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## TAXONOMIC STUDIES ON THE EPHEMEROPTERA. III. SOME INTERESTING EPHEMERIDS FROM SURINAM AND OTHER NEOTROPICAL LOCALITIES<sup>1</sup>

By HERMAN T. SPIETH<sup>2</sup>

Through the kindness of Dr. D. C. Geijskes, Entomologist at the Agricultural Experiment Station in Surinam, I received an unusually interesting collection of ephemerids, both imagoes and nymphs, most of which had been collected from localities in the interior of Surinam. Dr. Geijskes informs me that these localities can be reached infrequently and with considerable difficulty since rather elaborate expeditions are necessary. Since some of the species in the Geijskes collection are also represented in the American Museum of Natural History collection, I am proceeding with publication, even though some of them are represented by only a few specimens.

The localities at which the present specimens were found are mainly on the Marowijne (Maroni) River system. Geijskes,<sup>3</sup> in discussing this river system, has listed a number of the localities, and the reader is referred to his article for further information. Briefly, it may be noted that the Lawa is one of two major tributaries of the Marowijne, and the Litani, in turn, is one of the two major tributaries of the Lawa. The headwaters of the Litani are in the Toemoek-Hoemak Mountains at about 1000 feet above sea level.

Except for that portion of the material returned to Dr. Geijskes, all specimens, including the holotypes, have been deposited in the collection of the American Museum of Natural History.

### *Asthenopus curtus* (Hagen)

*Palingenia curta* HAGEN, 1861, Synopsis of the Neuroptera of North America, Smithsonian Misc. Coll., p. 304.

<sup>1</sup> I (1938, Amer. Mus. Novitates, no. 1002, 11 pp.), II (1941, Amer. Midland Nat., vol. 26, pp. 233-280).

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<sup>3</sup> Geijskes, D. C., 1942, Observations on temperature in a tropical river, Ecology, vol. 23, pp. 106-110.

*Asthenopus curtus* Hagen, EATON, 1871, Trans. Ent. Soc. London, p. 59.

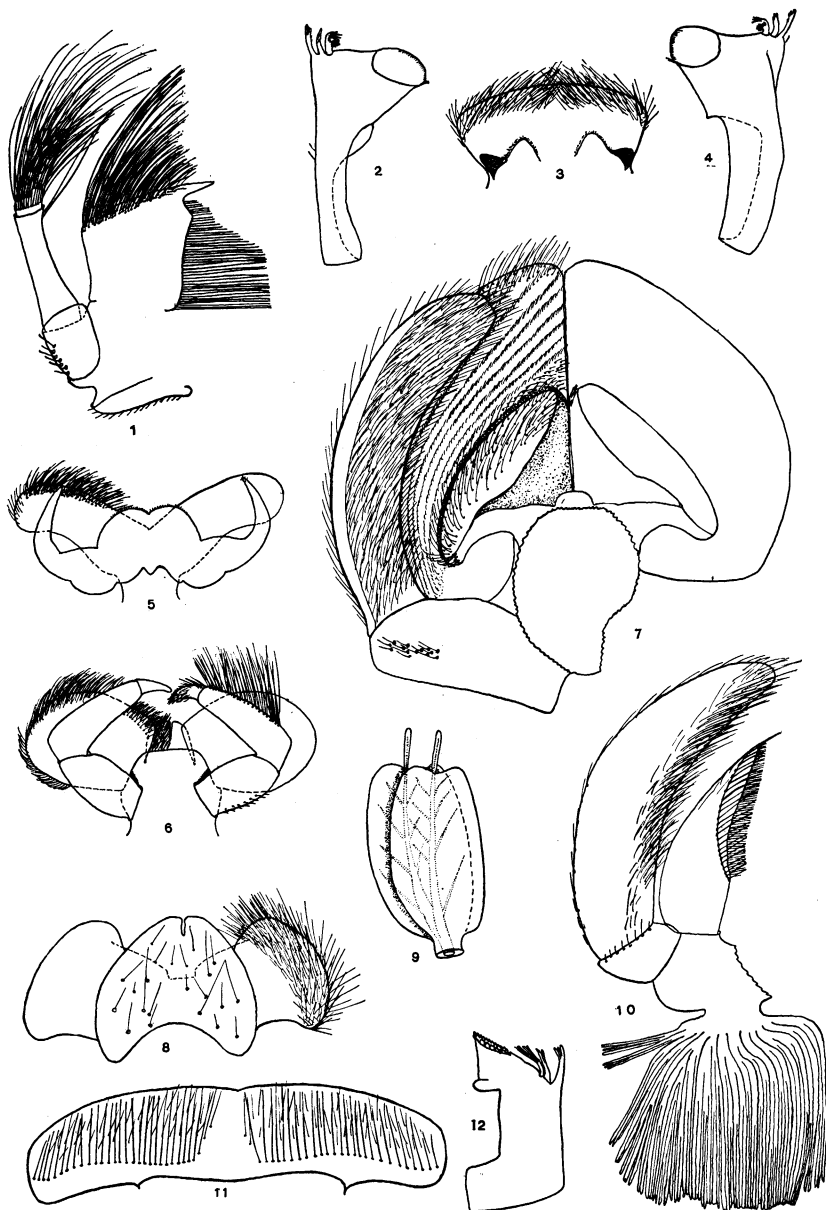
*Campsurus curtus* Hagen, EATON, 1884, Revisional monograph of recent Ephemeridae, Trans. Linn. Soc. London, ser. 2, zoology, vol. 3, p. 40.

*Asthenopus curtus* Hagen, ULMER, 1921, Arch. Naturgesch., vol. 87, div. A, no. 6, p. 240.

Two male specimens in the American Museum of Natural History collection from Rio Casiquiare, Venezuela, March 18, 1929, agree with Eaton's description (1883, p. 40) and illustrations of the genitalia (1883, pl. 5, fig. 8). The type, a male from Para, Brazil, in the British Museum (Natural History), has not been re-described since Eaton wrote his monograph, and is rather imperfectly known. Eaton's figures of the genitalia were made from a dried individual but are sufficiently detailed that they, plus the description, leave no doubt as to the identity of the species. The two American Museum of Natural History specimens have the second and third tarsal segments of the fore leg subequal and slightly shorter than the first and fourth which, in turn, are subequal to each other; the fore tibia of each is twice the length of the third tarsal joint and one and one-half times the femur length; the total fore-leg length is slightly more than three-fourths of the body length. It should be noted that these data do not agree with information supplied by Ulmer, who says he has seen specimens of *A. curtus* and indicates that the fore leg is almost equal to the body length.

### *Campylocia anceps* (Eaton)

*Euthyplocia anceps* EATON, 1883, Revisional monograph of recent Ephemeridae, Trans. Linn. Soc. London, ser. 2, zoology, vol. 3, p. 38, pl. 4, fig. 7c; ULMER, 1920, Festschrift . . . Friedrich Zschokke, no. 25, pp. 2-10.



- Fig. 1. Maxilla of *Hermanella* sp.  
 Fig. 2. Right mandible of *Oligoneuria* sp.  
 Fig. 3. Labrum of *Oligoneuria* sp.  
 Fig. 4. Left mandible of *Oligoneuria* sp.  
 Fig. 5. Hypopharynx of *Hermanella* sp.  
 Fig. 6. Labium of *Hermanella* sp.  
 Fig. 7. Labium of *Oligoneuria* sp.  
 Fig. 8. Hypopharynx of *Oligoneuria* sp.  
 Fig. 9. Third gill of *Hermanella* sp.  
 Fig. 10. Maxilla of *Oligoneuria* sp.  
 Fig. 11. Labrum of *Hermanella* sp.  
 Fig. 12. Right mandible of *Hermanella* sp.

*Euthyplocia Guntheri* NAVAS, 1920, Rev. Mus. Paulista, vol. 12, pt. 2, p. 414.

*Campylocia anceps* Eaton, NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, p. 26; ULMER, 1932, Stettiner Ent. Zeit., ann. publ. 93, pp. 206-207.

*Campylocia ampla* NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, pp. 25-26.

This species was described by Eaton from a male specimen collected at Rio Maukes, Brazil. Ulmer and Needham and Murphy agree that Eaton's figure of the genital forceps (pl. 4, fig. 7c) is not correct. Actually, as they indicate, the forceps are unsegmented distally (fig. 17). The nymph was described by Ulmer (1920). The Geijskes collection contained five imagoes and eight nymphs. In addition to these specimens, there are 48 imagoes in the American Museum of Natural History collection.

There is considerable variation in size and wing venation in the species. Such variation is both individual and dimorphic. Exact measurement of the body length of dried specimens is difficult, but the fore wings can be measured with considerable accuracy. Eaton lists the male fore-wing length as 13 mm. Ten male specimens that I have measured have fore-wing lengths that vary from 10 to 14.5 mm. Needham and Murphy report that a male specimen they studied has a wing length of 11 mm. Body length of five males seen by me varies from 11 to 12 mm. Needham and Murphy report 9.5 mm. and Eaton "about 12 mm." for the length of the body. The cerci of a perfectly preserved male I measured are 35 mm. long, while Eaton reports "about 26 mm." The female wings are considerably longer than are those of the male; 14 specimens I saw vary from 15 to 32 mm. Needham and Murphy report 12.5 mm. as the length of a single female fore wing, but this may be due to erroneous determination of the sex. The body length of four females in the American Museum of Natural History collection varies from 22 to 26 mm. In the huge fore wing of the female, paired short intercalaries are found in the spaces behind the  $IR_{3b}$ , the  $MA_1$ , the  $MA_2$ , the IMP, and the  $MP_2$ . Except for those behind the IMP and the  $MP_2$ , these are lacking in the

males. Further, the two pairs that are present in the males are reduced in length when compared to their female homologues. Eaton's figure (pl. 4, fig. 7c), although taken from an incomplete wing, shows that the type specimen, a male, has wings of this kind. The amount of color variation is small. Eaton's description is adequate except that it should be added that a pair of short, pale, oblique streaks are to be found on the dorsum of abdominal segments 2 to 8, inclusive, and often a postero-dorsally directed pale streak and a dot are found in the anterolateral corners of the tergites. Specimens that have been immersed in fluid show these markings poorly. Eight nymphs collected by Geijskes agree well with the description given by Ulmer (1920).

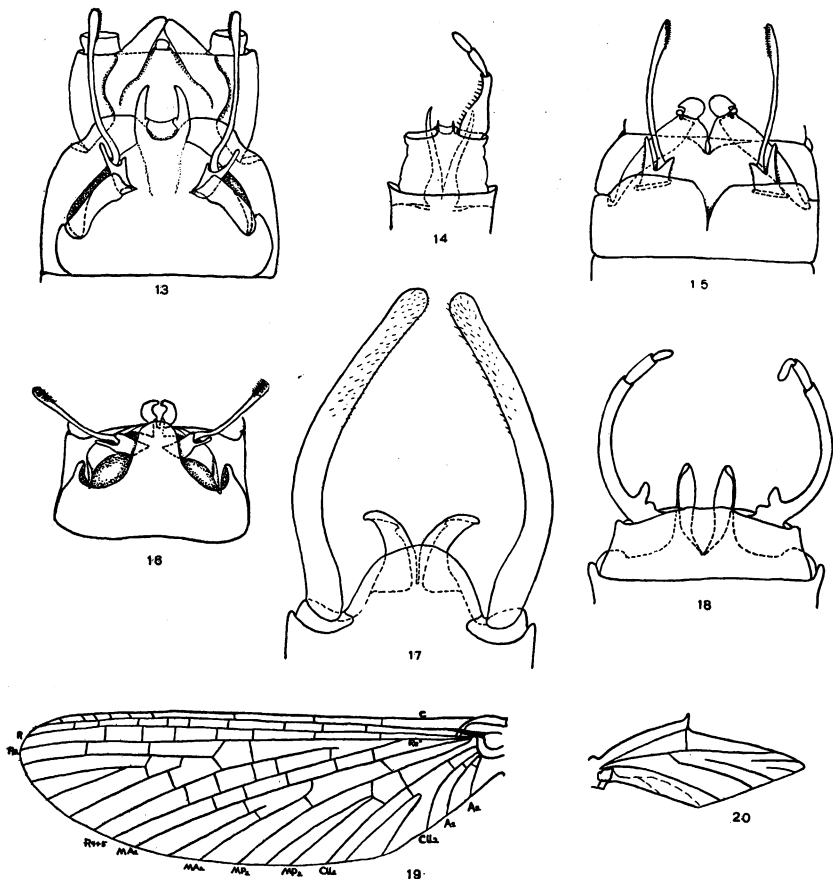
Ulmer (1932) showed that *intercalata* Banks, *Guntheri* Navas, and *ampla* Needham and Murphy are synonyms of *anceps*. Material I have seen, including types of *ampla*, substantiate Ulmer's conclusion. *C. ampla* was described from three females, and the critical difference (the paired intercalaries behind the  $IR_{3b}$ , the  $MA_1$ , and the  $MA_2$ ) is, as indicated above, dimorphic and not specific. The type series is preserved in alcohol, and although all individuals are in poor condition and badly faded, there is no doubt that *ampla* is synonymous with *anceps*. Wings and eggs are mounted on slides.

There seems to be some confusion concerning the material that Needham and Murphy assigned to *C. anceps*. They definitely state (1924, p. 26) that both males and females were to be found in the collections made by Parrish and Emerson. Actually I have found only male specimens in the collections.

BIOLOGY AND RANGE.—Little is really known about *C. anceps*. It inhabits the rivers of tropical America, having been recorded from Brazil, British Guiana, Colombia, Peru, Surinam, and Venezuela. Adults that I have seen are as follows:

Brazil: Para, Jan. 25, 1912, Parrish collector (Cornell Univ.); Ireng River to Mt. Roraima, Aug. 12, 1911 (A.M.N.H.).

British Guiana: Kaieteur, Aug. 1, 12, 27, 1911, Lutz collector (A.M.N.H.); Tukeit, Aug. 23-24, 27, 1911, Lutz collector (A.M.N.H.);



- Fig. 13. Ventral view of the male genitalia of *Campsurus duplicatus*, new species.  
 Fig. 14. Ventral view of the male genitalia of *Hermanella incertans*, new species.  
 Fig. 15. Ventral view of the male genitalia of *Campsurus pedicellarius*, new species.  
 Fig. 16. Ventral view of the male genitalia of *Campsurus titaninensis*, new species.  
 Fig. 17. Ventral view of the male genitalia of *Campylocia anceps* (Eaton).  
 Fig. 18. Ventral view of the male genitalia of *Thraulodes flavopedes*, new species.  
 Fig. 19. Fore wing of *Hermanella incertans*, new species (paratype).  
 Fig. 20. Hind wing of *Hermanella incertans*, new species (paratype).

Kamakusa, Dec., 1922 (A.M.N.H.); Rupununi River, Sept., 1913 (A.M.N.H.); Chenapowu to Saveritik, Aug. 20, 1911 (A.M.N.H.); Wismar, April 3, 1935 (A.M.N.H.); Tumatumari, July 12, 1911, Aug. 18, 1911, and Aug., 1913 (A.M.N.H.); no locality and no date (Cornell Univ.).  
 Peru: El Encanto, Aug. 25, 1920; Puerto Bermudez, no date.

Surinam: Temomairen Mt., July 27, 1939, Geijskes collector; Oelemarie, Nov., 1938, Geijskes collector.

Venezuela: Mt. Duida, Oct. 16, 1928, Nov. 4, 1928, March 7-8, 1929, Tate collector (A.M.N.H.).

To date imagoes have been collected during all months of the year except

February, May, and June. Unquestionably, further collecting will record material during February, but perhaps the species normally does not emerge during May and June. At least the species has a longer emergence period than do our northern ephemerids.

#### CAMPSURUS

There are 34 species in *Campsurus*, as it is now constituted. Some of these are inadequately known, having been poorly defined, and described only on the basis of

uniques or females. Many of them are superficially much alike, since they all have much reduced ambulatory appendages and lack distinctive coloration. Wing venation, the male genitalia, and, to some degree, size are the chief distinguishing characters. The extremely short life span of the imagoes has complicated the collecting of the various species; the delicacy of the individuals has added to the normal difficulty of preservation, and, finally, the types are widely scattered through the Americas and Europe. There are in the Geijskes collection three species, two of which appear to be new.

**Campsurus segnis** Needham and Murphy

*Campsurus segnis* NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. series, no. 4, pp. 19-20; MORGAN, 1929, Ann. Ent. Soc. Amer., vol. 22, pp. 61-68.

*C. segnis* was described from material collected at Kartoba (Bartica) British Guiana, November 14, 1920. Other material was from Igarape-Assu near Para, Brazil, January 25, 1912. Morgan collected and observed this species at Kartoba, British Guiana, July 8, 1926. She (1929) redescribed the species in detail and presented adequate drawings, including those of the male genitalia. Geijskes' specimens are from Litani River Cataract, Surinam, August 3, 1939. From these few data, conclusions concerning the emergence period are difficult to draw except to say that the species emerges over a long span of time.

**Campsurus litaninensis**, new species

**MALE IMAGO, DRIED.**—Scape and pedicel of antennae piceous, flagellum pale translucent; vertex of head piceous; fore legs translucent piceous, becoming progressively paler distally and slightly more than one-half the length of the body; fore femur subequal to tibia; all fore tarsal segments about equal. Dorsum of prothorax tinged with piceous, and becoming lighter posteriorly; lateral parts of prothorax a translucent cream color; posterior margin of prothorax piceous laterally but paling out dorsally. Meso- and metathorax a translucent pale tan which is

slightly tinged with piceous in the region of the sutures and various grooves. Wings with numerous cross veins; mesothoracic C, Sc, and R piceous basally but becoming very light beyond the bulla; longitudinal veins Rs to Cu<sub>2</sub>, inclusive, pale piceous basally and becoming pale distally; Cu<sub>2</sub> and anal veins pale throughout; ICu basally closer to Cu<sub>2</sub> than to Cu<sub>1</sub> and attached obtusely to the Cu<sub>2</sub>. Abdomen translucent pale piceous dorsally, translucent yellowish tan ventrally. Genitalia as in figure 16, with the ninth abdominal sternite considerably elongated. Cerci pale throughout and more than three times as long as body. Length: body, 9 mm.; mesothoracic wing, 9 mm.; metathoracic wing, 5 mm.; cerci, 34 mm.

**MALE IMAGO, IN ALCOHOL.**—Similar to the dried specimen, except that the general yellow coloration is much diluted. The dorsum of the abdomen displays a definite color pattern consisting of a pair of pale, teardrop-shaped submedian spots on segments 3 to 9, inclusive, and, in addition, transversely placed light areas, based upon the lateral margins of the segments and extending medially on 2 to 8. These areas arise in the intersegmented region and also in the middle of the segments and are much more indistinct than the teardrop-shaped spots.

**FEMALE IMAGO, IN ALCOHOL.**—Allowing for usual sexual differences, similar to male except that the piceous coloration is much more extensive and includes the venter as well as the dorsum of the entire body. Abdomen without color pattern save the annulated effect due to the telescoping of the segments. Length: body, 7 mm.; mesothoracic wing, 9-10 mm.; metathoracic wing, 4 mm.

**HOLOTYPE.**—Male imago, dried, upper Litani River, Surinam, August 4, 1939, Geijskes collector, in the American Museum of Natural History.

**ALLOTYPE.**—Female imago, in alcohol, Litani River Cataract, Surinam, August 3, 1939, Geijskes collector, in the American Museum of Natural History.

**PARATYPES.**—One male imago, dried, Litani River near Feti Creek, Surinam, August 11, 1939, Geijskes collector, in the

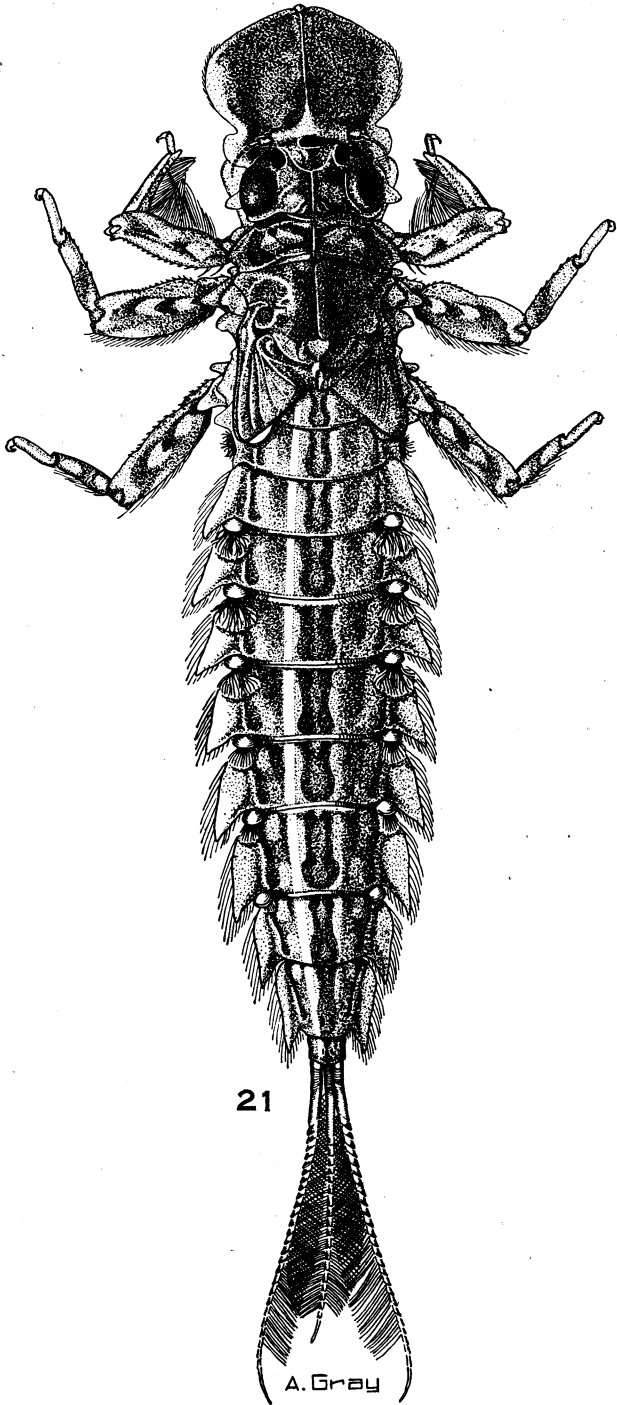


Fig. 21. Nymph of *Oligoneuria* sp.

American Museum of Natural History; one male and three female imagoes, in alcohol, same data as allotype, in Geijskes collection.

REMARKS.—This species, on the basis of the color pattern, the venation, and the male genitalia, is related to *violaceus* Needham and Murphy and *notatus* Needham and Murphy. The elongated shape of the ninth sternite distinguishes *litaninensis* from both of these which have short, rounded, ninth sternal plates. There are also color differences. On the meager evidence now at hand, we cannot tell much about the biology of the species.

#### **Campsurus pedicellarius**, new species

MALE IMAGO, IN ALCOHOL.—Fore leg infuscated with piceous; fore tarsal segments about equal to each other in length; femur subequal to tibia. Scape and pedicel faintly tinged with piceous; area between ocelli piceous with an anterior piceous extension on either side of the median ocellus; these extensions lie between the median ocellus and the antennae; remainder of head pale. Pronotum with a heavy T-shaped piceous area. The top of the T occupies the entire anterior third of the pronotum, while the upright part is median in position, very broad, and gradually fades out before it reaches the posterior margin. The remainder of the prothorax is pale, except for three triangularly disposed small piceous areas. Mesonotum with broad longitudinal areas that are infuscated with piceous. These join posteriorly to form a large U-shaped figure on the scutum. Metascutellum tinged with piceous. Remainder of thorax pale except for some depressions and ridges which are moderately piceous. All venation pale except for subcosta and basal part of costa and radius.  $MP_2$  lying closer to the  $CU_1$  than to the IMP and attached to  $CU_2$  by a cross vein. Thus the area between these two veins is broadly truncate at its proximal end. Fore wing with numerous cross veins but these are concentrated in the disk and lacking in the distal marginal areas. Hind wing with only a few weak cross veins. Abdominal tergites piceous laterally, gradually be-

coming lighter dorsomedially so that a pale median line runs the length of the abdomen. This pale line is widest on the first, second, and third segments. In addition there are submedial, pale, obliquely placed, teardrop-shaped areas on the tergites. These are immersed into the lighter part of the piceous region, and their anterior ends fuse with the pale median line. Venter of abdomen variegated with pale piceous. Genitalia (fig. 15) with broad penes that terminate distally in a rounded cap-shaped structure. Length: body, 8 mm.; mesothoracic wing, 7 mm.; metathoracic wing, 3.5 mm.

FEMALE IMAGO, IN ALCOHOL.—Excluding usual sexual differences, the female is similar to the male except that the dorsal color pattern is not so distinct and clear cut as is that of the male. Length: body, 10 mm.; mesothoracic wing, 16 mm.; metathoracic wing, 4 mm.

HOLOTYPE.—Male imago, in alcohol, Albina, Marowijne River, Surinam, September 3, 1939, in the American Museum of Natural History.

ALLOTYPE.—Female imago, in alcohol, Albina, Marowijne River, Surinam, September 3, 1939, in the American Museum of Natural History.

PARATYPES.—Three females, same data as holotype and allotype, in Geijskes collection.

REMARKS.—The broad, flat penes and the ninth sternite of the male are both unique and distinctive. The venation indicates that this species belongs to the same section of the genus as do *segnis* and *pallidus*.

In addition to the material in the Geijskes collection, a number of specimens of *Campsurus* are in the American Museum of Natural History collection. These are from British Guiana and Brazil, and at least one new species appears to be represented.

#### **Campsurus duplicatus**, new species

MALE IMAGO, DRIED.—Vertex piceous; fore legs infused with piceous; prothorax with two submedial piceous lines that extend from anterior margin to middle of notum; venation colorless except for

costa, subcosta, and radius of fore wing and costa and subcosta of hind wing, which are tinged with piceous proximally and gradually become pale distally. Cross veins abundant in fore wings, lacking in hind wings.  $MP_2$  closer to  $Cu_1$  than to  $IMP$ , and the proximal end terminates in the wing membranes. Meta- and mesonota tinged with piceous, especially posteriorly. Tergites of abdomen infuscated with piceous, especially the middle and posterior ones; a submedian pale spot on each side of the medial line in tergites beyond the third; genitalia as in figure 13; in addition to the genital forceps, a pair of broad, clasp-like structures arise from the ventral surface of segment 10. Length: mesothoracic wing, 7–8 mm.; metathoracic wing, 3.5 mm.

**HOLOTYPE.**—Male imago, dried, Bartica, British Guiana, October 5, 1922, in the American Museum of Natural History.

**PARATYPES.**—Nine male imagoes, dried, same data as holotype; 18 male imagoes, dried, Rio Negro, Brazil, September 8, 1928, Tate collector, in the American Museum of Natural History.

**REMARKS.**—The genitalia of this species are distinctive, especially the broad forceps-like structures on segment 10. These perhaps are used in copulation. The wing venation is somewhat similar to that found in *pedicellarius* and *segnis*. Unfortunately the Rio Negro specimens were kept in the killing bottle for a considerable period of time and have, therefore, taken on the purplish coloration that results from such procedure. Such false coloration completely obscures the true pattern.

#### HERMANELLA NEEDHAM AND MURPHY

MORRISON, 1919, Canadian Ent., vol. 51, p. 144, pl. 11, figs. 1–7; NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, pp. 39–40, pl. 10; TRAVER, 1938, Jour. Agr. Univ. Puerto Rico, vol. 22, pp. 6–22, pls. 1–3; ULMER, 1939, Arch. Hydrobiol., suppl. vol. 16, pp. 490, 494–499, figs. 40–48; ULMER, 1940, *ibid.*, suppl. vol. 16, pp. 617–623.

Needham and Murphy (1924) described the genus *Hermanella* "based on two nymphs from Chile of very unique character." The type species of the genus is *H. velma*, for which they list "two speci-

mens from Iguazu Falls, Argentina, January 25, 1920." Presumably the two specimens of *velma* are the same as the two nymphs from Chile. In addition they illustrate *H. velma* on plate 10 of their paper and include the figure of a second nymph (fig. 129) which they list as "? *Hermanella* sp." I am at a loss to know whether this latter is one of the two specimens that they consider as belonging to *H. velma*. In the Geijskes collection there are numerous nymphs, representing two species, that belong to the genus *Hermanella*. These differ in details from the description and illustrations of *H. velma* and probably belong to different species. The Geijskes collections were made at Waremapan Soela, Surinam, July 30, 1939; Kabelstation, Surinam, September 21, 1938; and Pologoedoe Vallen, Marowijne River, Surinam, August 31, 1939. Most of the individuals are fairly mature and consist of both males and females. It is possible by carefully examining them to determine what the imago venation is like as well as the male genitalia, and thus to place a number of imagoes that Geijskes collected in the genus *Hermanella*. The nymphs, although representing new species, I am not naming because to do so would eventually add to the complexity of the taxonomy of the genus. Morrison (1919) describes briefly and illustrates a nymph from Cuba which she places in the genus *Hagenulus*. No one has ever definitely connected this nymph with adults of the genus *Hagenulus*. Unquestionably, on the basis of the mouth parts, the shape of the head, and the gills, the Cuban nymph is a close relative of *Hermanella*. That Morrison may be correct in her association of the nymph to *Hagenulus* is indirectly supported by the fact that the adults of the genus *Hermanella* are closely related to the adults of the genus *Hagenulus*, as is shown by the similarity of the venation, the wing shape, and the male genitalia. The adults thus parallel the condition found in the nymphs. Ulmer (1939, 1940) erected the genus *Choro-terpides* for two species from Java and Sumatra. The type of *Choro-terpides* is *Thraululus exiguus* Eaton, 1884. The nymphs of these two species have been



associated with the imagoes, and Ulmer (1939, p. 490) definitely shows that the nymphs of *Choroterpides* and *Hermanella* are closely related although definitely distinct. Judging from Ulmer's figures and descriptions, the specimens which I consider as the imagoes of *Hermanella* are closely related to those of *Choroterpides*. This, of course, merely helps to confirm Ulmer's decision as to the relationship of these two genera. It should be noted that Needham and Murphy's illustration of the mesothoracic wing venation (pl. 10, fig. 133) does not conform to the venation as displayed by numerous Surinam nymphs of *Hermanella*. Actually the fore wing of *Hermanella* is much like that of *Choroterpides* except for the Cu intercalaries. The genus *Hermanella* can now be defined as small ephemerids of the family Leptophlebiidae that belong to the same section of the family as do *Hagenulus* and *Choroterpides*, and probably *Neohagenulus* and *Borinquena*.

**NYMPH.**—Somewhat depressed dorsoventrally; head large, rectangular, as wide as thorax and almost one-third of the total body length. Labrum (fig. 11) rectangular in shape and very broad but with considerable interspecific variation; mandible (fig. 12) with dentition and lacinia mobilis similar to that of *Choroterpides* but with the outer margin of the mandible straight instead of curved as in *Choroterpides*. Hypopharynx (fig. 5) much as in *Choroterpides*. Galea-lacinia of maxilla (fig. 1) very much like that of *Choroterpides*; maxillary palp (fig. 1) three-jointed, with the first joint short and robust; the second long, slender, and almost naked; the third short and heavily setose. Labium (fig. 6) with three-jointed palp, the distal segment short, slender, curved, and much less setose than the long, heavily setose second segment. Antennae arising from dorsal side of head; posterior margin of head slightly and evenly indented; prothorax rectangular, broad laterally and narrow anteroposteriorly; all femora and tibia flattened and expanded, heavily setose on outer surfaces; all tarsal claws pectinate. Gills 1 to 6 (fig. 9) double, consisting of two elongate lamellae. Seventh gill uni-

ramous, slender, and thread-like. Some specimens, but not all, have slender finger-like processes arising from the distal margin of the double lamellae. Caudal cerci three, of which the median one is heavier and slightly longer than are the lateral ones.

**IMAGO.**—Each male compound eye separated into a large, upward facing dorsal portion and a small, rounded, lateral part; the large upper parts of the two eyes contiguous. Prothorax deeply and rectangularly excavated on posterior margin; male fore femur less than one-half the tibia; fore tarsus slightly longer than the femur. The proportions of these three parts are 3:7:4, respectively. Male tarsal segment 1 is slightly longer than 2, 2 is longer than 3, and 3 is twice as long as 4. Hind femur subequal to tibia; hind tarsus about one-half as long as femur. All tarsal claws dissimilar. Mesothoracic wings as in figure 19; cross veins sparse; cross veins of basal half of costal area indistinct and few in numbers, more numerous and aslant in distal part of costal area; MA<sub>1</sub> straight and without sag at point where MA<sub>2</sub> joins it at an obtuse angle. Costal area with two intercalaries. Metathoracic wing (fig. 20) with sharp costal prominence. Genitalia (fig. 14) with elongated forceps basis and three-jointed forceps, of which the basal segment is heavy, conical, curved, and as long as segments 2 and 3 combined. Female seventh abdominal sternite not produced to form an ovipositor; female subgenital plate elongated and excavated on posterior margin. Cerci three, of approximately equal length.

#### *Hermanella incertans*, new species

**MALE IMAGO, DRIED.**—Head blackish, prothorax fuscous, heavily permeated with piceous, remainder of thorax similar but with less piceous coloring. All femora piceous, remainder of legs much lighter. Wings (figs. 19, 20) with costa and basal part of subcosta and radius fuscous; all other longitudinal veins pale fuscous; cross veins distinct. Wing membrane pale throughout. Abdominal segments 1 to 8, inclusive, transparent, tinged with piceous,

especially the posterolateral regions of the tergites. Genitalia as in figure 14.

**HOLOTYPE.**—Male imago, dried, Zandry I, Surinam, June 18, 1941, Geijskes collector, in the American Museum of Natural History.

**PARATYPES.**—One male imago, dried, same data as holotype, in the Geijskes collection; one male imago and three female subimagoes, Bonapark Placer, Pedrosoengoe Falls, Marowijne River, Surinam, July 1, 1939, Geijskes collector, the male and one female in the American Museum of Natural History, two females in the Geijskes collection.

**REMARKS.**—The venation and shape of the hind wing and the presence of only two cubital intercalaries clearly separate this species from all known species of *Hagenulus*, *Neohagenulus*, *Borinquena*, and *Choroterpides*. Except for the cubital area and the lack of sag in the MA<sub>1</sub>, the fore wings are similar to those of *Neohagenulus julio* and *Borinquena carmencita*.

There is a probability that the holotype is somewhat darker than normal due to its having been exposed to cyanide fumes for some time. The alcoholic male paratype, on the other hand, is rather faded. The other paratypes are female subimagoes preserved in fluid, and naturally they are faded. An allotype has, therefore, not been designated.

A single male imago from Kabelstation, Makambi-kreek, Surinam, September 27, 1938, Geijskes collector, also belongs to the same genus as does *incertans*. The head, entire prothorax, and the mesothoracic legs are missing. The meso- and metathoracic wing venation and the genitalia definitely place the specimen generically, while the color pattern and the details of the genitalia clearly differentiate it from *incertans*.

#### **Hagenulopsis minutus**, new species

**FEMALE IMAGO, IN ALCOHOL.**—Head piceous; prothorax fuscous, heavily marked with piceous; fore femur piceous; fore tibia fuscous; meso- and metathorax fuscous dorsally, becoming heavily impregnated with piceous ventrally, especially around the bases of the legs and the sterna;

mesothoracic wings hyaline; all venation pale fuscous; cross venation sparse, in the costal area no cross veins except for three or four slanting veins in bullar region; three or four upright cross veins in subcostal area; two intercalaries in the Cu<sub>2</sub> area, one free and the other attached to the Cu<sub>2</sub> at the point where it bends abruptly posteriorly; metathoracic wings lacking. Abdomen piceous; the posterior margins of tergites 1 to 4 somewhat lighter colored than is the body of the tergites; submarginal oblong light areas on sternites 1 to 6; elongate ovipositor reaching almost to the end of the abdomen; subanal plate deeply and acutely excavated, thus forming two lateral, sharply pointed processes. Length: body, 3 mm.; wing, 3 mm.

**HOLOTYPE.**—Female imago, in alcohol, Marowijne River, Surinam, August, 1939, Geijskes collector, in the American Museum of Natural History.

**REMARKS.**—*H. minutus* differs from the Brazilian species *H. diptera* Ulmer in the small size, 3 mm. as against 6–7 mm. for *diptera*, and in the reduction of the cross venation, especially in the costal and subcostal areas.

#### **Thrauloxenus convexus**, new species

**MALE IMAGO, DRIED.**—Entire thorax, with the exception of a few dark markings on the pleura, a clear light golden brown; fore coxa pale, translucent, and faintly colored with yellowish brown; fore femur similar to coxa basally but becoming much darker distally; fore tibia and tarsus light golden brown; meso- and metathoracic femora translucent pale brown, becoming darker distally; fore femur slightly more than one-half (7/12) of tibia; first tarsal joint one-third of tibia; second tarsal joint subequal to first, third half of first, and fourth half of third; meso- and metathoracic tibia and tarsi uniform pale translucent yellowish brown; wing membrane hyaline, very faintly tinged smoky golden brown basally; all longitudinal venation distinct and weakly tinged with same color as wing membrane; cross venation sparse and distinct, in the costal area consisting only of slanting veins in the bullar region. Abdominal tergite 1 opaque,

abdominal sternite 1 and abdominal segments 2 to 6 translucent; these tergites are faintly impregnated with smoky brown; the posterior margins are darker and piceous spots are located in the posterolateral corners; all sternites are faintly impregnated with pale yellowish brown; tergites 7 to 10 are opaque on purplish brown; cerci translucent, impregnated with pale brown; genital forceps and penes yellow.

**HOLOTYPE.**—Male imago, dried, Gran Soela, at junction of Litani and Lawa rivers, Surinam, July 9, 1939, Geijskes collector, in the American Museum of Natural History.

**PARATYPE.**—Male imago, dried, same data as holotype, in the American Museum of Natural History.

**REMARKS.**—*T. convexus* is a close relative of *T. misionensis* but can be distinguished by the lighter color of the thorax and the transparent male abdomen. It belongs to that section of the genus *Thraulius* that lacks projections on the subanal plate (ninth sternite) and does not have the subanal plate excavated. Both the holotype and the paratype have a purplish cast on the pleura and dorsum of the posterior abdominal tergites caused by cyanide fumes. A female specimen from Waremapan Creek, Surinam, July 30, 1939, which was collected by Geijskes from a pool where the spent individual had fallen and become somewhat decomposed, probably belongs to *T. convexus*.

#### **Thraulodes flavopedes, new species**

**MALE IMAGO, DRIED.**—Head fuscous, heavily marked with piceous; scape of antenna piceous; flagellum translucent light fuscous; thorax burnt umber, a

piceous band on posterior margin of pronotum and piceous markings on pleura and bases of legs; fore tarsus burnt umber, fore tibia burnt umber infuscated with piceous, especially distally; fore tarsi yellowish, tinged with smoky; meso- and metathoracic legs, except for the dark coxae, translucent, tinged with yellow; the meso- and metathoracic femora with three chestnut brown spots, viz., one proximally, one distally, and one medially. Fore femur eight-ninths of the fore tibia; fore tarsi subequal to fore tibia; hind tibia equal to fore tibia and slightly longer than hind femur; costal and subcostal wing membrane proximal to humeral cross vein and the wing membrane posterior to this vandyke brown; remainder of wing membrane hyaline; all venation hyaline. Abdomen chestnut brown; genitalia (fig. 18) with slender elongate penes; first forceps joint elongate, curved, and with process on inner side; forceps and penes light colored, translucent; cerci translucent, colorless except for narrow dark rings at joinings.

**HOLOTYPE.**—Male imago, dried, Mogeno, Surinam, April 12, 1939, Geijskes collector, in the American Museum of Natural History.

**PARATYPES.**—Male imago, dried, Litani River near Feti Creek, Surinam, August 17, 1939, Geijskes collector, in the American Museum of Natural History; two male imagoes, same data as holotype, in the Geijskes collection.

**REMARKS.**—*T. flavopedes* has the typical venation of all other species of *Thraulodes*. The genitalia are distinct, especially since the slender penes lack the distally attached, recurved process such as is found in *T. lepidus*, *T. hilaris*, and other species.

#### UNNAMED SPECIES

In addition to the species discussed above, a number of other species were sparsely represented by imagoes and nymphs which cannot be identified specifically, and I am merely listing them as follows. All these specimens are in the American Museum of Natural History.

*Paraleptophlebia* sp.—A single im-

mature female nymph from Brownsberg Kreeke, Surinam, 400 meters, September 16, 1938, Geijskes collector. There seems no doubt as to the generic placement of the specimen.

*Thraulius* sp.—Nine nymphs, four males, and five females, from Kabelstation, Surinam, September 25, 1938, Geijskes

collector, seem to belong to this genus. They differ from *Thraulius bellus* as described by Eaton in being more flattened, each labial palpus having two instead of three segments, and with the first gill similar to the other six. From a detailed study of the mouth parts and gills, however, this species unquestionably belongs in *Thraulius*. Needham and Murphy (1924, pp. 26-27) briefly described, without naming, three species of *Thraulius* nymphs from South America and noted that these were not typical of *Thraulius*. Since the nymphs of *Thraulius* are so poorly known, it is most probable that all these variations are merely intrageneric.

*Thraulius* sp.—Six female imagoes from the Marowijne River, Pedrosoengoe Falls, Surinam, June 30, 1939, Geijskes collector, apparently belong to this genus but I am unable to determine the species to which they belong.

*Habrophleboides* sp.—A species of uncertain status is represented by a male imago from Albina, Surinam, June 25, 1939, a male subimago from Waremapan Soela, Surinam, July 30, 1939, and an imperfect female imago from Toemoek-Hoemak, Waremapan Creek, Surinam, July 30, 1939, all collected by Geijskes. This species probably belongs to *Habrophleboides*, but the male genitalia are quite atypical for that genus as it is now described.

*Tricorythus* spp.—Two species, both collected at Albina, Marowijne River, Surinam, September 3, 1939, were in the Geijskes collection. Although both probably represent new species, I am refraining from describing them at this time. One species is represented by three specimens, the other by one. They are both extremely small, the former being 3 mm. long with a wing length of 2 mm., and the latter being 2 mm. long with a wing length of 1 mm.

*Callibaetis* sp.—This genus is represented by three species of nymphs and a single female imago of *C. apertus* Navas.

*Baetis* sp.—*Baetis* is represented by several species of nymphs and female imagoes.

*Oligoneuria* sp.—Finally, a single in-

dividual nymph from Waremapan Creek Falls in the Toemoek-Hoemak Mountains, Surinam, is of extreme interest in that it may represent the nymph of *Oligoneuria*, perhaps *O. anomala*. The specimen was taken by Geijskes, July 30, 1939, at the same place where he collected the nymph and adults of the remarkable zygopteran *Remanella arcana* Needham.

The nymph (fig. 21) is a typical oligoneurid and is closely related to *Oligoneuriella* and *Pseudoligoneuria*. It is a female, 20 mm. long, exclusive of the cerci which are 5 mm. long. Judging by the wing pads, it is at least one instar removed from the final instar. The frontoclypeal region is enormously expanded and flattened dorsoventrally to form a huge dome-shaped structure. The mouth parts, figures 2, 3, 4, 7, 8, and 10, agree in all respects with those of *Oligoneuriella* and *Pseudoligoneuria*. The wing pads are similar to those of *Pseudoligoneuria feuerborni* in not being broadly jointed on the inner surfaces. The first pair of gills are like those of *Oligoneuriella rhenana* in being located ventrally. This differs from *P. feuerborni* which has all gills, including the first pair on the dorsal surface of the abdomen. The color pattern, the shape of the abdomen, the caudal cerci, as well as the pseudocercus, are all very similar to those of *P. feuerborni*. The shape of the abdominal spines and the presence of the pseudocercus separate it from *Noya*. The nymphs of *Spaniophlebia*, *Lachlania*, and *Homeoneuria* are unknown, but all known species of adults are much smaller than the individual which will emerge from the nymph described above.

Ulmer (1939, 1940) described the genus *Pseudoligoneuria* with *P. feuerborni* as the type. This species is based upon one male and three female nymphs collected in south Sumatra. By utilizing the nymphal wing pads, he was able to study and illustrate the future imaginal wing (Ulmer, 1939, figs. 110, 111, 112). On the evidence derived from the venation of the nymphal wing pads, he has decided that *Pseudoligoneuria* belongs to the family Siphonuridae rather than to the Oligoneuriidae. He writes, "Das dichte Queradernetz und

besonders auch die Bildung der zahlreichen Interkalaraden am Aussenrande des Vorderflügels erinnern in etwas an gewisse Polymitarciden . . . ; doch die sehr lange Aussengabel des Sektor, der gebogene Verlauf der Adern  $M_2$  und  $Cu_1$  (an ehrer Basis) im Vorderflügel, ferner auch die lange Mediagabel des Hinterflügels und andere Einzelheiten bei der genannten Familie, schleissen diese aus." The nymph, which he has described and illustrated minutely, is, as he says, a typical oligoneurid. In fact, it is exceedingly close to *Oligoneuriella* except that the first gill is dorsal instead of ventral, and the mesothoracic wing pads are not broadly attached to the body on the inner side. With all due respect for Ulmer's profound knowledge of the ephemerids, I cannot but believe, on the basis of his descriptions and illustrations, that he has erred in placing *Pseudoligoneuria* in the Siphonuridae and that there is ample evidence that *Pseudoligoneuria* belongs to the family Oligoneuriidae. This conviction is based on the fact that the *P. feuerborni* nymphs are oligoneurid in all structural details and to a total extent that cannot be explained by parallelism but represents close generic relationship. The imago venation will,

however, certainly be different from that of any known oligoneurid in that it is abundantly supplied with longitudinal and cross veins, while all previously known imagoes of the family Oligoneuriidae have a much reduced venation due to the reduction and loss of both longitudinal and cross veins. In other words, *Pseudoligoneuria* has a more primitive wing than has any other oligoneurid known. As noted, Ulmer has interpreted this wing as being similar to that of the siphonurids, but the breadth of the wings, the amount and distribution of the cross venation, and the marginal intercalaries, especially in the medial and cubital fields of the fore wing, and lastly and most important when considered in connection with the above mentioned characters, the presence in the hind wing of an accessory vein between the  $R_1$  and  $R_2$  of the hind wing all lead to the belief that the wing is similar to that of *Ephoron* (the *Polymitarcys* of Ulmer). When imagoes of *Pseudoligoneuria* are found, they may prove that Eaton's original placement of *Oligoneuria* and its relatives in the Ephemeroidea, rather than in the Baetoidea as has been done by recent authors, is really correct phylogenetically.

