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SOME NEW AND INTERESTING SOUTH AMERICAN SPECIES
OF PHYLLOGOMPHOIDES IN THE MUSEUM OF ZOOLOGY,
UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN
(INSECTA: ODONATA: GOMPHIDAE)

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When I (1970) established the Neotropical genus *Phyllogomphoides* for the reception of the species *fuliginosus* (Hagen in Selys) and *audax* (Hagen in Selys), I suggested a possible further generic separation of the two species *infumata* (Rambur) and *praevia* St. Quentin from the other species then placed in *Negomphoides* Muttkowski because of the conformation of their male caudal appendages and the composition of their discoidal triangles and subtriangles in the wings. I deferred attempting this separation since the nymph of *infumata* was known by supposition only while that of *praevia* was unknown (Belle, 1970: 123). Soon afterwards Gloyd (1973) made this split partly on new characters found in the form of the tenth abdominal segment and the course of vein A2 in the hind wings of the male (another suggested character, Gloyd's finding that the anterior hamules are shell-shaped with a recurved hook about midway on the distal margin of each also applies to the species *annectens* (Selys) and *regularis* (Selys) now placed in *Phyllogomphoides*). As the generic name *Negomphoides* was invalid (Gloyd, 1973; Belle, 1973) Gloyd put the species *infumata* and *praevia* together with *perdita* (Förster) in the genus *Gomphoides* Selys (with the same type-species as *Negomphoides*) while the remaining species were transferred into *Phyllogomphoides*, although the nymphs of most of these remaining species do not conform

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to the characters I had used to define the genus *Phyllogomphoides*. Donnelly (1979) justifies Gloyd's placement with the remark that the anterior hamules of *pacificus* (Selys) are comparable in complexity to those of *fuliginosus* and *audax*. This is true but features found in certain Central American species of *Phyllogomphoides* lead me to suppose that the (unknown) nymph of *pacificus* will in all probability have labial characters essentially different from those of *fuliginosus*, the type-species of the genus *Phyllogomphoides*.

Most of the species pertaining to *Phyllogomphoides* are insufficiently known, and only a very small number of the nymphal forms have been described. As judged by the labial characters of the known nymphs, the species provisionally can be divided into three fairly well defined sections.

The first section comprises the species *fuliginosus* and its near allies. The inner margin of the lateral labial lobes of their nymphs is smooth (Belle, 1970). The members of this group are spread over a large part of continental South America, being known from the Amazon region, Mato Grosso, the Guianas, and Venezuela.

The species of the second section seem more numerous and comprise among others *andromedae* (Selys), *cristatus* (Needham), *undulatus* (Needham), and their nearest allies. The inner margin of the lateral labial lobes of their nymphs is armed with a few blunt teeth (Belle, 1970). This species-group seems to occur only in South America.

The third section comprises mainly the species *semicircularis* (Selys) and its near allies. Their nymphs have the inner margin of the lateral labial lobes crenate (Needham, 1940). The range of this third species-group is predominantly Central America but some of its representatives also occur in the Amazonian and Andean regions.

Each of these three sections can be further divided into groups based on peculiarities found in the conformation of the male caudal appendages. However, further collecting and rearing is needed before intrageneric classification is carried further.

Here I report on material of *Phyllogomphoides* belonging to the three sections mentioned above. It comprises three new and one little known species, all from South America, and all preserved in the collection of the Museum of Zoology, University of Michigan, Ann Arbor, Michigan (UMMZ). One species (*praedatrix* n.sp.) belongs to the *fuliginosus* group and is represented in the material by a single Brazilian female. Two species belong to the *undulatus* group, one of

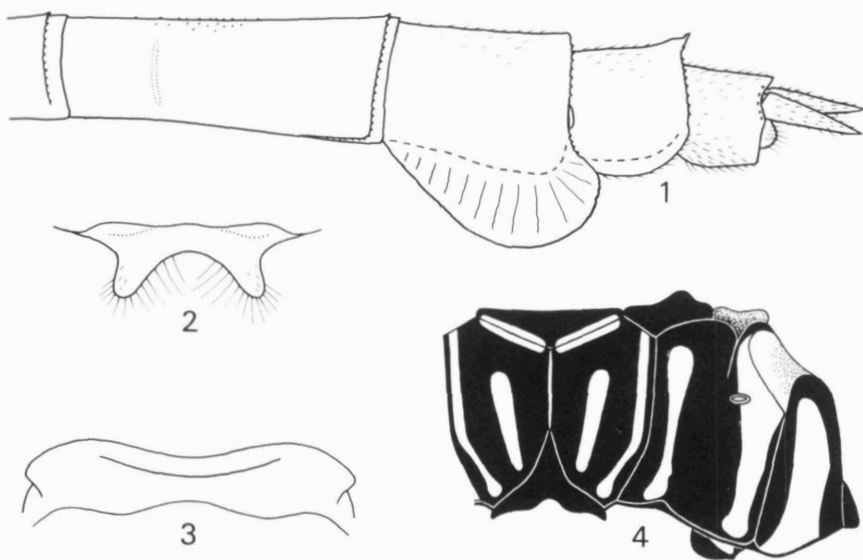
them (*aculeus* n.sp.) is represented by a single male from Peru and the other (*angularis* n.sp.) by several males from Brazil. The examples of the fourth species (*semicircularis* (Selys)) are from Colombia. Of this species both sexes are present; its female is described for the first time.

Phyllogomphoides praedatrix n.sp.

Figures 1-4

MATERIAL.—Brazil: State of Mato Grosso, Abuná, 8.III.1922, 1 ♀ (holotype), J.H. Williamson & J.W. Strohm leg.; in the UMMZ.

Female (holotype; an aged individual).—Total length 63 mm; abdomen 50 mm (incl. caud. app. 1.5 mm); hind wing 37 mm; pterostigma in fore wing 5.0 mm.



Figures 1-4. *Phyllogomphoides praedatrix* n.sp., holotype female: 1, apical segments of abdomen, left lateral view; 2, vulvar lamina, ventral view; 3, frons, frontal view; 4, diagram of thoracic color pattern.

A predominantly black specimen with yellow markings.

Labrum with a pair of small yellow spots in mid-field. Mandibles yellow externally except tips. Anteclypeus yellow. Postclypeus yellow at sides. Yellow anterior band of frons medially interrupted by blackish brown. Vertex blackish brown anteriorly, dark brown on posterior half, with a pair of mound-like prominences behind lateral ocelli. Occipital plate dark brown, its posterior margin almost straight and fringed with short black hairs. Rear of head blackish brown, with a central spot of yellow behind occiput. Labium and lateral lobes yellow except for anterior borders.

Prothorax entirely blackish brown. Pterothorax with the usual pale (yellow) stripes well-defined; its color pattern shaped as shown in the diagram. Mid-dorsal carina yellow. First pale antehumeral stripes not confluent with pale collar, the latter interrupted in middle.

Femora dark brown but inner sides of first pair yellow. Tibiae and tarsi black.

Wing membrane brown tinged, obscured at extreme bases. Venation blackish brown including frontal margin of costae. Pterostigma brown with a band of darker brown along costa, surmounting $8\frac{1}{2}$ -9 $\frac{1}{2}$ cells. Basal subcostal cross-vein present. Nodal index 18:25-23:17/18:18-16:18. Second primary antenodal cross-vein the sixth in right hind wing, the seventh in left hind wing and right fore wing, and the eighth in left fore wing. Trigonal interspace in fore wings starting with a row of three cells from triangle outwards two cells long, followed by two rows of cells two cells long and then again three rows of cells; those in hind wings starting with a row of four cells against triangle followed by two rows of cells. Discoidal triangles and subtriangles in fore wings four-celled, in hind wings three-celled, the dividing cross-veins of fore wing subtriangles tri-radiate from centre. Supratriangles three-celled. Anal loop in right hind wing four-celled, in left hind wing three-celled. Hind wings with area posterior to Cu2 six cells wide.

Abdomen predominantly blackish brown. Lower half of sides of segment 1 yellow. Sides of 2 with large yellow spot occupying basal half, and a mid-dorsal, lanceolate yellow basal spot. Sides of 3 with large yellow basal spots reaching to supplementary transverse carina. Segments 4 to 6 and 8 to 10 without pale markings. Base of 7 yellow to supplementary transverse carina. Stylets yellow but blackish brown at bases. Lateral dilatations of 8 broad and leaf-like, their greatest width about two-fifths the length of segment. Margins of lateral dilatations

of 8 and 9 without spines or teeth. Posterior margin of 9 mid-dorsally prolonged into two teeth, that of 8 not at all prolonged. Relative mid-dorsal length of last four segments approximately as 40:23:13:10, with the caudal appendages (stylets) 13 on the same scale. Vulvar lamina one-fifth as long as the ninth sternum, at base about two-thirds the width of eighth sternum; its posterior margin widely excised V-shaped, the bottom of the excision rounded, the lobes triangular, the interval between the lobes about 100°.

The present female exhibits the characters typical of the *fuliginosus* assemblage, having the discoidal triangles and subtriangles in the fore wings four-celled and those in the hind wings three-celled, the lateral dilatations of the eighth abdominal segment very broadly developed leaf-like, the vulvar lamina short and its posterior margin medially excised. The new species is most closely related to *fuliginosus* (Hagen *in* Selys) and *imperator* Belle. It agrees with these two species in the conformation of the frons and the development of the exfoliations of the abdominal segment 8; it agrees with *fuliginosus* but differs from *imperator* in having well-developed second pale antehumeral and pale metepisternal stripes; and it differs from both by the widely excised posterior margin of the vulvar lamina, by the smaller size, by the lack of triangular teeth at the posterior margin of the lateral dilatations of abdominal segment 9, and in having a much shorter pterostigma.

The triangular envelope in which the female is stored has the field note: "♀ gomphine—flying about 1' above water along bank—flying slowly. Caught by J.W. Strohm".

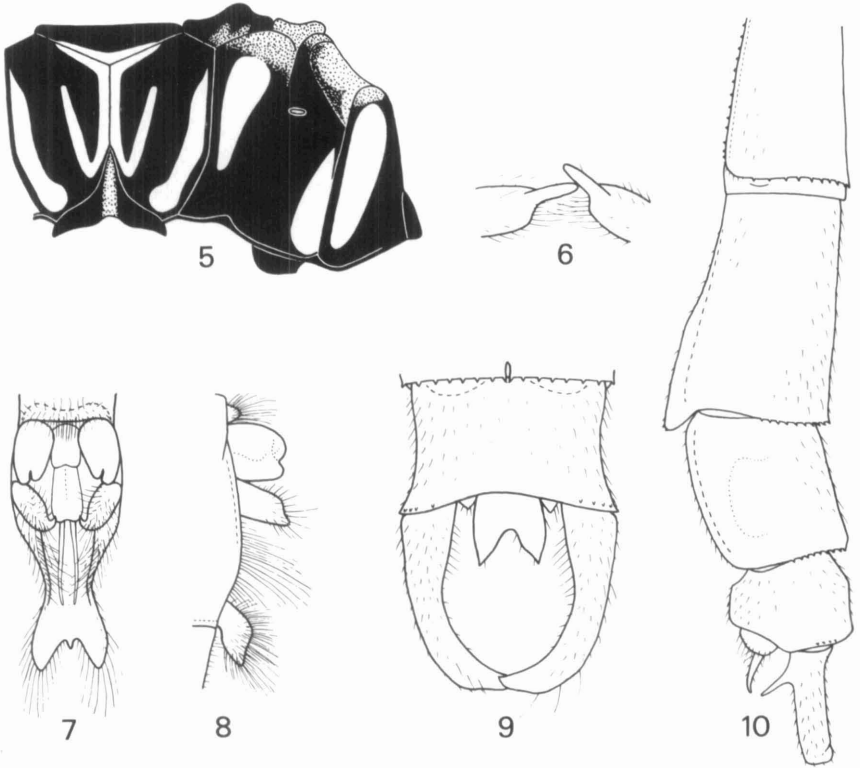
The male is unknown.

Phyllogomphoides aculeus n.sp.

Figures 5-10

MATERIAL.—Peru: Iquitos, IX.1939, 1 ♂(holotype), G.G. Klug leg.; in the UMMZ.

Male (holotype; abdomen broken between segments 3 and 4; first pair of legs broken off).—Total length 49 mm; abdomen 39 mm (incl.



Figures 5-10. *Phyllogomphoides aculeus* n.sp., holotype male: 5, diagram of thoracic color pattern; 6, tips of superior caudal appendages, caudal view; 7, accessory genitalia, ventral view; 8, the same, right lateral view; 9, tenth abdominal segment and caudal appendages, dorsal view; 10, apical segments of abdomen, left lateral view.

caud. app.); hind wing 31.5 mm; costal edge of pterostigma in fore wing 3.9 mm.

Pale colors green unless otherwise stated.

Labrum with symmetric pair of pale spots. Central part of anteclypeus pale. Central and posterolateral parts of postclypeus pale. Superior surface of frons largely pale, dark brown at base. Vertex dark brown, pale between postocillary prominences. Occipital plate dark brown with pale central spot, the posterior margin very slightly concave in middle. Rear of head brown, with pale spot on rear of

occiput, lower parts of temporae yellowish brown. Labium and adjacent mouth parts pale green.

Prothorax brown but hind lobe pale, middle lobe with pale mid-dorsal twin-spot. Pterothorax blackish brown with pale stripes; its color pattern shaped as shown in the diagram.

Femora brown, becoming black towards knees. Tibiae, tarsi and claws black. Lamina tibialis of first tibiae two-sevenths the tibial length.

Wings hyaline, membrane with slight flavescence at extreme bases of wings, venation blackish brown including frontal margin of costae. Pterostigma brown, surmounting 5-5½ cells. Basal subcostal cross-vein present. Second primary antenodal cross-vein the eighth in left fore wing, the seventh in other wings. Nodal index 14:24-21:12/14:15-16:14. Intermedial cross-veins 11-11/9-8 in fore and hind wings, respectively. Supratrangles three-celled. Subtriangles two-celled. Discoidal triangles in fore wings three-celled, the dividing cross-veins tri-radiate from centre. Discoidal triangle in hind wings two-celled (right) and three-celled (left). Hind wings with four-celled anal triangle, five paranal cells, and area posterior to Cu2 four (proximal) to five (distal) cells wide. Anal loop in hind wings pentagonal, made up of three cells, the fused portion of A1 and Cu2 about two-fifths the length of inner side of triangle. A1 and A2 behind anal loop strongly divergent.

Abdomen predominantly dark brown. Sides of 1 largely pale. Sides of 2 pale on and behind auricles. Pale markings on other segments probably obliterated owing to post-mortem changes (it would appear that the segments 3 to 7 have pale basal side markings). Ventral tergal margins of 7 denticulated. Lateral dilatations of 8 brownish yellow for basal two-thirds, narrow but apical end produced backward in an obtuse point. Sides of 9 with a large scar, brownish yellow along ventral tergal margins. Lateral dilatations of 9 narrow. Segment 10 twice as long mid-dorsally as mid-ventrally.

Accessory genitalia and caudal appendages shaped as shown in accompanying figures. Genital hamules and vesicle dark brown. superior caudal appendages blackish brown, forcipate, narrowed at apices, the tips sting-like.

This species belongs to the *undulatus* group. This group is marked by the possession of a long, thin basal spine at the inferior margin of each male superior caudal appendage. The other members

of the group are *undulatus* (Needham), *atlanticus* (Belle), and *angularis*, described in the following pages. *Phyllogomphoides aculeus* is easily distinguished from these members in having the anterior hamules with a very narrow posterior cleft, in having the male superior caudal appendages with sting-like tips, and in having the dorsum of the pterothorax with a broad pale mid-dorsal stripe and the lateral sides of the pterothorax with partly reduced first and second pale stripes.

The female is unknown.

Phyllogomphoides angularis n.sp.

Figures 11-16

MATERIAL.—Brazil: State of Amazonas, Porto Velho, 3.V.1922, 1 ♂; 5.V.1922, 3 ♂; 18.V.1922, 1 ♂; 24.V.1922, 1 ♂; State of Pará, Belém, 7.VIII.1922, 1 ♂; 8.VIII.1922, 1 ♂, all J.H. Williamson & J.W. Strohm leg. One of the males collected on 5.V.1922 is the holotype; all the other males are paratypes. Two males (dated 18 and 24.V.1922) are deposited in the author's collection; the others are in the UMMZ.

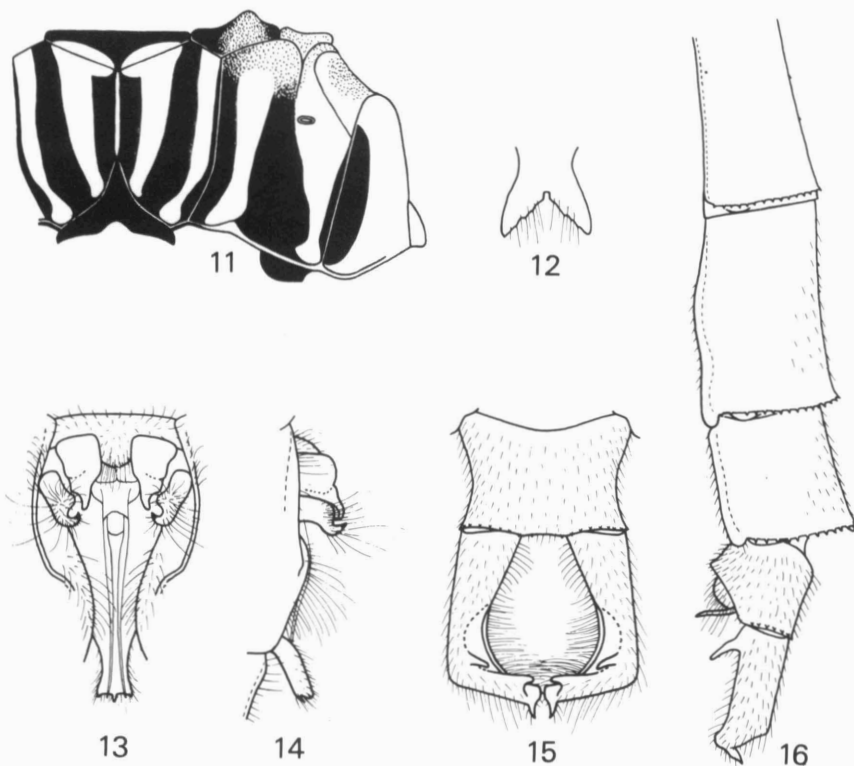
Male (holotype).—Total length 49 mm; abdomen 38.5 mm (incl. caud. app.); hind wing 28.5 mm; costal edge of pterostigma in fore wing 3.8 mm.

Face brown but anteclypeus pale green. Labrum with a symmetric pair of yellow-green spots parallel to free border and reaching to hind border. Base of mandibles externally pale green. Superior surface of frons with broad, green anterior band and brown basal band. Vertex brown. Occiput brown, its posterior margin straight and fringed with brown hairs. Compound eyes greenish grey above, light green below. Rear of head brown. Labium and adjacent mouth parts lighter brown.

Prothorax brown, with a mid-dorsal twin-spot of green. Pale colors of pterothorax green; the dark stripes almost black on dorsum, gradually shading to brown on sides. Color pattern of pterothorax shaped as shown in the diagram. Pterothorax light brown below, blackish brown with green spots between wings.

Femora light brown. Tibiae and tarsi black. Lamina tibialis of first pair of tibiae about one-third the tibial length.

Wings hyaline, membrane slight flavescence at extreme bases of



Figures 11-16. *Phyllogomphoides angularis* n.sp., holotype male; 11, diagram of thoracic color pattern; 12, inferior caudal appendage, dorsal view; 13, accessory genitalia, ventral view; 14, the same, right lateral view; 15, tenth abdominal segment and caudal appendages, dorsal view; 16, apical segments of abdomen, left lateral view.

wings, venation blackish brown including frontal margin of costae. Pterostigma brown, surmounting 6 to 7 cells. Basal subcostal cross-vein present. Second primary antenodal cross-vein the fifth in right hand wing, the sixth in other wings. Nodal index 12:18-17:11/13:14-13:13. Intermedian cross-veins 9-9/6-7 in fore and hind wings, respectively. Discoidal triangles two-celled. Subtriangles in fore wings two-celled, in hind wings small and open. Supratriangles two-celled. Hind wings with four-celled anal triangle, four (left) and five (right) paranal

cells, and area posterior to Cu2 three (proximal) and four (distal) cells wide. Anal loop in hind wings pentagonal, made up of two (left) and three (right) cells, with fused portion of A1 and Cu2 about half the length of inner side of triangle. A1 and A2 behind anal loop strongly divergent.

Abdomen predominantly dark brown. Segment 1 with green side spots. Segment 2 with green mid-dorsal stripe and green side markings. Segment 3 with green mid-dorsal stripe extending to a point about four-fifths the way along segment. Segments 4 to 7 very dark brown, almost black. Segments 8 to 10 brown. Lateral expansions of 8 and 9 narrow and black. Segment 10 nearly twice as long mid-dorsally as mid-ventrally. Venter of 3 to 7 black on sternites, bordered by light brown on either side. Venter of 8 and 9 mainly dull reddish brown, the lateral dilatations black. Venter of 10 dull reddish brown.

Accessory genitalia and caudal appendages shaped as shown in accompanying figures. Anterior hamules with long, acute, posteriorly directed hook. Tip of posterior hamules recurved. Tip of penis with a pair of long cornua. Vesicle long, slender and cleft, its posterior margin with a strong median tooth at bottom of cleft. Superior caudal appendages longer than segment 10, subequal to segment 9. In dorsal view each appendage straight for its proximal three-fifths; distal two-fifths perpendicularly curved inward, the superior inner side with two subapical parallel teeth; the extreme tip acute and upcurved; a long, thin spine projects downward from inferior margin near base. Inferior caudal appendage deeply excised V-shaped, the divisions widely spread out.

This remarkable species also belongs to the *undulatus* group as is apparent from the long, thin basal spine that projects downward from the inferior margin of each male superior caudal appendage. Nevertheless this species stands apart from the other members of the group in the uncrossed subtriangles of the hind wings. The male is very different from that of the other members in the conformation of the anterior genital hamules by the lack of a notch or cleft, and the superior caudal appendages are peculiar by the perpendicularly bent form.

The triangular envelopes, in which the specimens of this species are stored, are provided with field notes. One of the envelopes has a color description of the enclosed male when alive. This male is taken

here as the holotype. The color notes on the envelope are used in the description above.

The holotype was collected together with two other males of the same species. Jesse H. Williamson associated these three males with field note No. 129: "Saw only three gomphines today on big creek, all at once on bush within 15 feet of each other, netted two and shot one" and the holotype with the extra field note "Gomphine ♂—City water-supply creek. Sit on dead branches or green leaves over water". Some fragments of the other field notes for this species are "on dead branch hanging out almost horizontally over city water-supply creek" (No. 127, ♂ dated 3.V.1922), "on overhanging dead twig at first crossing of creek (No. 136, ♂ dated 18.V.1922), and "on leaf at main creek" (No. 182, ♂ dated 8.VIII.1922). The behavior of the species in the field is obviously in agreement with that of gomphids in general.

The pale spots on the labrum of the paratypes are better developed than in the type. Some paratypes have the abdominal segments 3 to 6 or 3 to 7 with pale basolateral spots which diminish in size on the rear segments. The venational characters of the eight males were tabulated with the following result: Discoidal triangle fore wing three-celled 62½%, two-celled 37½%; subtriangle fore wing two-celled 100%; supratriangle fore wing two-celled 87½%, three-celled 12½%; discoidal triangle hind wing two-celled 100%; subtriangle hind wing one-celled 100%; supratriangle hind wing two-celled 81%, three-celled 19%; anal loop hind wing three-celled 44%, two-celled 56%.

The female is unknown.

Phyllogomphoides semicircularis (Selys, 1854)

Figures 17-18

MATERIAL.—Colombia: Cristalina, 15.II.1917, 1 ♀; 18.II.1917, 1 ♀; 19.II.1917, 1 ♂; 20.II.1917, 1 ♂, all J.H. & E.B. Williamson leg.—Venezuela: Táchira, 8.IV.1920, 1 ♀, W.H. Ditzler, J.H. & E.B. Williamson leg. One pair (♂ dated 20.II.1917 and ♀ dated 18.II.1917) is deposited in the author's collection; the others are in the UMMZ.

Female (hitherto unknown).—Total length 56 mm; abdomen 43



Figures 17-18. *Phyllogomphoides semicircularis* (Selys), Colombian examples: 17, penis, right lateral view; 18, vulvar lamina, ventral view.

mm (incl. caud. app. 2.0 mm).—hind wing 38 mm; greatest width of hind wing 10.3 mm; costal edge of pterostigma in fore wings 5.0 mm.

Face dark reddish brown. Mandibles with a large green basal spot. Superior surface of frons with a broad green anterior band. Vertex dark brown with a green spot between postocellary prominences. Occipital plate dark brown, its posterior margin slightly concave in middle and fringed with black hairs. Rear of head brown, becoming blackish brown above. Labium and adjacent mouth parts brown.

Prothorax entirely dark brown. Color pattern of pterothorax resembling that of holotype male but second pale antehumeral stripes completely undeveloped and first lateral stripes reduced to an oblong dorsal spot and a narrow vestige at mid-height.

Femora dark brown, the inner sides of first femora green. Tibiae, tarsi and claws black.

Wings hyaline; venation blackish brown including frontal margin of costae. Pterostigma brown, surmounting 7 cells. Basal subcostal cross-vein present. Nodal index 17:23-23:16/17-18:15. Second primary antenodal cross-vein the seventh in left fore wing, the eighth in other wings. Intermedian cross-veins 13-13/9-9 in fore and hind wings, respectively. Discoidal triangles three-celled, the dividing cross-veins tri-radiate from centre. Subtriangles in fore wings three-celled, in hind wings two-celled. Supratriangles three-celled. Hind wings with five paranal cells, five postanal cells, and area posterior to Cu2 five (proximal) to six (distal) cells wide.

Abdomen blackish brown with pale markings as follows: Segment 1 with large pale side markings against inferior margin and a pale mid-dorsal spot. Segment 2 with large pale side markings and a triangular pale mid-dorsal spot which is widest at base of segment. Segment 3 to 6 with pale basal spots which diminish in size on rear

segments. Segment 7 with large pale side spots covering basal half of segment and confluent on mid-dorsum. Segments 8 to 10 very dark brown, almost black. Stylets yellow but black at bases and at extreme acute points. Relative mid-dorsal length of last four segments approximately as 25:16:11:10, with the stylets 9 on the same scale. Vulvar lamina in length about one-fifth the ninth sternum; its posterior margin deeply excised V-shaped, the lobes triangular and about 120° at tip, the interval between the lobes 90° (Fig. 18).

Phyllogomphoides semicircularis was hitherto known from a single male only. The exact locality from which this specimen was obtained is unknown. We now have two males and three females from northern Colombia and eastern Venezuela. The present males were directly compared with the holotype in the Institut Royal des Sciences Naturelles de Belgique at Brussels. They agree with it in all essential respects and differ only in minor characters of coloration and wing venation. In the more detailed description of the male in the *Monographie des Gomphines* (Selys & Hagen, 1858) "Face roux brunâtre" should have been stated instead of "Face roux olivâtre" since the face of the type is predominantly reddish brown and green only on the central part of the anteclypeus. There is no trace of green on the labrum. The mandibles of the type have a large green basal spot. The face of the present examples is entirely reddish brown or dark reddish brown, and only the base of each mandible is green.

The *semicircularis* group comprises the South American species *semicircularis* (Selys), *lieftincki* (Belle) and *brunneus* Belle, and further several other Central American congeners. The group is marked by the semicircular-forcinate form of the male superior caudal appendages.

In my paper of 1970 I have remarked that the holotype male of *semicircularis* did not serve for Fraser's (1940) figure of the penile organ under this name. My camera lucida drawing of the penis of the male dated 20.II.1917 (Fig. 17) shows the much longer cornua if a comparison is made with Fraser's figure.

The envelope in which the female here described is stored bears the field note "♀ Gomphine. Dorsal thoracic stripes white. Other pale markings light greenish yellow. Taken ovipositing unaccompanied by ♂ in riffle". The other female from Colombia is stored in a triangular envelope with the field note "♀ Gomphine ovipositing in riffle, in sun

at 10 a.m. Dorsal stripes almost white". The thoracic color patterns of the two Colombian females are very similar. The female from Venezuela is somewhat different, with the second pale antehumeral stripes reduced to dorsal spots and the first pale lateral stripes of the pterothorax well-developed. The female from Venezuela is also notably smaller than the females from Colombia: total length 47 mm; abdomen 37 mm (incl. caud. app. 1.9 mm); hind wing 37 mm; greatest width of hind wing 9.0 mm; costal edge of pterostigma in fore wing 4.2 mm.

The envelope in which the male dated 19.II.1917 is stored has the field note: "Rested on broad leaf palm-like aquatic, about 2' above water. ♂ of this species visit creek rarely where ♀♀ oviposited. They fly in, alight and leave at once".

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