 2015; Salinas-Jiménez et al. 2018). In Brazil, three species (*F. cuiabae*, *F. cururuensis*, and *F. maculatus*) have been recorded in the Northern, Midwest, and Southeastern regions, in the Caatinga, Cerrado, Atlantic Forest, and Amazon Forest (Savage 1986; Boldrini et al. 2009; Lima et al. 2012; Takyia et al. 2016; Costa et al. 2018; Gama-Neto et al. 2018; Nascimento et al. 2020).

The male imago of this genus is recognized by vein ICu1 of forewing joined at base to vein CuA; costal projection of hind wing prominent; tarsal claws of a pair similar, with apical hook and opposing blunt lobe; genital forceps two-segmented; and penes short and tubular, fused in basal 2/3 and without projections (Savage and Peters 1978; Domínguez et al. 2006; Kluge 2009). Until today, the male adults of *F. cururuensis* and *F. cuiabae* remain unknown. This paper aims to describe the male imago of *F. cururuensis* based on specimens collected in streams in the Caatinga and Amazon Forest regions of northern and northeastern Brazil.

Material and Methods

The nymphs were collected with the aid of a D-shaped net, and the adults were caught on Malaise

trap and light trap, or reared from nymphs according to Boldrini and Cruz (2013). Then they were fixed in 80% ethanol. Identifications were based on careful comparisons to Savage and Peters (1978), Boldrini et al. (2009) and Domínguez et al. (2006). Pictures were taken using a Nikon D7100, a 105 mm objective, and a Zeiss stereomicroscope (Stemi 2000) with a Samsung ST150F digital camera. Line drawings were made on Adobe Illustrator CS® based on photographs and were prepared according to Coleman (2003, 2006). Terms used in the description of the adult thorax are from Kluge (1994). The wings were mounted dry.

The material examined is housed in the Zoological Collection of the Universidade Federal de Roraima (UFRR), Boa Vista, Brazil, and in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil; and Coleção Entomológica Heróis do Jenipapo (CEHJ), Campo Maior, Brazil.

***Fittkaulus cururuensis* Savage, 1986**

Figs. (1–12)

Diagnosis. Male Imago: 1) Upper portions of eyes on short stalk (Fig. 1, 3–4); 2) forewing with reddish brown macula as in Fig. 5; 3) abdominal Terga I–VII with posterior and lateral margins washed with black (Figs. 2–4); 4) penes with proximal half fused; distal half with a latero-dorsal lobe apically rounded, and with a long, apically pointed and tubular medial lobe (Figs. 8–12).

Description Male Imago. Body: 5.5–6.0 (n=3) mm; forewing: 5.2–5.6 (n=3) mm; hind wing: 0.7–0.8 (n=3) mm; tibia I: 2.0 mm; tibia II: 1.5 mm; tibia III: 1.5 mm; cerci broken and missing.

Head. Base color light brown. Ocelli white, inner margins black. Antenna with scape, pedicel and flagellum whitish. Upper portions of eyes on short stalk, apex reddish brown, lower portions black.

Thorax (Figs. 3–4). Pronotum brown, median region dark brown. Mesonotum brown, anterior region of parascutellum, posterior scutal protuberance and scutellum dark brown. Metanotum brown. Pro-, meso- and metanotum whitish; furcasternum brown. Forewing (Fig. 5) with membrane hyaline, and with reddish brown macula on costal, subcostal and radial I sectors. Hind wing (Fig. 6–

7) with membrane hyaline costal projection very prominent and apex acute. Legs whitish; fore femur washed with reddish brown (Fig. 3); apex of mid and hind femur washed with a reddish-brown band.

Abdomen (Figs. 2–4). Base color whitish. Terga I–VII with posterior and lateral margins washed with black; tergum VIII with a triangular reddish-brown mark; terga IX–X washed with reddish brown. Sternum IX with posterior margin washed with brown.

Genitalia (Figs. 8–12). Styliiger plate, forceps and penes whitish washed with brown (Fig. 8). Penes with proximal half fused; distal half with a latero-dorsal lobe apically rounded, and with a medio-ventral lobe apically pointed and longer (Figs. 9–12). Forceps with spines in the inner margin.

Distribution. Brazil: states of Bahia (Costa et al. 2018), Espírito Santo (Boldrini et al. 2009), Maranhão (Nascimento et al. 2020), Mato Grosso (Boldrini et al. 2009), Pará (Savage 1986), Pernambuco (Lima et al. 2012), Piauí (Takiya et al. 2016) and Roraima (Gama-Neto et al. 2018).

Material examined. One male imago and two female imago, Brazil, Roraima State, Rorainópolis municipality, Vicinal 31, Lote 24, 00°39'22.0"N/ 60°24'09.8"W, 26.vii.2014–02.viii.2014, Malaise trap, Barroso, P.C.S. leg. (UFRR); same data as preceding except one male and one female subimagos (reared) 06.viii.2015 (UFRR). One nymph, Brazil, Roraima State, Cantá municipality, Serra Grande I, 2°32'N/ 60°46'W, 08.x.2015, Boldrini, R.; Barroso, P.C.S. leg. (UFRR). Six male imagos and one subimago, Brazil, Piauí State, Piracuruca municipality, National Park of Setes Cidades, Riacho Poço, 04°06'33.745"S/ 41°43'39.206"W, 16.viii.2022–30.viii.2022, Malaise trap, Lima, L.R.C. leg. (Four male imago and one subimago to CEHJ; two imago to INPA); same data as preceding except one male imago (reared) and three subimago (reared) 16.viii.2022 (CEHJ).

Discussion

The male imago of *F. cururuensis* is closely related to the *F. amazonicus* Kluge, 2009. They shared similar wings, abdominal coloration pattern, and similar shape of penes. In addition, the egg morphology of these species is very similar, characterized by fibrillose units uniformly distributed

in the chorion surface (Marulanda-Lopez et al. 2021).

However, *F. amazonicus* differs from the male imago ascribed to *F. cururuensis* by upper eyes, which in lateral view have no any stalk at all (as in other Terpidinae and most Leptophlebiidae) and by penes, which medio-ventral lobe is apically longer and broader in *F. cururuensis*. The subimago of *F. cururuensis* not showed differences in the wing, legs and abdomen pigmentation, except pronotum and mesonotum pale yellow with dark brown marks; and posterior scutal protuberances are pale yellow. Both populations do not exhibit significant differences in the wing venation and body color pattern. The genitalia is quite similar, presenting a slight difference in the apex of the median-ventral lobe: rounded in the Roraima population and tapered in the Piauí population.

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Statements and Declarations

Conflict of interest. The authors declared that there are no conflicts of interest.

Contributions. All authors conceived the review and reviewed and approved the final manuscript.

Lucas Lima created the first draft of the manuscript.

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Figure captions

Figs. 1–4 *Fittkaulus cururuensis*, male imago: 1) head, frontal view; 2) abdomen, dorsal view; 3) habitus, lateral view (Roraima population); 4) habitus, lateral view (Piauí population)

Figs. 5–7 *Fittkaulus cururuensis*, male imago: 5) forewing; 6) hind wing; 7) hind wing enlarged

Figs. 8–12 *Fittkaulus cururuensis*, male imago: 8) genitalia, ventral view; 9) penes, ventral view (Roraima population); 10–12) variation of penes (Piauí population)

Figures

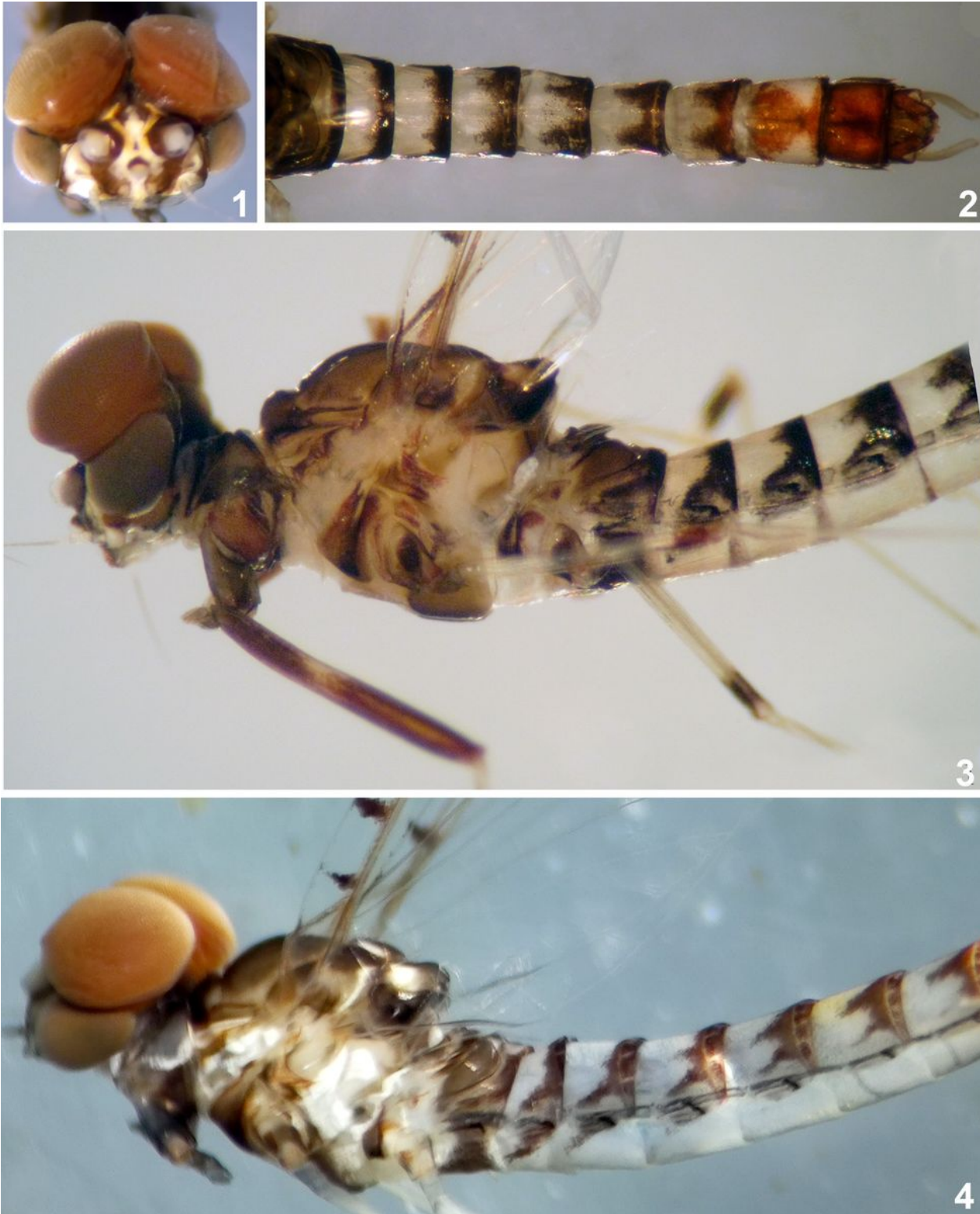


Figure 1

1–4 *Fittkaulus cururuensis*, male imago: 1) head, frontal view; 2) abdomen, dorsal view; 3) habitus, lateral view (Roraima population); 4) habitus, lateral view (Piauí population)

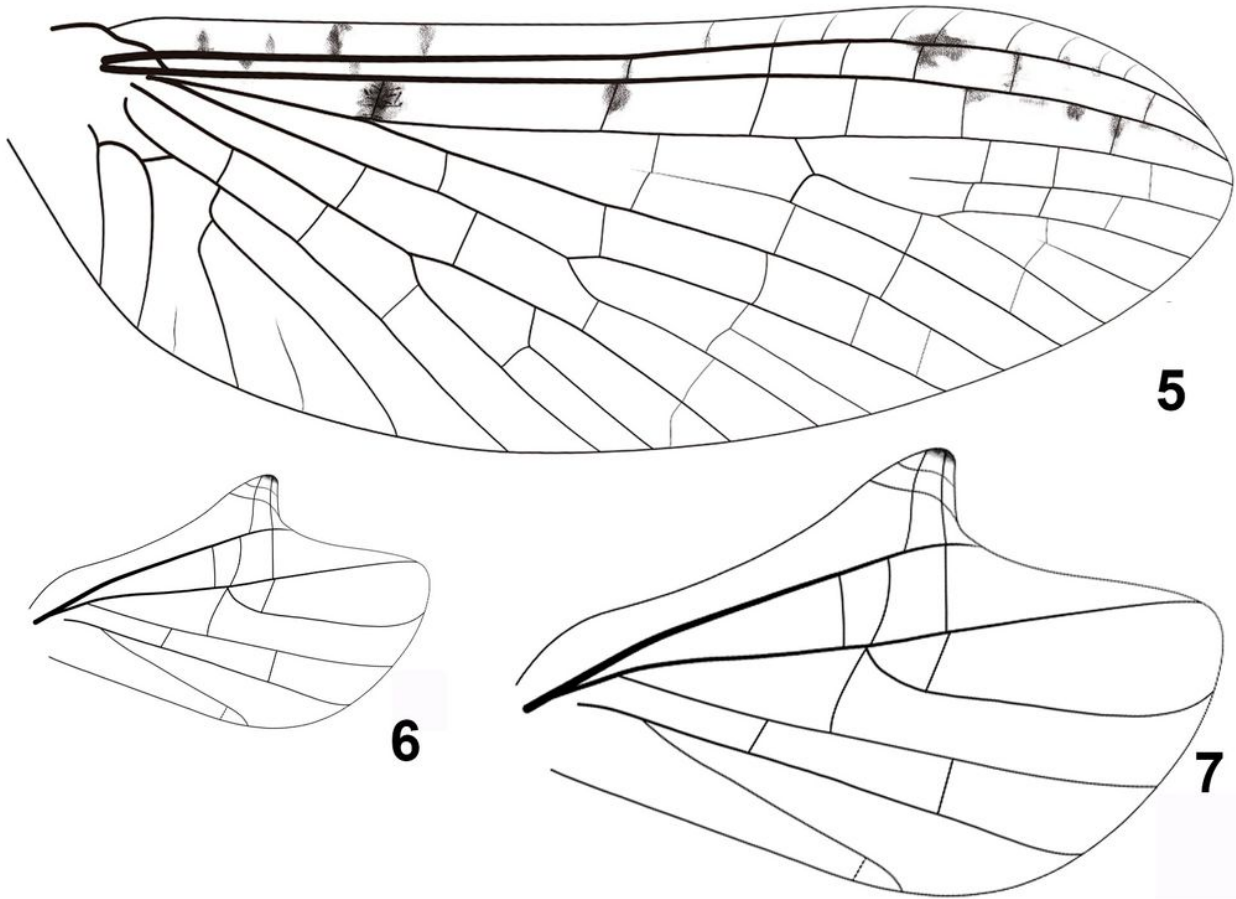


Figure 2

5–7 *Fittkaulus cururuensis*, male imago: 5) forewing; 6) hind wing; 7) hind wing enlarged

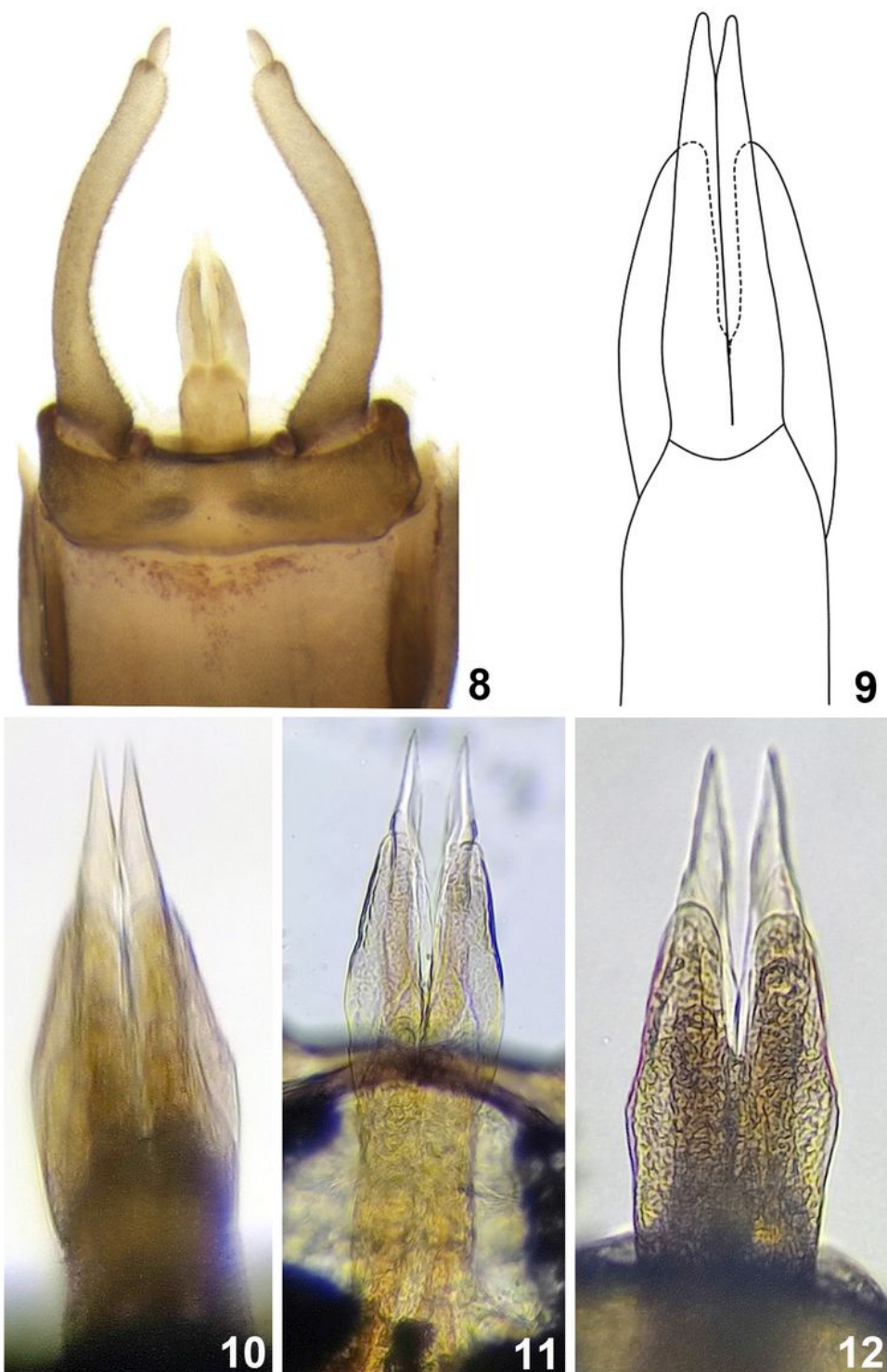


Figure 3

8–12 *Fittkaulus cururuensis*, male imago: 8) genitalia, ventral view; 9) penes, ventral view (Roraima population); 10–12) variation of penes (Piauí population)