

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

By Jay R. Traver, State College, Amherst, Mass.

(With 22 text figures).

This paper is a continuation of Part I of the same series (Rev. Ent. 1946, pp. 418-436), and deals with adult forms of Neotropical Leptophlebiine mayflies of the genera *Thraulius*, *Choroterpes* and *Hermanella*. For a discussion of other genera of this subfamily, see Part I.

Genus *Thraulius* Eaton

M of the hind wing not forked. Costal angulation of hind wing usually acute; *Sc* ends in this angulation; cross veins relatively few in number. In the fore wing, the outer fork of R_4 and R_5 may sag somewhat to rearward, R_s being somewhat bowed at its union with R_4 . Usually a single pair of cubital intercalaries, diverging toward the margin. Forceps base entire. Penes usually more or less conical, bearing each a slender projection. A pair of projecting processes is present between forceps base and penes, in some species, but is absent in others. Thirteen species of *Thraulius* are at present recognized from the Neotropical region. In *caribbeanus* Trav.¹, and to a lesser extent in the new species *roundsi*, the penes are reminiscent of those structures in certain species of Nearctic *Paraleptophlebia*.

Thraulius bradleyi Ndhm. and Murphy²

Fig. 142 of Neotropical Mayflies shows the penes and forceps adequately. The holotype slide seems to show, in addition, two short blunt projections between forceps base and penes, which however are difficult to determine.

Thraulius maculatus Ndhm. and Murphy²

A new drawing of the genitalia is presented in Fig. 1. The slide with genitalia of the holotype of this species could not be located. This figure was prepared from one of the paratypes.

Thraulius primanus Eaton

Four male imagos in the private collection of the writer may well be representatives of this species. The description given by Eaton for the male of *primanus* fits these specimens very well, with two exceptions: (1) length of wing; in *primanus* male, 9

mm., in my specimens, 7-8 mm.; (2) the extent of the brownish tinge on the fore wing; in *primanus*, "fore wing in its basal half, and in marginal area up to bulla, faintly tinged with very light pitch brown" (Eaton)³; in my specimens, brown tinting limited to extreme base except in costal and subcostal spaces, where it is quite uniform from base to apex except in region of bulla. It is difficult to be certain of the extent of this brown tinge except on the costal margin. Its amount is also variable in the four specimens. Hind wing uniformly brown-tinted, as in *primanus*; appearance as in Fig. 2. Since the determination is not positive, owing to the fact that the abdomen of the type male is now missing (Kinnins, 1934)⁴, the following additional notes on my specimens are presented. The males from which this description is drawn are in alcohol. — Antennae pale brown. Turbinate eyes red-brown in upper half, black below. Lateral portions of pronotum outlined in black, most distinct on outer border. Black line on suture above and back of fore leg; black markings also at bases of middle and hind legs. Black shading on coxae; black apical ring on trochanter, of hind leg. All legs similar in coloration, and as indicated by Eaton. Middle abdominal segments paler and almost transparent on anterior margins. Sternites likewise narrowly paler next to pleural fold. Tails blackish at extreme base, becoming gradually paler apically. Joinings noticeably darker only on four or five of the most basal joints. Genitalia as in Figs. 3 and 4. As noted by Eaton, the forceps are stout, with an oval apical joint. Specimens from Rio Pedregoso, Costa Rica, Feb. 1939. D. L. Rounds, Coll.

Thraulus demerara, sp. nov.

Male imago. Body 4½ mm.; wing 5 mm. In alcohol. Turbinate eyes very large, oval, contiguous apically; in color orange to orange-brown. Head dark red-brown. Thoracic notum reddish brown; pleura yellowish with black markings. Sternum yellow, unmarked. Fore femur yellow, paler at tip; purplish brown line along lower margin; partial subapical band of same color;

genitalia (holotype); details of, before making permanent mount. — Fig. 14. *Choroterpes bilineata*. Hind wing; female, from Moengo, Boven, Surinam. — Fig. 15. Idem. Male genitalia, subimago (in vial with allotype). — Fig. 16. *Choroterpes atramentum*. Hind wing. — Fig. 17. Idem. Male genitalia (subimago). — Fig. 18. Idem. Freehand sketches of (a) details of penes, male subimago, and (b) subanal plate of female. — Fig. 19. *Choroterpes vinculum*. Hind wing. — Fig. 20. *Hermanella incertans*. Variations in hind wing. (a) Specimen from Mackenzie; (b) from British Guiana, no locality label; (c) from Tumatumari. — Fig. 21. Idem. Male genitalia; specimen from Mackenzie. — Fig. 22. Idem. Male genitalia; specimen from British Guiana. No locality given.

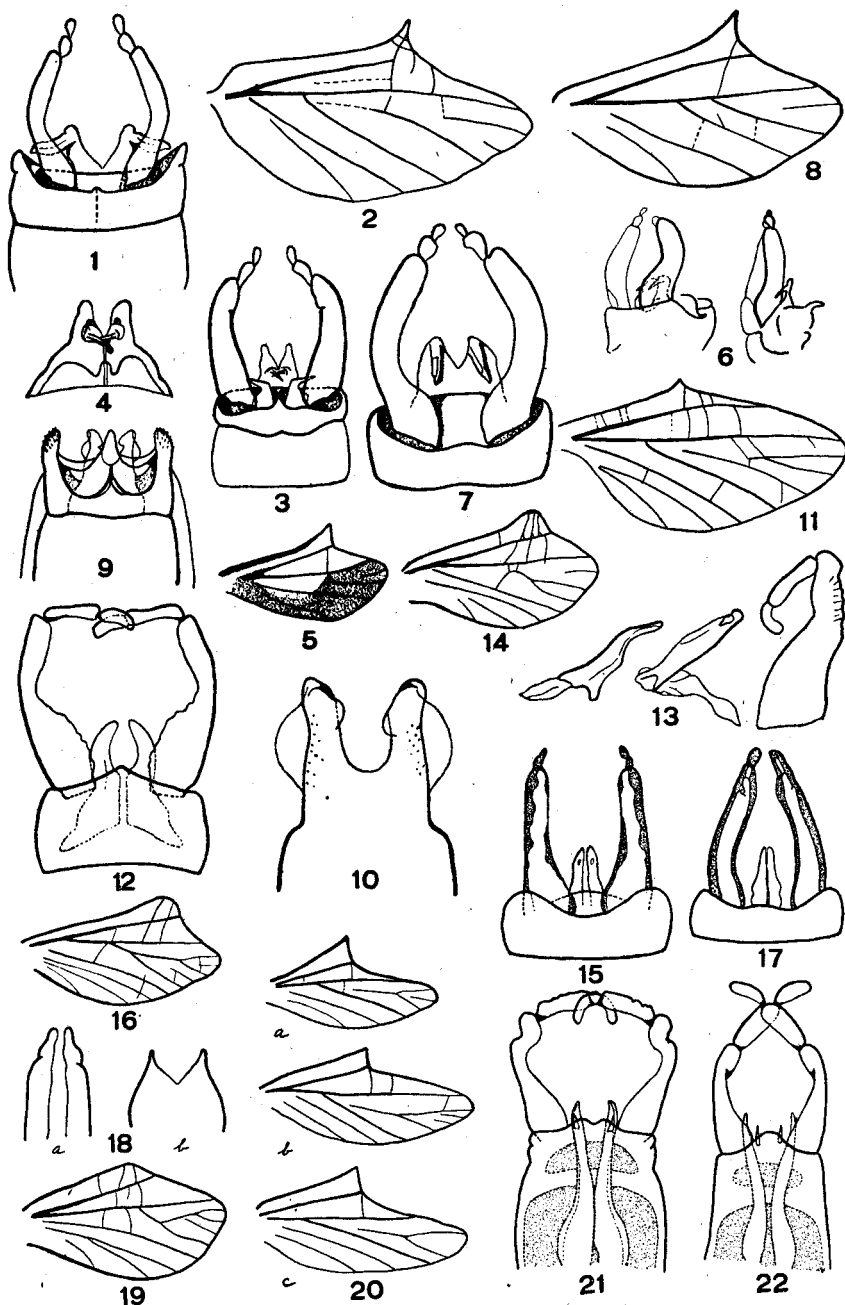


Fig. 1. *Thraulius maculatus*. Male genitalia (paratype). — Fig. 2. Idem. Hind wing. — Fig. 3. Idem. Male genitalia. — Fig. 4. Idem. Penes of same, enlarged. — Fig. 5. *Thraulius demerara*. Hind wing. — Fig. 6. Idem. Male genitalia; lateral aspect, before making permanent mount. — Fig. 7. Idem. Male genitalia, ventral aspect; from permanent mount. — Fig. 8. *Thraulius roundsi*. Hind wing. — Fig. 9. Idem. Male genitalia (forceps missing). — Fig. 10. Idem. Penes of same, enlarged. — Fig. 11. *Choroerpes emersoni*. Hind wing (holotype). — Fig. 12. Idem. Genitalia, male (holotype) treated with potash. — Fig. 13. Idem. Male

narrow dark pencilings on each margin apically. Knee yellow. Fore tibia purplish brown in basal half; apical half white, unmarked. Tarsus white. Fore femur slightly more than 1/2 length of tibia. First tarsal joint more than 1/3 but less than 1/2 length of tibia. Tarsal joints in descending order: 1, 2, 3, 4. Complete subapical band on second femur; quite similar to first but somewhat paler yellow. Tibia purplish brown except at apex; tarsus white. Hind femur pale yellowish at base and apex; wide purplish brown band occupies fully half of joint; brown mark on upper apical margin. Tibia and tarsus as in second leg. Black streak at apical margin of hind coxa. Membrane of costal margin of fore wing very faintly amber-tinged; hyaline elsewhere. Cross veins of costal space, beyond base, confined to stigmatic area. 9 or 10 weakly developed, strongly slanted stigmatic veins, which do not extend to Sc. Longitudinal veins pale amber. Costal margin of hind wing, to tip of angulation, and base of Sc, blackish; costal space, however, colorless except at extreme base. Almost entire posterior half of wing membrane pale smoky brown (paler in middle triangular space below R). This wing as in Fig. 5. Abdominal tergite 1 opaque, purplish brown; tergites 2 to 5 translucent, pale yellowish, with wide apical band of purplish brown occupying about half of each. Sternites 1 to 5 translucent, yellowish. Segments 6 to 9 opaque, purplish brown. Basal half of sternite 6, and very narrow margin on succeeding sternites, yellowish. Genitalia as in Figs. 6 and 7; yellowish brown in color. No projections from subanal plate. Extreme basal region of tails, also joinings of first four or five segments, purplish brown. Remainder of tail whitish, joinings not darkened.

F e m a l e i m a g o . Body 5 mm.; wing 5½ mm. In alcohol. Head purplish brown. Thorax red-brown, pleura and sternites somewhat paler than notum. Legs marked as in male, but dark areas less extensively pigmented. Wings as in male. Abdominal tergites pale purplish brown; posterior margins and postero-lateral angles deeper brown. Sternites 1 to 5 yellowish; wide posterior band of pale smoky brown on each, color deepening slightly on 5. Sternites 6 to 9 smoky brown. Subanal plate red-brown, paler basally; truncate at tip.

Holotype: Male imago. Mackenzie, Demerara River, British Guiana. Collected by Cornell University Entomological Expedition, June 24, 1927. In Cornell Collection.

Allotype: Female imago. Kwakoebron, Saramacca River, Surinam. C. U. Expedition, June 12, 1937. In Cornell Collection.

Paratypes: Male imago (parts on slide); same data as holotype; 1 male and 1 female imago; female, same data as holotype, male from Bartica, British Guiana, H. S. Parrish, Coll; no date. In private collection of writer.

This species seems closely allied to *convexus* Sph.⁵ Unfortunately the size of that species is not given, nor are genitalia nor hind wing figured. Distinguished from *convexus* by: color and markings of legs; darker thorax; smoky area of hind wing. It is smaller than *misionensis* Esb. Pet.⁶, also the abdominal segments are more extensively darkened than in that species.

Thraululus roundsi, sp. nov.

Male imago. Body 5 mm.; wing 5 mm. In alcohol. Turbinate eyes moderately large, contiguous apically; in color orange-brown. Head and antennae yellowish brown. Entire thorax dark red-brown. Prothoracic notum margined laterally with black; a small median and larger lateral dark dots. Legs missing. Posterior half of fore wing missing. Membrane of fore and hind wings amber-tinged. Venation amber-brown. In costal margin of fore wing, *very faint* indication of 2 or 3 cross veins before bulla; 1 at bulla; 3 or 4 very weak slanting cross veins just beyond bulla; 6 to 8 stronger stigmatic cross veins, also slanting, of which 2, on one wing, are incomplete. Cross veins quite numerous (7 to 9 in subcostal space; 8 in space behind *Rs*; 7 or 8 in next space following). Extreme basal area, basad of humeral cross vein, dark brown. Hind wing shown in Fig. 8. Abdominal segments 1 to 6, and basal half of 7, translucent yellowish to olive brown. Narrow paler band basally, and narrow dark posterior margins on 2 to 7 (on 7, dark band occupies fully half of segment). Pleural fold dark brown. Indications of faint paler median line on tergites, with darker dot at median posterior margin. Faint brownish spot in antero-lateral angle of these tergites. On sternites, paler line adjoining pleural fold. Short black stigmatic dash present, on each of these segments. Segments 8 and 9 opaque, rather dark olive brown. Tails missing. Genitalia (forceps missing) as in Figs. 9 and 10. Penes reminiscent of certain North American species of *Paraleptophlebia*.

Female imago. Body 5½ mm.; wing 6 mm. In alcohol. Head yellow; posterior margin gray. Antennae light yellowish brown. Thorax bright red-brown; paler purple-tinged area at wing roots; mid-region of sternum paler. Thoracic pronotum translucent, yellowish, dark-margined and with traces of dark lateral dots as

in male. Legs missing. Wings as in male, but cross veins very indistinct. Abdomen yellowish (eggs impart an orange tinge). Dark stigmatic dots present, also dark dot on pleural fold nearer basal margin, on segments 3 to 7. Posterior margins of tergites narrowly purplish brown. Gray shading across mid-area of each tergite; traces of pale median line, also of narrow dark submedian line, interrupted at margins. Indistinct dark triangle in postero-lateral angle. Subanal plate triangular, extending beyond 10th segment; apex obtuse (not retuse or notched, as is usual in this genus).

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

Allotype: Female imago. Same data.

This species is placed tentatively in *Thraulus*, on the basis of the structure of the hind wing. The genitalia are so different from most species of *Thraulus* that its affinities with other species cannot be determined. It may not belong in this genus.

Genus *Choroterpes* Eaton

M of the hind wing not forked. Costal angulation usually blunt, varying from basad of the center to a position between center and apex. Cross veins usually few in number, but in the unique species *nervosa* Etn.³ these are relatively numerous. Perhaps it is usual for the female wing to have more cross veins than the male, in some species. *Sc* extends to a point just beyond the costal angulation. In the fore wing there is usually a sag in the outer fork; *Rs* may be slightly bowed at its union with *R*₄. Cubital intercalaries variable in number from 2 to 3 or more; if several are present, they may be attached to one another basally, either directly or by cross veins. Forceps base entire. Forceps three-jointed, the first joint much widened basally. Penes elongate, simple, without processes of any sort. Four Neotropical species of this genus have been described: *inornata* Etn. and *nervosa* Etn., from Central America; *emersoni* Ndhm. and Murphy and *bilineata* Ndhm. and Murphy, from South America. Two new species are described below.

Choroterpes emersoni Ndhm. and Murphy.

Examination of the type material in the Cornell University Collection reveals the previously noted fact that the "allotype" female, characterized by the presence of a long ovipositor, belongs to the genus *Hagenulopsis*, species *minutus* Sph. This female,

minus legs and wings, along with the head of a male of the same species, plus several legs and tails, is mounted on a slide labeled "Female type — *Choroterpes emersoni*". The legs, — three fore legs and two others, of either the second or third pairs, — agree well with the description given for these parts by Needham and Murphy, under *Choroterpes emersoni*. On another slide are the wings of the male *Choroterpes emersoni*. The hind wing is shown in Fig. 11. The genitalia, remounted after treatment with potash, are shown in Figs. 12 and 13. These are evidently the basis for Fig. 145 of Neotropical Mayflies. No trace of the body of the male holotype can now be found. In a vial labeled *Choroterpes emersoni* are two males of *Hagenulopsis minutus*, also several nymphs. The latter are probably *Thraulodes*; the presence of hind wings precludes placing them in *Hagenulopsis*. In still another vial in the Cornell Collection are two male subimagos of *Choroterpes*, from Bartica Division, British Guiana, Mch. 22, 1917. Comparison of venation and genitalia of these two males with genitalia and figures of the wings of the type material indicates that they belong, without much doubt, to *C. emersoni*. However, since certain markings on the bodies of these males do not accord well with the original description of *emersoni*, a description of them is given.

Male subimago about to transform. In alcohol. Body $4\frac{1}{2}$ to 5 mm.; wing $4\frac{1}{2}$ to 5 mm. Turbinate eyes very large, oval, contiguous apically; yellowish. Antennal filament pale yellowish. Thorax light red-brown above, paler below; on each side of pronotum, a large triangular area outlined in black. Anterior and lateral margins of mesonotum outlined in dark red-brown; a transverse line of same color across anterior fourth of sclerite. Legs missing from one specimen; on another, yellowish without dark markings. Basal and middle abdominal segments semi-transparent, yellowish; basal segment opaque, light red-brown. Faint indications of dark lineations along pleural fold, and of pale submedian and lateral dashes. Ganglionic areas slightly opaque. *No darker markings* on posterior margins of segments. Wings very similar to type of *emersoni*. Tails missing. One specimen has darker red-brown thorax, abdomen likewise darker, basal and middle segments being light red-brown; posterior margins of tergites very narrowly darker; faint dark shading laterally on tergites and along pleural fold. A tail, in same vial, is very pale reddish brown at base, yellowish beyond; joinings not darkened.

Choroterpes bilineata Ndhm. and Murphy

A female imago which seems to be of this species was taken by the C. U. Entomological Expedition at Moengo, Boven, Cottica River, Surinam, in May 1927 (P. P. Babi, Coll.). Wings as in the original description except for the addition of 5 small brown blotches before bulla, 1 at bulla, and 4 between bulla and stigma, at costal margin of fore wing. Hind wing as in Fig. 14. Subanal plate has a deep triangular excision at middle line. Genitalia of the allotype, a male subimago, as shown in Fig. 15. Very little detail can be determined from this specimen.

Choroterpes atramentum, sp. nov.

Male subimago (2 specimens). In alcohol. Body $6\frac{1}{2}$ - $7\frac{1}{2}$ mm.; wing 7 - $7\frac{1}{2}$ mm. Entire body yellowish. Two blackish submedian lines extend backward from anterior margin of pronotum to, but not including the 10th tergite. These lines are discontinuous in middle areas of basal and middle tergites; present only as a short mark at anterior margin on tergites 6 and 7; present in median area only, of tergite 9; but wide, prominent and extending almost entire length of sclerite, on tergite 8. Interrupted oblique lateral dashes from dark mark at posterior margin, on tergites 2 to 5. Posterior margin of mesonotum outlined narrowly in black. Submedian black dashes on posterior margins of tergites 1 to 6, the median and lateral portions of these tergites uncolored. Fore legs pale yellowish, slender; a narrow black longitudinal streak on inner margin of femur, distally; also very short dark dash on same margin near base. Middle and hind legs missing. Humeral cross vein wholly pale. 5 blackish-brown blotches on costal margin before bulla, at location of as many basal costal cross veins, these veins surrounded by yellowish brown. 2 cross veins between bulla and stigma, marked like basals. 9 to 11 slanting stigmatic cross veins, one or more of which may be forked toward costal margin; first four of these toward bulla are slightly thickened, blackish brown, and brown-margined; remaining stigmatic veins pale yellowish except for indistinct darker shading at base of fourth from bulla. Costa yellowish, also Sc and Rs as far as stigma; Sc and Rs beyond bulla black, narrowly margined except at apex. Subcostal space below stigma fawn-colored or yellowish orange, the cross veins distinct but not margined. Cross veins at bulla in third space down from costa widely margined with blackish brown, appearing like an

ink blot. Cross veins basad to this in same space more narrowly dark-margined; those toward apex very dark, very narrowly margined toward R_s only. An oblique dark brown band extends across apex of this space and into upper part of space immediately below it; in third space, area toward apex from dark band is yellowish brown. 3 cross veins in space next below bulla, also between R_4 and R_5 and M_1 , darkened and distinct, as are also to a lesser degree 3 others in disc basad of these. Several in same spaces toward outer margin, and 2 between branches of M , faintly darkened. Other veins pale, as are all in hind wing. Hind wing shown in Fig. 16. Genitalia are shown in Figs. 17 and 18.

Female subimago. Body 8 mm.; wing $8\frac{1}{2}$ mm. Markings as in male. On occiput, two dark spots, one near each eye. At apex of coxa, also of trochanter of fore leg, a very narrow dark edging. Middle leg unmarked, third missing. Fore tibia at least 1 and $1/4$ times length of femur. Subanal plate deeply excised in middle area, as in Fig. 18.

Holotype: Male subimago (smaller specimen). Rio Pedregoso, Costa Rica. Feb. 1939. D. L. Rounds, Coll. In private collection of writer.

Allotype: Female subimago. Same data.

Paratype: Male subimago (larger specimen). Same data.

This species, allied to *bilineata*, differs from it as follows: humeral cross vein not darkened; distinct purplish black blotch at bulla, directly below subcosta; more extensive dark markings on veins of fore wing; certain differences in extent of dark abdominal markings.

Choroterpes vinculum, sp. nov.

Female imago. In alcohol. Body 6 mm.; wing 7 mm. Almost entire body very dark red-brown. Head yellowish; much black mottling on occiput, leaving pale median line and pale transverse lateral area behind each ocellus. Pronotum pale red-brown; anterior margin narrowly black; median line and wide central area on posterior margin blackish. Only stubs of the legs remain; these are light red-brown; coxa darker brown at base, apex dark-margined; trochanter with indistinct dusky shading. Slightly paler area around each leg base; diffuse dark spot above third coxal base, more extensive black markings above base of second coxa. Cross veins of fore wing distinctly margined, some rather widely. 5 rows of cross veins, of which the 3rd row from the base is interrupted, seem to extend across wing. Cross veins at bulla in first four spaces especially prominent because of

margining. 2 basal costal cross veins rather close to humeral vein; 2 at bulla; 1 between bulla and stigmatic area. At least 8 slanting stigmatic cross veins (tips of both wings damaged), of which the first 4 beyond the bulla are enveloped in a single brown cloud; 3rd and 4th of these joined by another partial cloud, on one wing. All veins brown; all important cross veins margined. Humeral cross vein blackish brown. In hind wing, darker area at base of principal veins; all veins distinct, but paler than in fore wing; *no* cross veins margined. Hind wing as in Fig. 19. Abdomen only slightly paler below. Both tergites and sternites more or less shaded with blackish. Posterior margins of all segments distinctly darkened, these bands widest on segments 1 and 2, and on tergites 3 and 4. Dark stigmatic markings. On middle tergites, indistinct paler submedian dashes at anterior margin; on same tergites traces of pale median line in anterior half. Antero-lateral areas of tergites tend to be paler, light reddish to yellowish brown. Tails missing. Subanal plate slightly and rather roundly excised on posterior margin.

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

Genus *Hermanella* Needham and Murphy

Hermanella belongs to that subdivision of Section B in which are included several genera of Neotropical mayflies thus far reported from the West Indies only. A discussion of *Hagenulus* and its allies will be found in the writer's *Mayflies of Puerto Rico*⁷, likewise in Spieth's recent article.⁵ Note that a typographical error occurs on pp. 6 of the former publication, where it is stated that *Hagenulus monstratus* Etn. occurs in Bermuda, instead of Burma, its real habitat. Spieth⁵ has described the imago of *Hermanella*, previously known only in the nymphal stage. A well-developed ovipositor is borne by the female of *Hagenulus* and *Borinquena*, and a shorter by *Neohagenulus* females; but no such structure occurs in *Hermanella*. *M* of the hind wing is not forked. Costal angulation of this wing acute, much more pronounced and sharp-pointed than in *Thraululus*, but less so than in some species of *Hagenulus*; *Sc* ends at this prolongation. Cross veins very few. In the fore wing, no sag in the outer fork (R_4 and R_5); cross veins relatively few in number, with none near the outer margin, in Spieth's figure (Fig. 19⁵). Fig. 133, however, of *Neotropical Mayflies*² shows many cross veins, of which the

usual number are near the outer margin. Specimens in the Cornell Collection, from British Guiana, agree well with Spieth's figure. Two cubital intercalaries, divergent toward the margin; according to Spieth's figure, these veins are united near the base, ending at point of union, but in the specimens in the Cornell Collection, each intercalary joins a cross vein, ending at that point, but is not joined directly to the other intercalary. Genitalia distinctly reminiscent of the same structures in *Hagenulus*. Two species have been described in this genus: *thelma* Ndhm. and Murphy, and *incertans* Spth.

Hermanella thelma Ndhm. and Murphy

(*Hermanella velma* Spth., 1943).

Known in the nymphal stage only, this species was described from two nymphs taken at Iguazu Falls, Argentina (a typographical error on p. 39 of Neotropical Mayflies locates these nymphs in Chile). The nymph shown in Fig. 129 of that paper probably does not belong to this genus. The species is referred to incorrectly by Spieth as *H. velma*.

Hermanella incertans Spth.

Among specimens collected by the C. U. Ent. Expedition in British Guiana are several male and female imagos and some subimagos, which are probably of this species. Some were taken at Mackenzie, the Demerara River, June 23, 1927; others at Tumatumari, the Potaro River, June 26, 1927; still others bear neither locality label nor date, at the present time. Examination of these specimens shows a certain amount of variation in the intercalaries of the fork of R_2 and R_3 , in the hind wing; three of these variations are shown in Fig. 20. The wing in 20a is from a specimen at Mackenzie; 20b, from one of the specimens which bear no locality label; 20c, from Tumatumari River. As noted above, the cubital intercalaries of the fore wing do not unite toward the base, but are connected each separately to a cross vein; the second and third intercalaries between R_2 and R_3 of this wing tend to run together at their bases, and are connected to the fourth intercalary by a short stem. Unfortunately none of these specimens is complete, and all are much faded by long immersion in alcohol, hence it does not seem advisable to describe the female. Males: body $3\frac{1}{2}$ to 4 mm.; females: body $3\frac{1}{2}$ to 4 mm.; unattached wings, 4 mm. Whether or not the slight

differences in genitalia are sufficient for separation of these specimens into two species, is problematical. Since Spieth did not give the size of his species *incertans*, it is also difficult to decide whether or not the Cornell specimens represent *incertans* or some allied species.

Hermanella sp.

Incomplete male and female imagos of a slightly larger species occur along with the above-mentioned specimens. Bodies and wings of the females measure $4\frac{1}{2}$ mm.; heads almost wholly blackish. All the males lack the apical portion of the abdomen; the basal portion seems more heavily and regularly shaded with black, and the head and eyes somewhat larger than in the specimens here referred to *incertans*. These may represent the true *incertans*, or the species referred to by Spieth, — “a single male imago from Kabelstation, Makambi-kreek, Surinam, September 27, 1938”, — which he considers of a different species than *incertans*. Details of the differences are unfortunately not stated, in Spieth's article, nor is the size given.

References

1. Traver, 1943, Bol. Ent. Venez. 2, p. 79.
2. Needham and Murphy, 1924, Bull. Lloyd Lib. 24, Ent. Ser. 4, pp. 1-79.
3. Eaton, 1892, Biol. Centr. Americana, Neur., Ephem., pp. 7 and 22.
4. Kimmins, 1934, Ann. Mag. Nat. Hist. Ser. 10, 14, p. 343, Fig. 7.
5. Spieth, 1943, Amer. Mus. Nov. 1244, pp. 1-13.
6. Esben-Petersen, 1912, Deutsch. Ent. Zeitsch., p. 339.
7. Traver, Jour. Agr. Univ. Puerto Rico 22, pp. 6-22.