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A Revision of the Moth Genus *Phyle* (Lepidoptera, Geometridae)

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CONTENTS

Abstract	2
Introduction	2
Acknowledgments and Abbreviations	2
Materials and Methods	3
Characters	3
Genus <i>Phyle</i> Herrich-Schäffer	4
Key to Males	8
Group 1	10
<i>Phyle glauca</i> Herbulot	10
<i>Phyle aspilotos</i> , new species	11
<i>Phyle transglauca</i> , new species	11
<i>Phyle infusca</i> , new species	14
<i>Phyle herbuloti</i> , new species	14
Group 2	15
<i>Phyle schausaria</i> (H. Edwards)	17
<i>Phyle arcuosaria</i> Herrich-Schäffer	18
<i>Phyle antioquia</i> , new species	18
<i>Phyle subfulva</i> Herbulot	19
<i>Phyle albifimbria</i> , new species	21
<i>Phyle orthogonia</i> , new species	23
<i>Phyle cartago</i> , new species	23
<i>Phyle neblina</i> , new species	25
<i>Phyle versatile</i> , new species	26
References	29

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ABSTRACT

The present paper is the first revision of the genus *Phyle*. The moths are recognized by the upper and lower surfaces of the wings being a unicolorous green, a color that is seldom found in members of the Ennominae. Within that subfamily, the genus is placed in the Semiothisini. In addition to the wing color, the males have the additional autapomorphic characters: a large, thick group of scales arising from the hind tarsi; numerous, very long, slender hairlike scales on the ventral surface of the abdomen; the genitalia with both the posterodorsal surface of the tegumen and each elongate costal lobe with their apex and posterodorsal surface having large, thickly set groups of long, curved, thick hairlike scales; and with a large, inflatable sac on each side attached to the

saccus, and the base of the valve having long, slender, hairlike scales.

Fourteen species are described and illustrated. Of these, the following are described as new: *albifimbria*, *antioquia*, *aspilotos*, *cartago*, *herbuloti*, *infusca*, *neblina*, *orthogonia*, *transglauca*, and *versatile*. *Mecoceras schausaria* H. Edwards (1884) is transferred from the Oenochrominae and placed in *Phyle* as a new combination.

The members of the genus occur from southern Mexico, through Central America, to Venezuela and the Guianas, south in the Andes Mountains to Bolivia, and east to northern Argentina and southeastern Brazil. No specimens have been seen from the Antilles, the Amazon Basin, northeastern Brazil, or Chile.

INTRODUCTION

It all appeared so simple at first. At hand was an easily recognized genus of moths that had had only one specific name since 1855. Herbulot added two more names in 1982. The object was to curate the collection, applying the two recently proposed names to the appropriate species. Thus began the study that lead to the present paper.

Even the placement of *Phyle* into the correct subfamily has not been without difficulties. Probably because of the unicolorous green upper and lower surfaces of the wings, early workers placed the genus in either the Geometrinae (as almost all of the included species have green wings) or in what is now the Oenochrominae (which has a few Neotropical green groups). But the structures of the moths precluded their being in either of these subfamilies; the earliest placement into the Ennominae of which I am aware was by Fletcher (1979).

As my study progressed it became evident that this genus belongs in the Semiothisini, a very large and worldwide group as now defined (Forbes, 1948: 36; McGuffin, 1972: 11). As there are no published tribal or generic revisions of Neotropical Semiothisini (and very few for North America), comparisons had to be made with the species from the United States and Canada to make this tribal placement. There are a number of characters that separate *Phyle* from the North American

genera; these may not prove to be so striking when other Neotropical genera in this tribe are studied and revised.

Almost a century ago, Druce wrote about the considerable variation that is to be found in the maculation and coloring of the under-surface of the wings. He concluded that "The specimens before me clearly show that these forms belong to one species [*arcuosaria*], although the two extremes look very distinct" (Druce, 1892: 93). Druce's observations were correct; his conclusion was wrong.

ACKNOWLEDGMENTS AND ABBREVIATIONS

I acknowledge with thanks the cooperation and aid of the following colleagues who have permitted me to study types and specimens in their charge: D. C. Ferguson for the United States National Museum of Natural History, Smithsonian Institution (USNM); J. E. Rawlins for the Carnegie Museum of Natural History (CMNH); J. K. Liebherr for Cornell University (CU); C. V. Covell, Jr., for the University of Louisville, Louisville, Kentucky; J. B. Sullivan of Beaufort, North Carolina (JBS); and C. Herbulot of Paris, France. I am particularly grateful to the last-named person for aid in checking the identification of the two species he named in this genus. To J. S. Miller, of the American Museum of Natural History (AMNH), who helped locate

specimens in several collections for this study, a similar expression of thanks. Helpful comments on the manuscript were received from C. V. Covell, Jr., R. S. Peigler, and J. B. Sullivan.

MATERIALS AND METHODS

A study of the genitalic structures is basic to most revisionary studies of Lepidoptera; I have found this to be an absolute necessity in working with the New World Geometridae. Accordingly, a considerable number of dissections were made from specimens of both sexes of *Phyle* that had different maculation and coloring on the undersurface of the wings, and from as many different localities as possible. At first glance, the preparations were dishearteningly similar, as obvious differences were not usually present. A more critical examination showed that the male terminalia did indeed have certain structures that proved to be of specific value; unfortunately, the female structures are basically so similar that I have not been able to point out specific characters for the members of this sex. As a result, a key to the males is provided that is based on a number of different characters; females must be identified primarily by association with the appropriate males. The male structures for each species are figured, but only two female genitalia are illustrated.

The basic work was done on specimens in the collection of the AMNH. To make the paper more complete, moths were sent to me on loan from a number of other institutions and individuals, as noted above. A total of 435 adults (271♂, 164♀), 175 genitalic dissections (137♂, 38♀), and 11 slide mounts (8♂, 3♀) of antennae and legs were studied.

Of the four previously described species now assigned to the genus, I have studied the holotype of only one (*schausaria*). The type specimen of *arcuosaria*, which is the type species of *Phyle*, is probably lost, but it was illustrated in color when described. Because of its type locality and certain features of color and maculation, there is no doubt as to what population this name applies. Herbulot's descriptions and accompanying illustrations of both the adults and male genitalia leave little doubt as to the identity of his two

taxa. In addition, he was kind enough to check my determinations by the use of a draft copy of the key to the males.

All the specimens that are illustrated are from the AMNH unless otherwise specified. Every specimen studied bears either one of my type labels or a determination label.

CHARACTERS

Study and measurements of the male hind tibia show that two kinds are present; this does not hold for the females. One is shorter and has a single hair pencil; the length varies from 5.4 to 8.0 mm. The second kind is longer, being between 8.9 and 11.0 mm, and has a second, apical hair pencil on the outer surface. This is an easy way to subdivide the genus into two groups, as the legs can be measured on pinned specimens.

Associated with the tibial grouping is the length of the process of the anellus, measured from its junction with the inner portion of the saccus to its apex, and the spatial relationship of the tip of the process to the transtilla. Males with the shorter tibia have a shorter anellus that does not extend posteriad to the transtilla; those with longer tibia have a longer process that reaches the transtilla or extends posteriorly over it.

The process of the anellus is usually straight, but it may be variably curved or slightly S-shaped; its conformation is of specific value.

The abdomens of some males may have a ventrolateral inflatable pair of tufts near the end of A5 (figs. 21, 22); tufts are absent in the "short" group but present in the other species. The basal portion and setae of these tufts vary from small and obscure to large and prominent, bearing hairlike scales up to 2 mm long that can be seen without dissection. Two types of scaling may be present in these tufts; either hairlike scales only, or a mixture of hairlike with a smaller number of flattened scales. It is often helpful to try to exert the tufts with a fine needled syringe that is normally used to inflate the vesica, and also to remove the abdominal scaling around each tuft.

The same technique can be used to help inflate the large sacs that are present at the bases of the saccus and valves. Once this is

done it is much easier to examine the distribution of the very long hairlike setae on each sac (figs. 27, 35, 39, 43, 45).

The same instrument is useful in exserting the vesica. This operation is necessary to study the spination, and to ascertain the true shape of the vesica. The number of spines is variable within each species; there is usually a longer and thicker group near the aedeagus and a second, thinner group distally. While exact numbers of spines cannot be relied on for any species, it is often possible to separate taxa by the relative numbers of basal and distal spines, and by their relative thicknesses.

As mentioned in the Introduction, it has long been known that the color and maculation on the undersurface of the wings is variable (figs. 5–18). This is a specific character, but it has to be used with caution. Several species have the ventral surface immaculate or almost so; others have the outer cross lines slender and with narrow shading; still others have very broad orange-brown areas along the cross lines. Those species with little or no maculation have hind wings with a relatively straight outer margin, whereas the taxa with more prominent maculation have angled outer margins.

There is some sexual dimorphism in the maculation, as the females of some species tend to have the color and markings more prominent than do the associated males.

When using the breakdown into the "short" (Group 1) and "long" (Group 2) assemblages, based on the lengths of the male hind tibia and the process of the anellus, it becomes apparent that what appears to be the same sort of variation in color and pattern is present on the undersurface of the wings in both groups. In Group 1, both *aspilotos* and *glauca* have plain, almost immaculate ventral surfaces. These species can be confused with *schausaria* and *arcuosaria* in Group 2, which have similar patterns. Likewise, *herbuloti* (Group 1) can be mistaken for *subfulva* and *versatile* in Group 2.

Genus *Phyle* Herrich-Schäffer

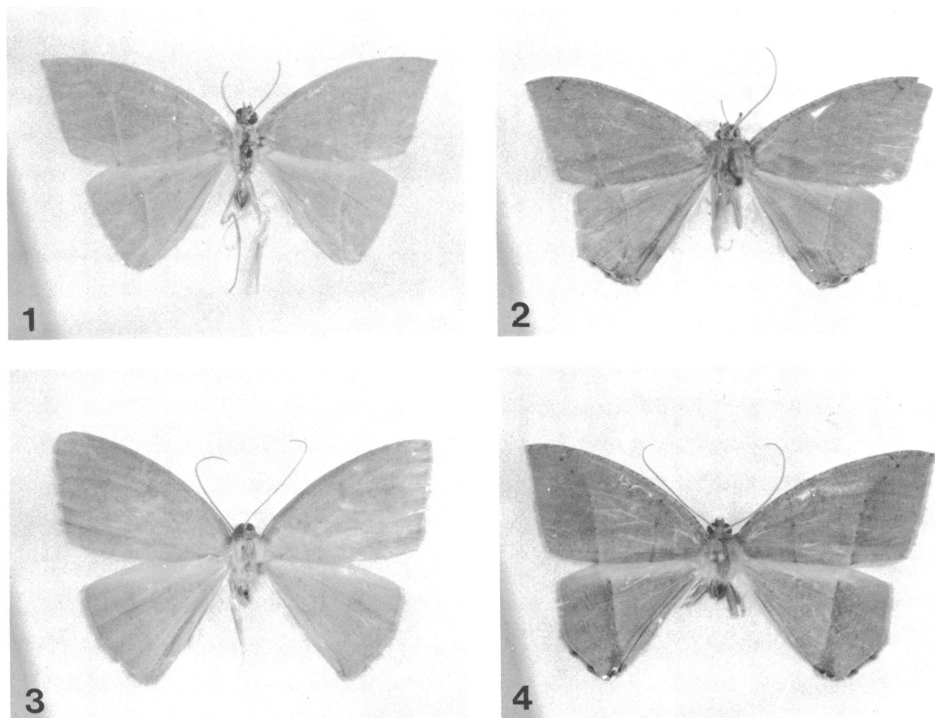
Phyle Herrich-Schäffer, 1855 (1850–1858): pl. 60, fig. 338. Guenée, 1857: 379. Walker, 1861: 588. Druce, 1892: 93.

DIAGNOSIS: The moths of this genus, belonging in the Ennominae, are recognized by the unicolorous green of the upper and undersurfaces of the wings. The males have the additional autapomorphic characters of a large thick group of scales arising from the hind tarsi; the ventral surface of the abdomen has numerous, very long, slender, hairlike scales (fig. 20); male genitalia with both the posterodorsal surface of the tegumen and each elongate costal lobe with their apices and posterodorsal surfaces have large, thickly set groups of long, curved, thick hairlike setae; and with a large inflatable sac on each side attached to the saccus and the base of the valves bearing long slender hairlike scales.

DESCRIPTION: Adults: Head with eyes large, those of females slightly smaller than those of males. Front pale brown, densely scaled; in males wider than in females and slightly swollen, of females narrower and flat. Proboscis fully developed. Palpi of males rising to about one-third height of eyes, second segment 0.8 mm long, third segment 0.2 mm; those of females smaller. Antennae of both sexes simple, with about 69–82 segments. Vertex concolorous with wings; scaling longer and looser than on front; collar and antennal bases brown.

Thorax above concolorous with upper surface of wings; without metathoracic tuft. Legs elongate, slender. Fore tibiae with epiphysis of males arising between three-fifths and two-thirds length of tibia, of females at two-thirds length, both just reaching end of segment; length of tarsi in both sexes 2.5 times that of tibiae. Middle legs of males with length of tarsi equal to that of tibiae or slightly longer, of females with tarsi slightly longer. Hind legs of males with large, thick group of scales arising from coxa; tibiae either slender, with hair pencil and groove, with both pairs of spurs of equal length, or swollen, with two elongate groups of hairlike scales arising on inner and outer surfaces at or near origin of segment, with groove, and having distal pair of spurs smaller than upper, the last being more noticeable in males than in females; hind legs of females simple.

Forewings with curved costa, apex square or pointed, outer margin straight, inner margin weakly curved; with 12 veins, two accessory cells, no fovea; discal cell less than one-



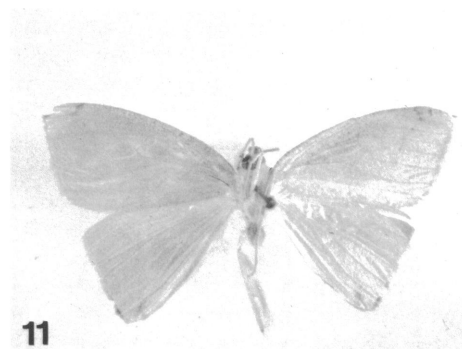
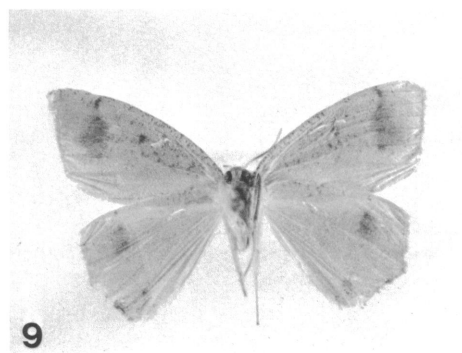
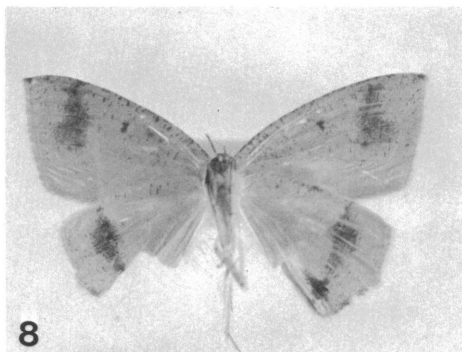
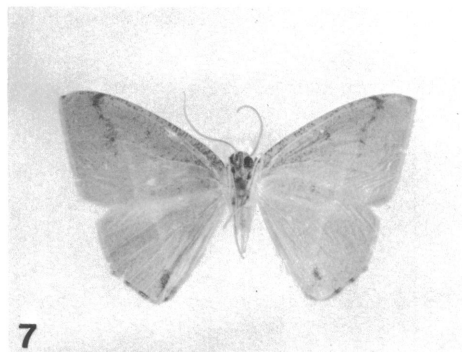
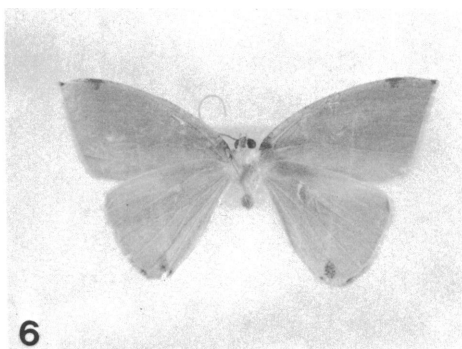
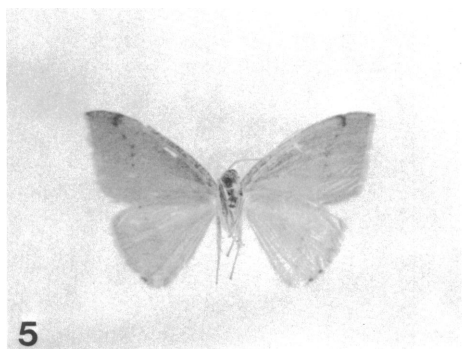
Figs. 1–4. Adults of *Phyle*, upper surface. 1. *P. schausaria* (H. Edwards), holotype (USNM). 2. *P. orthogonia*, new species, holotype (CMNH). 3. *P. neblina*, new species, holotype (USNM). 4. *P. versatile*, new species, holotype. All $\times 1.25$.

half length of wing; vein R dividing before end of discal cell, uniting with Sc, with R_{1+2} to costa; R_3 to beyond end of discal cell, forming first accessory cell, reaching costa and with short branch to form second accessory cell; R_{4+5} splitting about middle of second accessory cell, first going to costa near apex, other to distal margin; vein udc angled, short; veins mdc and ldc both curved, of about equal length; M_1 and M_2 straight or slightly curved; M_3 curved; Cu curved in basal part, narrowing basal portion of discal cell; Cu_1 straight; Cu_2 arising after middle of discal cell, curved; A2 with swollen base, straight or weakly curved.

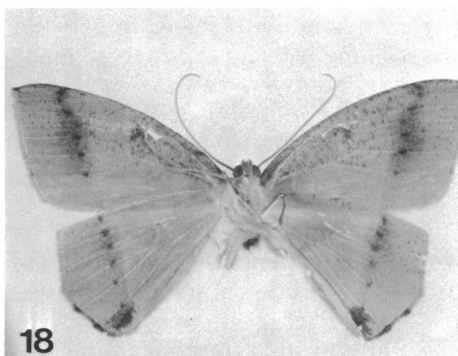
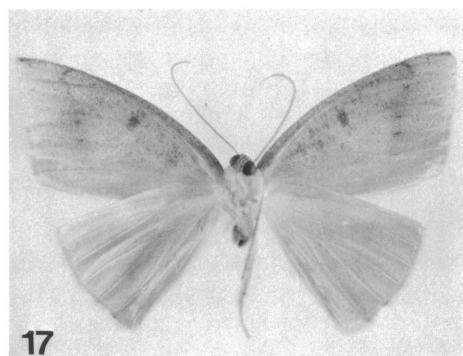
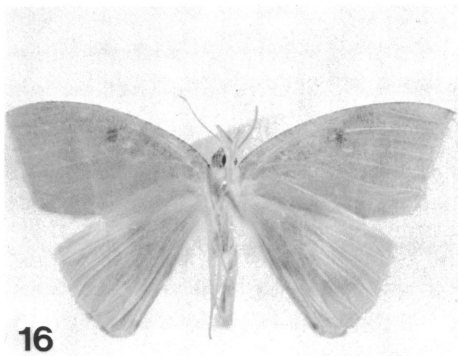
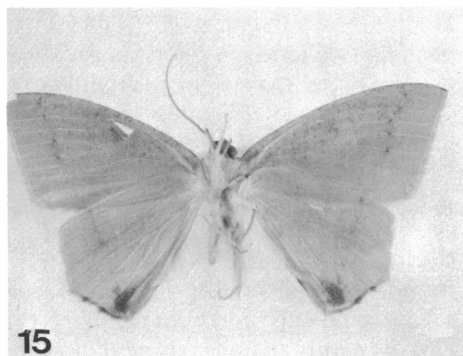
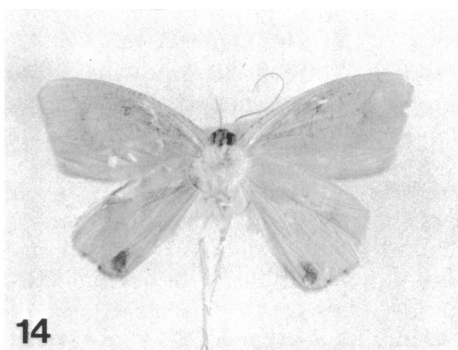
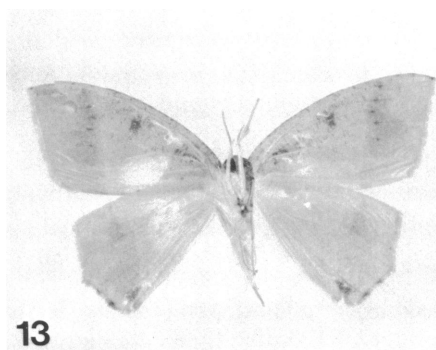
Hind wings with seven veins; costal margin straight, apex square, outer margin straight or angled at vein M_3 , anal margin straight and with fringe of long scales; discal cell less than one-half length of wing; vein Sc more or less paralleling costa; R with M_1 splitting off before middle of wing; vein $m+ldc$ curved; M_2 absent; M_3 upwardly arched; Cu_1 from near end of discal cell; Cu_2 from about two-

thirds length of cell; A2 weak basally, strong medially and distally. Frenulum strong in both sexes.

Wings with upper surface unicolorous green, usually with maculation; females of some species tending to have slightly more prominent markings than males. Forewings with weakly represented t.a. line, usually straight, indicated by venular dots; t.p. line arising on costa at about five-sixths length of costa, with short outward bend, then sharply recurved and bent to meet more clearly defined straight portion of line, upper part often vestigial or represented by venular dots, lower portion of dots more or less connected by dark scales, and lined basad by broader pale band; s.t. and terminal lines absent; fringe pale yellow. Hind wings with only extradiscal line, similar in appearance to t.p. line, gently curved, fading out below costa; anal angle with dark scaling forming either a small spot or a large dark area; fringe pale yellow anteriorly, variably darkened posteriorly. Undersurface similar to upper, paler, with some



Figs. 5-12. Adults of *Phyle*, undersurface. 5. *P. glauca* Herbulot. 6. *P. aspilotos*, new species, holotype. 7. *P. transglauca*, new species, holotype. 8. *P. infusca*, new species, holotype. 9. *P. herbuloti*, new species,



Figs. 13–18. Adults of *Phyle*, ventral surface. 13. *P. subfulva* Herbulot. 14. *P. albifimbria*, new species, holotype. 15. *P. orthogonia*, new species, holotype (CMNH). 16. *P. cartago*, new species, holotype (USNM). 17. *P. neblina*, new species, holotype (USNM). 18. *P. versatile*, new species, holotype. All $\times 1.4$

dark scaling on costa of forewings and at origin of straighter t.p. line; discal spot of forewing present or absent; outer cross lines varying from being absent to broadly shaded with orange-brown or dark brown scales; anal spot of hind wings present or absent.

Length of Forewings: 16 to 22 mm. In females tending to be about the same size as in males or slightly smaller.

Abdomen above concolorous with upper surface of wings; of males slender, extending beyond hind wings, of females thicker and

←

holotype. 10. *P. schausaria* (H. Edwards), holotype (USNM). 11. *P. arcuosaria* Herrich-Schäffer. 12. *P. antioquia*, new species, holotype. All $\times 1.3$

shorter, not extending beyond wings; without dorsal tufts. Males with ventral surface of A3 with transverse area of numerous setae (sometimes deciduous) and having semicircular area anteriorly with many thinner setae (fig. 19); A5 at posterolateral angles with (figs. 21, 22) or without small, inflatable tufts, remaining segments ventrally with numerous elongate hairlike scales (fig. 20), terminal segment unmodified; females with normal scaling.

Male Genitalia: Uncus with dorsal surface of base sclerotized around margin, in form of narrow rectangle, 0.56–0.67 mm wide, 0.10–0.13 mm high; ventrally with membranous surface narrower and deeper; shaft elongate, slender, very slightly curved, with parallel sides, 0.07–0.10 mm wide; apex with single spinelike point. Gnathos longer than uncus; posteriorly swollen, sides concave, elongate anteriorly, terminating in long, slender point, apically recurved, ventral surface of apex thickly covered with short denticulations. Tegumen broad anteriorly, tapered posteriorly to become narrower than base of uncus; posterior end bilobed; posterodorsal surface of each lobe with large, thickly set group of very long hairlike setae, these tending to curve ventrally over base of uncus, extending about one-half length of uncus. Saccus widest posteriorly, then narrowed, sides more or less parallel, anteriorly rounded or somewhat flattened. Valves with posterior margin bilobed; costa distinct, lightly sclerotized, projecting posteriorly as blunt lobe, each lobe with posterodorsal surface and apex with large, thickly set group of long hairlike setae, longer and more numerous than setae of tegumen; remainder of valve unmodified except as noted; inner surface concave, finely setose in basal portion; apex extended; outer margin broadly rounded, with weakly sclerotized and swollen sacculus. Large inflatable sac attached to saccus and base of valve on each side; outer surface thickly covered with long, hairlike scales, dorsal surface with very long hairlike scales, varying in length from shorter than to longer than valve. Transtilla widest medially. Anellus with rounded or angled anterior portion; posteriorly extending as parallel-sided, flattened rod, extending to near transtilla, ventral surface variably covered with minute denticulations or hairlike scales,

apically changing to more sclerotized scales; dorsal surface of basal area with small digitate process. Cristae prominent. Aedeagus a simple, more or less curved tube, anteriorly rounded, posterior end projecting as slender sclerotized point; 1.3–2.2 mm long, 0.2–0.3 mm wide. Vesica, when exerted, slightly swollen adjacent to aedeagus, with lobe to one side, then extending as narrowing tube at obtuse angle; with from 2 to 6 larger thicker basal cornuti, and with from 1 to 15 more slender spines distally.

Female Genitalia: Sterigma membranous. Ductus bursae sclerotized, lateral areas appearing thickened; longer than wide, slender posteriorly, variably enlarged anteriorly. Corpus bursae elongate, membranous, anterior two-thirds slightly swollen, with bluntly pointed anterior end; posterior one-third with longitudinal striations, short to moderately long sclerotized area extending anteriorly from ductus bursae. Signum large, round, or slightly elliptical, with numerous rays around edge and with raised central area. Ductus seminalis arising near posterior end of corpus bursae. Papillae anales elongate, 0.75–0.90 mm long, slender. Apophyses posteriores 2.15–2.85 mm long; apophyses anteriores 1.4–1.8 mm.

EARLY STAGES: Unknown.

FOOD PLANTS: Unknown.

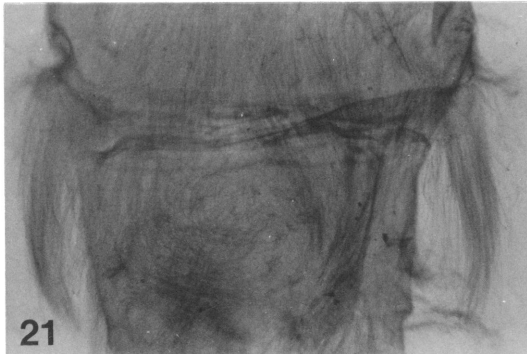
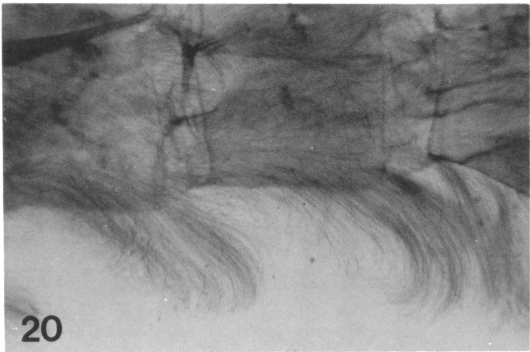
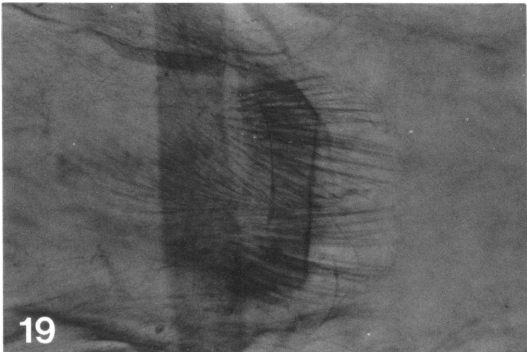
TYPE SPECIES: *Phyle arcuosaria* Herrich-Schäffer, 1855; by monotypy.

DISTRIBUTION: From southern Mexico, through Central America, to Venezuela and the Guianas, south in the Andes Mountains to Bolivia, northern Argentina, and southeastern Brazil. No specimens have been seen from the Antilles, the Amazon Basin, northeastern Brazil, or Chile. The moths apparently fly throughout the year, and have been caught from about 250 to 3000 m in elevation (according to the elevations given on the labels of the specimens).

REMARKS: A total of 421 specimens (260♂, 161♀), 170 genitalic dissections (132♂, 38♀), and 11 slide mounts (8♂, 3♀) of antennae and legs have been studied for this revision.

KEY TO MALES

1. Length of hind tibia 5.4–8.0 mm; anellus with posterior process not extending to



Figs. 19–22. Details of male abdomens. 19. *Phyle versatile*, new species, paratype; median spines on A3. 20. *P. antioquia*, new species, paratype; ventral scaling in lateral view. 21. *P. schausaria* (H. Edwards); ventrolateral tufts on A5. 22. *P. versatile*, new species, paratype; ventrolateral tufts on A5.

- transtilla, having a space of 0.1–0.2 mm between the two (Group 1) 2

Length of hind tibia 8.9–11.0 mm; anellus with posterior process just reaching the transtilla or extending to the middle of that structure (Group 2) 6

2(1). Hind wings with outer margin rounded; hind tibia 5.4–6.0 mm long 3

Hind wings with outer margin angled; hind tibia 7.2–8.0 mm long 4

3(2). Undersurface of all wings immaculate except for a black dot on the costa of forewings and a grayish black spot above the anal angle of hind wings (fig. 6) ..
..... *aspilos*

Undersurface of all wings with partial or complete t.p. and extradiscal lines being represented by venular dots (fig. 5) ..
..... *glauc*

4(2). Hind tibia 7.2 mm long; undersurface of wings with cross lines brown, seldom bordered with dark scaling (fig. 7) ...
..... *transglauc*

Hind tibia 7.5–7.9 mm long; undersurface of wings with cross lines broadly bordered with dark scaling 5
- 5(4). Undersurface of all wings with cross lines shaded distally with dark brown (fig. 8) *infusca*

Undersurface of all wings with cross lines broadly bordered with orange-brown (fig. 9) *herbuloti*

6(1). Process of anellus straight 7

Process of anellus curved or S-shaped ..
..... 10

7(6). Undersurface of all wings with or without faint traces of cross lines; shading absent 8

Undersurface of all wings with distinct cross lines shaded with orange-brown or dark brown 9

8(7). Undersurface of hind wings without anal spot (fig. 10); ventrolateral paired tufts of A5 of hairlike scales, 1.0–1.5 mm long (fig. 21) *schausaria*

Undersurface of hind wings with anal spot (fig. 11); ventrolateral paired tufts of A5 with mixture of flattened and hairlike scales, 0.6–1.0 mm long .. *arcuosaria*

9(7). Ventrolateral paired tufts of A5 up to 2.0 mm in length, often visible without dissection (fig. 22) *versatile*

- Ventrolateral paired tufts of A5 1.0 mm in length, usually not visible without dissection *antioquia*
- 10(6). Upper surface of wings immaculate, without cross lines (fig. 3) *neblina*
- Upper surface of wings with distinct cross lines 11
- 11(10). Ventrolateral paired tufts of A5 about 0.6 mm long 12
- Ventrolateral paired tufts of A5 1.0–1.5 mm long 13
- 12(11). Undersurface of hind wings with anal spots absent or reduced, orange-brown when present (fig. 16) *cartago*
- Undersurface of hind wings with anal spots dark brown (fig. 13) *subfulva*
- 13(11). Process of anellus sharply curved (fig. 41) *albifimbriata*
- Process of anellus slightly S-shaped (fig. 43) *orthogonia*

GROUP 1

MALES: Genitalia with the anellus not reaching the transtilla, having a space of 0.1–0.2 mm between the two; abdomens without ventrolateral paired tufts on A5; and with the length of the hind tibia 5.4–7.9 mm.

Phyle glauca Herbulot

Figures 5, 23, 24

Phyla glauca Herbulot, 1982: 69, fig. 14 (male genitalia), pl. 3, fig. 12 (holotype).

This is a small species having the under-surface of all wings a pale green with the outer cross line only weakly indicated (fig. 5).

Males with small group of white scales from each hind coxa; hind tibia slender, 5.4–6.2 mm long, with white to pale beige inner hair pencil in groove, with outer end of base of segment without long scaling.

Forewings with sharply pointed apex, straight outer margin; hind wings with outer margin rounded.

Upper surface of all wings having numerous, very slender striations in outer portion of wings. Forewings with t.a. line faint, usually with small venular dots; t.p. line yellow basally, outwardly narrowly shaded by reddish or reddish brown, with venular dots being more prominent than shading. Hind wings with extradiscal line similar to t.p. line, slightly more prominent, expanding above anal angle; anal spot circular or elliptical, red-

dish brown, darker on outer side, with central dark spot, and with single silvery white mark adjacent to spot at anal angle; fringe in lower one-half of wing with variable amount of black basally, medially faintly green, distally grayish black.

Undersurface greenish white. Forewings without t.a. line and discal spot; t.p. line dull black at costa, curved, short, then represented by variable number of small dark venular dots; without dark shading along t.p. line. Hind wings similar to forewings, with extradiscal line tending to be reduced or obsolete; fringe with diffuse grayish black spots opposite veins in lower portion of wing.

Length of Forewings: Males, 16–19 mm; females, 18–21 mm.

The male genitalia (fig. 23) have the anellus with its process (measured from junction of inner portion of saccus to apex) 0.4–0.5 mm long, with 0.10–0.15 mm between apex and transtilla, apex pointed, with a V-shaped minutely spined tip; aedeagus (fig. 24) 1.3–1.6 mm long; exerted vesica with a single lobe to right of aedeagus, having six to eight cornuti, four thicker basal ones and from two to four more slender distal spines.

The female genitalia have the ductus bursae with sides of equal length, constricted medially, swollen anteriorly; the corpus bursae has the posterior swelling medially, and a large sclerotized posterolateral area on the left side curving ventrally.

The holotype is a male from km 41 on the road from Gualaceo to Limon, 2400 m, Ecuador, and was caught in January; it is in the Herbulot collection. The remainder of the type series included two topotype males and a male and a female from Yungas del Palmar, 3000 m, Bolivia. These two countries include the known distribution of *glauca*; it is possible that it also occurs in Peru. Additional Bolivian localities include the departments of Cochabamba and La Paz, at elevations of from 2000 to 3000 m. Adults have been caught from November through February.

I have studied 29 specimens (21♂, 8♀), five genitalic dissections (3♂, 2♀), and one slide mount of a male antenna and set of legs; all of this material is from Bolivia. Herbulot was kind enough to confirm the identification of his species by the use of my key to the males.

Phyle aspilotos, new species

Figures 6, 25, 26, 51

DIAGNOSIS: Similar to *glauca* but with the upper surface of all wings a slightly yellowish green; undersurface pale green, immaculate except for small dark spots on the costa at the origin of the t.p. line and above the anal angle of the hind wings.

DESCRIPTION: Adults: Similar to *glauca*, differing mainly as follows: Males with strongly developed tuft of gray scales on each hind coxa; hind tibia 6.0 mm long.

Hind wings with rounded outer margin.

Upper surface of all wings faintly yellowish green; striations reduced on forewings to single scale dots or short dashes; cross lines narrower, less prominent. Hind wings with anal spot a curved black line, with small silvery white mark posterolaterally, and a few black scales distally; fringe with short strip of basal black scaling, distally pinkish gray or gray.

Undersurface (fig. 6) unicolorous pale green, immaculate except for a dark costal spot at the origin of each t.p. line and second grayish black spot above anal angle.

Length of Forewings: Holotype, 18 mm; paratypes, 17 (male) and 19 mm (female).

Male Genitalia (fig. 25): Anellus with process 0.4 mm long, with 0.03 mm between apex and transtilla, tapering to unarmed point. Aedeagus (fig. 26) 1.5 mm long. Exserted vesica with posteromedian swelling, having five cornuti, three thick basal ones, and two slender distal spines.

Female Genitalia (fig. 51): Ductus bursae with right side longer than left, weakly constricted medially, enlarged anteriorly. Corpus bursae with posterior swelling to left side, and with sclerotized posterolateral area on left side smaller than in *glauca*.

TYPES: Holotype, male, Cerro Pelon, 7052 ft, Municipio Yolox, Oaxaca, Mexico, Sept. 12, 1961 (E. C. Welling). The genitalia of the holotype are mounted on slide FHR 20,168A, and an antenna and a set of legs are on slide FHR 20,168B. Paratypes, both from Oaxaca, Mexico, and collected by E. C. Welling: Mo Cuou, 7050 ft, Cerro Pelon, Mpio. Yolox, Sept. 17, 1962, 1♂, 1♀.

All three type specimens are in the collection of the AMNH.

DISTRIBUTION: Known only from the Cerro Pelon, at 2150 m, in Oaxaca, Mexico, having been caught in September.

REMARKS: Three specimens, two genitalic dissections (1♂, 1♀), and one slide mount of an antenna and set of legs of the holotype have been studied.

ETYMOLOGY: The specific name is from the Greek *aspilotos*, meaning "spotless," referring to the undersurface of the wings.

Phyle transglauca, new species

Figures 7, 27, 28

DIAGNOSIS: Similar to *glauca* but larger; hind wings with outer margin angled and with anal spot on upper surface consisting of two dark areas and two silvery white marks. Undersurface slightly darker green; forewings with small discal dot and with some dark brown scaling along t.p. line.

DESCRIPTION: Adults: Similar to *glauca*, differing mainly as follows: Males with distinct tuft of short scales from each hind coxa, white on outer portion, pale gray medially; hind tibia 7.2 mm long.

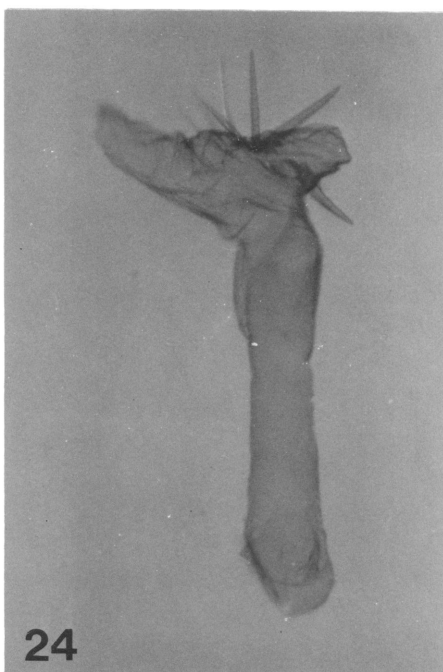
Hind wings with angled outer margin.

Upper surface of all wings with striations in outer portion shorter. Hind wings with anal spot larger, bilobed, with short, broad, silvery lunate mark between lobes and with second, silver-white, slender projection about twice as long as basal mark distad of outer dark area; fringe in lower half of wing with more basal black scaling, distally reddish.

Undersurface (fig. 7) tending to be slightly darker green than in *glauca*. Forewings with scattered dark brown scaling anteriorly; with small discal dot; t.p. line with slender irregular dark brown scaling along upper portion, variable in amount, never broad in males, tending to be somewhat wider in females than in males. Hind wings with or without small grayish black spot above anal angle; fringe darker than in *glauca*.

Length of Forewings: Holotype, 20 mm; males, 18–21 mm; females, 20–21 mm.

Male Genitalia (fig. 27): Anellus with process 0.50–0.55 mm long, with 0.13–0.17 mm between apex and transtilla; apex tapered to unarmed point. Aedeagus (fig. 28) 1.7–1.8 mm long. Exserted vesica with posteromedian

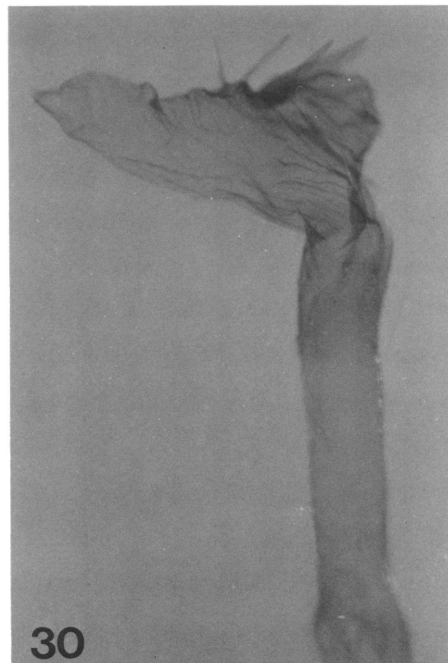


Figs. 23–26. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 23, 24, *Phyle glauca* Herbulot. 25, 26. *P. aspilos*, new species, holotype.

swelling on right side, having from three to eight cornuti, two to four thicker basal ones, and from one to four thinner distal spines.

Female Genitalia: Ductus bursae with right

side slightly longer than left, sides parallel, weakly enlarged anteriorly. Corpus bursae with posterior swelling slightly diagonal, ending to left of center, with small corneous area



Figs. 27–30. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 27, 28. *Phyle transglaucæ*, new species, paratype. 29, 30. *P. infusca*, new species, holotype.

on left; sclerotized posterolateral area prominent, bulbous, curving ventrally.

TYPES: Holotype, male, Rio Zongo, 1900 m, La Paz, Bolivia, Oct. 24–31, 1984 (L. E.

Peña). The genitalia of the holotype are mounted on slide FHR 20,152. Paratypes, all from Bolivia: Yungas del Palmar, 2000 m, Feb. 12, 1948, Feb. 5, 1950, March 4, 1948,

March 15, 1949, March 1951, April 10, 1950, 5♂, 1♀ [AMNH]; Chapare, Aug. 8, 1949, Oct. 12, 1949 (Peña), 2♀ [AMNH]; Paracti, 2200–2400 m, Chapare, Cochabamba, Feb. 1–5, 1976 (L. E. Peña), 5♂ [AMNH]; Unduavi to Coroico, 3000 m, La Paz, Nov. 19, 1984 (L. E. Peña), 2♂ [AMNH]; same as preceding but 2500 m, Nov. 19–24, 1984, 1♀ [AMNH]; same data as holotype, 1♂ [AMNH]; same as preceding but 1400 m, Oct. 24–30, 1984, 1♂ [AMNH]; Rio Songo [Zongo], 750 m (Fassl), 1♀ [USNM]; Incachaca, Cochabamba (J. Steinbach), 3♂, 3♀ [USNM, CMNH]. The type series is restricted to specimens from Bolivia.

The holotype is in the collection of the AMNH; paratypes are in the collections of that institution, USNM, and CMNH, as indicated.

DISTRIBUTION: Bolivia (Cochabamba, La Paz) and Peru (Cuzco, Huanuco, Junín, Puno), at elevations of between 750 and 3000 m, with the adults having been collected from February through April, and from July through November.

REMARKS: Forty-four adults (25♂, 19♀) and 10 genitalic dissections (5♂, 5♀) have been studied.

ETYMOLOGY: The specific name is formed from the Latin prefix *trans-*, and the Latin word *glaucus*, “bluish green”; used to indicate a general similarity to *P. glauca*.

***Phyle infusca*, new species**

Figures 8, 29, 30

DIAGNOSIS: Similar to *transglauca* but with outer margin of hind wings more prominently angled; undersurface having t.p. line broadly shaded distally with dark brown in center of wing and extradiscal line shaded with a darker brown, plus a prominent black spot above the anal angle. (The females have not been examined.)

DESCRIPTION: Adults: Similar to *transglauca*, differing mainly as follows: Males with smaller tuft of scales from each hind coxa; hind tibia 7.5 mm long.

Hind wings with sharply angled outer margin.

Upper surface of all wings with striations faint, elongate. Forewings with cross lines thinner, with venular dots appearing more prominent. Hind wings with posterior end of

extradiscal line broader; anal spot with black lunate inner portion, shaded outwardly by short, broad, subtriangular silver-white area, with deep reddish brown elongate area curving into extradiscal line, and with small, very short silver-white spot equal in length to basal one; fringe in lower half of wing with black scaling more solidly represented.

Undersurface (fig. 8) of each forewing with prominent discal dot; t.p. line shaded with brown on outer side from costa into cell Cu_1 , widest (1.5 mm) in cells M_2 and M_3 , with black venular dots in shaded area. Hind wings with entire extradiscal line shaded by blackish brown, widest in cells R and M_1 (1.2 mm), and with prominent, elongate, black spot in cell Cu_2 above anal angle; fringe darker than in *transglauca*.

Length of Forewings: Holotype, 19 mm.

Male Genitalia (fig. 29): Anellus with process 0.6 mm long, with 0.1 mm between apex and transtilla; apex tapered to blunt, minutely spined point. Aedeagus (fig. 30) 1.9 mm long. Exserted vesica with posteromedian swelling on right side, having seven cornuti, five thicker basal ones, and two thin distal spines.

Female Genitalia: Unknown.

TYPE: Holotype, male, Otavalo to Apuela, 2200 m, Imbabura, Ecuador, Sept. 8–10, 1977 (L. E. Peña). The genitalia of the holotype are mounted on slide FHR 20,128.

The holotype is in the collection of the AMNH.

DISTRIBUTION: Known only from the type locality in northern Ecuador on the Pacific slope of the Andes Mountains.

REMARKS: One specimen and one genitalic dissection have been studied.

ETYMOLOGY: The specific name is from the Latin *infuscus*, “dusky or dark brown,” in reference to the coloring on the undersurface of the hind wings.

***Phyle herbuloti*, new species**

Figures 9, 31, 32

DIAGNOSIS: This species is similar to *infusca*, differing mainly in the broader, orange-brown shading to the t.p. and extradiscal lines on the undersurface of the wings; sexual dimorphism is present in these markings.

DESCRIPTION: Adults: Males with tufts of

scales from each coxa and hind tibia similar to those of *infusca* but with latter 7.9 mm long.

Upper surface of wings having slightly more prominent t.a. and t.p. lines, along with included venular dots; extradiscal line either more grayish brown, slightly thicker, and more clearly defined (males), or having more prominent yellowish basad shading and narrower (females); anal spots variable, either being similar to those of *infusca* or with slightly larger outer silver-white spots; fringe tending to have basal black scaling in three areas, and darker outer portion.

Undersurface (fig. 9) of each forewing having larger discal dot and more dark scaling in anterior portion than in *infusca*; t.p. line broadly shaded with orange-brown from cells R_5 into Cu_1 , 2.0 mm wide in males, 1.5 mm in females, tending to have green veins showing through shading but with black venular dots obsolescent. Hind wings of males having extradiscal line broadly orange-brown in cells R and M_1 , 1.3–1.8 mm wide, with line becoming obsolescent posteriad, and with obsolescent to prominent grayish black spot above anal angle; females having complete extradiscal line, narrowly edged for its entire length on outer side by orange-brown, and with or without dark spot above anal angle; fringe variable in lower portion of wings, darker and more complete in males than in females.

Length of Forewings: Holotype, 20 mm; paratypes, males, 19–20 mm, females, 19–21 mm.

Male Genitalia (fig. 31): Anellus with process 0.50–0.55 mm long, with 0.18–0.22 mm between apex and transtilla, tending to be slightly swollen medially; apex bluntly pointed, minutely spinose. Aedeagus (fig. 32) 1.7–1.8 mm long. Exserted vesica with large posteromedian swelling on right side and with small swelling on left, having from four to six cornuti, three to five thicker basal ones, and one slightly thinner distal spine.

Female Genitalia: Ductus bursae with sides of equal length, slightly constricted medially, weakly enlarged anteriorly. Corpus bursae with posterior swelling mediad; posterolateral area on left weakly sclerotized, bulbous.

TYPES: Holotype, male, km 23, Santa Barbara to La Bonita, 2400 m, Napo, Ecuador,

April 8–9, 1986 (S. McKamey). The genitalia of the holotype are mounted on slide FHR 20,138. Paratypes, all from Ecuador: Otavalo to Apuelo, 2200 m, Imbabura, Sept. 8–10, 1977 (L. E. Peña), 1♂ [AMNH]; Sebundoi, between Santa Barbara and La Bonita, 2600 m, Napo, Sept. 11–15, 1977 (L. E. Peña), 1♂ [AMNH]; Quito to Santo Domingo, 1200 m, Pichincha, Feb. 25, 1965 (L. E. Peña), 1♀ [AMNH]; Tandapi, 1500 m, on road from Alaog to Santo Domingo, Pichincha, Jan. 28, 1971 (L. E. Peña), 1♀ [AMNH]; Sevilla Don Bosco, 1070 m, Morona-Santiago, May 8–11, 1986 (S. McKamey), 1♀ [AMNH]; Zamora, Zamora-Chinchi, March 27–31, 1965 (L. E. Peña), 1♀ [AMNH]; 3 km (air) SE Zamora, ca. 1200 m, Zamora-Chinchi, June 1–3, 1986 (S. McKamey), 1♀ [AMNH]; Environs de Loja, 1889, 1♂ [USNM].

The holotype is in the collection of the AMNH; paratypes are in the collections of that institution and USNM, as indicated.

There is also before me one male labeled "San Antonio W. Colombia Dec '07 5800 ft (M. G. Palmer)" [CU] that is not included in the type series.

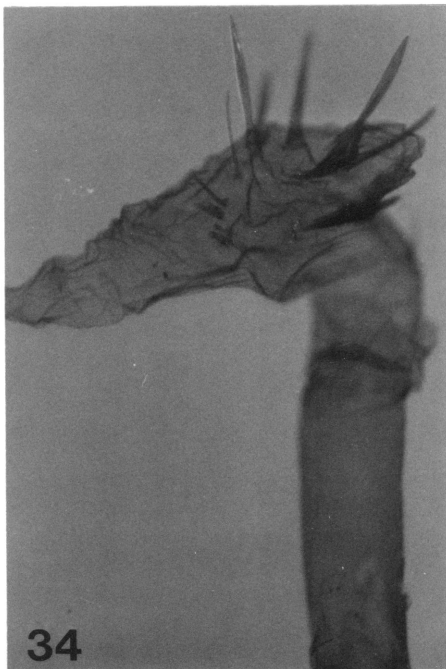
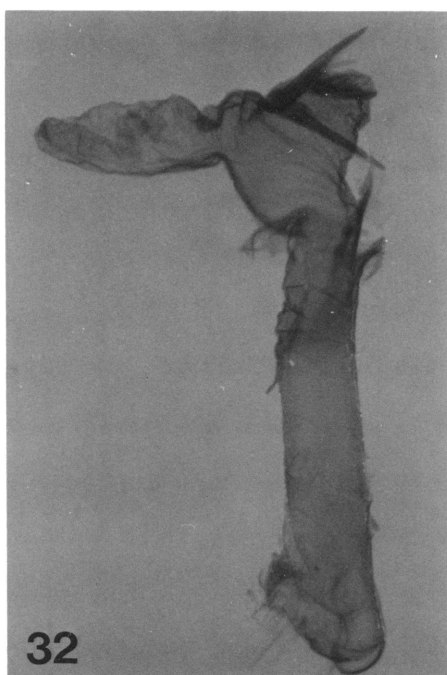
DISTRIBUTION: The lower elevations of the Andes in Ecuador on both the eastern and western slopes, and in western Colombia; label data indicate that specimens have been caught between 1070 and 2600 m elevation. The moths have been captured from January through May, September and December.

REMARKS: Eleven specimens (5♂, 6♀), seven genitalic dissections (4♂, 3♀), and one slide mount of a male antenna and a set of legs have been studied.

ETYMOLOGY: The species is named after Claude Herbulot, who has done the only recent work on this genus.

GROUP 2

MALES: Genitalia with the anellus just attaining the transtilla or extending part way over that structure; abdomens with ventrolateral paired tufts on A5; and with the length of the hind tibia 8.9–11.0 mm. The paired tufts on A5 may be relatively short (0.6–0.8 mm) and inconspicuous, or they may be long (up to 2.0 mm) and easily visible on undissected specimens (figs. 21, 22). The scales forming the tufts are usually hairlike but in



Figs. 31–34. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 31, 32. *Phyle herbuloti*, new species, holotype. 33, 34. *P. schausaria* (H. Edwards), holotype (USNM).

some species there are elongate flattened scales mixed in with the first type.

Phyle schausaria (H. Edwards),
new combination

Figures 1, 10, 21, 33, 34

Mecoceras schausaria H. Edwards, 1884: 18.
Druce, 1892: 95.

Ametris nitocris ab. (?) *schausaria*: Prout, 1912: 80.

This species has the undersurface of the wings immaculate except for some slight dark scaling in the cell of the forewings, the barest trace of the outer cross lines in the males and with the t.p. line sometimes weakly indicated at the costa of the females.

Males with large globose blackish brown coxal tuft surrounded by a few cream-colored scales; hind tibia 9.9–10.5 mm long, with prominent hair pencils.

Forewings with sharply pointed apices, similar to those of *glauca*; hind wings with a slightly curved outer margin.

Upper surface of wings (fig. 1) green or faintly bluish green; striations quite small, tending to be spread across anterior portion of forewings as well as in outer area; cross lines yellow, t.a. more weakly represented than t.p. line, latter tending to be shaded outwardly at inner margin in females by small lilac or reddish brown area. Hind wings with curved cross line, more prominent in females than in males, terminating in small anal spot, reddish in males, lilac or reddish lilac and larger in females, both sexes with small black dots shaded distally by white; fringe narrowly black posteriorly, tending to be widened opposite vein Cu_2 .

Undersurface (fig. 10) immaculate except for scattered dark scaling in cell of forewings; males with trace of outer cross lines, females with dark costal marking at origin of t.p. line, and some specimens with small venular dots marking t.p. line. Hind wings of both sexes without anal spots.

Length of Forewings: Males, 18–22 mm; females, 17–22 mm.

The male abdomen has moderate ventrolateral paired tufts on A5, with the hairlike scales ranging from 1.0 to 1.5 mm in length (fig. 21).

The male genitalia (fig. 33) have the anellus

with a straight process 0.67–0.90 mm long, varying from just attaining anterior edge of transtilla to extending 0.07 mm posterior thereof, weakly constricted basally, terminally weakly tapered, apex square, minutely spinose; aedeagus (fig. 34) 1.8–2.1 mm long; exerted vesica with prominent flat lobe to right of aedeagus, having from 8 to 13 cornuti, 5–7 thicker basal ones and from 3 to 7 much thinner distal spines.

The female genitalia have a short ductus bursae with sides of equal length, weakly constricted medially and enlarged anteriorly; the corpus bursae has the posterior swelling terminating toward the left side, and the posterolateral area on the left side is broad and curved ventrally.

Edwards described this species from one male; it is USNM type no. 34331, with its genitalia mounted on slide FHR 20,172. No type locality was given in the original description, nor is there any locality pin label on the holotype. As the description appeared in an article resulting from the author's examination of "... a magnificent collection of Lepidoptera, captured chiefly in the State of Vera Cruz, Mexico . . .," I think it is safe to accept Veracruz as the type locality.

This species has heretofore been placed in what is now the Oenochrominae, even though neither Druce (1892) nor Prout (1912) were familiar with the species. Ferguson had it correctly placed in the USNM collection, but has not published on its current status.

This species has a wide distribution, being known to occur in southern Mexico (Chiapas, México, Oaxaca, Veracruz), Guatemala (Alta Verapaz, Baja Verapaz, Chimaltenango, Quetzaltenango, Suchitepéquez), El Salvador, Honduras, Costa Rica (Cartago), Panama (Chiriquí), western Colombia (Valle), and western Venezuela (Aragua, Lara, Mérida). The moths have been caught in January, February, and March, and from June through December, at elevations of from 500 to 2300 m.

The only Colombian specimens examined are two males from two localities in Valle (in collection JBS). Both have the outer cross line on the undersurface of the forewings partially represented with a variable number of venular spots and faint orange-brown scaling; the hind wings below have just the faintest hint

of the cross line, and the anal spots are absent. These two moths are small, as the length of their forewings are 18 and 19 mm.

A total of 100 specimens (50♂, 50♀), 14 genitalic dissections (9♂, 5♀), and two slide mounts (1♂, 1♀) of antennae and legs have been studied.

Phyle arcuosaria Herrich-Schäffer

Figures 11, 35, 36

Phyle arcuosaria Herrich-Schäffer, 1855: pl. 60, fig. 338; 1858: 62, 82. Guenée, 1857: 380. Walker, 1861: 588. Druce, 1892: 93 (in part, Brazil only). Oberthür, 1916: 92 (in part, Brazil only). Fletcher, 1979: 164.

Chlorodes facetaria Guenée, 1857: 380 (nomen nudum; listed as synonym of *arcuosaria* by Guenée).

This species is similar to *schausaria* but the undersurface is paler, the ventrolateral paired tufts on A5 of the male abdomen have both elongate flattened scales and hairlike scales (only the latter in *schausaria*), and have a longer process of the anellus (0.95–1.03 mm, compared with 0.67–0.90 mm for *schausaria*).

Males with large globose grayish brown coxal tuft; hind tibia 8.9 to 10.6 mm long, large, with strong hair pencils on both outer and inner surfaces.

Wings similar in shape to those of *schausaria*.

Upper surface of wings green, sometimes faintly bluish green; striations reduced; t.a. and t.p. lines similar to those of *schausaria* but tending to have moderately strong venular dots; anal spots with larger purplish brown area near posterior end of t.p. line, with larger silver-white spot and with narrow silver-white line paralleling veins; fringe very pale green, with basal black portion thicker.

Undersurface (fig. 11) pale greenish white, paler in color than in *schausaria*, having very little black scaling, and without discal dots. Forewings with t.p. line obsolescent, with few or no dark scales (males) to a weak series of venular dots (females). Hind wings with extradiscal line similar to that of forewings; anal dot weakly represented, stronger in females than in males; fringe posteriorly grayer than in *schausaria*.

Length of Forewings: Males, 18–21 mm; females, 19–21 mm.

The male abdomen has short ventrolateral paired tufts on A5, with both elongate flattened scales and hairlike scales, ranging from 0.6 to 1.0 mm in length.

The male genitalia (fig. 35) have the anellus with a straight process 0.95–1.03 mm long, extending 0.13 mm beyond the anteriad margin of the transtilla, terminally tapered, apex bluntly rounded, minutely spinose; aedeagus (fig. 36) 1.85–2.00 mm long; exerted vesica with lateral lobe on each side at base, having from seven to nine cornuti, three basal ones on right lobe, and four to six more slender distal spines.

The female genitalia have the ductus bursae short, with the right side slightly longer than the left, and both sides broadly swollen anteriorly; the corpus bursae has the longitudinally striate posterior swelling terminating toward the left side, and a rather weakly sclerotized area on the left side.

The original description consisted of a colored figure of the upper surface of the female of *arcuosaria*; this was followed in 1858 by a listing of the generic and specific names. It is doubtful if the original specimen(s) is still in existence. It is assumed that the type locality, given as "Rio," is Rio de Janeiro, Brazil. Only one species of *Phyle* is known to occur in southeastern Brazil; the original figure matches females from that area, and so there is no question as to the application of the name.

Specimens are before me from Minas Gerais, Rio de Janeiro, São Paulo, Paraná, and Santa Catarina. The species probably flies throughout the year, although I have seen no moths that were caught in December and January. There is a specimen in the USNM from the Dognin collection that is labeled "Perou"; this locality needs to be verified if it is to be accepted.

Thirty-four specimens (24♂, 10♀), five genitalic dissections (3♂, 2♀), and two slide mounts (1♂, 1♀) of antennae and legs have been studied.

Phyle antioquia, new species

Figures 12, 20, 37, 38

DIAGNOSIS: Similar to *arcuosaria* but having angulate hind wings, and with a strong orange-brown shading on the outer cross lines

on the undersurface of the wings. (The females have not been examined.)

DESCRIPTION: Adults: Males with large globose coxal tufts, having cream to pale yellow scales outwardly, pale grayish brown inwardly (hind tibia absent in both specimens).

Forewings similar in shape to those of *arcuosaria*; hind wings with outer margin strongly projecting at vein M_3 .

Upper surface darker green than in *arcuosaria*; striations more numerous but not prominent; cross lines similar but tending to be less prominent; anal spots with more red scaling and with reduced or obsolescent silver-white line; fringe yellow, with black basal portion extending to vein M_3 .

Undersurface (fig. 12) yellowish green, with scattered black scaling in cell of forewings. Forewings with prominent discal dot; t.p. line prominently shaded outwardly by orange-brown, 2.5 mm wide. Hind wings without discal dot; extradiscal line with orange-brown shading anteriorly, and with dark brown anal spot; fringe with large dark spots at ends of veins in lower portion of wing.

Length of Forewings: Holotype, 22 mm; paratype, 20 mm.

Male abdomen with moderate ventrolateral paired tufts on A5, having hairlike scales about 1.0 mm long.

Male Genitalia (fig. 37): Anellus with straight process 0.8–0.9 mm long, being between 0.025 mm short of to 0.025 mm beyond antieriad margin of transtilla, terminally tapered; apex bluntly rounded, minutely spinose. Aedeagus (fig. 38) 1.9 to 2.0 mm long. Exserted vesica with prominent ventral lobe, having eight cornuti, three or four thick basal ones on both sides of lobe, and four or five more slender distal spines.

Female Genitalia: Unknown.

TYPES: Holotype, male, and paratype, male, Mesopotamia, 5000 ft (1525 m), Antioquia, Colombia. The genitalia of the holotype are mounted on slide FHR 20,154.

Both type specimens are in the collection of the AMNH.

DISTRIBUTION: Known only from the type locality at the northern end of the Cordillera Occidental.

REMARKS: Two specimens and two genitalic dissections have been studied.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

Phyle subfulva Herbulot

Figures 13, 39, 40

Phyle subfulva Herbulot, 1982: 69, fig. 12 (male genitalia), pl. 3, fig. 10 (paratype female).

This species is similar to *antioquia*, differing primarily in having a curved process of the anellus, whereas it is straight in *antioquia*; the orange-brown shading to the outer cross lines on the undersurface of the wings is wider than in the preceding species.

Males with large globose coxal tufts, having cream to pale yellow scales outwardly, dark grayish brown inwardly; hind tibia 10.2–11.0 mm long.

Wing shape similar to that of *antioquia*.

Upper surface of wings similar to that of *antioquia*, but with striations fewer and thicker, more noticeable anteriorly on forewings; cross lines and venular dots redder, t.p. line widened outwardly at inner margin of forewing and wider on hind wings; anal spots posteriad of broad lilac and reddish brown distad widening of extradiscal line, and having silver-white line represented; fringe with wider black basal line.

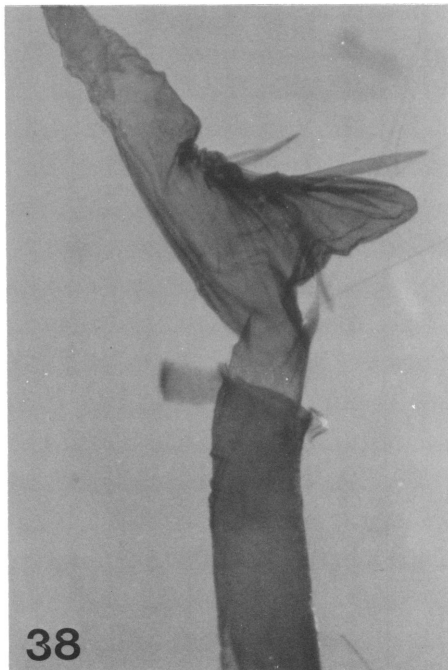
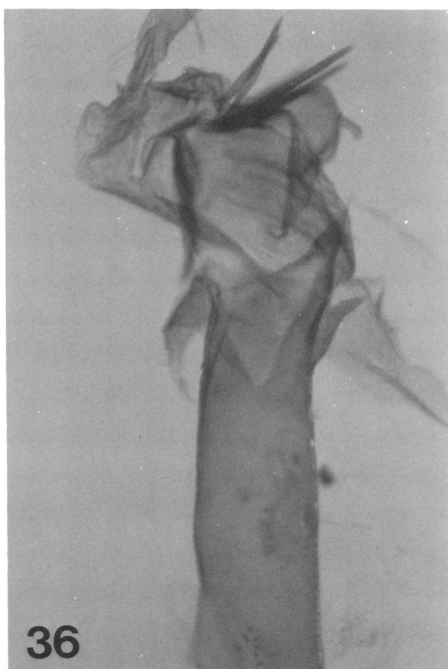
Undersurface (fig. 13) similar to that of *antioquia*, but with larger discal spots on forewings, and with orange-brown shading distad of t.p. line wider, extending 3.5–4.5 mm. Hind wings with more prominent orange-brown shading to extradiscal line, 2.0–2.5 mm wide; anal spot grayish black.

Length of Forewings: Males, 22–24 mm; females, 19–24 mm.

The male abdomen has short ventrolateral paired tufts on A5 with both numerous flattened scales and hairlike scales being about 0.6 mm in length.

The male genitalia (fig. 39) have the anellus with a slight to moderately curved process 0.65–0.80 mm long, extending 0.05 mm beyond antieriad margin of transtilla, terminally weakly tapered, apex square, minutely spinose; aedeagus (fig. 40) 2.00–2.05 mm long; exserted vesica with single lobe to right of aedeagus, having about 17–19 cornuti, 5 basally, and with from 12 to 14 distal spines of varying length and thickness.

The female genitalia have the ductus bursae with sides of equal length, more or less constricted medially, swollen anteriorly; the corpus bursae has the posterior swelling terminating toward the left side, and the pos-



Figs. 35–38. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 35, 36. *Phyle arcuosaria* Herrich-Schäffer. 37, 38. *P. antioquia*, new species, holotype.

terolateral area on the left is broadly rounded and lightly sclerotized.

The holotype male is from 16 km ESE of Santo Domingo de los Colorados, 650 m, Pichincha, Ecuador, having been caught in January; it is in the Herbulot collection. The remainder of the type series included ten females from Pichincha, Napo, and Morona-Santiago, Ecuador. I have not studied the type series; Herbulot determined his species for me from a draft version of my key to the males.

This species occurs in western Colombia (Valle) and Ecuador (Azuay, Cañar, Carchi, El Oro, Guayas, Imbabura, Napo, and Pichincha). Adults have been caught in most months of the year, although I have not seen specimens taken in March, June, or October. The elevations range from 250 to 2400 m.

I have studied 29 specimens (22♂, 7♀), 11 genitalic dissections (8♂, 3♀), and 2 slide mounts (1♂, 1♀) of antennae and legs.

***Phyle albifimbria*, new species**

Figures 14, 41, 42, 52

DIAGNOSIS: This species differs from *subfulva* by the much broader brown or lilac-brown anal spot on the upper surface of the hind wings and by the fringe of the same wings being narrowly white basally in the posterior part of the wings; the undersurface of all wings has noticeably less orange-brown scaling along the outer cross lines than in *subfulva*. The male genitalia have the curved process of the anellus arising from an asymmetrical base, and have the apical region more sharply curved than in *subfulva*; the vesica has fewer spines than are found in the preceding species.

DESCRIPTION: Adults: Males with coxal tufts similar to those of *subfulva* but paler brown; hind tibia shorter, 9.0–9.5 mm long.

Wing shape similar to that of *subfulva*.

Upper surface of wings similar to that of *subfulva*, but with striations and cross lines redder brown, former being more numerous basad of t.a. line and in anterior portion of forewing, especially in female; t.p. line tending to be more solidly represented between venular dots. Hind wings with extradiscal line broadly flared above anal angle for 3.0 (males) to 3.5 (females) mm, with width about equal

to length, forming brown to lilac-brown anal spot, with small semicircular invagination near outer margin, having very small black spot with white edging at anal angle and with obsolescent silver-white line; fringe with basal portion narrowly white from vein M_3 to anal spot, black medially and widened at ends of veins Cu_1 and Cu_2 , outer portion grayish to reddish brown posteriorly and gradually changing to green anteriorly.

Undersurface (fig. 14) similar to that of *subfulva* but with obsolescent discal spots on forewings, and with greatly reduced orange-brown shading on t.p. line. Hind wings with obsolescent orange-brown shading and extradiscal line (males), or with line represented by black venular dots and being narrowly orange-brown (female); both sexes with dull black anal spots, more strongly represented in female than in males.

Length of Forewings: Holotype, 19 mm; paratypes, 19 (male) to 22 (female) mm.

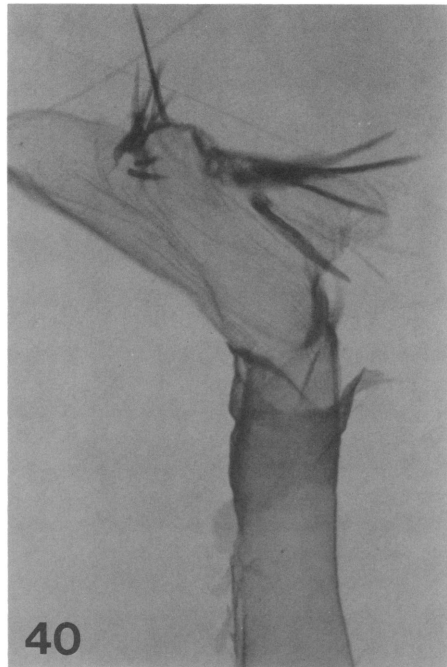
Male abdomen with moderate ventrolateral paired tufts on A5, with hairlike scales 1 mm long.

Male Genitalia (fig. 41): Anellus with sharply curved process about 0.9–1.0 mm long, extending 0.1 mm beyond antieriad margin of transtilla, terminally tapered; apex square, minutely spinose. Aedeagus (fig. 42) 1.9 mm long. Exserted vesica with single lobe to right of aedeagus, having 7–10 cornuti, 4–6 thick basal ones on lobe and with 3 or 4 much thinner distal spines.

Female Genitalia (fig. 52): Ductus bursae short, medially constricted, with right side slightly longer than left, enlarged anteriorly. Corpus bursae with broad posterior swelling terminating on left side; posterolateral area on left heavily sclerotized, slender, with irregular posterior margin near ductus bursae, becoming slightly enlarged anteriorly and curving ventrally.

TYPES: Holotype, male, Cusco [Cuzco?], Peru, March 1932 (F. L. Woytkowski). The genitalia of the holotype are mounted on slide FHR 20,182. Paratypes: Satipo, Junín, Peru, January, 1♂ [AMNH]; Chapare, 400 m, Bolivia, July 16–26, 1948 (J. Foerster), 1♀ [AMNH]; "Upper Amazon," 1♂ [CMNH].

The holotype is in the collection of the AMNH; paratypes are in the collections of that institution and of the CMNH.



Figs. 39–42. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 39, 40. *Phyle subfulva* Herbulot. 41, 42. *P. albifimbria*, new species, paratype.

DISTRIBUTION: Peru (Cuzco, Junín) and Bolivia (Chapare), having been captured in January, March, and July.

REMARKS: Four specimens (3♂, 1♀) and four genitalic dissections have been studied.

ETYMOLOGY: The specific name is formed from the Latin prefix *albi*-, "white," and the Latin *fimbria*, "fringe," in reference to this diagnostic character on the upper surface of the hind wings.

***Phyle orthogonia*, new species**

Figures 2, 15, 43, 44

DIAGNOSIS: This species is similar to *albifimbria*, differing in that the maculation has a larger brown anal spot on the hind wings above, and more complete and narrower cross lines below; the process of the anellus is broader and more S-shaped. (The females have not been studied.)

DESCRIPTION: Adults: Males with coxal tufts similar to those of *albifimbria*; hind tibia 9.5–10.3 mm long.

Forewings having apex more sharply pointed than in *albifimbria*.

Upper surface of wings (fig. 2) similar to those of *albifimbria*, differing in the forewings having t.p. line below costa more strongly represented; hind wings with more prominent extradiscal line and having larger lilac brown and pale brown anal spot, more or less rectangular in shape, 3.5–4.0 mm long along extradiscal line, meeting both outer and anal angles at right angles, and with small black anal spot and fringe similar to those of *albifimbria*.

Undersurface (fig. 15) similar to that of *albifimbria* but with more complete, narrower cross lines.

Length of Forewings: Males, 19 (paratype) to 20 (holotype) mm.

Male abdomen with ventrolateral paired tufts on A5 more prominent than in *albifimbria*, with hairlike scales 1.5 mm long.

Male Genitalia (fig. 43): Anellus with broad, slightly S-shaped process 0.9 mm long, extending 0.1 mm beyond anterior margin of transtilla, terminally tapered; apex rounded, broadly and minutely spinose. Aedeagus (fig. 44) 1.95 mm long. Exserted vesica with single pointed lobe to right of aedeagus, having 10 cornuti, 6 thick basal ones on lobe, and with 4 thinner ones distally.

TYPES: Holotype, male, Pied Saut, Oyapok River, Fr[ench] Guiana, Feb. 1918 (S. M. Klages). The genitalia of the holotype are mounted on slide FHR 20,212. Paratype: same data as holotype, 1♂.

Both type specimens are in the collection of the CMNH.

DISTRIBUTION: Known only from the type locality in French Guiana, with the moths having been caught in February. The Oyapok (Oyapok) River forms the boundary between eastern French Guiana and western Amapá, Brazil.

REMARKS: Two specimens and one genitalic dissection have been studied.

ETYMOLOGY: The specific name is from the Latin *orthogonius*, "rectangular," in reference to the shape of the large anal spot.

***Phyle cartago*, new species**

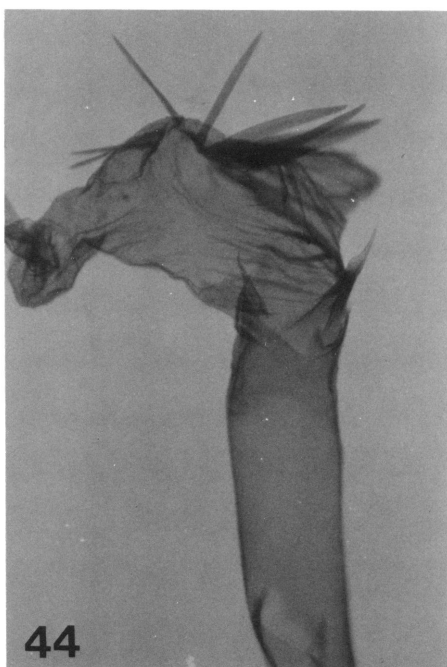
Figures 16, 45, 46

DIAGNOSIS: This species differs from *schausaria* by the more prominent cross lines on both surfaces of the wings, and by having broad spots at the ends of the lines at the inner margin of the upper surface of the forewings and at the anal angle of the hind wings. The process of the anellus is shorter than in *schausaria* and it is apically curved, and the vesica has more spines distally.

DESCRIPTION: Adults: Males with coxal tuft similar to those of *schausaria* but with thicker outer covering of cream-colored scales; hind tibia 10.5 mm long.

Forewings with shape similar to those of *schausaria*; hind wings with outer margin slightly angled.

Upper surface of wings with numerous elongate striations across anterior portion of forewings as well as in outer area. Forewings with t.a. line indicated primarily by reddish brown venular dots and by small spot basad at inner margin; with faint indication of large discal spot; t.p. line represented by dark spot on vein R₅, with remainder of line consisting of elongate, reddish brown venular dots and slender, pale greenish yellow connecting line, and having broad triangular area distad at inner margin. Hind wings with extradiscal line straighter than in *schausaria*, more prominent, tending to be enlarged distad on veins, having posterior 3.0–4.0 mm of line enlarged into grayish lilac to reddish lilac anal



Figs. 43–46. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 43, 44. *Phyle orthogonia*, new species, holotype (CMNH). 45, 46. *P. cartago*, new species, holotype (USNM).

spot, with prominent black dot broadly shaded distad by white, followed distad by reddish brown area, and with short silvery white line present; fringe narrowly black at base posteriorly at least as far anteriorly as vein M_3 , prominently widened opposite veins Cu_1 and Cu_2 .

Undersurface (fig. 16) with forewings having dark gray striations and variably sized discal spot in cell; t.p. line variable, ranging from being nebulous and faintly shaded on outer side in middle of wing by faint orange-brown area, to being prominent, with dark venular spots, shaded with orange-brown, 2.0 mm wide in males, 3.5 mm in females. Hind wings with either faint indication of cross line or with extradiscal line complete, of equal width for entire length, orange-brown, faint in males, more prominent in females; anal spot absent in males, appearing as widening of extradiscal line in females; fringe with dark spots opposite ends of veins Cu_1 and Cu_2 .

Length of Forewings: Holotype, 21 mm; paratypes, male, 21 mm, females, 19–22 mm.

Male abdomen with short ventrolateral paired tufts on A5, with hairlike scales 0.6 mm in length.

Male Genitalia (fig. 45): Anellus with curved process 0.80–0.81 mm long, varying from just attaining anterior edge of transtilla to extending 0.1 mm posteriad thereof, weakly to moderately curved at tip, slightly tapered; apex round or blunt, minutely spinose. Aedeagus (fig. 46) 2.05 mm long. Exserted vesica with prominent lobe to right of aedeagus, having 12–14 cornuti, 5 thicker basal ones and from 7 to 9 thinner distal spines.

Female Genitalia: Ductus bursae short, broad, right side straight and longer than medially concave left side, latter swollen anteriorly. Corpus bursae with median posterior swelling; posterolateral area on left weakly sclerotized, poorly defined.

TYPES: Holotype, male, Tuis [1200 m, Cartago], Costa Rica, May (Schaus and Barnes). The genitalia of the holotype are mounted on slide FHR 20,192. Paratypes, all from Cartago, Costa Rica: Finca Llanos de Quetzal, 1400 m, 83°24'W, 9°48'N, March 11–12, 1983 (W. Warfield and M. H. Evans), at UV [ultraviolet] light, 1♂ [CU]; Juan Vinas [1300 m], June (Schaus and Barnes), 1♀ [USNM];

Moravia, March 12–13, 1983 (W. Warfield and M. H. Evans), at UV light, 1♀ [CU].

The holotype is in the collection of the USNM; paratypes are in that collection and in CU.

DISTRIBUTION: The Province of Cartago, Costa Rica, with the moths having been caught in March, May, and June. DeVries (1987: 286) listed Tuis as being in the premontane rain forest life zone, and Juan Vinas in the lower montane wet forest life zone.

REMARKS: Four specimens and three genitalic dissections (2♂, 1♀) have been studied.

There is considerable variation in the maculation of the above specimens. After studying *versatile* (below), with its greater number of individuals and with their differences in color and pattern, as compared with the genitalic structures, I have placed the four Cartago moths under the same name.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

Phyle neblina, new species

Figures 3, 17, 47, 48

DIAGNOSIS: This species is recognized by the almost immaculate green of the upper surface of the wings due to the lack of cross lines, and by the undersurface of each forewing having a prominent discal dot and t.p. line. The male genitalia have an elongate, apically curved process of the anellus, and the vesica has about 13 thin distal spines.

DESCRIPTION: Adults: Male with coxal tuft similar to that of *schausaria*; hind tibia 10.0 mm long.

Forewings with apex not as pointed as in *schausaria*; hind wings with outer margin evenly rounded.

Upper surface of wings (fig. 3) an almost immaculate green, evenly and sparsely covered with grayish black scales; cross lines absent or only very faintly indicated, slightly stronger in female than in male; forewings with a slender grayish lilac costa; hind wings with anal spot small, red, with a few black scales medially; fringe yellow, with very slender dark basal line in lower part of hind wings of male.

Undersurface (fig. 17) pale green. Forewings with dark costa, scattered dark scaling

across anterior portion, a prominent grayish black discal spot, and with t.p. line represented by small black venular dots, shaded in middle of wing by orange-brown, faintly and 2.0 mm wide in male, more broadly (3.0 mm) and brightly in female. Hind wings with obsolescent extradiscal line anteriorly, stronger in female than in male; anal spot absent.

Length of Forewings: Holotype, 21 mm; paratype, female, 22 mm.

Male abdomen with moderate ventrolateral paired tufts on A5, with hairlike scales 1.0 mm in length.

Male Genitalia (fig. 47): Anellus with curved, weakly S-shaped process 1.17 mm long, extending 0.2 mm posteriad of anterior margin of transtilla; apically bluntly pointed, minutely spinose. Aedeagus (fig. 48) 2.2 mm long. Exserted vesica with prominent lobe to right of aedeagus, having 22 cornuti, 7 thicker basal ones and 15 thinner distal spines.

Female Genitalia: Ductus bursae with sides of about equal length, straight, without noticeable swelling anteriorly. Corpus bursae with posterior swelling apparently terminating on right side; posterolateral area on left heavily sclerotized, with sharply defined, nearly parallel margins.

Types: Holotype, male, Cerro de la Neblina, Camp II, 0°49' 41"N, 65°58' 56"W, 2085 m, Amazonas, Venezuela, Feb. 15–22, 1984 (T. McCabe). The genitalia of the holotype are mounted on slide FHR 20,194. Paratype: Same data as holotype although the label does not have "Camp II," and the name of the collector is printed as T. L. McCabe, 19.

Both type specimens are in the collection of the USNM.

DISTRIBUTION: Southernmost Venezuela, being known only from the Cerro de la Neblina, and having been caught in February.

REMARKS: Two specimens and two genitalic dissections have been studied.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

Phyle versatile, new species

Figures 4, 18, 19, 22, 49, 50

DIAGNOSIS: This species differs from the preceding ones in having the complete cross lines on the undersurface of all wings being

variably shaded by orange-brown, and by the very long and straight process of the anellus that extends to at least one-half the width of the transtilla.

DESCRIPTION: Adults: Males with coxal tufts similar to those of *schausaria*; hind tibia 9.0–10.0 mm long.

Forewings with less attenuate apex than in *schausaria*, with outer margin varying from being straight to slightly convex; hind wings with outer margin rounded or weakly angled.

Upper surface of wings (fig. 4) with elongate striations across anterior portion of forewings as well as in outer area. Forewings with t.a. line varying from obsolescent to complete, stronger in females than in males; t.p. line clearly defined except below costa. Hind wings with prominent extradiscal line, very slightly curved; anal spot variable in size, reddish brown, lilac, or grayish lilac above anal angle, with small black dot broadly shaded distally by white, and with slender silvery white line present; fringe black basally as far as vein M_3 , widened opposite veins Cu_1 and Cu_2 .

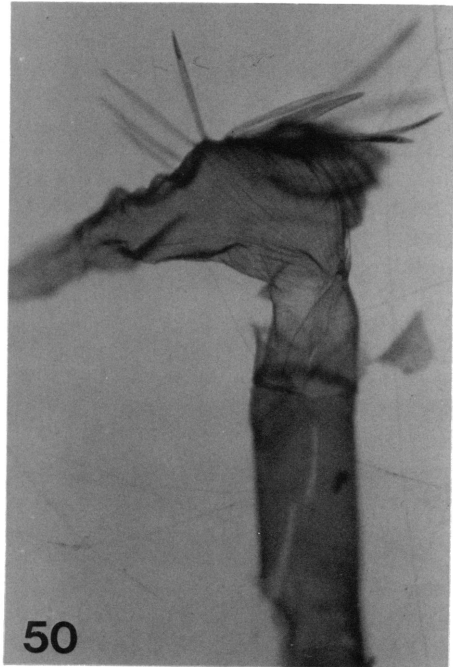
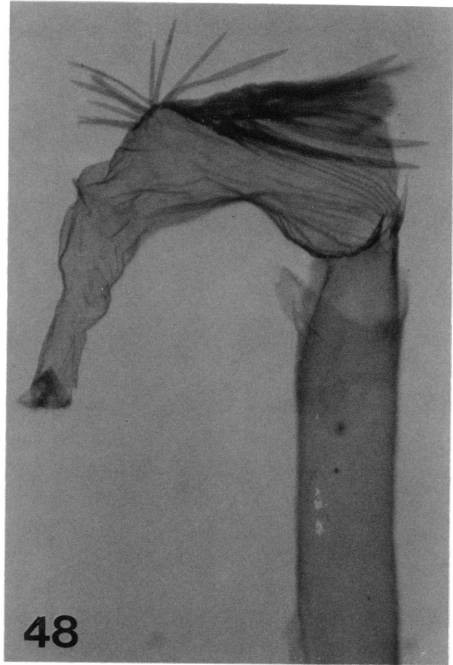
Undersurface (fig. 18) with variable maculation. Forewings with faint to prominent discal spot; t.p. line complete in most specimens, varying from line of black venular spots to having narrow to broad (4.0 mm) orange-brown shading in center of wing. Hind wings with partial to complete extradiscal line, shading similar to that of forewings; grayish black anal spot absent to strongly represented.

Length of Forewings: Holotype, 22 mm; males, 17 to 22 mm; females, 17 to 23 mm.

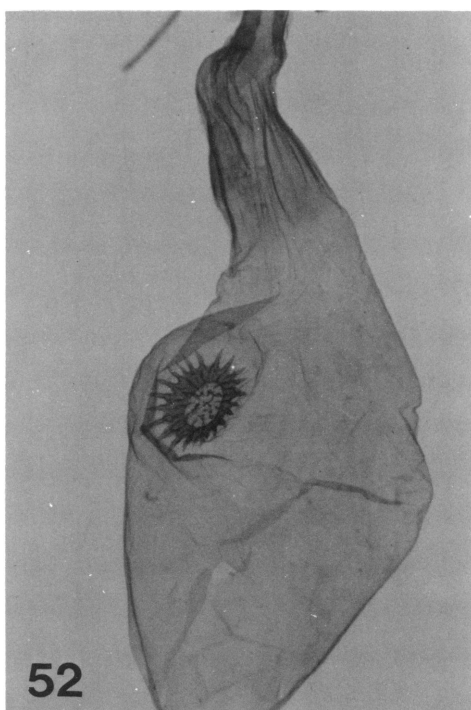
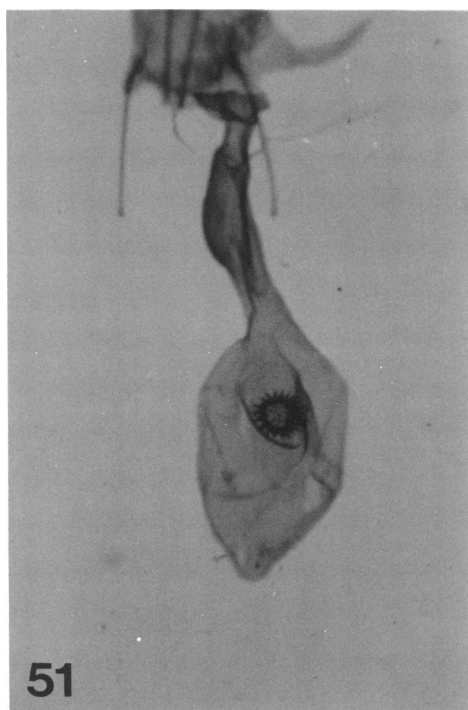
Male abdomen with very prominent ventrolateral paired tufts on A5, with hairlike scales up to 2.0 mm in length, usually visible without dissecting (fig. 22).

Male Genitalia (fig. 49): Anellus with straight process 0.9–1.3 mm long, extending 0.1–0.3 mm posteriad of anterior margin of transtilla, base with or without weak constriction, terminally tapered; apex broadly rounded, minutely spinose. Aedeagus (fig. 50) 1.8–1.9 mm long. Exserted vesica with prominent, flattened, apically pointed lobe to right of aedeagus, having 7–12 cornuti, 3–6 thicker basal ones, and from 3 to 6 somewhat thinner distal spines.

Female Genitalia: Ductus bursae with sides



Figs. 47–50. Male genitalia (right side only) and aedeagi; the latter at slightly larger magnification than the former. 47, 48. *Phyle neblina*, new species, holotype (USNM). 49, 50. *P. versatile*, new species, paratype.



Figs. 51, 52. Female genitalia. 51. *Phyle aspilotos*, new species, paratype. 52. *P. albifimbria*, new species, paratype.

of about equal length, weakly constricted medially, anteriorly scarcely swollen or with left side enlarged more than right. Corpus bursae with posterior swelling terminating medially or toward left side; posterolateral area on left well sclerotized, convex anterolaterally.

TYPES: Holotype, male, near San Rafael Falls, 4600 ft [1400 m], 69 km NE Baeza, 15 km SW Reveatador, Napo, Ecuador, Oct. 29, 1988 (J. S. Miller). The genitalia of the holotype are mounted on slide FHR 20,178. Paratypes, all from Ecuador: Zamora, "Zamora-Santiago" [Zamora-Chinchi], March 27–31, 1965 (L. E. Peña), 3♂; 3 km (air) SE Zamora, 1200 m, Zamora-Chinchi, June 1–3, 1986 (S. McKamey), 3♂; Quito to Santo Domingo, 1200 m, Pichincha, Feb. 25, 1965 (L. E. Peña), 1♂; Tandapi, on road from Alaog to Santo Domingo, 1500 m, Pichincha, Jan. 28, 1971 (L. E. Peña), 1♂. The type series is restricted to Ecuadorian males that I have dissected.

The holotype and paratypes are in the collection of the AMNH.

DISTRIBUTION: Colombia (Cundinamarca), Ecuador (Imbabura, Morona Santiago, Napo, Pastaza, Pichincha, Zamora-Chinchi), Peru (Cuzco, Huanuco, Junín, Puno), Bolivia (Cochabamba, La Paz), and Argentina (Formosa). The adults have been captured at elevations between 700 and 3000 m, and in every month of the year. Elevations by country, based on specimen labels: Colombia, 1800 m; Ecuador, 700–2400 m; Peru, 730–1300 m; Bolivia, 2000–3000 m.

REMARKS: One hundred eleven specimens (52♂, 59♀), 28 genitalic dissections (14♂, 14♀), and two slide mounts of male antennae and legs have been studied.

When analyzing this species, various groupings were attempted, such as those based on the maculation on the undersurface of the wings, wet vs. dry seasons, eastern vs. western slopes of the Andes, and northern vs. southern Andes; genitalic dissections were made from all of these groups. Not only were there differences within the different groupings but also, to a much smaller degree, with-

in the genitalia. The latter were so much more constant than the wing characters that the only conclusion that I was able to reach is that *versatile* is the most widespread species in the genus, and that it is the most variable. The extremes in variation in the maculation on the undersurface appear to equal specific differences in other taxa in *Phyle*.

ETYMOLOGY: The specific name is from the Latin *versatilis*, "changeable," in reference to the maculation on the undersurface of the wings.

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