

A SYNOPSIS OF THE SPECIES OF *PHYLLOCYCLA* CALVERT,
WITH DESCRIPTIONS OF FOUR NEW TAXA AND A KEY TO
THE GENERA OF NEOTROPICAL GOMPHIDAE
(ODONATA, GOMPHIDAE)

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ABSTRACT

A synopsis is given of the 30 species of the genus *Phyllocycla* Calvert, supplied by descriptive notes and additional figures. An attempt is made to classify the species into groups, based on adult male characters. A key to these groups and to the males is provided. Four new species are introduced, viz. *P. brasilica* (♂ holotype: Brazil, State of Sergipe, Propriá), *P. medusa* (♂ holotype: Brazil, State of Pará, Santarem), *P. foliata* (♂ holotype: Argentina, Province of Misiones, Apepú), and *P. murrea* (♂ holotype: Brazil, State of Sergipe, Propriá). Their genitalia and thoracic colour patterns are depicted, and the affinities and variations discussed. Neotypes are designated for *P. elongata* (Selys in Selys & Hagen) and *P. gladiata* (Hagen in Selys). *P. sordida* (Selys) is figured for the first time. The previously unknown females of *P. diphylla* (Selys) and *P. hespera* (Calvert) are described. Newly obtained material is recorded. A key to the genera of Neotropical Gomphidae is given in an Appendix.

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INTRODUCTION

Phyllocycla Calvert, 1948, is primarily a South American genus with the greatest number of its species occurring in Brazil. Its range extends from Argentina and Uruguay northward through Central America to Mexico.

Specimens belonging to the genus *Phyllocycla* are sporadic in collections. Many species are known from a few individuals only or often even from

a single specimen. This poor representation is largely due to the fact that most of the species are difficult to collect. The majority of them inhabits rivers in heavy jungle in which environment the insects are very cryptic and tend to escape even the expert collectors. Males normally are detected by the collector during their sallies above the water on which occasions they sometimes hover as well. Females are seldomly observed and then in most cases only when they visit the water for ovipositing. Hence females are extremely rare in collections. The females of 40% of the species are unknown. The larvae live in the soft mud of the river beds and possess a number of adaptations which are typical of the genus. They are sand-coloured and their body is cylindrical. The tibiae of the first and second pair of legs are sometimes armed with distinct burrowing hooks. The end segment of the abdomen is extraordinarily elongated to a sort of snorkel to reach clean water. In this respect the name "tube tails" used for these larvae is an appropriate one (Needham, 1943: 206). In Surinam, the emergence of the adult insect happens in the evening between 9 and 10 p.m. (D. C. Geijskes 1959, personal communication).

In this synopsis 30 species are treated. Three species have recently (Belle, 1987; Dunkle, 1987) been described while four new taxa are introduced here. All these new descriptions show that the genus *Phyllocycla* is very rich in species and that we have not yet come to the end.

The dearth of material makes an exhaustive treatment of the species impossible but rather than delay publication I present here my contribution to our knowledge of the genus for future research. Four new taxa are described here under the specific names *brasilia*, *foliata*, *medusa* and *murrea*. Neotypes are designated for *P. elongata* (Selys in Selys & Hagen) and *P. gladiata* (Hagen in Selys). Descriptions are also given of the previously unknown females of *P. diphylla* (Selys) and *P. hespera* (Calvert) while the male of *P. sordida* (Selys) is illustrated for the first time.

The Comstock-Needham terminology of the wing-veins is used. The pictures of the wings are based on actual photographs to depict exact details. The pictures representing thoracic colour patterns are diagrammatic. All other illustrations are camera lucida drawings made by the author (details have been completed by free hand) except for figures 77, 78 and 79 which are photographic copies of drawings made in 1935 by Miss Grace Eager, Museum artist of the University of Michigan (Ann Arbor) at that time.

DISPOSITION OF MATERIAL STUDIED AND ACKNOWLEDGEMENTS

The specimens recorded in the present synopsis are deposited in the institutions and personal collections mentioned below; the names are preceded by the acronyms used in the text. Without the co-operation of all those who assisted me so wholeheartedly, this study could not have been completed. I wish to express my sincere thanks to all of them. I should like to extend special thanks to Mrs L. K. Gloyd (UMAA), Prof. Dr G. Jurzitza (Karlsruhe) and Prof. Dr A. B. M. Machado (Belo Horizonte) who have been made available the new material for this study, and for their generous permission to retain some duplicate specimens.

AC	Author's collection
BMNH	British Museum (Natural History), London
CJ	Collection of Prof. Dr G. Jurzitza, Karlsruhe
CM	Collection of Prof. Dr A. B. M. Machado, Belo Horizonte
CU	Cornell University, Ithaca, New York
FSCA	Florida State Collection of Arthropods, Gainesville, Florida
IML	Fundación e Instituto Miguel Lillo, Universidad Nacional de Tucumán, San Miguel de Tucumán
IRSN	Institut Royal des Sciences Naturelles de Belgique, Brussels
MAKB	Zoologisches Forschungsinstitut und Museum "Alexander Koenig", Bonn
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
RNHL	Rijksmuseum van Natuurlijke Historie, Leiden
SMF	Senckenberg Museum, Frankfurt-am-Main
UCV	Instituto de Zoología Agrícola, Universidad Central de Venezuela, Maracay
UMAA	University of Michigan, Ann Arbor, Michigan
URM	Universidad de la República, Montevideo
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C.
ZMHB	Zoologisches Museum, Humboldt Universität, East Berlin
ZMUH	Zoologisches Institut und Zoologisches Museum, Universität von Hamburg, Hamburg

Table 1. Alphabetic list of names of the species of *Phyllocycla*, with type status and type location.

Species	Type (all males)				
	holo	lecto	lost	neo	location
1. <i>anduzei</i> (Needham, 1943)	X				CU
2. <i>argentina</i> (Hagen in Selys, 1878)	X				MCZ
3. <i>armata</i> Belle, 1977	X				CM
4. <i>basidenta</i> Dunkle, 1987	X				FSCA
5. <i>baria</i> Belle, 1987	X				UCV
6. <i>bartica</i> Calvert, 1948	X				ANSP
7. <i>brasilica</i> spec. nov.	X				CM
8. <i>breviphylla</i> Belle, 1975	X				RNHL
9. <i>diphylla</i> (Selys, 1854)		X			IRSN
10. <i>elongata</i> (Selys in Selys & Hagen, 1858)			X	X	BMNH
11. <i>foliata</i> spec. nov.	X				C J
12. <i>gladiata</i> (Hagen in Selys, 1854)			X	X	IRSN
13. <i>hespera</i> (Calvert, 1909)	X				ANSP
14. <i>malkini</i> Belle, 1970	X				RNHL
15. <i>medusa</i> spec. nov.	X				SMF
16. <i>modesta</i> Belle, 1970	X				RNHL
17. <i>murrea</i> spec. nov.	X				CM
18. <i>neotropica</i> Belle, 1970	X				RNHL
19. <i>ophis</i> (Selys, 1869)	X				IRSN
20. <i>pallida</i> Belle, 1970	X				MAKB
21. <i>pegasus</i> (Selys, 1869)	X				IRSN
22. <i>propinqua</i> Belle, 1972	X				RNHL
23. <i>signata</i> (Hagen in Selys, 1854)	X				ZMHB
24. <i>sordida</i> (Selys, 1854)	X				BMNH
25. <i>speculatrix</i> Belle, 1975	X				BMHH
26. <i>titschacki</i> (Schmidt, 1942)	X				ZMUH
27. <i>uniforma</i> Dunkle, 1987	X				FSCA
28. <i>vesta</i> Belle, 1972	X				USNM
29. <i>viridipleuris</i> (Calvert, 1909)	X				USNM
30. <i>volsella</i> (Calvert, 1905)	X				BMNH

SYSTEMATIC SECTION

The genus *Phyllocycla* belongs to Carle's (1986) tribe Gomphoidini, together with the genera *Aphylla*, *Gomphoides*, *Phyllogomphoides*, *Peruviogomphus* and apparently also *Idiogomphoides*, although the last genus has not been listed by him. *Phyllocycla* is a rather heterogeneous genus which is instantly distinguished in the male sex by the structure of the penis. This ends in a pair of long

curled flagella which are serrulated along the outer side. The lamina supra-analis of the male is not developed into a distinct inferior appendage. The venation of the wings is characterized in having the discoidal triangles, subtriangles and supratrangles usually crossed except for the hind wing subtriangles, which are usually not crossed. A basal subcostal cross-vein is normally present, while in the hind wings of the male, vein A2, or a branch of it,

Table 2. Geographic distribution of the species of *Phyllocycla*.

	Central America										South America									
Species	Belize	Costa Rica	Guatemala	Mexico	Nicaragua	Panama	Argentina	Bolivia	Brazil	Chile	Colombia	Ecuador	Guyana	Paraguay	Peru	Surinam	Trinidad	Uruguay	Venezuela	
<i>anduzei</i>								X			X	X			X		X		X	
<i>argentina</i>							X		X									X		
<i>armata</i>									X											
<i>basidenta</i>								X												
<i>baria</i>																			X	
<i>bartica</i>									X				X							
<i>brasilia</i>									X											
<i>breviphylla</i>			X	X	X															
<i>diphylla</i>									X											
<i>elongata</i>			X	X																
<i>foliata</i>							X													
<i>gladiata</i>									X											
<i>hespera</i>												X								
<i>malkini</i>									X			X			X					
<i>medusa</i>									X											
<i>modesta</i>													X			X			X	
<i>murrea</i>									X											
<i>neotropica</i>																X				
<i>ophis</i>									X				X			X			X	
<i>pallida</i>									X									X		
<i>pegasus</i>									X											
<i>propinqua</i>							X		X					X				X		
<i>signata</i>									X											
<i>sordida</i>									X											
<i>speculatrix</i>	X		X																	
<i>titschacki</i>								X							X					
<i>uniforma</i>															X					
<i>vesta</i>							X													
<i>viridipleuris</i>							X		X					X						
<i>volsella</i>	X		X	X		X														

usually converges to the lower end of the anal triangle. Other generic characters may be apparent from the key to the genera of Neotropical Gom-

phidae given in the Appendix at the end of this paper.
For the identification of the males, the structure

of the terminal segments of the abdomen, the anal appendages and the posterior genital hamules are of importance. The females however, have generally no clear distinguishing characters and are often very hard to determine, if the corresponding male from the same place of capture is unknown. Very few larvae have been described; their specific recognition is mainly based on differences in the conformation of the labium, the relative length of the tenth abdominal segment and the development of the dorsal hooks and lateral spines of the abdomen.

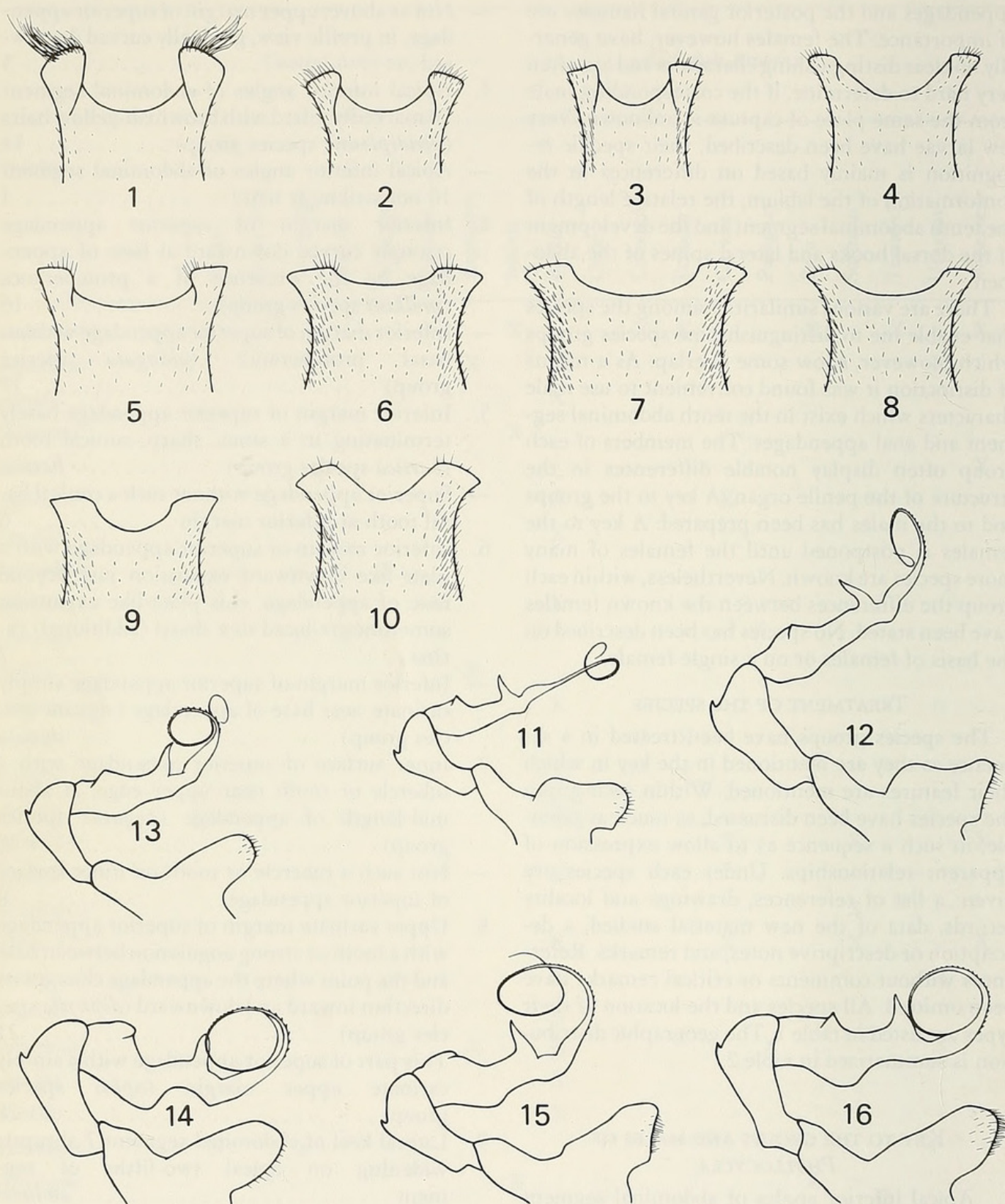
There are various similarities among the species that enable me to distinguish nine species groups which, however, show some overlap. As a means of distinction it was found convenient to use male characters which exist in the tenth abdominal segment and anal appendages. The members of each group often display notable differences in the structure of the penile organ. A key to the groups and to the males has been prepared. A key to the females is postponed until the females of many more species are known. Nevertheless, within each group the differences between the known females have been stated. No species has been described on the basis of females or on a single female.

TREATMENT OF THE SPECIES

The species groups have been treated in a sequence as they are mentioned in the key in which their features are mentioned. Within each group the species have been discussed, as much as possible, in such a sequence as to allow expression of apparent relationships. Under each species are given: a list of references, drawings and locality records, data of the new material studied, a description or descriptive notes, and remarks. References without comments or critical remarks have been omitted. All species and the location of their types are listed in table 1. The geographic distribution is summarized in table 2.

KEY TO THE GROUPS AND MALES OF *PHYLLOCYCLA*

1. Apical inferior angles of abdominal segment 10 produced inward or inward and downward (figs. 1—5) 2
 - Apical inferior angles of abdominal segment 10 not as above; hind border of venter of abdominal segment 10 of the usual form (figs. 6—10) 5
2. Upper margin of superior appendage, in profile view, with a distinct tooth or strong angulation at the point where the appendage
 - is down turned (*volsella* species group) 9
 - Not as above; upper margin of superior appendage, in profile view, gradually curved downward 3
3. Apical inferior angles of abdominal segment 10 markedly tufted with brownish-yellow hairs (*viridipleuris* species group) 14
 - Apical inferior angles of abdominal segment 10 not strikingly hairy 4
4. Inferior margin of superior appendage strongly curved downward at base of appendage by the presence of a protuberance (*malkini* species group) 16
 - Inferior margin of superior appendage without basal protuberance (*elongata* species group) 17
5. Inferior margin of superior appendage basely terminating in a stout, sharp, conical tooth (*bartica* species group) *bartica*
 - Superior appendage without such a conical basal tooth at inferior margin 6
6. Inferior margin of superior appendage with a plate-like downward expansion just beyond base of appendage; this plate-like expansion sometimes reduced to a sharp (additional) carina 7
 - Inferior margin of superior appendage simply carinate near base of appendage (*signata* species group) *signata*
7. Inner surface of superior appendage with a tubercle or tooth near upper edge, at about mid-length of appendage (*pegasus* species group) 20
 - Not such a tubercle or tooth on inner surface of superior appendage 8
8. Upper carinate margin of superior appendage with a tooth or strong angulation between base and the point where the appendage changes its direction inward and downward (*diphylla* species group) 21
 - This part of superior appendage with a simply carinate upper margin (*ophis* species group) 28
9. Lateral keel of abdominal segment 7 abruptly widening on apical two-fifths of segment *anduzei*
 - Lateral keel of abdominal segment 7 gradually widening to apex of segment 10
10. A pale, almost patternless species; tip of superior appendage blunt and, in profile view, bifid *uniforma*
 - A darker species with a well-developed thoracic colour pattern; tip of superior appendage, in profile view, acute and not bifid 11
11. Tip of superior appendage beyond superior



Figs. 1—10. Ventral view of apex of male abdominal segment 10 in *Phyllocycla*: 1, *viridipleuris*; 2, *volsella*; 3, *malkini* (paratype); 4, *hespera*; 5, *elongata*; 6, *bartica* (paratype); 7, *diphylla*; 8, *signata*; 9, *pegasus*; 10, *ophis*. Figs. 11—16. Right profile view of penis in *Phyllocycla*: 11, *pegasus*; 12, *medusa* (paratype); 13, *malkini* (paratype); 14, *volsella*; 15, *anduzei*; 16, *titschacki*.

- tooth with an internal hook near mid-length of tip *armata*
- Tip of superior appendage without such an internal hook 12
12. Labrum entirely brown or black-brown 13
- Labrum largely bluish-olive or with a pair of bluish-olive spots *volsella*
13. Superior appendage one and a half times as long as abdominal segment 10 owing to the very long tip, which is sharply pointed backward *titschacki*
- Superior appendage as long as abdominal segment 10; tip of superior appendage pointed sharply downward in an oblique direction *neotropica*
14. Thoracic colour pattern faintly discernible; no second pale antehumeral stripe *pallida*
- Thoracic colour pattern well-developed on dorsum of pterothorax; second pale antehumeral stripe present 15
15. Lateral dilatation of abdominal segment 8 entirely yellow *viridipleuris*
- Lateral dilatation of abdominal segment 8 entirely or largely black *propinqua*
16. Lateral dilatation of abdominal segment 8 regularly curved throughout; in profile view, each superior appendage abruptly narrowing behind inferior basal protuberance *malkini*
- Lateral dilatation of abdominal segment 8 more or less angulated at mid-length of segment; in profile view, each superior appendage gradually narrowing behind inferior basal protuberance *basidentia*
17. Lateral dilatation of abdominal segment 8 rather narrow and slightly concave for middle portion, the inner side margined with a row of denticles; abdominal segments 8 and 9 with a narrow, yellow middorsal stripe *hespera*
- Lateral dilatation of abdominal segment 8 broad and convex, the inner side without denticles; dorsum of abdominal segments 8 and 9 entirely dark brown 18
18. Lateral dilatation of abdominal segment 9 sharply angled near base of segment *elongata*
- Lateral dilatation of abdominal segment 9 curved throughout 19
19. Superior appendage, in dorsal view, nearly straight for proximal two-thirds; superior surface of frons largely leaden-grey to green *breviphylla*
- Superior appendage, in dorsal view, evenly curved inward from base; superior surface of frons entirely brown *speculatrix*
20. Lateral dilatation of abdominal segment 8 very broad and widest at mid-length of segment; thoracic colour pattern well-developed *medusa*
- Lateral dilatation of abdominal segment 8 rather narrow for proximal two-thirds; thoracic colour pattern only developed on dorsum of pterothorax *pegasus*
21. In ventral view, the blackly chitinized tip of the posterior hamule truncated and more or less pointed on each side 22
- Blackly chitinized tip of posterior hamule blunt or acute 25
22. First pale antehumeral stripe narrow, parallel-sided and not connected with the pale mesothoracic "half collar" *murrea*
- First pale antehumeral stripe becoming wider anteriorly, being confluent with the pale mesothoracic "half collar" 23
23. Lateral dilatation of abdominal segment 8 very broad and leaf-like, widest near mid-length of segment 24
- Lateral dilatation of abdominal segment 8 moderately broad, widest and about equal in width on apical half of segment *brasilia*
24. Lateral dilatation of abdominal segment 9 one-third as wide as that of segment 8 or narrower; truncated tip of posterior genital hamule distinctly two-pointed *argentina*
- Lateral dilatation of abdominal segment 9 about half as wide as that of segment 8; truncated tip of posterior genital hamule without evident anterior point *foliata*
25. Lateral dilatation of abdominal segment 8 widest at mid-length of segment, its free border consisting of two straight lines forming an angle of 120° *sordida*
- Lateral dilatation of abdominal segment 8 leaf-like and broadly rounded 26
26. Upper carinate margin of superior appendage with a tooth at one-third length of appendage; tip of inferior appendage deeply excised V-shaped *vesta*
- Upper carinate margin of superior appendage with a tooth at two-sevenths length of appendage; posterior margin of inferior appendage slightly concave 27
27. Lateral dilatation of abdominal segment 8 widest at mid-length of segment; labrum brown with yellow free border *gladiata*
- Lateral dilatation of abdominal segment 8 widest just distal to mid-length of segment; labrum yellow *diphylla*
28. Lateral dilatation of abdominal segment 8 widest at mid-length of segment 29
- Lateral dilatation of abdominal segment 8 wid-

- est at apex of segment *baria*
 29. Superior appendage, in profile view, tapering to apex, the tip slender *modesta*
 — Superior appendage robust, broad in profile view, the tip stout and with a notable, blunt superior angle *ophis*

THE *VOLSSELLA* SPECIES GROUP

The members of this group are *P. volsella*, *P. neotropica*, *P. anduzei*, *P. titschacki*, *P. armata* and *P. uniforma*. They are bound together by the following two male characters: (1) The apical inferior angles of the tenth abdominal segment is somewhat produced inward and downward (fig. 2) and (2) the superior anal appendage, in profile view, is foot-shaped and provided with a superior anteapical tooth at the "heel" (cf. Belle, 1970a: figs. 145, 147). The length of the "foot" is smallest in *P. volsella* and largest in *P. titschacki*.

The females of *P. neotropica*, *P. armata* and *P. uniforma* are unknown.

Phyllocycla volsella (Calvert, 1905) (figs. 2, 14, 31, 35)

Gomphoides volsella Calvert, 1905: 154, 156, tab. 7 figs. 13, 14 (♂ apex abd.); 1907 (supplement): 398; tab. 10 fig. 48 (♂ apex abd.) — ♂ Teapa in Tabasco, Mexico. Calvert, 1909: 217.

Cyclophylla volsella; Needham, 1940: 366, 376, 377 (exuviae El Salto, Guatemala), pl. 20 figs. 1, 4, 7, 19 (larval struct.), pl. 21 fig. 40 (base hw ♂), 44 (base hw ♀).

Phyllocycla volsella; Calvert, 1948: 66. May, 1979: 21, 37. Dunkle & Belwood, 1982: 227. Paulson, 1982: 256 (distribution)

Material. — Mexico: Veracruz, 3 km N. of Santiago Tuxtla, 13–14 September 1965, 1 ♂, 1 ♀, T.W. Donnelly, AC. — Guatemala: Dept. Zacapa, Gualán, 13 June 1909, 1 ♂ E. B. Williamson; Puerto Barrios, 30 May 1909, 1 ♀, E.B. Williamson, UMAA; Tenedores, Izabal, 17 June 1965, 1 ♂, AC. — Costa Rica: Guanacaste, Quebrada Azul, 2.5 miles W. of Tilaran, 24 July 1967, 1 ♀, O. S. Flint, Jr. & M. A. Ortiz B. USNM.

The male and female of this species have been reared; Needham (1940) published depictions of the bases of their hind wings. But no further information of the female of *P. volsella* is known. The present females are fully mature specimens in perfect condition. The one from Mexico is described below.

Female. — Total length 49 mm; abdomen 37 mm; hind wing 31.5 mm; costal edge of pterostigma in fore wing 3.8 mm.

Similar to male regarding stature and general coloration but abdomen stouter on middle segments and not notably widened before apex. Lat-

eral dilatations of abdominal segment 8 very narrow and denticulated on apical half, those of abdominal segment 9 also very narrow, but not denticulated. Vulvar lamina a quarter the length of ninth sternite, its posterior margin deeply excised, V-shaped, the interval between the lobes 90°. Dorsal apical rim of abdominal segment 10 one-sixth the dorsal length of segment. Anal appendages conical, acute at apex. Abdominal segments 7, 8, 9 and 10 approximately in ratio 38 : 23 : 15 : 10, with the anal appendages 8 on the same scale.

First pale antehumeral stripe wedge-shaped and broadly connected with mesothoracic "half collar". Second pale antehumeral stripe close to humeral suture and well-developed. Distal spines of outer row on third femur as long as half the diameter of femur.

Wing venation blackish brown, including frontal margin of costa. Pterostigma brown. Nodal index 10 : 18—18 : 11/13 : 13—13 : 13. Second primary antenodal cross-vein the sixth in fore wings, the fifth in hind wings. Intermedian cross-veins 7—8/6—5. Triangles, subtriangles and supratrangles two-celled, but subtriangles in hind wings one-celled. Hind wings with five paranal cells, three (left) and four (right) postanal cells, no anal loop, and area posterior to Cu2 four cells wide.

The specimens from Mexico are the largest of the series: those from Guatemala are the smallest and their size approaches that of *P. anduzei*. The right pair of the wings of the females from Guatemala have been removed and have not been reattached to the specimen. The remaining left pair of wings has uncrossed triangles; the subtriangle is one-celled in the hind wing and two-celled in the fore wing.

The female of *P. volsella* is distinguished from the females of *P. anduzei* and *P. titschacki* in having the anterior ridge of the frons weakly developed in middle and undeveloped in front of the pedicels; it is well-developed along the whole width of the frons in the female of *P. anduzei* and *P. titschacki*. The posterior margin of the occipital plate of the female of *P. volsella* is concave in the middle and resembles that of the female of *P. titschacki*; it is straight or almost straight in the female of *P. anduzei* (figs. 34—36).

Phyllocycla neotropica Belle, 1970

Phyllocycla neotropica Belle, 1970a: 97—99, figs. 147 (♂ apex abd.), 150—152 (thor., occiput, ♂ app. & apex abd.), pl. 13b (photogr. wings ♂); 99, 100 (exuviae), fig. 153 (larval struct.) — ♂ Brownsweeg, Surinam.

***Phyllocycla anduzei* (Needham, 1943)**

(figs. 15, 34)

Cyclophylla anduzei Needham, 1943, 198—202, fig. (♂ apex abd.) — ♂ ♀ San Esteban, Venezuela.*Phyllocycla anduzei*; Calvert, 1948: 65, 66. Belle, 1970a: 93—96 (♂ ♀ Trinidad, Venezuela, Colombia, Bolivia), figs. 142—146, 149 (♂ genit., ♂ ♀ apex. abd., dorsum thorax), pl. 11b, 13a (photogr. wings ♂ ♀); 1972: 227.

Material. — Colombia: Río Frio, 6 January 1917, 4 ♂; 8 January, 9 ♂, 2 ♀; Fundación, 10 January 1917, 8 ♂, 6 ♀; 12 January 1917, 1 ♂, 1 ♀, 14 January 1917, 1 ♂, 1 ♀, all J. H. & E. B. Williamson, UMAA but 5 ♂, 2 ♀ in AC. — Ecuador: Dept. Pastaza, Cusuimi on Río Cusuimi (about 150 km south-east of Puyo, 300 m), 18—23 July 1971, 1 ♀, B. Malkin, B. Yuma & C. Ikyam, RNHL. — Peru: Dept. Huánuco, vicinity of Afilador (670 m), 12 May 1937, 1 ♂; Shapajilla (jungle, 630 m), 21 December 1938, 1 ♀, both Felix Woytkowski. — Venezuela: San Esteban, 3 February 1920, 2 ♂, 1 ♀; 5 February 1920, 1 ♀; 6 February 1920, 2 ♂; 8 February 1920, 1 ♀; 6 February 1920, 2 ♂; 8 February 1920, 1 ♀; San Esteban, Carabobo, 3 February 1920, 2 ♂; 6 February 1920, 1 ♀, all W. H. Ditzler, J. H. & E. B. Williamson, UMAA, but 2 ♂, 2 ♀ in AC; Nirgua Yaracuy, 28 February 1920, 1 ♂, H. E. Baker, UMAA; Aragua, San Casimiro, 10 June 1952, 1 ♂; Aragua, Carmen de Cura, 10 June 1952, 1 ♀; Carabobo, El Trompillo, 27 June 1953, 2 ♂, all J. Rácanis; Carabobo, El Trompillo, 27 June 1953, 1 ♀, Roze, UCV; Monagas, Caripe, 19 July 1953, 1 ♂, Requena leg.; Monagas, Caripito, 13 December 1954, 1 ♀; same locality, 15 December 1954, 1 ♂ (AC); same locality, 13 December 1954, 1 ♂ (UCV), all J. Rácanis; Maracay, 1 ♀, SMF Od No. 33637.

In some specimens the green anterior band of the frons is medially interrupted by black, the first and second pale antehumeral stripes are confluent at their upper ends and the lateral black stripes of the pterothorax not developed. The apical end of the lateral keel of the seventh abdominal segment of the male from Peru is much more widened than in the other males and in structure like that of the Bolivian male formerly figured by me (Belle, 1970a: fig. 146).

The female from Maracay, Venezuela is much paler in general coloration than the other females. The face is predominantly pale brown but the anteclypeus is pale green, while the labrum has a pair of pale green markings. The sides of the pterothorax of this female are greenish yellow except for a narrow brown stripe along the humeral suture.

The female of *P. anduzei* differs from the female of *P. titschacki* in having the distal spines of the outer row on the third femur much more widely spaced and larger; their length is one-third or more of the diameter of the femur in *P. anduzei* and about a quarter of the diameter of the femur in *P. titschacki*.

Williamson provided some triangular envelopes, in which the specimens were stored, with field notes. One male from Fundación has on the envelope the field note "along the river" and another male from the same locality "Gomphines mostly in tall grass in bananafield along river". A female from Fundación has on the envelope the note "Gomphines of this species were taken usually in grass, or rarely in low leafy bushes in banana or shaded, 4.30 p.m.". The envelope of the male from Nirgua Yaracuy has the note "collected by H. E. Baker on creek west of town".

Measurements of the specimen: ♂ abdomen 33—37 mm (incl. app.), hind wing 25—27 mm; ♀ abdomen 31—36 mm (incl. app.), hind wing 26—29 mm.

***Phyllocycla titschacki* (Schmidt, 1942)**

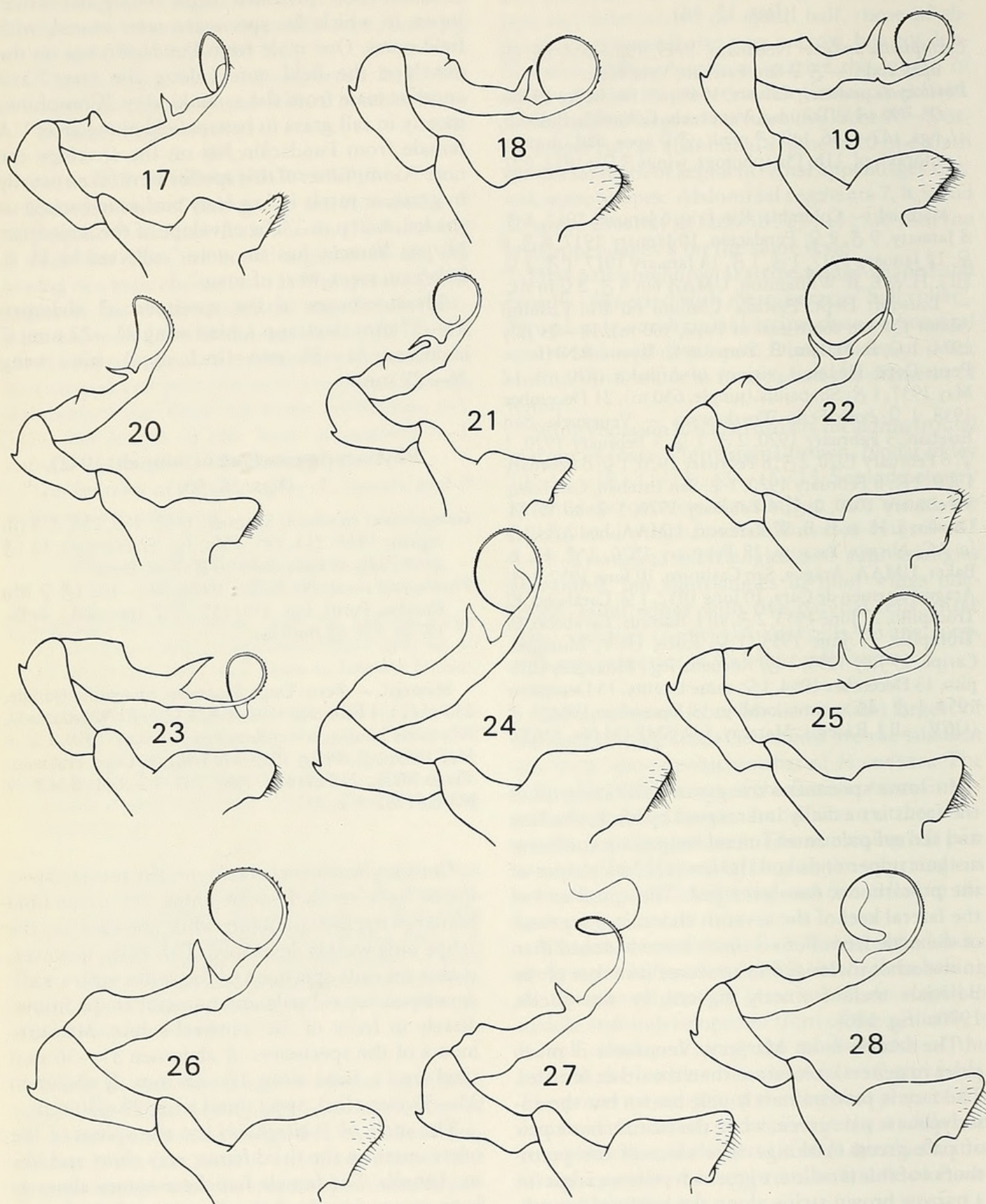
(figs. 16, 36)

Gomphoides titschacki Schmidt, 1942: 253, 254, 270 (in reprint 1952: 234, 235, 250), fig. 12 (thorax), 13 (♂ genit., app. & apex abd.) — ♂ Sivia, Peru.*Phyllocycla titschacki* Belle, 1970a: 100—102 (♂ ♀ Río Rondos, Peru), figs. 154, 155 (♂ ♀ apex abd.). Belle, 1972a: 227 (♂ Bolivia).

Material. — Peru: Dept. Huánuco, Shapajilla (jungle, 630 m el.), 4 February 1930, 1 ♂, 1 ♀, Felix Woytkowski, AC; same locality and collector, 5 February 1939, 1 ♀; 6 May 1939, 1 ♂; 8 May 1939, 1 ♂ UMAA; Dept. Huánuco, Tingo Maria, 25 February 1981, 1 ♂, 2 ♀, CM; B.M.R., 7 March 1981, 1 ♀, AC.

Contrary to the male holotype, the present specimens have no dark stripe along the aslant hind border of the metepimeron, while one male has the stripe only weakly developed. This male, however, is also the only specimen of the series with a well-developed second pale antehumeral stripe immediately in front of the humeral suture. Measurements of the specimens: ♂ abdomen 35—36 mm (incl. app.), hind wing 27—28 mm; ♀ abdomen 33—35 mm (incl. app.), hind wing 29—30 mm.

The male of *P. titschacki* has the spines of the outer row on the third femur very short and like in *Aphylla*. The female has these spines about as long as one-fourth of the diameter of the femur. The spines of the outer row of the third tibiae of the male are more or less modified; they are short and thickened at the base. The penis (fig. 16) agrees with *P. volsella* in robustness and the middle segment (Fraser, 1940: 544) has a distinct transverse membranous carina along the ventral apical margin.



Figs. 17—28. Right profile view of penis in *Phyllocycla*: 17, *bartica* (paratype); 18, *elongata*; 19, *hespera*; 20, *modesta*; 21, *ophis*; 22, *signata*; 23, *viridipleuris*; 24, *propinqua*; 25, *brasilia* (paratype); 26, *vesta* (paratype); 27, *foliata* (paratype); 28, *argentina*.

***Phyllocycla armata* Belle, 1977**

Phyllocycla armata Belle, 1977a: 6, 7, figs. 1—5 (♂ thorax, occiput, genit & apex abd.) — ♂ Itaituba, State of Pará, Brazil.

***Phyllocycla uniforma* Dunkle, 1987**

Phyllocycla uniforma Dunkle, 1987: 80—82, fig. 2 (♂ app. & apex abd.) — ♂ Puesto Guadalupe, Dept. La Libertad, Peru.

Thanks to Prof. Westfall (Gainesville) I was able to examine the single male of this species (and that of *Phyllocycla basidenta*). The specimen is very pale and almost patternless. The face is pale green. The pterothorax is yellow green, but more yellowish on the dorsum than on the lateral sides. The margin of the apical inferior angle of the tenth abdominal segment is less produced than in the other members of the group. In profile view, each superior appendage has a low superior tooth while the extreme apex is befid. The pterostigma is half as long as the distance between the nodus and the pterostigma.

THE VIRIDIPLEURIS SPECIES GROUP

The group is composed of the three species *P. viridipleuris*, *P. propinqua* and *P. pallida*. The male characters not encountered elsewhere in the genus are found in the apical inferior angles of the tenth abdominal segment which are folded under the sternite and conspicuously tufted with brownish-yellow hairs.

The three species composing this group are exceedingly close to each other, although separable by the characters mentioned in the key. The female of *P. pallida* is unknown.

***Phyllocycla viridipleuris* (Calvert, 1909)**
(figs. 1, 23)

Gomphoides viridipleuris Calvert, 1909: 217—219, pl. 7 figs. 126, 126s (♂ app. & apex abd.) — ♂ Sapucay, Paraguay. Calvert, 1948: 66.

Cyclophylla viridipleuris; Needham, 1940: 378 (exuviae, ? Nova Teutonia, State of Santa Catarina, Brazil), pl. 20 fig. 8 (larval struct.).

Phyllocycla viridipleuris; Belle, 19770a: 103—109 (♂ lectotype; ♂ ♀ States of Rio de Janeiro, Rio Grande do Sul and Santa Catarina, partly *propinqua* treated below), figs. 156—167 (thorax, ♂ ♀ genit. & apex abd., ♂ app.); 1972a: 233, 234 (♀ Paraguay), figs. 32—34 (♂ app., ♀ genit. & apex abd.), pl. 14 (photogr. wings ♂). Paulson, 1977: 176 (distrib.).

Aphylla viridipleuris; St. Quentin, 1967: 147—150 (♂ ♀ State of Rio Grande do Sul, Brazil), fig. 7 (thorax, ♂ ♀ genit., ♂ abd. segm. 10 & app.), fig. 8a (anal triangle hw ♂); 1973: 349 (♂ ♀ States of Minas Gerais, Pernambuco and Sao Paulo, Brazil).

Material. — Argentina: Misiones, stream 10 km N of Sta Ana on route 12, 21 November 1973, 1 ♂; stream 6 km E of Eldorado (on route 17), 22 November 1973, 1 ♂; Entre Rios, Arroyo P. Verné, on route 14 (km 355), N of Villa San José, 16 November 1973, 1 ♂ (teneral), all O. S. Flint, Jr., USNM. — Paraguay: Tacuapi, Cerro Pero, 3 February 1945, 1 ♂, F. H. Schade, UMAA. San Pedro, Arroyo Pindo (about 70 km north of Cnel Oviedo), 1 December 1973, 1 ♀; Guaira, stream 3.9 km south of Villa Rica on road to Caazapa, 2 December 1973, 1 ♀, O. S. Flint, Jr., USNM. — Brazil: State of Sao Paulo, Sao Carlos, 5 December 1976, 1 ♀ M. M. Dias Filho, AC. State of Minas Gerais, Caratinga, February 1979, 1 ♂, Inacio; Lagoa Santo, Parque do Sumidouro, December 1980, 1 ♂, 1 ♀, A. B. M. Machado, E. Machado & Valle; Florestal, January 1982, 1 ♂; December 1982, 3 ♂, E. Machado; December 1982, 1 ♂, E. & A. Machado, CM but 2 ♂ in AC.

Some of the present specimens have the tibiae black except for the proximal part of the carinae, a slight development of the dark midlateral (interpleural) stripe, a shorter pterostigma (costal edge of pterostigma in fore wing 3.5 mm) and the second anal interspace in the hind wings of the males filled with a single row of cells.

***Phyllocycla propinqua* Belle, 1972**
(figs. 24, 29)

Phyllocycla propinqua Bella, 1972a: 235, 236, fig. 35 (♀ apex abd.) — ♂ ♀ Nova Teutonia, State of Santa Catarina, Brazil. Belle, 1981: 263 (♂ ♀ Uruguay).

Material. — Argentina: Misiones, Arroyo Coati, route 14 (km 1053), 15 km NE of San José, 19 November 1973, 1 ♂; route 14 (km 1058), 20 km NE of San José, 20 October 1973, 1 ♂; Arro Liso, route 14 (km 1085), 20 km NE of San José, 20 November 1973, 1 ♂; Entre Rios, Arroyo Capilla, route 14 (km 382), S of Ubajay, 16 November 1973, 5 ♂; Arroyo P. Verne, route 14 (km 355), N of Villa San José, 16 November 1973, 2 ♂ (teneral); Arroyo Saura, route 4, 9 km NW of L. N. Alem, 21 November 1973, 1 ♀, O. S. Flint, Jr., USNM; Misiones, Iguazú, 2 February 1976, 1 ♂, R. Foerster, MAK. — Brazil: State of Santa Catarina, Nova Teutonia, 5 December 1936, 1 ♂, F. Plaumann, BMNH; State of Santa Catarina, 1 and 11 November 1940, 2 ♂ (UMAA); 12 January 1942, 1 ♂ (AC), all Fritz Plaumann. — Paraguay: Alto Parana, Stream on road to Salto del Acaray, near Pto. Press. Stroessnear, 26 November 1973, 2 ♂, O. S. Flint, Jr., USNM.

The second anal interspace in the hind wings of all males starts with a single row of cells at the anal vein. Some males are paler having the dark midlateral stripe of the pterothorax almost absent and the lateral dilatations of the ninth abdominal segment entirely or largely yellow. Also the face and the vesicle is sometimes pale. The penis is almost identical with that of *P. viridipleuris* but the form of the middle segment is slightly different (fig. 24). The

male from Iguazú is the smallest specimen of the series (total length 47 mm; abdomen 36 mm; hind wing 26 mm; costal edge of pterostigma in fore wing 3.0 mm).

Phyllocycla pallida Belle, 1970

Phyllocycla pallida Belle, 1970a: 109—111, figs. 168—170 (♂ app. & apex abd.) — ♂ Nova Teutonia, State of Santa Catarina, Brazil. Belle, 1972a: 236 (♂ Uruguay); 1981: 262. Paulson, 1977: 176 (distrib.).

THE MALKINI SPECIES GROUP

The two species composing this group are *P. malkini* and *P. basidenta*. The characters possessed in common are: (1) Apical inferior angles of tenth abdominal segment produced inward and downward (fig. 3) and (2) inferior margin of superior appendage strongly curved downward at base by the presence of a protuberance.

The female of *P. basidenta* is unknown.

Phyllocycla malkini Belle, 1970 (figs. 3, 13, 44—46)

Phyllocycla malkini Belle, 1970a: 75—77, figs. 112—115 (♂ app. & apex abd., occiput, ♀ genit.) — ♂ ♀ Aldeia Yavaruhu (Aracu), State of Maranhão, Brazil. Paulson, 1985: 12 (Madre de Dios, Peru).

Material. — Ecuador: Prov. Napo, Limoncocha (forest stream), 6 March 1972, 1 ♂, D. L. Pearson, AC.

The present record and that of Paulson (1985) extend the range of this species from Maranhão to the eastern slopes of the cordillera Andes (distance between the two localities 2000 miles). The species is apparently Amazonian in its distribution. Prof. Westfall wrote from Gainesville, July 27, 1977, that Dr Dennis R. Paulson (Seattle) has two other males from Ecuador. I have not seen them but compared with the male paratype from Maranhão in my possession, my male from Ecuador is larger (total length 43 mm; abdomen 33 mm; hind wing 26 mm; costal edge of pterostigma in fore wing 3.0 mm) and darker (pale markings somewhat reduced. fig. 44). Further, the occipital plate of my Ecuador male has a short central ridge (fig. 45) while each superior anal appendage has a relatively more slender tip and a somewhat more prominent inferior basal protuberance.

Phyllocycla basidenta Dunkle, 1987

Phyllocycla basidenta Dunkle, 1987: 77—80, fig. 1 (♂ body, penis, ♂ app.) — ♂ 10 km east of Warnes, Dept. Santa Cruz, Bolivia.

This species is exceedingly close to *Phyllocycla malkini* but it is larger and has a longer pterostigma. The anal loop of the hind wing is two-celled; it is one-celled in *P. malkini*. The pale (= grey-green) markings on the face are more extended than in *P. malkini*. The labrum has a broad pale transverse band; it has a pair of pale spots in *P. malkini*. The lateral dilatation of the abdominal segment 8 is more or less angulated halfway the segment; it is regularly curved throughout in *P. malkini*. The lateral dilatation of the abdominal segment 9 is less expanded on the basal half than in *P. malkini*. The superior appendages are stouter and the inferior basal protuberance of each superior appendage is two pointed with the distal tooth less produced downward than in *P. malkini*. The middle segment of the penis is more robust than in *P. malkini*.

THE ELONGATA SPECIES GROUP

In this group I place *P. elongata*, *P. breviphylla*, *P. speculatrix* and *P. hespera*. The females of all these species are known and a key to the species is provided.

The male characters of the group are: (1) Apical inferior angles of tenth abdominal segment produced inward and downward although in a less degree than in the preceding groups (figs. 4, 5) and (2) superior appendage without inferior protuberance at the base; in profile view, each superior appendage is regularly curved down near apex i.e. without a superior tooth at the point where the appendage is down turned.

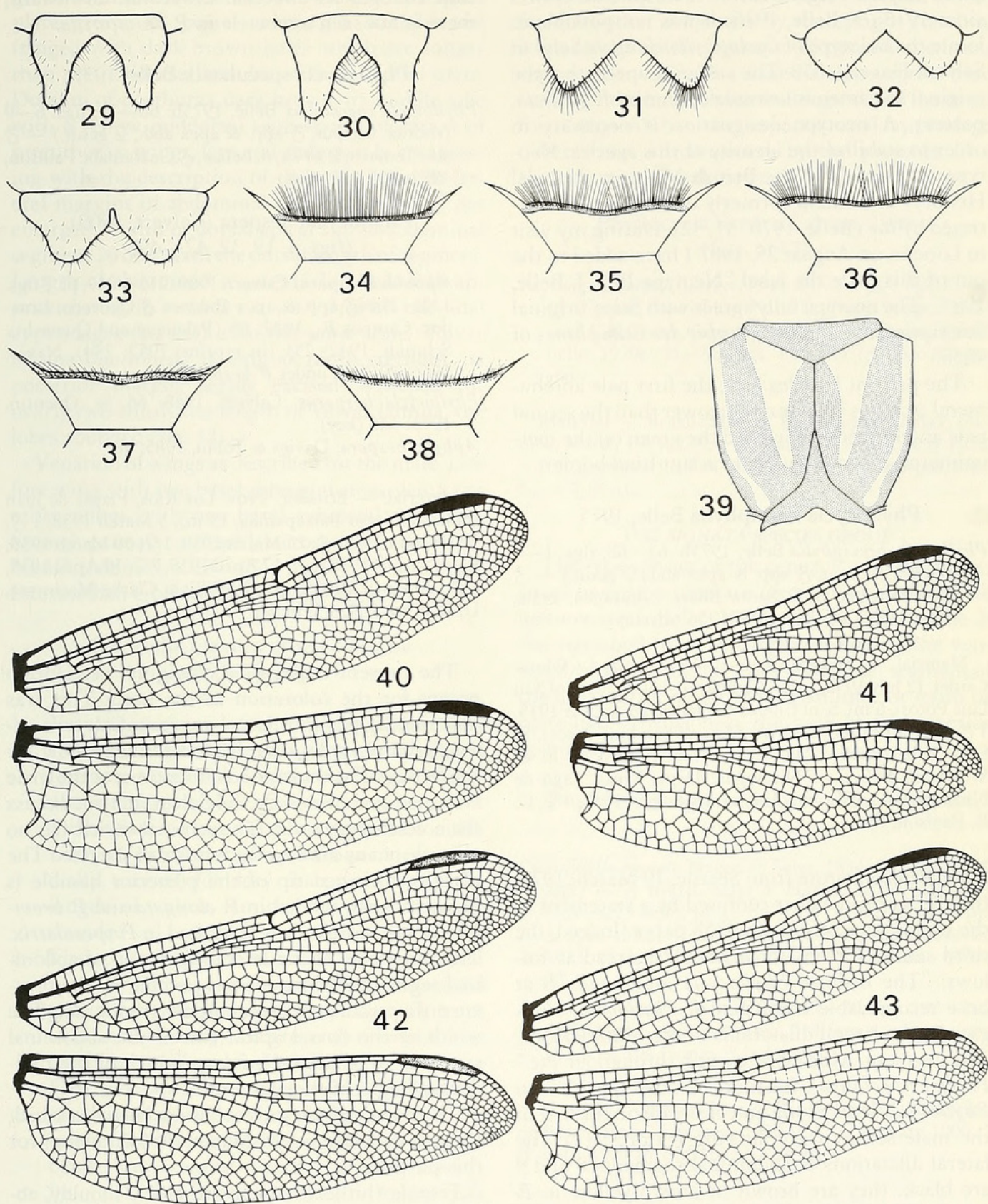
Phyllocycla elongata (Selys in Selys & Hagen, 1858) (figs. 5, 18)

Cyclophylla elongata Selys in Selys & Hagen, 1858: 484—487 (224—227 sep.), pl. 12 fig. 5 (♂ occiput, auricle & apex abd.) — ♂ Mexico. Selys, 1873b: 507 (62 sep.). Calvert, 1895: 500; 1899: 348 (♂ Mexico); 1947: 607. Needham, 1940: 377, 378 (exuviae), pl. 20 fig. 9 (larval struct.); 1943: 206.

Gomphoides elongata; Calvert, 1905: 154—157 (♂ ♀ Mexico); 1919: 33 (♂ Guatemala, possibly *breviphylla* treated below).

Phyllocycla elongata; Calvert, 1948: 65. Belle, 1976: 31, 32, figs. 1—4 (thorax occiput, ♂ app. & apex abd.). Paulson, 1982: 256 (distrib.).

Material. — Mexico: State of Sinaloa, Mun. Culiacán, Navolatillo, 7 September 1978, 1 ♂, R. E. Woodruff, FSCA; State of Sinaloa, 2.5 mi. NW of bridge in Culiacán, 29—30 August 1961, 2 ♀, I. J. Cantrall & T. J. Cohn, UMAA and 1 ♀ in AC.



Figs. 29—33. Ventral view of vulvar lamina in *Phyllocycla*: 29, *propinqua*; 30, *diphylla*; 31, *volsella*; 32, *hespera*; 33, *medusa* (allotype). Figs. 34—38. Occipital plate of female in *Phyllocycla*: 34, *anduzei*; 35, *volsella*; 36, *titschacki*; 37, *medusa* (allotype); 38, *diphylla*. Fig. 39. *Phyllocycla volsella*, ♀. Colour pattern of thoracic dorsum. Figs. 40—43. Right pair of wings in *Phyllocycla*: 40, *medusa* ♂ (paratype); 41, *pegasus* ♂; 42, *diphylla* ♀; 43, *brasilia* ♂ (paratype).

Neotype designation of *Cyclophylla elongata* Selys in Selys & Hagen, 1858. — Despite all efforts since 1976 (cf. Belle, 1976) it was not possible to locate the holotype of *Cyclophylla elongata* Selys in Selys & Hagen, 1858. The author suspects that the original specimen is lost (see also under *P. gladiata*, postea). A neotype designation is necessary in order to stabilize the identity of this species. Neotype is the male in the British Museum (Natural History) at London formerly discussed and illustrated by me (Belle, 1976: 31, 32). During my visit to London on August 25, 1987 I have added to the pin of this male the label "Neotype Rev. J. Belle, 1987". The neotype fully agrees with Selys' original description in the *Monographie des Gomphines* of 1858.

The present females have the first pale antehumeral stripe as wide as or narrower than the second pale antehumeral stripe and the green on the metepimeron extending to the aslant hind border.

Phyllocycla breviphylla Belle, 1975

Phyllocycla breviphylla Belle, 1975b: 65—68, figs. 1—4 (thorax, occiput, ♂ app. & apex abd., ♀ genit.) — ♂ El Salto, Mexico; ♀ Santa Elena, Nicaragua. Belle, 1976: 31, 32. Paulson, 1982: 256 (distrib.).

Material. — Mexico: State of Vera Cruz, La Gloria Cardel, 12 July 1938, 1 ♂, J. Camelo G., FSCA; State of San Luis Potosí, 6 mi. S. of Ciudad de Valles, 28 August 1938, 1 ♂, Mrs. Cheatum, UMAA; State of San Luis Potosí, El Salto Falls (2000—2500 ft), 16 June 1963, 1 ♂, R. E. Woodruff, FSCA. — Nicaragua: Dept. Rivas, Lago de Nicaragua at La Virgen (100 ft), 20 August 1967, 1 ♀, D. R. Paulson, FSCA.

Dr Paulson wrote from Seattle, 19 March, 1977, that he was somewhat confused by a statement at the top of page 66 of my 1975b paper. Indeed, the third sentence from above should be read as follows: "The male of *Phyllocycla breviphylla* is at once recognizable from that of *Phyllocycla elongata* by the lateral dilatations of the ninth abdominal segment which are curved throughout etc." *Phyllocycla elongata* is a more blackish species than *Phyllocycla breviphylla* and easily distinguished in the male sex by the following features: (1) The lateral dilatations of abdominal segments 8 and 9 are black; they are brown to brown-yellow in *P. breviphylla*. (2) The lateral dilatation of abdominal segment 8 is equal in width on the apical half of the segment while that of abdominal segment 9 is sharply angled near the base of the segment; the lateral dilatations of the segments 8 and 9 are curved throughout in *P. breviphylla*. (3) The upper edge of the superior anal appendage has a distinct

tubercle just beyond the point where the appendage changes its direction inward and downward; there is not such a tubercle in *P. breviphylla*.

Phyllocycla speculatrix Belle, 1975

Phyllocycla speculatrix Belle, 1975b: 68—71, figs. 6—9 (thorax, occiput, ♂ app. & apex abd., ♀ genit.) — ♂ Río Temash, ♀ El Cayo, Belize; ♂ Guatemala. Paulson, 1982: 256 (distrib.).

Phyllocycla hespera (Calvert, 1909) (figs. 4, 19, 32, 47—49)

Gomphoides hesperus Calvert, 1909: 215—217, pl. 7 figs. 125, 125s (♂ app. & apex abd.) — ♂ Quevedo, Ecuador. Campos R., 1922: 86 (Palenque and Quevedo). Schmidt, 1942: 253 (in reprint, 1952: 234). Navás, 1916: 70 (key, under *P. hespera*).

Phyllocycla hesperus; Calvert, 1948: 66. St. Quentin, 1973: 346 (key).

Aphylla hespera; Davies & Tobin, 1985: 48.

Material. — Ecuador: Prov. Los Ríos, Playas de Juan Montalvo (near Balzapamba, 15 m), 5 March 1938, 1 ♂; 20 March 1938, 1 ♂; 25 March 1938, 1 ♀; 30 March 1938, 1 ♀; 15 April 1938, 1 ♂; 17 April 1938, 2 ♀; 19 April 1938, 1 ♂; 20 April 1938, 1 ♂, all William Clarke-Macintyre, UMAA but 2 ♂, 1 ♀ in AC.

The present males fit the original description except for the coloration of the head. This was obscured by postmortem changes in Calvert's example but its coloration is as described below for the female. The thoracic colour pattern of the male is shaped as shown in fig. 49. Calvert did not discuss the accessory genitalia. The seminal vesicle has no tubercle of any kind on the bottom of the cleft. The blackly chitinized tip of the posterior hamule is pointed; it is rounded in *P. elongata* and *P. breviphylla* and more or less truncated in *P. speculatrix*. The inner side of the lateral dilatation of abdominal segment 8 of the male is peculiar by the presence of a row of denticles along the free border. The width of the dorsal apical rim of the abdominal segment 10 of the male is one-fourth of the mid-dorsal length of the segment.

The female of the species has not been described; the one collected on 25 March 1938 is chosen for this purpose.

Female (hitherto unknown; partly mouldy, abdomen broken between segments 4—5): Total length 40 mm; abdomen 37 mm (incl. app.); hind wing 31 mm; costal edge of pterostigma in fore wing 3.8 mm.

Head brown, but labrum with a symmetric pair of green spots, external surface of mandibles green, each lateral side of postclypeus with a round green

spot, and superior surface of frons with an anterior green band that is interrupted in middle. Occipital plate green, its posterior margin straight and fringed with dark brown hairs which are longer than the middorsal breadth of the occipital plate. Dorsum of prothorax dark brown, its middle lobe with a yellow middorsal twin-spot. Coloration of pterothorax, wings, legs and abdomen fairly agreeing with the description of the male. Inferior lateral margins of abdominal segments 8 and 9 not enlarged. Width of dorsal apical rim of abdominal segment 10 one-sixth the dorsal length of segment. Length of abdominal segments 7, 8, 9 and 10 approximately in ratio 9 : 5 : 4 : 3, with the anal appendages (stylets) 2 on the same scale. Vulvar lamina one-fourth as long as ninth sternum, its posterior margin deeply excised V-shaped for nearly two-thirds the length of vulvar lamina, the lobes rounded (fig. 32).

Venation of wings as described for the male. Left fore wing with two basal subcostal cross-veins, the other wings with one basal subcostal crossvein. Second primary antenodal cross-vein the sixth. Nodal index 11 : 18—17 : 10/9 : 14—13 : 10. Intermedian cross-veins 8—9/6—6.

Key to the females of the *elongata* species group

1. Vulvar lamina two-fifths the length of ninth sternum; its posterior margin medially excised for more than three-fourths the length of vulvar lamina, the lobes slender 2
- Vulvar lamina one-third the length of ninth sternum or shorter; its posterior margin medially excised for less than two-thirds the length of vulvar lamina, the lobes strongly rounded 3
2. First pale antehumeral stripe for the greater part as wide as or narrower than the second pale antehumeral stripe immediately in front of humeral suture; the green of metepimeron reaching to aslant hind border *elongata*
- First pale antehumeral stripe for the greater part distinctly wider than the second pale antehumeral stripe; metepimeron with a green band on central part of this sclerite *breviphylla*
3. Labrum with a pair of pale spots; metepimeron largely green *hespera*
- Labrum without pale spots; metepimeron largely brown *speculatrix*

THE *BARTICA* SPECIES GROUP

The sole member of this group, *P. bartica*, differs from all other congeners by the upright standing hairs on the apical segments of the abdomen (except segment 10). The male has the ventral hind border of the tenth abdominal segment of the usual form (fig. 6) but the superior anal appendage differs from all congeners by the presence of a sharp, conical, basal tooth.

Phyllocycla bartica Calvert, 1948
(figs. 6, 17)

Phyllocycla bartica Calvert, 1948: 63—66, pl. 1 figs. 8—15 (♂ ♀ genit., base of hw ♂ and ♀, ♂ app. & apex abd.) — ♂ ♀ Kartabo, Guyana and ♂ ♀ Rio Tapajos, Brazil. Belle, 1970a: 91—93, figs. 140, 141 (♂ app. & apex abd.).

Material. — Brazil: State of Pará, Tapajos River, Itaituba, March 1921, 1 ♂, 1 ♀; April 1921, 1 ♂; May 1922, 2 ♂ (1 ♂ teneral), all A. H. Fassl and all paratypes, SMF but 2 ♂ in AC.

THE *SIGNATA* SPECIES GROUP

The type species of the genus, *P. signata*, is classified here as a separate group. Its female is still unknown (cf. Belle, 1970a: 93, 94). The male is distinguished from all congeners having the ventral hind border of the tenth abdominal segment of the usual form, in not having an inferior tooth or plate-like expansion at the base of the superior appendage.

Phyllocycla signata (Hagen in Selys, 1854)
(figs. 8, 22)

Cyclophylla signata Hagen in Selys, 1854: 77, 78 (58, 59 sep.) — ♂ Brazil. Selys & Hagen, 1858: 480—483 (220—223 sep.), pl. 12 fig. 4 (♂ occiput, genit., app. & apex abd.). Kirby, 1890: 74 (type species). Navás, 1923: 72 (key). Needham, 1943: 201, 202. Chao, 1953: 45.

Phyllocycla signata; Belle, 1970a: 68—70, figs. 102—105 (♂ holotype thorax, occiput, 3rd femur, app. & apex abd.), pl. 10a (wings ♂ holotype).

Material. — Brazil: State of Rio de Janeiro, Bom Jezus do Itabapoana, 15 January 1906, 1 ♂, 17 January 1906, 1 ♂, both J. Zikán, SMF but 1 ♂ in AC.

The depiction of the penile organ published by Fraser (1940: pl. 5 fig. 6) under *Cyclophylla signata* Selys is not of that species as clearly appears on comparison with Hagen's figure 4m (pl. 12) in the *Monographie des Gomphines* of 1858 and with the present fig. 22.

THE PEGASUS SPECIES GROUP

The two species composing this group, *P. pegasus* and *P. medusa*, are bound together by the following two male characters: (1) Inferior margin of superior appendage with a plate-like expansion just beyond the base of the appendage and (2) inner surface of superior appendage with a tubercle or tooth near the upper edge at about mid-length of the appendage.

Phyllocycla pegasus (Selys, 1869)
(figs. 9, 11, 41, 50, 51)

Cyclophylla pegasus Selys, 1869: 195 (32 sep.) — ♂ ♀ Rio Tapajos, State of Pará, Brazil. Calvert, 1948: 66.

Phyllocycla pegasus; Belle, 1970a: 77—79, figs. 116—119 (♂ app. & apex abd., ♀ genit.). St. Quentin, 1973: 346 (key), 348 (♂ Santa Isabel do Morro, State of Goiás, Brazil), fig. 8 (♂ thorax).

Material. — Brazil: State of Mato Grosso, Santa Terezinha, January 1981, 1 ♂, J. H. V. Barbosa, CM.

The present male is very similar to the holotype. The wings are subhyaline, lightly tinged with brown-yellow. In the hind wing, A2 diverges also somewhat from A1 and A3 towards the rear border of the wing. The thoracic colour pattern is developed only on the dorsum of the pterothorax. The pale collar is not interrupted in the middle and connected with the first pale antehumeral stripes as well as with the pale colour of the middorsal carina. The second pale antehumeral stripe is very weakly developed and hardly discernible. St Quentin (1973) gave a diagram of the thoracic colour pattern of the holotype, with the first pale antehumeral stripes and the pale collar not confluent. The type is partly discoloured by post mortem changes but on moistening the insect with alcohol, the first pale antehumeral stripes prove to be connected with the pale collar. The blackish chitinized tip of the posterior hamule is very acute but not discernible in a side view of the abdomen (figs. 50, 51).

The measurements of the male from Santa Terezinha are: Total length 50 mm; abdomen 39 mm (incl. app. 1.6 mm); hind wing 26 mm; costal edge of pterostigma in fore wing 3.9 mm.

Phyllocycla medusa spec. nov.
(figs. 12, 33, 40, 52—56)

Material. — Brazil: State of Pará, Santarem (Amazon River), September 1920, 2 ♂, 1 ♀; April 1921, 2 ♂, 1 ♀, A. H. Fassl, SMF but 2 ♂, 1 ♀ in AC. The chosen male holotype and female allotype are individuals taken in September 1920. The other specimens are paratypes. The holotype is deposited in the Senckenberg Museum, Frankfurt-am-Main, under No. SMF Od 37385.

This species differs from *P. pegasus* by the larger size, the better developed thoracic colour pattern and the much broader lateral dilatations of the eighth abdominal segment in the male (figs. 52, 55). In dorsal view, each male superior anal appendage bends almost regularly inward (fig. 56); it is strongly angular at the point where the appendage bends inward in *P. pegasus*. The blackly chitinized tip of the posterior hamule is rounded and flat (fig. 54); it is very acute in *P. pegasus*.

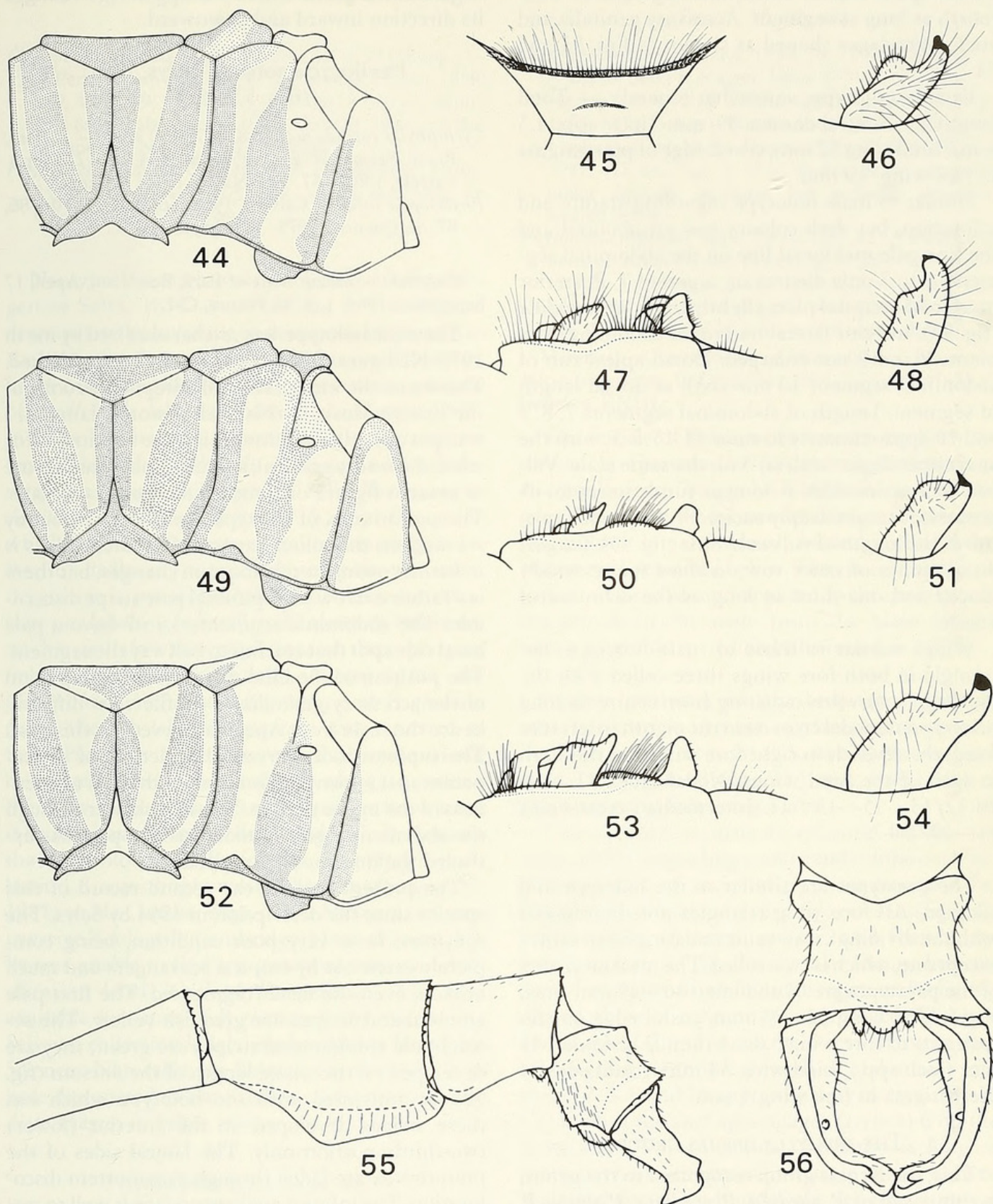
Male (holotype). — Total length 57 mm; abdomen 43.5 mm (incl. app. 2.1 mm); hind wing 31.5 mm; costal edge of pterostigma in fore wing 4 mm.

Labrum brown, its free border brown-yellow. Anteclypeus and external surface of base of mandibles light green. Postero-lateral portion of postclypeus green. Superior surface of frons green for greater anterior part, with brown at base. Vertex brown but concave area between and behind ocellar swellings green. Occipital plate green, its posterior margin straight and fringed with brown hairs.

Pterothorax brown with green, its colour design shaped as shown in diagram (fig. 52). Middorsal carina yellowish green. Legs yellow-brown, the tibiae, tarsi and claws darker. Lamina tibialis of first tibia two-fifths of tibial length. Larger distal spines of outer row on third femur widely spaced and about a quarter as long as the diameter of femur.

Wings with a faint brown tinge. Venation dark brown including frontal margin of costa. Pterostigma brown-yellow. Basal subcostal cross-vein present. Second primary antenodal cross-vein the seventh in left fore wing, the sixth in left hind wing and right fore wing, and the fifth in right hind wing. Nodal index 11:18—19:10/11:13—13:12. Intermedian cross-veins 10—10/7—7. Supratrangles two-celled. Triangle in left fore wing three-celled with the dividing cross-veins radiating from centre. Triangle in right fore wing and in hind wings two-celled. Subtriangle in fore wings two-celled, in hind wings uncrossed. Hind wings with a two-celled anal loop, a four-celled anal triangle and with the posterior part of A2 converging to A3. Second anal interspace of hind wings starting with a single row of cells at anal vein.

Abdomen predominantly brown. Segment 1 and 2 with green middorsum and green side spots. Segment 3 with a pale middorsal line which is broad at base but very fine on the apical three-fourths. Segments 4 to 7 with a fine pale middorsal line. Apical margin of segments 7 to 10 and free border of lateral dilatations of segments 8 and 9 blackish brown. Apical portion of lateral dilatations of segment 8 somewhat drawn inward.



Figs. 44—46. *Phyllocycla malkini*, ♂ from Ecuador: 44, thoracic colour pattern; 45, occipital plate; 46, right posterior genital hamule, ventral view. Figs. 47—49. *Phyllocycla hespera*, ♂: 47, accessory genitalia, right profile view; 48, right posterior genital hamule, ventral view; 49, thoracic colour pattern. Figs. 50, 51. *Phyllocycla pegasus*, ♂: 50, accessory genitalia, right profile view; 51, right posterior genital hamule, ventral view. Figs. 52—56. *Phyllocycla medusa* spec. nov., ♂ holotype: 52, thoracic colour pattern; 53, accessory genitalia, right profile view; 54, right posterior genital hamule, ventral view; 55, apical segments of abdomen and anal appendages, left profile view; 56, tenth abdominal segment and anal appendages, dorsal view.

Dorso-apical rim of abdominal segment 10 one-fourth as long as segment. Accessory genitalia and anal appendages shaped as shown in figs. 53 and 54.

Female (allotype; somewhat teneral). — Total length 53 mm; abdomen 39 mm (incl. app. 1.3 mm); hind wing 32 mm; costal edge of pterostigma in fore wing 3.9 mm.

Similar to male holotype regarding stature and coloration, but dark colours less pronounced and the fine pale middorsal line on the abdominal segments 3 to 7 only distinct on segment 7. Posterior margin of occipital plate slightly concave in middle (fig. 37). Inferior lateral margin of abdominal segments 8 and 9 not enlarged. Dorso-apical rim of abdominal segment 10 one-sixth of dorsal length of segment. Length of abdominal segments 7, 8, 9 and 10 approximately in ratio 18:13:8:5, with the anal appendages (stylets) 5 on the same scale. Vulvar lamina one-fifth as long as ninth sternum, its posterior margin deeply excised V-shaped for two-thirds the length of vulvar lamina (fig. 33). Largest distal spines of outer row on third femur widely spaced and one-third as long as the diameter of femur.

Wings similar to those of male holotype, but triangle in both fore wings three-celled with the dividing cross-veins radiating from centre. Second primary antenodal cross-vein the eighth in left fore wing, the seventh in right fore wing and the sixth in each of the hind wings. Nodal index 11:21—20:12/13 : 15—15 : 11. Intermedian cross-veins 11—10/7—7.

The paratypes are similar to the holotype and allotype. All fore wing triangles are three-celled with the dividing cross-veins radiating from centre except one, which is two-celled. The measurements of the paratypes are: ♂ abdomen 46—49 mm (incl. app.), hind wing 32—33 mm, costal edge of pterostigma in fore wing 3.6—4 mm; ♀ abdomen 41 mm (incl. app.), hind wing 34 mm, costal edge of pterostigma in fore wing 4 mm.

THE DIPHYLLA SPECIES GROUP

This, the largest group recognized in the genus, is composed of *P. sordida*, *P. gladiata*, *P. vesta*, *P. diphylla*, *P. foliata*, *P. brasilia*, *P. argentina* and *P. murrea*. The females of *P. sordida*, *P. gladiata*, *P. foliata* and *P. murrea* are unknown. The male characters in common are: (1) Superior appendage with an inferior plate-like expansion just beyond the base of the appendage and (2) upper carinate margin of superior appendage with a tooth or strong angulation between the base of the appen-

dage and the point where the appendage changes its direction inward and downward.

Phyllocycla sordida (Selys, 1854)

(figs. 57—61)

Cyclophylla sordida Selys, 1854: 78 (59 sep.) — ♂ Pará, Brazil. Selys & Hagen, 1858: 483, 484 (223, 224 sep.). Calvert, 1905: 157, 158. Navás, 1916: 72 (key). *Phyllocycla sordida*; Calvert, 1948: 66. Belle, 1970a: 86, 87. St. Quentin, 1973: 347 (key).

Material. — Brazil: State of Pará, Boa Vista, Apeú, 17 September 1964, 1 ♂, W. Franca, CM.

The male holotype was re-characterized by me in 1970. No figures of it have hitherto been published. Thanks to the kindness of Mr Stephen Brooks of the British Museum (Natural History), London, I was permitted to borrow this type specimen, for which I am very grateful, because it now enables me to present figures of some of its structural details. The pterothorax of the type is partly eaten out by scavengers; the colour pattern of its lateral sides is indistinct owing to postmortem changes, but there is a rather narrow mesepimeral pale stripe discernible. The abdominal segments 3 to 7 have a pale basal side spot that reaches to halfway the segment. The position of the hind wings makes a depiction of the accessory genitalia in profile view difficult, hence the male from Apeú has served for this goal. The superior tooth on one-third length of the superior anal appendage is no more than an unevenness of the upper margin. The fine skewer through the abdomen to give it additional support has extruded the inferior anal appendage.

The present male is the second record of this species since the description in 1854 by Selys. The specimen is in very poor condition, being completely eaten out by tropical scavengers and much broken, even the head fragmented. The first pale antehumeral stripes are greenish yellow. The second pale antehumeral stripes are green; they are developed on the whole length of the dorsum (fig. 58) as contrasted with the holotype which has these stripes developed on the anterior (lower) two-thirds portion only. The lateral sides of the pterothorax are faded through postmortem discoloration. The inferior anal appendage is well to see; its posterior margin is deeply excised V-shaped.

The accessory genitalia of *P. sordida* resemble that of *P. gladiata* but the incurved black tip of the posterior hamule of *P. sordida* is longer, very acute and discernible in a side view of the abdomen (fig. 62). The longest spines of the outer row on the third femur are about one-third of the diameter of the femur.

***Phyllocycla gladiata* (Hagen in Selys, 1854)**
(fig. 63)

Cyclophylla gladiata Hagen in Selys, 1854: 77 (58 sep.) — ♂ Pernambuco (Recife), Brazil. Selys & Hagen, 1858: 479, 480 (219, 220 sep.), pl. 12 figs. 3 (♂ occ., genit., app. & apex abd.). Selys, 1873a: 766 (38, 39 sep.; ♂ Rio de Janeiro), Navás, 1916, 72 (key).

Phyllocycla gladiata; Calvert, 1948: 65, 66. Belle, 1970a: 83, 84, figs. 129—132 (♂ genit., app. & apex abd.). St. Quentin, 1973: 347 (key).

Neotype designation of *Cyclophylla gladiata* Hagen in Selys, 1854. — According to the original description the holotype of this species belonged to the collection formerly owned by Hagen. However, in the Selysian collection at Brussels there is a male of *Phyllocycla*, labelled "Cyclophylla elongata S ♂" in Selys' handwriting, that exactly fits the original description of *Phyllocycla gladiata* and its redescription in Selys & Hagen's (1858) *Monographie des Gomphines* (cf. Belle, 1970: 83). The male, which is also from the type locality Pernambuco (= Recife) in Brazil, is probably the holotype itself. Because it is not improbable that the identification pin labels "gladiata" and "elongata" were interchanged after that depictions of the type specimens were made for the *Monographie des Gomphines*, and that the holotype of *P. gladiata* (with the pin label "elongata") was returned to Selys. However, the holotype of *P. elongata* cannot be located as well (see under *P. elongata*, anteà). Probably Hagen retained this type specimen since it should have been labelled "gladiata". Presuming that the holotype of *P. elongata* is in Hagen's collection, I accordingly wrote about it (January 27, 1987) to Mr Charles Vogt, of the Museum of Comparative Zoology in Cambridge, Massachusetts, but he was unable to find any gomphid with the identification label "*Cyclophylla gladiata*". The only available specimen of *P. gladiata* is the male in the Selysian collection lodged in the Institut Royal des Sciences Naturelles de Belgique at Brussels. It is here designated as the neotype of *Cyclophylla gladiata* Hagen in Selys, 1854.

***Phyllocycla vesta* Belle, 1972**
(fig. 26)

Phyllocycla vesta Belle, 1972a 227—230, figs. 19—25 (♂ thorax, genit., app. & apex abd.; ♀ genit. & apex abd.) — ♂ ♀ San Fernando, Prov. of Buenos Aires, Argentina. Paulson, 1977: 176 (distrib.).

Material. — Argentina: Prov. of Buenos Aires, Formosa, 1 February 1918, 1 ♀, Jörgensen, SMF; Punta Chica, 19 January 1952, 1 ♂ (teneral), Gloger, UCV.

***Phyllocycla diphylla* (Selys, 1854)**
(figs. 7, 30, 38, 42)

Cyclophylla diphylla Selys, 1854: 76, 77 (57, 58 sep.) — ♂ Brazil. Selys & Hagen, 1858: 477—479 (217—219 sep.), pl. 12 fig. 2 (♂ occiput, app. & apex abd.). Selys, 1878: 665 (75 sep.). Needham, 1903: 710, pl. 34 fig. 1 (photogr. wings ♂). Navás, 1916: 72 (key). Fraser, 1947: 441, 442, figs. a—d (♂ thorax, penis, apex abd., under *diphylla argentina* but probably *argentina* treated below).

Phyllocycla diphylla; Belle, 1970a: 79—82 (♂ Piracicaba, State of Minas Gerais, Brazil), figs. 120—125 (♂ lectotype, 3rd femur, genit., app. & apex abd.), figs. 126—128 (Piracicaba ♂ genit., 3rd femur). St. Quentin, 1973: 347 (key; ♂ ♀ State of Alagoas, Brazil).

Material. — Brazil: State of Minas Gerais, Piracicaba Mirin (riverside), 19 December 1954, 1 ♀ (teneral), D. C. Geijskes, RNHL.

The female of this species has not yet been described. St. Quentin (1973) did record a female of *P. diphylla* from "Engenho Riachao", State of Alagoas, Brazil, but he did not describe or illustrate it. The present female, recently located in the Leyden Museum, is described below. The specimen is from collection Geijskes and apparently the corresponding female of the male from the same locality which I have discussed and illustrated in 1970.

Female (hitherto undescribed; teneral, somewhat flattened and broken in pieces but complete). — Total length 49 mm; abdomen 35.5 mm (incl. app. 1.5 mm); hind wing 32.5 mm; costal edge of pterostigma in fore wing 5 mm.

Very similar to male from same locality (cf. Belle, 1970a) regarding stature and coloration. Posterior margin of occipital plate, in frontal view, straight, in dorsal view, evenly concave (fig. 38). Distal spines of outer row on third femur one-fourth as long as the diameter of femur. Inferior lateral margins of abdominal segment 8 slightly dilated, those of segment 9 not enlarged. Width of dorsal apical rim of segment 10 one-sixth the dorsal length of segment. Length of abdominal segments 7, 8, 9 and 10 approximately in ratio 18 : 11 : 7 : 6, with the anal appendages (stylets) 6 on the same scale. Vulvar lamina two-fifths as long as ninth sternum, its posterior margin deeply excised V-shaped for three-fourths the length of vulvar lamina (fig. 30).

Wings clear. Frontal margin of costa yellow. Triangle in fore wings three-celled, the dividing cross-veins parallel. Supratrangles, subtriangle in fore wings and triangle in hind wings two-celled. Subtriangle in hind wings uncrossed. Second primary antenodal cross-vein the seventh in right fore wing and left hind wing, the sixth in other wings.

Nodal index 10 : 19—19 : 11/10 : 14—13 : 10.
 Intermedian cross-veins 10—9/6—6.

***Phyllocycla foliata* spec. nov.**
 (figs. 27, 64—67)

Material. — Argentina: Prov. of Misiones, Parque Nacional Iguazú, 22 January 1979, 2 ♂, G. Jurzitza. Holotype in CJ, paratype in AC.

Phyllocycla foliata is closely related to *P. argentina*, but it is a more robust and somewhat darker species. The lateral dilatations of the abdominal segment 8 and 9 of the male are much better developed than in *P. argentina* (fig. 65), that of segment 9 is about half as wide as that of segment 8; in *P. argentina*, one-third as wide as that of segment 8 or narrower. The truncated, black chitinized tip of the posterior genital hamule has a distinct posterior point, but no evident anterior point (fig. 67); the truncated tip is distinctly two-pointed in *P. argentina*.

Male (holotype; an aged individual). — Total length 55 mm; abdomen 43 mm (incl. app. 2 mm); hind wing 32 mm; costal edge of pterostigma in fore wing 4.1 mm.

Face predominantly light green but base of labrum, transverse middle portion of postclypeus and vertical portion of frons darker coloured. Superior surface of frons light green with a narrow brown basal band. Vertex brown but concave area between and behind ocellar swellings light green. Occipital plate light green, its posterior margin slightly and evenly concave, and fringed with rather short dark brown hairs.

Dorsum of prothorax dark brown with a green twin-spot on middle lobe. Pterothorax dark brown with light green but green colour becoming lighter on dorsum. Colour design of pterothorax shaped as in *P. argentina*.

Femora brown on basal half, becoming black-brown towards knee. Tibiae, tarsi and claws black. Number of larger spines on distal half of outer row on third femur 8 to 9 (in *P. argentina* an average of 5). Lamina tibialis of first tibia two-fifths the tibial length.

Wings with brown tinge. Venation dark brown but frontal margin of costa with a yellow line. Pterostigma brown. A basal subcostal cross-vein in all wings. Second primary antenodal cross-vein the fifth in left hind wing, the seventh in left fore wing and the sixth in each of the right wings. All discoidal triangles, subtriangles and supratrangles two-celled but subtriangle in hind wings uncrossed. Nodal index 10 : 17—17 : 8/10 : 12—12 : 11.

Intermedian cross-veins 8—8/7—7. Hind wing with a single row of cells in second anal interspace, a four-celled anal triangle, a two-celled anal loop, and distal portion of A2 strongly convergent with A3 towards anal angle of wing.

Abdomen predominantly dark brown. Segment 2 with light green auricles and light green middorsal stripe. Side of segments 3 to 7 with lighter brown basal marking, that of segment 7 reaching to mid-length of segment. Segment 8 to 10 also with lighter brown side markings. Lateral dilatations of segment 8 largely black-brown, those of segment 9 largely pale yellow (brownish at base of segment). Dorsal apical rim of segment 10 about a quarter the length of segment. Accessory genitalia shaped as shown in figs. 64, 66 and 67. Seminal vesicle very pointed in profile view, the median cleft with a stout tubercle on bottom.

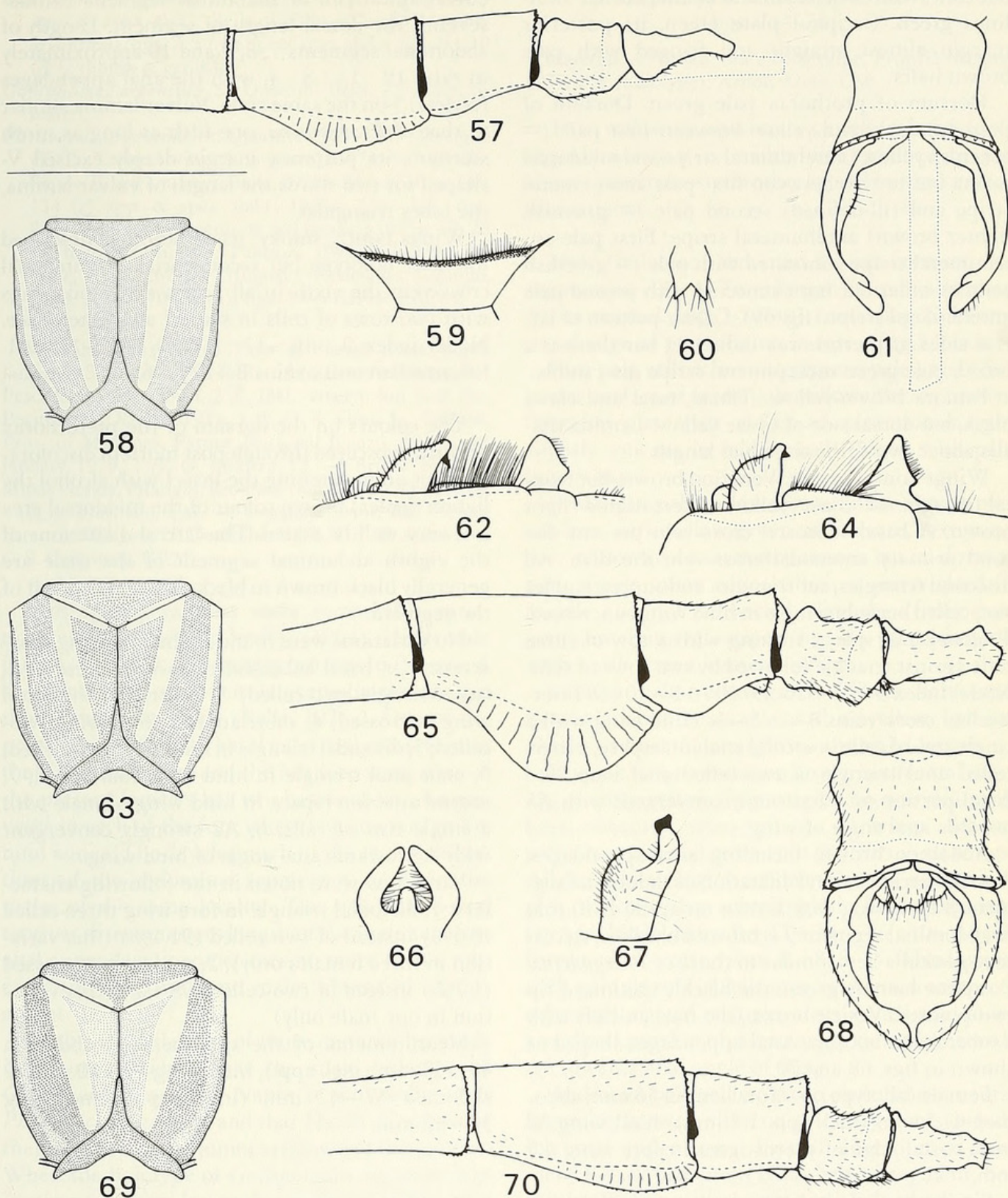
***Phyllocycla brasilia* spec. nov.**
 (figs. 25, 43, 68—70)

Material. — Brazil: State of Sergipe, Propriá, June 1979, 1 ♂; July 1979, 3 ♂, 3 ♀; August 1979, 15 ♂, 6 ♀, all Arnon Alves, CM but 3 ♂, 2 ♀ in AC. The chosen holotype (♂) and allotype (♀) are individuals taken in July 1979; they are deposited in the collection of Prof. Machado (Belo Horizonte). A number of specimens are partly or largely mouldy.

This species is very closely related to *P. argentina* but it is distinguished in having the dark colour between the first pale antehumeral stripe and the middorsal thoracic carina lighter than the dark colour between the first and second pale antehumeral stripes; in *P. argentina*, the dark colour is equal in dullness at each side of the first pale antehumeral stripe. The second pale antehumeral stripe immediately in front of the humeral suture is ill-defined and indistinct; it is well-defined in *P. argentina*. Three notable morphological differences distinguish the male from that of *P. argentina*: (1) The lateral dilatation of the eighth abdominal segment is much narrower than in *P. argentina* (fig. 70); (2) the plate-like downward expansion at the base of each superior anal appendage is produced to a sharply margined tooth; it is not forming a tooth-like bulge in *P. argentina*; (3) the posterior dorsal margin of segment 10 is strongly concave (fig. 68); it is slightly concave in *P. argentina*.

Male (holotype). — Total length 56 mm; abdomen 43 mm (incl. app. 1.8 mm); hind wing 29.5 mm; costal edge of pterostigma in fore wing 4 mm.

Face pale green. Superior surface of frons largely pale green, becoming brown at base. Vertex brown



Figs. 57—61. *Phyllocycla sordida*: 57, apical segments of abdomen and anal appendages, left lateral view (♂ holotype); 58, colour pattern of thoracic dorsum (♂ from Apeú); 59, occipital plate (♂ holotype); 60, inferior anal appendage, dorsal view (♂ from Apeú); 61, tenth abdominal segment and anal appendages, dorsal view (♂ holotype); 62, accessory genitalia, right profile view (♂ from Apeú). Fig. 63. *Phyllocycla gladiata*, ♂ neotype. Thoracic colour pattern. Figs. 64—67. *Phyllocycla foliata* spec. nov., ♂ holotype: 64, accessory genitalia, right profile view; 65, apical segments of abdomen and anal appendages, left profile view; 66, seminal vesicle, caudal view; 67, right posterior genital hamule, ventral view. Figs. 68—70. *Phyllocycla brasilia* spec. nov., ♂ holotype: 68, tenth abdominal segment and anal appendages, dorsal view; 69, colour pattern of thoracic dorsum; 70, apical segments of abdomen and anal appendages, left profile view.

but concave area between and behind ocellar swellings green. Occipital plate green, its posterior margin almost straight and fringed with pale brown hairs.

Dorsum of prothorax pale green. Dorsum of pterothorax brown-yellow between first pale (= greenish yellow) antehumeral stripe and middorsal carina but brown between first pale antehumeral stripe and (ill-defined) second pale (= greenish lighter brown) antehumeral stripe. First pale antehumeral stripe connected with pale (= greenish yellow) collar but not connected with second pale antehumeral stripe (fig. 69). Colour pattern of lateral sides of pterothorax indistinct but there is a broad, pale green mesepimeral stripe discernible.

Femora brown-yellow. Tibiae, tarsi and claws black, but dorsal side of tibiae yellow. Lamina tibialis about two-fifths the tibial length.

Wings faintly smoky. Venation brown, but frontal margin of costa yellow. Pterostigma light brown. A basal subcostal cross-vein present. Second primary antenodal cross-vein the fifth. All discoidal triangles, subtriangles and supratrangles two-celled but subtriangle in hind wings uncrossed. Trigonal interspaces starting with a row of three cells against triangle followed by two rows of cells. Nodal index 9 : 15—16 : 9/10 : 11—10 : 9. Intermedian cross-veins 8—9/5—5. Hind wing with a single row of cells in second anal interspace, a four-celled anal triangle, a two-celled anal loop, and distal portion of A2 strongly convergent with A3 towards anal angle of wing.

Abdomen brown, including anal appendages. Auricles green. Lateral dilatation of abdominal segment 8 becoming dark brown on apical half, that of abdominal segment 9 is brownish yellow. Accessory genitalia very similar to those of *P. argentina*. Posterior hamule green, the blackly chitinized tip two-pointed. Vesicle brown, the median cleft with a tubercle on bottom. Anal appendages shaped as shown in figs. 68 and 70.

Female (allotype). — Total length 56 mm; abdomen 41.5 mm (incl. app. 1.4 mm); hind wing 32 mm; costal edge of pterostigma in fore wing 4.5 mm.

Similar to male holotype in stature and coloration. Posterior margin of occipital plate slightly concave and fringed with rather short brown hairs. Largest spines of outer row on third femur slightly longer than a quarter the diameter of femur. Inferior lateral margin of abdominal segment 8 slightly dilated and provided with small black denticles for the apical two-thirds (left side) or more (right side). Inferior lateral margin of abdominal segment 9 not dilated and not denticulated. Width of

dorsal apical rim of abdominal segment 10 one-seventh the dorsal length of segment. Length of abdominal segments 7, 8, 9 and 10 approximately in ratio 19 : 13 : 8 : 4, with the anal appendages (stylets) 5 on the same scale. Vulvar lamina similar to that of *P. argentina*, one-fifth as long as ninth sternum, its posterior margin deeply excised V-shaped for two-thirds the length of vulvar lamina, the lobes triangular.

Wings faintly smoky, its venation as described for male holotype but second primary antenodal cross-vein the sixth in all wings and hind wings with two rows of cells in second anal interspace. Nodal index 9 : 16—17 : 11/10 : 12—12 : 11. Intermedian cross-veins 8—8/5—6.

The colours on the dorsum of the pterothorax are often obscured through post mortem discoloration but on moistening the insect with alcohol the lighter (paler) brown colour of the middorsal area can very well be stated. The lateral dilatations of the eighth abdominal segment of the male are generally black-brown to black on the apical half of the segment.

No variations were found in the following characters: 1, a basal subcostal cross-vein present; 2, supratriangle two-celled; 3, subtriangle in hind wing uncrossed; 4, subtriangle in fore wing two-celled; 5, discoidal triangle in hind wing two-celled; 6, male anal triangle in hind wing four-celled; 7, second anal interspace in hind wing of male with a single row of cells; 8, A2 strongly convergent with A3 towards anal angle of hind wing.

Variations were noted in the following characters: 1, discoidal triangle in fore wing three-celled (8.6%) instead of two-celled (91.4%) (this variation in three females only); 2, anal loop uncrossed (1.7%) instead of two-celled (98.3%) (this variation in one male only).

Measurements of the specimens: ♂ abdomen 40—43 mm (incl. app.), hind wing 29—30 mm; ♀ abdomen 37—42 mm (incl. app.), hind wing 30—32 mm.

Phyllocycla argentina (Hagen in Selys, 1878) (figs. 28, 76—79)

Cyclophylla argentina Hagen in Selys, 1878: 665 (73, 74 sep.) — ♂ ♀ Córdoba, Argentina. Ris, 1904: 18—20 (♂ ♀ Tigre, Prov. of Buenos Aires, Argentina); 1913: 74, figs. 12, 13 (♂ thorax & apex abd.). Navás, 1917: 187 (Santa Fe, Argentina); 1927: 23 (Martínez, Argentina). Fraser, 1947: 441, 442, figs. a—d (penis, ♂ thorax & apex abd., under *C. diphylla argentina*). Calvert, 1948: 66.

Gomphoides eugeniae; Navás, 1927: 23—25, fig. 9 (♂ app. & apex abd.). Belle, 1970b: 255—257 (partly *argentina*), figs. 2, 3 (♂ app. & apex abd.), figs. 6—10 (♂ ♀ thorax & genit.).

Gomphoides argentina; St. Quentin, 1938: 227 (lam. tibialis).

Phyllocycla argentina; St. Quentin, 1967: 144, 145, fig. 6 (T, Ti, Ts hind wing ♂, ♀ genit.); 1973: 347 (♂ div. States, Brazil and key). Belle, 1970a: 84—86, figs. 133, 134 (♂ app. & apex abd.); 1972a: 230—233, figs. 26—29 (♀ thorax, genit. & 3rd femur); 1975a: 27, 28 (♂ holotype thorax). Paulson, 1977: 176 (distrib.) Belle, 1981: 262 (♂ Uruguay). Rodrigues Capitulo, 1983: 267—270 (larva), figs. 1—6 (larval struct.).

Material. — Argentina: Prov. of Buenos Aires, Tigre, January 1891, 1 ♂, 1 ♀, F. Ris, AC; Prov. of Salta, Río Pescado, 24 May 1970, 2 ♂, IML; river 6 km S of Est. Pocitos, 15 October 1973, 1 ♂, O. S. Flint, Jr., USNM; Prov. of Misiones, Parque Nacional Iguazú, Aepú, 24 January 1979, 1 ♂, G. Jurzitza, CJ. — Brazil: State of Minas Gerais, Pitangui, Rio Pará (km 49), 10 April 1972, 1 ♂, A. Machado, CM. — Uruguay: Dept. Río Negro, Estancia Morgan, 17 December 1968, 1 ♂, F. Achaval & C. S. Carbonell, URM.

This species exhibits some remarkable variations as already stated by Ris (1904). His female form a, however, presumably belongs to *P. vesta*. A basal subcostal cross-vein is normally present but the holotype has none (Belle, 1975a). One of the present males has no basal subcostal cross-vein in the right hind wing and the left fore wing. One of the present females has two basal subcostal cross-veins in each of the fore wings but no extra in the hind wings. The development of the lateral dilations of the abdominal segment 8 varies in the males of the same locality. The subapical dorsal tooth at three-quarters length of the male superior anal appendage is sometimes no more than a tubercle and even in some males absent or almost absent.

With the availability of more material for study it becomes evident that the male holotype of *Gomphoides eugeniae* Navás is conspecific with *Phyllocycla argentina* and that Navás' *G. eugeniae* therefore becomes a junior synonym of this species. When the holotype of *Gomphoides eugeniae* was in my possession for study (cf. Belle, 1970b), the terminal segments of the abdomen were lacking. The type specimen was complete when Williamson borrowed it. Fortunately, Miss Grace Eager, Michigan Museum artist at that time, had made drawings of its accessory genitalia and apical segments of the abdomen. Mrs Gloyd (Ann Arbor) was kind enough to send me photographs of these drawings for publication (figs. 77—79).

Phyllocycla murrea spec. nov. (figs. 71—74)

Material. — Brazil: State of Sergipe, Propriá, August 1979, 1 ♂ (holotype), Arnon Alves, CM.

This yellowish species is closely related to *P. argentina*, but it is readily distinguished by the almost patternless pterothorax and by the smaller pterostigma.

Male (holotype; abdomen broken between the segments 4—5). — Total length 50 mm; abdomen 39.5 mm (incl. app. 1.5 mm), hind wing 27.5 mm; costal edge of pterostigma in fore wing 3.5 mm.

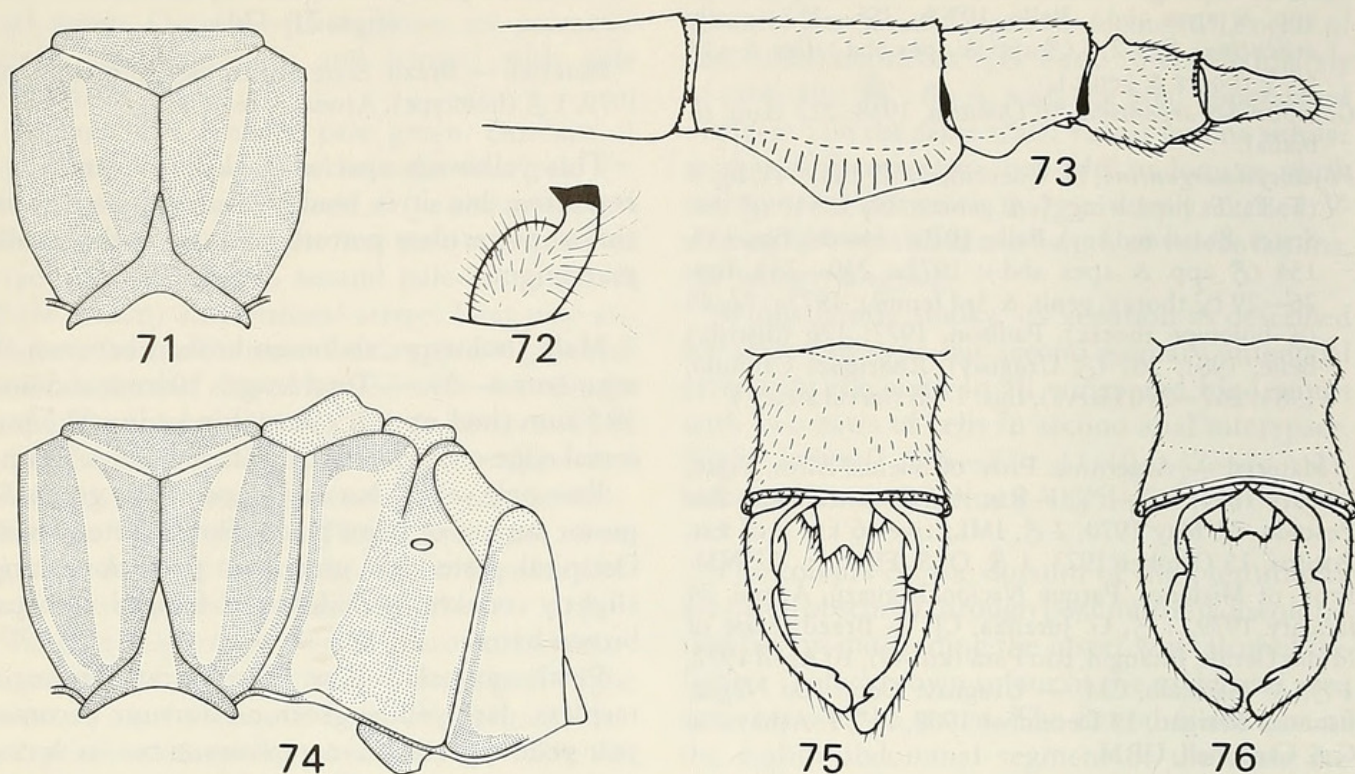
Face pale yellow but anteclypeus pale green. Superior surface of frons pale yellow. Vertex brown. Occipital plate pale green, its posterior margin slightly concave in middle and fringed with pale brown hairs.

Prothorax pale yellow. Pterothorax almost patternless, dark yellow-green on dorsum, becoming pale yellow-green on metepimeron but its dorsum with a pale green collar which is interrupted in middle and not connected with the (first) pale green antehumeral stripes (fig. 71). Mesepimeron with a pale green humeral stripe.

Femora pale yellow-green. Tibiae, tarsi and claws black but dorsal side of tibiae yellow. Lamina tibialis of first tibia two-fifths the tibial length.

Wings clear, its venation brown but frontal margin of costa yellow. Pterostigma brown-yellow. A basal subcostal cross-vein in all wings. Second primary antenodal cross-vein the fifth in all wings. All discoidal triangles, subtriangles and supratrangles two-celled but subtriangle in hind wings uncrossed. Nodal index 8—13—14 : 7/9 : 10—10 : 9. Intermedian cross-veins 8—8/6—5. Hind wing with a single row of cells in second anal interspace, a four-celled anal triangle, a two-celled anal loop, and distal portion of A2 strongly convergent with A3 towards anal angle of wing.

Abdomen pale yellow-green on basal segments, becoming brown-yellow on apical segments including anal appendages. Lateral dilatation of segment 8 dark brown on basal half of segment, becoming brown-yellow on apical half of segment. Lateral dilatation of segment 9 pale yellow. Apical segments with black nodules and black denticles along posterior dorsal margin. Posterior dorsal margin of segment 10 also black. Dorsum of segments 5 to 8 with an apical pair of small round brown spots. Accessory genitalia resembling those of *P. argentina* but truncated tip of posterior hamule with the anterior point better developed than



Figs. 71—74. *Phyllocycla murrea* spec. nov., ♂ holotype: 71, colour pattern of thoracic dorsum; 72, right posterior genital hamule, ventral view; 73, apical segments of abdomen and anal appendages, left profile view; 74, tenth abdominal segment and anal appendages, dorsal view. Figs. 75, 76. *Phyllocycla argentina*, ♂ from Salta: 75, thoracic colour pattern; 76, tenth abdominal segment and anal appendages, dorsal view.

the posterior point (fig. 72). Median cleft of vesicle with a small tubercle on bottom. Apical segments of abdomen and anal appendages shaped as shown by figs. 73 and 74.

THE OPHIS SPECIES GROUP

Included here are *P. ophis*, *P. modesta* and *P. baria*. The female of *P. baria* is unknown. The male characters of the members of this group are: (1) Superior appendage with an inferior plate-like expansion just beyond base of appendage and (2) superior appendage with a simply carinate upper margin between base of appendage and the point where the appendage changes its direction inward and downward (cf. Belle, 1987).

Phyllocycla ophis (Selys, 1869) (figs. 10, 21)

Cyclophylla ophis Selys, 1869: 193, 194 (30, 31 sep.) — ♂ Rio Tapajos, Amazon region, Brazil.

Cyclophylla pachystyla; Needham, 1944: 204—207 (♂ Surinam, ♀ Jari River, Território do Amapá, Brazil. Exuviae?), pl. 15 fig. 11 (♂ genit., app. & apex abd.), fig. 12 (labium larva).

Phyllocycla pachystyla; Calvert, 1948: 66.

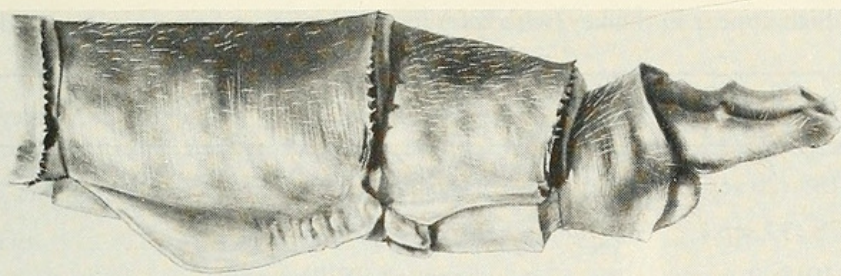
Phyllocycla ophis; Calvert, 1948: 65. Belle, 1970a: figs. 135—139 (thorax, ♂ app. & apex abd., ♀ apex abd.,

labium larva), pl. 12a (photogr. exuviae); 1977b: 290. St. Quentin, 1973: 347 (key).

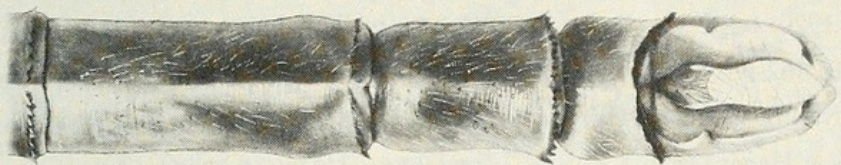
Material. — Brazil: State of Pará, Tapajos (Amazon region), Cachoeira I, May 1920, 1 ♂; Tapajos, Itaituba, April 1921, 1 ♂ (teneral), 4 ♀ (3 ♀ teneral), all A. H. Fassl, SMF; Rio Paru, 3 January 1941, 1 ♂, L. Schmidt, FSCA. — Guyana: Tumatumari, 1 February 1912, 1 ♀; 7 February 1912, 4 ♂; 9 February 1912, 1 ♂; Potaro River (near mouth), 4 February 1912, 1 ♂, all B. J. Rainey, L. A. & E. B. Williamson, UMAA but 1 ♂ in AC. — Surinam: Marowijne River, Poeloegoedoe, 15 October 1940, 1 ♀, L. Schmidt, FSCA. — Venezuela: State of Bolívar, Puerto Ordaz, Parque Punta Vista (lagune 10 m), 5 September 1974, 1 ♂ (teneral), G. von Rosen, in collection GvRosen (No. 4092).

Dr Gert von Rosen (München) has made a colour slide of his teneral specimen before collecting it. The male shows well-developed first pale antehumeral stripes but no second pale antehumeral stripes. These stripes, and also the pale lateral stripes of the pterothorax, are hardly developed in newly hatched and teneral specimens as several times stated by myself in Surinam specimens.

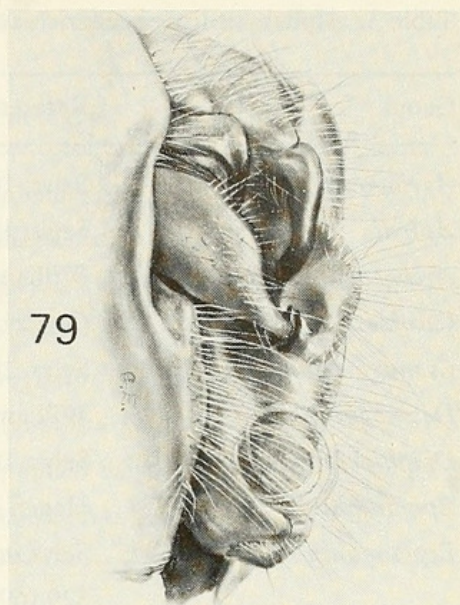
The triangular envelope of one of the males taken at Tumatumari has the field note "This Gomphine rests on vegetation along path, along river above Tumatumari".



77



78



79

Figs. 77—79. *Gomphoides eugenia* Navás, ♂ holotype (After Grace Eager, 1935): 77, apical segments of abdomen and anal appendages, left profile view; 78, the same, dorsal view; 79, accessory genitalia, viewed in oblique direction from right.

***Phyllocycla modesta* Belle, 1970**
(fig. 20)

Phyllocycla modesta Belle, 1970a: 70—74, figs. 106—111 (thorax, occiput, ♂ app., ♂ ♀ apex abd., larval struct.), pl. 10b, 11a (♂ ♀ photogr. wings), 12b (photogr. exuviae) — ♂ ♀ Surinam; 1972a: 227; 1977b: 291. St. Quentin, 1973: 346 (key), 348 (♂ State of Pará, Brazil).

Material. — Guyana: Wismar, 31 January 1912, 1 ♂, B. J. Rainey, L. A. & E. B. Williamson, UMAA. — Surinam: Coppename River, 3 February 1965, 1 ♀, P. J. M. Maas & P. A. Florschütz, RNHL. — Venezuela: Territorio Federal Amazonas, Río Mawarinuma (140 m, 0° 55' N — 66° 10' W), 2—12 February 1984, 1 ♂ A. Chacon & L. J. Joly, UCV.

***Phyllocycla baria* Belle, 1987**

Phyllocycla baria Belle 1987: 49, 50, figs. 1—7 (thorax, occiput, genit., app. & apex abd.) — Río Baria, TFA, Venezuela.

APPENDIX

KEY TO THE GENERA OF NEOTROPICAL GOMPHIDAE

The advance in our knowledge of the Neotropical Gomphidae has been considerable during the past four decennia and among others it has led to the naming of a number of new genera and subgenera. Therefore, it has been necessary to give close heed to a key of the genera of the Neotropical Gomphidae that is up to date. In the following pages an attempt to such a key is undertaken.

The first key to the genera of Neotropical Gomphidae is that of Navás (1916). He lists 10 genera but two are not Neotropical while three others (*Cyanogomphus*, *Erpetogomphus* and *Neogomphus*) are omitted. For his key Navás used venational, colour and morphological characters. The key is by far insufficient.

The second key to the genera of Neotropical Gomphidae is that of Needham (1940) which includes 16 genera. The key is entirely based on the wing venation but, although much more workable than that of Navás, it is insufficient as it fails to take into account several of the infrageneric variability. Needham supplemented his key with a verification table. Of the 16 genera listed by him, two (*Ammogomphus* and *Ischnogomphus*) have subsequently been reduced to synonymy, and two (*Cacus* and *Cyclophylla*) have been renamed.

The third key to the genera of Neotropical Gomphidae is that of St. Quentin (1973). He lists 19 genera which he placed in the three subfamilies Lindeniinae, Epigomphinae and Gomphinae. The principal characters appearing in his key are those of the wing venation, but a few characters of the head and the abdomen are also used. The key is inadequate because the criteria in some couplets are vague and/or controversial. Of the 19 genera listed by St. Quentin, two (*Ebegomphus* and *Ischnogomphus*) have been reduced to synonymy.

Finally, also Carle's (1986) key to the subfamilies and tribes of the Gomphidae is of importance. Some new characters recognized by him are valuable for the generic determination of Neotropical Gomphidae.

Table 3. Alphabetic list of generic names which appear in the key, with reference and type species.

Genus	Reference	Type species
<i>Agriogomphus</i>	Selys, 1869: 189 (26 sep.)	<i>sylicola</i> Selys
<i>Aphylla</i>	Selys, 1854: 78 (59 sep.)	<i>brevipes</i> Selys
<i>Archaeogomphus</i>	Williamson, 1919: 2	<i>hamatus</i> (Williamson)
<i>Cacoides</i>	Cowley, 1934: 201	<i>latro</i> (Erichson)
<i>Cyanogomphus</i>	Selys, 1873a: 753 (26 sep.)	<i>waltheri</i> Selys
<i>Desmogomphus</i>	Williamson, 1920: 1	<i>tigrivensis</i> Williamson
<i>Diaphlebia</i>	Selys, 1854: 81 (62 sep.)	<i>angustipennis</i> Selys
<i>Epigomphus</i>	Hagen in Selys, 1854: 59 (40 sep.)	<i>paludosus</i> Hagen in Selys
<i>Erpetogomphus</i>	Selys in Selys & Hagen, 1858: 329 (69 sep.)	<i>crotalinus</i> (Hagen in Selys)
<i>Gomphoides</i>	Selys, 1854: 73 (54 sep.)	<i>infumata</i> (Rambur)
<i>Idiogomphoides</i>	Belle, 1984: 106	<i>demoulini</i> (St. Quentin)
<i>Melanocacus</i>	Belle, 1986: 97	<i>mungo</i> (Needham)
<i>Mitragomphus</i>	Needham, 1944: 215	<i>ganzanus</i> Needham
<i>Neogomphus</i>	Selys in Selys & Hagen, 1858: 159 (419 sep.)	<i>molestus</i> (Hagen in Selys)
<i>Perigomphus</i>	Belle, 1972b: 64	<i>pallidistylus</i> Belle
<i>Peruviogomphus</i>	Klots, 1944: 3	<i>moyobambus</i> Klots
<i>Phyllocycla</i>	Calvert, 1948: 62	<i>signata</i> (Hagen in Selys)
<i>Phyllogomphoides</i>	Belle, 1970a: 112	<i>fuliginosus</i> (Hagen in Selys)
<i>Progomphus</i>	Selys, 1854: 69 (50 sep.)	<i>gracilis</i> Hagen in Selys
<i>Zonophora</i>	Selys, 1854: 80 (61 sep.)	<i>campanulata</i> (Burmeister)

The present key covers 20 genera (for the approximately 235 species and subspecies). Belle's (1972b) subgenus *Perigomphus* is raised here to generic rank, but Kennedy's (1946) subgenus *Eugomphus* is left out of consideration because of its disputable status. The (valid) generic names which appear in the key are listed in table 3. Five of the remaining seven generic names listed in table 4 have been reduced to synonymy and two have been renamed. The key must be used with some caution since the females of *Mitragomphus* and *Perigomphus* are unknown, and only a single male is known of each of the genera *Mitragomphus* and *Idiogomphoides*. Several characters are illustrated. The term "usually" as employed in the key means that, by way of exception, the feature lacks in one of the wings indicated.

- 1. Hind wing with second primary antenodal cross-vein about mid-way between first prim-

- ary antenodal cross-vein and nodus *Neogomphus*
- Hind wing with second primary antenodal cross-vein distinctly nearer to first primary antenodal cross-vein than to nodus 2
- 2. Occipital crest not ridged 3
- Occipital crest ridged 7
- 3. Wings usually with 2—3 cubito-anal cross-veins *Epigomphus*
- Wings with 1 cubito-anal cross-vein 4
- 4. Basal subcostal cross-vein usually present 5
- Basal subcostal cross-vein absent 6
- 5. Rear of head with a pair of spines near foramen; male anal triangle in hind wing absent; vulvar lamina not extending to beyond middle of ninth sternum *Agriogomphus*
- Rear of head without a pair of spines near foramen; male anal triangle in hind wing present; vulvar lamina extending to or beyond middle of ninth sternum *Cyanogomphus*

Table 4. Alphabetic list of generic names which do not appear in the key, with reference and present status.

Genus	Reference	Present status
<i>Ammogomphus</i>	Förster, 1914: 73	<i>Gomphoides</i> Selys
<i>Cacus</i>	Selys, 1854: 97 (78 sep.)	<i>Cacoides</i> Cowley
<i>Cyclophylla</i>	Selys, 1854: 76 (57 sep.)	<i>Phyllocycla</i> Calvert
<i>Ebegomphus</i>	Needham, 1944: 186	<i>Cyanogomphus</i> Selys
<i>Herpetogomphus</i>	Selys, 1879: 6 (2 sep.) (LXIII sep.)	<i>Erpetogomphus</i> Selys
<i>Ischnogomphus</i>	Williamson, 1918: 6	<i>Agriogomphus</i> Selys
<i>Negomphoides</i>	Muttkowski, 1910: 81	<i>Gomphoides</i> Selys
<i>Strumagomphus</i>	Needham, 1944: 180	<i>Cyanogomphus</i> Selys

6. Male anal triangle in hind wing absent; vulvar lamina with two, very slender, close-laid, tapering branches which extend from base to beyond apex of ninth sternum *Archaeogomphus*
- Male anal triangle in hind wing present; female unknown *Perigomphus*
7. Trigonal interspace in fore wing with a single row of cells *Peruviogomphus*
- Trigonal interspace in fore wing with 2—3 rows of cells 8
8. Rs (Comstock-Needham notation) strongly and more or less symmetrically forked owing to the fact that Rs is slightly askew forward at the fork 9
- RS unforked or weakly forked with Rs straight at the fork and the hinder branch strongly askew backward 10
9. Wings with brown patches at extreme bases; largest spines of outer row on third femur shorter than half the diameter of femur *Melanocacus*
- Wings wholly colourless; largest spines of outer row on third femur longer than half the diameter of femur *Cacoides*
10. Subalar carina (metaparapтерon) with a strong spine just before base of hind wing 11
- Posterior angle of metaparapтерon more or less obtuse 12
11. Fore wing subtriangle crossed *Mitragomphus*
- Fore wing subtriangle uncrossed *Zonophora*
12. Males 13
- Females 21
13. Anal triangle in hind wing not extending backward to anal angle of wing 14
- Anal triangle in hind wing extending backward to anal angle of wing 16
14. Posterior genital hamule broadly expanded at base; this part with an anterior row of denticles or a chitinous ridge *Progomphus*
- Posterior genital hamule of different shape 15
15. In hind wing, the first anal interspace greater than the second *Erpetogomphus*
- In hind wing, the second anal interspace greater than the first *Desmogomphus*
16. Penis with two, generally very long, flagella or cornua 18
- Penis without or with two very short degraded flagella 17
17. Vesicle consisting of two halves between which the tip of the penis lies when at rest *Diaphebia*
- Vesicle a mere transverse lamella whose margin is medially excised, V-shaped *Aphylla*
18. Flagella of penis fringed with microscopic serrations along outer border *Phyllocycla*
- Flagella of penis not serrulated 19
19. Inferior anal appendage robust and cleft into two very strong branches; each branch with a dorsal tooth or spur *Gomphoides*
- Inferior anal appendage not very stout, often thin and almost vestigial; the branches, if present, without a dorsal tooth or spur 20
20. Posterior genital hamule with two subapical internal teeth; abdominal segment 8 completely non-foliate; anal triangle in hind wing made up of 6—8 cells *Idiogomphoides*
- Posterior genital hamule ending in a tooth; abdominal segment 8 with distinct, although sometimes narrow, lateral dilatations; anal triangle in hind wing usually made up of 4 cells *Phyllogomphoides*
21. Supratrangles usually uncrossed 22
- Supratrangles usually crossed 25

- 22. Vulvar lamina extending to well beyond middle of ninth sternum 23
- Vulvar lamina not extending to beyond middle of ninth sternum 24
- 23. Distance from nodus to pterostigma less than 3 times the costal length of pterostigma *Diaphlebia*
- Distance from nodus to pterostigma more than 3 times the costal length of pterostigma *Desmogomphus*
- 24. Distinct rudiments of auricles present *Erpetogomphus*
- No auricles or rudiments of auricles *Progomphus*
- 25. Vulvar lamina large, cleft for nearly its entire length, the divisions extending to apex of ninth sternum *Idiogomphoides*
- Vulvar lamina not extending to beyond basal half of ninth sternum 26
- 26. Abdominal segment 10 with a dorso-apical rim (cf. Belle, 1970a: 41) 27
- Abdominal segment 10 without a dorso-apical rim 28
- 27. Distal spines of outer row on third femur as long as or shorter than one-sixth of the diameter of femur; venter of apical abdominal segments orange or reddish brown *Aphylla*
- Distal spines of outer row on third femur as long as or longer than a quarter of the diameter of femur; venter of apical abdominal segments not orange or reddish brown *Phyllocycla*
- 28. Abdominal segment 10 notable stout and longer than abdominal segment 9 *Gomphoides*
- Abdominal segment 10 not remarkable stout and shorter than abdominal segment 9 *Phyllogomphoides*

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