

Notes on Neotropical Mayflies. Part I. Family Baetidae, Subfamily Leptophlebiinae.

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(With 30 text figures)

In 1924, Needham and Murphy¹ published an account of certain Neotropical mayflies in the Cornell University Collection. Since that time, a few additional Ephemeroptera from this region have been acquired by that Collection, and the writer has obtained still others which are in her personal collection. Specimens from these two collections form the basis for the present paper, which is limited to the adult forms of the subfamily Leptophlebiinae, from Central and South America. In lieu of the fact that a goodly number of new species and several new genera have been described from the Neotropical region since 1924, it seemed desirable to re-examine the specimens and slides in the Cornell Collection which were the basis for the excellent treatise by Needham and Murphy. The need for several new figures of genitalia at once became apparent, since correct determination of a species is often dependent upon accurate and detailed representation of these structures. Such new figures as seemed advisable are presented herewith; a few typographical errors encountered in checking the types with the above-mentioned paper are indicated; and certain supplementary notes on the type material are added, with new distribution records for some of these species. In addition, several new species are described and a brief resumé of Neotropical Leptophlebiinae presented. Classification and venational nomenclature are essentially those employed in the Biology of Mayflies.² All figures of genitalia are from slides, material for which was treated with potash before mounting, and are camera lucida sketches, unless otherwise noted. Drawings of wings are made likewise with camera lucida. New figures of genitalia and wings of the Needham and Murphy species are from type material; wherever possible, the holotype was utilized, and exceptions to this rule are indicated in each case.

The subfamily Leptophlebiinae is divisible into two sections, characterized as follows:

¹) Needham and Murphy, 1924, Neotropical Mayflies, Bull. Lloyd Lib. 24, Ent. Ser. 4, pp. 1-79.

²) Needham, Traver, and Hsu, 1935, The Biology of Mayflies, Comstock Publishing Company, Ithaca, N. Y.

Section A. — Subcosta of hind wing reaches almost to wing apex, so that the costal space is relatively long and narrow; there is usually no angulation or prominence on the costal margin of the hind wing, but often a slight indentation near the center of this margin. To this section belong four genera having the tarsal claws similar and acute: *Atalophlebia*, *Atalonella*, *Massartella* and *Nousia*. In two other genera: *Deleatidium* and *Atalophlebioides*, the tarsal claws are edissimilar. *Atalophlebioides* is placed in Section A tentatively, since the costal margin of the hind wing does not conform with either Section A or Section B, but contains characters of each. It is probable that *Massartella* does not merit generic rank, but is in reality a synonym of *Atalophlebia*. The claim of *Atalonella* and *Nousia* to generic rank and their relationship to *Atalophlebia* and to each other is considered in the discussion of these genera.

Section B. — Subcosta of hind wing much shorter, usually ending at or just beyond the costal prominence, which may be quite distinct; the costal space is thus relatively short and wide. Here belongs the unique genus *Hagenulopsis*, in which hind wings are lacking, and the female possesses a well-developed ovipositor. Genera having four wings but lacking an ovipositor include *Thraulodes*, in which *M* of the hind wing is forked; and three others in which *M* of the hind wing is not forked: *Thraulus*, *Choroterpes* and *Hermanella*.

Section A.

Genus *Atalophlebia* Eaton

M of the hind wing is forked about 1/4 of the distance from its union with *R* and the margin; an intercalary is present normally in this fork. Cross veins of hind wing are relatively numerous, several being near the outer and hind margins. Eight Neotropical species have been described by Navas as of this genus. The very sketchy figures of genitalia presented with his meagre descriptions are totally inadequate for determination to species, even to genus. Eaton's *chilensis* may not belong to this genus. It is possible that Lestage's *brieni*, first described in *Atalophlebia*³ and later transferred to a new genus *Massartella* erected for it⁴, should be returned to *Atalophlebia*. Ulmer⁵ has transferred *patagonicum* Lest. to *Deleatidium*. The only other Neotropical species described in this genus is the following.

Atalophlebia fulvipes Ndhm. and Murphy

A new drawing of the genitalia of this species is presented, in Fig. 1. The penes are somewhat longer, more slender, and further separated from one another in the median line than in genitalia of the Indoaustralian members of this genus, to which fauna the genotype *australis* Wlk. belongs. The wings, however, are as in typical *Atalophlebia*.

Genus *Atalonella* Ndhm. and Murphy

M of the hind wing is forked about 1/3 of the distance from its base to the margin; no intercalary occurs in this fork. Cross veins of the hind wing are less numerous than in *Atalophlebia*, and confined to the disc and upper margin. Needham and Murphy present in tabular form a number of other venational differences between *Atalonella* and *Atalophlebia*, but certain of these, — i. e. presence or absence of basal cross veins in subcostal space, appearance of stigmatic cross veins, and relative length of Sc in the hind wing, — may be of specific rather than generic value. Navas⁶ considers *Atalonella* a synonym of *Nousia*, but if his text figure of the hind wing is taken as evidence rather than his statement in regard to *M* of that wing, *Atalonella* appears to be distinct from *Nousia*. Whether or not *Atalonella* or *Nousia*, or both, are synonyms of *Atalophlebia*, is a question which must await further knowledge of all three genera concerned. Nymphs of *Nousia* are unknown, and there is no certainty that the nymphs described by Needham and Murphy as *Atalonella* really belong to this genus. It should be noted that in the discussion of the genus *Atalonella* in Neotropical Mayflies, the Australian species *Atalophlebia fusca* Ulm. (in the above paper transferred to *Atalonella*) is in error stated to occur in Chile. There is but a single species of *Atalonella* described from Neotropical America.

Atalonella ophis Ndhm. and Murphy

A new drawing of the genitalia is given, in Fig. 2; this is from one of the paratypes.

³⁾ Lestage, 1924, Ann. Soc. Ent. Belg. 64, pp. 21-24.

⁴⁾ Lestage, 1930, Miss. biol. Belge Brésil (1922-23), pp. 251.

⁵⁾ Ulmer, 1938, Arb. morph. taxon. Ent. Berlin-Dahlem 5, pp. 85-108.

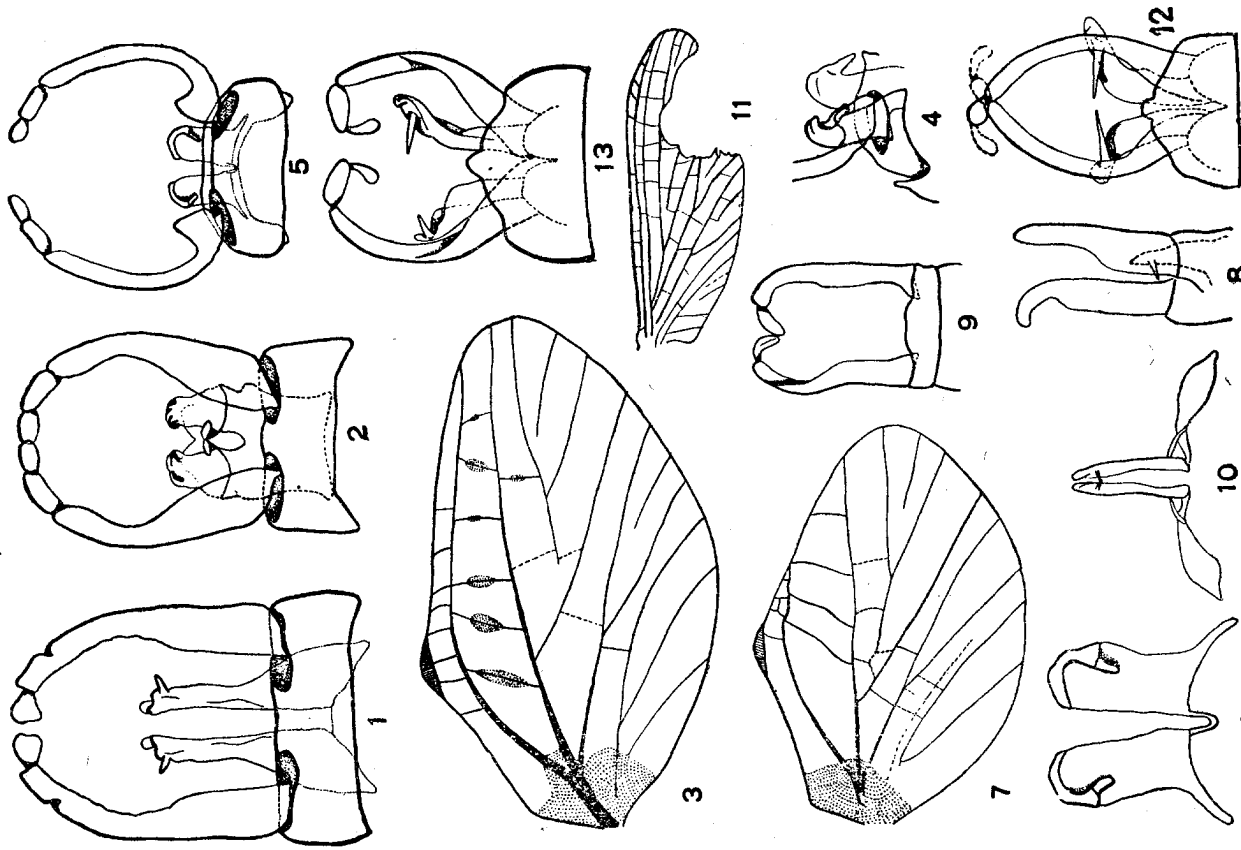


Fig. 1. *Atalophlebia fulvipes*. Male genitalia (holotype), not treated with KOH. — Fig. 2. *Atalonella ophis*. Male genitalia (paratype). — Fig. 3. *Atalophlebioides flavopiceus*. Male genitalia (holotype). — Fig. 4. Same. Male genitalia (holotype); lateral view, before making permanent mount. — Fig. 5. Same. Note tongue-like projection directed ventrad. — Fig. 6. Same. Permanent mount. — Fig. 7. *Atalophlebioides flavopiceus*. Male genitalia (holotype). — Fig. 8. Same. Hind wing. — Fig. 9. Same. Penes enlarged. — Fig. 10. *Thrautodes telegraphicus*. Male genitalia (holotype), after mounting. — Fig. 11. Same. Penes. — Fig. 12. *Thrautodes telegraphicus*. Male genitalia (holotype), after mounting. — Fig. 13. Same. Male genitalia, after treatment with KOH. —

Genus *Nousia* Navas

According to Navas' second reference⁶, the tarsal claws are similar and acute. He speaks of the absence of an intercalary in the median fork of the hind wing; yet his figure⁷ shows the vein so designated by Ulmer, and in Biology of Mayflies, to be unforked. Evidently his reference is to the vein R_2 and R_3 , rather than to M . If his figure of the hind wing is correct, *Atalonella* is not a synonym of *Nousia*, as Navas maintains; likewise *Nousia* is distinct from *Atalophlebia*. However, until a careful study of the type material of *Nousia* can be made, its real relationship to the above-mentioned genera must be problematical. Tentatively we leave it as a valid genus. Needham and Murphy, whose paper appeared before Navas' second reference, placed *Nousia* among the genera of the subfamily Leptophlebiinae in which the tarsal claws are dissimilar. A single species, *N. delicata* Nav., has been described in this genus.

Genus *Massartella* Lestage

Lestage (1930) separates this genus from *Atalophlebia* as follows: in the fore wing Cu_2 is forked, the first cubital intercalary coming directly from Cu_2 . It is questionable whether this character alone is sufficient to serve for the erection of a new genus. Further knowledge of the single species, *M. brieni* Lest., is required before the validity of this genus can be established.

Genus *Deleatidium* Eaton

M of the hind wing forked about 1/6 of the distance from its base to the wing margin, its stem being thus much shorter than in *Atalophlebia* or *Atalonella*; an intercalary is present in this fork. Cross veins of hind wing relatively numerous, much as in *Atalophlebia*. Usually there is a slight indentation on the costal margin of this wing. In the fore wing, the two cubital intercalaries are almost parallel, whereas in the allied *Atalophlebioides* these intercalaries seem to be strongly divergent. M of the fore wing is forked quite near the base, before the fork of R_2 and R_3 ; M_2 is quite strongly bowed to rearward at its union with M_1 , sometimes very angulate and appearing to arise from Cu_1 , or it may be connected to Cu_1 by a very short cross vein (the above

characters of M as in *biobionicum* and *patagonicum*). "Genitalia conformable in pattern to those of an *Atalophlebia*" (Eaton).⁸ Nymphs described by Needham and Murphy as ?*Deleatidium* are not of this genus. According to Ulmer (1938), four Neotropical species belong to this genus: *haarupi* (Esb. Pet.) described in *Thraulius*; *laminatum* Ulm.; *patagonicum* (Lest.), described in *Atalophlebia*; and the recently-described species from Chile, *biobionicum* Ulm. As indicated under *Atalophlebioides*, the species *haarupi* seems more nearly conformable to that genus than to *Deleatidium*, and is so considered in this article.

Genus *Atalophlebioides* Phillips

Phillips⁹ considers *Atalophlebioides* a subgenus of *Deleatidium*. We follow Ulmer (1938) in raising *Atalophlebioides* to generic rank. Phillips' description of venational and genitalic characters does not help much in a separation of *Atalophlebioides* from *Deleatidium*, but his figures seem to show that in the fore wing of *Atalophlebioides* the two cubital intercalaries are strongly divergent as they approach the margin. The species *haarupi* (Esb. Pet.), and the new species *são-paulense* described below, seem to have much in common, and to differ in certain venational characters from *Deleatidium*; also, in both of these species, the cubital intercalaries are strongly divergent. For this reason we are placing them tentatively in *Atalophlebioides*. Other differences in venation between these two species and *Deleatidium biobionicum* and *patagonicum*, are: (1) the later forking of M of the fore wing, this fork occurring nearer the margin than the fork of R_2 and R_3 in *haarupi*, and at the same level as that fork in *são-paulense*; (2) the fork of M in fore wing normal. M_2 not so strongly bowed to rearward, and thus not approaching Cu_1 so closely; and (3) the slight prominence on the costal margin of the hind wing, instead of a slight depression in this area. From the marked similarity in genitalia between *são-paulense* and Spieth's recently described *Thraulodes flavopedes*¹⁰, plus the fact that the genitalia of the latter species are so completely unlike those of all known species of *Thraulodes*, it is very probable that *flavopedes* is not a *Thraulodes*, but should be included in the same genus with *são-paulense*. The presence of

⁸) Eaton, 1899, Trans. Ent. Soc. London, pp. 288.

⁹) Phillips, 1930, Trans. N. Z. Inst. 61, pp. 385.

¹⁰) Spieth, 1943, Amer. Mus. Nov. 1244, pp. 1-13.

⁶) Navas, 1925, Rev. Chil. Nat. Hist. 29, pp. 308.

⁷) Navas, 1918, Bol. Soc. Arag. Cienc. Nat. 17, pp. 213.

the costal prominence on the hind wing in this genus would seem to mean either that it may really belong in Section *B*, or that it is a "connecting link" between Sections *A* and *B*, as here considered.

Atalophlebioides são-paulense, sp. nov.

Material: One male imago, one female imago; Brazil.

Male imago. Body 7 mm.; wing 8 mm. General color, dark redbrown; wings spotted. Head, thorax and abdomen very deep shiny redbrown. Top of head almost covered by the very large eyes, which are blackish and much shrunken. (Specimen was pinned originally, and immersed in alcohol only when thoroughly dried). Lateral margins of pronotum black. Numerous black markings of thoracic pleura, particularly around bases of legs. Black mid-ventral streak on sternum. Fore and middle legs missing. Femur of hind leg dark red-brown with black longitudinal streak; tibia paler red-brown at base, becoming almost yellowish in apical third; longitudinal smoky streak on this segment also. Basal tarsal joints concolorous with base of tibia; apical joint dark red-brown at apex, claws same dark color. Femur and tibia subequal; tarsus contained about $2\frac{1}{3}$ times in tibia. Wings shiny, iridescent. Longitudinal veins yellow; majority of cross veins purplish brown. Costal and subcostal spaces, and following space for short distance at bulla, with distinct reddish stain, except as noted: outer $\frac{1}{3}$ of costal space white between cross veins; white areas more extensive near bulla; outer half of same area paler reddish in stigmatic area. Humeral cross vein blackish brown; space basad of it yellowish brown. Cross veins behind subcosta not too numerous, the majority of them widely margined so as to appear like round red-brown spots. At bulla, five cross veins in third space, all included in one brown spot; three veins basad of bulla, that next to bulla not margined; seven apical of bulla, first three beyond bulla most widely margined. Other cross veins very widely margined are: two before bulla in next two spaces back of third space, and in medio-cubital area two irregular rows, these somewhat less widely margined; one large spot below bulla in space following R_5 ; irregular series extending backward from bulla toward hind margin; near apical margin, three in fourth space moderately large-spotted; behind fourth intercalary between R_2 and R_3 , one very large and two smaller blotches. Hind wing as in Fig. 3. Red-brown basal stain; *Sc* and

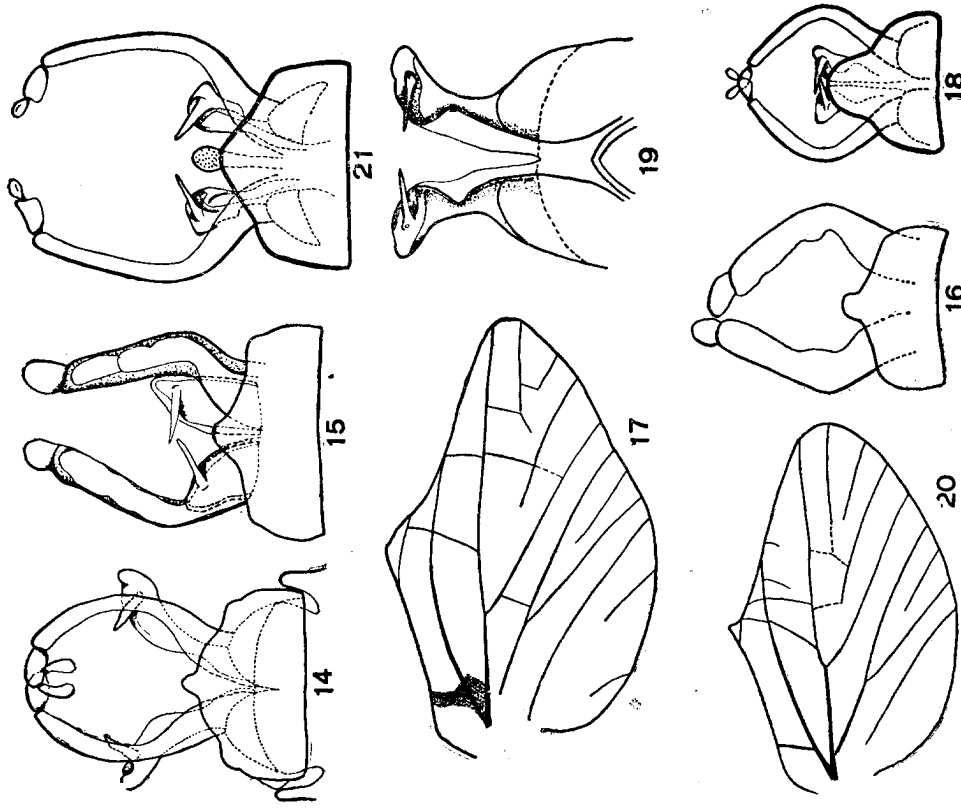


Fig. 14. Same. Male genitalia (paratype). — Fig. 15. Same. Male genitalia of *Thraulodes plicatus*, type material; specimen is a subimago. Here considered a synonym of *T. tetragraphicus*. — Fig. 16. Forceps and forceps base of *T. plicatus*; subimaginal cuticle removed. — Fig. 17. *Thraulodes plicatus*. Hind wing (holotype). — Fig. 18. Same. Male genitalia. — Fig. 19. Same. Penes, enlarged. — Fig. 20. *Thraulodes centralis*. Hind wing (holotype). — Fig. 21. Same. Male genitalia.

R deep red-brown at base; three cross veins in space behind *Sc* narrowly margined; three other cross veins in that space nearer apex, and one vein in space behind, somewhat purplish; all others pale. Abdomen more or less transparent; apical segments somewhat paler than basal and middle ones. Tergites rather evenly shaded with blackish, which is most evident on pleural fold and as narrow black posterior margins of segments. Sternites slightly paler than tergites, faintly tinged with smoky brown; apical margins of basal and middle sternites blackish. Tails light red-brown, joinings

darker. In middle area, every second or third joint somewhat paler than those adjoining. Genitalia as in Figs. 4, 5 and 6, as seen in lateral aspect before mounting, and in ventral aspect from permanent mount, the two latter drawings after treatment with KOH.

Female imago very similar to male except as noted. Vertex of head yellowish. Body somewhat paler red-brown; abdominal sternites almost yellowish. Femur of fore leg light red-brown, with wide blackish median band and narrower apical one. Broken black band across basal end of tibia. Tibia pale red-brown basally with an apparent dark streak near middle; yellowish white apically. Other legs missing. Costal strip of fore wing pale except for 1/3 next to subcosta; all cross veins purplish brown, those before the bulla rather widely margined. Practically every cross vein before the first anal bears a round dark spot or is widely margined. Pleural fold outlined in black; tiny black dot at each stigmatic area, and smoky brown patch in postero-lateral angle of each tergite. Tergites orange-brown. Tails missing. 9th sternite prolonged beyond the end of the 10th; truncate, with a slight excavation; in color yellowish with blackish shading on outer apical margins and gray shading near center. Body 8½ mm.; wing 9½ mm.

Holotype: Male imago, Bauru, São Paulo, Brazil, Dec. 4, 1919. C. U. Entomological Expedition. In Cornell University Collection.

Allotype: Female imago. Bello Horizonte, Minas Gerais, Brazil, Nov. 1-6, 1919; C. U. Ent. Expedition. In private collection of writer.

The widely-margined cross veins should distinguish this species easily from *haarupi* and *flavopedes*. Differences in venation between *são-paulense* and *haarupi* have been noted. In the hind wing, Sc is much longer in *são-paulense* than in *flavopedes*, extending almost to the apex of the wing in the former species; there are likewise certain differences in genitalia, especially in the basal joint of the forceps.

Atalophlebioides flavopedes (Spth.)

Thraulodes flavopedes Spth.

Four male imagos of this species and several subimagos of both sexes are in the Cornell Collection; they were taken in Moengo, Boven, Cottica River, Surinam, on May 12, 13 and 25, 1927, by the Cornell University Entomological Expedition. The hind wing of this species is shown in Fig. 7. The fore leg

of the male is relatively short, being not much longer than head and thorax combined. Wings of the male sub-imago are smoky with a distinct reddish tinge. Tails whitish, all joinings purplish black. Three wide pale horizontal streaks on mesonotum, the median of these extending to tip of scutellum. Abdomen much obscured by blackish shading, tergites apparently somewhat darker than sternites. Pale submedian dashes are faintly indicated on basal sternites. Otherwise very similar to imago. Size of the Cornell specimens: body 7 mm.; wing 8 mm.

Section B.

Genus *Hagenulopsis* Ulmer

No hind wing. Female possesses ovipositor. Two species of Neotropical mayflies have been described in the genus: *diptera* Ulm., and *minutus* Spth. It should be noted that the specimen described by Needham and Murphy as the female of *Choroterpes emersoni* is in reality the female of *Hagenulopsis minutus*. This is shown from a study of the type material of *C. emersoni*. Mounted on a slide labeled *Choroterpes emersoni* is the female of *Hagenulopsis*, along with head, legs and tails of a male specimen. In the vial labeled *Choroterpes emersoni* are two specimens of *Hagenulopsis*. Fig. 145 by Needham and Murphy is a good representation of the abdomen and ovipositor of *Hagenulopsis minutus*.

Hagenulopsis minutus Spth.

A male and female specimen of this species, also the torso of a second male, are in the Cornell University Collection. These specimens were taken at Kalacoon, Bartica District, British Guiana (A. E. Emerson, Coll.) in a spider's web, along with the male of *Choroterpes emersoni*. The male may be described as follows.

Male imago. Body badly twisted, head separated from thorax. Length probably about 3½ mm. Wing torn, was probably about 4 mm. Turbinate eyes very large, almost round; deep red-brown; contiguous apically. (Head mounted on slide with body of female). Top of head obscured by eyes. Thorax quite bright red-brown, without conspicuous markings. Legs missing (may be in assemblage of legs and tails on slide with head). Abdomen blackish brown, distinctly duller and darker than thorax. Posterior margins and line along pleural fold narrowly darker. On some

at least of the basal and middle tergites, a pale crescentic area on anterior margin at mid-line. Tails missing (unless those on slide belong here). Genitalia as in Figs. 8, 9 and 10. Apparently the distal forceps joint is missing, on each forceps. Wing shown in Fig. 11.

Genus *Thraulodes* Ulmer

It should be noted here that Fig. 145 in the Biology of Mayflies is in error labeled *Thraulodes speciosus*; Figs. 143 and 145 are interchanged, so that Fig. 145 represents *Habrophlebia vibrans*, and Fig. 143 is that of *T. speciosus*. *M* of the hind wing forked at about 1/3 of the distance from its base to margin; typically an intercalary is present in this fork. *Sc* of the hind wing extends beyond the costal angulation, but ends well before the apex of the wing. In some specimens of *Thraulodes*, the basal costal cross veins may be lacking or very indistinct, while in other species these cross veins are prominent. Prominent basal cross veins seem to be associated with margined cross veins in all or part of the fore wing, while in those species in which the cross veins are not margined, the basal cross veins are indistinct or lacking. Forceps base entire, prolonged in central area into a truncate, rounded or dome-shaped prominence, the size and shape of which seems to be a good specific character. Forceps three-jointed; basal joint long and slender, much bowed; the two distal joints much shorter. Penes possess beak-like or spear-like appendages, the appearance of which varies with each species. Seventeen species of Neotropical mayflies are at present considered to be of this genus. Of these, I propose the transfer of *flavopedes* Spth. to *Atalophlebioides*, and the reduction of *plicatus* Ndhm. and Murphy to synonyms with *telegraphicus* Ndhm. and Murphy.

Thraulodes telegraphicus Ndhm. and Murphy

Thraulodes telegraphicus and *plicatus* Ndhm. and Murphy.

A careful examination of the type material of *telegraphicus* and *plicatus* (the latter described from submarginal material, contrary to the statement in Neotropical Mayflies) leads me to conclude that the latter species is but a synonym of the former. The "shield-shaped field on the mesonotum that is sharply defined by angulate brown lines" (Ndhm. and Murphy), as indicated for *plicatus*, is not a specific character, but merely the normal appearance of the subimago of this genus. In older specimens of "*plicatus*" (not mentioned in Neotropical Mayflies), in the

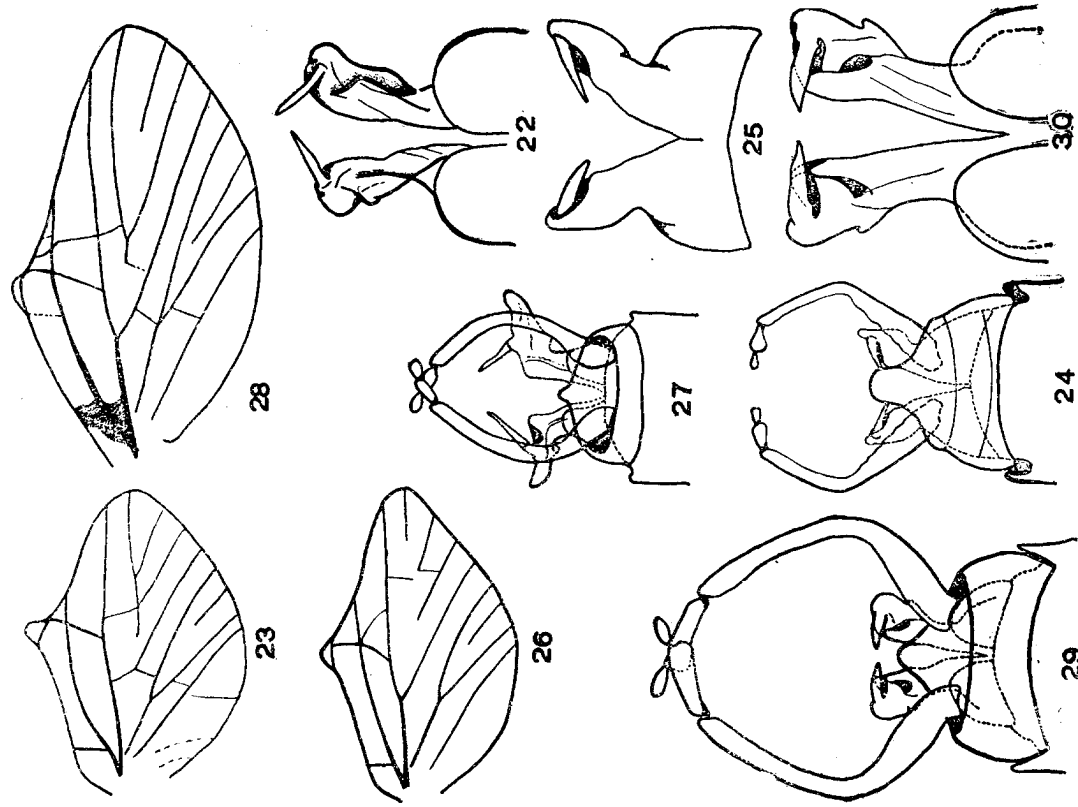


Fig. 22. *Thraulodes centralis*. Penes, enlarged. — Fig. 23. *Thraulodes hilaroides*. Hind wing (holotype). — Fig. 24. Same. Male genitalia. — Fig. 25. Same. Penes, enlarged. — Fig. 26. *Thraulodes prolongatus*. Hind wing (holotype). — Fig. 27. Same. Male genitalia. — Fig. 28. *Thraulodes furcatus*. Hind wing (holotype). — Fig. 29. Same. Penes, enlarged. — Fig. 30. Same. Penes, enlarged.

Cornell Collection, the coloring is extremely similar to that of *telegraphicus*, — dark spiracular dots, mid-ventral ganglionic patches, and dark markings on the tergites. Figs. 12, 13 and 14 show the genitalia of the holotype of *telegraphicus*, before and after treatment with KOH. Fig. 15 is from a paratype of this species (probably the specimen referred to in Neotropical Mayflies

as "one additional male"). Fig. 16 is of the genitalia of the so-called holotype of *plicatus*. All evidence seems to show that but one species is involved. All but two female specimens were taken at the same place, and at approximately the same time. The wing of the holotype of *telegraphicus* is 10 mm. in length, as is also that of the male paratype, whereas it is stated in the original description that the wing of the male is 11-11½ mm. in length.

Thraulodes pedregoso, sp. nov.

Male imago. — Body 7-8½ mm.; wing 8½-9½ mm. (In alcohol). Head brownish above; frontal carina pale. Antennae yellow, black line at base. Turbinate eyes large, almost round, contiguous apically; in color orange-brown. Thorax yellowish. Pronotum with wide black median band; wide black lateral margins; oblique submedian streaks. Rather wide band of interrupted black blotches extends longitudinally on pleura, above leg bases. On mesonotal shield, anterior hump, tip of scutellum, and raised areas just anterior to scutellum, dark brown (more pronounced on paratype than on holotype). Dark lateral lines along margins of scutellum. Fore legs absent from all males, but in vial with specimens are several fore legs which belong presumably to this species. Fore femur yellow with wide longitudinal orange streaks, wide red-brown elongate area near middle of inner surface, showing through to outer surface; narrowly blackish at apex, and along distal half of posterior margin. Knee dark brown. Tibia orange, becoming dark red-brown toward apex. Basal joint of tarsus yellow in proximal half, smoky red-brown distally; joints 2 and 3 smoky red-brown, joinings narrowly yellowish; 4th joint yellow with smoky shading. Femur about ¾ of tibia. Middle and hind femora yellow with less pronounced orange streaks; median purplish band, indistinct on second but very wide and pronounced on third, where it extends from middle almost to base; narrowly black at distal end. Tibiae and tarsi clear yellow; tips of claws and tarsal joinings very narrowly darker. Hind femur almost as long as tibia; tarsus much shorter (1/4 to 1/5 of tibia). Wings hyaline. Subcostal space of fore wing orange (slightly paler at bulla, and again in small areas below stigma). Purplish brown shading in basal half of costal space next to subcosta. Humeral cross vein, and costal cross vein before bulla, purplish brown; may be narrowly margined. 5 costal cross veins before bulla; 3 between bulla and

stigma; 8 to 10 slanting cross veins in stigma. Cross veins in distal half of subcostal space indistinct, basal ones purplish brown. Remainder of cross veins in fore wing very distinct, brown to purplish brown; many in disc are somewhat thickened. Faint cloud at base of R_s and R , also at branching of R_4 and R_5 in disc. In some of the paratypes but not on holotype, a distinct black transverse dash at subcostal ends of several pre-bullar costal cross veins. Longitudinal veins amber. Hind wing hyaline; veins whitish, indistinct except for purplish comma-shaped mark on humeral vein. Hind wing as in Fig. 17. Abdominal segments yellowish. Basal segment opaque, tergite largely purplish. Segments 2-6, and most of 7, translucent; posterior margins of tergites narrowly purplish brown; prominent brownish blotches in postero-lateral angles, connected to small darker blotch near antero-lateral angle. Tiny dark stigmatic dots. Submedian purplish brown blotches on tergite 2. Sternites unmarked, or with faint dusky submedian blotches on 2-4. Segments 8-10 opaque; tergites yellowish brown. Tergite 7 shaded with pale purplish brown in basal half; median dark dashes on tergites 7-9, widest on 7 and 8, not attaining apical margin (on 7, a pale line may occupy center or dark streak). Tails yellowish white. Joinings black, in the characteristic dot-dash fashion of this genus. Genitalia as in Figs. 18 and 19.

Female imago. Body 7½-8½ mm.; wing 8-9 mm. Very similar to male, with usual sex differences. Thorax and abdomen paler, but dark markings on tergites more extensive. Amber of subcostal space less intense, but continuous to apex.

Holotype: Male imago. Rio Pedregoso, Costa Rica. Feb. 1939. D. L. Rounds, Coll. In private collection of the writer.

Allotype: Female imago. Same data.

Paratypes: 9 male imagos, 3 female imagos. Same data.

This species seems closely allied to *lepidus* Etn. Differs from *lepidus*: (1) no lateral projections on penes externally (see Kimmins¹¹), either in those viewed in situ or on four treated with potash and mounted; (2) fore femur, tibia and tip of tarsus not wholly rufo-piceous; (3) humeral cross vein not paler at costal margin.

¹¹ Kimmins, 1934, Nnn. Mag. Nat. Hist. Ser. 10, 14, pp. 343, fig. 7.

Thraulodes centralis, sp. nov.

Male imago. Body 6-7 mm.; wing 7-8 mm. (In alcohol). Turbinate eyes almost round, contiguous apically; in color purplish black. Head dark brown. Basal antennal joint dark red-brown, filament paler brown. Pronotum yellowish white, unmarked. Mesonotum light red-brown; scutellum opaque whitish; dark brown line on either side of anterior portion; rather wide dark red-brown areas just anterior to scutellum. A few blackish pencillings on pleura; red-brown oblique streak anterior to middle legs. Metanotum red-brown with much black shading along posterior margin and above leg bases. Most of mesosternum red-brown; remainder of sternum yellowish white. Legs missing from all imagos. Legs of subimago as follows: All legs yellowish, femora whitish, paler than tibiae and tarsi. Small black median spot on under surface of fore femur; pre-apical brown spot on dorsal surface; black lines on upper and lower margins near apex, also dark brown spot at apex. Femora of other legs similar, but lacking median dark spot. Middle and hind tibiae, and all tarsi, unmarked. Wings hyaline whitish; membrane very faintly amber-tinged. Stigmatic area of fore wing opaque whitish. Humeral cross vein and adjacent area on large veins of costal margin deep purplish black. All other cross veins indistinct. Longitudinal veins pale amber. No costal cross veins before bulla. 7 to 8 stigmatic cross veins, slightly aslant. Hind wing as in Fig. 20. Humeral cross vein purplish black; some dark shading adjacent to it. Abdominal segments 2 to 6, and base of 7, translucent white. Tergite 1 semi-opaque whitish, basal margin purplish brown. Very prominent purplish black stigmatic dots. Submedian grayish purple blotches on each of these tergites. Pale red-brown band across central portion of each tergite, between submedian blotches; this band darkest and most extensive on tergite 6, appearing saddle-shaped. Narrow dark band on median area of posterior margins of tergites 5 to 8. Segments 8 to 10 opaque pale yellowish brown; 7 whitish. Black streak along pleural fold on 7, indicated also on 8. (One paratype has middle abdominal segments semi-opaque yellow; apical segments light red-brown; distinct chestnut-brown saddle-mark on tergite 6). Tails white, faintly yellowish at extreme base, where each joining is dark. Beyond base, alternate wide and narrow black marks at joinings, as in many species of this genus. Genitalia as in Figs. 21 and 22; yellowish white.

Holotype: Male imago. Rio Pedregoso, Costa Rica. Feb. 1939. D. L. Rounds, Coll. In private collection of the writer.

Paratypes: Two male imagos, 1 male subimago. Same data. This species seems allied to *boimplandi* Esb. Pet., but differs in details of the genitalia and in abdominal markings.

Thraulodes hilaroides, sp. nov.

Male imago. Body 7 mm.; wing 8 mm. (In alcohol). Turbinate eyes pale orange; almost round, contiguous apically. Head brown. Antennae amber-colored, basal joints black at apex. Dorsum and pleura of thorax very dark red-brown; median areas of pro- and mesonota paler red-brown, also narrow areas on pleura around bases of legs and wings. Scutellum and adjoining anterior areas almost black. Black markings at leg bases. Sternum largely yellow; posterior half of mesosternum red-brown. Legs missing. Membrane of both wings strongly tinted with yellowish brown of amber. Longitudinal veins amber brown; cross veins, especially those in disc of fore wing, darker brown and slightly heavier than longitudinals. Humeral cross vein purplish black. Extreme bases of Sc and Rs blackish. Cross veins of disc of fore wing arranged in 9 or 10 quite regular transverse series. 7 basal costal cross veins before bulla; 4 beyond bulla basad of stigma. About 8 stigmatic cross veins, slightly aslant, well developed, one or more of which may be somewhat angulate. Some cross veins of disc, also of costal and subcostal spaces, may be very narrowly margined. Hind wing as in Fig. 23; extreme bases of Sc and Rs black. Abdomen brown; middle segments translucent, yellowish brown; basal and apical segments opaque, dark red or blackish brown. Basal tergite heavily shaded with black. Posterior margins of all tergites narrowly black; arcuate deep brown markings follow margin of pleural fold. Dark brown submedian triangles on tergites 2 to 8, becoming progressively smaller apically. Large brown triangle occupies postero-lateral angle on 2 to 5, indicated also on 6; a yellowish oval mark between dark pleural fold and this dark triangle. Dark shading laterally next to pleural fold on apical tergite also. Small dark antero-lateral triangle on sternites 2 to 6. Indistinct dark rectangular patches on all sternites, becoming smaller, darker, and almost triangular on apicals. Median ventral streak is thus paler than remainder of sternum. Tails missing. Genitalia as in Figs. 24 and 25.

Holotype: Male imago. Rio Pedregoso, Costa Rica. Feb. 1939. D. L. Rounds, Coll. In private collection of the writer.

This species is allied to *hilaris* Etn., differing from it in certain details of the genitalia, the darker abdomen, and the amber-tinted wings.

Thraulodes prolongatus, sp. nov.

Male imago. Body 6-6½ mm.; wing 6-6½ mm. In alcohol). Head yellowish. Turbinate eyes large, almost round, contiguous apically. Pronotum light red-brown; triangular dark median line, and wide blackish band occupy most of each lateral area. Mesonotum lighter red-brown, margined with darker red-brown; red-brown patches just anterior to scutellum; scutellum largely yellowish, tipped with dark brown. Pleura light red-brown except for yellow areas at bases of wings and legs; a few inconspicuous blackish pencillings. Thoracic sternum yellow, middle area almost white. Fore legs of holotype missing, present on one paratype. Wide dark red-brown apical band on fore femur, definitely blackish at its proximal border; knee black; narrow black pre-apical band on tibia. Middle and hind legs not marked. Wings hyaline, white; whitish stigmatic cloud present. No basal costal cross veins. Prominent black spot at base of *Sc* and *Rs*, extending for slight distance only along humeral cross vein; smaller black spot nearer base on *R*. Humeral cross vein light brown very narrowly shaded with purplish brown; blackish at extreme base only. Venation pale amber, cross veins less distinct than longitudinal; stigmatic cross veins rather indistinct, slanting; a few tend to anastomose near outer margin. Small black spot at base of main veins in hind wing; costal angulation almost at center of wing. Hind wing as in Fig. 26. Abdominal segments 1 to 6 whitish or yellowish white; 2 to 6 (and extreme base of 7, in one paratype) transparent; segments 7 to 9 yellowish to light red-brown, more or less opaque. Tergite 1, and central portion of 2, largely purplish brown. Saddle-shaped purplish brown mark occupies most of central area of 3; similar but less extensive central dark area on 4; two submedian purplish blotches on 5, one smaller blotch on 6; median chestnut-brown mark on 6. Oblique purplish brown streaks, on tergites 2 to 6, extend inward from antero-lateral angle to dark posterior margin; on tergites 2 to 4, joined to saddle mark by narrow dark line. Thus pale triangular areas are left at postero-lateral angle and laterally along basal margins of tergites 2 to 4; on same tergites, a roundish yellow spot in postero-lateral angle of dark saddle mark. Tergites 5 and 6 largely pale, so that 5 appears to have three, and 6 two dark marks on each side. Very small blackish brown stigmatic

dots, and small brown spot nearer anterior margin. Sternites somewhat more yellowish than tergites, unmarked. Tergites 7 to 9 with narrow dark posterior margins. Tails white with black joinings, which in middle area are prominent at every fourth joining only, the intermediate joint between these being marked by a narrow black band. Genitalia amber, tips of forceps paler. Penes unusual because of their great lateral prolongation, on both inner and outer margins. Shown in Fig. 27.

Female imago. Body 5½ mm.; wing 6½ mm. Resembles male except for usual sexual differences. Head whitish, with gray band between eyes. Thorax yellow; dark markings on pronotum and on pleura, as in male. Abdominal markings similar in general, but paler. Apical segments same color as preceding ones. Before deposition of eggs, all segments more or less opaque. Subanal plate quite long, only narrowly indented at middle of apical margin.

Holotype: Male imago. Rio Pedregoso, Costa Rica. Feb. 1939. D. L. Rounds, Coll. In private collection of the writer.

Allotype: Female imago. Same data.

Paratypes: Two male and one female imagos. Same data.

This species belongs in the same group with *bomplandi* Esb. Pet., *taetus* Etn., *mexicanus* Etn., *humeralis* Nav., *telegraphicus* Ndhm. and Murphy, and *trijuncta* Ets. The genitalia are unlike any of those of the above species which have been figured, and markings of legs and abdomen do not correspond with other species for which no genitalic figures have been given.

Thraulodes furficulus, sp. nov.

Male imago. Body 10½ mm.; wing 14 mm. Head and pronotum yellowish; remainder of thorax red-brown. Turbinate eyes red-brown; large, contiguous apically. Filament of antenna yellow, basal portion brown. Black median line on pronotum, also oblique black lateral streaks on pleura at leg and wing bases. Scutellum yellowish. Legs yellow with piceous markings. Fore femur piceous except extreme base which is yellow, and narrow pale median band. Apex of tibia piceous; distal tarsal joints missing. Middle and hind femora with wide pre-apical piceous band and narrower pale brown post-basal band; apex of tibia, distal tarsal joint and blunt claw, piceous. Wings hyaline; very faintly amber-tinged, most noticeable along costal margin. Longitudinal veins deep amber. Cross veins of fore wing brownish to purplish brown, easily discernible; in costal, subcostal and

third spaces those in basal half of wing are narrowly margined; at bulla this margining is widest in cross veins of second and third spaces. 7 costal cross veins before bulla, about 5 between bulla and stigmatic area. Stigmatic veins oblique, about 9 in number, not margined. Humeral cross vein and small spot at base of anterior veins purplish black. A few veins in basal part of disc are very narrowly margined. Purplish spot on humeral cross vein of hind wing, as in fore wing. Basal cross veins at and below costal angulation blackish, all others pale yellowish, not easily seen. Costal angulation toward base from center of wing. One hind wing of holotype shown in Fig. 28; on other hind wing of the same specimen, there are but two cross veins extending across the costal and subcostal spaces at region of angulation, as is true also for one hind wing of the paratype. Basal abdominal segments mainly dark red-brown. Segments 2 to 6 yellow, transparent. Each of these tergites is marked thus: (1) purplish brown median triangle near to but not touching the posterior margin; (2) a similarly-colored oblong lateral spot, from which a narrow dark line may extend to pleural fold, or a smaller disconnected spot between large marking and pleural fold; and (3) a prominent black stigmatic dot. On basal sternites at least, a prominent orange-brown ganglionic blotch; two or three narrow dark dashes on each side of blotch, extending to pleural fold. Tergites 7 to 10 bright red-brown, opaque; sternites paler, that of 7 transparent and with ganglionic mark. Tails at extreme base dusky brown with narrow pale joinings; next, alternately dusky and white joints, the dusky joints often with a pale blotch; beyond this region a wide black joint followed by three pale ones, the joinings of the latter narrowly dusky. Genitalia distinctive, with peculiar thumb-shaped inner process and pincer-like apical structure. See Figs. 29 and 30, for appearance of genitalia.

Holotype: Male imago. Georgetown, British Guiana. Cornell University Entomological Expedition, 1913 (no other date). In Cornell Collection.

Paratype: Male imago. Same data. In private collection of the writer.

This species belongs in the group with *colombiae* Etn., of which only the female is known; *hilaris* Etn.; *lepidus* Etn.; *valens* Etn.; and *irretitus* Nav. In size it comes close to *colombiae*, and is rather too large for *valens*. The presence of 7 basal costal cross veins instead of 1 or 2, plus the differences in color of abdomen and markings of the abdominal segments, would seem to indicate that this is a distinct species from *colombiae*, which seems to be its nearest ally.

Contribuição Para o Conhecimento dos Meliponinae. (Hym. Apoidea).

Pelo Pe. Jesus Moure, C. M. F., Museu Paranaense, Curitiba.

Nas presentes notas descreve-se uma espécie, aparentemente nova, de *Tetragona* e estabelecem-se três novos grupos sistêmáticos pelo autor: *Friesella*, *Tetragonisca* e *Schwarzula*, dando a conhecer também, com a devida autorização, a diagnose de mais uma unidade sistemática *Mourella*, criada por Schwarz, e que deverá aparecer na grande revisão do referido grupo que está sendo ultimada pelo meu prezado amigo.

A razão de ser destas notas é para justificar certas consultas de alguns amigos que receberam material determinado com os nomes abaixo especificados, e que não haviam encontrado na literatura pelo simples facto de estarem inéditos até o presente.

Tetragona francoi, n. sp.

1 exemplar, operária, de Riachuelo, Sergipe, coletado pelo Eng. Agr. Dr. A. Franco Filho, a quem reconhecidamente dedico a espécie.

Descrição sumária:

Operária: A cabeça amarela e testácea, apenas com uma mancha negra em forma de retângulo transversal, que ocupa toda a região frontal, separada das órbitas internas por uma estria amarela, estando limitada inferiormente por uma linha transversa imaginária que se estende paralelamente à tangente superior dos alvéolos antenais, porém a uma distância de um diâmetro e meio do alvéolo ("antennal socket") e superiormente avança até a deflexão occipital; a extremidade apical das mandíbulas um pouco fusca, com os dois dentes do terço interno do bordo apical bem desenvolvidos; uma pequena mancha fusca no terço distal posterior do escapo; este atingindo a tangente inferior do ocelo médio; o 2.º artículo flagelar visto de frente quase o duplo do próprio diâmetro, o 1.º muito curto, e visto de frente mais curto que o pedicelo; a fronte com pilosidade normal erecta não muito longa e outra mais curta e plumosa, menos densa que em *T. viria* porém mais que em *T. nigra*.

Tórax (incluindo as pernas e as nervuras), propódeo e abdomen de um amarelo mais ou menos testáceo-ferrugineo-claro, tendendo um pouco para o fusco nos últimos segmentos abdominais; todo o disco do mesonoto preto em forma de quadrado, que atinge posteriormente a sutura escuto-escutelar e anteriormente