A revision of the South American species of *Aphylla* Selys, 1854 (Odonata: Gomphidae)

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A revision is given of the 16 recognized South American species of the New World genus *Aphylla* Selys. Three new species are described and figured, viz. *A. scapula* (♂ holotype; Brazil, Territorio de Rondônia, Fazenda Rancho Grande), *A. silvatica* (♂ holotype: Ecuador, Provincia Napo, Limoncocha) and *A. spinula* (♂ holotype: Perú, Departamento de Cuzco, Río Urubamba). *A. obscura* (Kirby, 1899) and *A. albinensis* Belle, 1970, are considered junior synonyms of *A. tenuis* Selys, 1859, and *A. brevipes* Selys, 1854, respectively, while *A. simulata* Belle, 1964, is considered a synonym of *A. dentata* Selys, 1859. Separate identification keys to the males and the females of the South American species of *Aphylla* are provided.

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Contents

Introduction

The Neotropical gomphid genus *Aphylla* Selys, 1854, includes twenty taxa of moderate to large size. Specimens of *Aphylla* are not rare in collections but the species

from the interior of continental South America are generally not, or only poorly represented.

In the field the species of *Aphylla* haunt near bodies of stagnant water (lakes and ponds) and streams with slowly running water and muddy bottoms. In tropical rain forests these insects can also be encountered in the vicinity of temporal pools, which means that their development from egg to imago takes about half a year. They do not avoid cultivated areas and I have often met them along edges of artificial ponds in town parks. As a rule they fly close above the ground and the water surface. Their flight is more or less gliding and not swift. The collector generally detects them when they are disturbed and flee to another site, where they perch carefully with horizontally outspread wings. They rarely hover and if so only for a very short time. Females are less frequently seen because of their more cryptic behaviour. In general specimens of *Aphylla* are not difficult to capture. The larvae live in the soft muddy bottoms of the water bodies. Their body is cylindrical and the tibiae of the first and second pair of legs are armed with strong burrowing hooks. Most striking is the extraordinarily long and slender tenth abdominal segment which is used as a sort of snorkel to reach the clean water above the mud (cf. Byers, 1930: fig. 8 on page 245). The emergence of the imagines takes place in the night. Their heavily silted cast-off skins are to be found on the leaves, twigs and roots of the bank vegetation. Larvae of this genus can be obtained by sifting bottom mud.

I have confined myself to the South American species of the genus in order to avoid reiterations and because *Aphylla williamsoni* (Gloyd, 1936) from the USA as well as *Aphylla caraiba* (Selys, 1854) from the Greater Antilles are well known species, while the Central American representatives of *Aphylla* have recently been treated by Garrison (1986). However, in the present study one of the species discussed by Garrison, viz. *Aphylla obscura* (Kirby, 1899), is shown to be a junior synonym of *Aphylla tenuis* Selys, 1859. Also, *Aphylla albinensis* Belle, 1970, is a junior synonym of *Aphylla brevipes* Selys, 1854. Further *Aphylla simulata* Belle, 1964, is considered to be no more than a variety of *Aphylla dentata* Selys, 1859.

Three new taxa are described, viz., *A. scapula*, *A. silvatica* and *A. spinula*, bringing the total number of South American species up to 16. This figure, however, can by no means be regarded as final. In the present paper there is, e.g., a unique female specimen not referable to any described species, and here described as *Aphylla* spec. indet. in the absence of the corresponding male. This specimen I have also included in the identification key to the females.

The terminology of wing venation used in this paper is that of Comstock-Needham. The pictures of the thoracic colour pattern are diagrammatic. All other illustrations were made with the aid of a camera lucida (details completed by free hand) except for the figures 38-43 which are reproductions of photographic copies of drawings made in 1935 by Miss Grace Eager, at that time museum artist of the University of Michigan (Ann Arbor).

Depositories of material and acknowledgements

The new material studied and recorded in this synopsis is deposited in the institutions and personal collections mentioned below; the names are preceded by the acronyms used throughout the text of this paper; they are followed by the names of the persons who made this material accessible for

study. These persons are most gratefully acknowledged here.

BMNH — British Museum (Natural History), London; Mr Stephen J. Brooks. CG — Collection Garrison, Azusa; Dr Rosser W. Garrison. CJ — Collection Jurzitza, Karlsruhe; Prof. Dr Gerhard Jurzitza. CM — Collection Machado, Belo Horizonte; Prof. Dr Angelo B.M. Machado. CP — Collection Paulson, Seattle; Dr Dennis R. Paulson. FSCA — Florida State Collection of Arthropods, Gainesville; Dr Sidney W. Dunkle and Prof. Dr Minter J. Westfall. Jr. MNRJ — Museu Nacional, Rio de Janeiro; Dra. Janira M. Costa. RMNH — National Museum of Natural History, Leiden; Mr Jan van Tol. SMF — Senckenberg Museum, Frankfurt-am-Main; Dr Heinz Schröder. UMAA — University of Michigan, Ann Arbor; Mrs Leonora K. Gloyd. USNM — National Museum of National History (formerly United States National Museum), Smithsonian Institution, Washington, D.C.; Dr Oliver S. Flint, Jr.

I should like also to extend my sincere thanks to Dr David G. Furth of the Museum of Comparative Zoology, Harvard University, Cambridge (MCZ), who allowed me to examine the holotype of Selys' *Aphylla tenuis*, to Drs Francesc Uribe and O. Escolá of the Museu de Zoología, Barcelona, who rendered the same service with respect to the type specimens of Navás' *Aphylla curvata*, and to Dr P. Grootaert of the Institut Royal des Sciences Naturelles, Brussels, who gave me access to the Collection Général to re-examine the types of some species of *Aphylla* described by Selys. The study of the old material will, I think, significantly enhance the value of this paper.

Systematic section

The genus *Aphylla* has been named by Selys (1854) for the reception of the two South American species *Aphylla brevipes* and *Aphylla producta*. The former of the two is the type-species of the genus, indicated by Kirby (1890). Carle (1986) put this genus in his tribe Gomphoidini along with the genera *Phyllocycla* Calvert, 1948, *Phyllogomphoides* Belle, 1970, *Gomphoides* Selys, 1850, *Idiogomphoides* Belle, 1984, and *Peruviogomphus* Klots, 1944. In both sexes the specimens of *Aphylla* can instantly be distinguished from those of the other members of the tribe by the very short spines on the anterior outer side of the hind femur. They agree with the specimens of *Phyllocycla* in having the tenth abdominal segment provided with a dorso-apical rim (cf. Belle, 1970: 41) and in having the subtriangle of the hind wings generally without cross-veins. Contrary to *Phyllocycla* the apical segments of the abdomen are often brilliant burnt orange in life (cf. Gloyd, 1936: 11), at least on the ventral side. In preserved specimens, however, these and other pale body colours, especially those of the pterothorax, are often obliterated by post mortem changes. The apical end of the abdomen is generally notably widened at the eighth segment, especially in the males. The inferior caudal appendage (lamina supra-analis or epiproct) of the male is vestigial and correlated with this strongly reduced inferior appendage; the hind angle of the inferior lateral borders of the tenth abdominal segment is generally prolonged backward in a point. This feature is not found in *Phyllocycla*, the nearest relative, although in this genus the inferior caudal appendage of the male is vestigial as well. Contrary to the other members of the tribe the hood of the penial peduncle is represented by no more than a transverse lamella the margin of which is medially with V-shaped excision. In some species this lamella is very low and widely notched.

There is in general a strong resemblance in the form of the accessory genitalia and caudal appendages between the males of the species of *Aphylla*. The genital hamules are small and low and have no clear differences for specific recognition except in *Aphylla theodorina*, which has relatively larger and more prominent anterior hamules (fig. 41). The superior caudal appendages (cerci) are strong and forcipate. The majori-

ty of the species have these appendages with a thickened basal part (seen in dorsal view), here termed "shoulder". The distal (incurved) part of the superior caudal appendages has a superior groove. Also the vulvar laminae offer but little specific differences in this genus. They are simply bilobed and about one-fifth as long as the ninth sternum. Sometimes they bear small but important specific differences in the structure of the posterior excision and the lobes. The femoral armature of the females is the same as that of the conspecific males.

The pterothorax is brown to almost black and marked with greenish yellow, grass-green or gray-green stripes which are often partly developed. The colour pattern of the dorsum of the pterothorax is most striking and can strongly vary in the individuals of some species. In the usual type (Type 1 = prototype) the first pale antehumeral stripe is neither connected with the pale mesothoracic "half collar", nor with the second pale antehumeral stripe (fig. 1). But the first pale antehumeral stripe can be connected with the pale mesothoracic "half collar" (Type 2; fig. 2) or with the second pale antehumeral stripe (Type 3; fig. 3), or with both (Type 4; figs. 4 and 5).

Keys to the species of *Aphylla*

Separate keys to the males and the females of the South American species of *Aphylla* are given. A key to the females is possible due to the fact that the females of only three species (*A. caudalis, A. silvatica* and *A. spinula*) are unknown. As regards the unknown females of *A. caudalis* and *A. spinula*: it will be very hard or even impossible to identify these until pairs in tandem position are secured. The yet unknown male of the *A.* spec. indet. can be recognized most likely by the upright hairs of the abdomen. Further collecting may confirm this supposition.

Caution should be exercised using colour characters mentioned in the key since discoloration by post mortem effects can seriously obliterate the colour pattern. To minimize misjudgements I have, whenever possible, added specific morphological features. Penile characters are not used in the key in order not to tamper with the males. In taking into account intraspecific variations (or discolorations?) it has been necessary to key out the females of two species at more than one point. At each couplet the number of the preceding one has been given so that the key can also be used backward.

Males

1. Costa of wings largely bright yellow. Postero-inferior lateral end of tenth abdominal segment more or less produced downward and pointed or rounded (figs. 6 and 43). Anterior (lower) part of postclypeus largely pale [Brazil, Guyana, Perú, Venezuela] ..... ***A. theodorina***
- Costa of wings brown to black, the frontal margin sometimes with a yellow line. Anterior half of postclypeus brown 2

2(1). Second pale antehumeral stripe absent or weakly developed and often interrupted; the first pale antehumeral stripe notably prolonged along antealar sinus. Costa of wings with a yellow line on frontal margin. Apical inferior bor-

der of tenth abdominal segment produced backward in a point 3
- Second pale antehumeral stripe well developed and sometimes connected with the first pale antehumeral stripe. Costa of wings without or without a distinct yellow line on frontal margin 4

3(2). Larger species; hind wing 33-35 mm. Superior appendage very stocky; its shoulder well developed, with a concave inner margin and a strongly projecting angulation at apex [Argentina, southern Brazil] ..... ***A. distinguenda***
- Smaller species; hind wing 28-30 mm. Shoulder of superior appendages weakly developed; its inner margin straight and strongly rounded at apex [Guyana, Venezuela] ..... ***A. alia***

4(2). Superior appendages without shoulder (fig. 32) 5
- Shoulder present, although sometimes weakly developed (figs. 33, 34). 6

5(4). Superior appendage regularly curved inward for its whole length, the inner margin with a thin sprig-like projection near midlength (fig. 32). Apical inferior border of tenth abdominal segment strongly produced backward in a point (fig. 35) [Perú] ..... ***A. spinula***
- Superior appendage strongly curved inward on apical third; inner margin of superior appendage smooth. Apical inferior border of tenth abdominal segment moderately produced backward in a short blunt point [Brazil (Amazone area), Paraguay, Perú] ..... ***A. edentata***

6(4). Hind wing > 40 mm 7
- Hind wing < 38 mm 8

7(6). Lateral sides of pterothorax with the pale stripes narrower than the dark stripes. Tibiae dark reddish brown. Hind dorsal margin of tenth abdominal segment denticulated at level of bases of superior appendages; these appendages with well-developed shoulders [Perú] ..... ***A. robusta***
- Pale stripes on sides of pterothorax much wider than the dark stripes. Tibiae black. Hind dorsal margin of tenth abdominal segment without denticles. Superior caudal appendages with weakly developed shoulders (fig. 33) [Ecuador] ..... ***A. silvatica***

8(6). Inner margin of shoulder of superior appendages concave and with an angulation at apex 9
- Inner margin of shoulder straight 10

9(8). Superior appendages with stout shoulder; in dorsal view each appendage about twice as wide at shoulder as it is beyond it. Postero-inferior lateral projection of abdominal segment 10 bluntly pointed. Tibiae almost black, contrasting with the brown femora [Brazil (Amazone region), Guyana] ..... ***A. molossus***
- Shoulder more slender, in dorsal view less than one and half a times as wide as the appendage beyound it. Postero-inferior lateral prolongation of abdominal segment 10 long and slender (fig. 7). Tibiae brown and of nearly the same colour as femora [South America (east of Andes)] ..... ***A. dentata***

10(8). Posterior inner portion of shoulder of superior appendage elevated and discernible in a side view of the appendage (fig. 37). Hind tibiae brown and of nearly the same colour as hind femora. Fore wing with 23-24 antenodals and 15 postnodals [Brazil (Rondônia)] ..... ***A. scapula***
- Inner portion of shoulder not discernible in a side view of the appendage 11

11(10). Lateral margins of eighth abdominal segment unexpanded or very narrowly

expanded with dilatations less than 0.15 mm wide 13
- Lateral dilatations of eighth abdominal segment 0.2-0.5 mm wide 12
12(11). Lateral dilatations of eighth abdominal segment 0.4-0.5 mm wide. Dorsal posterior margin of tenth abdominal segment slightly concave in middle [Brazil (Pará), French Guyana, Surinam] ..... ***A. brevipes***
- Lateral dilatations of eighth abdominal segment 0.2-0.32 mm wide. Dorsal posterior margin of tenth abdominal segment deeply notched in middle [Central-America, Colombia, Venezuela] ..... ***A. tenuis***
13(11). Dorsal posterior margin of tenth abdominal segment without denticles. Distance between bases of superior appendages smaller to slightly larger than basal width of superior appendage 14
- Dorsal posterior margin of tenth abdominal segment with denticles at level of bases of superior appendages. Distance between bases of superior appendages much larger than basal width of superior appendage [Bolivia, Perú, Ecuador] ... . ***A. boliviana***
14(13). A blackish species. Postclypeus with a pale posterior cross-band. Middorsal part of posterior margin of tenth abdominal segment straight or very slightly concave. Distance between bases of superior appendages distinctly smaller than basal width of superior appendage [Central Brazil] .....***A. brasiliensis***
- Dark colours of body predominantly brown. Postclypeus largely brown, with a pale spot on either lateral side. Middorsal part of posterior margin of tenth abdominal segment strongly concave or notched. Distance between bases of superior appendages as large as or slightly larger than basal width of superior appendage 15
15(14). Tenth abdominal segment shorter than ninth segment. Abdomen < 50 mm [South America (west of Andes)] ..... ***A. producta***
- Tenth abdominal segment as long as ninth segment. Longer species; abdomen 53-54 mm [Brazil (Pará)] ..... ***A. caudalis***

Females

(The females of *A. caudalis*, *A. silvatica* and *A. spinula* are unknown)

1. Costa of wings largely bright yellow. Anterior (lower) half of postclypeus largely pale. Vulvar lamina with V-shaped excision for half to three-fifths its length, the angle between the lobes 60°-90°, the lobes broadly rounded ..... ***A. theodorina***
- Costa of wings brown to black, the frontal margin sometimes with a yellow line. Anterior (lower) half of postclypeus brown 2
2(1). Second pale antehumeral stripe absent or very weakly developed; first pale antehumeral stripe notably prolonged along antealar sinus. Costa of wings with a yellow line on frontal margin 3
- Second pale antehumeral stripe well developed and often connected with the pale first antehumeral stripe. Costa of wings without or with a very narrow yellow line 4
3(2). Small species; abdomen < 41 mm, hind wing < 32 mm. Vulvar lamina with V-shaped excision for slightly more than half its length, the angle between the lobes 90°, the lobes broadly rounded (fig. 11) ..... ***A. alia***

- Larger species; abdomen > 43 mm, hind wing > 33 mm. Vulvar lamina with V-shaped excision for half its length, the bottom of the excision rounded, the angle between the lobes 90°, the lobes rounded ..... ***A. distinguenda***

4(2). Robust species; abdomen 53-56 mm, hind wing 44-47 mm ..... ***A. robusta***

- Smaller species 5

5(4). Abdominal segments 3 to 9 covered with short, upright (standing) hairs [Ecuador] ..... ***Aphylla*** spec. indet.

- Abdominal segments 3 to 9 covered with the usual soft hairs 6

6(5) Vulvar lamina excised for nearly half its length, the bottom of the excision sharply V-shaped, the angle between the lobes about 90°, the tips of the lobes notably pointed (fig. 12) ..... ***A. edentata***

- Lobes of vulvar lamina rounded, not acuminated or narrowed at the tip 7

7(6). Postclypeus with a pale posterior cross-band 8

- Postclypeus largely brown, often with a pale spot on either lateral side or with a pale spot in middle and on either lateral side 10

8(7). Posterior cross-band of postclypeus conspicuous and brown-yellow. Vulvar lamina with V-shaped excision, the angle between the lobes about 90°, the lobes subtriangular and in a ventral view widest at a point nearer to the midventral than to the lateral end of the lobe (fig. 16) ..... ***A. brasiliensis***

- Posterior cross-band not specially conspicuous and green. Vulvar lamina very widely excised, the lobes broadly rounded and in ventral view widest at a point nearer to the lateral than to the midventral end of the lobe 9

9(8). Frontal margin of wing costa with a narrow yellow line (interrupted by numerous black dots). First and second pale antehumeral stripes connected near antealar sinus. Abdomen of freshly killed specimens dorsally brown-orange or copper-red ..... ***A. tenuis***

- Costa of wings entirely dark brown. First and second pale antehumeral stripes generally not connected. Abdomen dorsally brown to dark brown. Lobes of vulvar lamina strongly rounded (fig. 13) ..... ***A. dentata***

10(7). Tibiae and femora of hind legs about of same colour 11

- Hind tibiae much darker than hind femora 12

11(10). Ventral tergal margin of ninth abdominal segment with black denticles along nearly its whole length. Frontal half of labrum largely brown-orange . ***A. scapula***

- Ventral tergal margin of ninth abdominal segment sparsely provided with black denticles. Frontal half of labrum largely brown ..... ***A. producta***

12(10). Frontal half of labrum brown except for extreme free border 13

- Frontal half of labrum largely brown-orange or with a broad brown-orange band along free border 15

13(12). Sides of abdominal segments 8 and 9 completely or almost completely unexpanded ..... ***A. producta***

- Sides of abdominal segments 8 and 9 somewhat expanded, the lateral dilatations 0.1-0.2 mm wide 14

14(13). Sides of abdominal segment 9 largely brown. Ventral tergal margin of same segment with black denticles on apical half ..... ***A. molossus***

- Sides of abdominal segment 9 largely orange or brown-orange. Ventral tergal margin of same segment without black denticles or with a few black denticles near apex ..... ***A. brevipes***

15(12). Abdomen broadened at segment 8. Sides of same segment somewhat expanded, the lateral dilatations 0.15-0.25 mm wide. Ventral tergal margin of abdominal segment 9 with black denticles on apical half 16
- Abdomen not evidently broadened at segment 8, the sides practically unexpanded. Ventral tergal margin of abdominal segment 9 without or with a few black denticles near apex ..... ***A. boliviana***

16(15). Frontal margin of costa of wings with a narrow yellow line that is interrupted by numerous black dots. First and second pale antehumeral stripes connected near antealar sinus. Abdomen, in freshly killed specimens, dorsally brown-orange or copper-red ..... ***A. tenuis***
- Costa of wings entirely brown. First and second pale antehumeral stripes not connected. Abdomen dorsally brown to dark brown ..... ***A. molossus***

Treatment of the species

The species are treated according to the sequence in the key to the males. For each species are given a list of synonyms, data on the new material studied, a description or descriptive notes, and remarks. References to authors quoting only names without further comment have generally been omitted from the synonymy.

Aphylla theodorina (Navás, 1933)
(figs. 6, 41-43)

Gomphoides theodorina Navás, 1933: 192, 193, fig. 12 (♂ apex abd.; ♂, ♀, Brazil, Rio Grande do Sul); Calvert, 1948: 66.

Aphylla theodorina; Belle, 1970b: 258-260, figs. 11-15 (holotype ♂ thor. patt., genit. & apex abd.); 1972: 226, 227.(Brazil, Minas Gerais); St. Quentin, 1973: 349-351, fig. 9 (thor. patt., ♂ & ♀ genit.); Belle, 1976: 374; Jurzitza, 1981: 117 (Argentina); Paulson, 1985: 12 (Perú); De Marmels, 1989: 54 (Venezuela).

Material.— **Argentina**: Misiones, Parque Nacional Iguazú, 9.i.1979, 1 ♀; Cantera, 31.i.1979, 1 ♂, G. Jurzitza, RMNH. **Brazil**: Mato Grosso, Mt. Salobra, i.1955, 1 ♀, Camargo; São Paulo, Hapetininga, 6.i.1971, 1 ♂; São Carlos, 26.ii.1978, 1 ♂, 1 ♀; Pernambuco, São Lourenco de Mata, 8.vii.1976, 1 ♂; x.1978, 1 ♂, all Machado; Sergipe, Propria, vii.1975, 1 ♂; vii.1979, 3 ♂♂, 2 ♀♀; viii.1979, 2 ♂♂, 1 ♀, all Arnon, CM but one pair in RMNH; São Paulo, São Carlos, 22.i.1978, 1 ♀; same locality, 5.ii.1978, 1 ♂, CG. **Guyana**: Georgetown, 18.ii.1912, 1 ♂, L.A. & E.B. Williamson and B.J. Rainey, UMAA.

The specimens vary in size and coloration. The smallest specimen is the male from Guyana (abdomen 44, hind wing 33), the largest one is the male from São Paulo, Hapetininga (abdomen 52, hind wing 39). Nearly all specimens have the same (well-developed) colour pattern as the male holotype but some individuals from Pernambuco and Sergipe have the second pale antehumeral stripe and, correlated with it, the pale metepisternal (mid-lateral) stripe partly or completely undeveloped. The hind dorsal margin of the tenth abdominal segment is generally denticulated at the level of the bases of the superior appendages. The postero-inferior lateral end of the tenth abdominal segment is more or less produced downward and bluntly pointed or rounded (figs. 6 and 43). The figure of the caudal appendages of the holotype of this species previously published by Belle (1970: fig. 12) was made after relaxing the specimen and placing the superior appendages in a normal position . The original position of the appendages was as drawn by Miss Eager (fig. 42).

Aphylla distinguenda (Campion, 1920)

Gomphoides distinguendus Campion, 1920: 132-134; pl. 6, figs 3-5 (♂ wings, apex abd.; ♂, Argentina, Buenos Aires); Calvert, 1948: 65.
Aphylla dentata; Ris, 1904: 16-18; 1913: 74, figs. 14, 15 (thor. patt., ♂ apex abd.).
Aphylla distinguenda; Calvert, 1948: 65 (under *distinguendus*); Belle, 1970a: 64, 65; figs. 94, 97, 98 (holotype ♂ thor. patt., apex abd., app.); Belle, 1972: 226, figs. 13, 14 (♀ thor. patt., vulv. lam.); St. Quentin, 1973: 349; Paulson, 1977: 175. See also under *dentata*.

Material.— **Argentina**: Prov. Buenos Aires, Dique Luján, 19.iii.1952, 1 ♂, Gloger, RMNH; La Balandra, 6.iii.1989, 1 ♂, G. Jurzitza, CJ. **Brazil**: Mato Grosso, Taiamã, Estacão Ecológica de Taiamã, 13.xii.1981, 1 ♂, G. Mascarenhas, CM.

Aphylla alia Calvert, 1948
(fig. 11)

Aphylla alia Calvert, 1948: 66, 67, pl. 1, figs. 16-19 (base of hw & genit. [h1 and h2 interchanged in fig. 16]; ♂, Guyana); Belle, 1970a: 60, 61, fig. 93 (thor. patt.; ♀, Venezuela); 1978: 159, 160, figs. 1, 2 (♂ apex abd.); St. Quentin, 1973: 349.

The vulvar lamina of the female allotype has been figured (fig. 11).

Aphylla spinula spec. nov.
(figs. 3, 9, 30, 32, 35)

Material.— **Perú**: Dept. Cuzco, Urubamba River, late xi.1986, 1 ♂ (holotype), Rudy Mancke, FSCA.

This species differs considerably from all other congeners by the exceptional structure of the male caudal appendages which have no shoulder, are almost semicircular of form while from halfway their inner margin a slender spine projects horizontally inward.

Male (holotype; abdomen broken between the segments 3-4, 4-5 and 6-7).— Total length 61 mm; abdomen 47 mm (incl. app. 2.5 mm); hind wing 34 mm; costal edge of pterostigma in fore wing 4.2 mm.

Head.— Face dark brown with green markings as follows: labrum with a pair of rather large, oblong, green spots; base of mandibles, genae and anteclypeus green; postclypeus with a green lateral spot on either side. Labium pale brown-yellow, the middorsal lobe very wide, its width twice the midventral length (fig. 9). Superior surface of frons with a conspicuous, broad, greenish yellow anterior band and the base dark brown. Vertex dark brown. Occipital plate green.

Prothorax.— Largely dark brown, but middle lobe with a middorsal green spot and with green lateral spots. Posterior lobe almost black.

Pterothorax.— Very dark brown to black on dorsum, marked with well-developed green stripes. First pale antehumeral stripe not confluent with the very broad pale mesothoracic "half collar" but connected with the second pale antehumeral stripe just in front of antealar sinus (Type 3). Thoracic colour pattern shaped as shown in fig. 3.

Legs.— Femora brown, but green on inner side of first femora. Tibiae, tarsi and claws black, contrasting with the brown femora. Lamina tibialis of first tibiae pale yellow and about two-fifths the tibial length.

Wings.— Venation blackish brown including frontal margin of costae. Pterostigma brown. Basal subcostal cross-vein present. Nodal index 16:22-23:15/17:15-16:18. Second primary antenodal cross-vein the sixth in left hind wing, the eighth in right fore wing and the seventh in other wings. Supratriangle in left fore wing with two cross-veins, in the other wings with one cross-vein. Discoidal triangle in fore wings three-celled with the dividing cross-veins tri-radiate from centre, in hind wings two-celled. Subtriangle in fore wings two-celled, in hind wings one-celled. Trigonal interspace starting with three cells (in right fore wing two cells long) from triangle outward followed by two rows of cells. Second anal interspace in hind wings starting with a single cell against anal vein followed by two rows of cells. Male anal triangle three-celled.

Abdomen.— Predominantly dark brown. Sides of first (basal) segment with a posterior brown-yellow spot. Segment 2 with a brown-yellow spot on middorsum and behind auricles. Other segments without distinct pale spots, but end segments paler on venter. Transverse lamella of vesicle shaped as shown in fig. 30. Lateral dilatations of segments 8 and 9 ca. 0.2 mm wide. Postero-inferior lateral angle of segment 10 produced backward in a strong point (fig. 35). Hind dorsal margin of segment 10 without denticles and with a semicircular median notch. Dorso-apical rim of segment 10 about a quarter the length of segment. Posterior margin of inferior caudal appendage with broad V-shaped excision. Superior caudal appendages shaped as shown in fig. 32.

Aphylla edentata Selys, 1869
(fig. 12)

Aphylla edentata Selys, 1869: 196 (p. 33 of reprint; ♂, ♀, Brazil, Amazonas [Ega =Tefé]); Butler, 1904: 122, 123, pl. 6, 7 (labium); Calvert 1948: 65, 67; Cumming, 1964 (thesis; Bolivia); Belle, 1970a: 65-67, figs. 99, 100 (lectotype ♂ apex abd.); fig. 15 (vulv. lam.; *dentata* lapsus calami pro *edentata*); St. Quentin, 1973: 347 (in *Phyllocycla*); Paulson, 1985: 12.

Material.— **Brazil**: Amazonas, Tefé, 1 ♀, BMNH. **Paraguay**: Dept. Alto Parana, Centro Forestal Alto Parana, 5.v.1986, 1 ♀, R.E. Woodruff, FSCA.

The female from Tefé has the (old) pin label "Ega" and "57 20" (on the reverse side) referring to the locality data. In this species the caudal appendages (stylets) of the female are relatively longer than in the other species; the stylets are slightly shorter than the tenth abdominal segment.

Aphylla robusta Belle, 1976

Aphylla robusta Belle, 1976: 371-374, figs 1-5 (thor. patt., wing, ♂ apex abd., vulv. lam.; ♂, ♀, Perú).

Material.— **Perú**: Dept. Loreto, Balsapuerto, Río Paranapura (220 m), iii.1940, 1 ♀ & vii.1940, 1 ♀, both G. Klug, UMAA.

The two females are somewhat smaller (abdomen 53, hind wing 44) than the allotype female from Tingo María, situated 350 km more to the south of Balsapuerto.

The female taken in July is an aged specimen as may be seen from the very brown wings. The triangular envelope in which the specimen is stored bears the

type-written note: "A few eggs taken from broken abdomen for egg collection. Add determination to envelope with the eggs".

The female taken in March has clear wings. This specimen is peculiar in having the subtriangle in either hind wing traversed by cross-veins; that of the right hind wing is three-celled with the dividing cross-veins tri-radiate from the centre, that of the left hind wing is two-celled with an (extra) undeveloped cross-vein for a third cell. Furthermore the fore wings have some doubled cells distal to the pterostigma, between the costa and R1.

Aphylla silvatica spec. nov.
(figs. 4, 8, 25, 33, 36)

Material.— **Ecuador**: Prov. Napo, Limoncocha, Río Playaco (0°24'S 76°36'W), 24.viii.1980, 1 ♂ (holotype), K.W. Knopff, FSCA.

This handsome species approaches *A. robusta* in size but is somewhat smaller and also less robust. It is easily distinguished from that species by the much paler head and thorax. Most striking is the pale colouration of the lateral sides of the pterothorax the pale stripes of which are much wider than the dark stripes.

Male (holotype).— total length 70 mm; abdomen 54 mm (incl. app. 2.6 mm); hind wing 41 mm; costal edge of pterostigma in fore wing 5.2 mm.

Head.— Face largely yellow, but labrum brown-orange along free border and with a brown middorsal stripe at base, brown along anterior (lower) border of postclypeus and vertical part of frons. Vertex brown, but yellow in depressed (central) area behind lateral ocelli. Occipital plate yellow, its posterior ridge brown and fringed with rather short brown hairs. Rear of head brown with a yellow central spot below occipital ridge and broadly yellow along border of temporae. Labium and adjacent mouth parts pale yellow. Middle lobe of labium broad, concave on frontal margin (fig. 8).

Prothorax.— Largely yellow, the hind lobe brown.

Pterothorax.— Largely yellow with brown stripes, colour pattern of dorsum of Type 4 (fig. 4).

Legs.— Hind femora reddish brown, the numerous spines on antero-inferior margin very short and in length one-tenth to one twentieth the diameter of femur. Fore and middle femora reddish brown but darkened toward distal ends. First pair of femora with yellow inner sides. Tibiae, tarsi and claws black. Lamina tibialis of first tibiae about two-fifths the tibial length.

Wings.— Clear. Venation black-brown including frontal margin of costa. Pterostigma yellow. Basal subcostal cross-vein present. Nodal index 15:21-20:17/18:16-17:18. Second primary antenodal cross-vein the sixth in left hind wing, the seventh in other wings. Intermedian cross-veins 11-13/7-7. Discoidal triangle three-celled with the dividing cross-veins tri-radiate from centre. Subtriangle in fore wings two-celled (right) and three-celled (left). Subtriangle in hind wings one-celled. Second anal interspace in left hind wing starting with a single row of two cells, from anal vein outward, in right hind wing starting with two rows of cells.

Abdomen.— Segments 2 and 3 largely yellow on lateral sides and middorsum.

Abdomen black-brown on segments 3 and 4, but becoming successively dark brown on apical segments and caudal appendages. Transverse lamella of vesicle shaped as shown in fig. 25. Superior caudal appendages shaped as shown in figs. 33 and 36. Posterior margin of inferior appendage with broad V-shaped excision. Lateral dilatations on segments 8 and 9, those on segment 8 narrower than those on segment 9 and about 0.1 mm wide. Dorso-apical rim of segment 10 about one-fourth as wide as middorsal length of segment. Hind dorsal margin of segment 10 without denticles and with a shallow median excision. Postero-inferior lateral angle of segment 10 produced backward in a blunt point and provided with stiff hairs.

Aphylla molossus Selys, 1869
(figs. 14, 15)

Aphylla molossus Selys, 1869: 196, 197 (pp. 33, 34 of reprint; ♂, Brazil, Amazonas); Calvert, 1948: 65-67; Belle, 1970a: 62, 63, figs. 95, 96 (♂ app.); 1972:, 225, figs. 11, 12 (♀ thor. patt., vulv. lam.); St. Quentin, 1973: 349.

Material.— **Brazil**: Pará, Diamantino b. Santarem, xii.1920, 2 ♂♂, 1 ♀; Santarem, xii.1920, 2 ♂♂, 1 ♀ (♀ in cop.), A.H. Fassl, SMF but one pair in RMNH; Pará; Rio Xingu Camp, ca. 68 km S. of Altamira (52°22'W, 3°39'S), Igarape Jabuti (mist nets at dusk), 8.x.1986, 1 ♀; Pará, Rio Iriri Camp, ca. 100 km S. of Altamira (52°40'W, 3°50'S), along survey line, 18.x.1986, 1 ♂, P. Spangler & O.S. Flint, CG; Amazonas, Rio Purus, Arima, xi.1922, 2 ♂♂, 4 ♀♀, S.M. Klages, FSCA but one pair in RMNH.— Guyana: Rockstone, 12.ii.1912, 2 ♂♂, L.A. & E.B. Williamson and B.J. Rainey, UMAA. **Venezuela**: Amazonas, Minisia de Orinoco, 28.ii.1957, 1 ♂, J. Rácenis, UCV.

The specimens differ in size; the hind wing length varies in the males from 32 mm to 35 mm, in the females from 33 mm to 36 mm. The pair from Santarem taken in copulation belongs to the largest specimens. The vulvar lamina of the female taken in copulation has a semicicular median excision (fig. 14), that of the other females are more or less V-shaped with a round bottom (fig. 15).

Aphylla dentata Selys, 1859
(figs. 7, 13, 28)

Aphylla dentata Selys, 1859: 547-548 (pp. 21-22 of reprint; ♂, ♀, Brazil, Amazon); 1869: 197 (p. 34 of reprint); 1894: 178 (under *dentata* ?; ♀, Guyana); Ris, 1911: 106; Campion, 1920: 130, 131, pl. 6, figs. 1, 2 (under *dentatus*, ♂ wings & apex abd.); Calvert, 1948: 65-67; Belle, 1964: 22-26, figs. 5, 6 (thor. patt., ♂ app.; Surinam); 1970a: 62-65; 1972: 224; Rácenis, 1970: 24, 25 (Venezuela); St. Quentin, 1973: 349; Paulson, 1977: 175 (Argentina, Paraguay).

Gomphoides dentata; Hagen, 1861: 313; Navás, 1927: 27; 1930: 125; 1933: 191 (under *dentatae*). All Argentine specimens probably belonging to *distinguenda*.

Aphylla simulata Belle, 1964: 26-35, figs. 7, 8, 9, 10, 12, 14 (thor. patt., ♂ app., wings, larv. struct., entire larva); St. Quentin, 1973: 349 [**new synonymy**].

Material.— **Brazil**: Amazonas, Rio Purus (between Beruri and Aiapua), 21.ii.1971, 1 ♀, P. Mees, RMNH; Mato Grosso, Sinop, x.1975, 1 ♂, 2 ♀♀, CM; Pará, Prata (100 km o. Rio Pará), ii.1920, 1 ♂; Rio Xingu, Altamira, i.1921, 1 ♂, both A.H. Fassl, SMF; Pará, Igarapé Assu, xii.1911, 1 ♂, 1 ♀, L.H. Parish, FSCA. **Ecuador**: Prov. Napo, Limoncocha (lake edge), 14.i.1972, 1 ♀, D.L. Pearson, CP. **Guyana**: Tumatumari, 9.ii.1912, 1 ♀; Rockstone, 12.ii.1912, 1 ♀, L.A & E.B. Williamson and B.J. Rainey, UMAA. **Surinam**: Paramaribo, i.1920, 1 ♂, Bollov, SMF; Distr. Brokopondo, Suriname River, Kabel, 24.ix.1938, 1 ♀; Brownsberg, 9.xii.1971, 1 ♂ & 15.xii.1971, 1 ♀; Distr. Saramacca, Tibiti River, 10.i.1949, 1 ♀; Coppename River (Raleigh Falls), 20.iii.1972, 1 ♂, all D.C. Geijskes; Distr. Nikerie, Kayser Mountain Range, airstrip,

ix.1960-i.1961, 1 ♀, Beatty; Distr. Commewijne: Mapane Creek, 9.xii.1953, 1 ♀, D.C. Geijskes, RMNH. **Venezuela**: Amazonas, San Fernando de Atabapo, 23.ii.1957, 1 ♂, 1 ♀, UCV; Minisia del Orinoco, 28.ii.1957, 1 ♂ (RMNH), 2 ♀♀ (UCV), all J. Rácenis; Bolivar, Uruyén-Auyántepui, 12.iv.1956, 1 ♂, 1 ♀, J. Rácenis; Region Alto Caura, Cuchine (300 m), 7.iv.1963, 1 ♂ & 11.iv.1963, 1 ♂, both collected during the expedition La Salle; Barinas, Reserva Forestal, Ticoporo (230 m), 3-10.iv.1966, 1 ♂, F. Fernandez Yépez & Luis J. Joly; 26-29.ii.1968, 2 ♀♀, F. Fernandez & C.J. Rosales, UCV.

The specific distinction between *Aphylla simulata* Belle, 1964, and *Aphylla dentata* Selys was mainly based on the stouter superior caudal appendages and the largely green coloured metepimeron of the first species. However, the present material obtained in Venezuela reveals that a separation of the two taxa is extremely doubtful because of the variation noticed in the structure of the male caudal appendages and the colouration of the metepimeron. Therefore I have used the name *Aphylla dentata* for all of the present individuals. Also the first pale antehumeral stripe is sometimes confluent with the second pale antehumeral stripe immediately in front of the humeral suture and (or) with the pale mesothoracic "half collar". Obviously, *A. simulata* is an intraspecific variety known only from the Guianas.

The largest specimens are from Surinam. Those from Venezuela and Brazil, especially from Amazonas, are for the greater part more delicate. The male from Mato Grosso has a hind wing length of 33 mm and an abdomen of 42 mm (incl. caud. app. 2 mm).

Aphylla scapula spec. nov.
(figs. 1, 10, 24, 29, 34, 37)

Material.— **Brazil**, Territorio de Rondônia, Fazenda Rancho Grande, 62 km SW of Ariquemes (10°50'S 63°07'W, 187 m), 2-11.xi.1989, 1 ♂ (holotype), 2 ♀♀ (allotype and paratype), R.W. Garrison; 62 km S of Ariquemes (10°32'S 62°48'W, 540 ft; Linea C-20, 7 km E of B-65), 15.xi.1991, 1 ♀ (paratype), M.J. Westfall, Jr. Holo- and allotype in MNRJ, paratypes in CG and FSCA.

This species is closely related to *A. dentata* as may be apparent from the structure of the male superior caudal appendages. The internal part of the shoulder is elevated and discernible in lateral view of the appendage. All pale markings are yellow, probably due to the fact that the specimens were acetoned; presumably most of these pale colours were green in freshly killed specimens.

Male (holotype; acetoned).— Total length 62 mm; abdomen 47.5 mm (incl. app. 2.5 mm); hind wing 36 mm; costal edge of pterostigma in fore wing 4.2 mm.

Head.— Brown with pale markings. Mandibles pale at base. Labrum with a symmetric pair of large pale spots. Anteclypeus pale. Postclypeus with a large transverse pale spot on either lateral side. Labium pale, the anterior margin of the middle lobe evenly convex (fig. 10). Superior surface of frons largely pale, brown along base. Vertex brown. Occipital plate pale. Its posterior ridge almost straight and fringed with pale brown hairs which are two-fifths as long as the middorsal length of the occipital plate. Rear of head largely brown; no pale spot below occipital ridge; temporae with an elongated pale spot along eye-border.

Prothorax.— Largely brown, the middle lobe with a pale spot on middorsum and on either lateral side.

Pterothorax.— Brown with well-developed pale stripes; its colour pattern of the usual type and shaped as shown in fig. 1.

Legs.— Femora brown but pale on inner side of first femora. Tibiae and femora

about of same colour, tarsi and claws darker. Lamina tibialis of first tibiae one-third the tibial length.

Wings.— With brown tinge. Venation blackish brown including frontal margin of costa. Pterostigma brown. Basal subcostal cross-vein present. Nodal index 15:23-24:15/17:16-17:17. Second primary antenodal cross-vein the seventh in fore wings, the sixth in hind wings. Intermedian cross-veins 11-10/6-7. Discoidal triangle in fore wings three-celled, the dividing cross-veins tri-radiate from centre. Supratriangle in all wings, subtriangle in fore wings and discoidal triangle in hind wings two-celled. Subtriangle in hind wings one-celled. Trigonal interspaces starting with three cells against triangle followed by two rows of cells. Second anal interspace in hind wings starting with a single row of three cells from anal vein outward.

Abdomen.— Predominantly brown. Segment 1 with a pale spot on either lateral side, the dorsum with a broad pale band along posterior margin. Segment 2 with pale dorsal spot. Auricles pale, the hind border with about 30 scattered black denticles. Transverse lamella of vesicle rather high and with a V-shaped excision (fig. 29). Glans of penis with broad basal half. Penis guard slightly concave at apex. Tip of posterior hamules unusual strong. Lateral sides of segments 8 and 9 slightly expanded, the dilatations about equal in width and ca. 0.2 mm wide. Postero-lateral angle of segment 10 well-produced backward. Posterior dorsal margin of segment 10 without denticles and slightly concave in middle. Dorso-apical rim of segment 10 on lateral sides about one-third the length of segment and about twice as wide as it is on mid-dorsum. Superior appendages stout and shaped as shown in figs. 34 and 37. Apical margin of inferior appendage with broad, shallow V-shaped excision.

Female (allotype; acetoned).— Total length 61 mm; abdomen 46 mm (incl. app. 1.75 mm); hind wing 39 mm; costal edge of pterostigma in fore wing 4.5 mm.

Pattern of head approaching that of male holotype but pale spots on labrum and postclypeus smaller. Vertex with a pale band on posterior part behind paired ocelli. Pale colours of pterothorax more extended, the first and second pale antehumeral stripes dorsally confluent. Abdomen much stouter than in male holotype, the lateral sides paler along ventral tergal margins. Lateral dilatations of segment 8 about 0.2 mm wide and slightly wider than those of segment 9. Ventral tergal margins of segment 9 with black denticles on nearly whole length. Length of abdominal segments 7, 8, 9 and 10 approximately in ratio 23:15:9:8, with the stylets 7 on the same scale. Vulvar lamina with V-shaped excision for three-fifths its length, the angle about 70°, the lobes broadly rounded (fig. 24).

Wings very similar to those of male holotype but supratriangle of fore wings with three (left) and two (right) traversing veins, and second anal interspace of hind wings starting with a single cell against anal vein followed by two rows of cells. Nodal index 17:23-21:15/16:16-15:18. Intermedian cross-veins 13-12/7-8.

The two female paratypes are smaller than the allotype (abdomen 42 mm and 44 mm, hind wing 36 mm and 37 mm) and have the two pale antehumeral stripes not confluent dorsally.

Aphylla brevipes Selys, 1854
(figs. 20, 21, 26)

Aphylla brevipes Selys, 1854: 78 (pp. 59-60 of reprint; ♂, ♀, Brazil, Pará); Hagen, 1861: 313 (in *Gomphoides*); 1875: 53; Kirby, 1890: 74 (type sp. of gen.); Calvert, 1948: 65-67; Belle, 1970a: 43-47, 51,

figs. 69-76 (lectotype, ♂ genit., apex abd., vesicle, occ. pl., femur), pl. 7a (wings).
Aphylla albinensis Belle, 1970a: 47-51, figs. 77-80 (♂ thor. patt., apex abd., larv. labium), pls. 8, 9b (♂, ♀ wings, phot. larva; Surinam); Belle, 1972: 224 (French Guiana); St. Quentin, 1973: 349; Machet, 1991: 13 **[new synonymy]**.

Material.— **Brazil**: Pará, Benevides, xi.1951, 1 ♂, Fluvio, CM. **Surinam**: Paramaribo, Botanical Garden (in trench), 6.iii.1944, 1 ♂, D.C. Geijskes, FSCA; Distr. Marowijne, Albina, 13.viii.1973, 1 ♂, 1 ♀ (in cop.), J.J. Belle, RMNH.

Reexamination of the old material and study of the newly obtained material revealed that *A. albinensis* and *A. brevipes* are identical. The many differences observed in the morphology and colouration fall within the variation limits accepted in other species of *Aphylla*. Most obvious is the variation found in the length of the tenth abdominal segment, the form of the lateral expansions of the ninth abdominal segment, the curving of the male superior caudal appendages in a side view and the extent of the first and second pale antehumeral stripes. The latter are often dorsally connected. The vulvar lamina also shows slight differences in shape (figs. 20 and 21).

Aphylla tenuis Selys, 1859
(fig. 27)

Aphylla tenuis Selys, 1859: 547 (p. 21 of reprint; ♂, Colombia); Hagen, 1861: 114; Calvert, 1905: 154; 1948: 66; Ris, 1918: 191; St. Quentin, 1973: 349.
Not *Aphylla tenuis* Selys, 1894: 178 [= *Phyllocycla ophis* (Selys, 1869)]
Cyclophylia obscura Kirby, 1899: 369, 370; pl. 15, fig. 4 (entire insect; ♀, Panamá); Calvert, 1948: 66.
Gomphoides obscura; Byers, 1939: 23 (in *Negomphoides*); Calvert, 1905: 156, 158.
Aphylla obscura; Needham & Heywood, 1929: 62; Belle, 1977: 7-12, figs 1-4 (thor. patt., occ. pl., vulv. lam., ♂ apex abd.; Costa Rica); May, 1979: 20, 37; Paulson, 1982: 255; Garrison, 1966: 941-943, figs. 1-5 (thor. & abd. patt., penis, ♂ segm. 10 & app., vulv. lam.; Guatemala); De Marmels, 1988: 100.
Aphylla elegans Belle, 1970a: 58-60, figs. 90-92 (♂ thor. patt., apex. abd.; Venezuela); St. Quentin, 1973: 349.

Material.— **Colombia**: Dept. Magdalena, Fundación (S of Aracataca), 12.i.1917 (1 ♀) & 14.i.1917 (12 ♂♂, 15 ♀♀); El Banco (along Río Magdalena); 23.i.1917, 1 ♂ & 24.i.1917, 1 ♂, 1 ♀; Dept. Antioquía, Río Nuevo (trib. of Río Magdalena) near Puerto Berrio, 22.i.1917, 1 ♂, all J.H. & E.B. Williamson; Boca Murindó, 9.ii.1918, 1 ♀, M.A. Carriker, UMAA but a few pairs in RMNH. **Venezuela**: Est. Bolivar, Río Orinoco, Palúa (near Puerto Ordaz), 27-30.x.1972, 1 ♀ (on light of ship), G.L. van Eyndhoven, RMNH; Est. Falcon, Tucacas, 21.iii.1920, 3 ♀♀; Est. Zulia, Encontrados, 25.iv.1920, 1 ♂, all J.H. & E.B. Williamson and W.H. Ditzler, UMAA.

The male holotype (MCZ Type No. 12383), originally preserved in alcohol (cf. Hagen, 1861: 114) but now pinned up, is teneral and in poor condition. The head and the tip of the left fore wing are broken away, the thoracic colour pattern almost completely obliterated and the abdomen shrivelled, distorted and broken off into two fragments with the left superior caudal appendage also broken off. The fragments are separately put in a triangular cellophane envelope and attached to the pin of the specimen.

The type has a pin label with the following locality data in Hagen's handwriting: "Neu Granada" (the name of Colombia before 1863), "Choco" (referring to the Departamento del Chocó situated in the north-west of Colombia bordering the Pacific coast and the Republic of Panamá) and "Schott" (probably the name of the collector).

Despite the poor condition of the holotype, *Aphylla tenuis* can be recognized as a

senior synonym of *Aphylla obscura* (Kirby) described from the adjoining Republic of Panamá. The wing venation of the type specimen is quite clear; the nodal index is ?:22-19:13/15:14-15:15 with the seventh (left fore wing) and sixth (other wings) antenodals thickened. The thoracic colour pattern has almost entirely disappeared. Only the pale lateral stripes of the pterothorax are very faintly discernible under slanting light. The tibiae, tarsi and claws are very dark brown, contrasting with the pale brown femora. The accessory genitalia are in perfect condition. The transverse lamella of the vesicle is low and its median excision shallow (fig. 27). The lateral dilatations of the eighth abdominal segment are 0.2 mm wide. Those of the ninth segment are slightly narrower. The tenth abdominal segment is strongly shrivelled; the median notch is stretched out so that the middorsal part of the hind margin is evenly concave; the apical inferior angles are produced backward in a point and about 50°; the width of the dorso-apical rim is about one-fourth of the length of the segment.

Aphylla tenuis ranges from Guatemala southward to Colombia and Venezuela. In Colombia the species has been reported from the Department of Chocó, the adjoining Department of Antioquía, and from the north-eastern Department of Magdalena. In the latter department a large series of specimens was collected by J.H. and E.B. Williamson (see Material). The hind wing length of the males varies from 31 mm to 38 mm. The type has a hind wing length of 32 mm. The specimens studied here from the boundary areas of the southern distribution range have the smallest average size.

Remark.— During a visit to the British Museum (Natural History) in London on November 19, 1991, I studied the female from Guyana (Demerara) which Selys (1894: 178) tentatively referred to *Aphylla tenuis*. The specimen proved to belong to *Phyllocycla ophis* (Selys, 1869).

Aphylla boliviana Belle, 1972
(fig. 2, 22)

Aphylla boliviana Belle, 1972: 222-224, figs. 9, 10 (thor. patt., vulv. lam.; ♀, Bolivia); 1978: 160-162, figs. 3-5 (♂ apex abd., vesicle; Perú, Ecuador).

Material.— **Ecuador**: Prov. Napo-Pastaza, 5.iii.1934, 1 ♀, William Clarke-Macintyre, UMAA; Prov. Napo, Limoncocha (lake edge), 16.viii.1971, 1 ♀; same locality, 6.i.1972, 2 ♂♂; Limoncocha (0°24'S 76°36'W), lake Limon, 29.viii.1978, 1 ♂, K.W. Knopf, CG. **Perú**: Dept. Junín, Satipo, ii.1982, 1 ♀, Farell, CM.

The specimens from Ecuador differ in some respects from those from the type locality Bolivia, but they are smaller (hind wing: ♂ 34 mm, ♀ 37 mm). The tenth abdominal segment of the males is somewhat longer or, in some males, nearly as long as the ninth segment. The transverse lamella of the vesicle has a less deep median excision and the posterior margin of the vulvar lamina is more roundly excised (fig. 22). The costa of the wings is entirely brown; in the Bolivian specimens with a narrow yellow line (interrupted by numerous black dots). The thoracic colour pattern varies in the individuals from Ecuador. The specimen (a male) secured by Dr Knopf has the first pale antehumeral stripes broadly confluent with the pale mesothoracic "half collar" but not connected with the second pale antehumeral stripes whereas in the other specimens the first pale antehumeral stripes are connected with the second pale antehumeral stripe but not with the pale mesothoracic "half collar".

Aphylla brasiliensis Belle, 1970
(fig. 16)

Aphylla brasiliensis Belle, 1970a: 51, 52, figs. 81, 82 (♂ apex abd.; ♂, ♀, Brazil, Mato Grosso); St. Quentin, 1973: 349.

Material.— **Brazil**: Amazonas, Rio Xié, Altamira, i.1921, 1 ♂; Pará, Rio Tapajos, Itaituba, ii.1922, 1 ♂, both A.H. Fassl, SMF; Mato Grosso, confluence of Rio Tapirapé and Rio Araguaia (50°30'W 10°45'S), 11-30.xi.1960, 2 ♂♂, 3 ♀♀; 1-10.xii.1960, 11 ♂♂, 9 ♀♀; 11-27.xii.1960, 22 ♂♂, 6 ♀♀; Santa Isabel, 9-11.i.1961, 2 ♂♂, 1 ♀; Goiás, Rio Araguaia (13 km S of Barra do Tapirapé), 9.i.1963, 1 ♂, all Borys Malkin, UMAA but a few pairs in RMNH.

The specimens of the present series are very uniform. The first pale antehumeral stripe is usually connected with the second pale antehumeral stripe but by way of exception confluent with the pale mesothoracic "half collar".

The vulvar lamina of the female allotype (from Mato Grosso) is shaped as shown in fig. 16.

Aphylla producta Selys, 1854
(figs. 5, 17-19, 31, 38-40)

Aphylla producta Selys, 1854: 79 (p. 60 of reprint; ♂, ♀, Brazil, Bahía; Guiana); Selys, 1869: 197 (p. 54 of reprint); Selys & Hagen, 1858: 489-493 (pp. 229-233 of reprint), pl. 12, fig. 6 (♂ genit. & apex abd., occiput, labium, labrum), pl. 23, fig. 4 (wing); Hagen, 1861: 113, 114 (in *Gomphoides*); Needham, 1940: 380, 382, pl. 22, fig. 42 (ant. hamule); 1944: 171, 193, 194, pl. 14, 15, fig. 7 (larv. struct.); Calvert, 1905: 155, 156, 158; 1948: 66; Fraser, 1940: pl. 6, fig. 11 (penis). Ris, 1911: 106; Cumming, 1964 (thesis; Bolivia); Belle, 1964: 23, 33, fig. 11 (larv. labium); 1970a: 53-58, figs. 83-88 (lectotype, ♂ thor. patt., apex abd., app.), pl. 9a (♂ wings); 1976: 374; 1978: 162, fig. 6 (vesicle); 1987: 24, 25; St. Quentin, 1973: 349 (Brazil, Pernambuco); De Marmels, 1981: 11 (Venezuela); Paulson, 1985: 12 (Perú).

Gomphoides curvata Navás, 1933: 191, 192, fig. 11 (♂ app.; ♂, ♀, Brazil, Rio Grande do Sul).

Aphylla curvata; Calvert, 1948: 65; Belle, 1970b: 257, 258, figs. 4, 5 (♂ app.); St. Quentin, 1973: 349; Jurzitza, 1981: 117 (Argentina).

Material.— **Argentina**: Prov. Misiones, Capiovy, 5.iv.1971, 1 ♀, C.M. & O.S. Flint, Jr., USNM; Iguazú Falls, 5.iv.1974, 2 ♂♂, G. Jurzitza, CJ but 1 ♂ in RMNH; Iguazú, 1978-1980, 2 ♂♂, R. Foerster, CJ. **Brazil**: Bahía, Cachoeira (Bexiga), xii.1956, 1 ♂, Petersen; same locality, 25.i.1957, 1 ♂, Lema; Pará, Igarapé Assu, xii.1911, 1 ♀, H.L. Parish, FSCA; Santa Catarina, Joinville, 9.iii.1979, 1 ♂, CM. **Paraguay**: Villarrica, 30.xi.1938, 1 ♀, FSCA. **Surinam**: Distr. Suriname, Republiek (on light), 28.viii.1959, 1 ♀, P.H. van Doesburg, RMNH. **Trinidad**: near Sangre Grande, 2.iv.1930, 1 ♀, S. Belmontes, UMAA; Cumuto, St. Andrews County, Aripo savannah, Cumuto Road, 6.v.1988 (11.30 a.m.), 1 ♂, Jerell J. Daigle, CG. **Venezuela**: Bolívar, El Bochinche, Res. Imataca (200 m), 6-13.xii.1974, 1 ♂, collected during the expedition of the Instituto de Zoología Agrícola, UCV.

Jurzitza (1981) erroneously stated that I have identified the Argentine specimens of *Aphylla*. I have seen these specimens, afterwards kindly sent me for examination by Prof. Jurzitza. I was especially interested in these dragonflies as they were referred to *A. curvata* (Navás). When I received the male holotype of this species for study (Belle, 1970b) the apical segments of the abdomen with the specifically important appendages were missing. I concluded that this species is closely related or identical with *Aphylla producta*. Mrs Leonora K. Gloyd (in litt., 7 July 1971) informed me that the male holotype of *A. curvata* was complete when Williamson borrowed it from Navás, and that the apical segments of its abdomen as well as its accessory genitalia were figured by Miss Grace Eager. She generously sent me copies of these valuable

drawings for publication (figs. 38-40). It turns out that the male of *A. producta* fits very well Miss Eager's drawings, especially regarding the form of the shoulder of the superior caudal appendages. Navás' misidentification may be due to the fact that he compared the male of his *A. curvata* with that of *A. dentata* (loc. cit.: "Similis *dentatae* Sel."). In the latter species the inner margin of the shoulder of the superior appendages is concave and ends with a projecting angulation at the apex. Apparently Navás was unfamiliar with *A. producta*.

A. producta is a polymorphic species. Especially specimens from widely separated localities can differ notably in the structure of the male caudal appendages (length of shoulder, tip of appendage), the length and the shape of the median notch of the transverse lamella of the vesicle, the development of the (narrow) lateral dilatations of the eighth and ninth abdominal segments, the width of the dorso-apical rim and the length of the tenth abdominal segment of the male, and the form of the excision of the vulvar lamina (figs. 17-19). Most striking is the difference in the extent of the pale markings of the pterothorax. A male from the Iguazú Falls has the largest pale markings; in this specimen the first pale antehumeral stripes are broadly confluent with the pale mesothoracic "half collar" and also confluent with the second pale antehumeral stripes (fig. 5). Such a colour pattern is approached by some specimens from Bahía (distance between the two localities 2000 km). The pterothorax of the two type specimens of *Aphylla curvata* have the usual colour pattern. The gynandromorphic male described by Belle (1976) I consider to belong to *A. producta*. The lengths of its abdominal segments 9 and 10 are in the ratio 4:3. The ventral tergal margins of the eighth abdominal segment are completely unexpanded; those of segment 9 are slightly expanded on the basal half. The pale markings on the head and the pterothorax are not sharply defined; the pale metapleural stripe is nearly wanting while the metepimeron is almost entirely green.

In my opinion the above mentioned differences between individuals of *Aphylla producta* represent intraspecific variation. The extremes are linked by all kinds of intermediate forms which partly seem to be of geographical nature.

Aphylla caudalis Belle, 1987

Aphylla caudalis Belle, 1987: 25, 26, figs. 1-5 (♂ thor. patt., midd. lobe labium, vesicle, apex abd.; ♂, Brazil, Pará).

No further material of this apparently rare species.

Aphylla spec. indet.
(fig. 23)

Material.— **Ecuador:** Prov. Napo, Limoncocha (lake edge), 5.vii.1971, 1 ♀, D.L. Pearson, CP.

This fully mature female very probably belongs to a distinct species of *Aphylla* which has the abdomen covered with short upright hairs (except for the basal segments and segment 10). The nearest relative of this species seems to be *Aphylla boliviana*.

Female.— Total length 57 mm; abdomen 43 mm (incl. app. 2 mm); hind wing 35 mm; costal edge of pterostigma in fore wing 4.9 mm.

Head.— Face brown but anteclypeus green, base of mandibles largely green, and lateral lobes of labrum and postclypeus with brownish yellow borders. Labium pale brown, the frontal margin of the middle lobe slightly concave. Superior surface of frons brownish yellow for its anterior two-thirds, brown on its basal third. Vertex brown. Occipital plate green, its posterior ridge almost straight and fringed with dark brown hairs which are half as long as the middorsal length of the occipital plate. Rear of head brown, the temporae largely green.

Prothorax.— Largely brown, the hind lobe almost black, the middle lobe with a small middorsal brownish yellow spot and a rather large brownish yellow spot on either lateral side.

Pterothorax.— Dark brown with green stripes; its colour pattern of the usual type.

Legs.— Femora brown, but inner side of first femora green. Tibiae, tarsi and claws almost black.

Wings.— Venation dark brown including frontal margin of costa. Pterostigma brown-yellow. Basal subcostal cross-vein present. Nodal index 11:21-20:12/14:14-16:13. Second primary antenodal cross-vein the sixth in left hind wing and right fore wing, the seventh in other wings. Intermedian cross-veins 11-12/7-7. Discoidal triangle of fore wings three-celled, the dividing cross-veins tri-radiate from centre. Subtriangle of fore wings and discoidal triangle of hind wings two-celled. Subtriangle of hind wings free from cross-veins. Supratriangle in right hind wing three-celled, in other wings two-celled. Trigonal interspaces starting with three cells against triangle followed by two rows of cells. Second anal interspace in hind wings starting with a single cell against anal vein followed by two rows of cells.

Abdomen.— Dark brown, including appendages, but segment 1 with a yellow middorsal spot at apex, segment 2 yellow on middorsum, and sides of segment 9 brownish orange along ventral tergal margins. Middorsum of segments 1 and 2 with long pale brown hairs standing on end. Segments 4 to 9 densely covered with short upright brown hairs. Segment 10 and stylets densely covered with (not upright) hairs. Ventral tergal margins of segment 8 very slightly expanded near apex of segment, those of segment 9 unexpanded and with a few black denticles. Segment 10 as long as segment 9. Hind dorsal margin of segment 10 with denticles. Length of segments 7, 8, 9 and 10 approximately in ratio 21:14:10:10, with the stylets 8 on the same scale. Vulvar lamina brown but blackish along hind margin, deeply excised for half its length, the excision more or less V-shaped, the lobes subtriangular, their hind margin with unusually short hairs (fig. 23).

Geographic distribution and affinities within the genus

The geographic range of the genus *Aphylla* extends from Argentina northward to Mexico, the southern regions of the USA and the islands of the Greater Antilles. Of the 20 species currently known, 16 occur in continental South America and Trinidad, with the greatest number (10) in Brazil (table 2). *A. producta*, A. *dentata* and *A. theodorina* seem to have the largest range in South America. *A. producta* is reported from eight

countries, *A. dentata* and *A. theodorina* each from five countries. Seven species (inluding spec. indet.) are known from one country only. There is no record of a species of *Aphylla* from Chile. A prognosis concerning the distributional range of some species can often be made. For instance, the occurrence of *A. theodorina* in French Guyana and Surinam can be expected.

The type localities of the 16 South American species of *Aphylla* are grouped as follows (table 1): Brazil 9; Perú 2; Argentina, Bolivia, Colombia, Ecuador and Guyana each 1.

A number of interspecific relationships can be of importance for a division of the species in groups. Such a division does not manifest itself in the key. The observed relationships may serve as a basis for further phylogenetical studies. A distinct species-group, based on structural characters of the male caudal appendages, is the *A. dentata* group which comprises the species *A. distinguenda*, *A. dentata*, *A. molossus*, and probably also *A. scapula*, although in the last-named species the main character, a concave inner margin of the shoulder, is not clearly present. *A. producta* and *A. caudalis* form a closely related pair of species.

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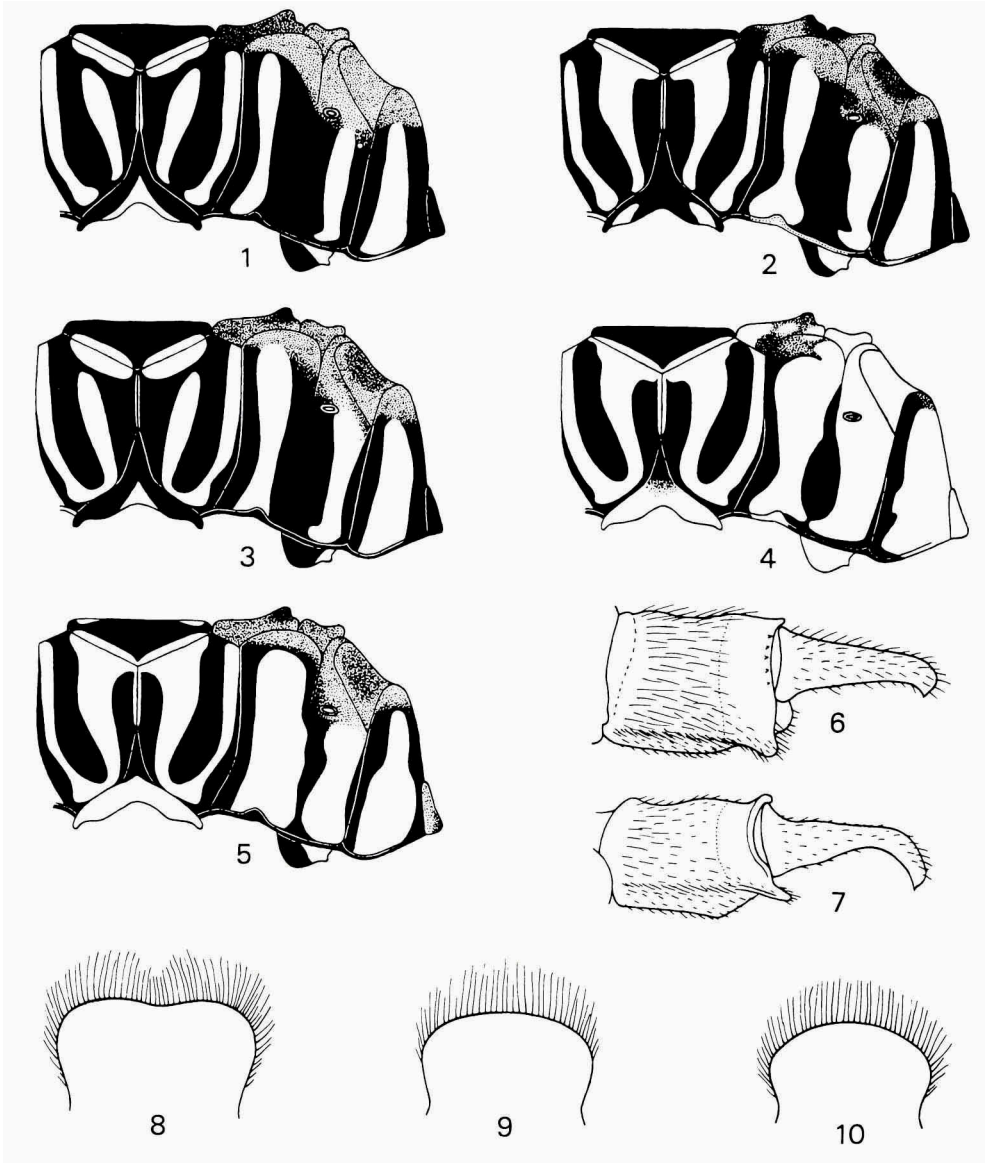
Table 1. Alphabetic list of the South American species of *Aphylla*, with type status, sex of the type and type depository.

Species	Type locality	Type status		sex	Type depository
		holotype	lectotype		
A. alia	Guyana	×		♂	ANSP
A. boliviana	Bolivia	×		♀	FSCA
A. brasiliensis	Brazil (Mato Grosso)	×		♂	RNHL
A. brevipes	Brazil (Pará)		×	♂	BMNH
A. caudalis	Brazil (Pará)	×		♂	SMF
A. dentata	Brazil (Amazon)	×		♂	IRSN
A. distinguenda	Argentina (Buenos Aires)	×		♂	IRSN
A. edentata	Brazil (Amazonas)		×	♂	IRSN
A. molossus	Brazil (Amazonas)	×		♂	IRSN
A. producta	Brazil (Bahía)		×	♂	ZMHB
A. robusta	Perú	×		♂	FSCA
A. scapula	Brazil (Rondônia)	×		♂	MNRJ
A. silvatica	Ecuador	×		♂	FSCA
A. spinula	Perú	×		♂	FSCA
A. tenuis	Colombia	×		♂	MCZ
A. theodorina	Brazil (Rio Grande do Sul)	×		♂	MZB

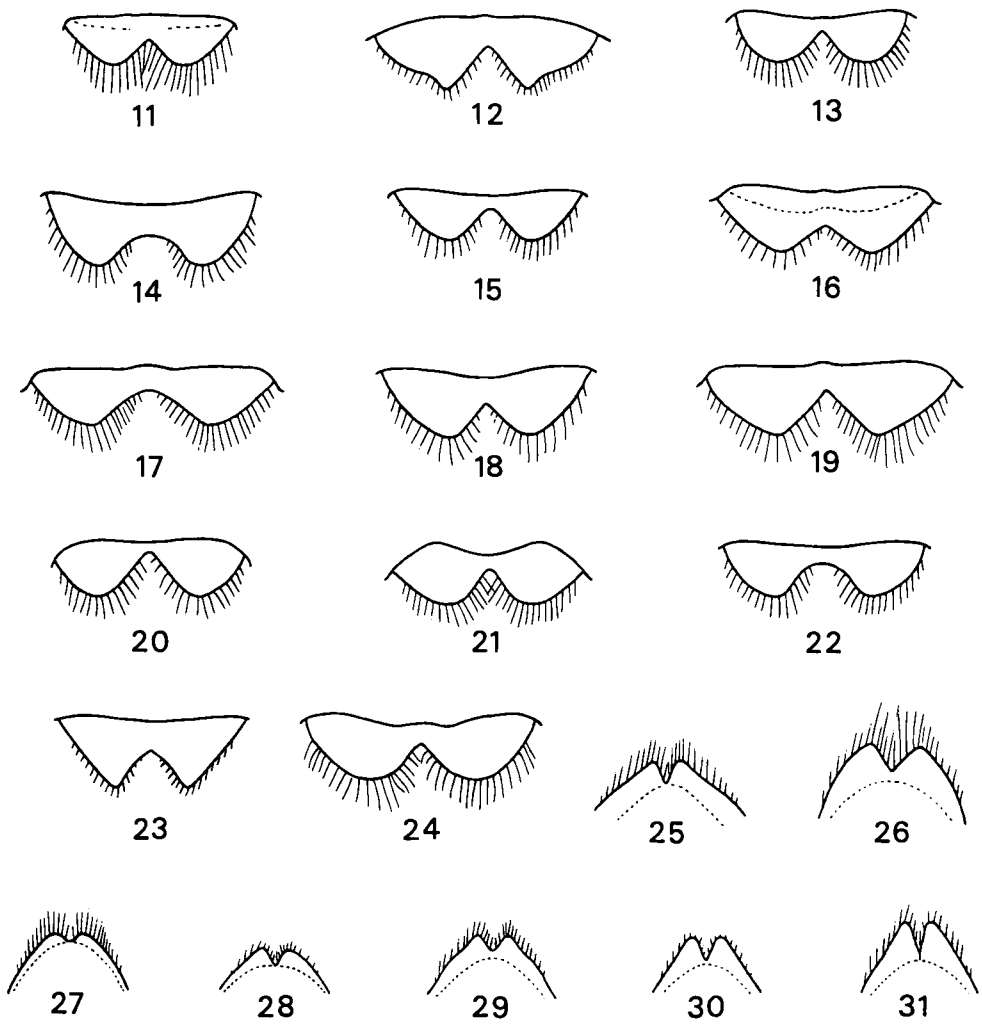
Table 2. Geographic distribution of the species of *Aphylla* in South America.

Species	*Arg	Bol	Bra	Chi	Col	Ecu	FrG	Guy	Par	Per	Sur	Tri	Uru	Ven
A. alia								×						×
A. boliviana		×				×				×				
A. brasiliensis			×											
A. brevipes			×				×				×			
A. caudalis			×											
A. dentata	×		×					×			×			×
A. distinguenda	×		×											
A. edentata		×	×						×					
A. molossus			×					×						×
A. producta	×	×	×						×		×	×	×	×
A. robusta										×				
A. scapula			×											
A. silvatica						×								
A. spinula										×				
A. tenuis					×									×
A. theodorina	×		×					×		×				×
A. spec. indet.						×								

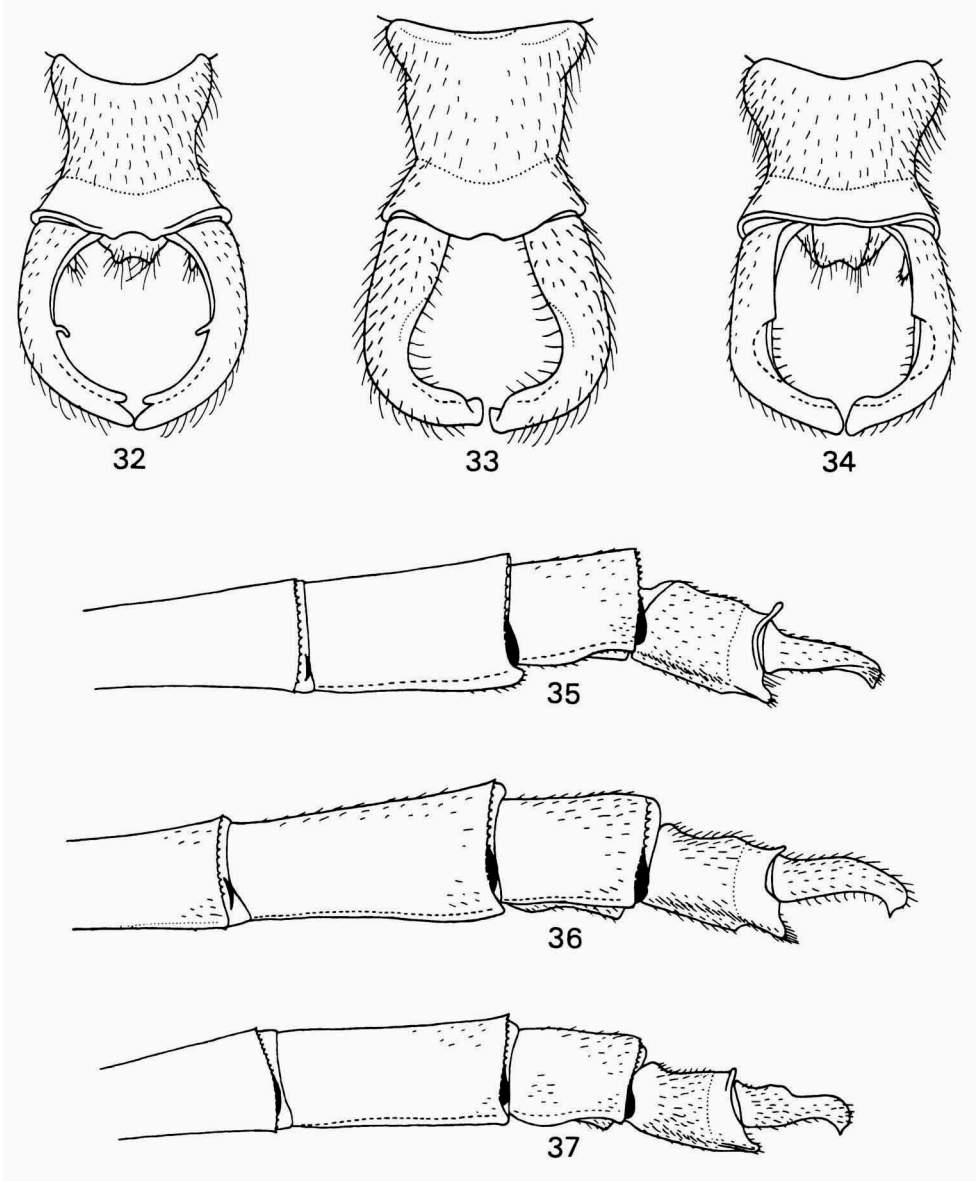
* Abbreviations are to be taken as follows: Arg = Argentina; Bol = Bolivia; Bra = Brazil; Chi = Chile; Col = Colombia; Ecu = Ecuador; FrG = French Guyana; Guy = Guyana; Par = Paraguay; Per = Perú; Sur = Surinam; Tri = Trinidad; Uru = Uruguay; Ven = Venezuela.



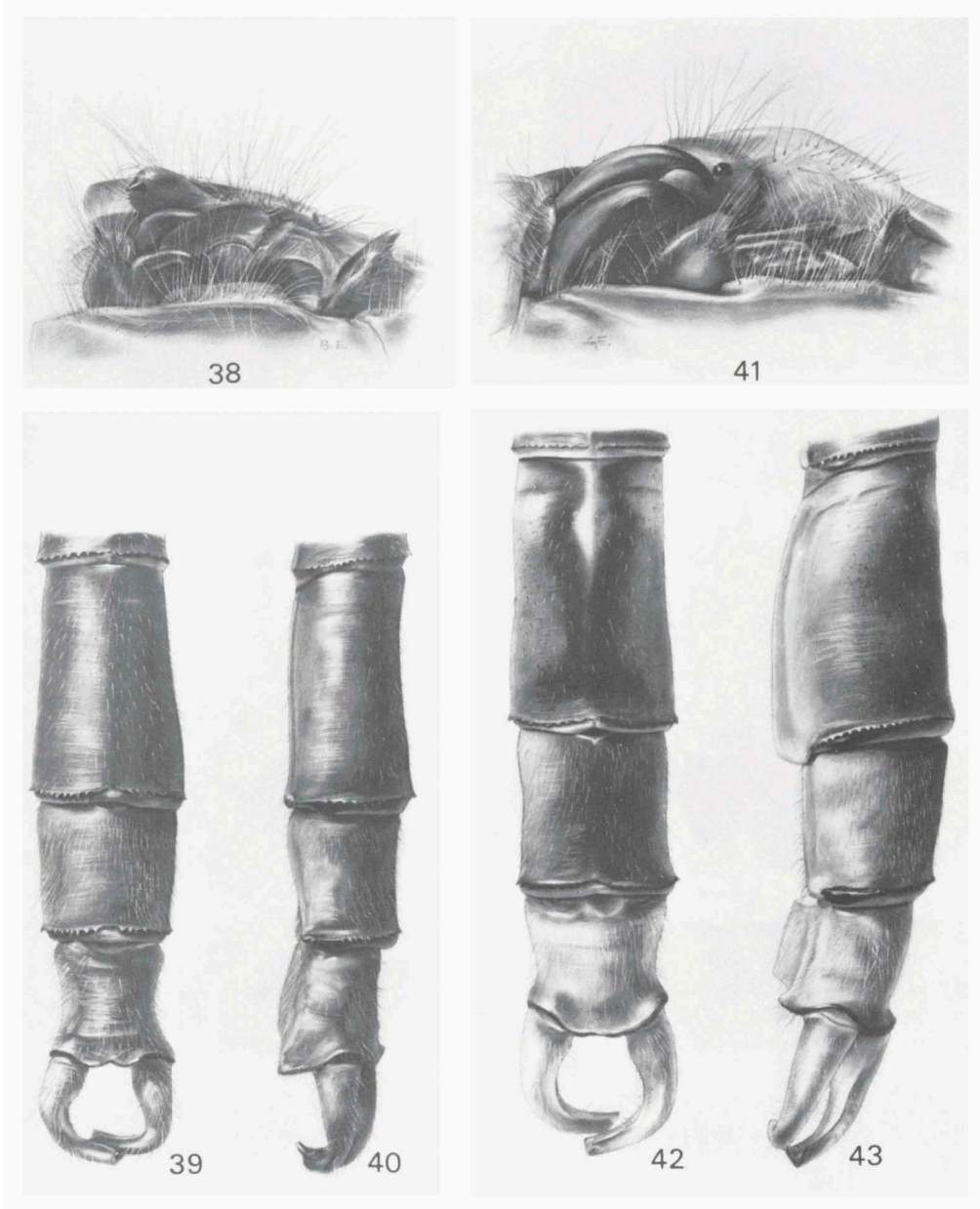
Figs. 1-5. Diagram of thoracic colour patterns in *Aphylla* species: 1, *A. scapula* (holotype); 2, *A. boliviana* (Ecuador, male collected by Dr Knopf); 3, *A. spinula* (holotype); 4, *A. silvatica* (holotype); 5, *A. producta* (Argentina, male from Iguazú). Figs. 6-7. Left profile view of tenth abdominal segment and caudal appendages in males of *Aphylla* species: 6, *A. theodorina* (Guyana); 7, *A. dentata* (Brazil, Mato Grosso). Figs. 8-10. Ventral view of middle lobe of labium in holotype males of *Aphylla* species: 8, *A. silvatica*; 9, *A. spinula*; 10, *A. scapula*.



Figs. 11-24. Ventral view of vulvar lamina in *Aphylla* species: 11, *A. alia* (Venezuela, allotype); 12, *A. edentata* (Paraguay); 13, *A. dentata* (Surinam); 14, *A. molossus* (Brazil, Pará, taken in cop.); 15, *A. molossus* (Brazil, Amazonas); 16, *A. brasiliensis* (Brazil, Mato Grosso, allotype); 17, *A. producta* (Trinidad); 18, *A. producta* (Argentina); 19, *A. producta* (Brazil, Rio Grande do Sul, allotype of *Gomphoides curvata* Navás); 20, *A. brevipes* (Brazil, allotype); 21, *A. brevipes* (Surinam, allotype of *A. albinensis* Belle, teneral specimen); 22, *A. boliviana* (Ecuador); 23, *A.* spec. indet. (Ecuador); 24, *A. scapula* (Brazil, Rondônia, allotype). Figs. 25-31. Caudal view of transverse lamella of vesicle in *Aphylla* species: 25, *A. silvatica* (Ecuador, holotype); 26, *A. brevipes* (Brazil, Pará, syntype); 27, *A. tenuis* (Colombia, holotype); 28, *A. dentata* (Brazil, Mato Grosso); 29, *A. scapula* (Brazil, Rondônia, holotype); 30, *A. spinula* (Perú, holotype); 31, *A. producta* (Brazil, Rio Grande do Sul, holotype of *Gomphoides curvata* Navás).



Figs. 32-34. Dorsal view of tenth abdominal segment and caudal appendages in holotype males of *Aphylla* species: 32, *A. spinula*; 33, *A. silvatica*; 34, *A. scapula*. Figs. 35-37. Left profile view of apical segments of abdomen and caudal appendages in holotype males of *Aphylla* species: 35, *A. spinula*; 36, *A. silvatica*; 37, *A. scapula*.



Figs. 38-40. *Gomphoides curvata* Navás, 1933, male holotype (unpublished drawings by Grace Eager, 1935): 38, accessory genitalia, viewed in oblique direction from right; 38, apical segments of abdomen and caudal appendages, dorsal view; 40, the same, left profile view. Figs. 41-43. *Gomphoides theodorina* Navás, 1933, male holotype (unpublished drawings by Grace Eager, 1935): 41, accessory genitalia, viewed in oblique direction from right; 42, apical segments of abdomen and caudal appendages, dorsal view; 43, the same, left profile view.