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ESTUDO LIMNOLÓGICO E BIOLÓGICO  
DAS LAGOAS DA REGIÃO LITORÂNEA SUL-RIOGRANDENSE

APRESENTAÇÃO

Desde junho de 1941, a Divisão de Caça e Pesca do Ministério da Agricultura vem realizando estudos intensivos sobre a limnologia e a biologia das lagoas situadas na região litorânea do Estado do Rio Grande do Sul.

Os resultados desses estudos serão objeto de uma série de publicações, cujo conjunto formará uma monografia a respeito dessas águas.

Os organismos coligidos em grande número, e em parte cultivados, foram e estão sendo identificados por 24 especialistas, nacionais e estrangeiros, cuja valiosa colaboração nos permite a elaboração de monografia hidrobiológica, abrangendo a ecologia e sistemática dos principais habitantes de um regime hidrográfico brasileiro.

No presente trabalho, o DR. J. R. TRAVER expõe os primeiros resultados de seus estudos sobre os espécimes que lhe foram enviados para identificação. Pequena parte desse material é procedente dos Estados d Minas Gerais e São Paulo; a maioria dos gêneros e espécies identificados, entretanto, foram coligidos nas lagoas sul-riograndenses, ora em estudo pelo qual os manuscritos do DR. TRAVER farão parte da referida monografia.

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## I — NOTES ON BRAZILIAN MAYFLIES

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## 1. Nymphs

Mayfly nymphs collected by Mr. HERM. KLEEREKOPER in the reservoir of the River Mogi-Guaçu, Brazil, and sent to the writer for determination, proved to be members of three subfamilies of the family Baetidae, and of one subfamily of the family Ephemeridae (Ephemeroptera)<sup>1</sup>. The subfamily Baetinae, family Baetidae, is represented by the three genera *Baetis*, *Callibaetis* and *Baetodes*, as well as by some undetermined Baetine nymphs; the subfamily Leptophlebiinae by two genera, *Thraulodes* and an undetermined ally of *Hagenulopsis*; the subfamily Caeninae by the three genera *Caenis*, *Leptohyphes* and *Leptohyphodes*. The family Ephemeridae, subfamily Ephoroninae, is represented by a single genus, *Campylocia*. In most instances, it was possible to determine nymphs to genus only, as very little is known of the Neotropical mayfly fauna, especially the nymphal stages. The nymph of the genus *Leptohyphodes* apparently has not been described heretofore. The specimens referred to this genus are placed here on the basis of: (1) their evident membership in the subfamily Caeninae, as shown by the incipient wing venation; and (2) certain important differences from nymphs of other known genera of this subfamily. Theoretically, hind wing buds should be lacking, as is the case; some of the nymphs studied were immature, hence the absence of these structures might be due to their immaturity; but no hind wing buds could be found on several nearly-mature specimens.

The nymphs will be discussed from two points of view: (1) taxonomic or systematic; and (2) ecological. Since it is the nymphal stage in

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<sup>1</sup> NEEDHAM, J. G., J. R. TRAVER and YIN-CHI Hsu. 1935. *The Biology of Mayflies*. Comstock Publishing Company.

the life cycle of mayflies in which the greatest structural modifications occur, coincident with a wide range of environment, the latter point of view is always important, in dealing with the nymphs.

### I. TAXONOMIC ASPECT

The following key may serve to distinguish the nymphs of the genera here represented, and to separate them from nymphs of allied genera which are known to occur in or near Brazil. Several Neotropical genera are not yet known in the nymphal stage. Nymphs doubtfully referred to certain genera are not included in the key (with the exception of *Leptohyphodes*, — see above) \* nor are those genera which have thus far been reported only from Mexico, Central America or Chile. \*\* Characters of the genera *Atalophlebia* and *Deleatidium* are taken from PHILLIPS' paper on New Zealand mayflies <sup>1</sup>; of *Atalophlebioides*, from that paper and ULMER'S Ephemeriden. <sup>2</sup> The key is adapted, with modifications, from the Biology of Mayflies, and Neotropical Mayflies <sup>3</sup>. Nymphs described in the latter publication as *?Deleatidium* do not belong to that genus, since they possess double lanceolate gills, while the true nymph of that genus, which PHILLIPS reared, has single gills, those of the first segment kidney-shaped. The *Atalophlebia* nymph described and figured in Neotropical Mayflies does not agree in all characters with the reared New Zealand nymphs of this genus described by PHILLIPS, as he notes in his paper. ULMER has commented on the nymph of *Atalophlebioides* (described in his 1904 paper as *Nymphen des Leptrophlebia-typus*) in a more recent article on mayflies from Chile <sup>4</sup>.

\* Doubtful forms are: *?Nousia*, *?Deleatidium* and *Hagenulopsis?*, as described in Neotropical Mayflies.

\*\* Chilean genera not included here are: *Hermanella*, *Murphyella* (*Metamoni*), in Neotropical Mayflies), *Siphonella* and *Chiloporter*. *Ameletoides*, from Tierra del Fuego, is likewise omitted.

<sup>1</sup> PHILLIPS, J. S. 1930. A Revision of New Zealand Ephemeroptera. *Trans. N. Z. Institute* 61.

<sup>2</sup> ULMER, GEORG, 1904. Ephemeriden. *Hamburger Magalhaemische Sammelreise*.

<sup>3</sup> NEEDHAM, J. G., and MURPHY, HELENE. E. 1924. Neotropical Mayflies. *Bull. Lloyd Lib.* 24, Ent. Ser. 4.

<sup>4</sup> ULMER, GEORG. 1938. Chilenische Ephemeropteren, hauptsächlich aus dem Deutschen Entomologischen Institut, Berlin Dahlen. *Arb. morph. tax. Ent.* Berlin-Dahlen 5, Nr. 2.

## KEY TO MAYFLY NYMPHS KNOWN TO OCCUR IN OR NEAR BRASIL

1. Mandible with an external tusk projecting forward and visible from above the head . . . . . Family EPHEMERINAE . . . . . 2
- Mandible with no such external tusk . . . . . Family BAETIDAE 5\*
2. Mandibular tusks upcurved apically, in lateral view; long hairs on outer margins of tusks usually confined to basal half; distinct elevated process on head, between antennae . . . . . Subfamily EPHEMERINAE - Genus *Hexagenia*
- Mandibular tusks held horizontally, not upcurved, their tips converging; long hairs on outer margins of tusks extend almost or quite to the tips; no such elevated frontal process on head . . . . . 3
3. Tusks more or less flattened, dentate on inner apical margin; tusks not longer than head, haired almost to tip on outer margin; femora and tibiae somewhat twisted (digging forms) . . . . . Subfamily CAMPSURINAE - Genus *Campsurus*
- Tusks more or less cylindrical, inner margin not dentate, but with many short spine-like processes on outer margin; tusks haired to tips on outer margins, usually as long as head and prothorax together; femora flattened, tibiae cylindrical (sprawling forms) . . . . . Subfamily EPHORINAE . . . . . 4

\* The third family of the order Ephemeroptera, — the family Heptageniidae, — is represented in Mexico and Central America but has not been reported as far south as Brazil. NAVAS' *Heptagenia molinae* is in reality a Siphonurine, of the genus *Dictyosiphon* (see ULMER: 1938. Chilenische Ephemeropteren.).

4. Antennae fully three times as long as tusks; tibial spine on fore leg long, more than 1/2 the length of the tarsus; claw of fore tarsus lateral, on lobed tip ..... Genus *Euthyplocia*
- Antennae shorter, about 3/4 as long as tusks; tibial spine of fore leg shorter, about 1/4 the length of the tarsus; claw of fore tarsus terminal, on truncate tip ... Genus *Campylocia*
5. Outer tails fringed on both sides; thorax more or less depressed ..... 6
- Outer tails with heavy fringes on inner side only (may have a few short hairs on outer side); thorax compressed ..... 17 \*
6. Gills present on abdominal segments 1-7 .. Subfamily LEPTOPHLEBIINAE. 7
- Gills present on abdominal segments 1-6, or 2-5 or 2-6 only; gill on segment 2 more or less elyroid, covering those behind it Subfamily CAENINAE ..... 15
7. Gills single, first pair kidney-shaped ..... Genus *Deleatidium*
- Gills double, at least on segments 2-7; first gills never kidney-shaped ..... 8
8. Gills of first pair similar in form to those of the following pairs ..... 9
- Gills of the first pair differing in form from those of the following pairs ..... 14
9. Lateral spines present on abdominal segments 2-9 (may be quite short on basal segments) ..... 10
- Lateral spines present on last four abdominal segments only ..... 12

\* In the peculiar Baetine genus *Baetodes*, which belongs here, the tails are wholly bare.

10. Lateral extensions of abdominal segments very prominent, widely flaring; margins of all gills finely dissected, forming a deep fringe of delicate filaments, as in *Thraulus* ..... *Thraulus* ally \*
- Lateral extensions of abdomen not so widely flaring; margins of gills entire, not dissected as above ..... 11
11. Gills narrow lanceolate, tapering regularly to apex; tracheae of gills with few or no lateral branches; anterior margin of labrum regularly emarginate, not deeply indented, and without denticles ..... Genus *Thraulodes*
- Gills wider in main or body portion, acuminate only at apex; tracheae with many large lateral branches; anterior margin of labrum deeply indented, and with several denticles within this indentation . Genus *Atalophlebia*
12. Hind wing buds absent ..... *Hagenulopsis* ally
- Hind wing buds present ..... 13
13. Several lateral branches arranged alternately on each side of main gill trachea; prominent denticle near apex of claw, almost as large as tip of claw; anterior margin of labrum deeply indented, and with several denticles ..... Genus *Atalonella*
- No lateral branches apparent on gill tracheae; denticle near apex of claw much less prominent, smaller; anterior margin of labrum more regularly emarginate, does not bear denticles ..... Genus *Atalophlebioides*

\* These nymphs are quite common among collections of Neotropical mayflies. See note under *Thraulus*, in key to imagos.

14. Gills of middle segments with margins finely dissected, forming a deep fringe of delicate filaments; gill of first segment deeply forked into two slender linear divisions Genus *Thraulus* \*
- Gills of middle segments not as above (each usually possesses a long terminal extension); gill of first segment single, unbranched ..... Genus *Choroterpes*
15. Gills on abdominal segments 1-6; gill on segment 1 is slender, thread-like, unbranched; elyroid portion of gill on segment 2 almost square, covers all following pairs; gills on 3-6 single, with deep marginal fringes ..... Genus *Caenis*
- Gills on segments 2-5 or 2-6 only; elyroid portion of gill on segment 2 ovate or rectangular, may or may not cover all following pairs; remaining gills double, margins entire, not as above ..... 16
16. Gills on segments 2-5 only; elyroid portion of gill on segment 2 moderately large, more or less rectangular; elytra almost meeting dorsally ..... Genus *Leptohyphodes*
- Gills on segments 2-6; elyroid portion of gill on segment 2 small, ovate, lateral in position; elytra do not approach on another dorsally ..... Genus *Leptohyphes*

\* This is the true *Thraulus*, with characters of the genotype, *Thraulus bellus* Etn.

17. Postero-lateral angles of apical abdominal segments prolonged into thin, flat lateral spines ..... 18
- Postero-lateral angles of apical abdominal segments hardly more than acute (usually rounded, except in *Callibaetis*); never with such prominent lateral spines Subfamily BAETINAE ..... 21
18. Abdominal gills, when present, are all on dorsal surface ..... Subfamily SIPHONURINAE .. 19
- Abdominal gills of first pair ventral in position, other pairs dorsal ..... Subfamily OLIGONEURINAE . 20
19. Gills on mid-ventral line of thorax, none on abdomen; gills also on bases of maxillae Genus *Murphyella*\*
- Gills absent from mid-ventral line of thorax, present on segments 1-4 of abdomen, elyteroid on first segment; mid-dorsal hooks on same segments; no maxillary gills ..... Genus *Siphonella*
20. Tails three ..... Genus *Oligoneuria*
- Tails two ..... Genus *Lachlania*
21. Gills present on abdominal segments 1-5 only; all are ovate, drooping downward; tails wholly bare; mid-dorsal hooks on abdominal segments typically present.. Genus *Baetodes*
- Gills present on segments 1-7; variable in shape, but not down-drooping; no such mid-dorsal hooks on abdominal tergites; tails haired as noted previously ..... 22

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\* ULMER thinks the genus *Murphyella* (known only as a nymph) may be synonymous with *Dictyosiphon* (known only as an adult). See ULMER — 1938. Chilenische Ephemeropteren.



22. Gills double, at least on segments 1-2 (on segments 3-6, a small recurved flap may be all that represents 'doubleness') . . . . . 23
- Gills single on all abdominal segments . . . . . 24
23. Tracheae of gills pinnately branched; hind wing buds present; abdomen rather flattened postero-lateral angles of middle abdominal segments definitely acute... *Genus Callibaetis*
- Trachaea of gills palmately branched; no hind wing buds; abdomen compressed, lateral angles rounded . . . . . *Genus Cloeon* \*
24. Hind wing bus present; tails three, middle one usually shorter and weaker than laterals . . . . . *Genus Baetis*
- Hind wing buds absent; tails variable . . . . . 25
25. Tails two only . . . . . *Genus Pseudocloeon* . . . . . \*\*
- Tails three, all of which may be approximately equal in length . . . . . *Pseudocloeon* ally . . . . . \*\*\*

\* As far as is known to me, no true *Cloeon* nymph has been reported from the Neotropical regions. See note under *Cloeon*, in key to imagos.

\*\* This is the true *Pseudocloeon*, as described by KLAPALEK for the genotype, *P. kraepelini* Klap., a species from Java. Two-tailed nymphs from the Nearctic regions have likewise been reared into typical *Pseudocloeon* imagos. For a discussion of the difficulties attendant upon the study of the genus *Pseudocloeon* and its allies, see: TRAYER, J. R. 1938. Mayflies of Puerto Rico (*J. Agri. Univ. of Puerto Rico* 22: 30). I do not know of any true *Pseudocloeon* nymph being reported from the Neotropical region, altho several species of imagos classed as *Pseudocloeon* have been described from that area. Nymphs described by NEEDHAM and MURPHY as *Pseudocloeon*, — three-tailed, reported as lacking hind wing buds, — prove on closer examination to have hind wing buds, hence cannot be *Pseudocloeon* nor even a close ally of that genus.

\*\*\* A three-tailed nymph reared by Mr. KLEEREKOPER proved to be the immature stage of a two-winged adult which would be classed as *Pseudocloeon*, were not the nymph known. This nymph bears considerable resemblance to a nymph described in the abovementioned paper on Puerto Rican mayflies as an aberrant *Cloedes*, — a genus thus far known only from that island.

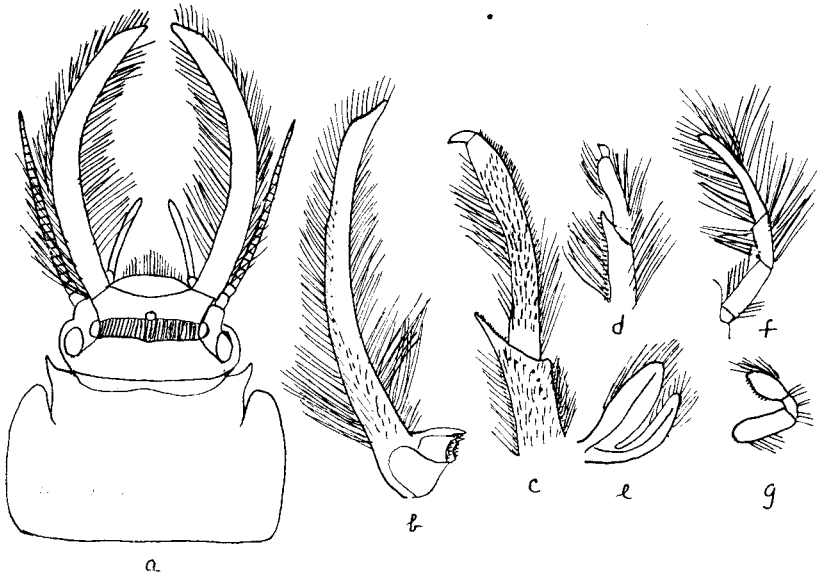
## A. TAXONOMIC NOTES ON THE NYMPHS.

## Family EPHEMERIDAE

## Subfamily EPHORONINAE.

Genus *Campylocia* Needham and Murphy*Campylocia anceps* (Etn.) Vial 99.

One specimen, about half-grown, measuring 25 mm. (exclusive of tails) was taken from a cascade in the brook "Cachoeirinha", Ouro Fino, State of Minas Gerais, on August 22, 1940. The nymph was in very

Fig. 1 — *Campylocia anceps*

swift current, on the under side of a stone. This is the largest nymph collected by Mr. KLEEREKOPER. The nymph of this species has been described and figured by ULMER<sup>1</sup>. Fig. 1, redrawn from ULMER's figures, shows head and pronotum, and details of mouthparts and legs. As noted in the key, nymphs of this genus may be distinguished from the closely allied *Euthyplocia* by the shorter antennae, shorter tibial spine on

1. ULMER, GEORG. 1920. Ueber die Nymphen Exotischer Ephemeropteren. Fest. f. Zschokke 25: 1-10.

fore leg, and by the terminal claw on the fore tarsus. Nymphs of both genera are sprawling forms, not 'diggers', as are many nymphs of the family Ephemeridae.

### Family BAETIDAE

#### Subfamily LEPTOPHLEBIINAE

#### Genus *Thraulodes* Ulmer

#### *Thraulodes* sp. A. Vial 99.

One male nymph, almost mature, was taken at the same time and place as *Campylocia anceps*. An immature nymph of the same species was collected along with *Thraulodes* sp. B. The mature nymph may be described as follows.

Body  $6\frac{1}{2}$  mm.; tails 9 mm. additional. Body dark red-brown; abdomen slightly darker than thorax; head darker than abdomen. Legs pale

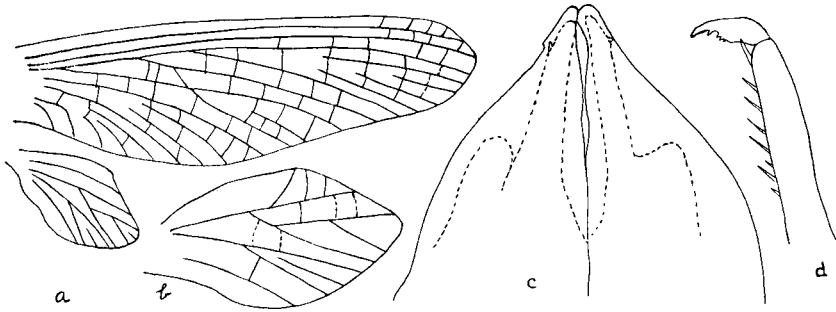


Fig. 2 — *Thraulodes* sp. A.

red-brown; each femur with a small basal and a larger apical pale spot. Femur dilated; very long marginal hairs, and numerous small spines on dorsal surface (as in sp. B). Posterior margins of abdominal tergites darker brown; no paler lateral margin, as in nymphs of *Hagenulopsis* ally. Dark submedian dots faintly indicated on basal tergites. Lateral spines on abdominal segments 2-9; very short on 2 and 3, becoming progressively longer; spine on 9 very large, triangular, extending almost to apex of 10. Row of short spines continuous across posterior margins of tergites. Gills lanceolate, narrow, tracheae unbranched; comparatively wider in body portion than gill of *Hagenulopsis* ally, also paler in color, being light purplish grey. Basal and middle gills largest (2nd gill as long as  $4\frac{1}{2}$  segments of abdomen); following gills progressively shorter

(6 and 7 about as in *Hagenulopsis* ally). Tails red-brown, darker at apex of each joint. At base, alternate joints wider; further out, three narrow joinings between each two wider ones. Incipiente venation of

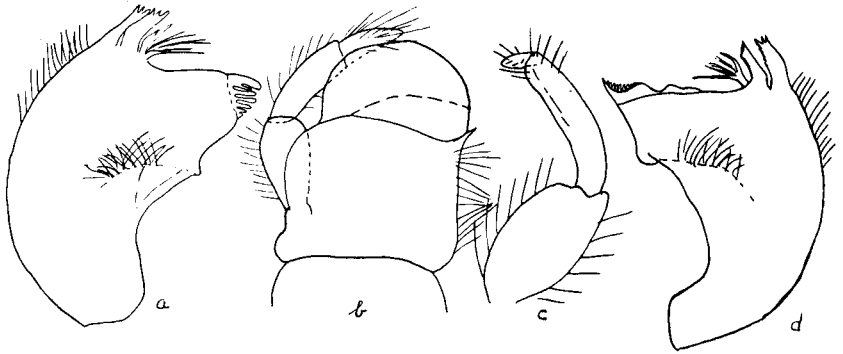


Fig. 3 — *Thraulodes* sp. A.

fore and hind wings and of genitalia, also tarsus and claw, shown in Fig. 2. Gills and mouthparts essentially as in *Thraulodes* sp. B.

*Thraulodes* sp. B. Vial 85.

One mature male nymph and one immature specimen, taken from a spring of the brook Boa Ventura, an affluent of the river Pitanga, tributary of river Mogi-Guaçu, in the southern part of the State of Minas Gerais; altitude 1,300 meters. On stones, in rather swift current. Aug. 21, 1940.

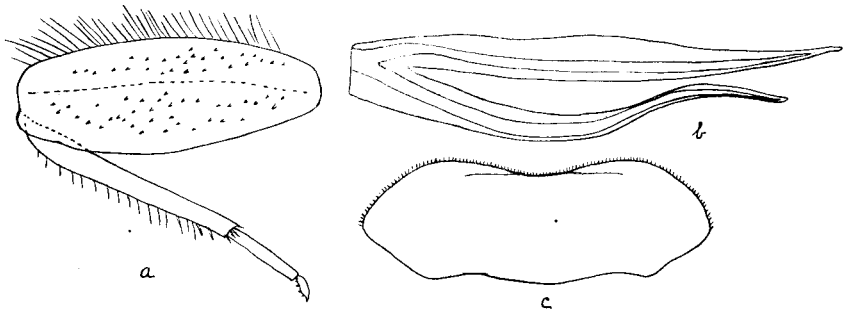


Fig. 4 — *Thraulodes* sp. B

Size as in *Thraulodes* sp. A. Body dark red-brown. Frontal portion of head, and posterior margin, paler than vertex. Legs yellow; femora dark at tip, with dark submedian band and dark mark parallel to anterior margin. Lateral margin and entire median area of pronotum yellow-

ish, as is also the mesonotal scutellum. Black markings on thoracic pleura. Abdominal tergites paler red-brown than thorax; apical segments and lateral margins yellowish. Black dots and dashes laterally on tergites, as in sp. A.; also black sumedian streaks and narrow dark line near posterior margin. Gills slightly narrower than in sp. A. Tracheation darker, hence more distinct. Abdomen yellowish ventrally, with row of dark dots on each sternite parallel to lateral margin. Tails missing, from mature specimen; on immature one, as in sp. A, basally, but darker joinings lacking from apical portion. Mouthparts, hind leg, and gill if fourth segment as in Figs. 3 and 4.

### *Hagenulopsis ally*

Two nymphs, one immature, the other an almost mature male, were taken at the same time and place as *Thraulodes* sp. B. No trace of hind wing buds can be found on either of nymphs, hence they are considered

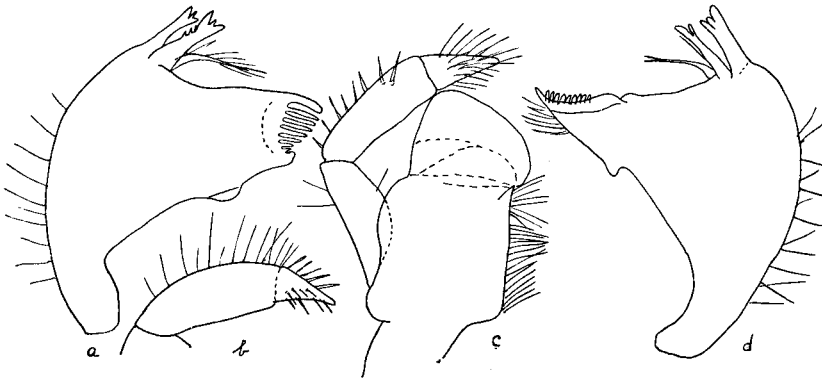


Fig. 5 — *Hagenulopsis ally*

as allies of *Hagenulopsis*. There is a good possibility that they may be nymphs of the genus *Hagenulopsis*, the nymph of which is unknown.<sup>1</sup> The incipient venation of the wing, and the spines on the penes, both point toward such a conclusion. Description of the male nymph is as follows.

Body  $7\frac{1}{2}$  mm.; tails broken off at 4 mm. from body. Body more or less flattened, especially thorax and lateral margins of abdomen. Note the denticles within the depressed anterior area of the labrum, and the

1. NEEDHAM and MURPHY describe a small two-winged nymph from Peru, which they refer doubtfully to the genus *Hagenulopsis*, on the basis of the entire lack of hind wings.

long denticle near tip of claw. Gills very long and slender, lanceolate; all pairs are double. On most, tracheae unbranched; but occasionally a number of *very fine* and quite inconspicuous twig-like extensions are present from main trachea. Gill on segment 1 extends back as far as posterior margin of segment 4 (i. e., as long as three abdominal segments). Gills on segments 2 and 3 slightly longer; missing from 4 and 5; on 6, shorter than basal ones, only two segments long; on 7, still shorter, about  $1\frac{1}{2}$  segments in length. Lateral spines on abdominal segments 6-9; shortest on 6, longest on 9 (this spine reaches almost to

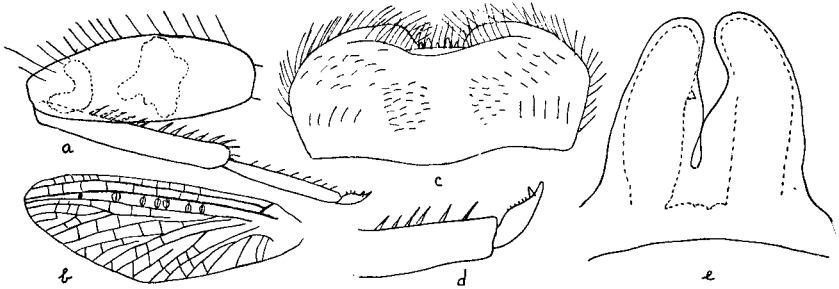


Fig. 6 — *Hagenulopsis ally*

posterior margin of 10). Body dark red-brown; legs yellow; two dark femoral bands on fore and hind leg, one only on middle leg; tips of tibiae brown. Lateral margin of abdomen paler, orange-red. On all tergites, paler mid-dorsal streak. Tail red-orange, very slightly darker at joinings. Mouthparts, leg, and incipient venation and genitalic structure as in Figs. 5 and 6.

### Family BAETIDAE

#### Subfamily CAENINÆ

#### Genus *Caenis* Stephens

#### *Caenis* sp.

A considerable number of nymphs of this genus, in various stages of development from very young to almost mature forms, occurred in six different areas from which collections were made (see list of these, under Ecological Notes). Variations in size of almost mature specimens may well be merely sexual, since the females of this genus are more robust and often considerably larger than the males. The square-cut elyptroid portion of the gill on segment 2, the presence of a single filiform gill on segment 1, and the deep-fringed single gills on segments 3-6,

distinguish nymphs of this genus from others of the subfamily thus far reported from Brazil and neighboring countries. These nymphs do not seem to differ much from one another, and are here assumed to be all of one species, which may be described as indicated below. Body of partly-grown nymphs, 3 mm. in length. Body light redbrown. Thorax more or less mottled with yellowish. Black pre-apical band (may be reduced to a dark dash) on femur; black band also on tibia and one on tarsus. Posterior margins of all abdominal tergites blackish. One larger specimen, presumably a female, differs as follows: Tergites wholly shaded with greyish, and not darker on posterior margins; tergites 8 and 9, also sternites of same segments, quite dark. Pale submedian streaks on tergites. Femoral band as above; but tibia and tarsus wholly greyish, darker bands not noticeable. Since the sexes of the adult insects of this genus vary somewhat in coloration, it is assumed that the above differences are sexual, not specific. Nymphs from *Nitella* in the reservoir of the Mogi-Guaçu River are so blackened as to make it impossible to ascertain their original color.

#### Genus *Leptohyphes* Eaton

Nymphs of this genus are described in Neotropical Mayflies. Among the specimens collected by Mr. KLEEREKOPER are eight which

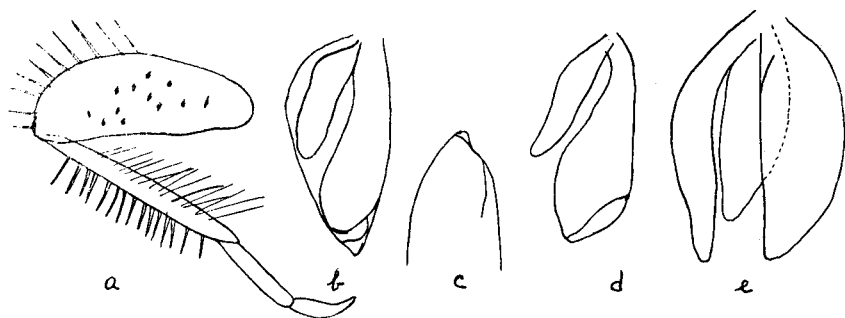


Fig. 7 — *Leptohyphes* sp. A

appear to be of this genus. They fall into two species, one of which (*Leptohyphes* sp. B.) is somewhat atypical, but is placed in this genus for reasons noted in discussion of the species.

#### *Leptohyphes* sp. A. Vial 129.

Seven half-grown specimens, from a reservoir of the brook Guatemi, State of S. Paulo, Aug. 10, 1940. The largest has a body length

of  $3\frac{1}{2}$  mm. General color yellowish brown. Black pencil markings on head and thorax; V-shaped purplish spot near apex of each femur. Abdominal tergites with yellowish mid-dorsal streak, smoky-shaped markings on each side of this stripe, and a line of black spots on each side near bases of gills, on basal and middle tergites. Lateral portions of tergites shaded lightly with grey. Sternites unmarked. Maxillary palp obsolescent; labrum with slight median indentation on anterior border. Elytroid gill on segment 2 covers gills on 3-6, except when the abdomen is greatly extended; no indications of a hinge-line across this elytroid gill. Gills on segments 2 and 4, and hind leg, as in Fig. 7. Lateral margins of abdomen extended into flattened areas, most prominent on basal and middle segments. Lateral spines present on segments 6-9; very short on 6.

*Leptohyphes* sp. B. Vial 99.

A single nymph, taken in the brook 'Cachoeirinha', along with nymphs of *Campylocia*, *Thraulodes* sp. A., and *Baetodes*. This mature nymph is fat and chunky, with a body length of 2 mm. only. In certain respects, it seems to be intermediate between *Leptohyphes* sp. A., and the nymphs listed as *Leptohyphodes*. Gills are present on segments 2-6, as in *Leptohyphes* sp. A. The elytroid gills on segment 2 are of the same general appearance and shape as in that species, but possess a definite hinge-line  $\frac{1}{3}$  of the distance from the apex. The lower portion of gill 2, and gills on segments 3 and 4, are very similar also to those of *Leptohyphes* sp. A., but that on segment 2 has a third and narrower lobe on the dorsal side, while four lobes instead of three are present on gills 3 and 4. Labrum, maxillary palp, and legs as in *Leptohyphes* sp. A. Lateral margins of all abdominal segments expanded into flattened areas; postero-lateral spines present on 3-9, very prominent on 6-9. Prominent mid-dorsal hooks on abdominal tergites 4-9 set this species apart from both *Leptohyphes* sp. A. and *Leptohyphodes* sp., neither of which possess such structures. The specimen is so small that wing buds might be present and not seen. None were found. Other interesting features of this nymph are as follows.

Pro- and mesothorax wider than head or abdomen. Claw slender, somewhat longer than in *L.* sp. A.; apparently a very slight 'hump' near tip, on inner margin. Prothorax somewhat angulate at antero-lateral



margin (would not call it 'square-cut', however, as in species described by NEEDHAM and MURPHY). Prominent mid-dorsal spines on abdominal tergites 4-9; of these, the ones on 6-8 are highest, that on 9 is somewhat less prominent. These spines are best seen from lateral aspect. Color reddish brown. Outer margin of notum pale yellowish. Pronotum, and to lesser extent head and mesonotum, mottled with yellowish. Lateral margins of abdomen, tergite 10 and apical portion of 9, yellowish. Legs yellowish brown. Ventrally, somewhat paler; a line of blackish dots laterally on sternites, next to pleural fold.

### Genus *Leptohyphodes* Ulmer

Body and legs long and slender. Head, thorax and elytrid gill covers bear numerous long hairs. Pronotum flaring in anterior portion,

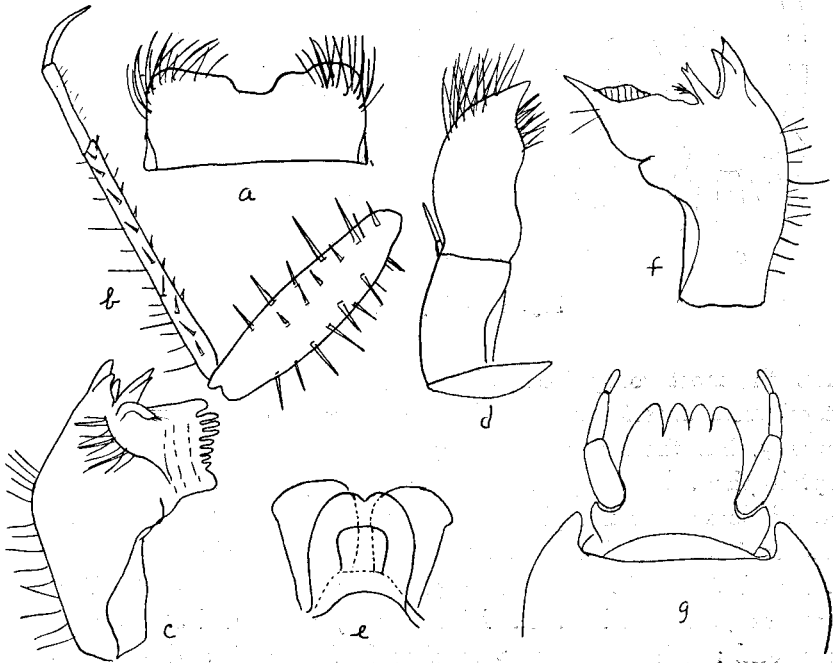


Fig. 8 — *Leptohyphodes* sp.

widest at this margin. Head small, somewhat rounded, not as wide as pronotum at anterior margin. Mouthparts as in Fig. 8. Note: (1) deep notch at middle of anterior margin of labrum, and shelf-like portion

on each side of this notch; (2) great reduction of maxillary palp, which is practically obsolescent. Hind leg longest; approximately equal in length to abdomen plus metathorax. Femur not dilated; a few long, stout hairs or spines on each margin. Similar long hairs, somewhat more numerous, on posterior margin of tibia. Tibia longer than femur, on middle and hind legs. Claws long, slender, curved; not denticulate. No hind wing pads. Gills on segments 2-5 only. Elytroid portion of gill on segment 2 more or less rectangular, covering all gills behind it. It has a transverse hinge line near the middle, and bears many long

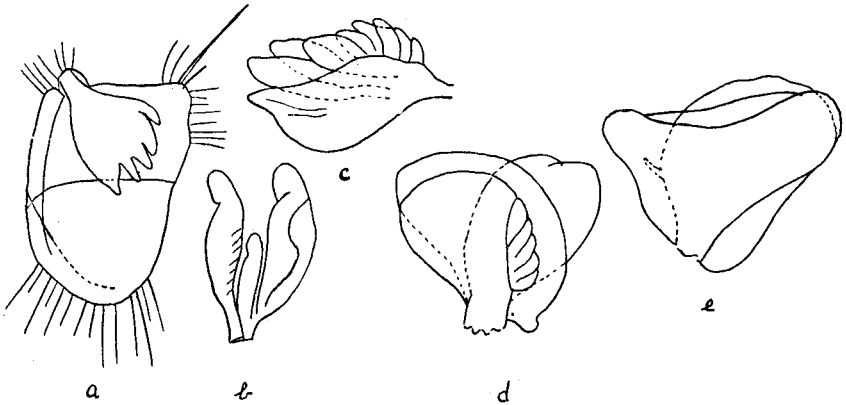


Fig. 9 — *Leptohyphodes* sp.

hairs, the most conspicuous of which are tufts projecting forward and lateral from anterior margin. These elytra-like covers do not quite meet dorsally, but there is no wide space between them, as is the case in *Leptohyphes*. Lower portion of gill on segment 2 is divided, on side toward dorsum or nymph, into several finger-like lobes (not fringes). Gills on 3-5 trilobed; margins entire, not fringed; short finger-like lobes on dorsal side of lower plate on gills 3 and 4, as on gill 2. For appearance of gills, see Fig. 9. Abdomen cylindrical. Lateral margins of basal and middle segments very slightly flattened, and with short postero-lateral spines, which are pressed against the body and not visible from dorsal view. Tails three, subequal; whorls of spines at joinings. *Leptohyphodes* sp. Vial 97.

Thirteen nymphs, several of which are almost mature, were taken from a spring of the brook Santa Isabel, a tributary of the Mogi-

Guaçu. Body length of five of the largest nymphs:  $5\frac{1}{2}$  to 7 mm.; tails  $4\frac{1}{2}$  mm. The following description is drawn from a nearly-mature male nymph.

Reddish brown. Head darker than thorax. Antennae yellowish. Legs yellowish brown. Abdominal tergites with yellowish tinge; smoky patches bordering pleural fold; tergite 9 darker red-brown, similar in color to head; tergite 10 a trifle paler, but darker than tergites 1-8. Elytroid gill covers have blackish shading along anterior and dorsal margins. Ventrally, only slightly paler. Tails yellowish; spines at joinings red-brown.

A female nymph appears thus: All abdominal tergites shaded transversely with smoky brown, posterior margins paler; an irregular dark mid-dorsal triangle on each, its base on anterior margin, its tip not quite attaining the posterior margin.

### Family BAETIDAE

#### Subfamily BAETINAE

#### Genus *Baetis* Leach

*Baetis* sp. Vial 85 (Vial 154)

One mature male nymph, from a spring of the brook Boa Ventura,

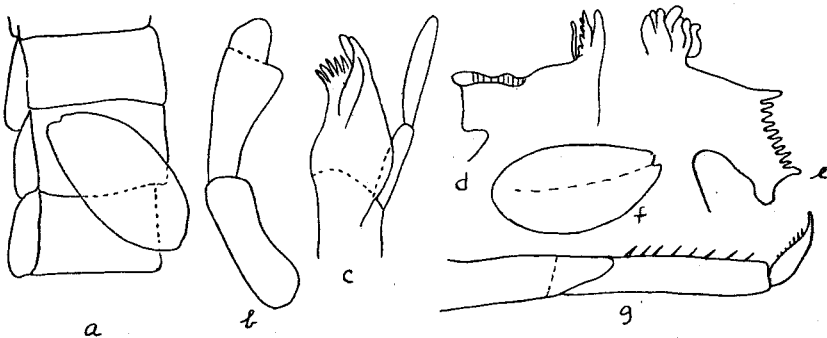


Fig. 10 — *Baetis* sp.

an affluent of the river Pitanga, State of Minas Gerais; Aug. 21, 1940.

Likewise a very immature nymph from the outlet of a reservoir in Campinas, which may be of the same species. Characters of the male nymph are as follows.

Middle tail  $3/4$  as long as the outer ones; two dark bands across tails. Hind wing buds very small and slender. Abdominal tergites 1, 4, 7 and 10 largely yellow; all others deep brown. Body length  $3\frac{1}{2}$  mm. Gills ovate, symmetrical, tracheation indistinct. Mouthparts, gill and fore tarsus shown in Fig. 10.

### Genus *Baetodes* Needham and Murphy

*Baetodes serratus* Ndhm. and Murphy. Vial 99.

A single *Baetodes* nymph, which corresponds very well with the description of *B. serratus*, was taken in company with *Campylocia*

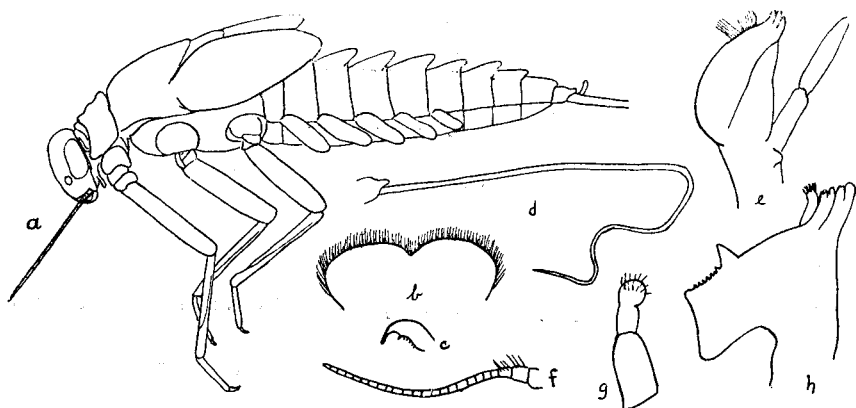


Fig. 11 — *Baetodes serratus*

*anceps*, *Leptohyphes* sp. *B* and *Thraulodes* sp. *A*, from the brook "Cachoerinha". Nymphs of this genus are unique among known genera of the subfamily Baetinae in possessing but 5 pairs of gills, all of which turn downward along the sides of the body; and in the total lack of hairs on the tails. The middle tail is a *very short* stub. Hind wings are lacking. Prominent mid-dorsal spines occur on all abdominal segments, in *B. serratus*, but are absent in *Baetodes* sp. N.º 1. Only these two species of *Baetodes* have been described. Both are stiff-looking, long-legged nymphs, of quite uniform dark red-brown coloration. *B. serratus*

has a body length of 7 — 8 mm., tails 10 mm. additional. The lateral aspect of this nymph, with details of mouthparts and claw, are shown in Fig. 11 (details redrawn from NEEDHAM and MURPHY).

### Genus *Callibaetis* Eaton

A considerable number of *Callibaetis* nymphs, many of them very immature, and many of which when received were lacking gills, tails and legs, were taken at several stations, as listed under Ecological Notes. Only those which were fairly mature and in good condition are considered for discussion. These nymphs appear to be representatives of two species, and may be differentiated by the structure of the gills. *Callibaetis* sp. A. Vials 108, 122, 315. Those from Vial 108 described.

Body 8-9 mm.; tails broken at tips. Two mature nymphs and several immature ones. General color yellowish to reddish brown. Head and pronotum indistinctly mottled. Fine red-brown dots sprinkled over mesonotum. Metanotal scutellum deep brown. Legs yellowish; short redbrown spines on femur more numerous than in the following species, especially along the upper margin. Two longer spines at apex. Tibial and tarsal spines mainly on lower margins, paler in color. Indistinct smoky subapical band on femur; base of claw and narrow line at apex of tarsus deep black-brown. Obscure dark spot on middle and hind coxae, and small dark spot at apex of trochanter. In mature nymph, tergites 2,3, and 5 very dark brown in median area, with prominent dark lateral V-markings (much more pronounced than in following species). Tergites 1,4, 6 and 7 only slightly paler; apical tergites more yellowish. Lateral extensions of abdomen pale yellowish on all segments except for transverse brown bands on segments 1-7. Narrow dark brown posterior margins, interrupted laterally. Small reddish brown dots sprinkled over all tergites. A transverse row of larger darker dots across central area of tergites 6-9 (six dots on tergites 6 and 7; four on 8; two only, on 9). On each tergite, submedian oblique blackish dashes slightly back of anterior margin; one of the dark dots just mentioned, near end of each oblique dash. Ventrally, no dark markings as in following species. Gills on 1st and 2nd segments differ from those next to be described in that the two parts of the under lamella are of very unequal size. Middle gill somewhat more symme-

trical than in next species. Postero-lateral spines on abdominal segments of this species noticeably longer than in sp. B. Long hairs fringing middle tail and inner margin of outer tails are silvery white, except

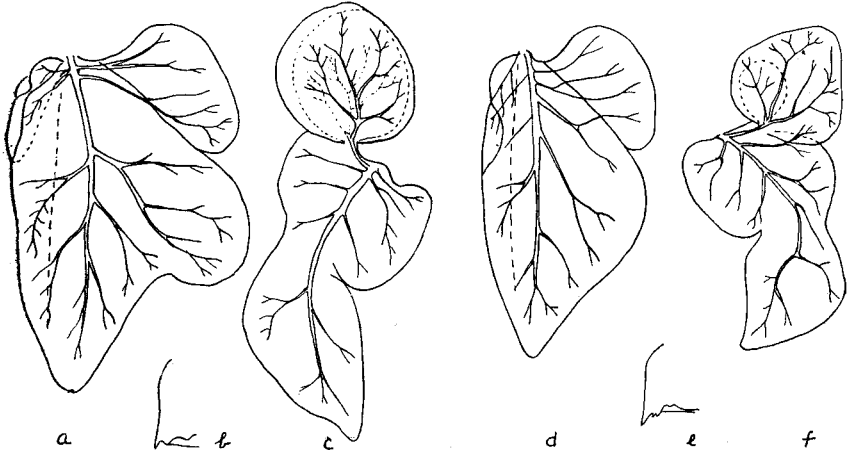


Fig. 12 — *Callibaetis* sp. A and sp. B

that alternate groups of hairs are black at *extreme base only*. Appearance of gills on segments 2 and 5, and lateral margin of abdominal segments, shown in Fig. 12. Note flaps on the 5th gill, as described under sp. B.

Other immature nymphs of this species are from a backwater of the river Tieté in São Paulo City (Vial 315), and from another station of the lake on the river Mogi-Guaçu (Vial 122). Very dark-colored nymphs from a reservoir in Pirassununga and a reservoir in Campinas (Vials 168 and 238) may also be of this species.

*Callibaetis* sp. B. Vials 28, 90, 108, 317.

Those from 90 and 108 described. Four mature female nymphs and several very immature specimens, from a lake on the river Mogi-Guaçu.

Body 8-9 mm; tails 5 mm. General color yellowish brown. Very faint and often incomplete subapical band on femur; faint median and basal bands on tibiae; small dark dots at apices of coxae and trochanters. Base and apex of tarsus narrowly dark brown; base of claw

shaded with brown. Short spines on tibia and femur red-brown; on tarsus, yellowish. Lateral flattened extensions of abdomen pale except for dark transverse bars on tergites 3-7. In brown area, two lateral whitish streaks extend longitudinally from posterior margin; on tergites 5-7, these attain half the length of the segment; and 4 and 3, progressively longer; on 2, becoming a large white blotch which attains anterior margin. Slightly laterad of this pale streak, a pale triangular area (connected with lateral pale margin) based on anterior margin, and not quite reaching upper end of pale streak. Between these white areas and on both sides of the pale streak, a somewhat darker brown patch forming a very indistinct V. At base of each gill, a small dark dot. Indications of a small pale median spot on anterior margin, and of a pale posterior median spot, on some middle tergites. Indistinct dusky submedian oblique dashes from anterior margin, on most tergites; on apical ones, a small pale dot near end of each dash. Ventrally, a dark brown spot near antero-lateral angle, and a short mid-ventral dash at anterior margin, on basal and middle sternites. Gills faintly yellowish; tracheation pale brownish. Gills of 1st and 2nd segments seem to be triple rather than double, since the two lobes of the underneath lamella are approximately equal in size. Note the two flaps on gill 5, the one toward the outer margin being dorsal, that on the opposite side ventral (in figure, the ventrally-folded portion is pulled out from its normal position). Middle tail heavily fringed with long black hairs in apical half; in basal half, hairs shorter and somewhat paler. Inner margins of outer tails likewise with a wide fringe of hairs, occurring in alternate clusters of light and dark. Tail joinings dark brown, alternate joinings wider. Postero-lateral spines on abdominal segments relatively shorter in this species than in sp. A. This character, along with the differences in shape and structure of gills, the less extensive abdominal dorsal markings, prominent black hairs on tails, and absence of small dark dots, distinguishes this species from the one preceding. Gills of segments 2 and 5, and lateral aspect of abdominal segments, shown in Fig. 12.

#### Baetine nymphs of uncertain genus

Here are placed several Baetine nymphs which somewhat resemble *Baetis* except that the middle tail is fully as long as the outer ones. Gills single; hind wing buds present or absent.

*Baetine N.º 1* — Via 85.

Two dark bands across tails. Body yellowish. Gills ovate; asymmetrical, inner portion slightly wider than outer; main trachea distinct. Legs short, rather stocky; tarsus somewhat bowed. Claw very peculiar; appears flattened and truncate at tip, shaped like tip of a spatula, this truncate portion set with fine spines. (Claws of most mayfly nymphs are sharp-pointed at tip). Maxillary palp rather stout; about as long as *galea-lacinia*. Too immature for hind wing buds to have formed. Body 4 mm.

*Baetine N.º 2* — Vial 85.

Middle tail broken; two dark bands, as above. Gills ovate; more asymmetrical than in *Baetine N.º 1* inner portion almost triangular, on basal gills; main trachea and four or five lateral branches (on inner side) are distinct. Claws not pectinate. Maxillary palp reduced; rather slender, not reaching crown of *galea-lacinia*. Distal joint of labial palp regularly rounded at tip. Too immature for hind wing buds to have formed. Body 5 mm. Coloration as in *Baetine N.º 1*.

*Baetine N.º 3* — Vial 129.

Tails not dark-banded. Gills ovate, rather pointed at apex; symmetrical, main trachea distinct. Body yellow and brown mottled. Claws not pectinate. Distal joint of labial palp mitten-shaped. Maxillary palp quite long and slender, extends well beyond crown of *galea-lacinia*. Hind wing buds present. Nymph half-grown; body 4 mm.

*Baetine N.º 4* — Vials 3 and 152.

Dark subapical band on tails. Gills much larger and longer than in any of the *Baetine* nymphs just described. Obovate, pointed at tip, main trachea pinnately branched, tracheation distinct; gills faintly brown-tinged. Middle gills as long as about  $2\frac{1}{2}$  abdominal segments. Legs long and slender. Claws not pectinate. Distal joint of labial palp regularly rounded at tip. Maxillary palp rather slender, does not quite reach to crown of *galea-lacinia*. Nymph too immature for hind wing buds to have formed; body  $3\frac{1}{2}$  mm.



## B. ECOLOGICAL NOTES

A. *Rapid-water forms.*

The following species of nymphs occurred in springs, brooks, or other rapid-flowing waters:

*Campylocia anceps*, *Leptohyphes* sp. B., *Thraulodes* sp. A, and *Baetodes serratus*, from: "Cascade in the brook "Cachoeirinha". Ouro Fino, State of Minas Gerais. Very swift current; on the lower sides of stones. Aug. 22, 1940". Vial 99.

*Leptohyphodes* sp., and a *Baetine* nymph with tails broken, from: "spring of the brook Santa Isabel, tributary of the river Mogi-Guaçu in Ouro Fino, Minas Gerais. Aug. 22, 1940". Vial 97.

*Hagenulopsis* ally, *Thraulodes* sp. B, *Baetis* sp., and *Baetines* N.º 1 and 2 from: "spring of the brook Boa Ventura, an affluent of the river Pitanga, tributary of the river Mogi-Guaçu, in the southern part of the State of Minas Gerais. Altitude 1,300 meters Rather swift current; on stones. Aug. 21, 1940". Vial 85.

*Baetis* sp. from: "outlet of a reservoir, Campinas, State of São Paulo. Rather swift current; in very thin sheet of water". Vial 154. Also from: "Brook Boa Ventura, Vicinity of Boa Ventura, Ouro Fino, Minas Gerais. Lower side of stones in swift current. Aug. 21, 1940". Vial 104.

Of these nymphs, *Baetis* sp., *Baetodes serratus* and the *Baetines* have compressed, stream-lined bodies, and are fitted for withstanding a strong current of water without being washed away by it. Nearctic *Baetis* nymphs are commonly found among gravel and small pebbles, in swift water, often unprotected by overhanging rocks, where they rest like minnows, heads upstream. Nymphs of *Thraulodes*, *Hagenulopsis* ally, *Campylocia*, *Leptohyphodes* and *Leptohyphes* are specialized in a different manner to resist the force of rapid currents. Here we find legs fitted for clinging; thorax either depressed or arched dorsally but flattened ventrally; head more or less flattened and not turned sharply downward, as in the first group; abdomen flattened ventrally and capable of appression against rocks.

### B. *Quiet-water forms.*

From one station in the "reservoir of the brook Guatemi, Campinas, State of S. Paulo, Aug. 10, 1940", Vial 129, specimens of *Baetina* No. 3, of *Caenis* sp. and of *Leptohyphes* sp. A. were taken. Of these, only *Caenis* is a typical quiet-water form. It would seem probable that this station was near an inlet or outlet. All other quiet-water forms, — from lakes, reservoirs and backwaters, — are members of the genera *Callibaetis* and *Caenis*. Nymphs of the former genus are long-legged, more or less compressed forms, found commonly in and among water weeds in quiet waters. Not dissimilar in general from other *Baetinae* that inhabit rapid waters, these nymphs have adapted themselves to climbing about on submerged vegetation, and are the commonest inhabitants of ponds. Nymphs of *Caenis*, on the other hand, are flattened forms commonly found burrowing in soft mud or silt, either in ponds or along the shores of more rapid streams. It has often been stated that the gill covers formed by the second pair of gills, and completely covering all following pairs, are distinct adaptations to protect these delicate structures from silt.

Nymphs of *Caenis* occurred in the following locations: "lake (backwater) of the river Mogi-Guaçu in Ouro Fino, State of Minas Gerais, Aug. 23, 1940"; "outlet of the reservoir Guatemi, Campinas, State of S. Paulo. Oct. 5, 1940"; "reservoir of the brook Guatemi, Campinas, State of S. Paulo, Aug. 10, 1940"; "water reservoir in Pirassununga, State of S. Paulo, Dec. 21, 1940"; and "Among *Nitella*" in an affluent of that reservoir, Mch. 6, 1941. Vials 108, 128, 129, 276, 314, and 315.

*Callibaetis* nymphs were taken at the following stations: "reservoir of the brook Guatemi, Rocinha, Campinas, State of S. Paulo, Jan. 31, 1940"; backwater of the river Tieté in São Paulo City, S. Paulo, Mch. 1941"; "lake (backwater) of the river Mogi-Guaçu in Ouro Fino, State of Minas Gerais, Aug. 23, 1940"; "reservoir of the Experimental Station for Fisheries at Pirassununga, State of S. Paulo — between inundated grass leaves — July 30, 1940", "reservoir in Pirassununga, State of S. Paulo, Oct. 9, 1940"; "reservoir in Água Fria, Perus, State of S. Paulo, one of the very rare alkaline waters of this state, — pH

8.5 —, Jan. 22, 1940"; "swamp (backwater) of the river Tieté, near São Paulo City, Nov. 26, 1940"; "reservoir in Campinas, State of S. Paulo, Dec. 27, 1940"; "in mud of the affluent of the Pirassununga, State of S. Paulo, Mch. 6, 1941", "reservoir of the brook Guatemi, Campinas, State of S. Paulo, Aug. 10, 1940"; and "among *Nitella* in the affluent of the river Pirassununga, State of S. Paulo, Mch. 6, 1941". Vials 3, 28, 90, 108, 122, 129, 145, 147, 152, 168, 234, 238, 266, 315, 317.

As regards the habitats listed for *Caenis* and *Callibaetis*, the following are worthy of comment. *Caenis* is not usually found among water plants, yet here it occurred among *Nitella* along with *Callibaetis*. Nor is it usual to find *Callibaetis* in mud, in company with *Caenis*, yet it is listed as having been taken in such a location.

It is interesting, also, to note that the several genera of the family Heptageniidae which are among the commonest inhabitants of rapid waters in Nearctic regions, are wholly lacking from the South American fauna. Of the genera found in the collections from the reservoir of the river Mogi-Guaçu (representatives of other two families of the Ephemeroptera) only four, — *Baetis*, *Callibaetis*, *Caenis* and *Thraulodes*, are common to both Nearctic and Neotropical faunas.

## EXPLANATION OF FIGURES

## 1. Nymphs

- Fig. 1 — *Campylocia anceps*. (Redrawn, from Ulmer)  
 a — head and pronotum, dorsal aspect; b — mandible; c — tip of fore leg; d — tip of middle leg; e — first gill; f — maxillary palp; g — labial palp.
- Fig. 2 — *Thraulodes* sp. A.  
 a — wings; b — hind wing enlarged; c — genitalia; d — tarsus and claw
- Fig. 3 — *Thraulodes* sp. B.  
 a — and d — mandibles; b — maxilla; c — labial palp.
- Fig. 4 — *Thraulodes* sp. B.  
 a — third leg; b — 4th gill; c — labrum.
- Fig. 5 — *Hagenulopsis* ally.  
 a — and d — mandibles; b — labial palp; c — maxilla.
- Fig. 6 — *Hagenulopsis* ally.  
 a — third leg; b — wing; c — labrum; d — tarsus and claw; e — genitalia.
- Fig. 7 — *Leptohyphes* sp. A.  
 a — third leg; b — elyroid gill, segment 2 (ventral view); c — tip of same gill; d — under part of same gill; e — gill on 4th segment (dorsal aspect).
- Fig. 8 — *Leptohyphodes* sp.  
 a — labrum; b — third leg; c and f — mandibles; d — maxilla; e — hypopharynx; g — labium.
- Fig. 9 — *Leptohyphodes* sp.  
 a — gill on segment 2 (ventral aspect); b — gill on segment 3 (lateral aspect); c — lower plate of gill on segment 2 (dorsal aspect); d — gill on segment 3 (ventral aspect); e — gill on segment 5 (dorsal aspect).
- Fig. 10 — *Baetis* sp.  
 a — abdominal segments 2-5, with 3rd gill; b — labial palp; c — maxilla; d — and e — details of mandibles; f — gill on segment 4; g — fore tarsus and claw.
- Fig. 11 — *Baetodes serratus* (details redrawn from Needham and Murphy).  
 a — Nymph, lateral aspect; b — labrum; c — claw; d — one of the lateral tails; e — maxilla; f — antenna; g — labial palp; h — mandible.
- Fig. 12 — *Callibaetis* sp. A. and B.  
 a, b, and c — *Callibaetis* sp. B.  
 a — 5th gill; b — middle abdominal segment, showing lateral margin; c — 2nd gill.  
 d, e, and f — *Callibaetis* sp. A.  
 d — 5th gill; e — middle abdominal segment, showing lateral margin; f — 2nd gill.

2. Imagos

Several fine specimens of *Campsurus*, of two different species, were taken by MR. KLEEREKOPER from Lagoa dos Quadros, Rio Grande do Sul, Brasil. Representatives of three other genera were reared from nymphs taken in the vicinity of Porto Alegre. The following key may prove useful in distinguishing imagos of those genera of Neotropical mayflies known to occur in Brazil or nearby countries. It is modified from keys by ULMER, NEEDHAM & MURPHY, and NEEDHAM, TRAVER & HSU.

— KEY TO MAYFLY IMAGOS KNOWN TO OCCUR IN OR NEAR BRAZIL —

- 1. Veins M and Cul of fore wing strongly divergent at base, with M2 strongly bent toward Cu in its basal portion. Venation copious. Eyes of male not divided . . . . Family EPHEMERIDAE . . . . . 2
  
- Veins M and Cul little divergent at base, and fork of M more nearly symmetrical. Venation may be much reduced. Eyes of male often divided . . . . . Family BAETIDAE 8
  
- 2. OF (outer fork, R4 and R5) of radius of fore wing forked near base of wing, and before the radial sector; between Cul and Cu2, two long simple intercalaries . . . . . Subfamily CAMPSURINAE . . . . . 3
  
- OF of radius of fore wing forked at not more than three-fourths the distance to the wing base, and behind or on a level with the radial sector; number and form of intercalaries between Cul and Cu2 . . . . . 6
- ; . . . . . varying . . . . .

3. Pronotum very short and ring-like, not broader posteriorly than in front; fore leg of male almost as long as or longer than the body; forceps stout ..... 4
- Pronotum longer, about as long as wide, much broader posteriorly than in front; fore legs of male about half as long as body; forceps long and slender ..... 5
4. Short intercalaries present at apical margin of fore wing; fore legs of male longer than body ..... Genus *Asthenopodes*
- No such short marginal intercalaries in fore wing; fore legs of male nearly as long as body ..... Genus *Asthenopus*
5. Middle and hind legs much reduced; broadened, finlike; no claw-like appendage extending from forceps base external to forceps limbs ..... Genus *Campsurus*
- Middle and hind legs better developed, thinner, not broadened and finlike; a claw-like appendage present extending from forceps base external to forceps limbs.. Genus *Tortopus*
6. Fork of OF on fore wing occupies not more than half the length of the vein; vein M2 more strongly bent at its base than is Cul ..... Subfamily EPHEMERINAE — Genus *Hexagenia*
- Fork of OF of fore wing reaches two-thirds to three-fourths the distance to the wing base; vein M2 not more strongly bent at its base than is Cul. .... Subfamily EPHORONINAE .... 7

7. Behind Cul of fore wing and parallel with it, cutting across the S-shaped veins that join Cul to wing margin, one or more strong, straight intercalaries ..... Genus *Campylocia*  
 No such intercalaries behind Cul ..... Genus *Euthyplocia*
8. Sc of fore wing not visible, concealed in a fold under R (or visible at base only); wings milky or grey-tinged, with very simple venation (4 to 7 longitudinal veins in fore wing, cross veins very few) Subfamily OLIGONEURIINAE . 9  
 Sc of fore wing normal, fully developed and clearly visible; entirely separate from R. and not concealed by it ..... 11
9. With two tails only ..... 10  
 With three tails ..... Genus *Oligoneuria*
10. In fore wing, three long strong longitudinal veins extend to wing base between the veins R and Cu; M with very long fork; several to many cross veins in costal region, 3 to 4 in radial region, 2 in following region ..... Genus *Spaniophlebia*  
 In fore wing only two long longitudinal veins between R and Cu; M with shorter fork; several cross veins in each region .... Genus *Noya* \*
11. Posterior branch of OF (outer fork of Rs) in fore wing normal, attached basally.. ..... 12

\* NEEDHAM and MURPHY would reduce this genus to synonymy with *Lachlania*, on the basis of the similarity of the nymph of *Lachlania* from Guatemala which they describe and figure, with a nymph similarly described and figured by ULMER from Argentina, as of the genus *Noya*. Both authors base their identification on venational characters of the nymph; ULMER also had several subimagos in the same vial, presumably the same genus as the nymph. The wing of the NEEDHAM-MURPHY nymph has typical *Lachlania* venation. If it should prove that ULMER's nymph had fewer cross veins in wing than are indicated for the genus *Noya* there still remains the question of the validity of *Noya*. Are the additional cross veins and deeper fork of M. indicated for *Noya*, sufficient for the establishment of a new genus distinct from *Lachlania*. *Lachlania* has been reported from Cuba and Guatemala only.

- Posterior branch of OF in fore wing detached basally ..... Subfamily BAETINAE  
..... 27
12. Tails three; OF of hind wing absent (hind wing may be absent or greatly reduced); cubital intercalaries never forming such a long series of veinlets as described below ..... 13
- Tails two (a very short middle tail may be present, or may be represented by a very short stub only); hind wing always present; OF of hind wing present; cubital intercalaries of fore wing consist of a series of sinuate or forking veinlets attaching Cul to the hind margin ..... Subfamily SIPHLO-  
NURINAE .. 15
13. Hind wings may be absent; if present, much reduced (with not more than two longitudinal veins, no cross veins); small mayflies with whitish wings; no free marginal intercalaries; cross veins few in number ..... Subfamily CAENI-  
NAE ..... 17
- Hind wings usually present, never so greatly reduced; fore wings usually with some free marginal intercalaries; cross veins numerous ..... 14
14. Two short intercalaries in fore wing between median intercalary and posterior branch of M1, also between the latter vein and Cul; forceps of male with a single terminal joint ..... Subfamily EPHEME-  
RELLINAE - Ge-  
nus *Melaname-  
rella*
- No true intercalaries on fore wing in positions indicated above; forceps of male with two of three short terminal joints ..... Subfamily LEPTO-  
PHLEBINAE. 19



15. Hind tarsus longer than tibia; M of hind wing forked very near the margin of the wing ..... Genus *Siphonella*
- Hind tarsus shorter than tibia; M of hind wing forked near wing base ..... 16
16. Claws of hind leg similar, sharp-pointed; cubital intercalaries of fore wing generally simple ..... Genus *Metamonius*
- Claws of hind leg dissimilar; some or all of cubital intercalaries of fore wing forked ..... Genus *Dictyosiphon*
17. Vein M2 of fore wing and median intercalary as long as M1, running up to the wing base; hind wing absent ..... Genus *Caenis*
- Vein M2 and median intercalary of fore wing shorter than M1, not running up to wing base; hind wing present or absent ..... 18
18. Hind wing absent; legs long and thin, about as long as body; hind leg about equal in length to fore leg ..... Genus *Leptohyphodes*
- Hind wing present, much reduced, may have two longitudinal veins or none; usually with a long costal projection; legs shorter, hind leg somewhat longer than fore leg ..... Genus *Leptohyphes*
19. Hind wing absent; female with well-developed ovipositor ..... Genus *Hagenulopsis*
- Hind wing present, may be small; no such distinct ovipositor ..... 20
20. Claws all similar, narrow and sharp-pointed ..... 21
- Claws dissimilar on each tarsus, one blunt, the other sharp-pointed ..... 23

21. In fore wing, Cu2 is forked, the first cubital intercalary coming directly from Cu2.. Genus *Massartella* ..... \*
- In fore wing, Cu2 not forked, the first cubital intercalary being connected to Cu2 only by a cross vein or not at all ..... 22
22. In hind wing, Sc reaches the wing margin at 9/10 of the wing length; intercalary present in median fork; cross veins present in anal region ..... Genus *Atalophlebia*
- In hind wing, Sc reaches wing margin at 3/4 of the wing length; no intercalary in median fork; no cross veins in anal region ..... Genera *Nousia* and *Atalonella* . \*\*
23. Hind wing obtuse oval; costal area relatively narrow and long ..... 24
- Hind wing angularly broken on costal margin; costal area broader and usually greatly shortened ..... 25
24. In fore wing, cubital intercalaries more or less parallel to one another ..... Genus *Deleatidium*
- In fore wing, cubital intercalaries strongly divergent ..... Genus *Atalophlebioides*
25. M of hind wing forked; Sc of this wing usually extending a short distance beyond costal projection (may reach half of distance between costal projection and wing tip) ..... Genus *Thraulodes*

\* *Massartella* may not be distinct from *Atalophlebia*.

\*\* From descriptions of *Nousia* and *Atalonella*, and specimens of *Atalonella*. I am unable to distinguish between these two genera. NAVAS's figure shows M of hind wing not forked, but he states that it is forked twice; in a later paper, speaks of claws as similar; says, no intercalary in median fork of hind wing. His figures of genitalia lacks essential details. He considers *Atalonella* a synonym *Nousia*. LESTAGE keeps these genera distinct, but considers both 'problematisch'. ULMER seems inclined to accept the synonymy stated.

M of hind wing not forked; Sc of hind wing usually ending opposite to or very slightly beyond costal projection . . . . .	26
26. Sc of hind wing extends slightly beyond costal projection; penes lack appendage	Genus <i>Choroterpes</i>
Sc of hind wing ends at costal projection; penes with appendages . . . . .	Genus <i>Thraulius</i> *
27. Hind wing absent . . . . .	28
Hind wing present, but may be much reduced . . . . .	29
28. Marginal intercalaries of fore wing occur in pairs . . . . .	Genus <i>Pseudocloeon</i> **
Marginal intercalaries of fore wing occur singly . . . . .	Genus <i>Cloeon</i> ***
29. Fore wing usually with numerous costal cross veins before the bulla; hind wing with a moderate number of cross veins . . . . .	Genus <i>Callibaetis</i>
Fore wing without costal cross veins before the bulla; hind wing with no cross veins, or with a very few only . . . . .	30
30. Marginal intercalaries absent . . . . .	Genus <i>Bruchella</i> ****
Marginal intercalaries paired . . . . .	Genus <i>Baetis</i>

\* Some or all of the Neotropical species now placed in *Thraulius* may really belong to an undescribed allied genus. Nymphs commonly taken in these regions do not conform to the nymph of *T. bellus* Ét., the genotype, nor are they similar to *Thraulius* nymphs taken in North America.

\*\* Some or all of the Neotropical species now placed in *Pseudocloeon* may prove to belong to some allied genus as yet undescribed. Three-tailed nymphs reared by Mr. KLEEREKOPER produced adults which resemble *Pseudocloeon* in venational characters. Philippine and Nearctic *Pseudocloeon* nymphs are two-tailed.

\*\*\* The occurrence of the true genus *Cloeon* in Neotropical regions is somewhat doubtful. Several species originally described in that genus have been proved to belong elsewhere. There remain three species described by NAVAS and two by WEYENBERG, one or more of which may really belong to the genus *Cloeon*.

\*\*\*\* Complete absence of marginal intercalaries is a most unusual character, for the Baetinae. One wonders of these intercalaries were really present, but very fine, and hence overlooked.

**Family EPHEMERIDAE**

## Subfamily CAMPSURINAE

Genus *Campsurus* Eaton

NEEDHAM and MURPHY (1924) give a key to the then-known species of Neotropical *Campsurus*, in which the genus is divided into two main sections on the basis (1) of the relative location of the proximal end of vein M2 in the fore wing, in terms of adjacent veins, and (2) the presence or absence of an elevated triangular hump on the anterior margin of the pronotum, extending forward and partly concealing the hind margin of the head. To the first group belong those species in which the proximal end of M2 is intermediate between Cul and the median intercalary, usually appearing to be conjoined to the latter, and in which the above-mentioned elevated triangular hump is present. The second section is characterized by the approximation of the proximal end of M2 to Cul (so that M2 appears to spring from Cul), and the absence of any such triangular hump, the anterior margin of the pronotum appearing more or less smoothly truncate. One of the species of *Campsurus* taken by Mr. KLEEREKOPER falls into the first, the other into the second of these two sections of the genus. Since I am unable to reconcile either of these species with descriptions of any of those previously described in the genus, I am considering each as representing a new species. I consider that it is preferable to create a synonym rather than to place in a species specimens that do not rightly belong there; and only an examination of the type material will enable anyone to be certain of the identity of several of the species thus far described in *Campsurus*.

***Campsurus Brasiliensis*, sp. n.**

Belongs to the first section of the genus. Apparently allied to *C. major* Ndhm. & Murphy, but larger, and a whitish rather than a yellowish species. Represented by 42 male specimens. Body: 13-17.5 mm.; wings 15 -16 mm.; tails 40 -45 mm.

HOLOTYPE — Male imago. Body 17,5 mm.; wings 16 mm.

Eyes black. Ocelli white, black-ringed at base; small purplish red spot on upper surface of each ocellus, next to black band. Basal joints of antenna suffused with greyish purple; filament white. Front of head pale. Between eyes and backward from median ocellus, light reddish brown with black shading. A distinct black V between eyes, and less distinct submedian blackish streaks from base of median ocellus. Thorax above, clay-colored; forward-projecting triangle of pronotum

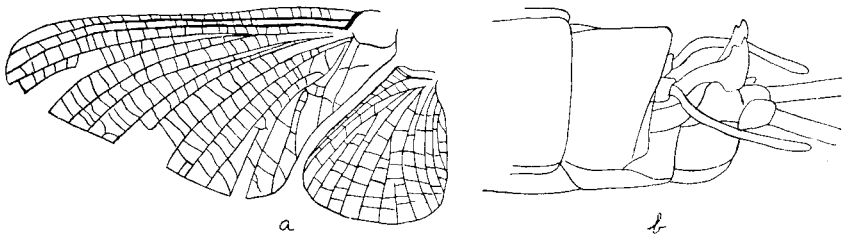


Fig. 1 — *Campsurus brasiliensis*

pale grey-brown; a spot on each end of this triangle, also one at postero-lateral angle of prothorax, purplish. Deep lateral and anterior grooves on mesonotum amber-colored (those on anterior margin edged narrowly with black). No evident dark shading on either meso- or meta-thorax. Thorax slightly paler ventrally. Fore femora streaked with brown above; tibiae washed with light purplish brown; tarsi purplish grey; claws whitish. C, Sc and R of fore wing purplish except near apex; darkest at base; humeral cross vein purplish. In hind wing, humeral cross vein and base of Sc purplish. All other veins pale (longitudinals appear faintly yellowish) except cross veins in costal space as far as stigmatic area, which are pale purplish grey. Cross veins in several spaces behind radius in fore wing may appear faintly greyish under binocular. On one fore wing, M2 turns upward and runs into the median intercalary, while on the opposite wing (the one figured) it appears connected by cross veins to the veins on either side. Abdomen whitish. Pale smoky lateral patches on tergites; on basal tergites, these are much restricted; more extensive on middle ones, but leaving a pale anterior and posterior margin, and broad pale mid-dorsal stripe. Terminal tergites largely suffused with smoky, which color is somewhat

deeper on posterior margins; on tergite 9, pale mid-dorsal streak restricted by dark submedian streaks which converge at anterior margin. Sternites wholly pale. Tails white. Genitalia very similar to those of

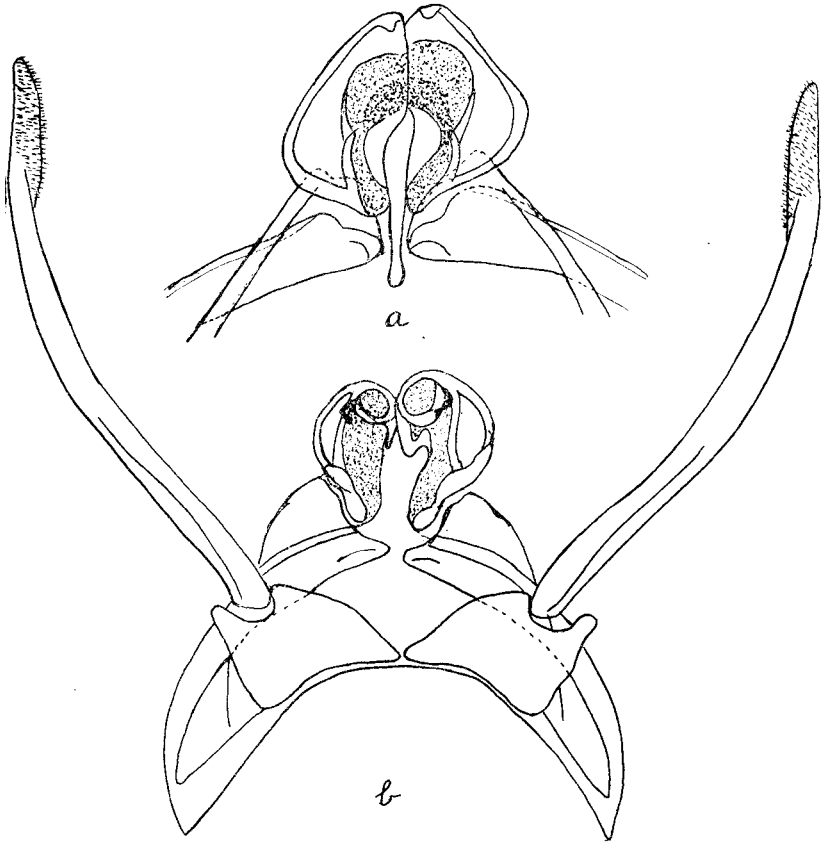


Fig. 2 — *Campsurus brasiliensis*

two specimens in the Cornell University Collection, taken at same time and place as the type of *Campsurus major*, and which I am considering as type material of that species. Penes shown in Fig. 2. Wings torn at tips, hence figure is made from one of the paratypes.

Variations from the above description, as exhibited by some of the paratypes, as follows:

Male imago (smaller specimen- body 16 mm. wings 15 mm).

Similar to holotype, but abdominal markings somewhat paler smoky. M2 of both wings appears connected by cross veins to adjacent veins.

Male imago (body 14, wings 15 mm). Abdominal markings so pale as to be barely noticeable, so that abdomen appears white on basal and middle tergites. Coloring on fore leg also paler.

Still other paratypes which were examined showed the abdominal markings fully as distinct as in the holotype; in others, as pale as or paler than those indicated above. Still others were intermediate as to abdominal markings. In all, the forward-projecting triangular portion of the anterior pronotal margin is very large and prominent, as described for *C. major*. But in none of them are the cross veins of the costal margin of the hind wing as plainly visible as in that species, nor is there any such complete and extensive network of small veins in the anal region of the hind wing. Furthermore, the type of *C. major*, also the above-mentioned additional specimens, are distinctly yellowish and without any apparent dark markings. The size of that species was incorrectly reported in *Neotropical Mayflies*; body of holotype is 13 mm. as stated, but wing is not more than 16 mm. instead of the 20 mm. of the original description. Wings of both the other two specimens are likewise 16 mm. Because of these differences, it seems probable that the Brazilian material just described represents a different species than *C. major*, altho certainly closely allied to it.

HOLOTYPE — Male imago. Lagoa dos Quadros, Rio Grande do Sul, Brazil; Nov. 1941. H. KLEEREKOPER, Collector. This specimen in Mr. KLEEREKOPER'S possession.

PARATYPES — 41 males, same data. Half of these in Mr. KLEEREKOPER'S possession; the remainder in private collection of J. R. TRAVER.

#### *Campsurus assimilis*, sp. n.

Belongs to the second section of the genus. In type of genitalia and in arrangement of dark markings, allied to *C. notatus* Ndhm. and Murphy, but larger, and whitish rather than yellowish. Represented by two male and one female specimens. Body of male: 17 mm.; wing 15 mm.; tails broken at 21 mm. Female: body 18 mm; wings 21 mm.

HOLOTYPE — Male imago. This is a well-marked specimen. Top of head heavily shaded with purplish black; a paler yellowish band precedes the black posterior margin. No reddish purple marks on lateral ocelli, as in preceding species. Anterior margin of pronotum more or less truncate, but somewhat more prolonged forward than in paratypes of *C. notatus*. Dark median area on pronotum extending the length of that sclerite. Prothorax above base of leg shaded with purplish brown. Middle area of mesonotum outlined and considerably shaded with smoky brown. Scutella of meso- and metanota, and folds extending from wing root, partially outlined and lateral portions shaded with smoky. Femur of fore leg light purplish brown; tibiae deep purplish grey; tarsi very dark smoky, barely paler at joinings. Tibia equal in

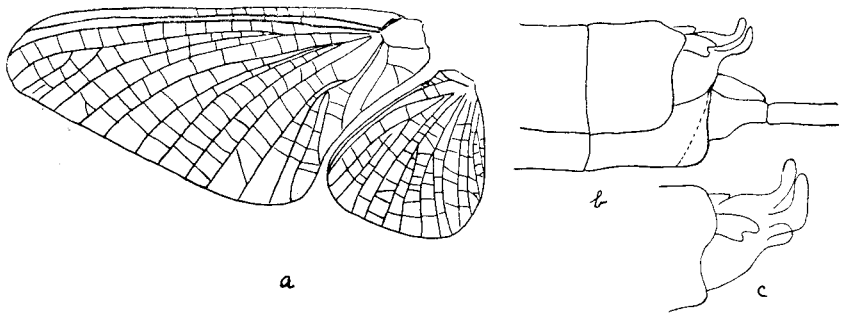


Fig. 3 — *Campsurus assimilis*

length to femur. Claws yellowish; a narrow black longitudinal streak on shorter one, and faint smoky shading on the longer. In fore wing, M2 turns sharply downward to join Cul, but is connected to median intercalary by well-defined cross vein. C, Sc and Rof fore wing purplish; stigmatica area of costal and subcostal spaces tinged faintly with greyish purple. Both longitudinal and cross veins of this species somewhat better defined than in *C. brasiliensis*; in anterior half of wing, faintly purplish grey. In hind wing, humeral cross vein and base of Sc greyish, all other veins colorless; cross veins in basal half of costal and subcostal spaces, few or none apically. (It is difficult to determine this point, on most *Campsurus* wings, since the costal margin is usually rolled over on to the wing surface). Relatively fewer cross veins in fore wing in any given space in wing of *C. brasiliensis*; hence cells thus formed are longer than wide. Abdominal tergites marked much as in well-marked specimens of *brasiliensis*, but dark markings are more prominent and



more extensive, and pale mid-dorsal stripe remains on basal tergites only; on all others, obscured by greyish shading. On middle tergites, dark markings appear as continuous dark submedian bands from which lateral extensions run out along the posterior margin and just behind

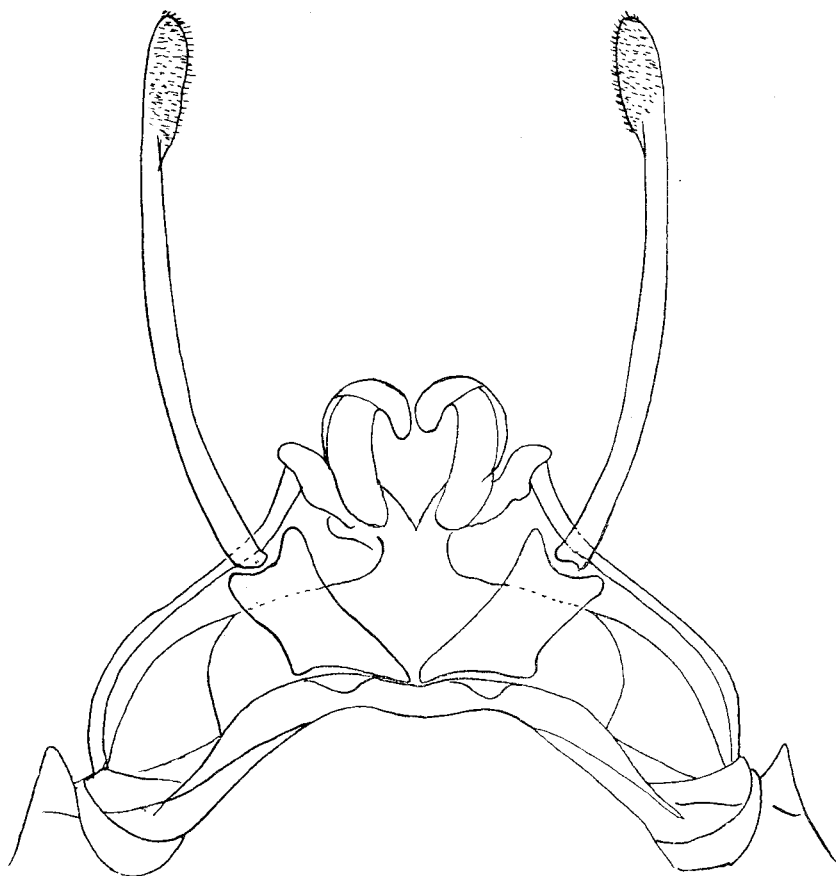


Fig. 4 — *Campusurus assimilis*

the anterior margin; the latter extend almost to the pleural fold, these near the posterior are somewhat shorter. Dark submedian bands of apical tergites deeper in color, wider, and lateral extensions ill-defined or wanting. Posterior margins of tergites 8 and 9 narrowly black; pleural fold marked by narrow deep smoky line. Sternites wholly pale, whitish. Tails white. Genitalia similar in type to *C. notatus*. Wings and genitalia shown in Figs. 3 and 4.

PARATYPE — Male imago — paler specimen. Similar to the above, but all markings somewhat paler. Femur somewhat darker; tibia and tarsus rather paler, with distinct pale area at base of each tarsal joint. In this male, the tibia is slightly shorter than the femur.

ALLOTYPE — Female imago. The markings of thorax and abdomen, the character of the basal ending of M2 in the fore wing, and the rather truncate anterior margin of the pronotum, indicate that the female belongs with the two males just described, rather than with *C. brasiliensis*. (All specimens were in a single large bottle). Entire top of head blackish. Wide median blackish band on pro- and mesonota. Meso- and metanotal scutella margined and heavily shaded with blackish. Dark markings on prothorax above base of leg. Posterior and lateral margins of pronotum purplish black. Fore legs heavily washed with purplish brown. Longitudinal veins of costal margin of fore wing reddish purple. Costal space tinged faintly with greyish, subcostal space with purplish grey, except in stigmatic area, which in both costal and subcostal spaces is semi-opaque yellowish white. Entire membrane of both wings *very faintly* tinged with yellow. All other veins in anterior half of fore wing pale purplish grey; in posterior half, yellowish. Veins of hind wing faintly yellowish, except bases of main longitudinals which are pale grey. M2 of fore wing runs directly into Cul; a cross vein connects it to the median intercalary. Cells in fore wing variable, but in anterior half the greater number are about as broad as long. Abdominal tergites heavily washed with purplish grey; posterior margins of all but the two basal tergites rather widely blackish.

Lateral area next to pleural fold, and a pale transverse streak at about the middle area of each middle tergite, whitish. On 1st and 2nd tergites, a narrow whitish mid-dorsal line, and more extensive pale lateral areas. Tergite 10 likewise deep grey, but with white lateral margins and submedian streaks. Tails broken; remaining stubs faintly yellowish. Thorax and abdomen pale ventrally; very faint grey pencilings on prosternum between bases of fore legs.

HOLATYPE — Male imago. Lagoa dos Quadros, Rio Grande de Sul, Brazil; Nov. 1941. H. KLEEREKOPER, Collector. In Mr. KLEEREKOPER'S collection.

ALLOTYPE — Female imago; same data. In Mr. KLEEREKOPER'S collection.

PARATYPE — Male imago; same data. In collection of J. R. TRAVER.

In the original description of *C. notatus*, the body of the male is reported as 13½ mm, wings 11½ mm. This is the largest of the specimens, which range in size from a body length of 9 and wing of 8 mm., to the above large male, the holotype. It does not seem probable that a range in size of 9 to 17 mm. for length of body would occur normally in a single species, hence the above specimens are kept separate from *notatus* and designated by the new specific name. Very few of the species of *Campsurus* thus far described are as large as *assimilis*. *C. bruchianus* Nav., described from a female, seems by the wing figure to belong to the first section of the genus. *C. corumbanus* Ndhm. and Murphy, also described from females, proves, on examination of the type material, to consist of specimens of two sizes, of which the smaller size (wing 10 mm only) embraces the holotype. *C. longicauda* Nav., another large species, does not appear to conform in type of genitalia to *assimilis*. *C. wappaei* Weyenb. is described as yellowish.

## Family BAETIDAE

### Subfamily CAENINAE

#### Genus *Caenis* Stephens

In this genus of small two-winged mayflies, the female is generally more robust and somewhat larger than the male, and may possess more dark shading on the body. Markings of head and legs are similar in both sexes. Several female imagos of this genus were reared from nymphs by Mr. KLEEREKOPER; all are from a small lake near Porto Alegre. Since no males are present, and there is nothing particularly distinctive about the nymphs (which may be similar to those taken near São Paulo) the specimens are designated as *Caenis* sp.

*Caenis* sp. Female imago. Body 4 mm; wing 3 mm. Rather dark red-brown dorsally, yellowish ventrally; 3 blackish marks on femora.

Head with black band between eyes; frontal portion shaded with reddish, midline black. Pronotum blackish centrally and on margins; an oval yellowish lateral area somewhat shaded with greyish. Mesonotum rich mahogany brown; sutures narrowly black; scutellum smoky brown. Ventrally, thorax yellowish with reddish tinge. Fore leg greenish yellow, middle and hind legs yellowish. Two black marks on coxa; narrow longitudinal black streak on trochanter. On hind leg, median blackish band on tibia (faintly indicated also on middle leg). At base of femur,

a short black line near outer margin; near middle, a short black dash on outer margin; incomplete black subapical band (on fore leg, this band more incomplete than on other legs). C and Sc of wing, and longitudinal veins in costal (anterior) half of wing purplish; all others colorless. Abdominal tergites red-brown, heavily shaded with blackish; 1,2 and 6-10 darkest, with blackish posterior margins. Middle tergites somewhat less blackish. Lateral margins yellow, widest on middle tergites, narrower on basal and apicals. Dark stigmatic dots plainly visible

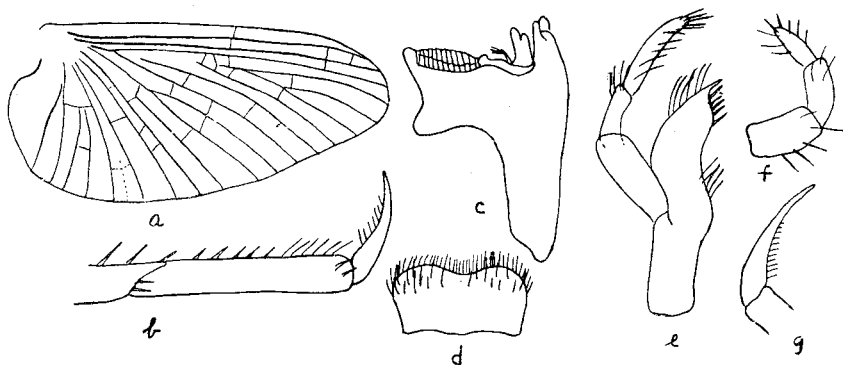


Fig. 5 — *Caenis* sp.

on middle tergites; on each of these tergites also, two small yellow dots on anterior margin, one on each of median line. Sternites yellow; blackish brown lateral triangular markings, on all sternites, base of triangle toward pleural fold. On one specimen, a narrow dark line extends from tip of this triangle almost to mid-ventral line, near middle of sternite. Faint dark mid-ventral streak on basal segments. Tails broken on all specimens. Three basal segments reddish, joinings yellow; following segment yellow.

Nymph slough. Length of body, 4 mm. No color pattern distinguishable. No dark markings on legs. General color pale brown. Gill fringes purplish. Abdominal segments 4-7 with rather wide lateral flanges; postero-lateral spines of moderate length. Shorter spines on segments 3 and 8 also, but no lateral flanges. Tails yellowish at base, brownish toward apex; in middle area, an occasional pale segment seems to alternate with several dark ones.

Two species of *Caenis* have been described from Chile and four from Argentina; all of these by NAVAS. Determination of these species must be based on the type specimens, since the descriptions are wholly

inadequate. Apparently no species of *Caenis* has been described from Brazil. The above specimens may well represent a new species.

The wing of the female imago, and leg and mouthparts of the nymph, are shown in Fig. 5.

## Family BAETIDAE

### Subfamily BAETINAE

#### Genus *Callibaetis* Eaton

In this genus, male and female imagos often differ markedly as to color of body, and color pattern of both body and fore wing. For those species of which one sex only is described, it is not possible to determine the opposite sex from that description, with certainty. Useful characters of specific value are: presence or absence of small dark dots sprinkled more or less densely on various parts of body and legs; color pattern of thorax, abdomen and fore wing; venational characters of fore wing, including number of marginal intercalaries in a given interspace, relative number of cross veins behind the radius, presence of cross veins in basal costal space, color of legs and tails. Male genitalia are similar thruout the genus. In some species, both sexes possess a brownish vitta on the fore wing; in others, this vitta occurs in the female only, or is much reduced in the male. If present, the extent of this vitta, — whether confined largely to the first four anterior spaces known as the costal strip, or distributed in fasciae across the disc of the wing, — also the presence within it of fenestrated whitish areas usually coincident with cross veins, are both useful characters.

A species of *Callibaetis* reared from the nymph by Mr. KLEERKOPER, and taken near Porto Alegre, Brazil, may be diagnosed as follows: Female — fenestrated light brown vitta on fore wing, largely confined to costal strip; venation dark brown. Male — wing wholly pale, but with yellowish tinge, most distinct in stigmatic area of fore wing; venation canary yellow; no slightest trace of vitta. In both sexes, cross veins of fore wing are relatively few in number (15 — 30 being considered as 'few'); marginal intercalaries paired; several more or less distinct cross veins in basal costal space. Hind wing with obtuse costal angulation, in which is an obscure brownish spot; several cross veins; two intercalaries between 2nd and 3rd veins, these intercalaries well developed and connected by cross veins. A more detailed description

of both sexes and of the nymph is given below. The above combination of characters does not exactly fit any previously-described species from Brazil, Paraguay or Argentina, altho it is quite close to three of these. Since descriptions of many species of Neotropical *Callibaetis* are incomplete, or apply to one sex only (sometimes the sex is not indicated) or were described from subimagos (perhaps so teneral that the color pattern of the imago was not yet distinguishable), it is often impossible to determine from description alone, whether a given specimen belongs to a certain species. Hence, at the risk of creating a synonym, I am listing the reared Brazilian specimens as a new species.

*Callibaetis alegre*, sp. n.

Diagnosis of both sexes as indicated above. Represented by one female and two male imagos, one male subimago about to shed its cuticle, and one male and four female subimagos. Probably allied to *C. vitreus* and *C. apertus* Nav.

HOLOTYPE — Female imago. Imago, to which some of subimaginal cuticle still adheres. Body 9 mm; wing 9 mm. A yellowish species; abdomen sprinkled above and below with fine reddish dots; costal margin of fore wing with fenestrated red-brown vitta; cross veins relatively few in number; intercalaries paired. Two longitudinal brown stripes on head, extending from middle ocellus to posterior margin, where two blackish dots are formed. Basal joint of antenna yellow, brownbanded at apex; second joint paler below and at base, dark brown elsewhere; filament pale at extreme base, smoky brown beyond. Pronotum yellow except for indistinct submedian brown longitudinal stripes. Middle area of meso- and metanota brownish with yellow median band; anterior margin of metanotum also yellowish; all sutures and carinae dark brown; two dark triangles extend forward from dark portion of metanotum on to yellow anterior area. No small dark dots evident anywhere on thorax. Legs yellow. Interrupted black line on outer surface of fore femur and on inner surfaces of middle and hind femora. Indistinct smoky subapical bands on all femora. Knee, a spot near base and another near apex of tibia (others between these faintly indicated), and all other joinings, dark brown. Last tarsal joint deep smoky, narrowly paler at base. No small dark dots on legs. Fenestrated light red-brown vitta on costal margin of fore wing, as shown in Fig. 6. A few indistinct cross veins before bulla, in fenestrated areas; some are incomplete, most are oblique. Altho the marginal intercalaries are paired, in some

spaces one member of the pair is longer and more distinct than the other. About 26 cross veins behind radius, arranged irregularly in about four series. Longitudinal veins dark brown, those in basal half narrowly paler where touched by cross veins. Cross veins likewise dark brown, fully as heavy as longitudinals; in anal region, somewhat paler. Hind wing as shown in Fig. 6. An indistinct pale brown spot in costal hump; a small dark spot at roots of longitudinal veins. A pale brownish median patch occupies the anterior half of all basal and middle tergites,

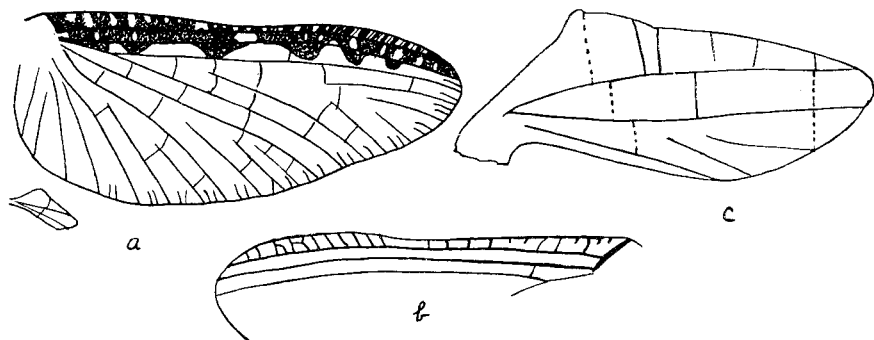


Fig. 6 — *Callibaetis alegre*

bisected by a rosecolored mid-dorsal line. On tergites 2, 3, 5 and 7, submedian patches of pale brown based on posterior margin are united to (or nearly touch) the median patch at its outer posterior corners. Oblique streaks run forward from these submedian patches almost to anterior margin, on tergites 3 and 5, and are faintly visible also on 6 and 7. A brown median band on tergites 8 -10, bisected by a pale mid-dorsal line, narrow on 10, much wider on 9. Posterior margins of all tergites narrowly rose-colored in median area. An indistinct smoky longitudinal streak in middle area of pleural fold on most segments. Ventrally, a dark brown comma-shaped mark in antero-lateral angle of each sternite. Short dark mid-ventral dash on each tergite, at anterior margin. Entire abdomen thickly set with small reddish dots. Tails dark brown at extreme base, yellowish brown beyond. Joinings narrowly darker. In basal portion, alternate joinings wider; dark brown at base, becoming red-brown further out.

ALLOTYPE — Male imago. Some of the subimaginal cuticle still adheres to the specimen, but wing, thorax and abdomen largely freed. Body 8 mm; wing 7 mm. Reddish brown dorsally, yellowish ventrally; ven-

ational characters as in female; fore wing faintly yellow-tinged, lacking vitta. Antennae as in female. Top of head hidden by the large orange oval turbinate eyes. Pronotum red-brown; pale median dorsal streak and incomplete wider lateral streaks margined with deeper brown. Dark submedian marks on anterior border. Mesonotum red-brown except for yellowish lateral areas on each side and wide brown median band. Pleura yellowish; all sutures and several small sclerites dark brown. Metanotum almost wholly dark red-brown. Lateral sutures, margins of scutella, and extensions of wing roots on both meso- and metanota, blackish. Sternum light red-brown; numerous small reddish dots in middle of meso- and metasterna. Legs much as in female, but femora deeper yellow with faint red-brown tinge. Two blackish spots on basal half of middle and hind femora; on latter, another dark spot between middle and apex. In fore wing, the yellow tinge is deepest in costal strip as far as stigmatic region. All veins of fore wing canary yellow except humeral cross vein at subcosta and radius, where it is purplish black. Cross veins in basal costal area more plainly visible than in female. Subimaginal cuticle still adheres to hind wing, hence markings if any cannot be distinguished. Venation of this wing as in female. Abdomen red-brown above, this color deeper and clearer on apical tergites; on preceding segments, somewhat smoky brown. Yellow median area on basal and middle tergites, appearing as a triangle based on anterior margin; an almost white mid-dorsal streak bisects this triangle. Two short parallel purplish-red streaks close together on each side of median line, near anterior margins of all but basal apical tergites. On dark apical tergites, two oblique pale submedian dashes from anterior margin; at end of each, near middle of tergite, a white dot; faint indications of similar pale markings on basal and middle tergites. Laterally on each tergite, a pale sickle-shaped stigmatic mark ending in a white dot; two pale longitudinal lines between mid-dorsal line and pleural margin, extending length of tergite. Indications of an oblique deeper smoky mark outlining the pale middle triangle, this mark somewhat deeper brown at each end. Interrupted dark brown line immediately above pleural margin. Posterior margins of all tergites narrowly pale; a very narrow black line on anterior margin of each, not reaching mid-dorsal line. Sternites yellowish, apicals deeper in color. Dark markings on each as on female. Tails as in female. Small reddish dots, very indistinct, are faintly visible in certain lights on this specimen; on the male paratype, plainly evident. Less regularly and evenly distributed than



in female; occur in median and lateral tracts on sternites; on apical tergites, generally distributed, but confined to lateral brown areas on basal and middle tergites.

Subimagos of both sexes. Color characters imperfectly developed. Venational characters similar to those described for male and female imago.

Nymph slough. Yellowish brown. Probably similar to nymphs from Mogi-Guaçu River, designated as *Callibaetis* sp. *B*. Gills very

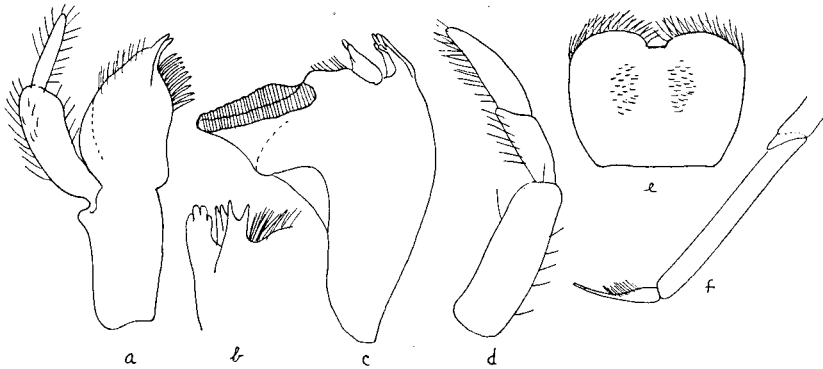


Fig. 7 — *Callibaetis alegre*

similar to that species in size and shape, and in apparent 'tripleness' of gills on segments 1 and 2, as indicated in account of that species, but distinctly more yellowish, with yellow-brown venation. Postero-lateral spines relatively short, as in sp. *B*. Thoracic notum indistinctly mottled with pale brown. Deep brown mark at middle area of metanotum, its lateral margins tridentate (not present on all specimens). Legs yellowish, with short red-brown spines. Femur with incomplete dusky subapical band; narrow black line and some short black spines at apex of tibia; base of tarsus faintly brownish; small black dots at tibiotarsal joining and at base of claw. Lateral portions of tergites largely pale, except for dark brown transverse bands on pleural folds, on segments 2-7. Middle areas of tergites 2, 5, and 7 somewhat deeper brown than others; on some specimens, tergites 1 and 2 with darker brown mottling near median line; dark brown lateral marks on tergites 3, 4, 5 and 7, faintly indicated also on 2 and 6. Thus abdomen appears somewhat banded. Pale lateral longitudinal streaks from posterior margins; brownish submedian

oblique dashes from anterior margin with brown dots at ends of these, and small pale median dots, as indicated for nymph of sp. *B*. On apical tergites, median brown area margined narrowly with whitish, in posterior half. Ventrally, no dark markings on nymph slough, such as occur on nymph of sp. *B*. (These may represent markings of the subimago seen thru the nymphal cuticle). Tais as in sp. *B*. All nymph sloughs very similar except for some minor color variations, with exception of one female, which has a rather wide pale mid-dorsal band the length of the abdomen. Mouthparts and claw as in Fig. 7.

HOLOTYPE — Female imago (some of subimaginal cuticle remains). Reared from nymph, by H. KLEEREKOPER. Porto Alegre, Rio Grande do Sul, Brazil, Sept. 1941. In collection of Mr. KLEEREKOPER.

ALLOTYPE — Male imago (with some cuticle still adhering) May 1941. Same location, same collector. In collection of Mr. KLEEREKOPER.

PARATYPES — two males, to which some subimaginal cuticle still clings. Same data. One of these in private collection of J. R. TRAVER.

Within the size range, and agreeing provisionally as to presence of vitta on wing of female and its absence from the wing of the male, are three species which seem rather closely allied to the present specimens. *C. vitreus* Nav., from Argentina, was described from a subimago, sex not stated; wings said to be wholly white but venation light brown. If the specimen was a male, it still does not agree as to color of venation, since the venation of the male subimago of *C. alegre* is pale. Also, *C. vitreus* has dark dots on the femur, which are not found on *C. alegre*. *C. viviparus* Ndhm. and Murphy, from Brazil, was described from a female; vitta corresponds well with *alegre*, but marginal intercalaries are single, and dark dots occur on both thorax and abdomen. *C. apertus* Nav., from Argentina, does not agree too well with color of subimago of *alegre*; sex of specimen not stated. It is possible that *alegre* is really the imago of *apertus*, — a fact which can be determined only by careful examination of the type of *apertus*.

#### PSEUDOCLOEON ally

As indicated in the footnotes under keys to imagos and nymphs, it seems probable that at least some of the Neotropical species now

listed as *Pseudocloeon* are really of some allied and as yet undescribed genus. The three-tailed nymphs reared by Mr. KLEEREKOPER bear some resemblance to the forms from Puerto Rico tentatively listed as ?*Cloeodes* sp., but probably not of that genus. Since both nymph sloughs in the vials with the subimagos have the tips of the tails broken, and the reared insects are in the subimago stage only, the species will here be considered under the genus *Pseudocloeon*. When more material is available, it may seem advisable to erect a new genus for it.

??*Pseudocloeon* sp.?

Two male subimagos, reared from nymphs; Porto Alegre, Brazil, Sept. 1941. Body 5 mm; wing  $4\frac{1}{2}$  mm. General color light red-brown.

Turbinate eyes oval; divergent at front margins; orange-brown in color. Lower part of eye black. Head yellowish to orange. Antennal filament dusky, whitish at base; basal joints paler, yellowish. Pronotum mottled olive brown; median paler line; indistinct submedian dusky streaks; anterior margin and transverse line at about middle of segment, pale. Mesonotum light red-brown; median anterior elevation and entire scutellum pale yellowish. Pale narrow median and submedian lines. Two parallel black lines along antero-lateral margin; postero-lateral and posterior margins narrowly blackish. Large patch of darker olive brown on each side, posteriorly. Metanotum pale yellowish; posterior margin narrowly dark brown. Pleura light red-brown; several narrow black lines above legs. Sternum concolorous with pleura; posterior margin of prosternum and narrow curved marks at leg bases, black. Legs pale yellowish; femora with faint red-brown tinge. Longitudinal brown streak on femur, interrupted near middle; indistinct subapical band; apex whitish, two black dots at tip. Longitudinal chestnut band on basal half of tibia. Tarsal joinings narrowly black; base and apex of distal joint smoky brown. 7 to 9 complete and 2 or 3 incomplete oblique cross veins in stigmatic region of wing. Abdomen somewhat duller brown than thorax; sternum only slightly paler than tergum. Dark dash on posterior margin on each side, between mid-dorsal line and pleural fold. Tergite 10 pale except for brown pleural margin and extensions of this on to posterior margin. Pale lateral longitudinal band near pleural fold, on basal and middle tergites. From anterior margin of each tergite, also each sternite, pale oblique submedian dashes; a white dot near end of

each dash. Tails pale except at base, where slightly tinged with reddish. Basal joints reddish, others pale. Genitalia discernible thru subimaginal cuticle. Wing and genitalia of subimago shown in Fig. 8.

Nymph slough. General color, pale yellowish brown. Apices of femora, tibiae and tarsi deep brown; apical third of tarsus brownstained.

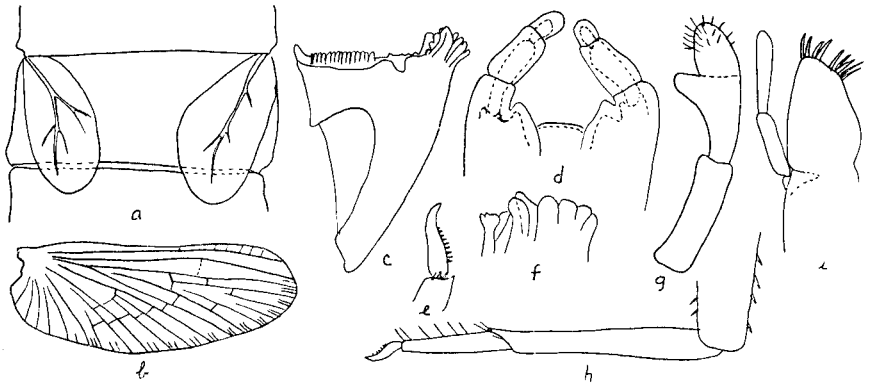


Fig. 8 — ?? *Pseudocloen* sp.

Pale mid-dorsal streak on abdomen, bounded in anterior half of each tergite by dark oblique submedian dashes, with dark dot near end of each. Margins of tergites narrowly deep brown; deep brown spot at base of each gill. Very short spine at postero-lateral angle of each segment. Gills single, asymmetrical; 1 and 7 smallest, 4 largest; tracheae pinnate, with a few branches. Tails broken at tips, but middle tail fully as large as laterals in basal portion remaining. Gill, mouthparts and leg as in Fig. 8. \*

It is not possible to determine, from these subimagos, whether the middle abdominal tergites of the abdomen of the imago will be pale or brownish. The size is right for *binocularis* Ndhm. and Murphy, which has whitish middle tergites; for *jorgenseni* Esb. Pet., with light brown middle tergites; or for *oldendorffii* Weyenb., with grey-brown middle tergites. The first-mentioned is a Peruvian species, the others from Argentina. The genus does not seem to have been recorded from Brazil.

\* It should be noted here that the three-tailed nymphs described by NEEDHAM and MURPHY as *Pseudocloen*, and stated to lack hind wing buds, prove on closer examination to possess hind wing buds. At least some of these specimens, presumably including the one from which the parts are figured, are of the genus *Callibaetis*.

## EXPLANATION OF FIGURES

### 2. Imagos

Fig. 1 — **Campsurus brasiliensis**, sp. n.

a and b — Genitalia, ventral aspect (removed from specimen, treated with

Fig. 2 — *Campsurus brasiliensis*

a and b — Genitalia, ventral aspect (removed from specimen, treated with KOH); a — details of penes; b — penes and forceps, another specimen.

Fig. 3 — **Campsurus assimilis**, sp. n.

a — Fore and hind wings; b — and c — Genitalia, in situ, (lateral aspect).

Fig. 4 — *Campsurus assimilis*.

Genitalia, ventral aspect (removed from specimen, and treated with KOH).

Fig. 5 — *Caenis* sp.

a — Wing of imago; b thru g, nymphal structures; b — third leg; c — mandible; d — labrum; e — maxilla; f — labial palp; g — claw.

Fig. 6 — **Callibaetis alegre**, sp. n.

a — Fore and hind wings, female imago; b — costal margin of fore wing, male imago; c — hind wing, enlarged.

Fig. 7 — *Callibaetis alegre*. Nymphal structures.

a — maxilla; b — details of canines, mandible; c — mandible; d — labial palp; e — labrum; f — tarsus and claw.

Fig. 8 — ??*Pseudocleon* sp. Nymphal structures, except b and d.

a — second abdominal segment, with 1st gill; b — wing, male subimago; c — mandible; d — genitalia of male subimago; e — claw; f — details of canines, mandible; g — labial palp; h — third leg (basal half of femur omitted); i — maxilla.