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## **Fittkaulus maculatus** a new genus and species from northern Brazil (Leptophlebiidae: Ephemeroptera)

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### Abstract

A new genus and species of Leptophlebiidae, **Fittkaulus maculatus**, is described from male and female imagos, subimagos, and nymphs collected from streams of the eastern Guiana Shield, Pará State, Brazil. Association of life cycle stages is by rearing. **Fittkaulus** appears to be most closely related to **Terpides** Demoulin.

### INTRODUCTION

Recent revisionary studies of the Neotropical Leptophlebiidae (Traver 1959, 1960a, b, 1963; Traver and Edmunds 1967; Peters 1971; Pescador 1976) have greatly increased our knowledge of the mayfly fauna of this region. There are numerous new genera and species, particularly from the warmer northern areas, that still remain to be defined. Herein we describe a new genus and species from the mayfly collections of Dr. E. J. Fittkau.

The following terms and procedures used in the generic descriptions of the imagos and nymphs require explanation. Venational terminology used is as given by Peters and Edmunds (1964). Each segment of the fore legs of the male imagos is compared to the length of the fore tibiae and expressed as a ratio, while the average length in millimeters of the fore tibiae is given in parentheses. In the figure of the labium, the ventral surface is shown on the right hand side of the drawing, and the dorsal surface is shown on the left.

### **Fittkaulus**, new genus (Fig. 1-24)

**IMAGO** — Length of ♂: body, 5.0 — 6.0 mm; fore legs, 4.9 — 5.0 mm. Length of ♀: body, 5.5 — 6.8 mm; fore wings, 5.3 — 6.0 mm. Eyes (Fig. 8-9): eyes of ♂ meet on meson of

head, dorsally upper portion of eyes circular with large facets, dorsal portion of eyes on long stalk as in Fig. 8-9; lower portion of eyes large, bulbous, maximum width of lower portion slightly greater than length of stalk; eyes of ♀ large, separated on meson of head by a length 2 times as great as maximum width of an eye, eyes extend posteriorly beyond margin of head. Lateral ocelli enlarged. Wings (Fig. 1-3): maximum width of fore wings approximately 1/3 maximum length of fore wings; vein  $R_s$  of fore wings forked 1/5 of distance from base to margin; vein MA of fore wings forked a little more than 1/2 distance from base to margin, fork asymmetrical, distal portion of vein MA strongly sagged; vein MP of fore wings forked from a little more than 2/5 to a little more than 1/2 distance from base to margin, fork asymmetrical; vein  $ICu_1$  attached near base to vein  $CuA$  with cross vein, remainder of cubital area as in Fig. 1; cross veins few. Hind wings small; costal projection of hind wings well developed, apex rounded, base of projection narrow, apex located approximately 3/4 distance from base to margin of wings; apex of wings obtuse, cross veins few. Legs: ratios of segments in ♂ fore legs, 0.71: 1.00 (1.97 mm): 0.03: 0.23: 0.26: 0.14: 0.08. Claws of a pair similar, both apically hooked, each with an opposing hook (Fig. 5). Genitalia (Fig. 4): forceps two segmented, segment 2 of forceps 1/8 — 1/7 length of segment 1, segment 1 basally expanded, segment 2 acute apically; maximum length of styliger plate along lateral margin approximately 1/3 maximum width, maximum length of styliger plate along median line approximately 1/5 maximum width, posterolateral margins developed dorsal to forceps; penes tubular, fused except for apical 1/3,

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without appendages. Ninth sternum of ♀ deeply cleft apically (Fig. 14). Terminal filament slightly longer than cerci.

**SUBIMAGO** — Characters similar to imago except upper portion of eyes of ♂ subimago smaller, eyes of ♂ subimago meet on meson of head to separated by a distance approximately  $1/5$  the width of an upper portion (Fig. 10-11). Fore legs and genital forceps not fully extended in ♂ subimagos. Wings: membrane translucent, whitish, with long hair on apical and anal margins of fore and hind wings neither thickened nor branched.

**MATURE NYMPH** — Head hypognathous. Antennae  $2\ 1/2$  to 3 times maximum length of head. Mouthparts (Fig. 19-24): dorsal hair on labrum as in Fig. 19, submedian areas of hair ventrally, anteromedian emargination with 6 very small, subequal-sized denticles (Fig. 19-20). Clypeus tapered apically as in Fig. 19. Left mandible as in Fig. 24. Lingua of hypopharynx without lateral processes, widens distally as in Fig. 21; superlingua of hypopharynx as in Fig. 21, with an area of hair along anteromedian margin. Galea-lacinia of maxillae with 5-8 pectinate spines in subapical row; segment 2 of maxillary palpi approximately  $3/4$  length of segment 1; segment 3 of palpi from  $7/10$  to a little less than length of segment 2; hair on maxillae as in Fig. 23. Labium as in Fig. 22; segment 2 of palpi a little greater than  $1/2$  to  $3/4$  length of segment 1; segment 3 of palpi a little greater than  $3/4$  to a little greater than length of segment 2; glossae curved over ventrally. Legs (Fig. 15, 18): fore legs as in Fig. 15; claws apically hooked and narrow, with a basal group of 5-6 short, subequal denticles along margin, and with a subapical group of narrow, unequal, denticles set in from margin as in Fig. 18. Gills (Fig. 16-17): dorsal and ventral portions of gills on segments 1 and 7 alike, dorsal and ventral portions of gills on segments 2-6 dissimilar; both dorsal and ventral portion of gills 1 and 7 slender, gradually tapered apically tracheae of gill 7 branched or unbranched, or unbranched, tracheae of gill 1 unbranched; dorsal portion of gills 2-6 large, basally narrowed, apically truncated, with median apical projection, tracheae branched; ventral

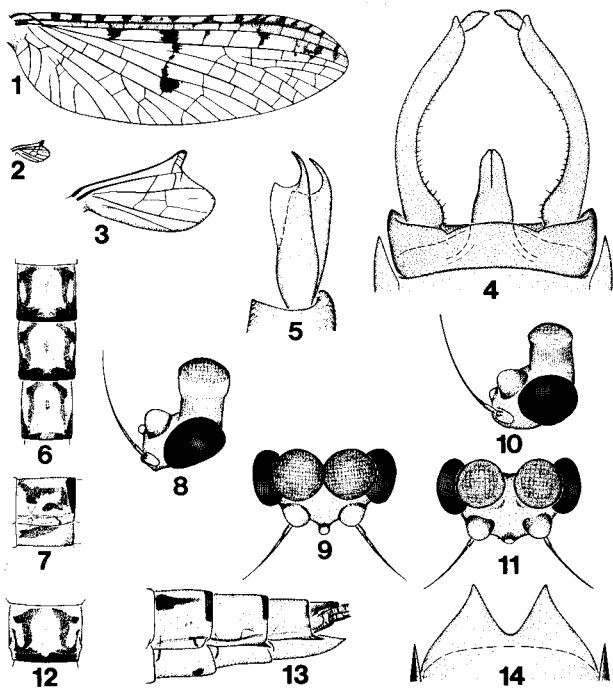
portion of gills 2-6 smaller, elliptic with apical projection, tracheae branched or unbranched. Posterolateral spines acute on abdominal segments 4-6 and 8-9, spines small on 4-6, large on 8 and 9; blunt posterolateral margins on abdominal segments 1-3 and 7. Terminal filament with long setae on both lateral margins, cerci with long setae on inner lateral margins. (Caudal filaments broken apically).

**ETYMOLOGY** — The genus is named for Dr. E. J. Fittkau, who collected the specimens.

**TYPE SPECIES** — *Fittkaulus maculatus*, new species.

**Fittkaulus maculatus**, new species  
(Fig. 1-24)

**MALE IMAGO** (in alcohol) — Length: body, 5.0 — 6.0 mm; fore wings, 4.8 — 5.2 mm; fore legs, 4.9 — 5.0 mm. Eyes (Fig. 8-9): stalked turbinate portion long, pale yellow, streaked with brownish-black, facets large, pale yellow; lower portion of eyes blackish-grey, facets small. Head pale yellow, carinae brownish-yellow. Scape and pedicel pale yellow, flagellum brownish-yellow. Basal  $1/2$  of ocelli black, apical  $1/2$  white. Cervix brownish-black. Thorax: pronotum brownish-black; mesonotum and metanotum light brown, carinae and peripheral margins brownish-black, median area of metanotum with a long, narrow black mark; sterna yellowish-brown, lateral margins and carinae dark brown; pleurae yellowish-brown, median longitudinal area of pleurae washed irregularly with brownish-black. Wings (Fig. 1-3): longitudinal and cross veins of anterior  $1/4$  of fore wings light brown, remainder of veins of fore wings with a prominent brownish-black macula at fork of vein MA, brownish-black pigment on anterior  $1/3$  of fore wings, darker around cross veins as in Fig. 1, remainder of membrane of fore wings and hind wings hyaline. Legs femora brownish-yellow, remainder of legs pale yellow. Abdomen (Fig. 6-7): terga pale yellow, terga 1-8 and 10 with brownish-black transverse band along posterior margin and with a brownish-black right-triangular shaped posterolateral macula, macula on terga 8 smaller, terga 2-7 with a longitudinal, large, sublateral brownish-



**Fittkaulus maculatus** n. sp. — Fig. 1-9, male imago : 1, fore wing; 2, hind wing; 3, hind wing enlarged; 4, ventral view of genitalia; 5, fore claw; 6, dorsal view of abdominal segments 4-6; 7, lateral view of abdominal segment 5; 8-9, lateral (8) and dorsal (9) views of eyes. Fig. 10-11, male subimago : lateral (10) and dorsal (11) view of eyes. Fig. 12-14, female imago : 12, dorsal view of abdominal segment 5; 13, lateral view of abdominal segments 7-10; 14, ventral view of ninth sternum.

black mark as in Fig. 6, terga 3-7 with a small median brownish-black macula, posteromedian area of terga 10 brownish-black; spiracles black, tracheae smoky; sterna pale yellow, posterior margin of sterna 1-7 with a transverse brownish-black band, lateral margins of sterna 2-6 with a brownish-black right-triangular shaped mark, base of triangle anterior, mark small on sternum 6, progressively larger anteriorly. Genitalia (Fig. 4): forceps brownish-yellow; styliger plate yellowish-brown; penes approximately 1/2 length of segment 1 of forceps, penes dark brown basally, pale apically. Caudal filaments slightly less than twice the length of body, pale yellow.

**FEMALE IMAGO** (in alcohol) — Length: body, 5.5 — 6.8 mm; fore wings, 5.3 — 6.0 mm. Eyes: black. Head pale yellow, with a posterior

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submedian brownish-black macula between eyes. Color of antennae as in ♂ imago. Thorax: color and marks as in ♂ imago, except long submedian black marks present on pronotum, and pleurae with median longitudinal brownish-black wash forming a distinct stripe entire length of thorax. Wings: color and marks as in ♂ imago. Legs: color as in ♂ imago, except median marks absent on segments 6 and 7 and weakly developed on other terga; color and marks of sterna as in ♂ imago except sternum 7 with a small submedian black circular macula. Caudal filaments pale yellow.

**SUBMAGOS** (in alcohol) — Characters similar to imagos except stalked turbinate portion and facets of eye of ♂ subimago yellowish-white. Scape and pedicel yellowish-

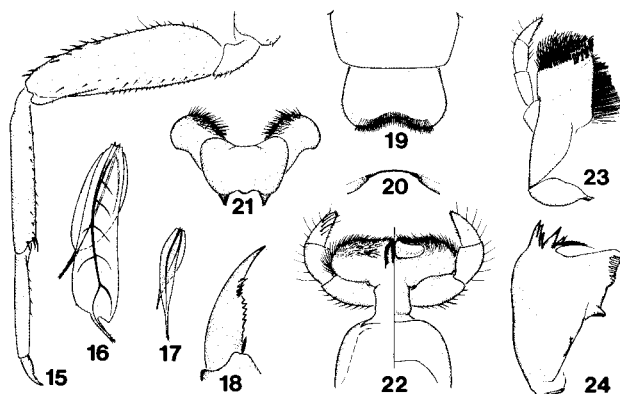


Fig. 15-24, mature nymph of **Fittkaulus maculatus** n. sp.: 15, fore leg; 16, gill 4; 17, gill 7; 18, fore claw; 19, labrum; 20, enlargement of denticles on enteromedian emargination of labrum; 21, hypopharynx; 22, labium; 23, ventral view of right maxilla; 24, left mandible.

white, flagellum as in ♂ imago. Thorax: pronotum as in ♂ and ♀ imagos; mesonotum pale yellow, with anterior, anterolateral areas and inner parapsidal suture yellowish-brown, carinae blackish-brown; metanotum as in ♂ and ♀ imagos; pleurae brownish-yellow, markings as in ♂ and ♀ imagos. Legs: legs brownish-yellow, except articulations dark brown. Abdomen: terga brownish-yellow, marks as in ♂ imago except posterolateral macula of terga 1-8, and sublateral marks of terga 2-7 narrower.

**MATURE NYMPH** (in alcohol) — Body length, 4.5 — 6.8 mm. Head yellowish-brown, lateral edges of genae dark brown. Antennae pale yellow. Thorax: light brown, color pattern as in ♂ and ♀ imagos except with a black triangular macula on median area of metanotum. Legs: brownish-yellow, prothoracic legs slightly darker. Abdomen: brownish-yellow, color pattern as in subimagos. Gills: membrane translucent, tracheae smoky. Caudal filaments brownish-yellow.

**SPECIMENS EXAMINED** — Holotype ♂ imago, **Brazil: Pará State**, Akahe Creek, near Tiriyo Mission, near Brazil-Surinam border. 15-III-1962, E. J. Fittkau. Allotype ♀ imago, same data as for holotype. Paratypes: 10 ♂ subimagos and 7 ♀ subimagos, same data as for holotype; 6 nymphs, same data as for holotype; 2 nymphs, **Brazil: Pará State**, Iveraca I Creek, near Brazil-Surinam border 17-18-IV-1962, E. J. Fittkau. Holotype, allotype, 3 ♂ subimago, 2 ♀ subimago, and 3 nymphal paratypes are deposited in the collections of the Instituto Nacional de Pesquisas da Amazônia, Manaus. 4 ♂ subimago, 3 ♀ subimago, and 3 nymphal paratypes are deposited in the collections of Florida A&M University, Tallahassee. 3 ♂ subimago, 2 ♀ subimago, and 2 nymphal paratypes are deposited in the collection of the University of Utah, Salt Lake City.

Association of life cycle stages is by rearing. All specimens except for the 2 nymphal paratypes from Iveraca I Creek, were collected from the same locality. No differences between the nymphs from the two sites were detected.

**ETYMOLOGY** — Macula, L., meaning spot, mark; in reference to the macula on the fore wings at the fork of vein MA.

**DISCUSSION** — *Fittkaulus* can be distinguished from all other genera of Leptophlebiidae by the following combination of characters. In the imagos: (1) upper portion of ♂ eyes is on a long stalk, facets are large (Fig. 8-9); (2) vein MA of fore wings is forked a little more than 1/2 distance from base to margin, fork asymmetrical, distal portion of vein MA strongly sagged; (3) vein MP of fore

wings is forked from a little more than 2/5 to a little more than 1/2 distance from base to margin, fork is asymmetrical (Fig. 1); (4) hind wings are small with a well developed, long, narrow, apically rounded costal projection located approximately 3/4 distance from base to wing margin (Fig. 2-3); (5) basal 2/3 of penes are fused and without appendages (Fig. 4); (6) forceps of the ♂ genitalia are 2-segmented; (7) ninth sternum of ♀ has a deep V-shaped cleft apically (Fig. 14); and (8) claws of a pair are similar, both apically hooked, each with an opposing hook (Fig. 5). In the nymphs: (1) dorsal and ventral portions of gills on segments 2-6 are dissimilar, dorsal portion is large, apically truncated, with median apical projection, ventral portion is smaller, elliptic (Fig. 16); (2) glossae of the labium are curved over ventrally (Fig. 22); (3) claws are apically hooked and narrow, with a basal group of 5-6 short, subequal denticles along margin, and with a subapical group of narrow, unequal denticles set in from margin as in Fig. 18; (4) posterolateral spines are acute on abdominal segments 4-6 and 8-9, but are absent on segment 7; and (5) cerci have a row of long setae on the inner lateral margin, while the terminal filament has long setae on both lateral margins.

*Fittkaulus* appears to be most closely related to *Terpides* Demoulin. Demoulin (1966) established *Terpides* based on nymphal specimens of *T. guyanensis* from Surinam. The imaginal description of *Terpides* was provided by Peters and Harrison (1974) who described *T. jessiae* from St. Vincent, West Indies. *Fittkaulus* can be distinguished from *Terpides* by the following combination of characters. In the imagos: (1) upper portion of eyes of ♂ is on a long stalk, facets are large (Fig. 8-9); (2) vein MP of fore wings is forked from a little more than 2/5 to a little more than 1/2 distance from base to margin, fork is asymmetrical (Fig. 1); (3) hind wings are small with well developed, long, narrow, apically rounded costal projection (Fig. 2-3); (4) claws of a pair are similar, both apically hooked, each with an opposing hook (Fig. 5); (5) forceps of the ♂ genitalia are two segmented; and (6) ninth sternum of ♀ has a deep V-shaped cleft apically (Fig. 14). In the nymphs: (1) dorsal

and ventral portion of gills on segment 2-6 are dissimilar, dorsal portion is large, apically truncated, with median apical projection, ventral portion is smaller, elliptic (Fig. 16); (2) claws are apically hooked and narrow, with a basal group of 5-6 short, subequal denticles along margin, and with a subapical group of narrow, unequal, denticles set in from margin as in Fig. 18; and (3) the lingua of the hypopharynx widens distally as in Fig. 21.

**BIOLOGY** — Nymphs of *Fittkaulus maculatus* have been collected in streams 3-5m wide, 20-50cm deep, with sandy bottoms and partly exposed bedrock. Most nymphs were found on leaves and other large detrital fragments in areas of slow current. A few specimens were collected from fine detritus and sand in calm areas. (Based on field notes of Dr. E. J. Fittkau).

#### ACKNOWLEDGMENTS

We offer our sincere thanks to: Dr. E. J. Fittkau, Zoologische Sammlung des Bayerischen Staates, München, for allowing us to study his material; and to G. J. Wibmer, F.A.M.U., and the editorial staff of "Acta Amazonica" for assistance with the Portuguese portion of this manuscript. We wish to thank Dr. M. L. Pescador, Dr. D. R. Towns, and J. G. Peters for reading the manuscript, and J. G. Peters for preparation of the illustrations under our supervision.

This research was supported by a grant from the Cooperative State Research Service, United States Department of Agriculture (P.L. 89-106) to Florida A&M University.

#### Sumário

Um novo gênero e espécie de Leptophlebiidae, *Fittkaulus maculatus*, são descritos no presente trabalho, baseado em imagos machos e fêmeas, subimagos e ninfas coletadas em igarapés da parte oriental do estado das Guianas, Estado do Pará, Brasil. A associação dos diversos estágios do ciclo de vida foi obtida por criação. O gênero *Fittkaulus* parece estar mais diretamente relacionado com *Terpides* Demoulin (1966) e pode ser diferenciado de todos os outros gêneros de

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Leptophlebiidae pela seguinte combinação de caracteres. Nos imagos: (1) a porção superior dos olhos dos machos fica sobre um pedículo longo e as facetas são grandes (Fig. 8-9); (2) a veia MA das asas anteriores é bifurcada um pouco além da metade da distância da base à margem, de maneira assimétrica, e sua porção distal é fortemente curvada; (3) a veia MP das asa anteriores é bifurcada entre os 2/5 e um pouco mais da metade da distância da base à margem, com ramificação assimétrica (Fig. 1); (4) as asas posteriores são pequenas e apresentam uma projeção costal bem desenvolvida, longa, fina, arredondada apicalmente e localizada aproximadamente a 3/4 da distância da base à margem da asa (Fig. 2-3); (5) os 2/3 basais dos penis são unidos e sem apêndices (Fig. 4); (6) os fórceps da genitália masculina são bi-segmentados; (7) o nono segmento do esterno das fêmeas apresenta uma profunda fissura apical em forma de V (Fig. 14); (8) cada tarso tem duas garras tarsais similares, ambas com o ápice em forma de gancho e cada uma com um gancho oposto (Fig. 5). Nas ninfas: (1) as partes dorsal e ventral das brânquias nos segmentos 2-6 são diferentes — a parte dorsal é grande, truncada apicalmente e com projeção apical mediana, e a ventral é menor e elíptica (Fig. 16); (2) as glossas do lábio são curvadas na direção ventral; (3) as garras tarsais têm o ápice em forma de gancho e são finas, apresentando um grupo basal de 5-6 pequenos denticulos aproximadamente do mesmo porte ao longo da margem, e um grupo subapical de denticulos desiguais e finos, localizados na margem interna, conforme a Fig. 18; (4) os espinhos laterais posteriores dos segmentos abdominais 4-6 e 8-9 são agudos, porém estão ausentes no segmento 7; e (5) os cercos possuem uma fileira de pêlos longos na margem lateral interna, enquanto o filamento terminal possui pêlos longos em ambas as margens.

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(Aceito para publicação em 05/05/78)