

Notes on Neotropical Mayflies. Part. IV. Family Ephemeridae (continued).

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(With 22 figures)

Genus *Campsurus* Eaton (cont.)

Ulmer's recent papers have now become available, and in one of these (1942) he discusses the genus *Campsurus* and several species of that genus.

Campsurus cuspidatus Etn. — The male is redescribed and new figures are presented of the genitalia and of both wings.

Campsurus jørgenseni Esb. Petersen. — Valuable additional notes are given in regard to this species, also new figures of the genitalia and wings.

Campsurus argentinus Esb. Petersen. — Additional notes and figures as for *C. jørgenseni*.

Campsurus truncatus Ulmer. — Notes on the venation of this species are given, as well as figures of both wings.

Campsurus quadridentatus Etn. — Venation of this species is discussed.

Campsurus dorsalis Burm. — The male specimen previously described by Ulmer as of this species, he now considers to belong to a different species (see *burmeisteri*). Notes on the females of *dorsalis* are given. The male is unknown. My previous surmise that *dorsalis* should be transferred to *Tortopus* is applicable therefore not to *dorsalis* but to Ulmer's new species, *burmeisteri*. See further notes on this, under discussion of that species.

Campsurus burmeisteri Ulmer. — As noted, this new species was erected for the male specimen previously considered by him to represent *dorsalis*. Wings and side view of the genitalia are figured. In his 1921 paper, the genitalia were shown from ventral view. The structures we interpret as penis lobes are, in the 1921 paper, designated by Ulmer as parts of the subgenital plate; he considered that the penes were not visible. In view of the fact that the genitalia of *burmeisteri* are so similar to those of the specimens we are here describing as *Tortopus harrisi* sp. nov., can it be possible, as suggested in our 1947 paper, that *burmeisteri* should be transferred to *Tortopus*? Ulmer does not indicate that the legs of the male specimen are long and thin, as in *Tortopus*, however; neither is any lateral spine-like process shown in his figure, nor any knob at the base of the forceps. Probably therefore *burmeisteri* is a true *Campsurus*.

Campsurus indivisus Ulmer. — Another species added to the genus. Genitalia and portions of the wings are figured. Apparently the species described and figured in my 1947 paper on *Campsurus* as *Campsurus* species D, belongs to Ulmer's species *indivisus*, even though in my species M_2 runs backward directly into Cu_1 in the fore wing, while in Ulmer's figure for *indivisus* this vein lies halfway between the intercalary and Cu_1 , and ends free, without attachment.

Dr. Ulmer, in correspondence received from him during the past year, has requested that I describe the new species, the genitalia of which I figured in my 1947 paper as "Dr. Ulmer's

undescribed species". I do so at his urging, and take pleasure in naming the species for him. He has sent me data concerning it.

Campsurus ulmeri, sp. nov.

Prothoracic hump present; M_2 of fore wing almost intermediate between Cu_1 and the median bisector. Apparently an ally of *segnis* Ndhm. and Murphy.

Male imago (holotype). Alcoholic specimen. Body 11 mm.; wing 11 mm. Head whitish beneath, heavily shaded with black above, between the ocelli. Basal joints of antenna brownish; a dark brown streak on outer side extending upward from eye. Pronotum yellowish shaded with smoky. A wide black transverse or oblique mark across postero-lateral corner of anterior "humped" portion; narrow black median line in this area also, not attaining the anterior margin. Comma-shaped submedian marks, not attaining posterior margin, occur on pronotum proper, back of the "hump". Smoky streaks laterally, above leg base. Mesonotum light reddish brown; heavy black submedian and lateral longitudinal streaks; area just preceding scutellum heavily shaded with blackish. Metanotum light red-brown. Thoracic sternum yellowish brown; sclerites outlined in blackish; quite extensive submedian blackish marks and shading, especially wide on mesosternum; narrow V-shaped black lines on metasternum in submedian position. Fore leg yellowish; black streaks on coxa; black lines laterally at bases of femur and tibia; femoro-tibial joint and tip of tibia blackish; tarsus largely smoky with gray pencillings; claws whitish. Wings hyaline; longitudinal veins of costal margins of both wings violet gray, this color extending on fore wing to region of the bulla. Venation hyaline. No cross veins near outer margin of either wing. M_2 almost intermediate between the median bisector and Cu_1 (slightly nearer Cu_1); at its proximal end connected to Cu_1 by a short cross vein, and to the median bisector by a somewhat longer slanting cross vein.

Abdomen yellowish white. Tergites 4 to 10 prominently marked with blackish brown transverse saddle-shaped bands occupying most of each tergite, but leaving the mid-dorsal line narrowly pale. These markings are wider and darker on tergites 8 and 9. Within these dark patches are scattered numerous small pale dots, also lateral pale streaks, and near center of dark area on each side, an ovate pale spot. On tergites 8 and 9, submedian oblique streaks occur in addition to the ovate marks. Dark

transverse bands also on basal tergites, but narrower and somewhat paler; bands become progressively wider and darker from base to apex of abdomen. In general, the dorsum of the abdomen presents a distinctly banded appearance. Pleural patches yellowish. Sternites 7 to 9 with blackish submedian and lateral markings, most extensive on 8; faint traces of similar narrow submedian lines on sternite 6 as well. Tails yellowish white. Genitalia as figured in Part III (1947 paper) of this series, as indicated above; of the *segnis* type, but easily distinguished from that species by details of structure.

The species appears close to *segnis*, but is separable by its much larger size, its paler ground color, and structural details of the genitalia.

Holotype: Male imago. Hansa-Humboldt, Sta. Catharina, Brazil, Nov. to Dec. 1931; E. Ehrhardt, Coll. In private collection of J. R. Traver.

Paratypes: Seven male imagos. Same data. In addition, Dr. Ulmer has in his private collection a number of other specimens of this species, which should certainly be considered type material. In some of the seven specimens designated as paratypes, the dark markings on the abdominal sternites are more extensive than in the holotype, being present on segments 5 to 9; the pigmentation of the abdominal tergites is also somewhat deeper and more extensive; likewise there is more smoky shading on the fore leg.

Five small slender females (body 8 mm., wing 8 mm.) and six larger and more robust females (body 10-11 mm., wing 12-13 mm.) were also present in the vial with the holotype and paratype males. Both sets of females are marked obscurely on the apical sternites, the markings being however much more diffuse than in the males; this is especially true of the small forms. Dorsally, the abdominal tergites of the larger females are almost obscured by brownish black shading: general appearance is of a rather wide dark median band (including pale mid-dorsal line) on each side of which is a longitudinal black line, this in turn bordering the lateral portions which contain ovate pale spots much as in the males. As in the males also, the apical tergites are darker. Tergites of the smaller females are much as in the males, the dark markings occupying less area than in the larger females. Although none of these females is designated as the allotype, it seems probable that the larger more robust females should be associated with the males. There remains the possibility, of course, that this species may be one of the four described by Needham and Murphy from females only. Since, however, it is uncertain which females to associate with the males, there seems little possibility of certainty on this point.

Venation of the hind wing of *Campsurus*.

It is to be noted here that the statement made in *Biology of Mayflies*, p. 284: "Median vein forked about halfway from

base to margin", was based on insufficient evidence. Examination of wings and figures of wings of many species of *Campsurus* shows that this condition is by no means generic, — is, in fact, found to occur in a small number of species only. A "break-down" of the situation as regards M of the hind wing appears rather to be as follows. The median bisector may (1) run up to join M_1 about midway between base and outer margin, as in *burmeisteri* and *assimilis*; (2) join M_1 about $1/4$ the distance from base to margin, as in *ulmeri* and *indivisus*; (3) appear detached at base, held in position only by cross veins, as in *lucidus* and *latipennis*; (4) run into M_1 almost at the base of the wing, as in *cuyunensis* and *essequibo*. It is frequently difficult to decide whether in a given wing the bisector should be interpreted as (3) or (4), however. As regards M_2 , it may (1) run into M_1 about halfway from base to margin, as in *argentinus*, or (2) meet M_1 about $1/4$ from the base, as in *burmeisteri*. In either event, M appears to be forked. More commonly, however, M_2 appears (3) completely detached at the base, held in place by cross veins, as in *indivisus*, or (4) dips down to join Cu_1 basally. The latter condition seems to be the most common, as it has been observed in the hind wings of eleven species of *Campsurus*. Again, it is often difficult to decide whether to interpret M_2 as detached at base, or joined directly to Cu_1 . In the two latter possibilities, M is *not* forked. How much variation there may be in wings of the same species, or in both wings of the same insect, as to the relative positions of these two veins, has not been adequately studied. Nomenclature of veins is as given in *Biology of Mayflies*.

Genus *Tortopus* Needham and Murphy

This genus was characterized from female imago alone. According to the authors (1924), the genus differs from *Campsurus* in that (1) the middle and hind legs, although degenerate, are longer and more slender, in the female being as long as the fore legs; (2) in the fore wing, the median bisector is attached laterally to M_1 , and M_2 is similarly attached to the bisector (in their paper, these veins are designated respectively as bisector of the cubital fork, and Cu_1 and Cu_2); (3) in the hind wing, the median vein (posterior fork of median, in their paper) is forked. Their figure of the hind wing shows another distinctive feature which they do not mention: namely, the absence of the customary fork on R_{2-3} of this wing. Ulmer (1932) discussing the genus *Tortopus* in connection with the transfer of his species *ungui-*

culatus from *Campsurus* to *Tortopus*, calls attention to the claw-like appendage at the base of the forceps, and says: "den von Needham & Murphy angezeigten Unterschied in der Nervatur des Hinterflügels (Media gegabelt bei *Tortopus*, ungegabelt bei *Campsurus*) kann ich weder aus Needham-Murphy's Figur noch aus meinem Material erkennen". In 1942 he discusses *Tortopus* at greater length, stating that *primus* McDunnough and *incertus* Traver belong here, as does also *parishi* Banks; all three of these were described in *Campsurus*. In discussing the venational features of the fore wing as given by Needham and Murphy, he says: "dieses Merkmal trifft für das ♂ von *T. unguiculatus* nicht immer zu und passt, allerdings in geringer Modifizierung, auch für gewisse *Campsurus*-Arten; das zweite Nervatur-Merkmal (eine richtige *M*-gabel, von halber Flügellänge, im Hinterflügel) ist wohl nur für *igaranus* charakteristisch, bei meinen ♂♂ ist die Form der *M* anders (s. u.); ausserdem zeigt sich eine ähnliche *M*-Gabel, wenn auch länger, bei *Camps. scutellaris* Needh. und Murph. (28), t. 1., f. 2a; diese Nervatur-Unterschiede sind nicht ganz zuverlässig". He stresses, however, the important features of legs and genitalia that do serve to differentiate *Tortopus* from *Campsurus*. He figures the wings of *unguiculatus*, and presents a lateral view of the genitalia. A new species, — *circumfluus*, — is described, based on two female specimens from Texas, apparently from McLachlan Collection. Wings of one of these are figured.

In 1924, McDunnough described *Campsurus primus* from Illinois, figuring the genitalia but without showing much detail of these structures. In 1935, Traver described *Campsurus incertus* from Georgia and Alabama; the genitalia were figured, but one important detail was not shown. A note indicated that the species was very close to *primus*. Judging from the description and figure of the genitalia of *primus*, the principal differences between that species and *incertus* lay in the dark median shading of *incertus*, as well as in details of the genitalia. The writer has recently seen specimens of *primus* from Kearney, Nebraska, [A. R. Gaufin, Coll. (Figs. 1 and 2)], and a drawing of the genitalia of a paratype of that species. There seems to be no good reason at the present time to reduce *incertus* to *primus*, and both species are here treated as valid. The relationship of either of these to *Campsurus puella* Pictet, which may likewise be a member of the genus *Tortopus*, will probably never be known. Many females were taken along with the two males of *incertus* from Eufaula,

Ala., and still others from Macon, Ga. These seem to be of the same species as the males. In *Biology of Mayflies*, both *primus* and *incertus* were considered under *Campsurus*, pending further study of the genus *Tortopus*. *Tortopus* being now recognized as a valid genus, both *primus* and *incertus* should now be transferred to that genus, as Ulmer has indicated.

The venation of the males of *incertus* (Fig. 3), judging by that of the specimens from Georgia and Alabama, seems to be very similar to that of *Campsurus*. The same may be stated for the males of *primus*, as seen in the specimens from Nebraska (Fig. 4). As to the females, mention was not made at the time of the description of *incertus* of the thickening of the veins of both wings, nor of the absence of the customary fork on R_{2-3} of the hind wing (Fig. 5). Females of *primus* (Nebraska specimens) show similar thickenings of the veins of both wings, both longitudinal and cross veins (Fig. 6). In both sexes of *primus* and of *incertus*, the middle and hind legs are longer and much more slender than in *Campsurus*, while from the forceps base of the male there arises on each side a long slender appendage, a feature not found in *Campsurus*. The presence of an inconspicuous knob-like structure on the basal joint of the forceps was not shown in the figure of *incertus* when this species was described, nor was such a structure shown on the figure of the genitalia of *primus*. In both species, however, it is present. Differences between the two species as regards this small structure are not great, but may prove of specific value. This structure is well shown on two of the specimens of *incertus*, from Alabama, as seen in Figs. 7, 8-9; a similar but less conspicuous knob is present in the male from Georgia, as indicated in Figs. 10, 11-12. Compare these figures with Figs. 1-2, the genitalia of *primus*, from Kearney, Neb. It will be noted that the knob is somewhat longer and more slender in the male of *primus*.

Ide (1941) described *Campsurus manitobensis* from Manitoba, Canada. From the figure of the genitalia given in his description, it is evident that *manitobensis* likewise belongs to the genus *Tortopus* rather than to *Campsurus*. From the description and genitalic figures, the species is not clearly differentiated from *primus*, but Ide must certainly have compared his specimens with the types of the latter species. He mentions the presence of a short spine on the distal part of each penis lobe of *manitobensis*, stating that this is absent in *incertus*. Indeed such a feature was not shown in the original drawing of the genitalia of *in-*

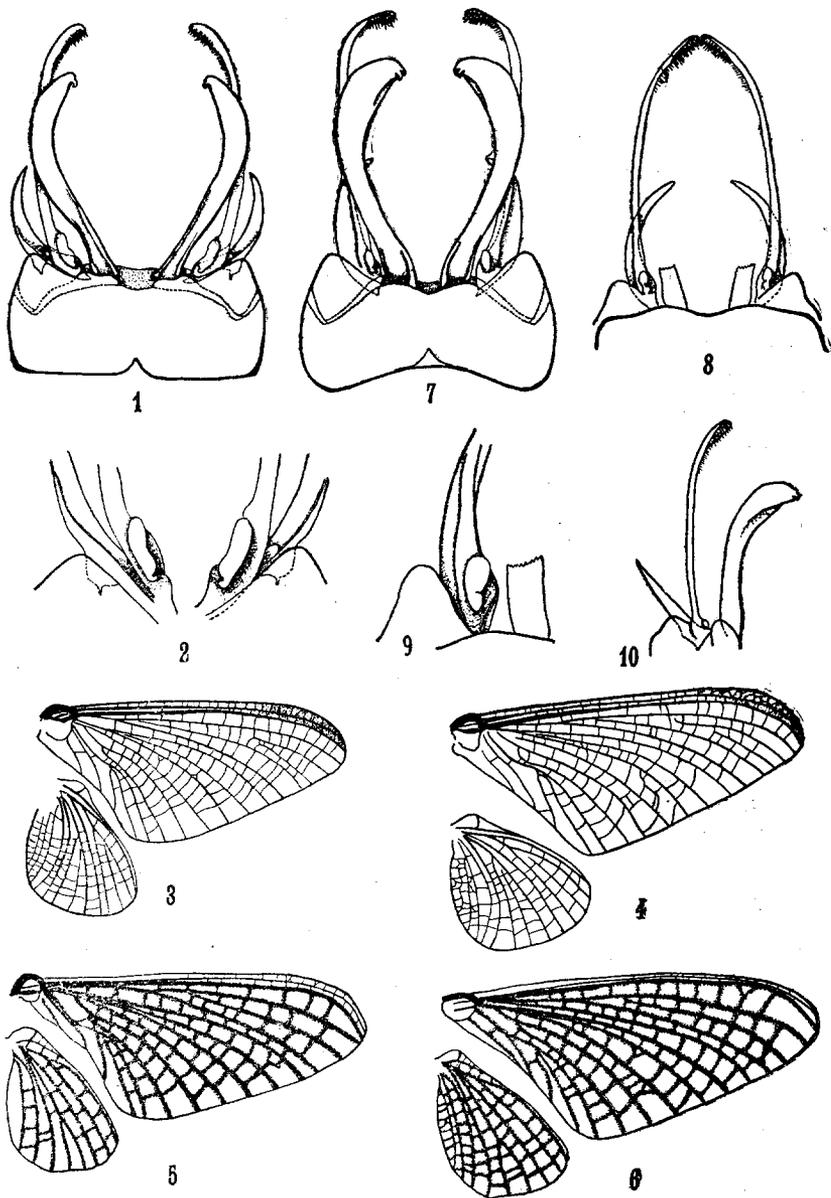


Fig. 1. *Tortopus primus*. Genitalia of ♂ specimen from Kearney, Neb. — Fig. 2. *Tortopus primus*. Details of bases of forceps; same specimen as in Fig. 1. — Fig. 3. *Tortopus incertus*. Wings of ♂ paratype from Eufaula, Ala. — Fig. 4. *Tortopus primus*. Wings of ♂ from Kearney, Neb. Same enlargement as wings of *T. incertus*, Fig. 3. — Fig. 5. *Tortopus incertus*. Wings of ♀ paratype from Macon, Ga. Thickening of veins indicated by stippling. — Fig. 6. *Tortopus primus*. Wings of ♀ from Kearney, Neb. Slightly less enlarged than those of ♂ from same locality. Thickening of veins indicated by stippling. — Fig. 7. *Tortopus incertus*. Genitalia of ♂ paratype, Eufaula, Ala. — Fig. 8. *Tortopus incertus*. Forceps and lateral processes of another ♂ paratype, Eufaula, Ala. Penes omitted. — Fig. 9. *Tortopus incertus*. Details of base of one forceps. Same specimen as in Fig. 8. — Fig. 10. *Tortopus incertus*. One half of genitalia of ♂, holotype, from Georgia; drawn after re-mounting, following additional treatment with KOH.

certus. Actually it is possible to make out a faint indication of such a spine on the genitalia of the Georgia and Alabama specimens. A similar spine is present on the figure which the writer has seen of the genitalia of the paratype of *primus*, and is faintly indicated on the specimen from Nebraska.

Of *parishi* Banks (1918-1919), also described in *Campsurus*, little is known except the rather sketchy figure of the genitalia, the size and general coloration. This Ecuadorean species seems quite certainly to belong in *Tortopus*. Only the male is known. Ulmer (1942) thinks his species *unguiculatus* seems more closely allied to *parishi* than to *primus*. He notes that no basal appendages are shown, in the figure of *parishi*. Could they have been present, but overlooked, as was the case with the knob-like structure on the forceps in both *primus* and *incertus*? Or very short and easily detached, as seems to be the situation in *harrisi*?

Thus the genus *Tortopus* consists at the present time of the following species:

- (1) *igaranus* Needham and Murphy, — genotype — only females known. Peru.
- (2) *parishi* Banks, — (desc. in *Campsurus*, — only males known. Ecuador. Transferred to *Tortopus* by Ulmer, 1942.
- (3) *unguiculatus* Ulmer, — (desc. in *Campsurus*), — both sexes known. Colombia and Costa Rica. Transferred to *Tortopus* by Ulmer, 1932.
- (4) *primus* McDunnough, — (desc. in *Campsurus*), — both sexes known. Illinois and Nebraska. Transferred to *Tortopus* by Ulmer, 1942.
- (5) *incertus* Traver, — (desc. in *Campsurus*), — both sexes known. Georgia and Alabama. Transferred to *Tortopus* by Ulmer, 1942.
- (6) *manitobensis* Ide, — (desc. in *Campsurus*), — only males known. Manitoba, Canada.
- (7) *circumflus* Ulmer, — only females known. Texas.
- (8) unnamed species, — described by Eaton, 1871 (in *Asthenopus*), — only females known. Texas.
- (9) a ninth species, *harrisi*, is described below. Only males known. Brazil.

From our present rather limited knowledge of the genus *Tortopus*, what venational characters, if any, seem to have generic value? *The most outstanding feature seems to be sexual dimorphism as regards the venation*, — a phenomenon such as that which has already been established for the genus *Campylocia*, by Ulmer (1932 and 1942), and reaffirmed by Spieeth (1943). The venation in the males, as far as known, is very similar to certain species of *Campsurus*. Costal cross veins of the outer portion of this space in the fore wing are well developed, but faint in the basal portion; M_2 usually appears to arise laterally from the median sector, but the bisector may run into M_1 at a more acute angle; few or no cross veins are present near the

outer margin of either fore or hind wing; R_{2-3} of the hind wing is quite deeply forked; M of the hind wing is likewise forked, the depth of this fork being variable; a network of cross veins occurs in the anal area of the hind wing. No unusual thickening of the veins of either wing is noticeable. Nor does there seem to be present any feature which may not also be found in certain species of *Campsurus*. It is to be noted that Ulmer, although making the statements previously quoted in regard to the venation of *Tortopus*, presents a figure of the wings of a male specimen of *unguiculatus* in which M_2 and the bisector of media in the fore wing arise laterally from the vein preceding, and M of the hind wing is quite deeply forked. The situation is quite different in the opposite sex. In all female specimens of *Tortopus* which the writer has examined, — including many specimens of *incertus* from Georgia and Alabama, of *primus* from Nebraska, and of the type material of *igaranus*, — M_2 and the median bisector of the fore wing appear to arise laterally from the vein preceding, forming an "elbow" at the point of union. However, since M_2 is likewise attached to Cu_1 by a cross vein at a point just preceding the "elbow", it may appear as though the seeming "elbow" was formed merely by another cross vein from M_2 to the bisector, similar to that between M_2 and Cu_1 . In such a case the basal end of M_2 would appear to end blindly in the wing membrane at the point of junction with the cross vein connecting it to the bisector. Such a condition exists in at least one of the specimens of *igaranus*, and is shown thus in one of Ulmer's specimens of *circumfluus*. The longitudinal veins of the costal margin of the fore wing are crowded together so as to obscure the costal space and any faint traces of cross veins that might be present here. *The most striking feature in both wings is the marked thickening of the veins*, most noticeable perhaps in the cross veins. As in *Campsurus*, the fore margin of the hind wing fits snugly into a "fold" on the hind margin of the fore wing, in both sexes. In the hind wing of the female, R_{2-3} is a simple unbranched vein in females of *incertus*, *primus* and *igaranus*. Of the female of *unguiculatus*, Ulmer states (1942): "Aderlauf in beiden Flügeln wie beim ♂". His figure of the hind wing of *circumfluus* shows a shallow fork on this vein. Ulmer believes that the two females from Texas, on which the description of *circumfluus* is based, certainly belong to the same series of specimens as those studied by Eaton in the McLachlan Museum, and collected in Bosque Co., Texas. While evidence points to the fact that the Texas

specimens which Eaton studied and figured (1871 and 1883) belong to the genus *Tortopus* instead of to *Asthenopus* in which they were described, or to *Campsurus* to which Eaton later transferred them, his specimens differed from Ulmer's *circumfluus* in possessing a simple R_{2-3} and an unbranched M in the hind wing (unless the intercalary between M and Cu_1 , held in place by cross veins, be interpreted as a branch of M which is disconnected at the base). It is for this reason that Eaton's specimens are considered to represent an unnamed species. Thus it appears that of the known females of the genus *Tortopus*, three species lack the customary fork on R_{2-3} of the hind wing, while a shallow fork is present on that vein in the two others. As regards M of the hind wing, a fork is present on this vein in all known females except those figured by Eaton, from Texas, — and it is possible that in his figure, M should be interpreted as noted above. The depth of this fork is very variable, however, even within in the limits of a single species. Even more variable is the presence within this fork of a short bisector, and of cross veins. In an examination of a number of females of *incertus*, of *primus* and of *igaranus*, the condition of this fork was found to be as follows: if the fork was rather deep, — approximately $1/2$ the length of the vein, — a short bisector was present, held in place by a few cross veins; if the fork was very shallow, neither bisector nor cross veins occurred; forks of intermediate length frequently possessed a few cross veins but no bisector (Fig. 13). The cubito-anal region of the hind wing is less well developed in females of *incertus*, *primus* and *igaranus* than in the corresponding males of *incertus* and *primus*, but a network of cross veins is usually present in the anal area. Apparently this region is similar to that in the male, in the species *unguiculatus* and *circumfluus*. In both *incertus* and *primus* as well as in *igaranus*, the hind wing often tends to be folded fanlike on its longitudinal axis, making it difficult to mount this wing without tearing or distorting its parts.

It would seem that three constant factors in the venation of this genus are: 1st, an indubitable sexual dimorphism; 2nd, the thickening of the veins in the wings of the female; 3rd, the network of cross veins in the anal area of the hind wing of both sexes. The latter condition may occur also in large specimens of *Campsurus*, hence is probably not of generic value.

The genus *Tortopus* may therefore be characterized as follows: (1) Middle and hind legs of both sexes longer and more slender than in *Campsurus*, in the female being as long as the

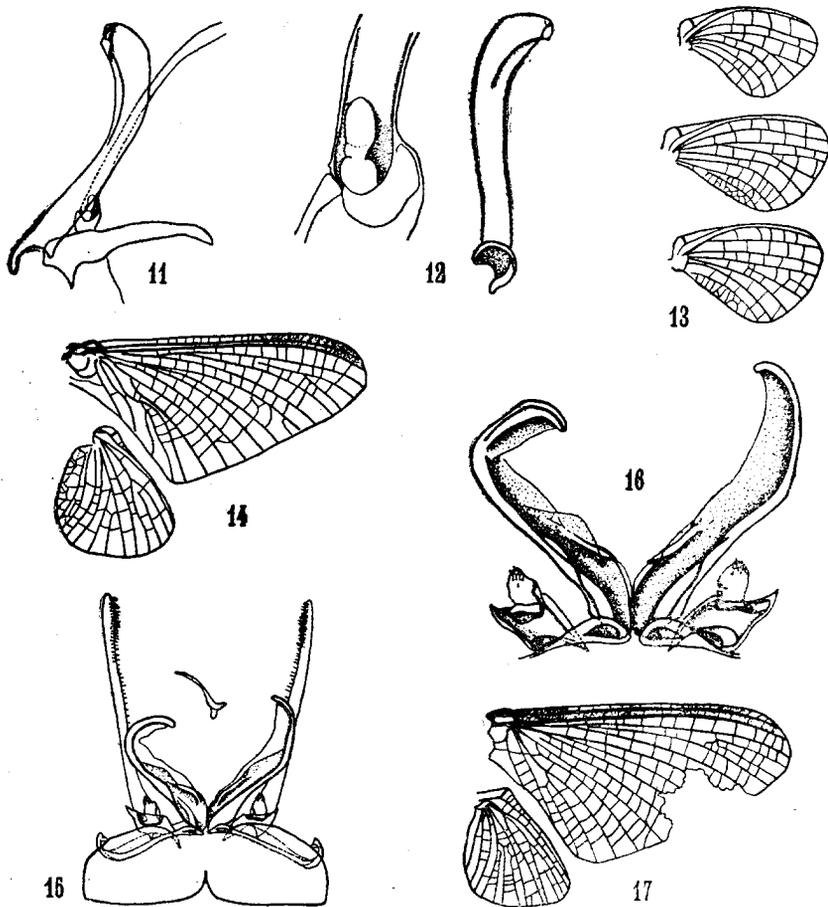


Fig. 11. *Tortopus incertus*. Details of genitalia, ♂; holotype. Same as above. — Fig. 12. *Tortopus incertus*. Details of genitalia, ♂; holotype. Same as above. — Fig. 13. *Tortopus incertus*. Hind wings of three ♀ specimens from Eufaula, Ala., showing variations. Thickening of veins omitted. — Fig. 14. *Tortopus harrisi*. Wings of ♂ holotype. — Fig. 15. *Tortopus harrisi*. Genitalia of ♂ holotype. — Fig. 16. *Tortopus harrisi*. Penis and base of forceps of ♂. Same specimen as in Fig. 15. — Fig. 17. *Asthenopus amazonicus* ?. Wings of ♂ specimen from Kwakoegeon, Surinam.

fore legs. (2) A lateral rod-like or claw-like process is present on each side of the genitalia of the male, arising from the forceps base near the origin of the forceps. (3) Penis lobes broad, flattened, and much longer as a rule than in *Campsurus*. A small spine-like process is typically present distally on the inner margin of each penis lobe. (4) Small knob-like structures, one attached to the base of each forceps, are present in three of the species for which the male is known, and are probably present also in the others, but have been overlooked because of their small size.

(5) Venation characterized by sexual dimorphism as noted above. Thickened veins of the wing in the female seem to be of generic value.

Tortopus harrisi, sp. nov.

Male imago, pinned. (Holotype). Body $8\frac{1}{2}$ mm.; wing 9 mm. Head yellow (middle portion eaten out); black shading at bases of ocelli. Thorax yellowish brown. Anterior two thirds of pronotum shaded evenly with purplish gray; two oblique grayish streaks laterad of central gray area; lateral areas canary yellow. Inconspicuous anterior projection at anterior margin. Posterior margin narrowly whitish at center, gray laterally; anterior margin narrowly blackish. Pro- and mesonota shaded with brownish black. Two parallel longitudinal lines on each side of median area. Two narrow black lines at base of fore wing. Pleura and sternum yellow. Scutella yellow, but with purplish brown shading preceding and surrounding projections. Fore legs missing. Middle leg relatively long and slender, extending back to anterior margin of metanotum. Hind leg even more slender and elongate; extends backward as far as end of third abdominal segment. Both middle and hind legs yellow, unmarked. Wings hyaline white; costal strip not dark-tinged; *very faint* purplish tinge in basal third of C, Sc and R of fore wing, all other veins white. Costal cross veins before bulla indistinct, about 13 in number; none in area immediately following humeral vein. Venation is shown in Fig. 14. Note that at least two of the stigmatic cross veins are forked on the side adjoining Sc as well as toward C. Abdomen yellow. Basal and middle tergites with faint shading of grayish brown, mainly evident as parallel gray lines on each side of pale median area, and much fainter pencillings laterally; small blackish stigmatic dots indicated. Apical tergites somewhat more heavily shaded. Overlapping of segments gives appearance of whitish bandings. Sternites yellow, unmarked. Tails missing. Genitalia shown in Figs. 15-16. The lateral claw-like process is very small in this species, and was at first thought to be absent. However, it appears that one of these processes is wholly missing, whilst the other was torn loose in mounting, and is seen lying unattached to the forceps base, between the penes.

Paratype; male imago. Head yellow, except for some blackish shading at bases of ocelli. Fore leg present, about $3\frac{1}{2}$ mm. in length. Tibia about $\frac{3}{4}$ as long as femur; tarsus slightly longer

than femur and tibia combined. Tarsus 5-jointed; its joints in descending order: 5, 4, 3 and 2 subequal, 1. Claw (only one remaining) long and slender, curved, sharp-pointed at tip; about $3/4$ as long as distal tarsal joint. Femur and tibia canary yellow, the latter shaded faintly with grayish in apical half; yellow of tarsus mostly obscured by grayish purple shading; claw yellow, tips brown. A brownish triangle on mid-line of mesonotum at anterior margin. Genitalia and tails missing. Apical abdominal segments more heavily shaded with gray dorsally than are those of the holotype. Otherwise similar to holotype.

Holotype: Male imago, pinned. Corumbá, Matto Grosso, Brazil; December 14-23, 1919. R. G. Harris, Collector. In Cornell University Collection.

Paratype: Male imago, pinned. Same data as holotype. In private collection of J. R. Traver.

As previously noted, the genitalia of *harrisi* are in certain respects strikingly similar to those of *Campsurus burmeisteri*, yet differ markedly in the presence of the short claw-like lateral appendages and the knobs at the bases of the forceps. *G. harrisi* is likewise a much smaller species than *C. burmeisteri*. The elongate slender legs as well as the genitalia indicate that *harrisi* is a member of the genus *Tortopus*. The penis lobes are shorter in comparison with the length of the forceps in *harrisi* than in *primus* and *unguiculatus*. The claw-like lateral process is much shorter than in any described species of *Tortopus*, while the knob-like basal structures are correspondingly larger. The relationship of *harrisi* to other species of the genus is uncertain.

Genus *Asthenopus* Eaton

The characteristics of this genus have been adequately set forth by Ulmer (1942), and may be summarized as follows. It differs from *Campsurus* thus. (1) Pronotum very short and broad, ring-like, as in *Povilla*; (2) fore leg of male almost as long as body, hind leg with "deutlichem dünnen Tarsus, nicht verflacht"; (3) in the fore wing the second cubital vein is very long "und reicht weit über die Mitte des Hinterrandes hinaus"; (4) forceps two-jointed, the basal joint short, "nicht ausgeschnitten oder gespalten", the second joint broad and bandlike. Femur and tibia of fore leg of male short, tibia a little longer than femur; tibia about $1/3$ as long as the very long tarsus; first tarsal joint short, "die 4 anderen sind untereinander fast gleich, das dritte nicht länger als die 2 letzten"; claws long, one of these about as

long as the distal tarsal joint, the other shorter. In this paper also, Ulmer notes certain differences between the two known species of this genus, in the form of a key. These are: (1) two intercalary veins, of about equal length, between R_2 and the bisector of the fork R_{2-3} , in the fore wing, for *A. curtus* (Hagen) Eaton, as against 3 to 4 such intercalaries for *A. amazonicus* Hagen; (2) in the hind wing, median bisector and M_2 relatively short in *curtus*, these veins longer in *amazonicus*; (3) "Adernetz beider Flügel nicht auffällig dicht, im Hinterfl. eher zerstreut", in *curtus*; "Adernetz beider Flügel sehr dicht, besonders nach dem Aussenrande hin", in *amazonicus*.

The male of *A. curtus*, from Para, Paraguay, was named but not described by Hagen (1861); Eaton described and figured it (1871); Ulmer (1942) adds to the description from two male specimens taken in Paraguay, figures the wings, and presents a new figure of the genitalia of the male. The female of this species is as yet unknown. In 1888, Hagen described *amazonicus* from a single male specimen taken at Teffé on the Amazon River, in Brazil. No figures accompanied the description, but Hagen stated that the wings figured by Eaton (1883-1888) in the Revisional Monograph, as a "nameless Brazilian insect, McLachlan Mus.", were those of *amazonicus*. Ulmer (1942) describes three females, in the Stettiner Museum, taken at Demerara, British Guiana, which he thinks may perhaps belong to this species. The hind wing of one of these females is figured. Spiehl (1943) mentions two males of this genus from Rio Casiquiare, Venezuela, in the collection of the American Museum of Natural History, which he considers to be *A. curtus*. He notes that in these specimens "the total fore-leg length is slightly more than three-fourths of the body length", gives relative measurements of the tarsal joints, the femur and the tibia, and adds: "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".

In material collected at Kwakoepron, the Saramacca River, Surinam, on June 8, 1927, by the Cornell Entomological Expedition, are two specimens of the genus *Asthenopus*, — one male and one female, — both of them imagos. Although both specimens are now in alcohol, it seems quite evident from their appearance

that they had been dried thoroughly before such immersion. In comparing the fore wings of these specimens, it was noted that *three* intercalaries are present in the fore wing of the female, between R_2 and the bisector of that fork, whilst in the male only *two* intercalaries occur in that space. According to Ulmer's key, this would throw the male into *curtus*, the female into *amazonicus*. As it is highly probable that the two specimens are of the same species, it is equally possible that this character, — the number of intercalaries present in the fork of R_{2-3} of the fore wing, — is either variable within a given species to a greater extent than indicated by Ulmer, or that we are dealing with another example of sexual dimorphism. As it is not certain to which of the two known species to assign these two specimens, they are placed tentatively in *amazonicus*. A description of each is given, followed by comments emphasizing differences and similarities between them and the two described species.

Asthenopus amazonicus ? Hagen

Male imago. Body $6\frac{1}{2}$ mm.; wing 8 mm. Frons of head orange-yellow; bases of antennae yellow, with black line apically at each joining. Vertex, occiput and eyes black. Membrane between occiput and anterior margin of pronotum yellow. Pronotum orange-yellow, heavily shaded with black in middle region, less heavily shaded laterally; anterior margin narrowly black, followed by a very narrow yellow strip before the heavy shading begins. Some black markings on prosternum at bases of legs. Meso- and metanota largely orange-brown; center of mesonotum yellow; five dark longitudinal lines on mesonotum, also a triangular area outlined in blackish anterior to scutellum. Scutellum blackish, and all its margins black. Metanotum likewise with black outlinings and considerable blackish shading. Black lines on pleura anterior to root of fore wing, also preceding middle leg. Meso- and metasterna orange, unmarked. Fore legs broken so that only the femur and extreme base of tibia remain. Femur broad, flattened; orange-brown with blackish longitudinal pencillings; base of tibia darker, with apparent fin-like extensions on one side. Femur somewhat twisted, but appears short, not longer than head plus thorax as far as base of the fore wing. Middle leg slender, yellow

with indication of a small dark mark near base of femur. Hind leg somewhat stouter, orange in color, with two black dashes on outer surface, at what appears to be the apex of the tibia and the outer surface of the tarsal joints. In both middle and hind legs, the joints are very indistinct; on each also is a short spur-like process, apparently at the base of the femur. Wings hyaline, with *very faint* tint of yellow on membranes of both wings. In each wing, veins in the basal portions appear light violet-brown, becoming yellowish in the apical portions. One fore wing present and intact except for one small area on outer margin, the other badly torn so that only the basal parts remain. Both hind wings present. In the one good fore wing, two intercalaries only, in space between R_2 and the bisector of the fork R_{2-3} . Venation of both wings is shown in Fig. 17. Basal abdominal segments slightly telescoped upon one another. Abdomen orange-brown; middle portion of each tergite heavily shaded with grayish black, but leaving indications of paler submedian streaks, most evident on tergites 3-7. Posterior margins of all basal and middle tergites quite prominently black; on apical ones, the black border is very narrow. Lateral areas of tergites orange; diffuse brownish or blackish spots on spiracular region of each basal and middle tergite, each such spot joined by an oblique gray stripe to the dark posterior margin. On tergite 7, two yellow streaks extend transversely inward from pleura, one at anterior and one at mid-region of tergite; on 8, one such yellow streak only. Pleura orange. Sternum orange, unmarked. Tails missing, except basal stubs which are yellow. An abortive rudiment of a middle tail, faintly segmented, is present. In the vial with the specimens is a portion of one tail, which may belong to the male; it is clear yellow, slightly paler at joinings. Genitalia as shown in Fig. 18. The forceps are reminiscent of those of *curtus*; the penes, however, curve downward so sharply and are of such a contour that it does not seem that they would resemble those of *curtus* even if in an upright position. Since this genus may be like *Campsurus* in the tendency of the penes to change shape and thereby appear different from different angles, or even to become flaccid and fall over from the usual upright position, position may be less important than the contours of the individual parts.

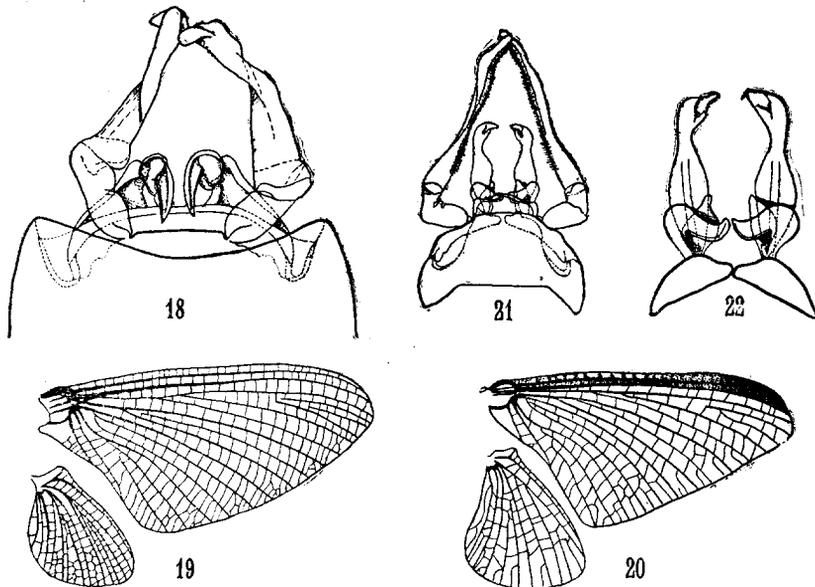


Fig. 18. *Asthenopus amazonicus* ?. Genitalia of ♂ specimen from Kwakoegron, Surinam. — Fig. 19. *Asthenopus amazonicus* ?. Wings of female specimen from Kwakoegron, Surinam. — Fig. 20. *Asthenopodes* sp.? Wings of ♂ specimen from Kartabo, British Guiana. — Fig. 21. *Asthenopodes* sp.? Genitalia of ♂ specimen from Kartabo, British Guiana. — Fig. 22. *Asthenopodes* sp.? Details of penes and allied structures of same ♂ specimen shown in Fig. 21.

F e m a l e i m a g o. Body 10 mm.; wing 12 mm. Considerably larger and stouter than the male. Head wholly black except for narrow yellowish frontal area. Thorax much as in male, but sternum more yellowish, with indistinct paler midventral line. Middle of mesonotum and ground color of metanotum yellow. Fore legs orange; tibia and tarsus paler than femur, "curled up". Slight blackish shading; and blackish spot near apex of femur. Middle legs slender, yellow. Hind legs stouter, orange, femur slightly dark-shaded. Wings, when held against a white background, appear yellow-tinted throughout, somewhat more heavily than are those of the male. Can it be that the alcohol has dissolved some of the yellow pigment from the bodies of these specimens and deposited it on the wings? Veins in basal and middle areas of each wing violet-brown; at margin, these have faded to a very pale yellow, so that outer borders of wings appear much paler than basal and middle parts. In the fore wing, three intercalaries

following R_2 , instead of two as in the male. Venation as shown in Fig. 19. Note that the hind wing bears considerable resemblance to that figured by Ulmer as a possible *amazonicus*. Abdomen resembles that of the male except for the usual sexual differences. Gray shading on the tergites is much fainter; the black posterior margins are narrower, but still definitely present, heaviest on apical segments. A very narrow paler mid-dorsal line is seen, as well as the somewhat wider submedian streaks. Apical tergites also are deeper orange in color than the basal and middle ones. Faint oblique gray streaks connect the dark posterior border to the stigmatic area, but no dark dots are present at the stigma. Sternum yellowish orange, outlined laterally by the deep orange pleural patches. Sternite 7 also orange on posterior margin. Narrow paler mid-ventral line. Apical margin of last sternite truncate. Extreme bases of tails bright canary yellow, all other parts missing. A very short rudiment of a middle tail is present.

The male does not accord very well with Hagen's description of *amazonicus* as regards color of veins and length of fore femur. His description of the penes is as follows: "der Penis besteht aus 2 gekrümmten Haken, welche die Leibesspitze erreichen; dazwischen ein eiförmiger Raum plötzlich verschmälerter Basis". The first part might be considered an adequate description of the genitalia shown in Fig. 18, but not the latter portion. In fact, the male comes closer to fitting Ulmer's notes on *curtus* than to *amazonicus*, in many respects, but the penes appear to be quite different from those of *curtus*. It fits *curtus* for body length, *amazonicus* for length of wing. Only two intercalaries occur in the R_2 and 3 fork of the fore wing, in this male from Surinam, as against 4 shown in Eaton's figure which Hagen maintained was that of *amazonicus*.

As to the female, the coloration of thorax does not accord too well with that which Ulmer gives for the females he thinks may be *amazonicus*. The abdomen is not as dark in Ulmer's females, but in his specimens, some of the segments may have been telescoped. As to the wings, these seem to have more color than Ulmer's specimens, also the coloration of the fore legs does not agree well. The venational pattern however seems to be quite similar to that of his specimens, especially in the hind wing.

Were it not for the unique down-curved penes, the writer would have placed this male and female from Kwakoepron in *Asthenopes curtus* without much hesitation. With these structures to consider, however, the specimens are placed very tentatively in *amazonicus*.

Genus *Asthenopodes* Ulmer

This genus was established by Ulmer (1924) for the single known species, *albicans* Pictet (1843-45), which had been placed previously by Eaton (1883) in *Campsurus*, and later transferred by Ulmer (1921) to *Asthenopus*. The species is represented by a single male specimen from Brazil, the abdomen and hind wings of which are missing. The fore wing was figured by Ulmer in 1921. Ulmer separates *Asthenopodes* from *Asthenopus* on the following characters. (1) Short intercalary veins are present along the apical margin of the fore wing (not so in *Asthenopus*). (2) The first of the two long intercalaries in the cubital space of the fore wing runs into Cu_1 ; the second is connected to the first only by a cross vein (in *Asthenopus*, these two intercalaries arise together from Cu_1). (3) Fore legs of male longer than body (in *Asthenopus*, nearly as long as the body).

In the Cornell University Collection are three slides, — two of the wings and the third of the genitalia, — of a male imago taken at Kartabo, Bartica District, British Guiana, on April 20, 1919, by the C. U. Entomological Expedition. Most unfortunately, the specimen itself cannot now be located. Inasmuch as the fore wing accords well with Ulmer's description and figure of *Asthenopodes*, the specimen is tentatively placed in this genus. It is probably not *albicans*, however, as the size is much too small for that species. Were it not for the possibility that this may really be an *Asthenopodes*, of which to date neither the hind wing nor the genitalia are known, no mention would be made of the few remaining parts of this specimen.

Asthenopodes sp. ?

Fore wing $8\frac{1}{2}$ mm. Venation of both wings as shown in Fig. 20. Ulmer (1924) has indicated the principal venational features of the fore wing. The upper branch of the radial sector (R_{2-3}) seems to fork slightly further from the base than in *Asthenopus*. Of the two short veins between R_2 and the longer vein that appears to bisect this fork, the first is longer than the second, which is attached laterally to the first by an "elbow" curve, at least in the one wing figured. In the opposite wing, this vein ends in the membrane, being attached by cross veins to the longitudinal vein on each side. Basal and middle costal cross

veins well developed; those in the stigmatic area fainter and almost obscured by the opaque whitish cloud which covers both costal and subcostal spaces in this region. In the cubital area, the first intercalary arises laterally by an "elbow" curve from Cu_1 ; the second, which is slightly shorter than the first, arises in a similar manner from the first. (Ulmer, in 1924, was designating these as intercalaries of the 1st anal space). In the hind wing, R_1 appears to be forked near the margin, since the second of the two short veins following it turns upward and joins R_1 . This is evidently the same vein which, in *Asthenopus*, forms an apparent intercalary in the fork here considered to be R_{2-3} . In *Asthenopodes* the upper member of that fork is thus seen to be the shorter of the two veins following R_1 , and is here attached only by cross veins to the veins on either side. R_{4-5} is not forked. Compare the situation in this hind wing with that shown by Ulmer for the hind wing of *Asthenopus amazonicus*, in which R_{2-3} is forked about midway to the margin, arising at the base from R_{4-5} , the latter in turn arising from the stem of R_1 . The remainder of the hind wing is not too unlike that of *Asthenopus curtus*, as figured by Ulmer (1942), except for the longer and more prominent marginal intercalaries. In one hind wing, marginal intercalaries behind the sector occur between R_{4-5} , and M_1 ; between the median bisector and M_2 , and between Cu_1 and Cu_2 ; in the other hind wing, an additional intercalary is present between M_2 and Cu_1 . These are usually attached basally to the preceding vein by a wide "elbow" curve.

As stated above, the stigmatic area in the fore wing is opaque whitish in both costal and subcostal spaces; in the costal space, this opacity extends basad as far as the bullar region. The three main longitudinal veins of the costal margin are pale purplish in their basal halves. The wing membrane is similarly tinted in the basal costal space and in the entire subcostal space up to the whitish opaque area. Thus there remains in the costal space a hyaline area between the basal purplish region and the bullar area; all other portions of the costal and subcostal spaces are either lilac-tinted or opaque whitish. Cross veins in the hyaline portion of the costal space are narrowly margined with the lilac tint, as is also the upper edge of *Sc*. Other longitudinal veins are faintly tinted at their bases with the same purplish color, as are also the costal margin and base of *Sc* in the hind wing. All other

veins pale, except as follows. Apical portions of longitudinal veins of the fore wing, and most of the veins of the hind wing, appear bluish, or as though margined with milky blue, when the wings are held against a dark background. This is especially striking along the other (apical) margin of the hind wing. In this wing also, almost the entire anal region is obscured by a cloud of the same milky blue. Against a white background, this blue margining is seen in the hind wing mainly, principally along the outer margin, and gives the appearance of a slight thickening of the veins.

The unusual genitalia are shown in Figs. 21 and 22. The forceps appear quite similar to those of *Asthenopus*. The most striking feature is the two upright structures, one on each side of the middle line, — barrel-shaped at the base, narrowing to a “neck” region, upon which is borne a “head” with a small spine-like distal projection directed inward. These appear to lie dorsad of the two other structures which are apparently the penes, — shaped somewhat like the head and beak of a duck, the tip of the beak upturned, directed inward, and “hooded” near its base. Are the upright structures to be interpreted as processes of the tenth sternite, — perhaps homologous to such structures in *Campsurus duplicatus*? The apical margin of the ninth sternite is narrower than that of *Asthenopus amazonicus*?, and of a distinctive shape.

Ulmer (1924) in his description of the single male specimen of *Asthenopodes albicans*, mentions the “schwach bläulichen Schein” of the fore wing, likewise the violet-colored veins, especially the subcosta and radius. Length of the fore wing is given as about 13 mm. It is to be hoped that other specimens of *Asthenopodes* may soon be collected for study, so that at least one entire male imago may be known.

Errata

In Part III of this series (Rev. de Ent. 18, Dec. 1947) please read Homeotype for Paratype, in the following places:

Campsurus lucidus, p. 376; “I propose to designate”, etc.

Campsurus major, p. 378 and 379; “I consider these specimens”, etc.

Campsurus evanidus, p. 379; “I propose to designate”, etc.

Campsurus violaceus, p. 379; “I designate”, etc.

Campsurus segnis, p. 380; “I designate”, etc.

Campsurus notatus, p. 382; “I designate”, etc.

The dates for the paratypes of *Campsurus essequibo*, p. 390, should read: Apl. 12 and 13, 1913, instead of 1927.

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