PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

Volume 75

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PUBLISHED BY THE SOCIETY

WASHINGTON, D.C.

1973

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Vol. 75 MARCH 1973 No. 1

PROCEEDINGS

of the

ENTOMOLOGICAL SOCIETY of WASHINGTON

DEPARTMENT OF ENTOMOLOGY
SMITHSONIAN INSTITUTION
WASHINGTON, D.C. 20560

PUBLISHED QUARTERLY

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(Continued on back cover)

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

All correspondence concerning Society business should be mailed to the appropriate officer at the following address:

Entomological Society of Washington
c/o Department of Entomology
Smithsonian Institution
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MEMBERSHIP.—Members shall be persons who have demonstrated interest in the science of entomology. Annual dues for members are $7.00 (U.S. currency).

PROCEEDINGS.—Published quarterly beginning with March by the Society at Washington, D.C. Members in good standing are entitled to the *Proceedings* free of charge. Nonmember subscriptions are $10.00 per year, both domestic and foreign (U.S. currency), payable in advance. All remittances should be made payable to *The Entomological Society of Washington.*

The Society does not exchange its publications for those of other societies.

STATEMENT OF OWNERSHIP

Title of Publication: Proceedings of the Entomological Society of Washington.
Frequency of Issue: Quarterly (March, June, September, December).
Location of Office of Publication, Business Office of Publisher and Owner: The Entomological Society of Washington, c/o Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.
Editor: Dr. Lloyd Knutson, same address as above.
Managing Editor and Known Bondholders or other Security Holders: none.

This issue was mailed April 26, 1973

Second Class Postage Paid at Lawrence, Kansas, U. S. A. 66044

ALLEN PRESS, INC. PRINTED IN U.S.A. LAWRENCE, KANSAS 66044

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Vol. 75 MARCH 1973 No. 1

BRAZILIAN COCKROACHES FOUND IN BIRDS' NESTS, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

(DICTYOPTERA: BLATTARIA: BLABERIDAE AND BLATTELLIDAE)

LOUIS M. ROTH, *Pioneering Research Laboratory, U. S. Army Natick Laboratories, Natick, Massachusetts 01760*

ABSTRACT—The following species of cockroaches were collected in pendulous birds' nests in the Amazon: **Alphelixia** *sicca*, n. gen., n. comb., **Schultesia lampyridiformis**, n. gen., n. sp., *Amazonina* **nidicteridicola**, n. sp., *Chorisoneura* (2 undetermined species), *Chorisoneura inversa*, *Dendroblatta cnephaia*, and *Lophoblatta arlei*. More than 1 species of cockroach may be found in the same nest. The nest habitat is undoubtedly a normal one for most of these cockroaches which probably act as scavengers.

There are very few records of cockroaches taken from the nests of birds. *Euthlastoblatta facies* (Walker) (= *Aglaopteryx facies* (Walker)) lives in large numbers among twigs in the nests of the grey Kingbird in Puerto Rico (Danforth *in* Wolcott, 1950). Immature cockroaches were commonly found in the nests of Ploceinae in Madagascar and Ivory Coast. All nests of *Foudia* spp. examined in Madagascar contained many cockroaches, and Paulian (1950) believed that the blattids were species peculiar to the nests of birds. In the Ivory Coast, Delamare Deboutteville and Paulian (1952) found a few cockroaches in nests of *Ploceus* sp., and *Estrildine* sp. *Griffiniella heterogamia* Karny (= *Ploceophilus kohlsi* Rehn, *in* Princis, 1971) live, probably as scavengers, in the communal nests of the Social Weaver Bird (*Philetairus socius*) in Southwest Africa (Rehn, 1965).

During the 1967 Alpha Helix expedition to the Amazon, I collected about 10 species of cockroaches in the pendulous nests (fig. 105) of an icterid (probably the oriole, *Cassicus persicus* (Linn.)). Most of the nests apparently were abandoned and a few had the remains of dead young birds. The cockroaches probably are scavengers and may have inhabited the nests while the birds occupied them. This paper reports on the cockroaches collected in the nests. The insects were cultured and the descriptions of the new genera and species are based on reared material.

Alphelixia, n. gen.[1]

Type-species: *Ischnoptera* (?) *sicca* Walker (present designation)

Generic Description: Sexes markedly dissimilar. Male tegmina and wings normally developed, lacking in ♀.[2] Legs short, femoral armament as follows (12 specimens): small stout spines on ventral margins of front femora bimarginally serrated (fig. 16). Ventral anterior margin of front femur (♂) basally with a row of 4 to 8 (average 6) short, broad, tapering spines followed by a row of small piliform setae, usually terminated by a short spine (fig. 15); a few piliform setae may precede the proximal spines, and sometimes may occur between two spines; ventral posterior margin with 1 or 2 small stout spines (rarely none), 1 of these usually distad. Ventral front margin of mid femur with 2 spines (rarely 3); ventral hind margin with 3 spines (rarely 2 or 4). Ventral anterior margin of hind femur with 2 spines; ventral hind margin with 3 spines (rarely 4). Distal spines absent from both ventral margins of the mid and hind femora. Spines on female femora usually smaller, fewer in number than in the male, and tend to be atrophied. Female caudal metatarsus much smaller, and in male slightly smaller than succeeding tarsal segments. Ventral margins of all metatarsi unarmed except for a few piliform setae. Pulvilli well developed, arolia very large. Tarsal claws equal, in ♂ microscopically serrulate (teeth truncate) (fig. 17), in ♀ simple (fig. 18). Subgenital plate (♂) slightly asymmetrical, subtrigonal, apex rounded (fig. 6). Male genitalia lacking dorsal sclerite of the second left phallomere (fig. 19).

The marked differences of the sexes of *Alphelixia* (Blaberidae, Epilamprinae) are similar to those found in *Hyporhicnoda* Hebard, and the femoral armament (including atrophy of the female spines) also resembles that genus. However, both sexes of *Alphelixia* have well developed arolia and the metatarsi are unarmed ventrally whereas in *Hyporhicnoda* the arolia are small in males, subobsolete or absent in females, and the caudal metatarsi have 2 rows of ventral spines. The male genitalia of these 2 genera also differ markedly; *Hyporhicnoda* has internal genital structures more typical of Blaberinae (Roth, 1970a).

Alphelixia sicca (Walker), n. comb.
figs. 1–24

Syn. *Ischnoptera* (?) *sicca* Walker (Walker, 1869: 149, ♂ not ♀ as indicated).

Pinaconota sicca (Walker) (Cohen and Roth, 1970: 1524)

The male of this species (figs. 2–3) was found to be conspecific with the holotype male of *Ischnoptera* (?) *sicca* Walker (fig. 1).

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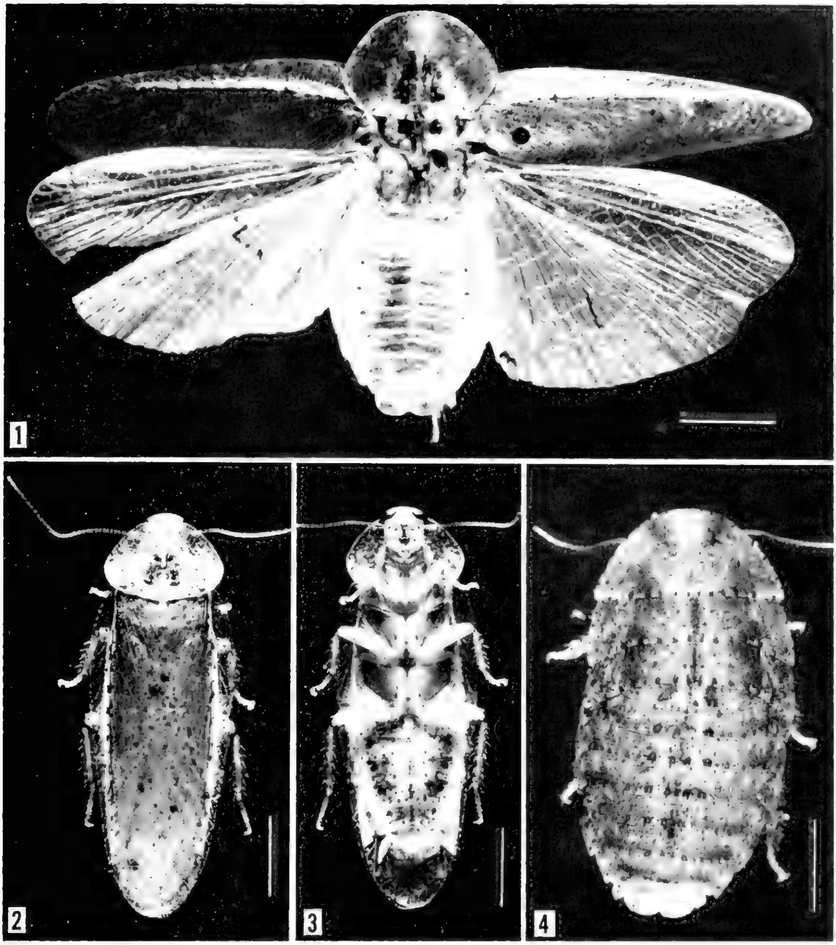
[1] The genus is named after the Research Vessel Alpha Helix, of the Scripps Institution of Oceanography.

[2] For descriptive purposes I consider the female as lacking tegmina and wings. However, Lefeuvre (1971) has found from studies of the tracheae that subapterous species (e.g. *Hyporhicnoda* ♀) have wing pads which remain "nymphal" in the adult.



Figs. 1–4. Adults of *Alphelixia sicca.* 1. Male. Holotype of *Ischnoptera* (?) *sicca* Walker. 2–4. Brazilian specimens (reared) collected in a bird's nest. 2. Male (dorsal). 3. Male (ventral). 4. Female. (scale = 3 mm).

I have examined a female of *Pinaconota bifasciata* (Saussure) (det. by Rehn and confirmed by K. Princis) in the Museum of Comparative Zoology. Kirby (1904:113) misidentified the species and erred in synonymizing Walker's *Ischnoptera sicca* with *Pinaconota bifasciata.* Not only do the external characters differ markedly between these 2 species but the genitalia of *Pinaconata* sp. and *A. sicca* clearly indicate different genera (Roth, 1971a). Both sexes of *Pinaconota* also have well developed tegmina and wings (Shelford, 1910:2), structures absent in female *Alphelixia.* Cohen and Roth (1970)

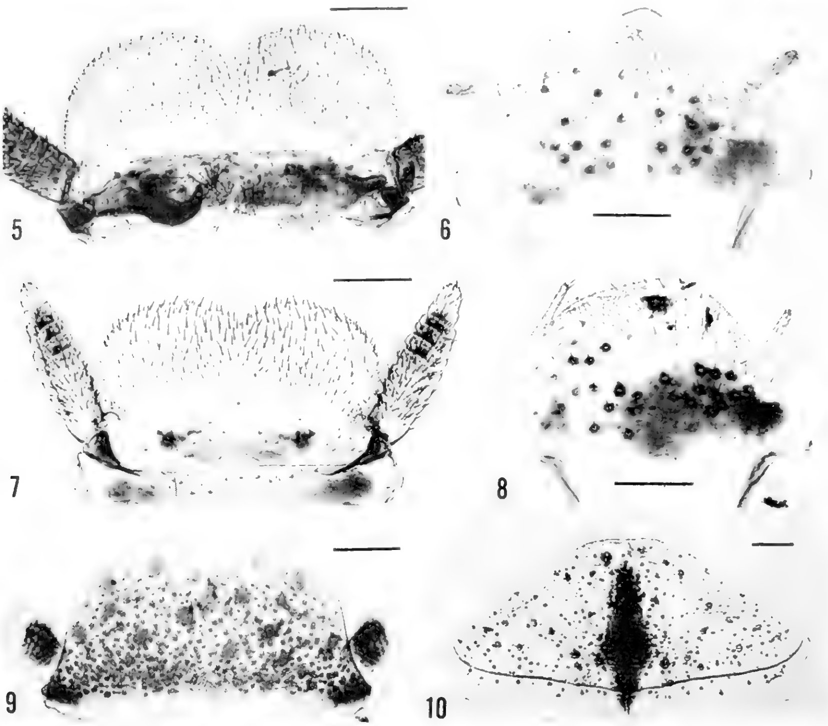
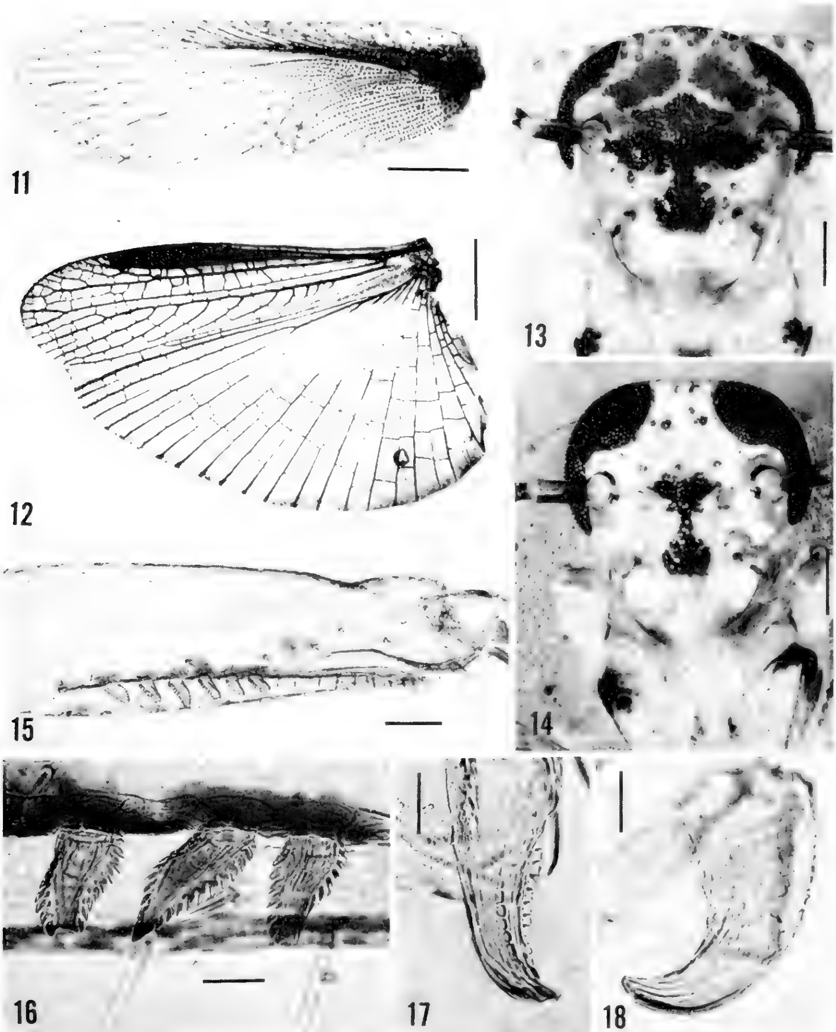


Fig. 5–10. *Alphelixia sicca.* Supra-anal plates (left; dorsal) and subgenital plates (right; ventral). 5–6. Holotype ♂ of *Ischnoptera* (?) *sicca* Walker (From specimen shown in Fig. 1). 7–10. Reared Brazilian specimens. 7–8. Male. 9–10. Female. (KOH, cleared flattened preparations; scale = 0.5 mm).

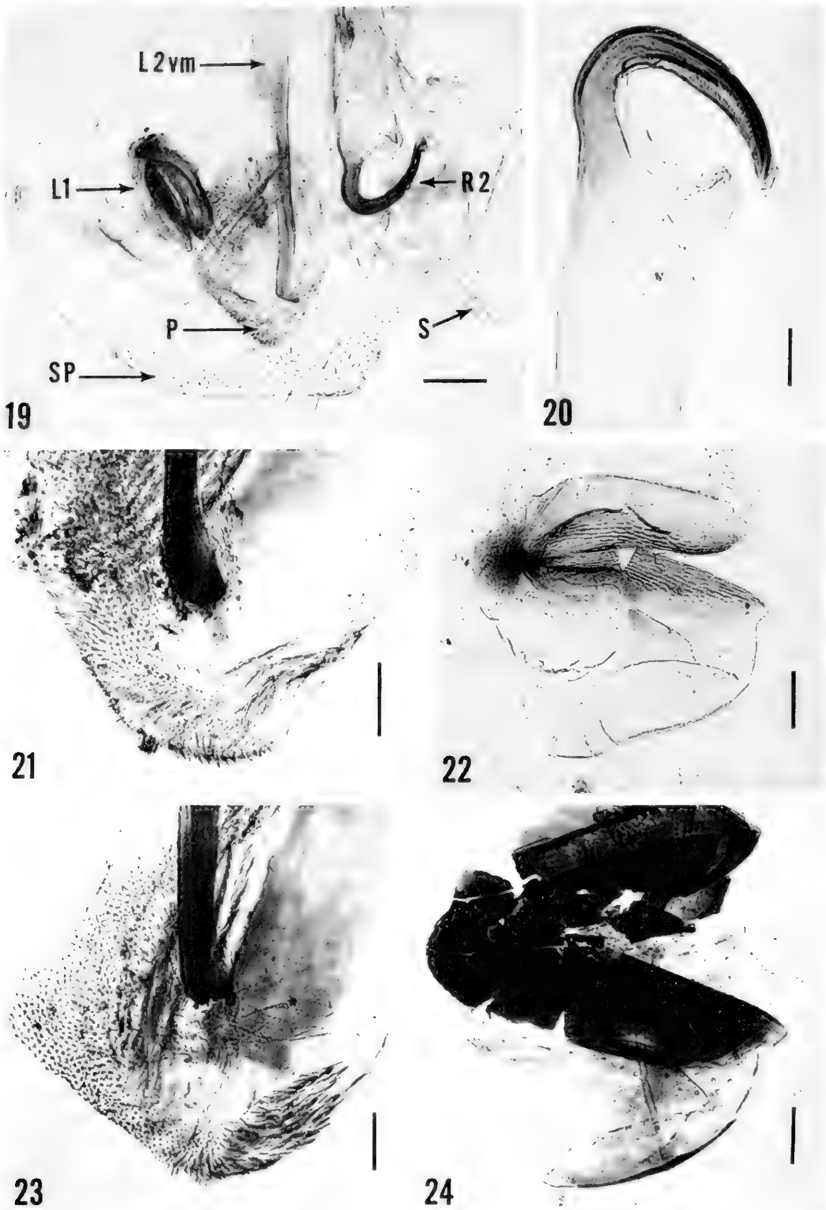
used the name *Pinaconota sicca* realizing that the species was not *bifasciata*, but they assumed that Kirby had placed the species in the correct genus.

Male: Head reaching to about or slightly beyond edge of weakly arched front margin of pronotum (fig. 2). Interspace between eyes wide but subequal to interspace between antennal sockets (fig. 14). Wings and tegmina extend well beyond tip of abdomen (fig. 3). Tegmen and wing venation as shown in figures 11 and 12. Tergal glands absent. Legs as in generic description. Subgenital plate (figs. 6, 8) slightly asymmetrical, roughly trigonal, apex rounded. Styli slender, elongated. Supra-anal plate (figs. 5, 7) spiculate, hind border deeply emarginate. Cerci extend beyond hind margin of supra-anal plate (fig. 7). Internal genitalia (fig. 19): Apex of L2vm unmodified; L2d absent; preputial membrane spiculate (figs. 21, 23); margins of cleft of L1 broadly sclerotized (figs. 22, 24); apex of R2 with a membranous extension, the membranous base of hook (R2) broadened, its outer margin rounded (fig. 20).



Figs. 11–18. *Alphelixia sicca.* 11–12. Left tegmen and wing (♂). 13. Head (♀). 14. Head (♂). 15. Prothoracic femur (♂). Ventrocephalic margin. 16. Spines on ventrocephalic margin of front femur (♂). 17. Tarsal claw (♂). 18. Tarsal claw (♀). (Figs. 15–18 KOH preparations; scale, figs. 11–12 = 2 mm, figs. 13–14 = 0.5 mm, fig. 15 = 0.2 mm, figs. 16–18 = 0.05 mm).

Coloration: Pale, cinereous, with fusco-rufous and white markings. Head: Several small reddish brown spots between eyes. A median longitudinal band about as wide as interspace between eyes, and 1 on base of clypeus, both connected by vertical narrower band (fig. 14). Pronotum: Pellucid with reddish brown Rorschach ink blotlike figure medially (fig. 2). Small dark spots widely



Figs. 19–24. Male genitalia of *Alphelixia sicca*. 19. Genital structures and subgenital plate (dorsal). L1 = first sclerite of left phallomere; L2vm = median sclerite of left phallomere; P = prepuce; R2 = hooked sclerite of right phallomere; S = style; SP = subgenital plate. 20–22. R2, prepuce and apex of L2vm, and L1 respectively, of a reared specimen. 23–24. Prepuce and apex of

spaced around pronotal margin. Minute fusco-rufous dots over surface except near lateral and anterior margins. Latero-posterior margins white. Tegmen pellucid with broad white line at base between subcosta and radius, tapering posteriorly (this line may appear longer than it actually is because an underlying white area between the costal veins of the hind wing shows through the transparent tegmen). Punctate-striate basally along and/or between veins, fusco-rufous dots sparse along posterior parts of anal veins (fig. 11). A few large and small irregularly shaped spots distributed over surface (not seen in fig. 11). Hind wing with spaces between costal branches, thickened, whitish (fig. 12).

Measurements (mm; 5 males, alcoholic specimens): Overall length (including folded tegmina) 14.5–15.0; pronotum length 3.0–3.2, width, 4.2–4.5; tegmen length 12.1–12.5; widest width (both tegmina) 5.2–5.7; abdomen length 6.0–7.4; length of caudal femur 2.2–2.4. The reared males are somewhat smaller than the holotype ♂.

The male accessory sex glands have 3 or 4 uricose tubules. In the Blaberidae, uricose glands have, so far, only been found in the Epilamprinae (Roth, 1967).

Female: Completely lacking tegmina and wings (fig. 4). Head hidden under arched pronotum. Interocular space wider than in male, about equal to interspace between antennal sockets (fig. 13). Leg armament (6 specimens): ventral anterior margin of front femur with 1 to 6 spines (average 3) followed by a row of piliform setae, usually terminated by distal spine; ventral hind margin without, or with 1 spine. Ventral anterior margin of mid femur with 2 (rarely 1) spines, hind margin with 0 to 2 spines. Ventral anterior margin of hind femur with 2 (rarely 1 or 3) very small spines; three somewhat larger spines on hind margin. Generally, the femoral spines on mid and hind femora are greatly reduced. Supra-anal plate with sides slightly tapering, broadly rounded with medial indentation; cerci broad, short, not reaching beyond posterior margin of supra-anal plate (fig. 9). Subgenital plate broadly convex posteriorly, slightly sinuate laterally (fig. 10).

Coloration: Light tan, densely mottled with light reddish brown spots. Frons with 3 large markings separated by thin clear lines which form an inverted Y; the 2 lateral markings between eyes reddish. Broad longitudinal band about equal in width to distance between antennal sockets; upper half reddish, lower half darker (these 2 areas sometimes "separated" by longitudinal impression); narrow connecting dark band extends downwards medially and expands slightly on clypeus (fig. 13). (Small ♀ nymphs have the same facial markings as the adult ♀). Large spots uniformly spaced around outer margins of pro-, meso-, and metanotum. Posterior margins of thoracic and abdominal segments appear beaded (fig. 4) with large dots that are bicolored, i.e. dark reddish brown posteriorly and lighter anteriorly. Under-surface pale with widely spaced reddish brown spots. Median band on penultimate segment broadens noticeably on subgenital plate (fig. 10). Legs pale, outer corner of front coxa with large reddish brown spot and large irregular shaped spots on dorsal anterior surface of mid coxa. Small dark dots surround bases of minute setae on mid and hind femora.

←

L2vm, and L1 of holotype ♂ of *Ischnoptera* (?) *sicca* Walker (from specimen shown in Fig. 1). (KOH preparations; scale, fig. 19 = 0.25 mm, figs. 20–24 = 0.1 mm).

Measurements (mm.; 5 females, alcoholic specimens): Total length 11.5–12.5; pronotum length 3.0–3.7, width 5.0–5.5; abdomen length 6.2–6.8; caudal femur length 2.1–2.4.

The chromosomes of *A. sicca* number 33 (♂) and 34 (♀), and are mostly submetacentric with some metacentric (reported as *Pinaconota sicca* (Walker), Table 1 and fig. 95 *in* Cohen and Roth, 1970).

Holotype Male: *Ischnoptera* (?) *sicca* Walker. British Museum (Natural History).

Allotype Female: Near Serra Tamendaui, Rio Negro, Amazonas, Brazil (64° 45′ W 0° 27′ S). Coll. L. M. Roth. Academy of Natural Sciences, Philadelphia. Reared males, paratypic females, and nymphs deposited as follows: 1 ♀, 4 ♂, 2 nymphs, Academy of Natural Sciences, Philadelphia; 2 ♀, 4 ♂, U. S. National Museum, Washington, D. C.; 1 ♀, 3 ♂, Zoological Institute, Lund, Sweden; 1 ♀, 2 ♂, British Museum (Natural History).

The original material of *Alphelixia sicca* was collected in 2 nests, July 18, 19, 1967, along the shore of the Rio Negro, near Serra Tamendaui. The nests were hanging from a tree, about 10 feet above the water surface. Nest number 1 yielded 1 adult ♂ and 17 nymphs; nest 2 had 15 nymphs. *Lophoblatta arlei* Albuquerque (1 ♂, 1 ♀; nest No. 1) and *Amazonina nidicteridicola* n. sp. in both nests were also found with *Alphelixia*. The large number of nymphs of the ovoviviparous *Alphelixia* collected indicates that the bird nests are probably a normal habitat for this species.

Lophoblatta arlei is unusual in that it, and the related *Lophoblatta brevis* Rehn, are the only known members of the Plectopterinae which carry their non-rotated oötheceae externally until the eggs hatch (Roth, 1968). The oötheca of *L. arlei* is unusual in shape being wider than high and the dorsal and ventral surfaces are flattened (fig. 104).

Schultesia, n. gen.[3]

Type-species: *Schultesia lampyridiformis*, n. sp.

The male genitalia of this ovoviviparous genus (Blaberidae) places it in the Zetoborinae (Phortioecini) but its nondeplanate form and marked resemblance to adult winged fireflies separate it from other genera of this subfamily (and tribe) (Roth, 1970) most of which are larger and markedly deplanate. *Achroblatta luteola* (Blanchard) also resembles certain species of Lampyridae (Hebard, 1921a). However, *Achroblatta* is a member of the Panchlorinae whose male genitalia (Roth, 1971b) differ markedly from the Zetoborinae (Roth, 1970).

[3] The genus is named in honor of the Botanist, Dr. Richard Schultes, Harvard University, a member of the Alpha Helix expedition, who spent many years collecting in the Amazon.

Generic Description: Sexes similar. Form not deplanate. Tegmina and wings equally developed, covering abdomen. Head not hidden under pronotum. Occipital space between eyes about equal to interspace between antennal sockets. Pronotum subelliptical, arched anteriorly, caudal margin straight. Wings dusky, median vein concave basally. Ventral anterior margin of front femur with row of almost uniform piliform setae terminated by large distal spine. Tarsal segments without heavy spines on ventral margins. Caudal metatarsus about equal in length to succeeding segments. Pulvilli large, covering entire or almost entire (metatarsus) ventral surfaces of tarsal segments. Arolia well developed. Tarsal claws equal, minutely serrulate. Male tergite 1 modified. Caudolateral angles of eighth tergite roundly produced. Supra-anal plate medially invaginated. Subgenital plate (♂) asymmetrical, indented on right, styli subequal.

Schultesia lampyridiformis, n. sp.[4]
figs. 25–43

Male: Head exposed beyond anterior pronotal margin (fig. 28). Eyes wide apart, interspace between them about equal to interspace between antennal sockets (fig. 30). Pronotum with anterior margin arched, subelliptical, widest portion below middle; hind margin straight. Wings and tegmina of equal length extending slightly beyond end of abdomen (fig. 29). Costal veins of wing indistinct, area between them slightly thickened. Median vein concave. Second plical vein short, joining first plical about ⅓ the distance from its base (fig. 39). First abdominal tergite with pale median vertical ridge with lateral elevations arising anteriorly and extending obliquely downward (transparent in living specimen) (fig. 37). Somewhat similar but sclerotized elevations decreasing in width caudally on segments 2 to 6 (subobsolete on segment 6). Narrow medial ridge extends from first to sixth tergite where the line is continued to supra-anal plate as a slightly broader pale marking. Caudolateral angles of eighth tergite roundly produced posteriorly (fig. 32). Supra-anal plate spicular, medially indented; cerci relatively short, not extending much beyond free margin of supra-anal plate (fig. 34). Subgenital plate densely setose and spicular, asymmetrical, broadly convex, margin near right style indented (best seen when plate is flattened); styli slender, elongate, right slightly larger than left (fig. 35). Ventral anterior margin of front femur with row of piliform setae almost uniform in length (distal setae closer together and may be slightly smaller than basal setae) terminated by large distal spine; ventral hind margin with distal spine smaller than one on opposite margin (fig. 36). Mid femur with large distal spine on ventral anterior and hind margins. Ventral anterior margin of hind femur with 1 large distal spine; ventral hind margin without or with 1 large spine about ⅓ distance from apex. A few piliform setae also present on ventral margins of mid and hind femora. One geniculate spine on mid and hind femora only. Other leg characters as in generic description. Internal male genitalia (fig. 40): Enlarged L2d extends dorsally (fig. 42), L1 (fig. 41), and R2 with subapical incision (fig. 43), all characteristic of Zetoborinae.

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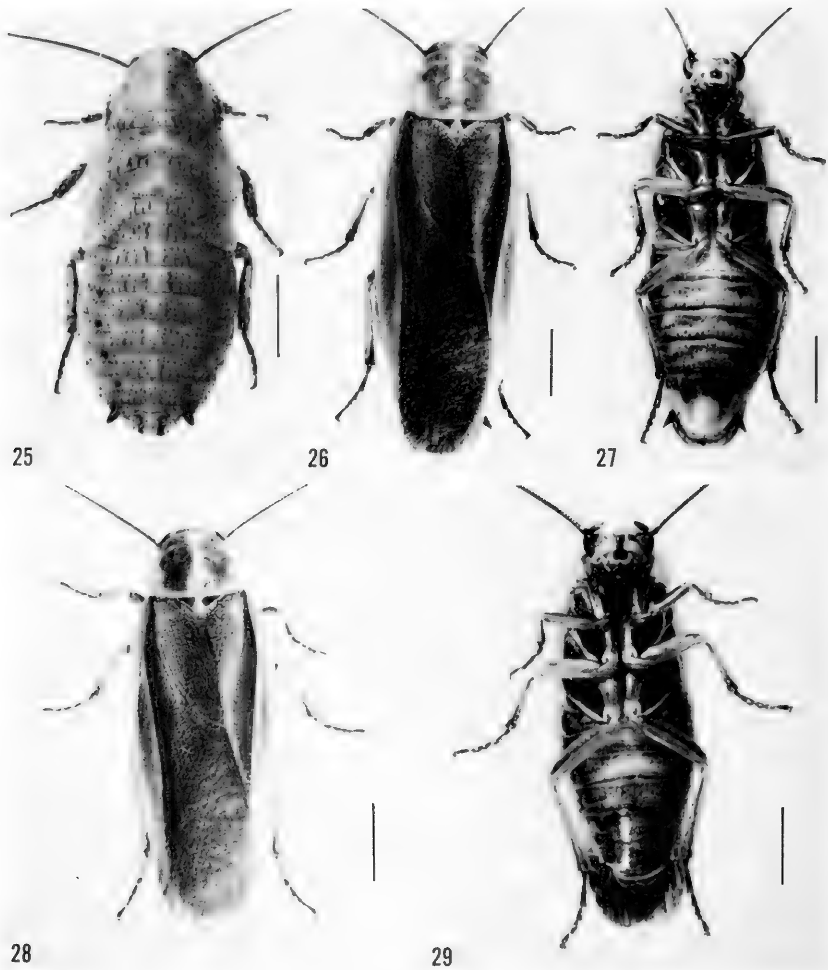
[4] Because of its resemblance to fireflies, the species is named after the beetle family Lampyridae.

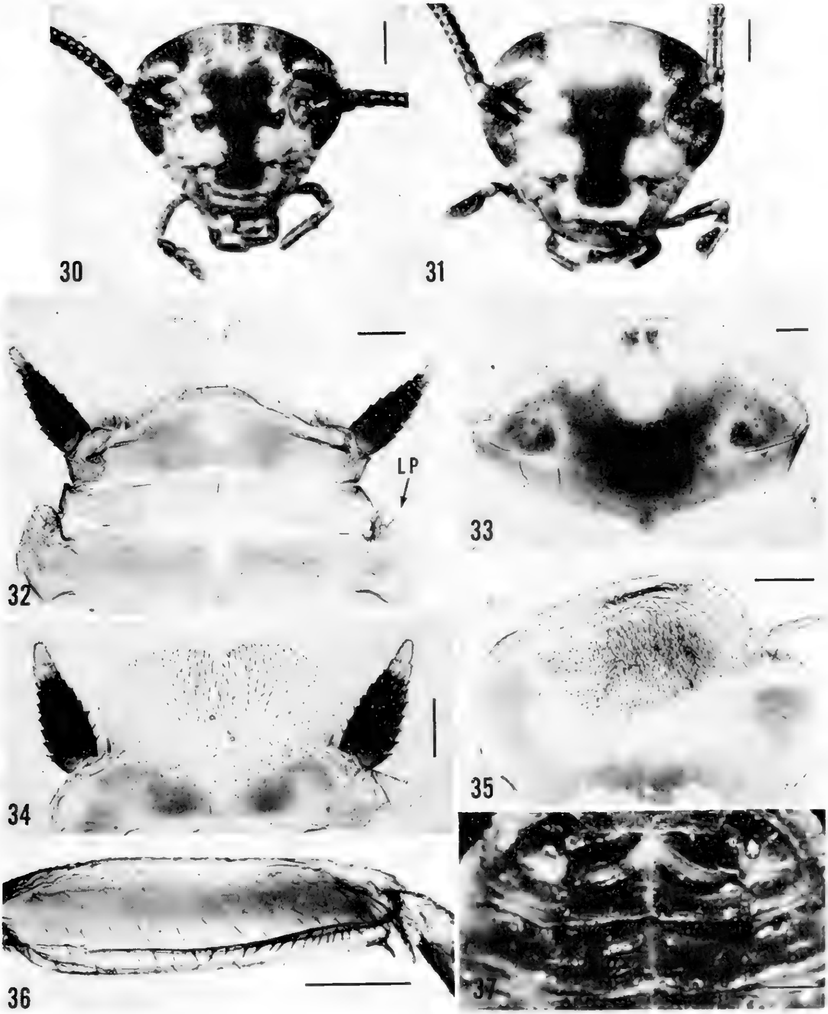


Figs. 25–29. *Schultesia lampyridiformis.* 25. Nymph. 26–27. Adult (♀). 28–29. Adult (♂). (scale = 3 mm).

Measurements (mm; 3 males): Total length (including folded tegmina) 15.4–15.7, pronotum length 2.9–3.0, width 4.1–4.5; tegmen length 12.8–13.2, width 3.6–4.0 (widest combined width 5.5–5.8); abdomen length 8.7–9.4.

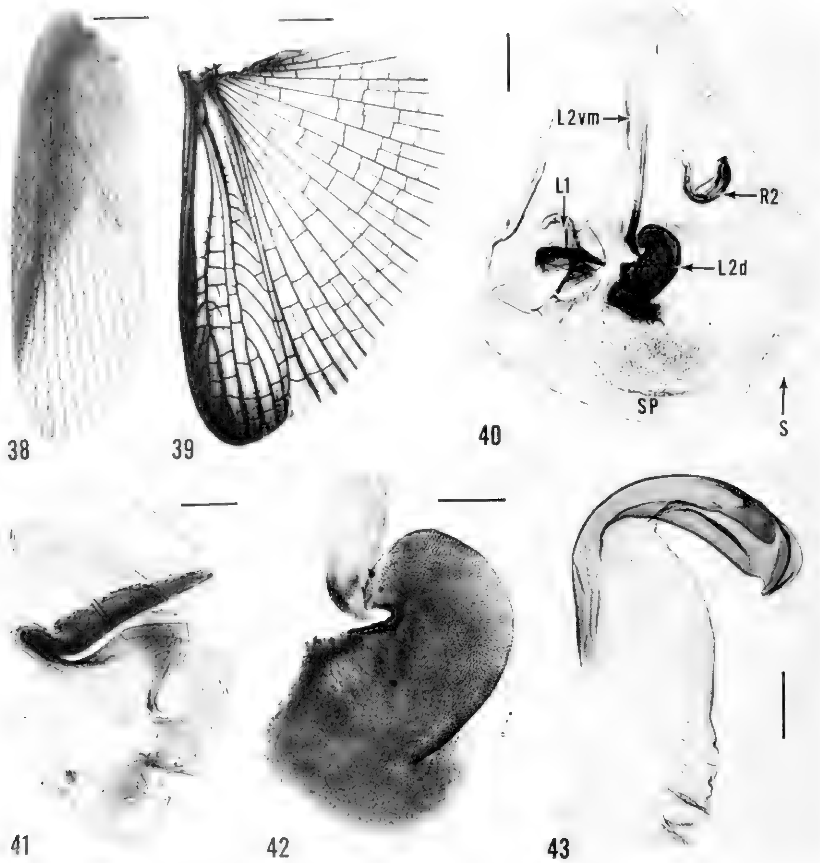
Female: Similar to male (figs. 26, 27, 31, 32) except for following: Elevations on abdominal tergites lacking. Subgenital plate symmetrical, subtrigonal, apex round with a shallow median invagination (best seen in flattened preparation) (fig. 33).

Measurements (mm; 3 females): Total length (including folded tegmina) 17.8–20, pronotum length 3.3–3.4, width 4.5–5.1; tegmen length 14.5–15.3, width 4.2–4.4 (widest combined width 6.6–7.6); abdomen length 8.5–9.3.



Figs. 30–37. *Schultesia lampyridiformis.* 30. Head (♂). 31. Head (♀). 32. Supra-anal plate and tergites 8 and 9 (♀; dorsal). LP = laterocaudal projection on segment 8. 33. Subgenital plate (♀; ventral). 34. Supra-anal plate (♂; dorsal). 35. Subgenital plate (♂; ventral). 36. Front femur (♂; ventrocephalic margin). 37. First and second abdominal tergites (♂). (figs. 32–36 from KOH preparations, scale = 0.5 mm).

Coloration: (♂ and ♀).—Head buffy brown (Ridgway, 1912, pl. XL) with broad median clove brown band between antennal sockets extending downward to clypeus (figs. 30, 31). Vertex dark with a few very light lines. Antennae and palps dark. Pronotum olive buff with 2 broad, laterally concave, olive brown markings separated by pale median line (figs. 26, 28). Tegmina



Figs. 38–43. *Schultesia lampyridiformis.* 38–39. Left tegmen and wing (♀). 40. Male genitalia and subgenital plate (dorsal). L2d = dorsal sclerite of left phallomere; other abbreviations as in fig. 19. 41–43. Male genitalia. 41. L1. 42. Apex of L2vm, and L2d. 43. R2. (Figs. 40–43 from KOH preparations; scale, figs. 38–39 = 2 mm, fig. 40 = 0.5 mm, figs 41–43 = 0.2 mm).

olive brown with broad olive buff marking in area bounded by radius and costa; below this pale area a somewhat sinuous dark band followed by paler region covering part of anal field; distal part of overlapping tegmina more intense brown (figs. 26, 28). Wings dusky, upper distal half darker than remainder (fig. 39); area between costal veins pale. Dorsal surface of abdomen dark brown with pale lateral margins; undersurface light brown but may have extensive dark areas. Posterior margin of subgenital plate pale (fig. 29). Cerci dark brown except for 2 pale terminal segments (figs. 32, 34). Coxae dark with pale margins. Femora, distal parts of tibiae, and tarsi dark, with parts of tibiae pale.

Male holotype, Female allotype: Adolpho Ducke Preserve, outside of Manaus, Brazil. Coll. L. M. Roth. Academy of Natural Sciences, Philadelphia. Nymphs and adult paratypes (reared) deposited as follows: 3 ♂, 3 ♀, 3 nymphs, Academy of Natural Sciences, Philadelphia; 3 ♂, 3 ♀, 3 nymphs, U. S. National Museum; 1 ♂, 3 ♀, 2 nymphs, Zoological Institute, Lund, Sweden; 2 ♂, 2 ♀, 2 nymphs, British Museum (Natural History).

The chromosomes of S. *lampyridiformis* number 29 (♂) and 30 (♀), and are mostly submetacentrics and a few metacentrics (reported as an undetermined genus (41B), Table 1, *in* Cohen and Roth, 1970).

Schultesia lampyridiformis was first collected July 20, 1967, at Gaviaõ, Rio Negro, Amazonas (61° 46′ W 1° 24′ S) (near the expedition base camp). Seven nests were collected in 1 tree, much of which was under water about 50 yards from shore. An undetermined species of *Chorisoneura* was also found in these nests and the approximate numbers of both genera collected were as follows:

	Schultesia		*Chorisoneura* sp. A.	
Nest Number	*Adults*	*Nymphs*	*Adults*	*Nymphs*[b]
1[a]	0	0	0	2
2	0	0	4	27
3[a]	0	0	0	5
4	4♂, 8♀	29	2	13
5	0	1	4	6
6	4♂, 3♀	7	12	7
7	0	6	14	13

[a] Large ant colony in nest.
[b] Not all of the very small nymphs were counted.

The oöthecae of *Chorisoneura* sp. A. (fig. 99) were very numerous and attached to the straw of the nests. One specimen of *Amazonina nidicteridicola* n. sp. (reared), and an undetermined blattellid (♀ reared) were also found in 1 of these nests.

Eight nests were collected July 21, 1967, at Moura, Rio Negro (61° 38′ W 1° 28′ S). Five ♂, 2 ♀, and 19 nymphs of *Schultesia* were found with 3 blattellid nymphs, 1 of which was reared and determined by Ashley Gurney as *Chorisoneura inversa* Hebard.

Several nests were collected about 60 feet from the ground near the Adolpho Ducke Preserve, outside of Manaus on August 1, 1967. Three species of cockroaches were found in these nests: *Schultesia lampyridiformis* (2 ♂, 3 ♀, 1 nymph); *Dendroblatta cnephaia* Hebard (fig. 91), 1 ♂, 1 ♀, 3 nymphs (an adult ♀ of this species was also collected by F. Kafatos, at black light in the Adolpho Ducke Preserve); *Chorisoneura* sp. *B.*, several first instars and 2 oöthecae (which differ from the egg cases produced by *Chorisoneura* sp. A. (fig. 99) in being pale with a dark uneven longitudinal band along the sides (fig. 98)).

A laboratory colony of *Schultesia* has been maintained on laboratory chow for the past 5 years. Newly emerged females attract and mate with males who court in the typical cockroach manner by raising the wings and exposing their tergites. The females respond sexually by palpating the male's dorsum prior to copulation. Like all Blaberidae (Roth, 1967a), *Schultesia* extrudes and retracts its oötheca into a uterus where the eggs develop. The oötheca consists of a thin transparent membrane surrounding the eggs (fig. 103). A habitus of the nymph is shown in figure 25. The large numbers of *Schultesia* and *Chorisoneura* (plus oöthecae) taken indicate that the bird nest habitat is undoubtedly a normal association for these genera.

Some characteristic features of *Dendroblatta cnephaia* (fig. 91) are illustrated in figures 92–97. The supra-anal plate has a slight mesal indentation, and the cerci are very long (fig. 92). A small sclerotized extension with large curved apical spines is found between the large lamellate styles (fig. 94). Normally this structure is closely adpressed into a curved depression of the inner face of the large right style. It is well hidden and difficult to see unless the subgenital plate is cleared and flattened. Hebard (1926) did not mention this distinctive structure in his original description. The ventral anterior margin of the front femur has a long row of small spines more or less uniform in length, terminated by 2 large distal spines (fig. 93). The internal genitalia are illustrated (figs. 95–97) for the first time. The L2d is large, bulbous, and separated from L2vm (fig. 95). The hook (R2) has a subapical incision (fig. 97). The oötheca has a distinctive, broad, dark, ventral, longitudinal band (fig. 100).

D. cnephaia has 31 (♂) and 32 (♀) chromosomes, almost all of which are submetacentric (Cohen and Roth, 1970).

Dendroblatta cnephaia was only recorded from French Guiana by Hebard (1926). Princis (1969) also listed it from Surinam, but he referred to Bruijning (1959) for this record; Bruijning did not report it from Surinam.

Amazonina nidicteridicola, n. sp.[5]

figs. 44–49, 52–54, 56–57, 62, 65, 66, 71, 80–82

This species agrees with the generic characters (Hebard, 1929) of minute scattered tegminal dots, armament of the ventral anterior margin of the front femur, wing venation, and specializations of the male and female subgenital plates.

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[5] Named after the family (Icteridae) of birds that make pendulous nests in which this species of *Amazonina* is found (nidus = nest, Icteridae, cola = dweller).

Male: Ventral anterior margin of front femur with row of spines which decrease in size distad terminated by 2 long spines (fig. 52); ventral hind margin with 3 spines and 1 distal. Ventral anterior and hind margins of mid and hind femora well armed with large spines, widely spaced, each margin possessing a distal spine; piliform setae interspersed between large spines. Tarsal claws symmetrical, minutely serrulate. Pulvilli and arolia well developed. Tegmina with small darkened spots, each indicating the insertion of a fine seta. Spots on left tegmen occurring on many veins, but more numerous distally, those on right tegmen few in number occurring principally on costal veins, very few (basally) on cubital and medial veins. Costal veins of hind wing clubbed; cubital vein with 3 or 4 complete branches (fig. 54). Tergal glands absent. Supra-anal plate broadly but shallowly rounded (fig. 56). Subgenital plate with distal margin curved ventrad and small median nipplelike protuberance which may curve dorsad; shallowly convex laterally, each corner broadly rounded, thickened, curved ventrad, bearing apically a dense patch of stout spines, some directed ventrad, others caudad (fig. 66). Internal genitalia (figs. 80–82): L2d curved, pointed, fused to and a continuation of L2vm (fig. 80).

The extent of the ventral curvature of the lateral protuberance on the posterior margin of the subgenital plate is variable (6 paratypes), not at all occurring in some specimens.

Holotype measurements: (mm; measured as alcoholic specimen prior to being pinned): Total length (including folded tegmina) 14.3; pronotum length 2.5, width 3.2; tegmen length 12, width 3.1; abdomen length 6.5.

Female: Very similar to male in size and wing development. Supra-anal plate roundly notched at apex (fig. 57). Subgenital plate with meso-distal margins black, thickened, shallowly convex dorsally and bearing short, stout spines (figs. 65, MC, 71). More slender setae forming setal comb in anal chamber (fig. 65, AC) not contiguous and their separated bases clearly indicated by large, round, dark pigmentation (fig. 71). Curved dorsolateral corners of the plate each armed with a patch of multiple rowed small, slender, setae, these also delineated by dark round bases (fig. 65, LS).

Allotype measurements (mm; measured as alcoholic specimen, prior to being pinned): Total length (including folded tegmina) 14.0; pronotum length 2.7, width 3.4; tegmen length 11.2, width 3.0; abdomen length 6.3.

Coloration (♂ and ♀): Similar (general color buckthorn brown) to *A. platystylata* (Hebard) and *A. conspersa* (Brunner) except for the absence of a broad medio-longitudinal blackish band on the ventral surface of the abdomen (figs. 46, 48). The pronotal markings of *A. nidicteridicola* (fig. 49) are similar to, but much more intense than *A. platystylata* (fig. 51). The pronotal markings of *A. conspera* (fig. 50) are even lighter than those of *A. platystylata.* (The markings shown in figs. 49–51 are much darker than they actually are because of the use of high contrast film; cf. figs. 45, 83, 89).

A habitus of the nymph of *A. nidicteridicola* is shown in fig. 44, and the oötheca in fig. 101.

Holotype male and allotype female: Near Serra Tamendaui, Rio Negro, Amazonas, Brazil (64° 45′ W 0° 27′ S). Coll. L. M. Roth, Academy of Natural Sciences, Philadelphia. Reared paratype adults, and nymphs distributed as follows: 2 ♂, 3 ♀, 1 nymph in the Academy

Table 1. Differences between females of 3 species of *Amazonina*.

Characters[a]	*nidicteridicola*	*platystylata*	*conspersa*
Supra-anal plate (posterior margin)	broadly rounded, apex indented (fig. 57)	broadly rounded, apex indented (fig. 59)	subtrigonal, with median invagination (fig. 61)
Subgenital plate (posterior margin)	mesodistal border rounded; slightly thickened convex elevations produced dorsad, bearing minute stout comb-like contiguous spines; setae forming comb in anal chamber few in number, not contiguous, each spine delineated by dark round spots. Dorsolateral margins of plate with multiple rows of small non-contiguous setae. (figs. 65, 71).	mesodistal border truncate, lateral corners produced dorsad in small truncate plates, apex armed with contiguous spines; setal comb in anal chamber with fewer contiguous spines on truncate apex of an elongate sclerotized bar. Dorsolateral margins of plate armed with single row of fine setae. (figs. 67, 72).	mesodistal border truncate, lateral corners produced in slightly raised truncate plates bearing contiguous spines apically; setal comb of anal chamber with few spines on a sclerotization approximately the combined width of spines. Dorsolateral margin of plate as in *platystylata* (figs. 69, 73)
Paired spermathecae	Transparent, each incompletely divided by a constriction (fig. 62)	Lightly pigmented, each incompletely divided by a constriction (fig. 63)	Opaque, black, without constrictions (fig. 64)

[a] As seen in KOH treated, flattened preparations.

Table 2. Differences between males of 3 species of *Amazonina*.

Characters[a]	*nidicteridicola*	*platystylata*	*conspersa*
Supra-anal plate (posterior margin)	shallowly convex (fig. 56)	Subtrigonal, apex rounded (fig. 58)	Subtrigonal, apex rounded, sides slightly concave (fig. 60)
Subgenital plate (posterior margin between styles)	lateral corners broadly rounded, armed with short spines; small pointed mesad nipplelike protuberance (fig. 66)	mesad protuberance broad, the apex truncate (ventral aspect) sometimes V-emarginate (caudal aspect); mesolaterally shallowly concave, followed by broad, transverse margins[b] bearing many minute stout spines (fig. 68)	distinct mesad invagination, lateral corners with patch of small heavy spines located apically on narrow protuberances (fig. 70)
L2d (at apex of L2vm)	with marked curvature, surface scalelike (fig. 80)	1 margin subapically swollen, surface scalelike (fig. 77)	gradually tapering without swelling, surface smooth (fig. 74)
R2	Fig. 81	Fig. 78	Fig. 75
L1	Fig. 82	Fig. 79	Fig. 76

[a] as seen in KOH treated, cleared, flattened preparations.
[b] Hebard (1921) mistakenly considered these structures to be the styles which are actually located on the outer corners of the subgenital plate (fig. 68,S); when folded the styles are hidden and not seen ventrally.

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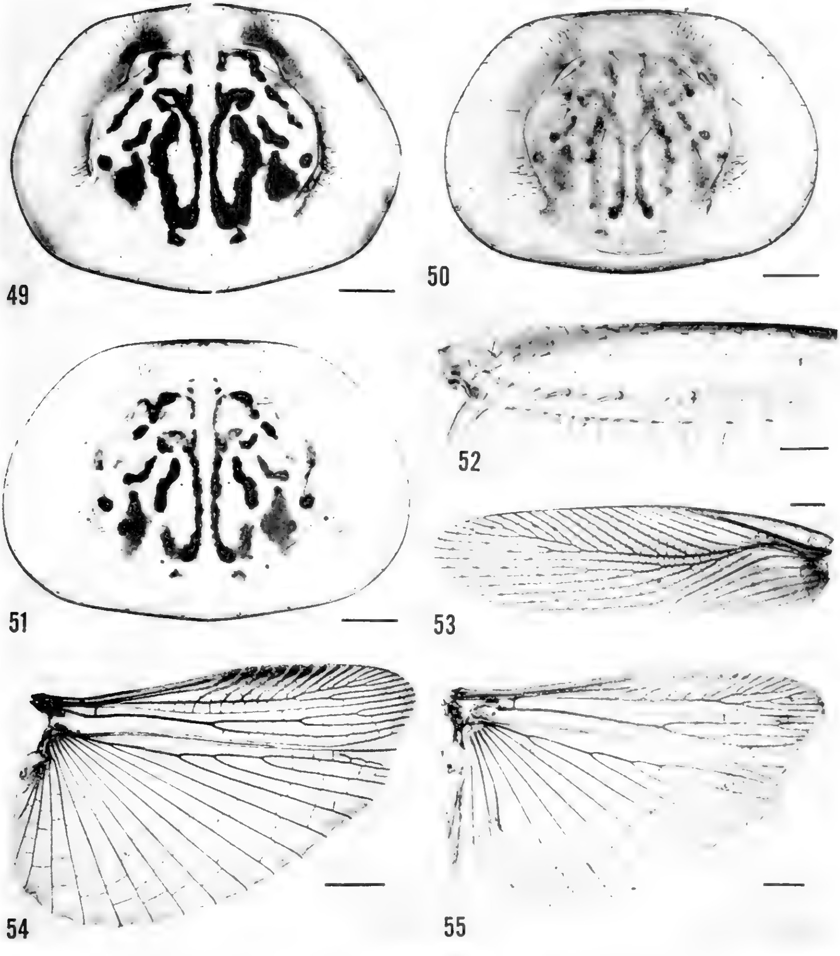
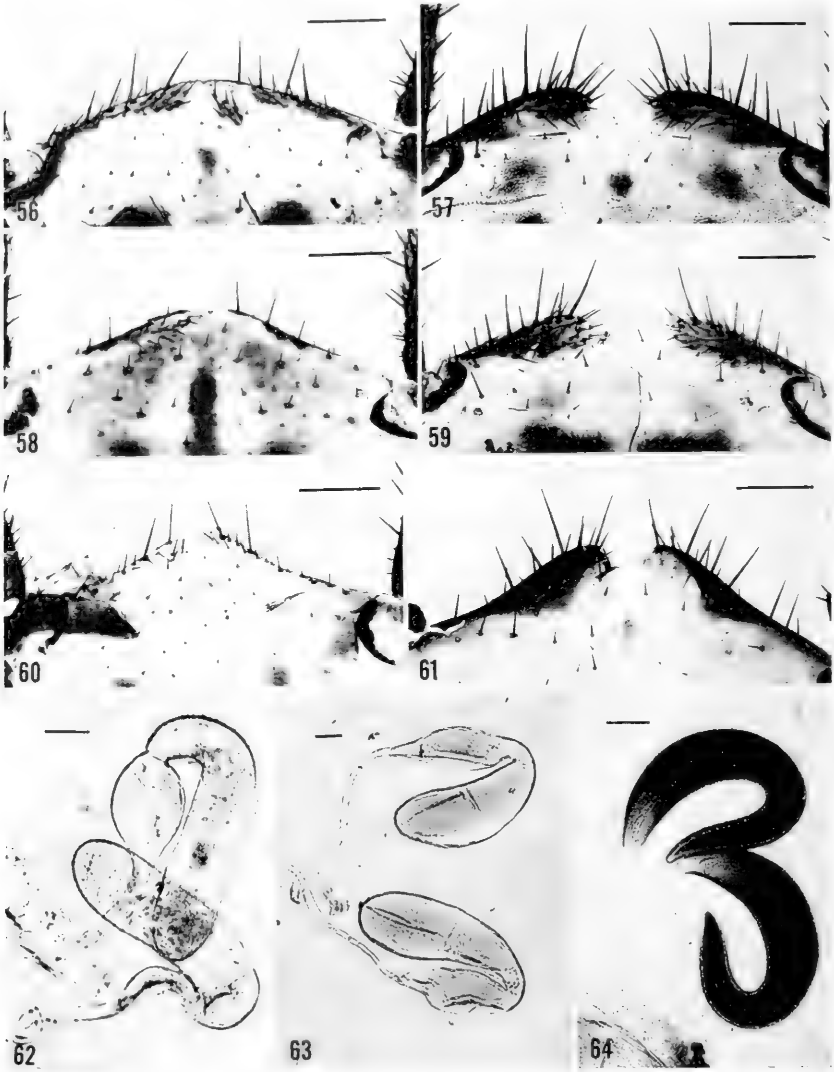
Figs. 44–48. *Amazonina nidicteridicola*. 44. Nymph. 45–46. Adult (♂). 47–48. Adult (♀). (scale, fig. 44 = 2 mm, figs. 45–48 = 3 mm).



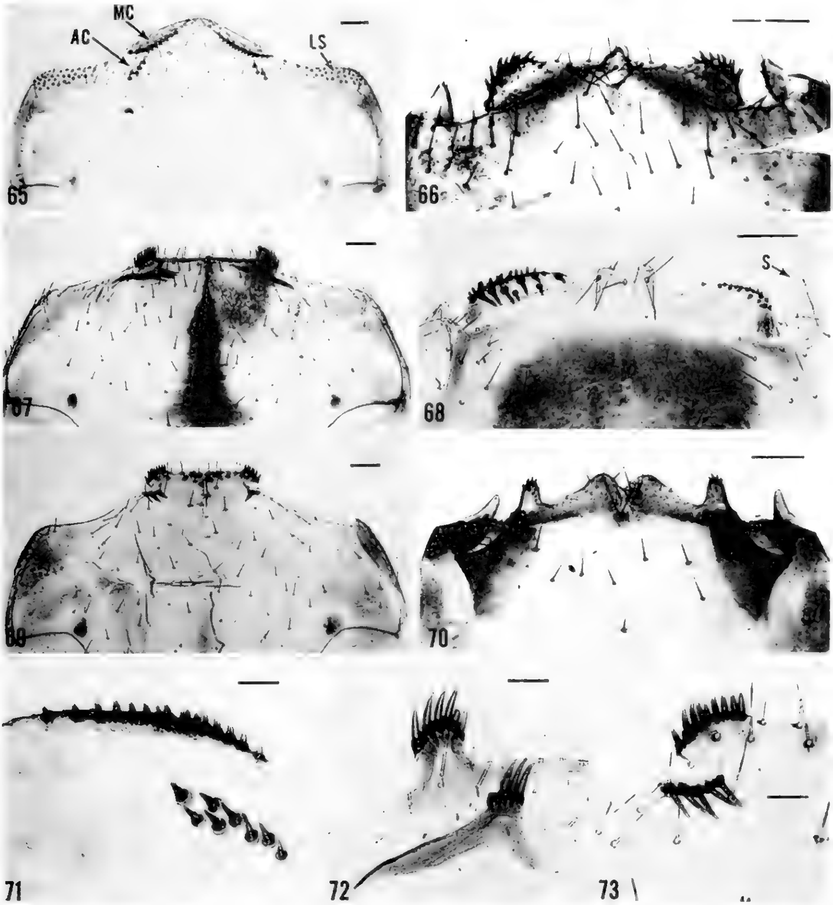
Figs. 49–55. *Amazonina* spp. 49. *A. nidicteridicola*, pronotum (♂). 50. *A. conspersa*, pronotum (♀). 51. *A. platystylata*, pronotum (♂). 52–54. *A. nidicteridicola*. 52. Prothoracic femur (♂; ventrocephalic margin). 53. Left tegmen (♀). 54. Right wing (♀). 55. *A. conspersa*, right wing (♀). (figs. 49–52 from KOH, cleared, flattened preparations; scale, figs. 49–51 = 0.5 mm, fig. 52 = 0.25 mm, figs. 53–55 = 1 mm).

of Natural Sciences, Philadelphia; 3 ♂, 2 ♀, 1 nymph, U. S. National Museum, Washington, D. C.; 1 ♂, 1 ♀, 1 nymph Zoological Institute, Lund, Sweden; 1 ♂, 1 ♀ British Museum (Natural History).

The collection data for *A. nidicteridicola* is as follows: 2 nests collected near Serra Tamendaui, Rio Negro, July 18 and 19, 1967. Nest No. 1, 2 ♀ (1 carrying oötheca), 4 nymphs, and 2 empty oöthecae.



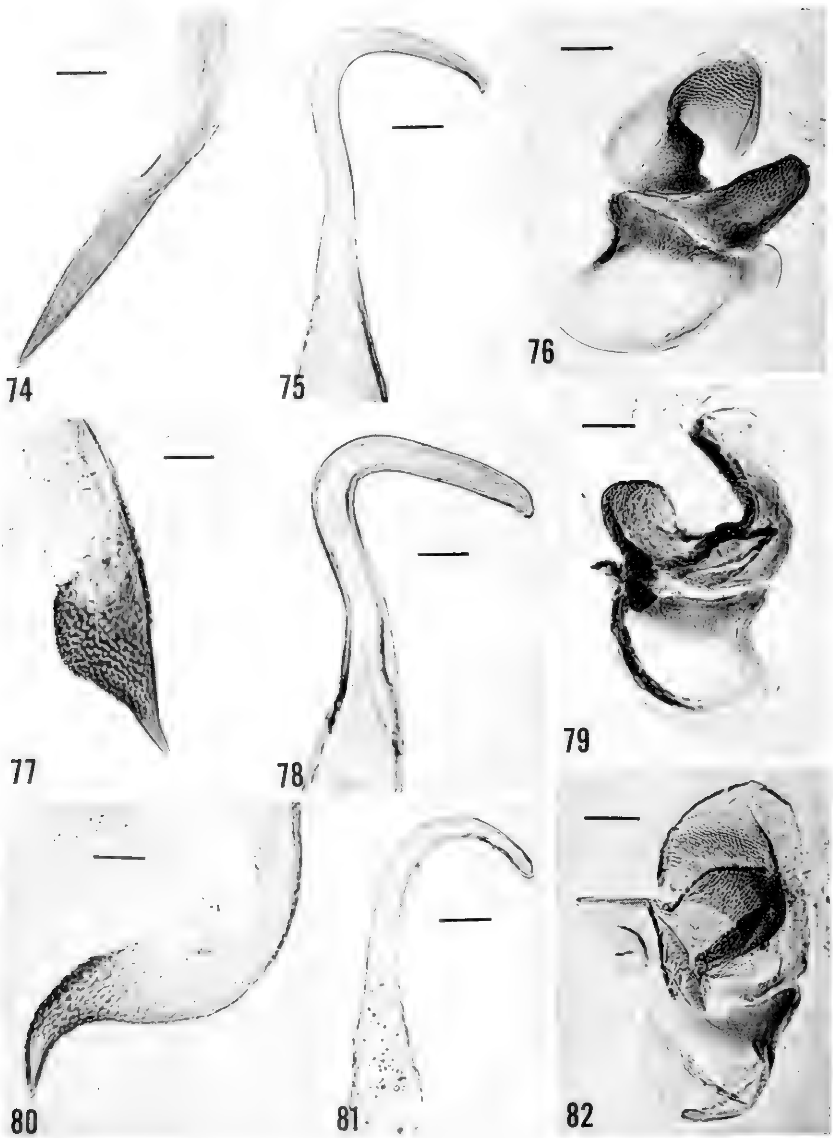
Figs. 56–64. *Amazonina* spp. 56–61. Male (left) and female (right) supra-anal plates. 56–57. *A. nidicteridicola.* 58–59. *A. platystylata.* 60–61. *A. conspersa.* 62–64. Spermathecae. 62. *A. nidicteridicola.* 63. *A. platystylata.* 64. *A. conspersa.* (KOH, cleared, flattened preparations; scale, figs. 56–61 = 0.25 mm, figs. 62–64 = 0.1 mm).



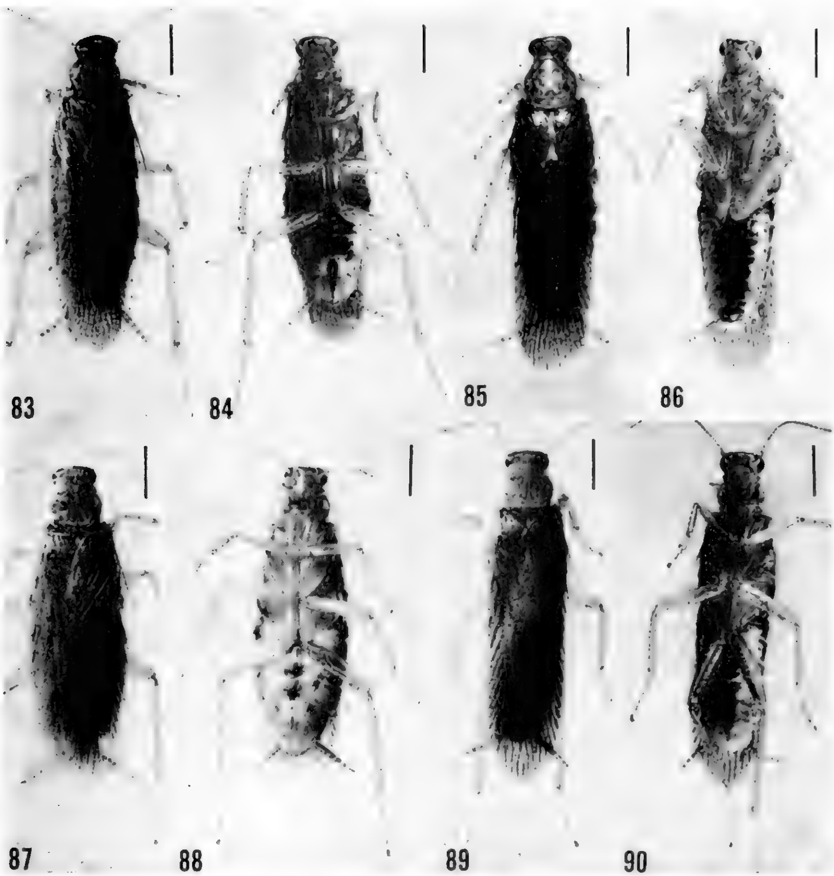
Figs. 65–73. *Amazonina* spp. Subgenital plates (female, dorsal, left; male ventral, right). 65–66. *A. nidicteridicola.* AC = setal comb in anal chamber; MC = marginal comb; LS = lateral group of setae. 67–68. *A. platystylata.* S = style. 69–70. *A. conspersa.* 71–73. Setal combs on female subgenital plates (dorsal). 71. *A. nidicteridicola.* 72. *A. platystylata.* 73. *A. conspersa.* (KOH, cleared, flattened preparations; scale, figs. 65–70 = 0.25 mm, figs 71–73 = 0.1 mm).

The other nest had 4 ♂, 2 ♀ (1 carrying oötheca), 18 nymphs, and 2 empty oöthecae (1 of these had been parasitized, as evidenced by a round exit hole). *Alphelixia sicca* was also found in these same nests and an adult female of *Lophoblatta arlei* was also taken in nest number 1. One adult *A. nidicteridicola* (reared) was also taken in a nest at Gaviaõ, Rio Negro (near base camp), July 20, 1967.

The numbers of *A. nidicteridicola* taken in these nests, including the



Figs. 74–82. *Amazonina* spp. Parts of male genitalia. L2d and apex of L2vm (left), R2 (middle), L1 (right). 74–76. *A. conspersa*. 77–79. *A. platystylata*. 80–82. *A. nidicteridicola*. (KOH preparations; scale, figs. 74–75, 77–78, 80–81 = 0.05 mm, figs. 76, 79, 82 = 0.1 mm).

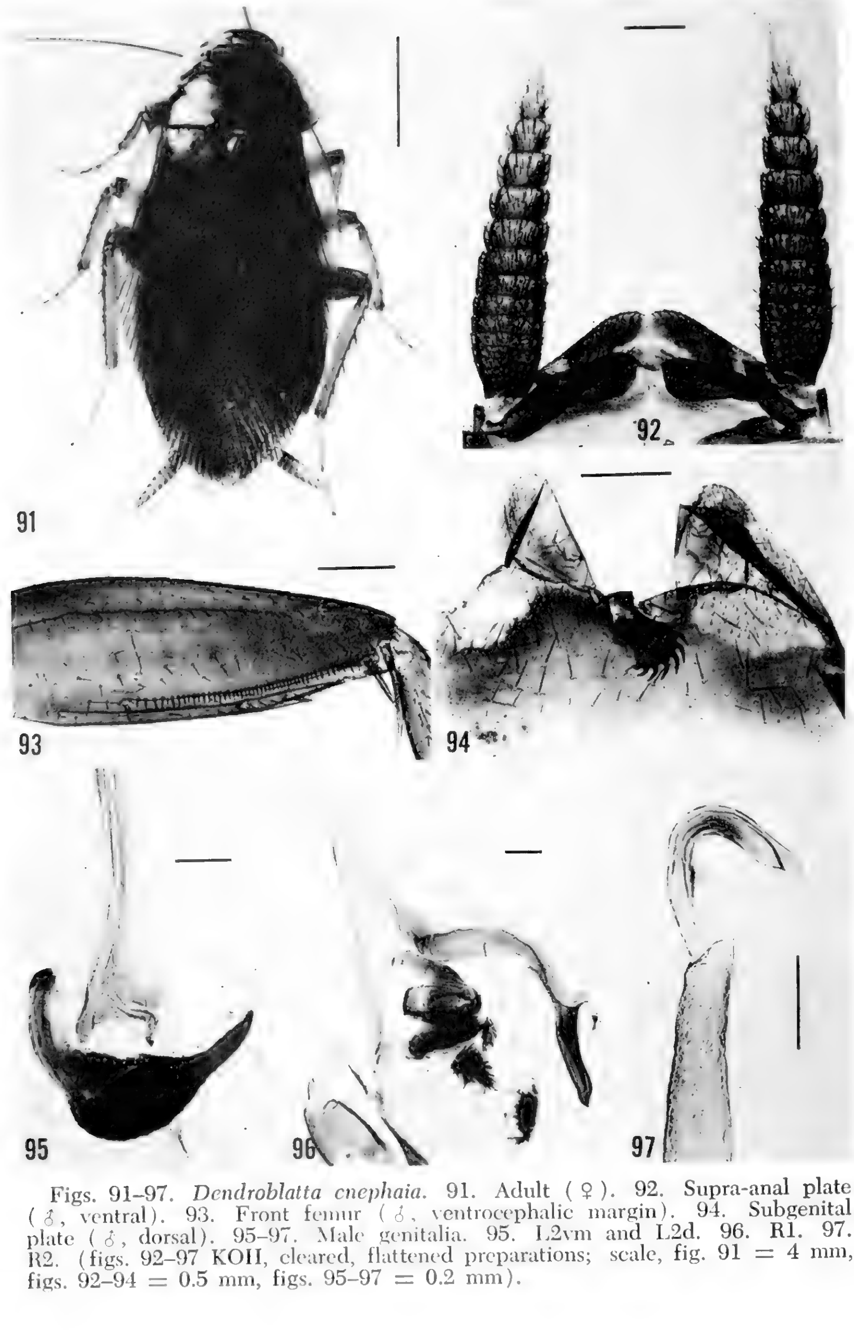


Figs. 83–90. *Amazonina* spp. Adults (dorsal and ventral). 83–86. *A. platystylata*. 83–84. Female. 85–86. Male. 87–90. *A. conspersa*. 87–88. Female. 89–90. Male. (scale = 2 mm).

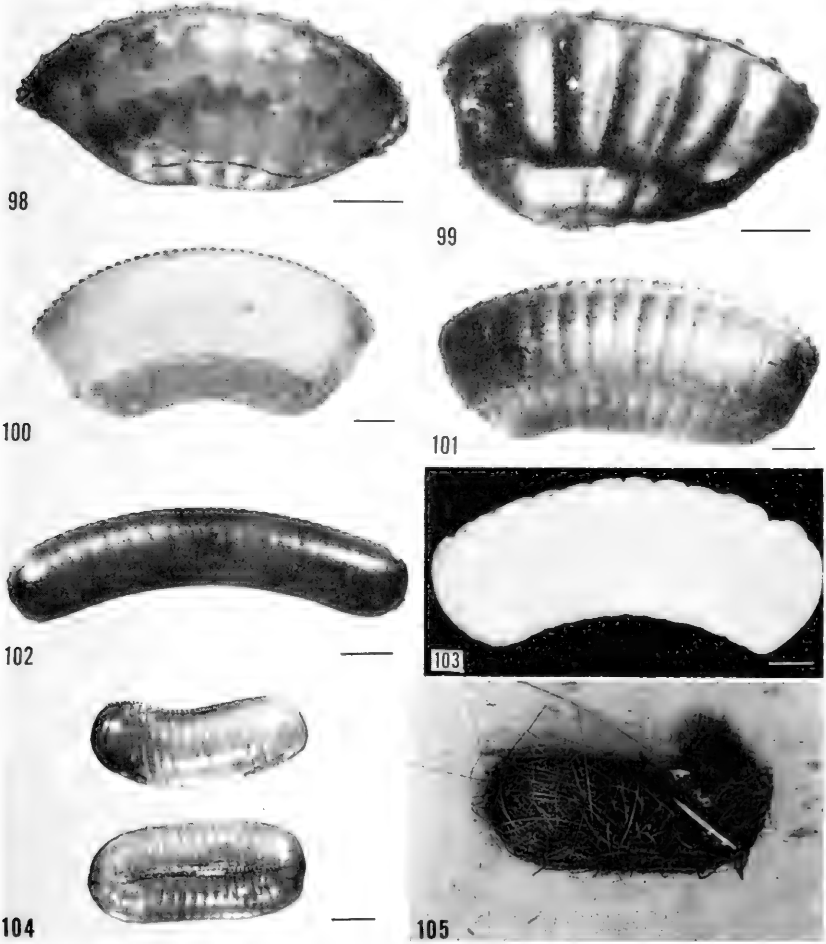
presence of oöthecae, indicate that the nest habitat is undoubtedly normal for the species.

The chromosomes of *A. nidicteridicola* number 25 (♂) and 26 (♀), and are metacentric and submetacentric (reported as *Amazonina* n. sp. (38B), Table 1 and fig. 24 *in* Cohen and Roth, 1970).

The females of *A. platystylata* and *A. conspersa* are difficult to differentiate (Hebard, 1921). Distinguishing characters for females and males of these 2 species and *A. nidicteridicola* are given in Tables 1 and 2. There is some inter- and intraspecific variation in the number of main branches of the cubitus of the hind wing. In *A. nidicteridicola* there are 3 (fig. 54) or 4; *A. platystylata* has 3



Figs. 91–97. *Dendroblatta cnephaia*. 91. Adult (♀). 92. Supra-anal plate (♂, ventral). 93. Front femur (♂, ventrocephalic margin). 94. Subgenital plate (♂, dorsal). 95–97. Male genitalia. 95. L2vm and L2d. 96. R1. 97. R2. (figs. 92–97 KOH, cleared, flattened preparations; scale, fig. 91 = 4 mm, figs. 92–94 = 0.5 mm, figs. 95–97 = 0.2 mm).



Figs. 98–105. 98–104. Oöthecae of cockroaches found in bird nests. 98. *Chorisoneura* sp. *B*. 99. *Chorisoneura* sp. *A*. 100. *Dendroblatta cnephaia*. 101. *Amazonina nidicteridicola*. 102. *Cahita* or *Galibia* (probably *Galibia*). 103. *Schultesia lampyridiformis* (this species is ovoviviparous and the oötheca is carried internally until the eggs hatch). 104. *Lophoblatta arlei* (top, lateral view; bottom, dorsal view). (scale, figs. 98–99, 101 = 0.5 mm, figs. 100, 102–104 = 1 mm). (Figs. 98–102, from Roth, 1971; *Amazonina nidicteridicola* was reported as *Amazonina* sp. (78B) in Figs. 42 and 100). 105. Typical bird nest in which cockroaches were found.

(sometimes 4), and *A. conspersa* has 1, 2 (fig. 55), or sometimes 3 branches. An examination of the wings of several specimens of *platystylata* and *conspersa* showed that the number of cubital branches could differ by one on the right and left wings of the same specimen.

Collection data (none from bird nests) for *A. platystylata* and *A. conspersa* taken on the Alpha Helix 1967 expedition follow:

A. platystylata: Tapurucuara, July 12 (♀); Adolpho Ducke Preserve, July 4 (♀, reared); July 24 (♂; also nymphs taken under leaf litter along shallow ditch of clay road); Flores, Manaus, July 25 (♀, 2 ♂ reared from nymphs taken under leaf litter in sandy soil); Egler Preserve, near Manaus, July 30 (♀); Puraquequara, Rio Negro, July 31 (2 ♂, reared); Borba, Rio Madeira, Aug. 4 (2 ♂, reared from nymphs collected under wood chips); Serra Tamendaui, Rio Negro, July 16 (♂ and ♀, reared from nymphs taken in sandy soil).

A. conspersa: Gaviaõ, Rio Negro, July 18 (♂ and ♀, sweeping tall weeds); Urucurutuba, Rio Madeira, Aug. 9 (♀ reared from nymph collected under cut palm fronds); Moura, Rio Negro, July 21 (♀).

One bird's nest was collected about 10 miles east of Manaus along the Rio Amazonas, Aug. 12, 1967. A few cockroaches belonging to 3 genera (det. Gurney) were found: either *Cahita* or *Galibia* (probably *Galibia*) (2 ♀, reared); atypical "*Eudromiella*" (♂, reared); and *Chorisoneura* sp. A. (♂ and ♀, reared). The oötheca of *Cahita-Galibia* has an unusual sausagelike shape (fig. 102).

Acknowledgments

All of the specimens taken in birds nests were collected during Phase C of the Alpha Helix expedition to the Amazon in 1967. I thank the National Science Foundation for support on the Amazon expedition under Grant NSF-GB-5916.

I thank Dr. David R. Ragge, British Museum (Natural History), London, for the loan of the holotype ♂ of *Ischnoptera* (?) *sicca* Walker, Dr. Ashley B. Gurney, Systematic Entomology Laboratory, USDA, for some of the identifications, Mr. Samuel Cohen for taking the photographs, and Raimundo, a Brazilian botanical collector, who climbed trees to collect some of the nests.

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NORTH AMERICAN SAWFLIES DESCRIBED BY KLUG AND KONOW (HYMENOPTERA: SYMPHYTA)

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ABSTRACT—A study of types of some North American sawflies described by J. C. F. Klug and F. W. Konow is presented. Many of these have not been studied or properly placed; 4 new combinations and 9 new synonymies are proposed.

J. C. F. Klug and K. W. Konow, both German workers, described a number of sawflies from North America, but most of their species have not been studied because of the remote location of their collections, at least to the North American authors. Consequently, some of the species were placed in the category "Unplaced Species of Tenthredinidae" by Ross (1951) in the Catalog of Hymenoptera of America North of Mexico. Klug's work is especially important because the sawflies he described were among the first to be described from North America.

Through the courtesy of Dr. E. Königsmann, Zoological Museum of Berlin, Germany, where most of Klug's collection is located, and Dr. J. Oehlke, Institut für Pflanzenschutzforschung, Eberswalde, Germany, where most of Konow's collection is located, I have been able to study the types of the species below. I am giving the original combination, date of description, exact data as found on the specimens, and a statement of taxonomic placement, including any necessary changes.

Lyda circumcincta Klug, 1808:279. ♀. Labels: "14501," "TYPE" [red], "*Circumcincta* Kl.*, Georgia Kl." [green]. Correctly placed as *Acantholyda circumcincta* (Klug) by Middlekauff (1958).

Lyda plagiata Klug, 1808:272. ♀. Labels: "14509," "TYPE" [red], "var: *L. plagiata* Kl., Baltimore" [green]. Correctly placed as a synonym of *Pamphilius amplectus* (Fabricius) by Middlekauff (1964).

Lyda tesselata Klug, 1808:276. ♀. Labels: "14502," "TYPE" [red], "*tessellata* Kl.*, Georgia Kl." [green]. Correctly placed as *Acantholyda tesselata* (Klug) by Middlekauff (1958).

Hylotoma miniata Klug, 1814:298. ♂. Labels: "13654," "Georgia, Klug!" [small, green], "*miniata* Kl., Georg. Kl." [large, green]. A male of *Arge coccinea* (Fabricius) (= *Hylotoma miniata* Klug, new synonymy).

Hylotoma plumigera Klug, 1814:306. ♂. Labels: "13701," "Georgia, Klug" [small, green], "*plumigera* Kl., Crypt. *Klugii* Leach., Georg.

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Kl." [large, green]. This is the species I treated as *Sphacophilus klugii* (Leach) (Smith, 1971b). Klug must have been in error when he stated this was from "New-York in Nordamerika." Klug's name has precedence over Leach's name; consequently, the following synonymy is in order: *Sphacophilus plumiger* (Klug) (= *Cryptus klugii* Leach, new synonymy).

Hylotoma rubra Klug, 1814:299. ♀. Labels: "13653," "Georgia, Klug" [small, green], "*rubra*, Georg., Kl." [large, green]. Correctly placed by Ross (1951) as a synonym of *Arge coccinea* (Fabricius). Klug stated that his specimen was from "Newyork in Nordamerika,"; probably an error on his part.

Hylotoma sanguinea Klug, 1814:299. ♀. Labels: "13652," "Georgia, Klug" [small, green], "*sanguinea* Kl., Georg. Kl." [large, green]. Correctly placed by Ross (1951) as *Arge sanguinea* (Klug). Further study may reveal this to be a synonym of *Arge humeralis* (Beauvois).

Hylotoma scapularis Klug, 1814:298. ♂. Labels: "13655," "Baltimore, Klug," [small, green], "*scapularis* Kl., Baltim., Kl." [large, green]. Correctly placed by Ross (1951) as *Arge scapularis* (Klug); however, the specimen is a male.

Hylotoma virescens Klug, 1814:296, ♀. Labels: "13647," "Georgia, Klug," [small, green], "*virescens*, Georg., Kl." [large, green]. Placed as a synonym of *Arge clavicornis* (Fabricius) by Ross (1951) and is without question a member of this complex.

Tenthredo (*Emphytus*) *articulata* Klug, 1818:284. ♂. Labels: "14167", "Baltimore, Klug" [small, green], "*articulata* Kl., Baltimore, Kl." [large, green], "*Emphytus articulatus*" [white, penciled label, probably subsequently added to specimen]. Identical to *Ametastegia inornata* (Say) and has precedence over Say's name: *Ametastegia articulata* (Klug), new combination (= *Dolerus inornatus* Say, new synonymy).

Tenthredo (*Allantus*) *formosa* Klug, 1818:115. ♀. Labels: "13919," "Georgia, Klug," [small, green], "*Macrophya formosa* Kl." [handwritten, white label, probably subsequently added to specimen]. Correctly placed by Ross (1951) as *Macrophya formosa* (Klug).

Tenthredo (*Allantus*) *labiata* Klug, 1818:73. ♀. Labels: "13810," "Georgia, Klug," [small, green], "*labiata* Kl., Georg. Kl." [large, green]. This name is preoccupied by *Tenthredo labiata* Fourcroy, 1785. Klug's species is the same as *Periclista subtruncata* Dyar (= *Tenthredo labiata* Klug, new synonymy).

Tenthredo (*Allantus*) *litura* Klug, 1818:83, ♀. Labels: "13907," "Georgia, Klug" [small, green], "*Dineura litura* Kl." [penciled on white paper, probably a subsequent label], "*litura* Kl., Georg., Kl." [large, green]. Correctly placed as *Neopareophora litura* (Klug) by Ross (1951).

Tenthredo (*Allantus*) *obtusa* Klug, 1818:55. ♀. Labels: "13748," "Georgia, Klug" [small, green]. "*Tenthredo obtusa*" [penciled on white paper, probably a subsequent label]. This name is a senior homonym of *Tenthredo obtusa* Klug, 1818:211; Enslin (1914) proposed the name *obtusalis* for Klug's *obtusa* on p. 211. This species is identical to *Craterocercus albidovariatus* (Norton) and takes precedence over Norton's name: *Craterocercus obtusa* (Klug), new combination (= *Hemichroa albidovariata* Norton, new synonymy).

Tenthredo (*Allantus*) *pulchella* Klug, 1818:121, ♂. Labels: "13925," "Georgia, Klug," [small, green], "*Macrophya*" on top and "*pulchella*" on bottom of a white label, probably subsequently added to specimen. Correctly placed by Ross (1951) as *Macrophya pulchella* (Klug).

Hylotoma biramosa Klug, 1834:242. ♂. Labels: "13687", "Mexico, Deppe" [green], "*biramosa* Kl., Mexico Deppe" [large, green], a folded white label with 4 lines of description, "Zool. Mus. Berlin" [white]. Though this is a Mexican species, it necessitates another name change for a species treated in my revision of *Neoptilia* (Smith, 1971b): *Neoptilia biramosa* (Klug), new combination (= *Hylotoma varicolor* Norton, new synonymy: = *Neoptilia mexicana* Ashmead, new synonymy).

Xyela bakeri Konow, 1898b:328. ♀ ♂. "Nevada, Colorado." Two specimens, both labeled "Nevada," "Coll. Konow," "TYPUS," and on the male only, the name label "*Xyela bakeri* Konow, Nevada." Also, 1 female labeled "Colo. 1519." The male with the name label is hereby designated as lectotype. Correctly treated by Burdick (1961) as *Xyela bakeri* Konow.

Acorduleceros biclinius Konow, 1898a:253. ♀. Two females, both labeled "Dallas, Texas," "Coll. Konow," "TYPUS", and one with the name label "*A. biclinius* Knw.", the other "*Acorduleceros biclinius* Knw., Amer. b. Texas." The specimen with the label "*A. biclinius* Knw." is hereby designated as lectotype. This species was correctly placed as a synonym of *Acordulecera dorsalis* Say, by Ross (1951).

Acorduleceros pellucidus Konow, 1898a:253. ♀. The type is a female labeled "Dallas, Texas," "Coll. Konow," "TYPUS," "*Acorduleceros pellucidus* Knw., Am. b. Texas," the only specimen Konow saw. This is the same as *Acordulecera minuta* MacGillivray, and Konow's name takes precedence: *Acordulecera pellucida* (Konow) (= *Acordulecera minuta* MacGillivray, new synonymy).

Arge inops Konow, 1906:181. ♂. A single male labeled "Dallas, Texas," "Coll. Konow," "TYPUS," "*Arge inops* Knw., Texas," is the type. This was correctly placed as a synonym of *Arge clavicornis* (Fabricius) by Ross (1951).

Brachyphatnus nigriceps Konow, 1906:251. ♀. A female labeled "Dallas, Texas," "Coll. Konow," "TYPUS," "*Brachyphatnus nigriceps*

Knw., Texas," is the type. This is correctly treated as *Sphacophilus nigriceps* (Konow) in my revision of that genus (Smith, 1971b).

Entodecta humilis Konow, 1908:84. ♀. One specimen labeled "Sitcha," "Sahlberg," "Coll. Konow," "TYPE," "*Entodecta humilis* Knw., Alaska," is the type, a female. Correctly placed as a synonym of *Metallus capitalis* (Norton) in my revision of the Heterarthrinae (Smith, 1971b).

Pachynematus sahlbergi Konow, 1908:83. ♀ ♂. One female, labeled "Sitcha," "Sahlberg," "Coll. Konow," "TYPE," "*Pachynematus sahlbergi* Konow" may be the type. I saw only the 1 specimen. Correctly placed as a synonym of *Melastola resinicolor* (Marlatt) by Wong (1968).

Periclista mutabilis Konow, 1904:241. ♀ ♂. Five specimens, all with the labels "Dallas, Texas," and "Coll. Konow." One male with the additional labels "TYPUS" and "*Periclista mutabilis* Knw., Texas," is hereby designated as lectotype. The other four specimens, females, each have the additional label "Paratypus," and lack a name label. The type male and one paratype are the same as *Periclista albicollis* (Norton) (= *Periclista mutabilis* Konow, new synonymy); the other three paratype females are *Periclista rileyi* (Cresson).

Tenthredo commata Konow, 1908:90. ♀ ♂. Two specimens, a male labeled "Sitcha," "Sahlberg," "Coll. Konow," "TYPUS," and "*Tenthredo commata* Knw., Alaska." A female has the same data but lacks the name label. I am hereby designating the female as lectotype because of better diagnostic characters in this sex for separation of most species of *Tenthredo*. This species is correctly placed as a synonym of *Tenthredo perplexa* MacGillivray by Ross (1951).

Tenthredo juga Konow, 1908:89. ♀. Not examined.

Tenthredo sahlbergi Konow, 1908, p. 91. ♀ ♂. Two specimens, a male labeled "Sticha," "Sahlberg," "Coll. Konow," "TYPUS," and "*Tenthredo sahlbergi* Knw., Alaska." A female has the same data but lacks the name label. I am hereby designating the female as lectotype because of better diagnostic characters in this sex for separation of most species of *Tenthredo*. This species is adequately placed as a synonym of *Tenthredo subcoerulea* Eschscholtz by Ross (1951).

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THE TYPES OF SOME NOCTUID MOTHS FROM THE GALAPAGOS ISLANDS DESCRIBED BY WILLIAM SCHAUS IN 1923 (LEPIDOPTERA)

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ABSTRACT—The type-specimens of 16 noctuid moth species described by William Schaus from the Galapagos Islands in 1923 are discussed. A lectotype is selected for each of the following species: *Euxoa williamsi* Schaus, *Perigea ruthae* Schaus, *Harrisonia williamsi* Schaus, *Amyna insularum* Schaus, *Paectes indefatigabilis* Schaus, *Mocis incurvalis* Schaus, *Anomis porfessorum* Schaus, *Melipotis harrisoni* Schaus, *Rivula? dubiosa* Schaus and *Psorya hadesia* Schaus.

William Schaus, 1923, Zoologica, 5(2):23–45, described 18 new species and 1 new form (subspecies) in the family Noctuidae. The specimens on which the descriptions were based were collected by William Beebe as a member of the Williams Galapagos Expedition of the New York Zoological Society. Schaus indicated that the types of the new entities were to be deposited in the collections of the United States National Museum (USNM) and he assigned numbers from the type catalog of that institution to each new species and to the new form. The specimens bearing the USNM type numbers (1 specimen of each species or form) are in the United States National Museum and have been examined. Part of these must be considered to be holotypes for various reasons that will be explained in the discussions to follow. The others, most of the species based on multiple examples, require lectotype selection and designation in order to insure that they are considered to be the type-specimens by all. It has been argued that if only 1 specimen bears a given USNM type number agreeing with the number cited in the original description that specimen should be considered to be the holotype. I am inclined to agree with that view, but other workers do not agree that the inclusion of such type numbers in the original descriptions and the apparent placement of the type number label on a single specimen is indicative of holotype selection. One argument that has been advanced is that type numbers were not always placed in the descriptions and/or type number labels were not placed on the specimens by the authors, but by others. There are other arguments, but they need not be discussed since one argument is sufficient to demonstrate that different interpretations exist as to the significance of included type numbers.

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According to information received from contemporary workers of Schaus, it was his practice to describe new species from 1 specimen of a series and to apply the name label, type label, and type number label, when used, to the described specimen only. Unfortunately, he did not indicate this procedure in most of his papers and he seldom specified in the descriptions which specimen was to bear the labels (See Article 73 (b) of the International Code of Zoological Nomenclature, 1961). Furthermore, he was not consistent in this practice as can be demonstrated by examples treated in this paper in which more than 1 specimen was described and/or labeled. It has already been established that in some instances he failed to label any of the specimens (Todd, 1972).

The paper under discussion is composed of 2 parts. The first part is a list of collecting data for each species. The data for the species of Noctuidae are found on pages 23 through 27. The list of data is followed by a part in which the new species are described. Pages 32 to 45 contain the descriptions of the new species of the family Noctuidae.

Two of the noctuid species described by Schaus from the Williams Galapagos Expedition material are being treated in a separate paper on some Noctuidae of the Galapagos and will not be included herein.

Euxoa williamsi Schaus, 1923, Zoologica, 5(2):32, pl. 1, fig. 1

"Habitat: Indefatigable, James Island, Albemarle and South Seymour."

"Type Cat. No. 26504. U. S. N. M."

On page 24 in a list of the specimens collected Schaus stated:

"Conway Bay, Indefatigable	8♀	April 1st."
"James Island	1♀	April 5th."
"Tagus Cove, Albemarle	1♂	April 6th."
"South Seymour	1♂ 6♀	April 23rd."

Schaus described a female and added 2 brief sentences about the male. The specimen selected and now designated as the lectotype, a female, is labeled: "*Euxoa williamsi* Schs, type"; "Conway Bay, Indefatigable, Galapagos, April 1, 1923"; "Type No. 26504 U. S. N. M."; "♀ genitalia, Slide USNM 1723, J. G. Franclemont" and "Lectotype, *Euxoa williamsi* Schaus, by E. L. Todd." There are 2 other syntypic specimens in the USNM, the male from Tagus Cove, Albemarle and a female from South Seymour. It is assumed that the other 14 syntypes are in the collection of the New York Zoological Society, but some may have been distributed elsewhere. The same assumption is applied to the syntypes of the other species described by Schaus from the Williams Galapagos Expedition that have not been located in the collection of the USNM.

Lycophotia oceanica Schaus, 1923, Zoologica, 5(2):32, pl. 1, fig. 2.
"Habitat: Galapagos Islands, the type from South Seymour."
"Type Cat. No. 26505. U. S. N. M."
In the list of specimens on p. 24 Schaus stated:

"Conway Bay, Indefatigable	1♀	April 1st."
"Tagus Cove, Albemarle	1♂	April 6th."
"South Seymour	1♂	April 23rd."

Holotype: Schaus indicated in this description which specimen was the type. There was only 1 specimen from South Seymour, and the specimen in the USNM bearing the type number label and the label "*Lycophotia oceanica* Schs, type ♂" is from that locality. It is the specimen figured by Schaus, but it is a female, not a male!

Cirphis cooperi Schaus, 1923, Zoologica, 5(2):33, pl. 1, fig. 3.
"Type Cat. No. 26506. U. S. N. M."

Holotype: A unique female from Conway Bay, Indefatigable.

Trachaea (sic!) *roseae* Schaus, 1923, Zoologica, 5(2):33, pl. 1, fig. 4.
"Type Cat. No. 26507. U. S. N. M."

Holotype: A unique male from Conway Bay, Indefatigable. Schaus spelled the generic name, *Trachea*, correctly on page 24.

Perigea ruthae Schaus, 1923, Zoologica, 5(2):35, pl. 1, fig. 5.
"Habitat: Tagus Cove, Albemarle; also occurs on other islands."
"Type Cat. No. 26508. U. S. N. M."
In the list of specimens on pp. 24–25 Schaus stated:

"Conway Bay, Indefatigable	1♂ 2♀	April 1st."
"James Island	1♂ 5♀	April 5th."
"Tagus Cove, Albemarle	3♂ 1♀	April 6th."
"South Seymour	1♀	April 23rd."

Schaus described the male sex only, and cited only 1 specific locality in the description, but even so, he did not clearly indicate 1 specimen as "the type". The specimen in the USNM labeled "*Perigea ruthae* Schs, type ♂"; "Type No. 26508 U.S.N.M."; "Tagus Cove, Albemarle, Galapagos, April 6, 1923", a male, has been selected, labeled, and is presently designated as the lectotype. A ♀ from Conway Bay, Indefatigable, is the only other syntype in the USNM.

Perigea ebba Schaus, 1923, Zoologica, 5(2):36, pl. 1, fig. 6.
"Expanse male 28 mm., female 30 mm." "Habitat: James Island, Indefatigable and South Seymour." "Type Cat. No. 26509. U. S. N. M."

Holotype: On page 25 Schaus listed single specimens from each of the three localities, a male from James Island and a female from each of the other two localities. His description is based on the specimen he determined as a male. It is the only specimen in the USNM and is labeled: "*Perigea ebba* Schs, type ♂"; "James Islan (sic), Galapagos, April 5, 1923"; "Type No. 26509 U.S.N.M." It is 28 mm in expanse, but it is a female, not a male, as indicated by Schaus!

Harrisonia williamsi Schaus, 1923, Zoologica, 5(2):36, pl. 1, fig. 7. "Habitat: South Seymour." "Type Cat. No. 26510. U. S. N. M."

Schaus described this species from 3♂ and 13♀ from South Seymour. Three specimens, 1 male and 2 females, from that series are in the collection of the USNM. The male is labeled: "*Harrisonia williamsi* Schs, type"; "South Seymour, Galapagos, April 23, 1923"; "Type No. 26510 U.S.N.M." It has been selected, labeled and is now designated as the lectotype.

Amyna insularum Schaus, 1923, Zoologica, 5(2): 37, pl. 1, fig. 8. "Habitat: Conway Bay, Indefatigable; also from other islands." "Type Cat. No. 26511. U. S. N. M."

On page 25 Schaus cited the following collecting data:

"Conway Bay, Indefatigable	18♂	34♀	April 1st."
"James Island	5♂	8♀	April 5th."
"Tagus Cove, Albemarle	2♂	2♀	April 6th."
"Chatham Island	1♂	2♀	April 7th."
"South Seymour	5♂	9♀	April 23rd."

The specimen selected and now designated as the lectotype of *Amyna insularum* Schaus is labeled: "Amyna insularum Schs, type"; "Conway Bay, Indefatigable, Galapagos, April 1, 1923"; "Type No. 26511 U.S.N.M."; "Lectotype, *Amyna insularum* Schaus by E. L. Todd." It is a male and it is the specimen figured by Schaus. Six other syntypes, 2♂ and 2♀ from the type-locality and 1♂ and 1♀ from South Seymour, are also in the collection of the USNM.

Paectes indefatigabilis Schaus, 1923, Zoologica, 5(2):38, pl. 1, fig. 11. "Habitat: Conway Bay, Indefatigable; also occurs on South Seymour."

"Type Cat. No. 26514. U. S. N. M."

The data cited on page 26 under this species reads:

"Conway Bay, Indefatigable	11♂	19♀	April 1st."
"South Seymour	2♂	2♀	April 23rd."

The specimen selected, labeled and now designated as the lectotype is a male in the collection of the USNM. It is labeled: "*Paectes* *indefatigabilis* Schs, type"; "Conway Bay, Indefatigable, Galapagos, April 1, 1923"; "Type No. 26514 U.S.N.M." There are 5 other syntypes in the USNM, 2♂ and 3♀, all from the type-locality.

Paectes isabel Schaus, 1923, Zoologica, 5(2):39, pl. 1, fig. 12.
"Habitat: Conway Bay, Indefatigable." "Type Cat. 26515. U.S.N.M." Holotype: Described from a unique male. The specimen is in the collection of the USNM.

Syngrapha egena galapagensis Schaus, 1923, Zoologica, 5(2):41, pl. 2, fig. 14.
"Habitat: James Island." "Type Cat. No. 26516. U. S. N. M."

Holotype: Schaus described the male sex or what he thought was the male and cited only 1 locality. However, on page 26 he listed a ♂ from James Island, 1♂ and 1♀ from Chatham Island, and a ♂ from South Seymour. Since he did not mention the material from the other islands on page 41, it is my opinion that the specimen in the USNM bearing Type No. 26516 U.S.N.M. from "James Islan (sic), Galapagos, April 5, 1923" is the holotype. It is, however, a female, not a male!

Mocis incurvalis Schaus, 1923, Zoologica, 5(2):41, pl. 1, fig. 13.
"Habitat: the male from Conway Bay, Indefatigable, the female from South Seymour."
"Type Cat. No. 26517. U. S. N. M."
The male bears the labels "*Mocis incurvalis* Schs, type ♂" and "Type No. 26517 U.S.N.M." It has been selected, labeled and is presently designated lectotype for this species. The female syntype from South Seymour is also in the collection of the USNM.

Anomis professorum Schaus, 1923, Zoologica, 5(2):42, pl. 2, fig. 16.
"Habitat: Chatham and other islands."
"Type Cat. No. 26518. U. S. N. M."
On page 27 Schaus cited the following collecting data:

"Conway Bay, Indefatigable	2♂	2♀	April 1st."
"James Island		1♀	April 5th."
"Tagus Cove, Albemarle		2♀	April 6th."
"Chatham Island	7♂	15♀	April 7th."
"South Seymour	8♂	10♀	April 23rd."

There are 5 syntypes of this species in the collection of the USNM, 1♂ and 2♀ from Chatham Island and 1♂ and 1♀ from South Seymour. The male from Chatham Island is labeled "*Anomis professorum* Schs, type ♂" and "Type No. 26518 U.S.N.M." It is selected, labeled and now designated as lectotype. One of the 2 females from the same locality is labeled "*Anomis professorum* Schs, type ♀", indicating that Schaus was not always consistent in labeling a single specimen as type as a routine taxonomic procedure. The same situation exists in the following species, *Melipotis harrisoni* Schaus.

Melipotis harrisoni Schaus, 1923, Zoologica, 5(2): 42, pl. 2, fig. 15.
"Habitat: South Seymour and other islands."
"Type Cat. No. 26519. U. S. N. M."
The data cited on page 27 is as follows:

"Conway Bay, Indefatigable	5♀	April 1st."
"Tagus Cove, Albemarle	3♀	April 6th."
"South Seymour	6♂ 5♀	April 23rd."

A male in the collection of the USNM is labeled: "Melipotis harrisoni Schs, type"; "South Seymour, Galapagos, April 23, 1923"; "Type No. 26519 U.S.N.M." It has been selected, labeled and is presently designated as the lectotype. There are 2 other syntypes in the USNM, both females, 1 from Conway Bay, Indefatigable, the other from Tagus Cove, Albemarle. The latter is labeled: "*Melipotis harrisoni* Schs, type ♀."

Epidromia zephyritis Schaus, 1923, Zoologica, 5(2):43, pl. 2, fig. 17.
"Habitat: Conway Bay, Indefatigable."
"Type Cat. No. 26520. U. S. N. M."

Holotype: This species was described from a unique female. It is in the USNM.

Rivula ? dubiosa Schaus, 1923, Zoologica, 5(2):44, pl. 2, fig. 19.
"Habitat: Conway Bay, Indefatigable."
"Type Cat. No. 26522. U. S. N. M."
On page 27 Schaus indicated that he had 2 female specimens of this species. Only 1 is in the collection of the USNM. It bears the Schaus type and type number labels and it is from the locality given in the original description. This specimen has been selected, labeled and is now designated as the lectotype.

Psorya hadesia Schaus, 1923, Zoologica, 5(2):44, pl. 2, fig. 18.
"Habitat: South Seymour." "Type Cat. No. 26521. U. S. N. M."
Schaus had available for study 2 specimens, a ♂ and a ♀ from South Seymour as stated on p. 27 in the collecting data. Both were apparently reared from pupae found under stones. The male has a label to that effect and the pupal case is on the pin. There is another pupal case on a separate pin, but without a label. In the specific description, Schaus described only the female sex and the female is the specimen figured; it bears the type number label, but is labeled

"Ypsoria hadesia Schs, ♀ type". The male is labeled *"Psorya hadesia* Schs, type", but does not bear the type number label. The female probably should be considered to be the holotype, but because the generic name on the name label is erroneous and because the female does not agree with the generic diagnosis, I prefer to select it as the lectotype and I so designate and label it. The male was not mentioned in the specific description, but the part of the generic diagnosis relating to the antennae was obviously prepared from the male, not the female, which has simple, not pectinate, antennae.

Reference

Todd, E. L. 1972. Notes concerning some moths described by William Schaus in 1915. (Lepidoptera). J. Wash. Acad. Sci. 61(4):266–271.

NOMENCLATURAL PROBLEMS IN SIX GENERA OF TENEBRIONIDAE (Coleoptera)

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ABSTRACT—The nomenclature of the following generic names in 6 genera of the Tenebrionidae is explained (the first name in each series is now the valid name): *Adelina, Doliema; Cheirodes, Anemia; Cymatothes, Pyanisia; Hypogena, Ulosonia; Mylaris, Iphthinus, Nyctobates;* **Iphthiminus**, *Iphthinus* of authors. The type-species of *Hypogena* and *Iphthinus* are designated. **Iphthiminus** is newly proposed for the genus previously known as *Iphthinus*.

For the past few years I have been assembling a catalogue of the Tenebrionidae of America, north of Mexico, and have been re-examining all original descriptions of genera and species and designations of type-species. Because the world Tenebrionidae are so well catalogued—Gebien finished his second catalogue in 1948—my task has not been difficult. However, I did find a few things that had been overlooked or misinterpreted by previous workers, and because these things are somewhat complicated and require explanations, I am presenting them before the catalogue is published. My investigations also apply to other areas of the world because the genera also contain non-North American species.

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All but one of the 6 problems discussed below concern generic names first published and made available by Dejean in his catalogue of Coleoptera. Dejean did not morphologically describe any tenebrionid genera or species; his catalogue was merely a list of genera or species, with an author given for both and a locality given for the species. Many of the generic names were being used for the first time. Some of the genera included only names of undescribed species, that is, *nomina nuda*; such generic names are, of course, themselves *nomina nuda*. On the other hand, many generic names used for the first time included names of previously described species, and those generic names were thereby made available, according to Article 16(a) (v) of the International Code of Zoological Nomenclature. However, most older authors considered a generic name to be available only when a morphological description of the genus was given, and they therefore rejected all instances of possible authorship of genera by Dejean. Most modern authors have perpetuated these incorrect interpretations.

All of these problems and the resultant changes concern only nomenclature. No species have been transferred from genus to genus, no species have been synonymized, and no generic taxa are newly synonymized, though in 1 case generic names are newly synonymized. All classification is still exactly as given in Gebien's and Blackwelder's catalogues. The first 4 problems discussed below are quite simple: the junior synonym becomes the senior synonym. However, the fifth problem is quite complicated: 2 genera are involved, junior and senior synonyms change places, a generic name is transferred, and a new generic name is proposed.

Adelina Dejean

Adelina Dejean, 1835:315. Type-species: *Cucujus planus* Fabricius; monotypic.
Doliema Pascoe, 1860:50. Type-species: *Doliema platisoides* Pascoe; monotypic.

These names apply to a genus usually known by the name *Doliema*; the genus is in the Ulomini. The names have been subjective synonyms for many years because their type-species are congeneric. *Doliema* had been used as the valid name because previous cataloguers had considered *Adelina* Dejean to be a *nomen nudum*. However, the inclusion of *plana* Fabricius, originally described as *Cucujus planus*, made the name *Adelina* available; 3 other included species were actually *nomina nuda*. Dejean attributed the name *Adelina* to Chevrolat, but Chevrolat had used the name only in a collection or in an unpublished manuscript.

The older name *Adelina* is the valid name for this genus. This change of position of the 2 generic names does not constitute a new synonymy. The genus occurs in all faunal realms except the Ethiopian.

The species are listed under the generic name *Doliema* in Gebien's catalogue (1940:785(592)). (Incidentally, Gebien (1940:785(592)) synonymized *Cucujus planus* Fabricius, 1801 (p. 94) under *Tenebrio planus* Olivier, 1795 (p. 57–14, pl. 2, fig. 17). I believe Olivier's description and illustration of *Tenebrio planus* apply more readily to *Pytho americanus* Kirby, 1837 (p. 165), as was indicated by Blair (1928:5).)

Cheirodes Gené

Cheirodes Gené, 1839:73. Type-species: *Cheirodes sardous* Gené; monotypic.
Anemia Laporte, 1840:218. Type-species: *Anemia granulata* Laporte; monotypic.

These names apply to a genus usually known by the name *Anemia*; the genus is in the Opatrini. The names have been subjective synonyms for many years because their type-species are congeneric. *Anemia* had been used as the valid name because previous cataloguers had credited *Cheirodes* to Dejean (1834:194) and had considered it a *nomen nudum*. However, Gené's description of *Cheirodes sardous* in 1839 made *Cheirodes* available.

The older name *Cheirodes* is the valid name for this genus. This change of position of the 2 generic names does not constitute a new synonymy. The genus occurs in all faunal realms except the Neotropical. The species are listed under the generic name *Anemia* in Gebien's catalogue (1938:422(549)).

Cymatothes Dejean

Cymatothes Dejean, 1834:208. Type-species: *Helops undatus* Fabricius; monotypic.
Pyanisia Laporte, 1840:235. (Proposed as a subgenus of *Helops* Fabricius). Type-species: *Helops undatus* Fabricius; designated by Hope, 1840:133.

These names apply to a genus usually known by the name *Pyanisia*; the genus is in the Amarygmini. The names have been objective synonyms for many years because they are isogenotypic. *Pyanisia* had been used as the valid name because previous cataloguers had considered *Cymatothes* Dejean to be a *nomen nudum*. However, the inclusion of *undatus* Fabricius, originally described in *Helops*, made the name *Cymatothes* available; 3 other included species were *nomina nuda*. This generic name is occasionally spelled *Cymathotes*, but that is based on a spelling error of Blanchard (1845:33, 36).

The name *Pyanisia* was accidentally spelled *Pyganisia* by Hope when he made the type-species designation.

The older name *Cymatothes* is the valid name for this genus. This change of position of the 2 generic names does not constitute a new synonymy. The genus occurs in the Western Hemisphere. The species are listed under the generic name *Pyanisia* in Gebien's catalogue (1948:514 (859)) and in Blackwelder's catalogue (1945:543).

Hypogena Dejean

Hypogena Dejean, 1834:199. Type-species: *Tenebrio biimpressus* Latreille; here designated.

Ulosonia Laporte, 1840:220. (Proposed as a subgenus of *Uloma* Dejean). Type-species: *Phaleria tricornis* Dalman; designated by Lucas, 1920:665.

These names apply to a genus usually known by the name *Ulosonia*; the genus is in the Ulomini. The names have been subjective synonyms for many years because their type-species are congeneric. *Ulosonia* had been used as the valid name because previous cataloguers had considered *Hypogena* Dejean to be a *nomen nudum*. However, the inclusion of *biimpressa* Latreille and another previously described species made the name *Hypogena* available; 8 other included species were *nomina nuda*. The type-species was originally described as *Tenebrio biimpressus* Latreille.

The type-species of *Ulosonia* was listed by Laporte as *tricornis* Palisot, but it was originally described as *Phaleria tricornis* Dalman.

The older name *Hypogena* is the valid name for this genus. This change of position of the 2 generic names does not constitute a new synonymy. The genus occurs in the Western Hemisphere. The species are listed under the generic name *Ulosonia* in Gebien's catalogue (1940:786(593)) and in Blackwelder's catalogue (1945:533).

Mylaris Pallas

Mylaris Pallas, 1781:37. Type-species: *Tenebrio gigas* Linnaeus; designated by Guérin-Méneville, 1844:120.

Iphthinus Dejean, 1834:203. Type-species: *Tenebrio gigas* Linnaeus; here designated. [NEW SYNONYMY].

Nyctobates Guérin-Méneville, 1834:33. Type-species: *Tenebrio gigas* Linnaeus; original designation.

Iphthiminus Spilman, n. gen.

Iphthiminus Spilman. Type-species: *Iphthinus italicus* Truqui; here designated.
Iphthinus (spelled *Iphthimus*) of Truqui, 1857:92, and subsequent authors.

Both of these genera are in the Tenebrionini. In the first genus, the names *Mylaris* and *Nyctobates* have been objective synonyms for a long time because they are isogenotypic. The genus has been called *Nyctobates* by most authors even though *Mylaris* was recorded as being older and even though Guérin-Méneville in 1844 pointed out that *Nyctobates* should be the junior synonym. Incidentally, Pallas correctly attributed *Tenebrio gigas* to Linnaeus, but he unnecessarily renamed it *Mylaris gigantea*; Guérin-Méneville credited *T. gigas* to Fabricius and accidentally spelled the generic name *Mylasis*; Motschulsky (1872:23) made an incorrect type-species designation and accidentally spelled the generic name *Milaris*.

The generic name *Iphthinus* has not previously been in synonymy with *Mylaris* and *Nyctobates*. In 1834 Dejean listed 30 species under the generic name *Iphthinus* Dejean in his catalogue; 7 of those species had been previously described. Then in 1857 Truqui presented the first morphological description of *Iphthinus*, but he used the spelling *Iphthimus*. One of the 4 species which Truqui included and described was the new species *Iphthimus italicus*; Motschulsky (1872:24) designated it type-species. Since that time all authors have considered: 1) Truqui to be the author of the generic name; 2) *Iphthimus* to be the correct spelling; 3) *italicus* to be the type-species. However, the facts are that: 1) Dejean is the author of the name because his inclusion of previously described species made the name available; 2) *Iphthinus* is the correct spelling and Truqui's *Iphthimus* must be considered a spelling error because he did not actually emend the name; 3) the genus still does not have a type-species because "*italicus* Bonelli? (*Upis*)", as included by Dejean, was a *nomen nudum* in 1834.

None of the 7 species available for type-species designation is now in *Iphthinus*. Six of those 7 species are in genera which are younger than *Iphthinus*, and selection of any 1 of them would change the name of another genus to *Iphthinus*. The above selection of *Tenebrio gigas* Linnaeus, credited by Dejean to Fabricius, has made *Iphthinus* isogenotypic with *Mylaris* and *Nyctobates*; the name *Iphthinus* is effectively buried under *Mylaris*, the oldest name.

Because of the type-species designations made above, the genus known as *Iphthimus* was left without a generic name. For that genus I have proposed the name *Iphthiminus* and have designated *Iphthinus italicus* Truqui as type-species. In the above synonymy under the new genus *Iphthiminus* I have cited Truqui's (1857:92) description of *Iphthimus*; this makes the new generic name available under Article 13(a) (ii) of the Code.

The genus *Mylaris* includes *gigas* (Linnaeus) and its congeners, all from Mexico and Central and South America; the species are listed under the generic name *Nyctobates* in Gebien's catalogue (1941: 344(639)) and in Blackwelder's catalogue (1945:535).

The genus *Iphthiminus* includes *italicus* (Truqui) and its congeners, all from the western Palearctic and from the Nearctic, the species are listed under the generic name *Iphthimus* in Gebien's catalogue (1941:339(634)).

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A NEW SPECIES OF STRIGIPHILUS FROM THE SAW-WHET OWL, AEGOLIUS ACADICUS
(Mallophaga: Philopteridae)

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ABSTRACT—*Strigiphilus* **acadicus** n. sp. is described and illustrated from *Aegolius acadicus* (Gmelin) collected in Canada.

Through the courtesy of Mr. John G. Woods, Guelph, Ontario, and Mr. Paul M. Catling, Toronto, Ontario, several series of Mallophaga from the Saw-Whet Owl were made available to us for study. In our opinion, these specimens represent a new species and we are describing and illustrating it here.

Strigiphilus acadicus, n. sp.
Figs. 1–4

Male: External morphology and chaetotaxy as shown in fig. 2. Anterior dorsal plate of forehead as shown in fig. 3. Genitalia, less sac, as in fig. 4. Total length, 1.81–1.87 mm.

Female: External morphology and chaetotaxy as shown in fig. 1. Anterior dorsal plate of forehead as for the male. Total length, 1.96–2.18 mm.

Discussion: This species belongs to the *cursitans* group as defined by Clay (1966). Ledger (1970) illustrated the head of each species in the group when he described *S. zumpti* Ledger. In general shape, the head is essentially the same as for *S. tuleskovi* Balat and *S. cursitans* (Nitzsch); however, the anterior dorsal plate of the forehead differs from both in that the posterior projection does not extend beyond the posterior margin of the plate. The male genitalia, while being shorter than for *S. cursitans* and approximately the same length as for *S. tuleskovi*, are distinctive; the distally central forked prolongations of the basal apodeme are widely separated in *S. cursitans* and *S. tuleskovi* (see Clay, 1966: fig. 27), but barely separated in *S. acadicus*. Abdominal tergites of *S. acadicus* are narrow, each with 2 long setae on the posterior margin, while both *S. cursitans* and *S. tuleskovi* have wider abdominal tergites, each with 4 long setae on the posterior margin. In general shape, *S. acadicus* is more robust, especially in the abdomen, than either of the other 2 species.

Type host: *Aegolius acadicus* (Gmelin), Saw-Whet Owl.

Type material: Holotype male, allotype female, and 95 paratypes collected off the type host on Toronto Island, York Co., Ontario, Canada, on July 18, 1971, by John G. Woods; 20 paratypes collected off type host in Ontario, Canada, by Paul M. Catling; 55 paratypes

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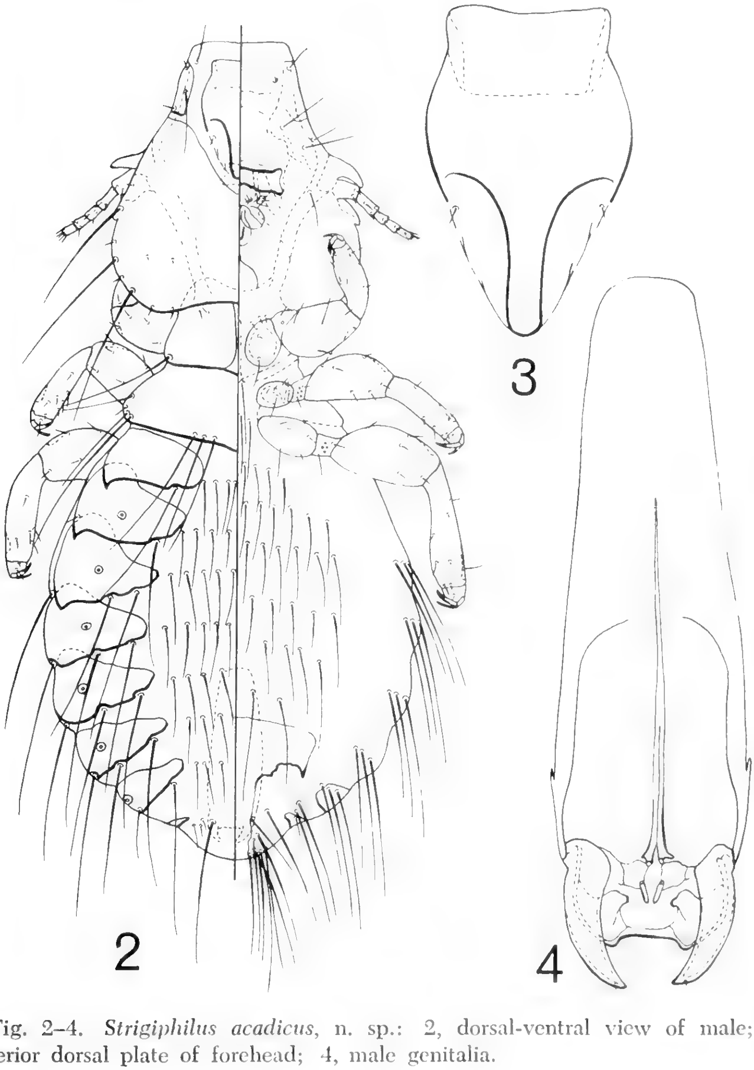

Fig. 2–4. *Strigiphilus acadicus*, n. sp.: 2, dorsal-ventral view of male; 3, anterior dorsal plate of forehead; 4, male genitalia.

collected off the type host at Dundas, Ontario, Canada, on February 13, 1971, by John G. Woods. The holotype and allotype will be deposited in the U. S. National Museum; paratypes will be retained by each author, and distributed to leading museums.

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Fig. 1. *Strigiphilus acadicus*, n. sp., dorsal-ventral view of female.

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A NEW GENUS, TWO NEW SPECIES, AND A SPECIES KEY FOR BYRRHODES
(Coleoptera: Anobiidae)

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ABSTRACT—The new genus **Striatheca** with the new species **S. lineata** is described from southeastern U. S. The new species *Byrrhodes* **grandis**, from Maryland and South Carolina, is described; *B. grossus* White is synonymized with *B. ulkei* Fall; and a revised key to *Byrrhodes* is presented.

A new species of anobiid from the southeastern United States is sufficiently distinct from described genera to warrant a new generic name.

Striatheca, n. gen.

Type-species: *Striatheca lineata*, new species.

General: Body elongate-robust; pubescence moderate in length and density, not obscuring surface sculpture.

Head: Large; front nearly evenly rounded throughout; carina over antennal base distinct, meeting with impressed groove over eye; eyes large, bulging, not notched; antenna 10 segmented, 1st segment large, only 1 visible in retraction, 2nd segment much smaller, oval, segments 3 through 7 very small, segments 8 through 10 distinctly enlarged, segments 8 and 9 triangular, 10th segment elongate oval, last 3 segments together longer than all preceding united; last segment of maxillary palpus elongate triangular, tip pointed, last segment of labial palpus triangular, broad; undersurface of head between eyes distinctly excavated for reception of antennae, excavation posteriorly delimited by raised carina in shape of a 3.

Dorsal surface: Pronotum nearly as a segment of a sphere, at sides somewhat concave, surface punctate, anterior angle nearly a right angle, posterior angle not evident, lateral margin sharp, produced; scutellum moderate in size, rounded apically, wider than long; elytron with distinct humerus and 10 complete,

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distinctly impressed striae and a short scutellar stria, striae 1 and 10, 2 and 9, 3 and 4, 5 and 8, and 6 and 7 meeting at elytral apex; lateral elytral margin foveate for hind leg.

Ventral surface: Prosternum short and broad, concave, longitudinally carinate at center, base produced and pointed; fore coxae elongate, diagonal, touching, concealed in retraction, anterior surface flat; mesosternum concave, produced between middle coxae, nearly vertical posteriorly; middle coxae oval, separated, nearly vertical, concealed in retraction, anterior face flat; metasternum with about anterior third markedly inflexed each side of center, inflexed portion delimited posteriorly with strong carina that is continuous from side to side, metasternum anteromedially produced into concave, hooklike process; metasternum with deep longitudinal groove, arising anteriorly in a fovea beneath raised carina, extending to apex, metasternum at sides most distinctly rounded before posterior margin; metepisternum very narrowly exposed, slightly widest posteriorly; metepimeron not visible; hind coxae widely separated, nearly parallel sided, attaining elytra at side; first abdominal segment distinctly depressed each side for hind legs, margin behind depression produced, carinate, first segment at center excavate for tarsi, each excavation bordered by distinct, diagonal carina, this portion of first segment triangular in shape, first segment shortest, 3rd and 4th short, subequal, 2nd moderate, 5th longest, all sutures distinct throughout, 2nd weakly bisinuate, 3rd and 4th weakly arcuate.

Striatheca belongs to the subfamily Dorcatominae and is nearest the genus *Protheca* Lec. The 2 differ in that the elytral striae of *Striatheca* consist of deeply impressed lines and are distinct throughout; the elytral striae of *Protheca* consist of rows of punctures and are less distinct to absent at the elytral apex. Also, the anterior portion of the metasternum in *Striatheca* is produced into a narrow, hooklike process concealed in retraction; that of *Protheca* is produced into a broad lobe which forms the anterior part of the tarsal grooves and is visible in retraction.

In my key to the North American genera of Anobiidae (White, 1971) *Striatheca* keys to *Byrrhodes* at couplet 46. To separate them the following should be inserted.

46a(46). Metasternum produced anteriorly into a broad lobe visible in retraction and usually with a linear pit at center .... *Byrrhodes*
Metasternum produced anteriorly into a narrow hooklike process concealed in retraction, metasternum at center longitudinally grooved throughout .... *Striatheca*

Striatheca is a neo-Latin name of feminine gender formed by taking the termination -theca and combining with it stria- which refers to the strongly developed elytral striae.

Striatheca lineata, n. sp.
Figs. 1, 2, 3

General: Body elongate-robust, 1.9 to 2.0 times as long as wide; pubescence yellowish, moderate in length and density, erect or inclined, that of ventral

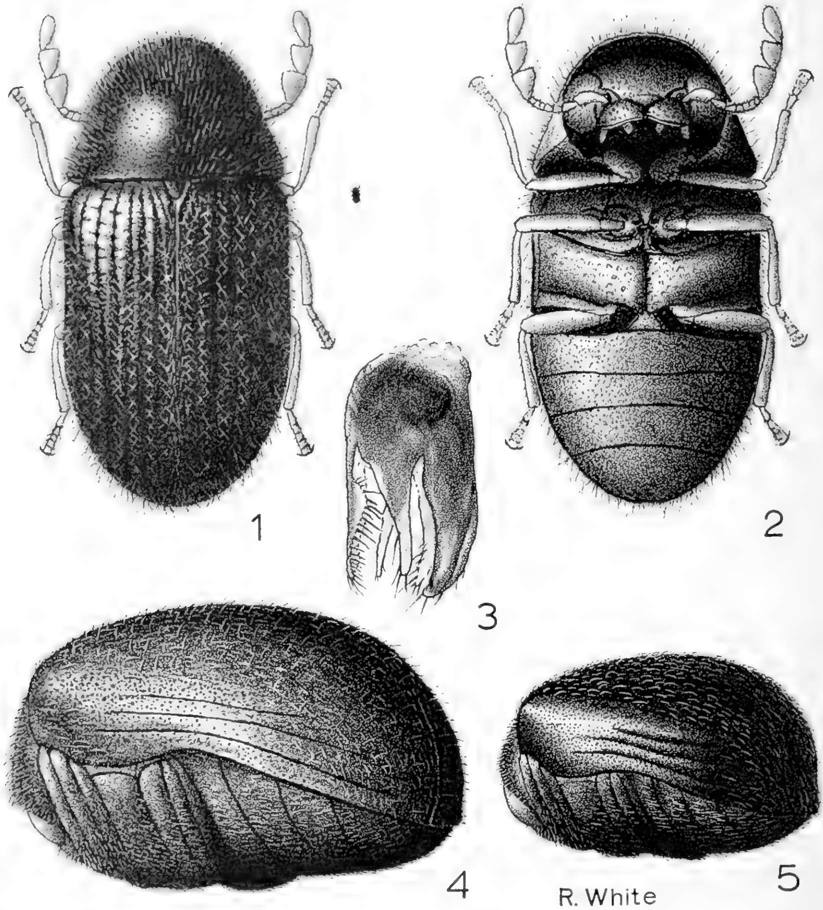

Fig. 1, 2, 3, *Striatheca lineata* White; Fig. 1, dorsal view, small figure equals actual size; Fig. 2, ventral view; Fig. 3, genitalia of male holotype, dorsal. Fig. 4, *Byrrhodes grandis* White, diagonal view. Fig. 5, *Byrrhodes tristriatus* (Lec.), diagonal view.

surface inclined posteriorly, that of head inclined anteriorly, that of elytra erect, hairs forming regular rows each side of a stria, hairs of each row inclined over adjacent stria, thus hairs of each pair of rows crossing above stria, hairs along elytral suture inclined backward; elytra black, shining, margins more or less distinctly clouded with red, pronotum dull dark red, disk usually more or less distinctly clouded with black to predominantly black with margins clouded with red, head and 1st antennal segment dull dark red usually clouded with black, ventral surface dull dark red usually clouded with black, legs dull red orange, antennae dull orange.

Head: Front distinctly, deeply punctured, punctures slightly irregular in size, separated on an average by a little more than their diameter, surface shining; eyes separated by 1.7 to 1.8 times vertical diameter of eye; 1st antennal segment large, nearly as long as last (10th) segment, 2nd segment oval, less than ½ length of 1st, 3rd segment oval, over ½ length of 2nd, segments 4–7 small, subequal, each a little wider than long, last 3 segments distinctly enlarged, clearly longer than all preceding united, segments 8 and 9 triangular, a little longer than wide, segment 10 oval, a little over 2 times as long as wide; last segment of maxillary palpus about 2 times as long as wide; last segment of labial palpus a little longer than wide.

Dorsal surface: Pronotum with discal punctures distinct, somewhat irregular in size and density, those at base separated on an average by less than their diameter, those near apex separated on an average by about their diameter, punctures toward sides becoming larger, more irregular in size and shape, at extreme side punctures very irregular and running together, surface nearly scabrous; elytral striae deeply, distinctly impressed, margins minutely irregular, along each side of a stria with fine setate punctures regularly placed and with raised margins, intervals smooth, nearly flat.

Ventral surface: Metasternal punctures large, dense, irregular in size and shape, running together in some places, least dense before posterior margin; abdomen finely, densely punctate, punctures round, varying somewhat in size, much smaller than those on metasternum, separated on an average by a little over their diameter; 5th segment somewhat flattened at center, apex grooved.

Length: 2.0 to 2.4 mm.

Described from 5 specimens. The male holotype (USNM 71724) bears the data "MISS: Harrison Co., Gulfport, June 10-1968, LH Williams coll., collected at blacklight trap". Two paratypes (USNM) bear the data "MISS. Harrison Co., Gulf Park Coll., June 16-1969, Coll. L. H. Williams, Light trap". Two additional paratypes are in the Florida State Collection of Arthropods at Gainesville, Florida: 1 bears the data "McRae, Ga., J. W. Patton coll. 9 VI 63, coll. at light"; the other, "Weems property, Red Water Lake, Putnam Co. Fla., H. W. Weems, Jr., 27-28-V-1967, blacklight trap".

I have found no external sexual characters and cannot be certain of the sex of the paratypes without dissection.

The male genitalia (fig. 3) were drawn with light transmitted through them from a white background.

Byrrhodes grandis, n. sp.
Fig. 4

General: Rather broadly oval, body 1.5 to a little over 1.6 times as long as wide; body dark dull red to dark brown, body margins black, abdomen and, to a lesser extent head, pronotum, and sides of elytra lighter than remainder of body, antenna, except first segment, orange; pubescence dull yellow, short, moderate in density, on dorsal surface semi-bristling, elytra with nearly erect, convergent hairs over nonpunctate elytral lines, pronotum with scattered, nearly erect hairs; body surfaces shining; body finely, densely punctured, punctures largest, most dense on elytra, arranged in longitudinal bands separated by narrow, non-punctured lines, latter in some places minutely impressed, punctures of head, pronotum, metasternum and abdomen nearly comparable in size and density.

Head: Eyes separated by slightly less than their vertical diameter (♂), or separated by a little less than 1.3 times their vertical diameter (♀); antenna 10-segmented; in male, 8th antennal segment emarginate apically, slightly longer than wide, outer margin sinuate, 9th segment emarginate apically, nearly 1.5 times as long as wide, 10th segment weakly arcuate, slightly widest near apex, about 2.6 times as long as wide; in female 8th antennal segment emarginate apically, a little over 1.2 times as long as wide, outer margin nearly straight, 9th segment weakly emarginate, nearly 1.8 times as long as wide, 10th segment as that of male; maxillary palpus triangular, 2 times as long as wide, labial palpus triangular, slightly wider than long, outer tip pointed, inner tip rounded.

Dorsal surface: Pronotum at side weakly concave; elytral punctures arranged into longitudinal bands delimited by narrow nonpunctate lines, lines sometimes minutely impressed, bands averaging 5 punctures wide; side of elytron with 3 striae, all sharply, distinctly impressed, lowest stria distinct from about posterior limit of metasternum to very near elytral suture at apex, weakly developed to absent from metasternum to elytral base, middle stria distinct from level of metasternum to near elytral apex, becoming weaker posteriorly, sometimes weakly developed to near elytral base, uppermost stria distinct from about level of hind coxa to about level of 4th abdominal segment, sometimes weakly developed to about anterior limit of metasternum, becoming weaker posteriorly, sometimes upper stria noticably weaker than lower 2; elytra at side nearly vertical, not inclined between outer margin and lowest stria.

Ventral surface: Metasternum at center with a longitudinal slit-like fovea, usually continued posteriorly as a groove; anterior metasternal lobe not constricted by tarsal grooves; abdominal sutures most distinct at sides, weaker but evident at center, suture between 2nd and 3rd segments weakly, anteriorly arcuate at center, next suture more distinctly arcuate, last suture most distinctly arcuate; abdomen longitudinally, weakly concave at center from 3rd to 5th segments, more distinct in female.

Length: 2.8 to 3.1 mm.

This species is described from 5 individuals. The male holotype (USNM, 71717), the allotype (USNM), and a female paratype (in W. H. Tyson collection) bear the data "Bristol, MD., II-1970" and were taken by W. H. Tyson. The holotype bears "Reared Brack, fung.", the allotype has "ex Bracken fung." (*sic*), and the paratype has "ex: Bracken fungus". Two additional paratypes (USNM, 1 male, 1 female) bear "9181 27c, Hopk US, Greenville, S. C., J. E. Smith Coll., June 5/12, Liquidambra styraciflua". On a Hopkins card is the additional data "Ptinid beetle which lives on fungi Sweetgum bush".

Among East Coast species *B. grandis* is most similar to but larger than *B. tristriatus* (Lec.); the former is 2.8 to 3.1 mm in length, the latter is 2.0 to 2.8 mm. Also, the intervals between the elytral striae of *grandis* are flat (fig. 4), whereas the intervals between the elytral striae of *tristriatus* are convex (fig. 5).

The nearest relative of *grandis* is *ulkei* from California. In *ulkei* the interval between the lowest elytral stria and the elytral margin is distinctly inclined outward at the bottom and not in the same plane as the intervals above; this interval in *grandis* is vertical and in the same plane as the intervals above.

Byrrhodes ulkei (Fall)

Byrrhodes ulkei (Fall), 1905:266.
Byrrhodes grossus (White), 1966:235. NEW SYNONYMY.

I have recently examined the 2 cotype specimens of *B. ulkei* and found them to be the same species that I described as *grossus*. The description in the key to species of *Eutylistus* Fall (=*Byrrhodes*) by Fall (p. 265) as follows, "Elytra with a well defined though shorter third inner stria at sides", is intended by Fall to apply to *ulkei*, but does not. Fall (p. 266) also gave the following description "The inner stria begins farther back, not attaining anteriorly the posterior margin of the metasternum, and is formed by one of the smooth lines becoming finely impressed". This description is very misleading. What is referred to by Fall as the third, or inner elytral stria, is a very feebly, and (in the type) irregularly impressed line which is not at all comparable in depth or distinctness to the 2 impressed striae. The feebly impressed line is comparable to the feeble lines to be found on the puncture-free lines near the elytral base and suture, and it cannot be accurately termed a stria.

Following is a key to species of *Byrrhodes*. It accommodates the above change, the new species, and *B. setosus*. I have seen all of the species during construction of the key.

Key To North American Species Of *Byrrhodes*

1. Each elytron with 10 distinct striae; 2.7 to 3.5 mm long; Florida to Mississippi .... *setosus* Lec.
   Each elytron with 2 or 3 distinct striae; 1.3 to 3.1 mm long; widely distributed 2
2(1). Lowest lateral elytral stria deeply impressed anteriorly and attaining elytral fovea for middle legs 3
   Lowest lateral stria distinct only to level of hind coxa or metasternum or weakly impressed to absent anteriorly, not attaining fovea for middle legs 5
3(2). Elytra with just 2 distinct lateral striae; northeast U. S. to Florida .... *intermedius* (Lec.)
   Elytra with a short, upper, 3rd stria; Florida to Mississippi 4

4(3). Third elytral stria extending from base to level of hind coxa; southern Florida .... *granus* (Lec.)

Third elytral stria extending from level of metasternum to level of 4th abdominal segment; Florida to Mississippi .... *levisternus* (Fall)

5(2). Elytral punctures dense, forming longitudinal bands separated by narrow, smooth lines; eastern States, Texas, and California; 2.0 to 3.1 mm long 6

Elytral punctures not as above, sparse, forming more or less regular rows, or irregular; Texas to Florida; 1.5 to 2.0 mm long 9

6(5). Elytron with an upper, distinct 3rd stria nearly or just as strong as lower striae 7

Elytron without a 3rd upper stria as above 8

7(6). Intervals between elytral striae flat or nearly so (Fig. 4); 2.8 to 3.1 mm long .... *grandis* White

Intervals between elytral striae convex (Fig. 5); 2.0 to 2.8 mm long .... *tristriatus* (Lec.)

8(6). Reddish brown; 2.2 to 3.0 mm long; California .... *ulkei* (Fall)

Reddish brown to mostly black; 1.7 to 2.3 mm long; eastern U. S. .... *incomptus* (Lec.)

9(5). Metasternal punctures large, distinct, forming a series along posterior margin; base of metasternal lobe narrowed by tarsal grooves; South Carolina to Florida to Mississippi .... *fallax* (Fall)

Metasternal punctures very small, fine, not forming a series along posterior margin; base of metasternal lobe not narrowed by tarsal grooves; Texas .... *facilis* (Fall)

My thanks are offered to George Wallace of the Carnegie Museum for the loan of type specimens of *Byrrhodes ulkei* (Fall), to Lonnie H. Williams of the Southern Forest Experiment Station for allowing me to retain for the USNM collection the specimens of *Striatheca lineata* White, and to Robert Woodruff of the Florida State Collection of Arthropods for loan of specimens.

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NOTES CONCERNING CIIDAE (COLEOPTERA) ASSOCIATED WITH MACRO-FRUITING BODIES OF HIGHER FUNGI (BASIDIOMYCETES) IN WISCONSIN[1]

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ABSTRACT—Ciidae from sporophores collected in Wisconsin were reared individually on fungal material. The beetles are mycetophages or mycetobionts of many Polyporaceae and some warrant further investigation as possible biological control agents of polypores destructive to timber. A new species was discovered and some were found for the first time to grow in fungi not dependent upon wood. Associations of the beetles occur.

Ciidae (Coleoptera) have long been known to frequent various kinds of polypores as mycetophages or, more commonly, mycetobionts. While in recent years the major emphasis in their study has been on ecological and host preference aspects (Elton 1949; Lawrence 1965; 1967a, 1967b) much remains to be learned concernng their biology.

MATERIALS AND METHODS

In conjunction with a search for biological agents which might reduce damage caused by wood-rotting fungi, sporophores were collected over a four-year period (1966–69) at 32 sites in 21 counties in Wisconsin (fig. 1). The samples were placed in individual plastic bags, and after being brought to the laboratory each was placed in an ice cream carton provided with a water wick (dental roll inserted through the bottom) and a Saran-wrap cover. Paper towels were used to maintain humidity or to prevent accumulation of excess moisture. After 6 months at room temperature, cold treatment (1 week at 40 F followed by 2 to 4 weeks at 0 F) was used to break any resting or dormant state. Emerging ciids were preserved in 80% ethyl alcohol, pinned, or retained for rearing studies.

Fungi containing ciids were sorted from the rest of the material, placed in baby-food jars supplied with a dental roll wick as a water source, and development of the insects, species associations, and destruction of fruiting bodies were recorded.

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[1] Research supported by the Research Division, College of Agricultural and Life Sciences, University of Wisconsin and by the Guido Rahr Foundation, the Wisconsin Department of Natural Resources and the University Research Committee.

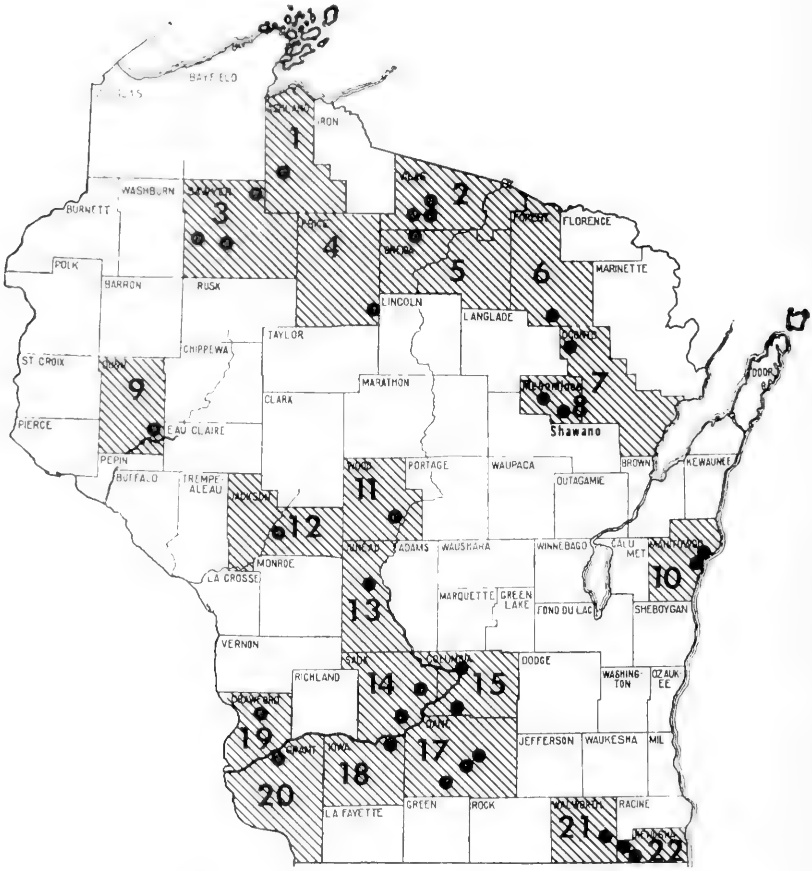

Figure 1. Distribution of collection sites.

Results and Discussion

Table 1 provides information concerning the fungi and the ciids associated with them. For the first time a definite association was made between a ciid and members of the soft-bodied, non-wood associated Agaricaceae. Twelve species of beetles were found in 19 species of fungi. Among the insects was a genus, *Rhopalodontus*, not previously recorded from the New World, and a new species recently described by Dr. J. F. Lawrence.

Table II indicates that certain rather consistent associations occurred. These relationships were not alike in different fungus species. For example, *Cis levettei* (Casey), which is in general associated with all other ciids, was found with only 5 in *Fomes applanatus* (Pers.)

Table 1. Ciidae associated with species of fungi.

Ciidae[1]	Hosts																			Counties[2]
	Daedalea sp.	*Daedalea confragosa* (Bolt.) Fr.	*Fomes* sp.	*F. applanatus* (Pers.) Gill.	*Fomes fomentarius* (Fr.) Kickx.	*Lactarius* sp.	*Lycoperdon perlatum* Pers.	*Pleurotus ostreatus* (Jacq. ex Fr.) Quél.	*Polyporus* sp.	*P. betulinus* (Bull.) Fr.	*P. fibrillosus* Karst.	*P. frondosus* Dicks. ex Fr.	*P. hirsutus* Wulf. ex Fr.	*P. lucidus* Lexs. ex Fr.	*Polyporus resinosus* Schrad. ex Fr.	*Porothelium* sp.	*Russula* sp.	*Stereum* sp.	*Trametes malicola* Berk. & Curt.	
Ceracis sallei Mellie	1	147		30			1								52	127				2,11,22
C. singularis (Dury)		38					10				7									2,17,22
C. thoracicornis (Ziegler)	147			49					6											2,5
Cis americanus Mannerheim					200			1			74					130				2,21
C. fuscipes Mellie	2	426		2					79				4			3		42		2,3,5,10,11,14,17,22
C. levettei (Casey)			1	10	22				4		3			197						2,5,10,11
C. subtilis Mellie		86		4	5								2			5				2,3,11,14
Dolichocis manitoba Dury					163				3							101				2
Malacocis brevicollis (Casey)		6		4	9				2			3								2,21,22
Octotemnus laevis Casey	45	1			2				7					2		48			1	2,5,10,12
Rhopalodontus americanus Lawrence			2			8				26	4						6			2,5
Sulcacis curtulus (Casey)		1		55	110				154											2,10,11,22

[1] Numbers indicate total number of individuals obtained from specific fungi.
[2] Numbers refer to counties as numbered in Figure 1.

Table 2. Associations among Ciidae within individual sporophores.

Ciidae	Ciidae: *C. sallei*	*C. singularis*	*C. thoracicornis*	*C. americanus*	*C. fuscipes*	*C. levettei*	*C. subtilis*	*D. manitoba*	*M. brevicolis*	*O. laevis*	*R. americanus*	*S. curtulus*
Ceracis sallei	X											
C. singularis	X	X										
C. thoracicornis	X		X									
Cis americanus		X		X								
C. fuscipes	X	X	X	X	X							
C. levettei	X	X	X	X	X	X						
C. subtilis	X	X	X	X	X	X	X					
Dolichocis manitoba			X	X	X	X	X	X				
Malacocis brevicolis	X	X	X	X	X	X	X	X	X			
Octotemnus laevis	X	X	X	X	X	X	X	X	X	X		
Rhopalodontus americanus		X		X		X						
Sulcacis curtulus	X	X	X	X	X	X	X	X	X	X		X

"X" indicates that the species was found in the same sporophores as the other species, e.g. *C. sallei* and *C. singularis* quite regularly occurred together.

Gill. but with 7 in *F. fomentarius* (Fr.) Kickx. *Daedalea confragosa* (Bolt.) Fr. supported as many as 6 different species in the same fruiting body.

Relationships Of Beetles And The Hosts

Ceracis sallei Mellie

Three-hundred fifty-eight specimens were obtained from 6 fungi, the best hosts being *Porothelium* sp., *D. confragosa* and *P. tomentosus. Fomes applanatus*, the only fungus previously recorded as a host for *sallei*, yielded only a few specimens. The insect caused extensive sporophore damage, tunneling throughout the fungal pore areas. It was a mycetophage on all hosts except *Lycoperdon perlatum* Pers. where it was a mycetoxene. Both Graves (1960) and Lawrence (1967a) have provided additional host lists. Lawrence also indicated that *C. sallei* has often been associated with *Eridaulus levettei* (Casey), a ciid which did not occur in our collections.

Ceracis singularis (Dury)

Only 59 individuals were collected from 3 specimens of fungi taken in 3 counties. Adults and larvae actively bored through the pore area of *Polyporus fibrillosus* Karst. and completely destroyed fruiting

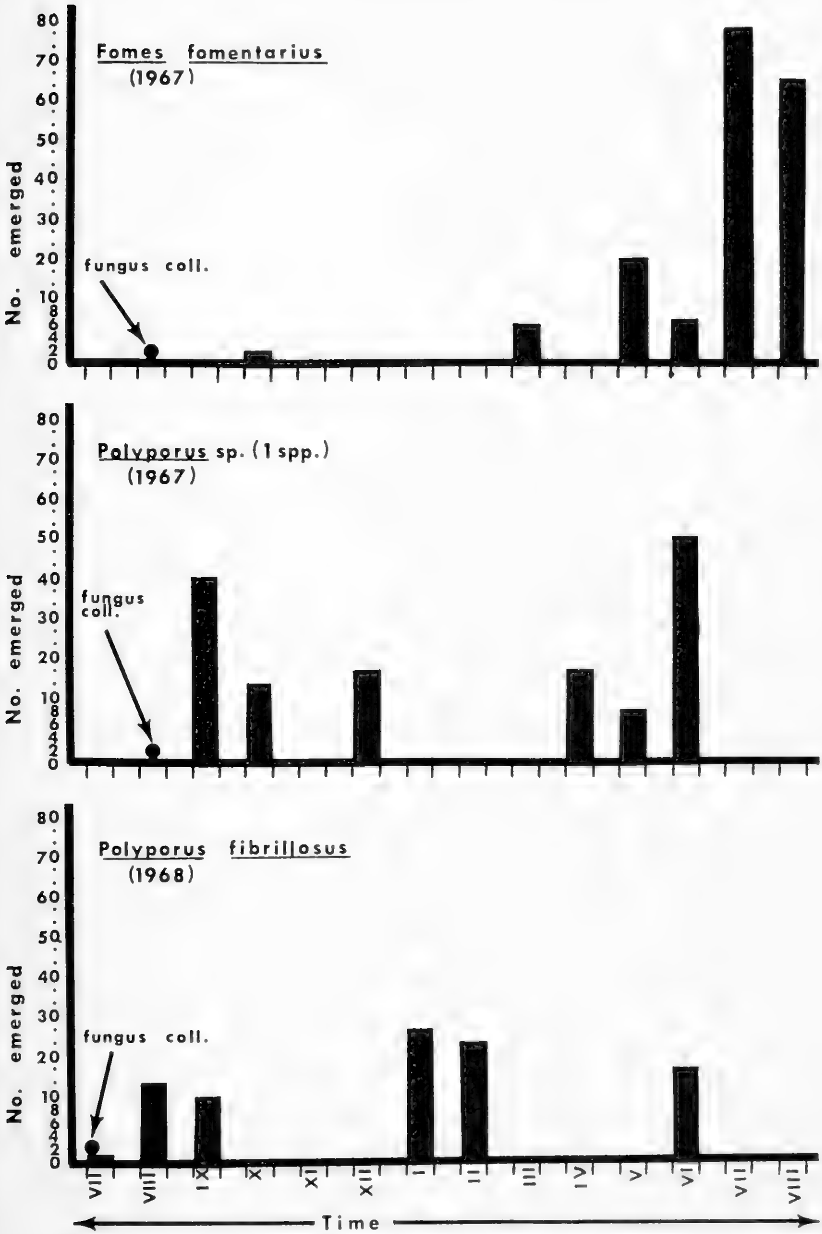

Figure 2. Emergence of *Cis americanus* Mannerheim from three fungi collected in Vilas county.

bodies of *D. confragosa.* The adults were generally observed in groups of 2–4 on the surface of sporophores but were found singly within tunnels while the larvae were quite gregarious.

Ceracis thoracicornis (Ziegler)

This beetle, under the name *Ennearthron thoracicorne* LeConte, had previously been recorded from a number of polypore species (Weiss 1920, 1921) and all hosts here recorded were previously known. The developmental period appeared to be about 74–78 days, during which time a great deal of fungal damage was caused by larval activity.

Cis americanus Mannerheim

Fomes fomentarius supported the largest population of this insect. The emergence pattern from the 3 major hosts was very erratic (Figure 2), and months occurred between initial and final appearance. Extensive sporophore damage was associated with this beetle.

Cis fuscipes Mellie

C. fuscipes has been extensively studied in the past and is quite common, with host lists, ecological relationships, and life-cycles presented by Lawrence (1967b), Paviour-Smith (1960) and Elton (1949). *C. fuscipes* occurred in 7 fungi, of which only 2 were previously identified hosts. Its activities resulted in extensive sporophore destruction. The major host was *D. confragosa* which appeared to serve as an overwintering site.

Cis levettei (Casey)

This is the first record of *C. levettei* in Wisconsin. Its most utilized host was *P. lucidus* Lexs. ex Fr. which also seemed to provide an overwintering site. Sporophore damage by this insect was extensive, especially by the larvae which would literally rip chunks of the fungus out with their mandibles and then grind them up. Frass and fungal debris accumulated in large quantities on the floors of incubation chambers.

Cis subtilis Mellie

This is also a new record for Wisconsin. *D. confragosa* was the only significant host.

Dolichocis manitoba Dury

The most important host was *F. fomentarius.* Larvae were found in large numbers and were quite active. In *F. fomentarius* emergence began 9 months after sample collection and adults were observed thereafter for a period of 2 months. During this 11-month period the insects completely destroyed the sporophores.

Malacocis brevicolis (Casey)

Few individuals of *M. brevicolis* were found, but the species was associated with nearly all other ciid species encountered.

Octotemnus laevis Casey

This beetle was found in 7 fungal species but in insignificant numbers. Further host lists were given by Graves (1960).

Rhopalodontus americanus Lawrence

This ciid was found to live in 5 species of fungi, the most important being *P. betulinus* (Bull.) Fr. Eight adults emerged from *Lactarius* sp. and 6 from *Russula* sp., both agarics, and neither associated with wood. The beetles emerged 4 and 5 months respectively after these fungi were collected. The insects were definitely developing within the agarics, the first such finding for any member of this family.

Sulcacis curtulus (Casey)

This also represents a new record for Wisconsin. Major hosts for the insect were *F. applanatus* and *F. fomentarius*. Several months of laboratory incubation were necessary before adults began emerging, indicating a relatively long developmental period within the sporophores.

Summary

A great deal of damage to the fruiting bodies of some of the bracket fungi important in the timber industry was accomplished by members of the Ciidae. The beetles tunneled just beneath and through the pore canals of the sporophores, and it seems possible that they might influence the amount of fungal sporulation. They were usually found in associations of species, not alone, and there may be some mechanism requiring that the species occur in groups. While knowledge of their biology is sketchy, Lawrence (1967b) has provided information on *Cis fuscipes*. The results indicated that some ciids might be useful in the control of some of the fungi involved, but additional information is needed on their associations and biological requirements, especially on their apparent group syndrome.

Acknowledgments

Our deep appreciation and thanks are expressed to: Dr. J. F. Lawrence for his help in ciid identifications; Dr. R. F. Patton, project advisor; and Dr. M. P. Backus and Dr. D. Myron for assistance and guidance in naming the fungi.

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FLORIDA MEALYBUGS OF THE GENUS RHIZOECUS WITH DESCRIPTION OF A NEW SPECIES
(Homoptera: Pseudococcidae)

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ABSTRACT—*Rhizoecus* **floridanus**, a new hypogeic mealybug from Florida and Georgia is described and illustrated. Two taxa, *Morrisonella spinipes* Hambleton and *Ripersiella simplex* Hambleton are assigned to *Rhizoecus*. *Ripersiella simplex*, described originally from Brazil, is reported for the first time from the United States. A key to 8 Florida species is presented with data on host plants and distribution.

This paper provides a name for an undescribed mealybug, presents a key to the Florida species of *Rhizoecus* and includes notes on their identity, host plants and distribution.

The genus *Rhizoecus* is 1 of 9 genera now recognized in the tribe Rhizoecini, as defined by Williams (1969). Of the 9, most of which

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are tropical or subtropical in origin, only members of *Rhizoecus* and one species of *Geococcus* are known to occur in Florida. While engaged in a revision of the genus *Rhizoecus* for the New World, it has been my privilege to study all of the slide-mounted specimens of the genus represented in the Florida State Collection of Arthropods at Gainesville.

In recent years several species of these subterranean mealybugs have become of increasing importance in the production of commercially grown ornamentals and other perennial plants. Prior to 1959, however, there were no records of their occurrence in the State. Subsequently, many specimens have been collected by personnel of the Division of Plant Industry, Florida Department of Agriculture, particularly in nurseries. This intensive collecting has made it possible to record certain facts relative to the identification, presence, and distribution of several species heretofore not known to occur in Florida.

Rhizoecus Künckel d'Herculais, 1878:163; Hambleton, 1946:50; Ferris, 1953:426; McKenzie, 1967:370; Williams, 1962:41.

Type species: *Rhizoecus falcifer* Künckel d'Herculais.

The genus is characterized as follows: Antennae 5- or 6-segmented, geniculate, sensory setae of terminal segments well developed. Anal ring usually distinct, bearing 6 setae, its cellular structure diversiform. Anal lobes usually undeveloped, with or without some degree of sclerotization and bearing 3 or more elongate setae. Derm with either bitubular or tritubular cerores of 1 or more sizes, trilocular pores, with or without multilocular disk pores and tubular ducts. Circuli number 0–5, their size and shape varying from circular and depressed to conical or truncate. Head often with an irregularly-shaped sclerotized ventral cephalic plate anterior to mouth parts. Eyes small or absent. Legs generally spinose, claws long, ungual digitules short and setose or elongate and often swollen apically. Body setae varying in length, mostly minute. Dorsal ostioles usually distinct, often strongly sclerotized.

Key To The Florida Species Of *Rhizoecus*

1. Abdomen with a circulus; derm without multilocular disk pores 2
   Abdomen without a circulus; derm with multilocular disk pores 5
2. Eyes absent; anal lobes weakly sclerotized .... *floridanus*, n. sp.
   Eyes present; anal lobes not sclerotized 3
3. Body small, maximum length about 1.40 mm; rostrum moderately short, about 50μ long; outer portion of anal ring containing 17–23 cells; antennae rather short, sensory setae weakly clavate .... *simplex* (Hambleton)
   Body large, minimum length about 1.20 mm; rostrum stout, 84–88μ long; outer portion of anal ring containing 32–40 cells; antennae rather long, sensory setae not clavate, weakly tapered 4
4. Ungual digitules about ½ as long as claws, the latter narrow, elongate, about 40μ long; cells of outer portion of anal ring small, mostly elongate oval or irregularly polygonal .... *maritimus* (Cockerell)

Ungual digitules longer than claws, the latter stout, curved, about 20μ long; cells of outer portion of anal ring rather large, mostly subtriangulate and quadrate .... *cacticans* (Hambleton)

5. Antennae 5-segmented; eyes absent; anal lobes roundly protruding, each bearing 5–7 elongate setae .... *falcifer* Künckel d'Herculais

Antennae 6-segmented; eyes present; anal lobes simple or only weakly protruding, each bearing less than 5 elongate setae 6

6. Anal ring setae short, stout, about 35μ long; tritubular cerores large, of 1 size only; multilocular disk pores mostly with 7 loculi .... *spinipes* (Hambleton)

Anal ring setae more elongate, $70–90\mu$ long; tritubular cerores of 2 or 3 sizes; multilocular disk pores mostly with 10 loculi 7

7. Anal lobes not sclerotized; eyes very small, usually weakly pigmented; multilocular disk pores relatively sparse, occurring only ventrally near vulva; tritubular cerores of 2 sizes; cephalic plate apparently absent .... *pritchardi* McKenzie

Anal lobes usually sclerotized; eyes much larger, strongly pigmented; multilocular disk pores more numerous, occurring dorsally and ventrally over entire derm; tritubular cerores of 3 sizes; cephalic plate present .... *americanus* (Hambleton)

Rhizoecus americanus (Hambleton)

Morrisonella americana Hambleton, 1946:18, fig. 18–19c.
Rhizoecus americanus: Ferris, 1953:428, fig. 163.

The first authentic record for the occurrence of this species in continental United States was made in Florida in August, 1959 from specimens collected on the roots of *Dieffenbachia* sp. by C. O. Youtsey at Altamonte Springs. *Rhizoecus americanus* was originally described from Columbia, Ecuador, Cuba, Jamaica, and the British West Indies from the roots of grasses, coffee, and palm. In recent years this mealybug has been collected on some 30 different host plants, representing at least 17 plant families from Gainesville in the north to Sugarloaf Key, near Key West in the south. Its occurrence on local grasses and its wide distribution lend support to the belief that the species may be endemic to the State.

Unless otherwise indicated, the names of collectors and collecting dates for the taxa *americanus* and *simplex* are omitted to conserve space. The majority of records were made during 1970 to 1971.

Host records: On *Aralia* sp., Largo; *Areca* sp., Seminole; *Arecastrum romanzoffianum*, Largo; *Araucaria excelsa*, Bradenton, Palmetto, Snead Island, St. Petersburg; *Asparagus sprengeri*, Snead Island; *Calliandra haematocephala*, Osprey; *Calliandra* sp., Largo, Snead Island; *Callistemon viminalis*, Tallevast; *Callistemon* sp., Delray Beach; *Chlorophytum* sp., Largo; *Chrysalidocarpus lutescens*, High Point, Largo; *Dieffenbachia amoena*, Clarcona; *Dieffenbachia picta*, Fern Park, Aug. 1962; *Dieffenbachia* sp., Altamonte Springs, Aug., 1959, Clarcona, Fern Park, Apr., 1965; *Dizygotheca elegantissima*, Largo, Sarasota; *Ernodes* sp., Sugarloaf Key; *Euphorbia milii*, Largo; *Ficus nitida*, Largo; *Gnaphalium* sp., Fern

Park; *Hemigraphis replans*, Clarcona; *Hibiscus rosasinensis*, Largo, Osprey; *Hibiscus* sp., St. Petersburg; *Lantana* sp., Gainesville; *Liriope* sp., Largo; *Malpighia coccigera*, N. Fort Meyers, Orlando; *Nephthytis* sp., Fern Park; *Peperomia pellucida*, Fern Park; *Phoenix loureiri*, Snead Island; *Pothos* sp., Fern Park; *Pyracantha coccinea*, Largo; *Rhaphiolepsis* sp., Largo; *Saintpaulia ionantha*; Winter Garden, Aug., 1967; *Strelitzia reginae*, Largo; on Gramineae, Flamingo; in debris of packrat nest, Upper Key Largo, March, 1968.

Rhizoecus americanus may be readily distinguished from all other Florida hypogeic mealybugs by the presence of tritubular cerores occurring in 3 distinct sizes. Other helpful identification characters are its larger size, the sclerotized anal lobes, and wide distribution of the multilocular disk pores.

Rhizoecus cacticans (Hambleton)

Ripersiella cacticans Hambleton, 1946:64, fig. 57–58.
Rhizoecus cacticans: Ferris, 1953:432, fig. 165; McKenzie, 1960:745; McKenzie, 1967:379, fig. 153.

The only known record for *Rhizoecus cacticans* in Florida is based on 2 specimens collected on *Mesembryanthemum* sp. at Sanford, Seminole Co., 15 February 1963, by C. O. Youtsey. Until additional material is discovered, the true status of *cacticans* in Florida will remain questionable. The Sanford specimens were originally recorded (Tri-ology 1963) as *R. leucosomus* (Cockerell), a species not known to occur in Florida. This species and *cacticans* have been confused with *R. simplex* (Hambleton) and the new species *floridanus*, both quite common in the State.

R. cacticans is a comparatively large mealybug with a long rostrum, unsclerotized anal lobes, and with its anal ring composed of 32–40 rather large subtriangulate or quadrate cells in its outer portion. Other distinguishing differences are presented in the key (p. 64).

Rhizoecus falcifer Künckel d'Herculais

Rhizoecus falcifer Künckel d'Herculais, 1878:163; Hambleton, 1946:53, fig. 41–43; Ferris, 1953:444, fig. 172; Williams, 1962:47; McKenzie, 1967:389, fig. 158.

Rhizoecus falcifer has not been collected in Florida. Its inclusion here is based upon 4 specimens in the United States National Museum (USNM) collected by W. S. Craig in Iowa, 20 November 1953, from roots of palm shipped from Florida. At the present time *falcifer* is known to occur in Missouri, New Jersey, New York, and California. According to McKenzie (1967) this mealybug is one of the more common species in California, occurring there on a wide variety of host plants.

The important characters separating *falcifer* from related species are its large size, 5-segmented antennae, absence of eyes, and number of elongate anal lobe setae.

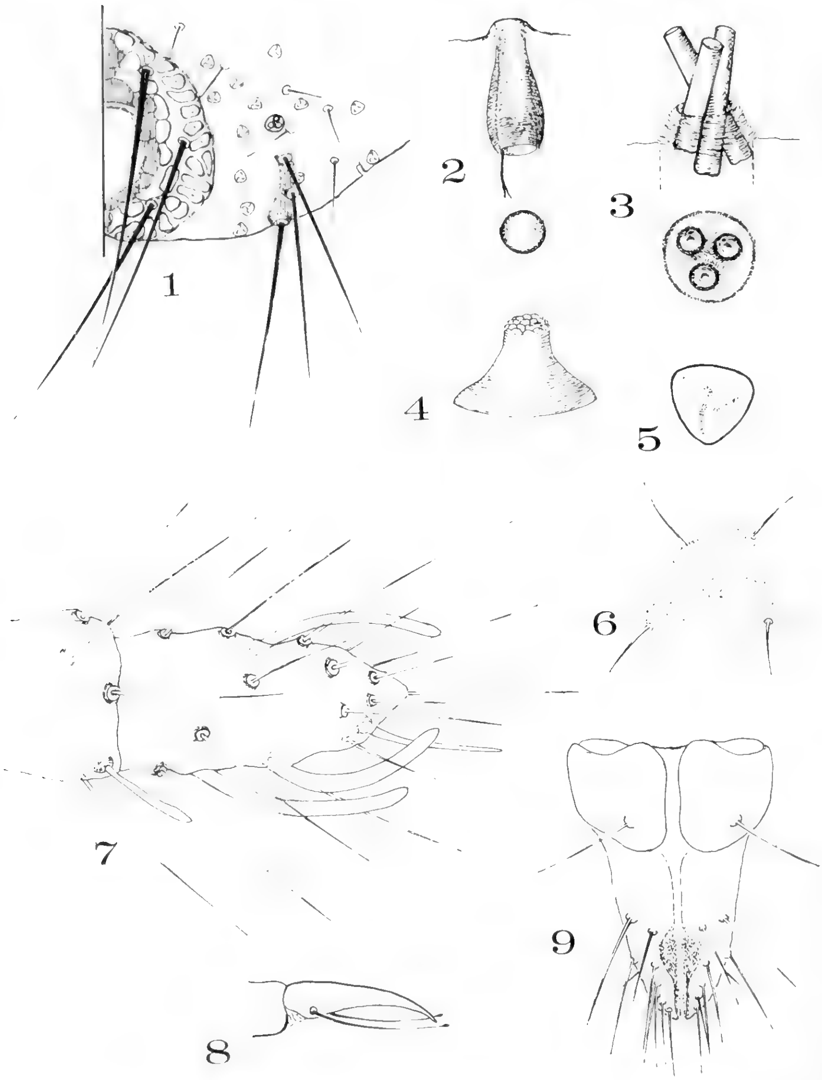

Fig. 1–9, *Rhizoecus floridanus*, n. sp., ♀: apex of abdomen, right half, showing anal ring and anal lobe characters; 2, tubular duct; 3, tritubular ceror; 4, circulus, lateral view; 5, trilocular pore; 6, cephalic plate; 7, 5th and 6th antennal segments showing falcate sensory setae; 8, claw; 9, rostrum.

Rhizoecus floridanus, n. sp.
fig. 1–9

Adult female: Rather broadly ovate, more acute in area of head and thorax. Length, 1.20–1.63 mm; width, 0.65–0.80 mm. Antennae 6-segmented, of medium size, average length of segments in microns as follows: I, 31; II, 19; III, 25; IV, 17; V, 16; VI, 37; apical segment slightly less than twice as long as wide, bearing 3 moderately long, stout falcate setae and 1 slender, acute sensory seta; penultimate segment with 1 smaller, rather elongate, weakly clavate sensory seta. Interantennal space equal to about twice the length of segment I. Eyes absent. Rostrum relatively short, measuring about 57μ long, 40μ wide; rostral loop extending to or near insertion of 2nd pair of legs. Cephalic plate irregularly triangulate to quadrate, wider posteriorly, about 38μ across its base, bearing indistinct vacuoles. Dorsal ostioles weakly sclerotized, inconspicuous.

Legs of medium size, average length of segments of hind pair measured in microns as follows: trochanter, 37; femur, 81; tibia, 69; tarsus, 51; claw, 22; ungual digitules long, their tips swollen, surpassing claws, the latter narrow, elongate, weakly curved.

Abdomen bearing 1 conical circulus, variable in size, width at base varying from 21–35μ, its apex finely foveolate. Anal lobes undeveloped, each with a small, narrow sclerotized patch between the 3 elongate setae, the longest measuring about 60μ long. Anal ring about 60μ in diameter, its 6 setae considerably longer and stouter than lobe setae, averaging about 87μ long; outer anal ring cells large, diversiform, 24–33 present, mostly isolated; inner portion of anal ring with 14–20 cells of similar size and shape lying adjacent to an inner darkened area of semicircular cells. Tritubular cerores small, walls of their individual ducts almost parallel, 36–40 present dorsally and ventrally, most abundant on abdomen and rather evenly distributed elsewhere. Multilocular disk pores absent. Tubular ducts small, occurring on both surfaces widely scattered but absent on dorsum of head. Trilocular pores fairly evenly distributed. Body setae mostly short.

Holotype female: Florida: Pembroke, Broward Co., 2-VIII-67, R. G. Schmidt, on roots of *Dracaena marginata*, in USNM.

Paratypes: FLORIDA. 133 adult females from *Aechmea orlandiana*, Lockhart, 6-I-64, R. J. Griffith; *Anthemis* sp., Tall Timbers, 12-XII-69, H. H. Tippins; *Aralia* sp., Clearwater, 12-II-71, E. W. Miller; *Arecastrum romanzoffianum*, Osprey, 10-II-71, J. R. McFarlin; *Araucaria excelsa*, Arcadia, 26-II-71, G. P. Lamb; *Bambusa* sp., Orlando, 20-X-69, F. L. Ware; *Billbergia* sp., 30-XII-63, R. J. Griffith; *Buxus carissa*, Eau Gallie, 8-II-71, H. C. Levan; *Buxus* sp., Mango, 19-II-71, E. R. Simmons, Plant City, 19-II-71, D. A. Vaughn; *Calliandra* sp., Largo, 10-II-71, C. K. Hickman et al.; *Callistemon rigidus*, Lakeland, 6-VI-69, J. W. McLeod; *Callistemon* sp., W. Melbourne, 12-II-71, H. C. Levan; *Carissa grandiflora*, Fairvilla, 2-II-71, F. L. Ware, Largo, 10-II-71, C. K. Hickman, Naples, 4-III-71, W. T. Walsh, Orlando, 21-V-71, F. L. Ware, Sarasota, 22-II-71, J. R. McFarlin, Tampa, 15-II, 2-III-71, C. W. Hale; *Carissa* sp., Fairvilla, 22-II-71, F. L. Ware, Punta Gorda, 16-V-71, G. B. Lamb, Seffner, 12-II-71, D. A. Vaughn, W. Palm Beach, 11-II, 4-III-71, H. L. Messec; *Citrus mitis*, Largo, 10-II-71, C. K. Hickman; *Cortaderia selloana*, Largo, 11-II-71, C. T. Williams; *Dizygotheca elegantissima*, Bradenton, 5-I-71, J. R. McFarlin, Delray Beach, 15-II-71, W. E.

Wyles, Grant, 19-II-71, H. C. Levan, Osprey, 5-II-71, J. R. McFarlin; *Eremechloa ophiuroides*, Gainesville, 29-III, 19-IV-67, G. W. Dekle and C. Lyons; *Eugenia* sp., Palmetto, 25-II-71, J. R. McFarlin; *Gardenia thunbergia*, Pembroke, 14-IV-67, H. G. Schmidt; *Hoya* sp., Orlando, 10-II-71, E. R. Fatic; *Ilex opaca*, Oneca, 27-V-71, J. R. McFarlin; *Ilex rotunda*, Fairvilla, 2-II-71, F. L. Ware; *Ilex vomitoria*, Englewood, 29-IV-71, C. J. Bickner; *Ilex* sp., Seffner, 17-VIII-71, D. A. Vaughn; *Ilex cornuta burfordi*, Fairvilla, 21-XII-71, F. L. Ware; *Ixora* sp., Sebastian Inlet, 12-II-71, H. C. Levan; *Jasminum* sp., Gillette, 23-V-71, C. J. Bickner; *Lachnanthes tinctoria*, Casselberry, 26-XII-63, C. O. Youtsey; *Leucophyllum frutescens*, Winter Haven, 11-VII-68, H. C. Burnett; *Philodendron selloum*, Apopka, 11-II, 15-II-71, C. L. Speaker, Plymouth, 29-I, W. W. Smith and E. R. Fatic, 19-V-71, H. M. Van Pelt; *Pyracantha* sp., Mango, 19-II-71, E. R. Simmons; *Rhododendron* sp., Bradenton, 11-I-71, S. L. Poe, Largo, 11-II-71, G. T. Williams; *Viburnum suspensum*, Osprey, 15-II-71, J. R. McFarlin; Bromeliaceae, Orlando, 26-II-71, D. A. Grady; palm, Pinellas Park, 18-II-71, C. K. Hickman; Gramineae, Plymouth, 12-X-71, H. M. Van Pelt. GEORGIA. 4 adult female paratypes, Spaulding Co., on perennial grasses, 16-V-1968, H. H. Tippins.

All paratypes are in the Florida State Collection of Arthropods, Gainesville, with the exception of 2 each to be deposited in the collections of the University of California, Davis: Virginia Polytechnic Institute, Blacksburg; University of Georgia, Experiment; British Museum (Natural History), London, and 5 in the USNM.

This mealybug should not be mistaken for any of its Florida relatives. Its closest ally is probably *R. simplex*, but this species has eyes and unsclerotized anal lobes, characters that separate it at once from *floridanus*. The cellular structure of the outer portion of the anal ring of the former is also of smaller size, the cells being more oval elongate than those of *floridanus*.

Rhizoecus maritimus (Cockerell)

Ripersia maritima Cockerell, 1894:42.
Ripersiella maritima: Cockerell, 1899:278.
Morrisonella maritima: Hambleton, 1946:31, fig. 14–17.
Rhizoecus maritimus: Ferris, 1953:452, fig. 176.

This maritime species has not previously been reported from the State of Florida. Known heretofore only from the coastal area of the northeastern States, *R. maritimus* may be restricted in its host preference to those salt-tolerant plants inhabiting coastal waterways.

Host records: On *Faucaria tigrina*, Tampa, 17-II-71, E. R. Simmons; *Rhizophora mangle*, Bailey's Bluff, 7-III, 3-VIII-71, G. T. Williams; *Spartina patens*, Cedar Key, 19-VII-70, G. W. Dekle.

The distinguishing characters of *R. maritimus* are its large, stout rostrum, small tritubular cerores, long, slender claws, and small cells of the outer portion of the anal ring.

Rhizoecus pritchardi McKenzie

Rhizoecus pritchardi McKenzie, 1960:749, fig. 23; McKenzie, 1967:400, fig. 162.

Since this species was first described by McKenzie (1960) from California, *R. pritchardi* has been taken in 6 additional States, including Florida in 1966. African Violet appears to be a perferred host, and it has undoubtedly been widely distributed on this plant in commerce across the United States.

Host records: On *Saintpaulia ionantha*, Apopka, 1-IV, 11-V-71, R. M. Remington, Gainesville, 23-V-68, E. Mercer, Largo, 22-IV-66, J. R. McFarlin.

No other Florida species of *Rhizoecus* is easily confused with *R. pritchardi*. Some specimens measure more than 2 mm in length, and the antennae are widely separated. The derm bears tritubular cerores of 2 sizes but lacks tubular ducts of the usual type.
Ripersiella simplex Hambleton, 1946:73, fig. 77–77a.

Rhizoecus simplex (Hambleton), n. comb.

This little mealybug is here recorded for the first time in the Northern Hemisphere. Previously it was known only from the type locality, São Paulo, Brazil. Material first collected in Gotha, Fla. in August, 1961 was misidentified as *R. cacticans* and reported (Tri-ology 1963) as a new state record. Also, 5 specimens from Bellingham, Washington, September, 1965, were incorrectly identified and noted (CEIR 1969) as new for the State. Two specimens before me from Berkeley, California labeled *cacticans* agree with the type of *simplex*.

R. simplex is now distributed in at least 10 counties in Florida and is commonly encountered in nursery stock.

Host records: On *Buxus carissa*, Eau Gallie; *Calendula* sp., Gainesville; *Carissa grandiflora*, Orlando, Tallevast; *Coccoloba uvifera*, Fairvilla; *Cordyline* sp., Lockhart; *Cryptanthus* sp., Winter Garden; *Dieffenbachia* sp., Lockhart; *Dizygotheca elegantissima*, Bradenton; *Eriobotrya japonica*, Pompano Beach, Oct., 1963; *Euphorbia milii*, Fairvilla; *Gardenia* sp., W. Melbourne; *Hedera helix*, Fairvilla; *Hoya carnosa*, Apopka, Lockhart, Winter Garden, Jan., 1965; *Hoya exotica*, Winter Garden, Feb., 1968; *Ixora coccinea*, Osprey; *Ixora* sp., Sebastian Inlet; *Neoregelia* sp., Gotha, Jan., 1961; *Nephrolepsis exaltata*, Lockhart; *Peperomia* sp., Lockhart; *Pilea microphylla*, Lockhart; *Strelitzia reginae*, Homestead, Snead Island; *Zygocactus truncatus*, Leesburg, Oxford; *Zygocactus* sp., Palma Sola, Dec., 1967; in packrat nest debris, Upper Key Largo, March, 1968.

This subterranean species bears no resemblance to *R. cacticans*, with which it has previously been confused. *Rhizoecus simplex* is 1 of the smallest mealybugs. Of the Florida species, it more closely resembles *floridanus*. Their differences, however, are readily observed and are indicated in the key.

Rhizoecus spinipes (Hambleton), n. comb.

Morrisonella spinipes Hambleton, 1946:36, fig. 22–24.

To date, only 1 collection of this rather unique mealybug has been made in Florida, but its occurrence in the State comes as no surprise since it was originally described from Arkansas. Study of the 8 Florida specimens as well as a single female from Mexico confirms the validity of *R. spinipes*. Unfortunately this species was omitted from Ferris' Atlas of the Pseudococcidae (1953), and from the more recently published keys to the North American species of *Rhizoecus* by McKenzie (1960, 61, 62, 67).

Host record: *Andropogon rhizomatus*, Gainesville, 10-X-67, K. R. Langdon.

The broadly ovate body, small appendages, large tritubular cerores, and short, stout anal ring setae separate *spinipes* from any other described member of the *Rhizoecus*.

Acknowledgments

For their generous cooperation in sending material for study, I am very grateful to Mr. Harold Denmark and Mr. George W. Dekle, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture, Gainesville, Florida. Special acknowledgment is extended to Miss Louise M. Russell and Dr. Douglass R. Miller, Systematic Entomology Laboratory, USDA, Washington, D. C. for their encouragement and assistance in many ways, and for reading and criticizing the manuscript. I thank Dr. Hamlin H. Tippins, Division of Entomology, Experiment Station, Experiment, Georgia, for the loan of specimens.

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MITES ASSOCIATED WITH AQUATIC AND SEMI-AQUATIC DIPTERA FROM SAN MATEO COUNTY, CALIFORNIA

(ACARINA: HYGROBATIDAE, UNIONICOLIDAE, PIONIDAE, ASCIDAE AND DIPTERA: CHIRONOMIDAE, TIPULIDAE, PSYCHODIDAE)

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ABSTRACT—Light trap collections near a reservoir in San Mateo County, California, included many aquatic and semi-aquatic Diptera (Chironomidae, Tipulidae, Psychodidae) with attached mites (Acarina: Hygrobatidae, Unionicolidae, Pionidae, Ascidae). Insects and associated mites are listed along with abundance and some observations on their biology. Weekly tabulation of mite incidence on *Phaenopsectra profusa* (Townes) is presented.

We have been concerned with an assessment of the chironomid fauna occupying the Crystal Springs Reservoir, San Mateo County, California. Early in this study a number of Diptera were observed in a symbiotic relationship with certain Acarina. The purpose of this paper is to report the association of representatives of 4 families of mites and 3 families of Diptera collected during the spring of 1967.

Crystal Springs Reservoir, which occupies a small basin along the San Andreas Fault, has a capacity of 22 billion gallons and an approximate surface area of 1341 acres. The Reservoir, owned by the City and County of San Francisco, is one of their many water-holding areas that extend from the Sierra Nevada Mountains north of Yosemite National Park to the San Francisco Peninsula. These reservoirs supply drinking water to the residents of San Francisco and several neighboring cities on the Peninsula. Recent changes in the water delivery will bypass the Crystal Springs Reservoir and thus transport water directly from the Sierra Nevada Mountains to the consumer. Projected use of this area remains uncertain. Constant encroachment onto land adjacent to the Crystal Springs Reservoir has occurred at an increased rate. Either recreational or residential developments will place increased population burdens upon this land during the immediate years ahead. Aquatic insect populations along the perimeter of the Crystal Springs Reservoir were sampled in order to evaluate potential nuisance problems.

Methods and Materials

Two convenient and well protected locations were selected to conduct this study. One site, near Hillsborough, California was on a ridge ½ mile from the Crystal Springs Reservoir and the second site was adjacent to the shoreline approximately 5 miles south of the former location. At each site a single light trap (New Jersey type) was suspended 5 feet above the ground. The power source for the traps was obtained from electric outlets at nearby buildings. Semiweekly collections were necessary because of the large volume of adults attracted to the traps and the desirability of fresh specimens. After each collection was sorted and tabulated, Diptera found to have attached mites were mounted. The traps were operated for a period of 4 months from mid-February to mid-June, 1967.

Results and Discussion

Baker & Wharton (1952) noted that ⅔ of the nearly 100 mite families associated with arthropods were either predators or parasites. Since the form of symbiosis has not been established in all cases, the authors decided to refer to all Diptera and Acarina found in close union as symbiotes. One can speculate as to the type of symbiotic relationship between the Diptera and Acarina when the life histories of closely related mites within the family are known.

The mites found on the insect specimens belong in 2 suborders of the order Acarina: Mesostigmata and Prostigmata (Table 1). Each of these suborders includes a wide range of ecological types—predators, scavengers, and plant parasites as well as a variety of symbiotes of vertebrate and invertebrate animals. Hughes (1959) related that dipterous insects are often parasitized by trombidiform mites.

The chironomids collected were parasitized by larval water mites (Prostigmata: Hydrachnellae or Hydracarina) of 3 mite families (Hygrobatidae, Unionicolidae, and Pionidae; Table 1). Sparing (1959) lists 11 genera of the supercohort Hydrachnellae that parasitize the Chironomidae. The larvae of the Hydrachnellae are usually parasitic while the nymphs and adults of this group are (in most cases) predaceous upon aquatic insects. All of the larval water mites that we collected are of the aquatic type in the sense of Mitchell (1957); that is they are highly adapted for swimming beneath the surface and, in the case of the species taken in our study, do so until the time that they

Table 1. Diptera and Acarina symbiotes.

Chironomidae	Prostigmata, Pionae
Phaenopsectra profusa (Townes)	Hygrobatidae, *Hygrobates* Koch
	Unionicolidae (same spp. on *Chironomus* n. sp. #51)
Chironomus n. sp. #51	Unionicolidae
Calopsectra n. sp.	Hygrobatidae, *Hygrobates* Koch
Chironomus nervosus Staeger	Pionidae
Tipulidae	Mesostigmata, Parasitoidea, Ascidae
Psiloconopa cana (Walker)	*Cheiroseius* Berlese
Psiloconopa caliptera (Say)	*Cheiroseius* Berlese
Limonia canadensis (Walker)	*Cheiroseius* Berlese
Psychodidae	Mesostigmata, Parasitoidea, Ascidae
Psychoda satchelli Quate	*Iphidozercon californicus* Chant
	Iphidozercon (undescribed sp.)

attach to emerging adults of insects with aquatic larvae. The abundance of mites found on 2 families of Diptera are listed in Table 2. In the family Chironomidae, *Phaenopsectra profusa* (Townes) was the most frequently parasitized species in the light trap collections. Other chironomid hosts with mite symbiotes occurred in considerably fewer numbers as noted for *Chironomus nervosus* Staeger, *Chironomus* n. sp. 51, and *Calopsectra* n. sp. Eighty-seven specimens of *Chironomus plumosus* (L.), the largest of the chironomids, were found in the light trap collections. Two female *C. plumosus* were parasitized but they were not included in Table 2 since the mites were dislodged before tabulation.

Generally, the larvae of the chironomid hosts listed may be considered littoral forms. All of these species construct silken tubes in the littoral mud or on submerged vegetation. *Chironomus plumosus* occurs in the profundal region of some American lakes. Generally all of the *Chironomus* species and *P. profusa* reside in the bottom mud. However, *C. nervosus* larvae were collected from the bottom mud and from vegetation in about equal numbers according to Buckley and Sublette (1964). The chironomid hosts have more than 1 generation per year. *Phaenopsectra profusa* exhibits spring and fall adult population peaks as reflected by previous light trap collections. This species seems to prefer colder water where the dissolved-oxygen content is relatively high (Darby 1962). *Chironomus nervosus* was interpreted to have 3 generations per year by Mundie (1957). Hilsenhoff (1966) and Johnson and Munger (1930) related that *C. plumosus* had 2 generations per year in shallow Wisconsin lakes.

Table 2. Abundance of mites on 2 families of Diptera collected from light traps in San Mateo County, California (spring, 1967)

Host	Collection location	Hosts with mites	Number of mites/host								Mean number (mites/host)	Range of (mites/host)
			1	2	3	4	5	6	7	8+		
Chironomidae												
Phaenopsectra profusa (Townes)	Hillsborough	37	12	15		1	3	3		3	2.8	1–8
	Crystal Springs	48	15	6	11	5	3	1		7	3.8	1–17
Chironomus nervosus Staeger	Hillsborough	2	1	1							1.5	1–2
Chironomus #51	Hillsborough	2	1							1	5.0	1–9
	Crystal Springs	6	2	3	1						1.8	1–3
Calopsectra n. sp.	Hillsborough	4	3	1							1.3	1–2
	Crystal Springs	7	4	1	2						1.7	1–3
Psychodidae												
Psychoda satchelli Quate	Hillsborough	38	36	1	1						1.1	1–3
	Crystal Springs	22	17	2	2	1					1.4	1–4

Table 3. Incidence of mites observed on *Phaenopsectra profusa* (Townes)[1]

Weekly collection period		Crystal Springs Reservoir			Hillsborough		
		Number trapped	Number with mites	Percent with mites	Number trapped	Number with mites	Percent with mites
March	2–8	11	0	0	9	0	0
	9–15	22	0	0	27	0	0
	16–22	28	0	0	40	1	2.5
	23–29	38	6	15.8	21	3	14.3
	30–Apr. 5	28	5	17.9	16	4	25.0
April	6–12	26	7	26.9	16	6	37.5
	13–19	13	7	53.8	24	14	58.3
	20–26	13	7	53.8	2	2	100.0
	27–May 3	1	1	100.0	8	6	75.0
May	4–10	4	4	100.0	0	0	0
	11–17	1	1	100.0	0	0	0
	18–24	7	7	100.0	0	0	0
	25–31	3	3	100.0	1	1	100.0

[1] For purposes of comparison the above table incorporates only data collected during the period from March 1 to May 31, 1967.

The incidence of mites on *P. profusa*, during the 13-week study period, appears in Table 3. Peak flights of *P. profusa* were collected at both study areas by mid-March 1967 while the mite build-up to near peak abundance trailed this population by 1 month.

The site of mite attachment on the Diptera was primarily on the abdomen. On all of the Diptera, mite attachment was most frequent on the ventral and lateral sides of the abdominal segments and intersegmental membranes. For *P. profusa*, only 3 of the 285 mites noted were attached to the thorax. With this species, the largest number of mites were associated with the first and second abdominal segments. A lesser number of mites were noted on segments 3–7, particularly the fifth and sixth segments. Mites on hosts varied in number from a single specimen, which was most common, to an instance when 17 larval mites were found clustered on the abdomen of 1 *P. profusa*. Such large numbers of mites undoubtedly caused considerable difficulty to the flight and dispersal of the midges from their breeding grounds or resting areas. The few adults collected that bore large numbers of mites may have represented the most vigorous members of this *P. profusa* population.

Psychoda satchelli Quate, widely distributed in the United States, was represented in collections from 2 light traps previously discussed. Quate (1955) reared *P. satchelli* at room temperature in the laboratory.

He found that they developed in the upper layers of high moisture fig compost. He noted that no larvae or pupae were found in the compost where standing water was present. In our collections, the adults of *P. satchelli* undoubtedly came from the decaying vegetable matter present above the reservoir shoreline.

Only two genera of Mesostigmata, *Cheiroseius* Berlese and *Iphidozercon* Berlese, in the family Ascidae, were present in the collections. *Cheiroseius* is noted to be cosmopolitan and 1 of the largest ascid genera with approximately 50 species (Lindquist and Evans 1965). The genus belongs to the subfamily Platyseiinae which is associated with subaquatic habitats and is thought to be predaceous. Little is known of the genus *Iphidozercon*, subfamily Arctoseiinae. *Iphidozercon californicus* Chant was the first species of this genus described from North America. The original collection of females was found in leaf mold at Davis, California (Chant 1963).

The family Ascidae was associated with 3 species of tipulids whose larvae reside in moist habitats such as organically rich soil, sand, and mats of algae along marsh and lake margins. *Limonia canadensis* (Walker) and *Psiloconopa cana* (Walker) are widespread in California while *Psiloconopa caliptera* (Say) is recorded only from the central and southern parts of California (Alexander 1967). *Limonia* Meigen, the largest genus in the order Diptera (2000 species), covers habitats that include semi-aquatic situations such as saturated mats of algae, liverworts, and mosses (Alexander 1965). *Psiloconopa* Zetterstedt in the immature stages is found in soil and decaying vegetable material. Most species occur in wet, sandy to richly organic soil at margins of bogs, marshes, and streams (Alexander 1965).

The psychodids and tipulids collected have similar larval requirements. Semi-aquatic habitats such as algal mats, mosses, decaying vegetable matter, or richly organic soil near margins of streams or lakes provide the necessary requirements needed by the species discussed.

The association of the mites collected in this study with the hosts of all 3 families is suspected to take place when the host is terminating the pupal stage, immediately prior to or at the time of adult emergence (Radovsky 1969).

Acknowledgments

The authors are grateful to Alan Stone, Systematic Entomology Laboratory, USDA, Washington, D. C. for determination of the psychodids and tipulids; J. E. Sublette, Department of Biological Sciences, Eastern New Mexico University, Portales, New Mexico for determination of the chironomids; Rodger Mitchell, The Ohio State University, Columbus, Ohio, for confirmation of the unionicolid identification; and F. J. Radovsky, Department of Entomology, B. P. Bishop Museum, Honolulu, Hawaii for mite determinations and valuable review of this paper. The authors are appreciative to Mr. John O'Marie, Division Manager, San

Francisco Water Department, for permission to utilize the water company property for our survey.

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A NEW GENUS OF CICADELLIDAE FROM BRAZIL[1]

(HOMOPTERA)

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ABSTRACT—**Evanirvana aurea**, n. gen. and n. sp., from Brazil is described, illustrated and provisionally included in the tribe Evacanthini.

The 2 specimens included in this description were first recognized as being unusual by Dr. James P. Kramer, Systematic Entomology Laboratory, USDA. The specimens are of interest because work with female characters has indicated that they may be annectent between Evacanthini and Nirvaninae. They are being described to be available for inclusion in an already completed work on the higher categories of Cicadellidae to be published soon.

Evanirvana, n. gen.

Head with crown roundly produced beyond eyes; crown marginally carinate, with carina more pronounced apically, central portion with distinct longitudinal striae which are slightly curved. Ocelli absent; antennae more than twice as long as head, antennal ledges scalelike. Clypeus tumid, with median longitudinal carina lightly developed anteriorly and absent posteriorly. Forewings subhyaline, each with 4 apical cells and a small appendix (large, however, as compared with other genera of Evacanthini). Female genitalia (as compared with *Dussana* Distant, *Evacanthus* Le Peletier and Serville, *Onukia* Matsumura and *Vangama* Distant) with first and second valvulae of ovipositor comparatively heavily sclerotized, short and broad. First valvular sculpturing with distinct maculose area (fig. b). Second valvulae with teeth crowded apically; teeth somewhat irregular and not arranged in a distinct convex curve. Third valvulae short and broad with dorso-apical margin forming almost straight line. Pygofer about 1½ times as long as broad, terminating posterior to the first valvular apices and not sharply constricted subterminally.

Type-species, *Evanirvana aurea*, n. sp.

Evanirvana, new genus, is not close to any other genus in the Evacanthini and is included in this tribe provisionally. The genus can be separated from other genera of the tribe by the sculpturing on the first valvula (fig. b), the general shape of the second valvulae (fig. d) or many other of the above characters.

[1] Study accomplished with the aid of a 3-year fellowship from the Entomology Research Division, Agriculture Research Division, U. S. Department of Agriculture.

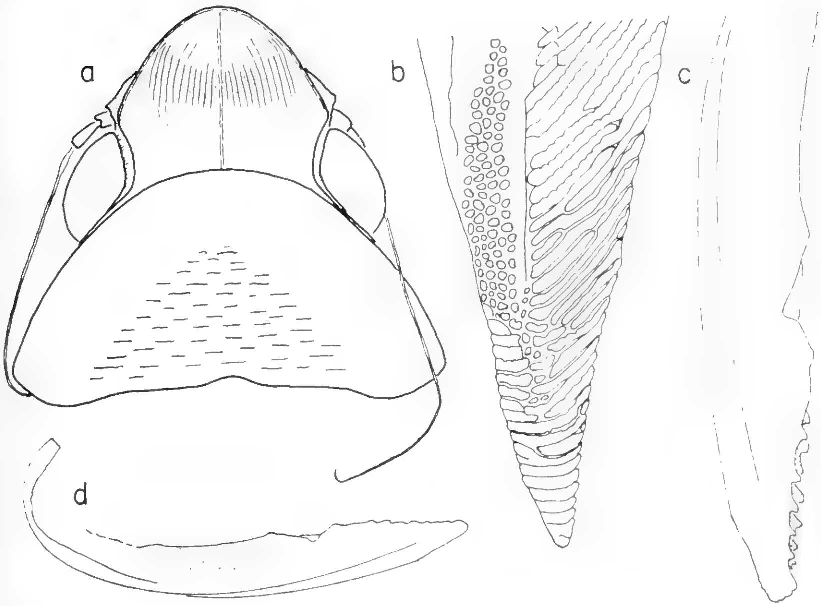

Fig. a–d, *Evanirvana aurea*, n. gen., n. sp.: a, head and pronotum, dorsal aspect; b, left first valvula apex, 150 x; c, second valvulae apices, lateral aspect; d, second valvulae, lateral aspect.

Evanirvana aurea, n. sp.

fig. a–d

Length of female 8.5 mm including forewings; width 3 mm.

Color: Dull yellowish tan with markings on crown and pronotum. Crown with somewhat W-shaped dark spot in apical portion which is nearly co-extensive with enlarged ridges of longitudinal striae. Pronotum with orange arcuate spot near anterior margin.

Leg chaetotaxy: Posterior tibia with 18 to 24 setae in row 1; 14 or 15 major setae in row 2; about 24 setae in row 3; and many small setae gradually increasing in size distally in row 4. First and second tarsomeres of posterior leg with 5 and 2 platellae, respectively.

Male unknown.

Type: Holotype female (4-1868A) JUSSARAL [Maranhao], ANGRA-E. DO RIO, BRAZIL, L. TRAVASSOS, XI-934, in U. S. National Museum. A second specimen, also a female, Joinville, S. Cath. Brazil, X-25, A. Maller.

CHEMICAL PROOF OF VALIDITY OF THE TAXONOMIC SEPARATION OF VESPULA SUBGENUS VESPULA FROM VESPULA SUBGENUS DOLICHOVESPULA

(HYMENOPTERA: VESPIDAE)

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ABSTRACT—The positive attraction of 7 species of yellow jackets, *Vespula* (*Vespula*), to 2,4-hexadienyl butyrate, and the lack of attraction of this compound for 2 or more species of hornets, *Vespula* (*Dolichovespula*), is chemical proof of the validity of the subgeneric separation by taxonomists. Four species of yellow jackets responded to the lure in Oregon, and 3 other species responded in Maryland.

Bequaert (1930) recognized 2 subgenera of *Vespula* in his study of the generic classification of the Vespinae. This separation is based primarily on the malar space, which is nearly as long as or longer than the penultimate segment in subgenus *Dolichovespula* Rohwer and almost ½ the length of that segment in subgenus *Vespula* Thomson. There are also behavioral differences between representatives of the 2 subgenera: species of *Vespula* (*Vespula*) usually nest in the ground, but species of *Vespula* (*Dolichovespula*) usually nest above ground. The former are ordinarily called yellow jackets and the latter, hornets.

Also, the synthetic chemical 2,4-hexadienyl butyrate[2] attracts species of the subgenus *Vespula* but is not attractive to species of the subgenus *Dolichovespula*. Davis et al. (1967) first noted the attractiveness of this chemical to yellow jackets in August, 1962 when *Vespula pensylvanica* (Saussure)[3] entered traps designed to capture the little house fly, *Fannia canicularis* (L.) at Corvallis, Oregon. Then I tested 2,4-hexadienyl butyrate during the summer of 1963 in Silver Spring, Maryland and caught 3 more species of the subgenus *Vespula*, *V. maculifrons* (Buysson), *squamosa* (Drury), and *vidua* (Saussure). At least 2 species of subgenus *Dolichovespula*, *V. arenaria* (Fabricius) and *maculata* (L.), were seen from time to time but did not enter the traps.

In additional testing in Oregon, Davis et al. (1968) caught 3 more *Vespula* (*Vespula*), *V. acadica* (Sladen), *atropilosa* (Sladen), and

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[1] Retired June 30, 1971.

[2] Synthesized by T. P. McGovern, Beltsville, Maryland 20705.

[3] *Vespula vidua V. acadica*, and *V. atropilosa* are considered subspecies of *Vespula* (*Vespula*) *rufa* in Hymenoptera of America North of Mexico—Synoptic Catalog (1951, USDA Agriculture Monograph No. 2, prepared under the direction of C. F. W. Muesebeck, K. V. Krombein, and H. K. Townes). In treating these as distinct species, I have followed C. D. F. Miller (Taxonomy of Nearctic *Vespula*. 1961. Canad. Ent. Vol. XCIII, Supplement 22:1–52) and Supplement 2 of USDA Monograph No. 2 (*loc. cit. supra*).

vulgaris (L.). However, despite intensive trapping studies conducted in Maryland and Oregon to exploit this chemical for possible practical control of yellow jackets, hornets were trapped on only 1 occasion. A few *V. maculata* (L.) were found in 1 trap in Oregon, but they were never trapped in Maryland, though the species is common there. Three other *Dolichovespula* (*V. arctica* Rohwer, *V. arenaria*, and *V. norvegicoides* (Sladen)) have been reported from Oregon, but were not captured.

Thus, 7 species of yellow jackets, *Vespula* (*Vespula*), showed strong positive responses to 2,4-hexadienyl butyrate, but 2 or more species of hornets, *Vespula* (*Dolichovespula*), did not. *Vespa crabro germana* Christ, the European hornet, was seen in Maryland from time to time within a few yards of traps baited with this chemical but showed no interest.

In addition, any attempt to use the lure to determine the relative abundance of species of yellow jackets must be a cautious one since the Maryland studies indicated that the 3 common species were not attracted equally.

After several preliminary tests with traps of various designs, 1 type was selected and used more or less routinely. This trap consisted of a glass pie dish filled with water to which a small amount of liquid household detergent had been added. Then the lure was placed by various means in the center of the dish. Figure 1 shows a bit of wire screen folded in such a manner that it held the bit of paper towel treated with the 2,4-hexadienyl butyrate just above the detergent-water. (A paper plate was used to line this pie dish to improve photography.) The yellow jackets responding dipped in flight as they reached the lure; contact with the water usually resulted in drowning. In earlier tests, a whiskey shot glass served the same purpose as the folded wire screen. However, this trap design may have favored 1 species over another. On 1 occasion (September 5 through 8, 1965), an electrocuting grid was suspended in a tulip tree and baited with the lure, and bits of canned tuna fish were placed at random points on the charged wires to add attractiveness to the trap. When tuna fish was used in the pie dish trap without the synthetic lure, no *maculifrons* were captured, but the grid trap baited in this way caught 71 specimens.

The standard pie dish trap caught the 3 species in the following order: *squamosa* (76.2%), *vidua* (22.3%), and *maculifrons* (1.5%). However, 48 sight identifications of queens gave the following order: *maculifrons* (56.2%), *squamosa* (37.5%), and *vidua* (6.3%).

No doubt trap design, trap location, and competition for available food sources for the 3 species of yellow jackets all played a role in the relative numbers collected. My general impression is that the percentage represented by the relative abundance of queens sighted

Fig. 1. *Vespula* (*Vespula*) trapped with 2,4-hexadienyl butyrate.

is closer to the true picture, that is, both *squamosa* and *maculifrons* were rather common, and *vidua* was relatively uncommon. However, I may be in serious error. An imported species, *Vespula germanica* (Fabricius) has been found from New York to Maryland that closely resembles *V. maculifrons*. Thus, many specimens of presumed *maculifrons* may have been *germanica*; on the other hand, the possibility exists that *germanica* may not respond to the synthetic lure since it was never trapped. The subgenus for *germanica* is *Vespula*, which makes it a yellow jacket. Then if *germanica* has not been erroneously placed in this subgenus, the species may be an important exception to the chemical proof of validity of subgeneric separation.

That *maculifrons* is not rare in Maryland is evident to anyone interested in yellow jackets. They are most often seen flying an inch or 2 off the lawn, possibly searching for ants. I saw three *maculifrons* preying on alate ants (*Lasius neoniger* Emery) that were swarming on my lawn on September 17, 1967.

Only a weak conjecture can be made in regard to the behavioral or physiological reasons for attractiveness of 2,4-hexadienyl butyrate: It may somehow be associated with the underground nesting of yellow jackets since it is attractive to several genera and species of chloropids (Fluno et al. 1972) and to the European chafer, *Amphimallon majalis*

(Razoumowsky) (McGovern et al. 1970), all of which develop in soil. However, the attraction for even the yellow jackets was limited to the workers, though queens sometimes approached the traps in Maryland when the bait was tested in the spring.

The positive response of *Vespula* (*Vespula*) and the absence of a similar response by *Vespula* (*Dolichovespula*) substantiates the taxonomic separation between the subgenera. I would even suggest that the subgenera should be elevated to full generic rank on the basis of such a strong behavioral characteristic.

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PTEROMICRA INERMIS STEYSKAL A SYNONYM OF SCIOMYZA VARIA (COQUILLETT)

(Diptera: Sciomyzidae)

Several dipterists, viz., G. E. Shewell, C. O. Berg, L. V. Knutson, and T. W. Fisher, have expressed a suspicion that *Pteromicra inermis* Steyskal, 1956 (Papers Mich. Acad. Sci., Arts, and Letters 41:76) and *Sciomyza varia* (Coquillett), 1904 (Canad. Entomol. 36:12) are synonymous. Examination of the respective types and other specimens of this rather rare species, including several reared specimens of both sexes, shows that they are indeed synonymous. The virtually sole character distinguishing *Pteromicra* from *Sciomyza*, a single dorsal pre-apical bristle on the foretibia in the former and 2 such bristles in the latter, is subject to considerable variation in *Sciomyza varia*. Generic concepts in the tribe Sciomyzini, involving at least the genera *Sciomyza*, *Pherbellia*, *Pteromicra*, and *Colobaea*, seem to be becoming ever more hazy and a serious attempt at their revision on a broad basis should be made.

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COLASPIS FULVOTESTACEA LEFÈVRE AND ITS CLOSE RELATIVES (COLEOPTERA: CHRYSOMELIDAE)

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ABSTRACT—Three new species of *Colaspis* are described: *C.* **leiosomata** and *C.* **cacaoi** from Costa Rica and *C.* **ostmarki** from Panama. A new description of the holotype of *C. fulvotestacea* Lefèvre is presented.

Recently I have received from H. E. Ostmark of the Division of Tropical Research at La Lima, Honduras, specimens of beetles of a species that was devastating banana fruit over 4,500 acres in Changuinola, Panama, near Almirante, with the request for a name of these. By coincidence I had just been drawing the type of *Colaspis fulvotestacea* Lefèvre which I had borrowed from the National Museum of Natural History, Paris because no one here had been able to identify that Lefèvre species. The Panama specimens are closely related to *fulvotestacea*, which was described from Cañoas, Colombia, although with some differences. In the United States National Museum is a series of smaller beetles from Waldeck, Costa Rica, collected on *Theobroma cacao* by Ballou that are also very close to *fulvotestacea*, and another series from San Carlos, Costa Rica, collected by Schildt and Burgdorf, still different but belonging to the same group with *fulvotestacea*. At first I was inclined to view these 3 as subspecies of *fulvotestacea*, but the aedeagi of all 3, while similar, are each different. These differences in the aedeagi together with other small differences are analogous to the differences found in the *brunnea* group in the United States. These beetles also form a group that is distinctly different from the other costate species in that the males show little or no elytral costation, being smooth and shiny, but the punctation is of the same pattern as the punctures between the costae of the costate species. The elytra of the females show more traces of costae, usually on the sides and at the apex. There are 2 other differences in these species making them unlike other costate *Colaspis*: first, there is a prominent transverse depression on the elytra below the basal umbone, and secondly, on the head is a line of indented punctures from the eye to the top of the clypeus. Possibly someone might think they are not of the same genus as *Colaspis*, but the strongly sinuate margin of the prothorax and the pattern of elytral punctures are distinctive features of *Colaspis*.

Colaspis fulvotestacea Lefèvre
fig. 1

Colaspis fulvotestacea Lefèvre, Mitth. Munch. Ent. II, 1878:123.

6.2 mm in length, elongate oval, shiny reddish brown with apex of femora and base of tibiae deeper brown, jaws piceous, antennae entirely yellowish brown, prothorax with undulate margin having finely pointed tips, finely punctate, elytra also finely punctate with punctures more or less in rows, transverse depression across base below umbone.

Head with interocular space ½ width of head, smooth with a few punctures over occiput and front, row of punctures from eye to frontal tubercles forming a depressed line, clypeus with a few coarser punctures, anterior margin almost straight over labrum. Antennae slender and long, entirely pale yellow brown. Prothorax not twice as wide as long with strongly undulate, almost toothed, margin; surface finely punctate, shining. Scutellum shiny deep reddish brown. Elytra almost 3 times as long as prothorax and a little wider with transverse depression near base, punctation moderately fine except in depression and in lines, after the pattern of the punctation in costate species. This male specimen without costae. Body beneath shining, smooth, reddish brown with coxae and apex of femora and base of tibiae deeper brown. Length 6.2 mm; width 3 mm.

Type: male, in National Museum of Natural History, Paris.
Type locality: Cañoas, Colombia, M. E. Steinheil.

Colaspis leiosomata, n. sp.
fig. 2

Between 6 and 6.5 mm in length, elongate oval, shining reddish brown with darker coloring at juncture of femora and tibiae, and dark 7th and terminal joint of antennae; prothorax finely punctate and with undulate margin; elytra with transverse depression below basal umbone, not costate in male, except possibly on side, and with vestiges of costae in female, elytral punctation moderately coarse and in female with traces of being in geminate lines.

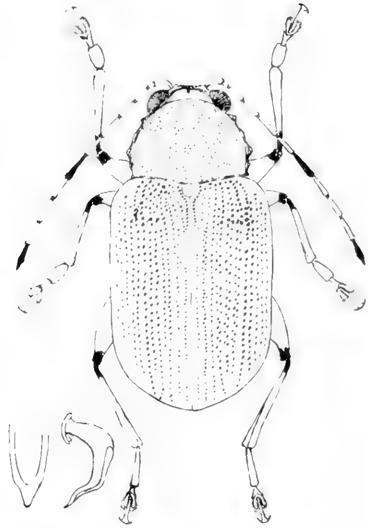
Head with interocular space ½ width of head, occiput and front smooth and shiny, sometimes with a few very fine punctures, a depressed line of punctures running from eye to frontal tubercles, clypeus well defined and usually with a few coarse punctures, anterior margin varying from being nearly straight to widely curved over labrum, jaws piceous and large. Antennae long and slender, yellow brown with usually the 7th and last joint dark. Prothorax not twice as wide as long with undulate sides, margin often darker, moderately convex, shining with usually rather fine punctures. Scutellum smooth. Elytra almost 2½ times as long as prothorax and somewhat wider, a transverse depression near base, very little trace of costae in males, but in females vestiges of costae on sides and at apex; punctation in males not noticeably geminate but in females punctures geminate as in the costate species. Body beneath pale except at the joining of femora and tibiae, which is darkened. Length 6–6.5 mm; width 3–3.4 mm.

Type: male, and 3 paratypes, USNM Type No. 72429.

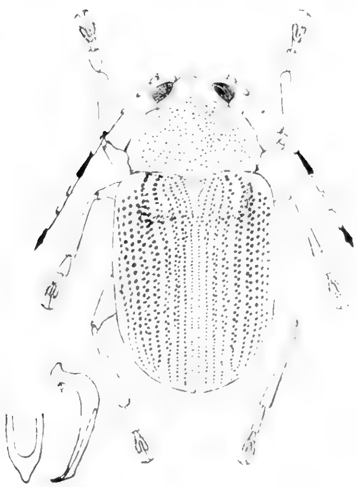
Type locality: San Carlos, Costa Rica, Schild and Burgdorf collectors.

This species has the dark reddish-brown coloration of *C. fulvotestacea* Lef., but differs from it in that the elytra are not so long proportionately as in *fulvotestacea* and are more coarsely punctate. The aedeagus is much shorter than in the other 2 species.

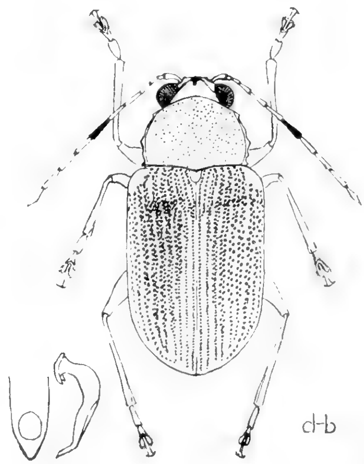
1 Colaspis fulvotestacea Lefevre Type



2. Colaspis leiosomata new species



3. Colaspis ostmarki new species



4. Colaspis cacaoi new species

Colaspis ostmarki, n. sp.
fig. 3

From 5.5–8 mm in length, elongate oval, shining yellowish brown with deeper brown prothorax, prothorax moderately finely punctate and with undulate margin, elytra with coarser punctures, mostly in geminate rows, except near apex and margin where they become single, basal transverse depression on elytra below umbone, in female vestiges of costae along sides and at apex, females much larger than males.

Head with interocular space approximately ½ width of head, occiput and front sometimes entirely smooth, without punctures, sometimes densely and finely punctate, always a row of depressed punctures from eye to frontal tubercles, clypeus coarsely and densely punctate, anterior margin nearly straight over labrum, jaws deep brown. Antennae long and slender, yellow brown with 7th and terminal joint often dark. Prothorax not twice as wide as long, convex, with undulate margins sometimes verging on being angulate, surface shining and usually finely punctate, but sometimes more coarsely and densely punctate. Scutellum deep brown. Elytra more than twice as long as prothorax with transverse depression below basal umbones, in female with costae along sides and subcostate at apex, in male very little costate vestiges; punctation near suture and margin in single rows but between in geminate rows becoming single near apex, punctation of the same pattern as in costate species. Body beneath and legs yellowish brown, occasionally femora at apex slightly deeper brown. Length 5.5–8 mm; width 3–4.5 mm.

Type: male, and 31 paratypes, USNM Type No. 72430.

Type locality: Changuinola, Panama, collected by H. E. Ostmark, June 26, 1972 and C. A. Stephens, April 21, 1971, on bananas.

These beetles were found in great numbers feeding on bananas over 4,500 acres in Changuinola, northern Panama, near Almirante. They are closely related to *C. fulvotestacea* Lefèvre, described from Colombia, but are more coarsely punctate and yellowish brown instead of reddish brown, and the elytra are not so long. There is a great difference in the size of the sexes—the female being much larger than the male. The species is named after Dr. H. E. Ostmark who has been working on them extensively as a pest to bananas, and who has observed their life history and written it up.

Colaspis cacaoi, n. sp.
fig. 4

From 4.5–6 mm in length, elongate oval, shining yellowish brown with jaws, the 7th and last antennal joints dark, head nearly impunctate except on clypeus, prothorax finely punctate and with undulate margin; elytra with pronounced depression below basal umbones, feebly costate on sides, punctation in basal half more or less alternately geminate, towards apex in single rows.

Head with interocular space ½ width of head, occiput and front shining, smooth, often impunctate except for the line of depressed punctures from eye to tubercles, clypeus with coarse punctures, anterior margin of clypeus nearly straight over labrum, jaws large and dark. Antennae long and slender, with 7th and usually apical joint dark. Prothorax not twice as wide as long with undulate margins, surface shining, finely punctate. Scutellum pale brown. Elytra more than twice but not 3 times as long as prothorax, and wider, with pronounced transverse depression below basal umbones, lines of punctures irregularly alternate in basal half, becoming more or less single on sides and at apex, somewhat costate, more so in female specimens. Body beneath entirely pale yellow brown. Length 4.5–6 mm; width 2.4–3 mm.

Type: male, and 13 paratypes, USNM Type No. 72431.

Type locality: Waldeck, Costa Rica, collected by S. and C. H. Ballou, on *Theobroma cacao*, July 21, 1936 and Feb. 13, 1934.

This is the smallest of the *fulvotestacea* group, and the palest yellow brown without any trace of deeper coloring at the apex of the femora. The male specimens often have a trace of costa from humerus to apex, the female with more pronounced vestiges of costae. All the specimens have strong elytral punctation. The aedeagus has a wider, more rounded tip than the other 2 species.

DR. MARION RUSSELL SMITH, A BIBLIOGRAPHY

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ABSTRACT—A list of the 150 publications of Dr. Marion Russell Smith is presented, almost all of which are on the taxonomy of ants, Formicidae. A list of the new taxa proposed is given following the reference in which they appear.

Dr. Marion Russell Smith worked and published on ants during a period of 51 years, most of the time while employed by the Bureau of Entomology and later the Insect Identification and Parasite Introduction Research Branch of the U. S. Department of Agriculture, Washington. D. C., from which he retired in 1963. He is presently living at his home in Arlington, Virginia. Dr. Smith was employed as an ant specialist in 1921 by the Mississippi State Plant Board where his duties were to identify, map infestations, and direct control and eradication programs of the Argentine ant (*Iridomyrmex humilis* (Mayr)). During this time, he worked under the direction of the late R. W. Harned who encouraged him to work on other ants of Mississippi as well as those of other States. Through Mr. Harned's encouragement, Dr. Smith was guided into his very productive career as one of the leading ant specialists of the world.

An impressive number of publications was produced by Dr. Smith, and few reprints of his articles are still available. The following bibliography will serve as a guide to those who wish to acquaint themselves with Dr. Smith's work. The bibliography contains 150

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entries, mostly on the taxonomy of the Formicidae. Eighty-six new taxa were proposed by Dr. Smith, and these are listed, in parentheses, following the publications in which they appear. The first list are those publications for which Dr. Smith is the sole author, the second list are those which Dr. Smith co-authored.

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1922. Some ants noted to infest houses in Mississippi during the summer and fall of 1921. J. Econ. Entomol. 15:113–114.

1923. Two new varieties of ants. Entomol. News. 34:306–308. (*Camponotus caryae* var. *essigi*, n. var., *Aphaenogaster lamellidens* var. *nigripes*, n. var.)

——. Two new Mississippi ants of the subgenus *Colobopsis*. Psyche. 30:82–88. (*Colobopsis mississippiensis*, n. sp., *C. pylartes fraxinicola*, n. subsp.).

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——. An annotated list of the ants of Mississippi. Entomol. News. 35:47–54, 77–85, 121–127.

——. A new species of ant from Kansas. Entomol. News. 35:250–253. (*Pheidole hayesi*, n. sp.).

1927. The Argentine ant, an odorous species. J. Econ. Entomol. 20:646–647.

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THE MOUTHPARTS OF BRYOBIA RUBRIOCULUS (SCH.) (ACARINA: TETRANYCHIDAE)

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ABSTRACT—The morphology of the stylophore and pedipalps of the spider mite, *Bryobia rubrioculus* (Sch), is described from conventional stained sections and from electron microscope photographs. The study demonstrates new structures on the tip of the rostrum and the manner in which stylophore and rostrum fit together. The arrangement of these mouthparts suggests that the stylets form a hollow probe through which food may be ingested.

The mechanism of feeding by spider mites is imperfectly understood at present and we have only indirect or inferential knowledge about how the mouthparts operate, i.e., whether probing and ingestion occur concomitantly or alternately. Several bits of information to be presented here seem to favor the first hypothesis, *viz.*, that spider mites ingest through their exserted cheliceral stylets.

Much of the internal anatomy of spider mites has been described by Thor (1904), Becker (1935), and Blauvelt (1960) for *Tetranychus* and by Ehara (1960) for *Bryobia eharai* Pritchard & Keifer. We have studied the morphology of the oral appendages of 1 of the larger spider mites, *Bryobia rubrioculus* (Sch.), with the hope that such information may provide a better insight into how feeding occurs. Included here are several photomicrographs of *Panonychus ulmi* (K.) which demonstrate features not photographed for *Bryobia.*

METHODS

The *Bryobia* mites were prepared for study in 4 ways. Whole, live specimens were mounted on slides in several fluids: water, methyl cellulose, glycerine, vegetable oil, and Hoyer's fluid. The thickness of the rostral skeleton and reddish pigment in the soft tissues greatly limited the usefulness of these mounts for the tracing of internal ducts and channels with conventional microscopy. More useful were serial sections of mites embedded in paraffin and subsequently stained with Delafield's haematoxylin and alcoholic eosin. Large numbers of mites were beaten from almond shoots onto sheets of paper, and the dust and debris eliminated by lifting and inverting the paper so that only the living mites remained attached to its under-side. The paper was then loosely rolled into a closed tube which was positioned vertically and thumped to drop the mites into flat dishes of tissue fixative.

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Two fixatives were regularly used for paraffin sections: Carnoy-Lebrun's fluid and Bouin's alcohol mixture.

The mites prepared for examination with a scanning electron microscope (SEM) were fixed in ethanol, critical-point dried, and then coated. The specimen having its stylets protruding was fixed in the act of feeding by flooding the host leaf with boiling ethanol and later cutting the leaf so as to free the mouthparts. Other specimens were fixed in glutaraldehyde and sectioned for study with a transmission electron microscope (TEM).

We are especially indebted to 3 colleagues who volunteered their technical services for preparing material and operating the electron microscopes: to Mssrs. M. G. Kinsey and R. O. Schuster for operating the SEM and Mr. E. J. Houk for operating the TEM. The SEM photographs were made in the Facility For Advanced Instrumentation and the TEM study was done with instruments in the Department of Botany, University of California, Davis.

Skeletal Parts

Stylophore: The cheliceral stylets of *Bryobia rubrioculus* originate in the anterodorsal portion of the stylophore. The proximal or basal segment of each stylet comprises a spatulate sclerite, the *lever*, which is deeply folded or U-shaped in cross section. The lever is much longer than wide and bears the attachments of the protractor muscle fibers on its upper, anteriormost expansion (Becker, 1935). Its mid-section is suspended between mesal and lateral walls of the stylophore. When at rest, the lever lies with its long axis almost parallel with that of the stylophore itself. It is articulated behind with the *shaft* of the stylet proper. The lever is suspended between two knobby apodemes on which it pivots. The inner apodeme is a thick process developed on the median vertical septum of the stylophore, 1 process on each side of the septum (fig. 6). The outer apodeme of each side is a thickened portion of the exterior wall of the stylophore.

The shaft of each stylet extends backward a short distance and then loops down and turns forward so that its sharp tip projects from the apical end of the stylophore. The loop lies close beside the sigmoid piece whereas the lever anchors far forward (fig. 11).

The mechanism of forward thrust by the reverse-curved stylets appears to require that the lever be pulled backward on short ligamentous tethers before it begins to swivel and add impetus to stylet protraction. The initial rearward displacement of the lever before it begins to pivot is a conjecture, however, because we have not directly observed how the stylar thrust is accomplished.

A SEM photograph of the stylophore of *Panonychus ulmi* (Koch) shows that the stylets emerge from the stylophore at the apices of paired stylar lobules which underlie the projecting fixed digits (fig. 18). The outer cuticle intucks to form an internal *stylar sheath*, an enwrapment for individual stylets. In *Tetranychus urticae* the sidewalls of the sheath form a spacious bursa which accommodates the entire shaft, including its loop. The sheath in *Bryobia rubrioculus* fits very snugly around the shaft and appears as a membranous ligature spanning the diameter of the loop (figs. 7 and 11).

In *B. rubrioculus* the shaft of a stylet measures approximately 2.5μ across its wide diameter in the region of the loop. The convex surface of each stylet faces the rostral gutter where its shaft straightens out of the loop to extend apically. Sections photographed with a TEM demonstrate that the stylets are hollow and that, within the separate stylar channels, their convexities are mesal. Figure 20 demonstrates unmistakably that the shafts are provided with a tongue and groove slide arrangement, a ridge or tenon on 1 and a linear groove on the other member of the pair. In the protruded position the stylets are probably juxtaposed to form a hollow probe (fig. 19).

The keel-like inferior surface of the stylophore fits into a V-shaped trough, the *rostral gutter*, on the upper midline of the basis capituli (fig. 6). The gutter has elevated lips which lie appressed to the keel of the stylophore and constitute a bearing against which it slides. The pair of fixed digits projecting from the stylophore are also wedge-shaped in cross section to conform to the shape of the gutter (fig. 5). The fitting together of these parts is illustrated in an SEM photograph of *Panonychus ulmi* (fig. 15). Beneath the fixed digits and along the more distal portion of the rostrum the stylets lie free within right

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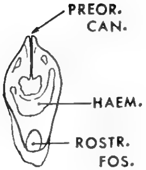
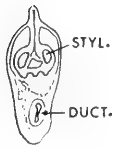
All drawings and photographs represent *Bryobia rubrioculus* unless otherwise stated. Scale indices = 0.05 mm, each applicable only to nearest figure.

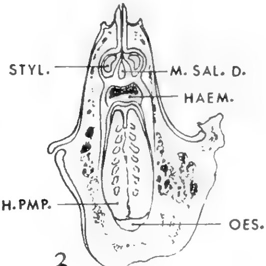
Fig. 1–6, *Bryobia rubrioculus*. Fig. 1. Frontal section cut somewhat obliquely through tip of beak. This cut includes ventral surface of beak and external aperture of rostral fossette. Fig. 2. Same section as fig. 1 but with optical focus on opposite face of the section cut 7 microns thick. Internal ductule of rostral fossette is illustrated. Fig. 3. Second 7-micron section of same specimen from which fig. 1 was drawn. Section contains upper or tissue side of pharyngeal pump piston with its numerous apodemes by which muscles insert in its concave surface. Haemocoele between pharyngeal pump and median salivary duct locates approximate internal end of fossette ductule shown in fig. 2. Fig. 4. Third 7-micron section of same specimen illustrated on fig. 1. This cuts obliquely through femur of pedipalps. Fig. 5. Portion of cross section to illustrate fitting of tips of fixed digits into rostral gutter. Fig. 6. Cross section through mouthpart near anterior tip of stylophore with its median suture (see also fig. 18) showing as an open cleft. Side by side shafts of forwardly directed stylets are pressed deep into rostral gutter close behind point of origin of stylar lobules on stylophore. Dilator muscle fibers of pharyngeal pump occupy midregion of rostrum.


PREOR.
CAN.
HAEM.
ROSTR.
FOS.

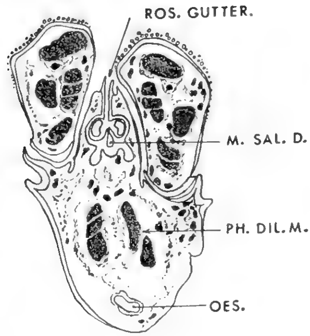
1


STYL.
DUCT.

2


STYL.
M. SAL. D.
HAEM.
PH. PMP.
OES.

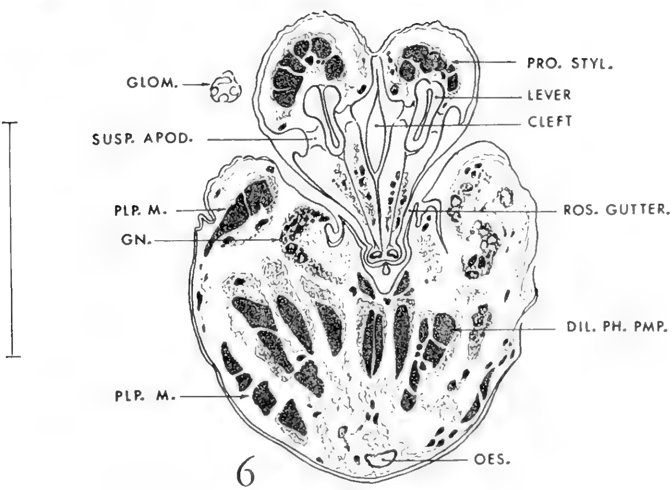
3


ROS. GUTTER.
M. SAL. D.
PH. DIL. M.
OES.

4


F. DIGIT

5


GLOM.
PRO. STYL.
LEVER
CLEFT
SUSP. APOD.
PLP. M.
ROS. GUTTER.
GN.
DIL. PH. PMP.
PLP. M.
OES.

6

and left channels developed deep within the rostral gutter. Near the tip of the beak the margins of the gutter are not appreciably elevated; the lips press together to cover the stylar channels but they do not fuse. The limit of travel of the stylophore in the rostral gutter is not known. We believe that the body of the stylophore slips back and forth over only a part of the length of the rostrum because the stylar channels are separated and partly covered near the tip of the beak.

Rostrum: Longitudinal sections of the rostrum indicate that this mouthpart comprises a fleshy basis capituli within which the pharyngeal dilator and pedipalp muscles originate. The apex of the rostrum is fashioned into a rigid, slender beak (fig. 3 and 12).

An anterior view of a highly magnified beak of *B. rubrioculus* reveals several novel anatomical details. The apex of the beak is blunt or cupuliform and surrounded by projecting adoral sensilla. The slit-like fissure of the rostral gutter continues forward over the dorsal rim of the beak to divide the front curtain—the *velum*—into two lateral flaps. The stylets thrust through a widened part of the slit. Three pairs of squamate sensilla border the convex tip. The dorsalmost are nearly setiform; the lateral and ventral ones are wide-based lappets. One crossrow of 6 dentiform sensilla guards the ventral lip of the aperture in the velum (fig. 13). The dorsal lips of this aperture show 4 similar dentiform sensilla, 2 on each side of the vertical fissure. The groups of oppositely placed dentiform sensilla possibly interdigitate when the stylets are fully retracted.

There is an open pore on the midventral aspect of the beak of *B. rubrioculus*. Until its internal connections are convincingly established, we propose to call this aperture the *rostral fossette*. In lyophilized whole mounts (fig. 14) and in conventionally stained microtome sections the opening stands agape but the fossette continues internally as a constricted ductule. The latter ascends through the very thick skeleton of the beak to the vicinity of the confluence of the pre-oral channel and the lumen of the pharynx. The ductule comes to lie very close to the membranous front wall of the pharyngeal pump. Materials now available provide no further enlightenment about the internal connections of this problematic structure.

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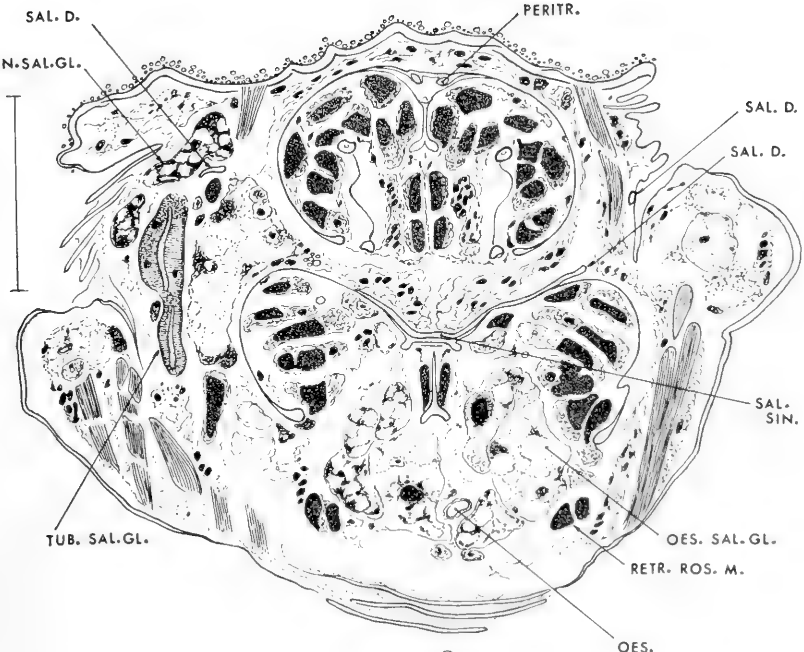
Fig. 7, 8. *Bryobia rubrioculus*. Fig. 7. Center portion of fig. 8 drawn slightly larger and at deeper focus to show where pair of minute ducts joins principal ducts of tubular glands. Very large cells illustrated in both drawings tentatively identified as elements of posterior esophageal glands of Thor. Fig. 8. Cross section through propodosoma at level of coxae I, with skeletal shells of both stylophore and rostrum open below. Several segments of duct of tubular salivary gland are identifiable in this 10-micron thick section.


PRO. STYL.
STYL. SH.
SEPT. RETR. STYLOPH.
SMALL DUCT
NON-FIB. MYOPL.
OES. SAL. GL.

7


SAL. D.
REN.SAL.GL.
PERITR.
SAL. D.
SAL. D.
SAL. SIN.
TUB. SAL.GL.
OES. SAL.GL.
RETR. ROS. M.
OES.

8

The median silk duct of the species which Blauvelt (1945) called *Tetranychus telarius* L. is a groove which traverses the length of a thickened rib in the bottom midline of the rostral gutter. An anatomically similar duct occurs in *Bryobia rubrioculus.* However, the second species is not known to produce silk. The cuticular fold between the cheliceral and the pedipalpal appendages forms a sinus into which the paired ducts of the tubular salivary glands flow. The supportive rod becomes the grooved duct leading forward from the salivary sinus; this rod is continuous with an *aliform apodeme* in the haemocoele behind the salivary sinus. The apodeme anchors the oblique retractor muscles of the stylophore; it is also the basal expansion of the sigmoid piece—remnant of the median septum—through which the main tracheal trunks descend.

The uppermost margins of the median salivary duct are closed over, at least for part of its length, by longitudinal folds appended to a *bifid process* positioned below and partly embedded in the fixed digits (fig. 20). The interleaved folds are believed to form a sliding seal.

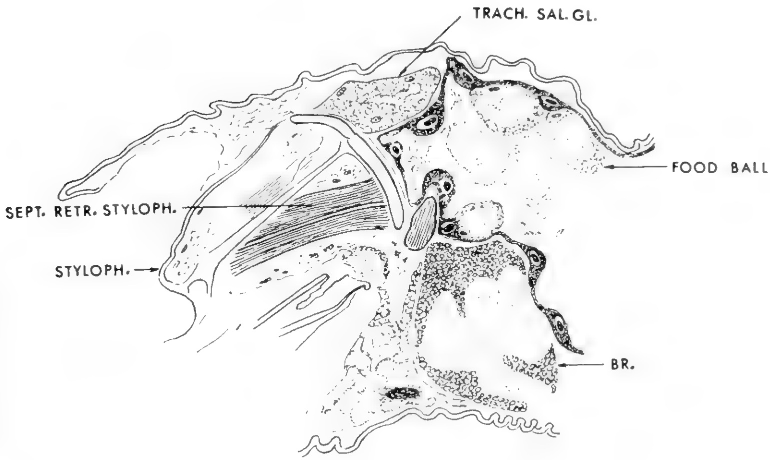
The median salivary duct and the flanking stylar channels blend into a common pre-oral canal close behind the apical velum. We believe that it is in this heavily sclerotized part of the beak that the shafts of the 2 stylets are pressed together and interlocked during protraction. The point of stylet interlock during protraction—or divarication during retraction—lies close to the aperture of the pharynx. Valvular flaps appear to be present within this area of the ingressive zone but their structure and operation are not yet understood.

Salivary Glands

The several glands associated with the mouthparts of *B. rubrioculus* have not been described before. This study provides only limited information about them because cytological and histochemical techniques of greater delicacy than employed here will be required.

There are at least 3 sets of salivary glands which correspond to structures identified in *Tetranychus* by Blauvelt (1945). Convoluted tubular glands of 1 pair lie in the pleuroventral region of the podosoma. This pair of glands corresponds anatomically to the tubular silk glands of *Tetranychus.* The secretory cells of the gland on each side give way to a thin-walled duct, the podocephalic canal (Grandjean, 1938), in the vicinity of coxa I. The duct becomes subcuticular in the pleural region above this coxa, then arches over the basal part of the pedipalpal coxa and turns mesad to enter the *salivary sinus.* The mergence of right and left ducts with this sinus is illustrated in figure 8.

Another pair of glands underlie the sigmoid piece, in front of the brain and beneath the great muscles of the pharyngeal pump. Each gland comprises a few very large vacuolated cells, the texture of the



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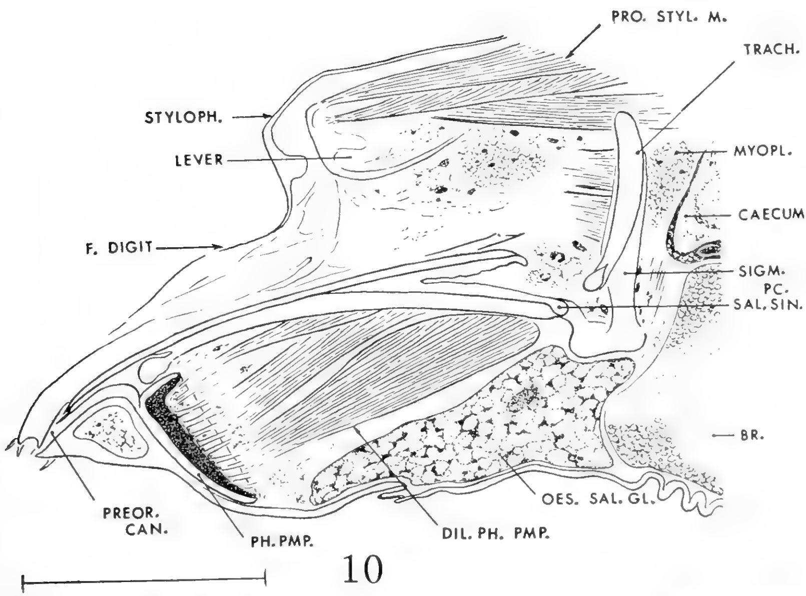

10

Fig. 9, 10. *Bryobia rubrioculus.* Fig. 9. Parasagittal section to show placement of unpaired tracheal salivary gland behind descending tracheal trunks and partly enveloped by gastric caecum. Fig. 10. Sagittal section (slightly tilted) through gnathosoma.

vacuolization depending upon the vagaries of fixation. These paired clusters of cells (fig. 8 and 10) correspond in position to the fat body described for *Tetranychus* by Blauvelt and possibly are the posterior oesophageal glands mentioned by Thor (1904). It is possible that the 2 small ducts identified in figure 7 connect these gland cells with the ducts of the tubular glands close to the salivary sinus. Their distal connections with gland cells have not been traced; the ducts are very minute, about 1μ in diameter, and are approximately the caliber of nearby tracheoles. This pair of ducts probably corresponds to the median branches of the podocephalic canal as illustrated in *Cheyletus* by Summers and Witt (1971).

Reniform salivary glands are located between the eyes and the posterior lobes of the stylophore (fig. 8). The groups of cells comprising this pair of glands are less voluminous than in *Tetranychus urticae*. The ducts of these glands have not been identified in *B. rubrioculus*.

An unpaired tracheal salivary gland (Thor, 1904) lies beneath the dorsal integument of the propodosoma and is wedged between the vertical trunks of the tracheae and the lobes of the gastric caeca (fig. 9). Blauvelt traced the duct of this gland to the bases of the stylets of *Tetranychus* but we have not been able to do so for *B. rubrioculus*.

Two pairs of very small, compact cell masses are situated close to the base of the beak. One pair is larger than the other. The bodies of the larger pair are almost globular in shape and are positioned below the union of palp femur with the basis capituli. Strands of similar cells, 1 strand per side, pass forward from the globular bodies into the slender part of the beak, dorsal and lateral to the skeleton of the pharyngeal pump. The strands transform into an ill-defined or loosely organized reticulum in the vicinity of the rostral fossette. The bodies of the second pair of small organs are fusiform and lie above and external to the larger bodies. Both pairs of these organs (fig. 12) are believed to be ganglia, not glands as we first supposed.

The characteristic reddish-amber color of this brown mite, especially evident in the mouthparts and legs, is attributable to dispersed grains of red pigment. Some of the grains may be incorporated in the hypodermis but others occur in great numbers and almost uniformly

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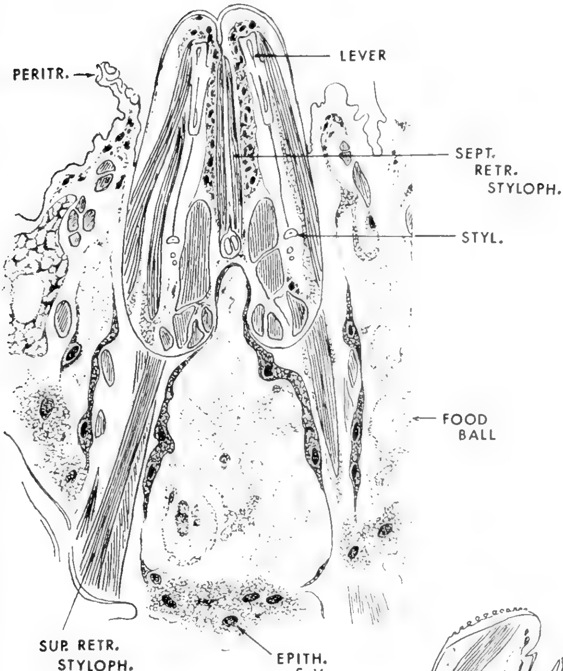
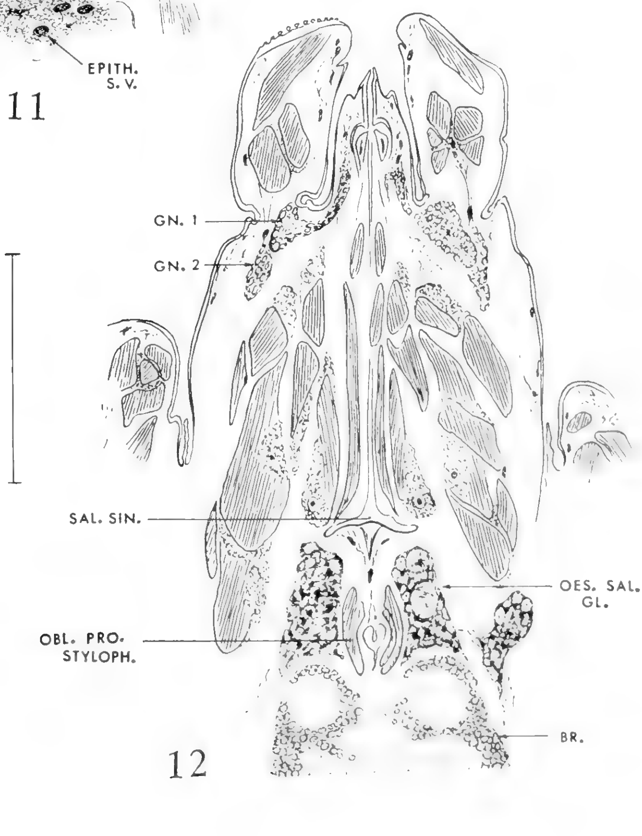
Fig. 11, 12. *Bryobia rubrioculus*. Fig. 11. Frontal section through propodosoma and stylophore. Median lobe of gastric caecum pushes small appendage between paired stylet protractor muscle fibers. Superior and inferior stylophore retractor muscle fibers almost complete on left side. Squamous epithelium of gastric caeca show as sections and also in surface view (s.v.). Fig. 12. Frontal section through gnathosoma. Tip of beak projects between femora of pedipalps. Two pairs of peripheral ganglia illustrated.


PERITR.
LEVER
SEPT.
RETR.
STYLOPH.
STYL.
FOOD
BALL
SUP. RETR.
STYLOPH.
EPITH.
S. V.

11


GN. 1
GN. 2
SAL. SIN.
OES. SAL.
GL.
OBL. PRO.
STYLOPH.
BR.

12

dispersed within deep-lying tissues. There is a noticeable increase in numbers of the red granules in the immediate vicinity of the brain.

Muscles

Ten or 11 pairs of fibers originate fanwise around the posterior rim of the stylophore shell (fig. 8). They converge to insert on the anteriormost expansion of the stylar levers (fig. 6). These fibers function as protractors of the stylets. They appear to have no antagonists and it is supposed that elasticity and tension developed in the loop suffice to restore the stylets to their resting position.

The forward thrust of the stylophore is accomplished by 3 pairs of robust fibers, the *oblique protractors*, stretching between the aliform apodemes of the sigmoid piece and the inner, posterior rim of the stylophore shell. These muscles straddle the descending tracheal trunks (fig. 12). The angle of repose for these muscles is uncertain because preserved specimens show the stylophore variously positioned within the midrange of its travel. No other stylophore protractors have been identified.

The stylophore bears 2 sets of retractor fibers. One set, the *septal retractor* muscles comprises 2 pairs of parallel, straplike fibers which lie close beside its median vertical septum (figs. 7 and 11). These fibers originate far anteriorly on the median septum and insert, 1 pair above the other, on the skeletal support of the descending tracheal trunks (dorsoventral trunks of Blauvelt). Another group of paired fibers arises on the propodosomal cuticle, on or close to the weakly defined humeral sulcus. There are 3 substantial fibers per side, only 2 of which act directly on the stylophore. The uppermost fiber passes

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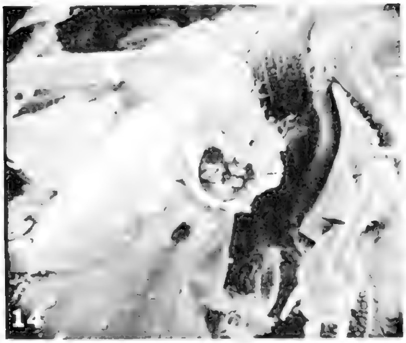
Fig. 13, 14, 17. *Bryobia rubrioculus.* Fig. 15, 16, 18, 19. *Panonychus ulmi.* Fig. 13. SEM photomicrograph of pedipalps and beak of *B. rubrioculus* (×2240). Velum partly agape and 6 dentiform sensilla prominently displayed. Rostral fossette located near bottom line of picture. Fig. 14. SEM photo of beak of another specimen of *B. rubrioculus* (×1175). Velum obscured by foreign matter whereas rostral fossette, dorsal fissure of rostral gutter, and setiform adoral sensilla clearly demonstrated. Fig. 15. SEM photo of *Panonychus ulmi,* dorsal view of mouthparts (×560). Domed tip of stylophore positioned at bottom of picture and pointed fixed digits nestle within outfolded lips of rostral gutter. Paired condition of fixed digits evident only near their pointed tips. Fig. 16. Another specimen of *P. ulmi,* with shafts of stylets lifted out of open rostral gutter (SEM ×700). Fig. 17. Similar preparation of *B. rubrioculus* (SEM ×700). Paired condition of fixed digits is obvious. Fig. 18. Especially good profile of lifted stylophore of *P. ulmi* (SEM ×950). Stylar lobules beneath fixed digits and emergence of stylet shafts clearly revealed. Note also median sulcus of stylophore. Fig. 19. Lateral view of mouthparts (upper left) of *P. ulmi,* with protruding stylets stuck together (SEM ×590).


13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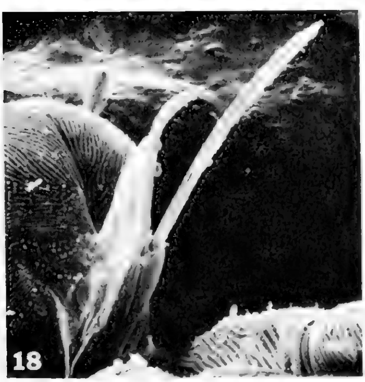
16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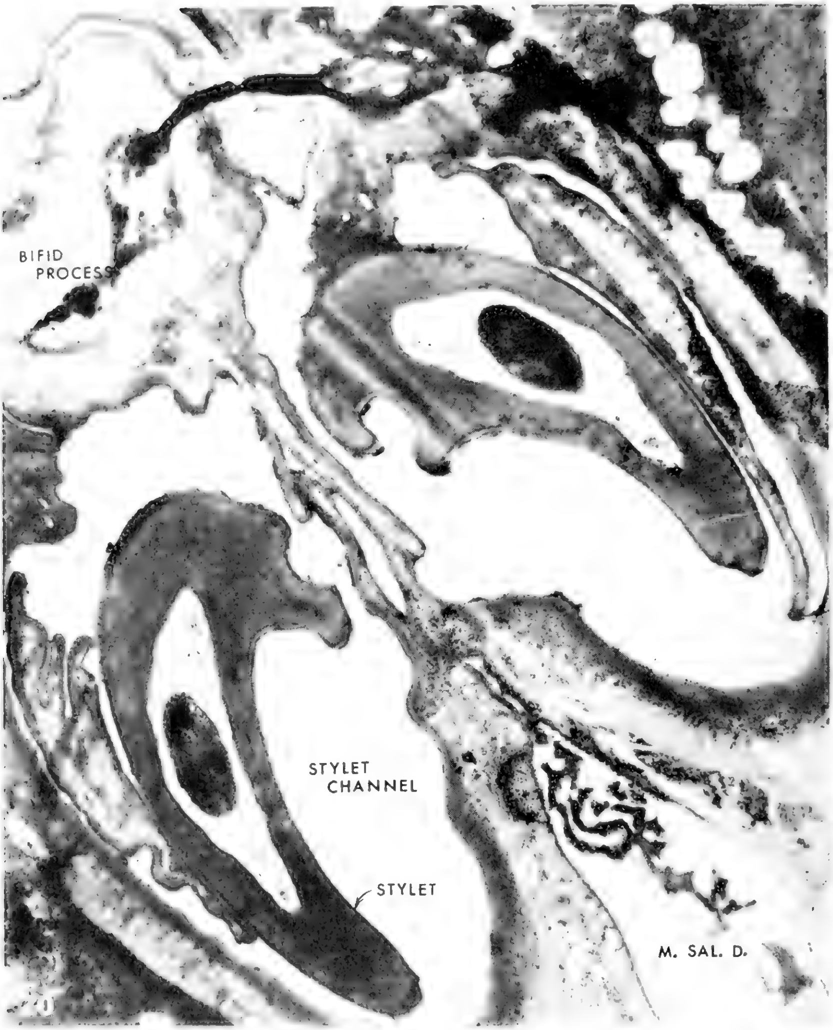

Fig. 20. TEM photograph of *B. rubrioculus*. Represents oblique section through rostrum below fixed digits of stylophore. Bifid process partly embedded within fixed digits shown (×16,000).

forward to attach high on the posterolateral rim of the stylophore shell and is here named the *superior retractor* of the stylophore (fig. 11). The fiber situated immediately beneath the superior retractor courses slightly downward to insert on the posterior rim of the stylophore, considerably below the anchorage of the superior fiber. This muscle fiber is called the *inferior retractor*. The deepest of the 3 fibers passes obliquely down and forward to insert on the thickened posterolateral lip of the rostral skeleton. Fibers of this pair retract the rostrum. The dorsal retractors of the rostrum possibly also abduct this mouthpart so that the beak moves towards the substrate. These 3 pairs of muscle fibers are homologues of the muscles labeled dorsoventrals 10, 9, and 8 respectively by Blauvelt.

A cluster of muscle fibers which insert on the piston of the pharyngeal pump are the dilators of this suctorial organ (fig. 10). Seven or more fibers per side originate fanwise on the posterodorsal skeletal pillars of the rostrum. They converge to insert on the piston by a series of about 11 pairs of slender apodemata. The latter appear V-shaped in frontal sections of the mite. Antagonists of the dilators have not been identified.

Discussion

In the light of current fragmentary knowledge about how spider mites feed, it is possible only to present available evidence favoring the notion that they feed through probing stylets. The stylets of *B. rubrioculus* have an interlock and sufficient mesal convexity to form a food tube. The punctures in the epicuticle of the upper epidermis of almond leaves are minute and elliptical, very few punctures sparsely distributed relative to numbers of palisade cells sucked empty (Summers and Stocking, 1972). The smallness and symmetry of each perforation in the leaf surface leads us to suppose that the interlocked stylets are not completely withdrawn and reinserted numerous times through the same hole. The better hypothesis is that the stylets form a feeding tube through which disrupted cell material is drawn as it churns up and down or is re-directed to thrust into nearby, new leaf cells, all without being completely withdrawn.

The most obvious structure of the feeding mechanism is the pharyngeal pump. The amount of dilator muscle presupposes that the force of the suctorial draft is considerable, sufficient to evacuate fluids and cell wreckage from deep-lying palisade leaf cells.

There is also a complex salivary system which requires much more study in *Bryobia* and other genera of spider mites. We have not identified a special salivary pump or syringe to assist with the outflow of glandular secretions. The structural relations of the paired salivary ducts to the median sinus, and the continuity of the sinus with the longitudinal salivary duct indicate that at least some of the secretions are expelled through the preoral channel and, possibly, the protracted stylets.

The various glands associated with the mouthparts may not be continuously secreting organs; the flow during intermittent secretory phases may provide sufficient force for excretion. Motions of the muscles or sclerites of the mouthparts may also compress the salivary sinus to assist in the outflow.

Abbreviations

bifid pr.—bifid process

br.—brain

dil. ph. pmp.—dilator muscles of pharyngeal pump

duct.—ductule of rostral fossette

f. digit—fixed digit (spina) of chelicera

glom.—glomerular lobe of peritreme

gn.—peripheral ganglion

haem.—haemocoele

m. sal. d.—median salivary duct

myopl.—non-fibrillar myoplasm, i.e., the coagulated protoplasm exclusive of the striated fibrillae

obl. pro. styloph.—oblique protractor muscle of stylophore

oes.—oesophagus

oes. sal. gl.—oesophageal salivary gland

peritr.—peritreme; the superficial canal which terminates in a projecting lobe or glomerulus

ph. dil.—pharyngeal dilator muscle comprised of numerous separated muscle fibers

ph. pmp.—pharyngeal pump

plp. m.—muscle of pedipalp

preor. canal—preoral canal

pro. styl.—protractor muscle of stylet

ren. sal. gl.—reniform salivary gland

retr. ros. m.—retractor muscle of rostrum (VI of Blauvelt)

rostr. fos.—rostral fossette

ros. gutter—rostral gutter

sal. d.—salivary duct

sal. sin.—salivary sinus

sept. retr. styloph.—septal retractor muscle of stylophore

sigm. pc.—sigmoid piece, the remnant of the vertical septum formed by the union of right and left chelicerae

styl.—stylet, or moveable digit of chelicera

styl. sh.—sheath membrane enclosing stylet

styloph.—stylophore or mandibular plate of classical literature

susp. apod.—suspensory apodeme

trach.—descending limb of tracheal system which connects peritreme with distributing tracheae

trach. sal. gl.—tracheal (or azygos) salivary gland

tub. sal. gl.—tubular salivary gland

Scale indices in figures = 0.05 mm, each applicable only to nearest figure

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THREE NEW SPECIES OF CULEX SUBGENUS CULICIOMYIA THEOBALD FROM SOUTHEAST ASIA AND A REDESCRIPTION OF THE TYPE OF C. TRICUSPIS EDWARDS FROM ALOR, LESSER SUNDA ISLANDS, INDONESIA

(DIPTERA: CULICIDAE)[1]

SUNTHORN SIRIVANAKARN, *Southeast Asia Mosquito Project, Smithsonian Institution, Washington, D.C. 20560*

ABSTRACT—The 3 new species of *Culex* (*Culiciomyia*) described and illustrated in this paper are: **lampangensis** from Thailand, **delfinadoae** from the Philippines, and **ramalingami** from West Malaysia (Malaya). The redescription of *C. tricuspis* is based on the holotype male from Alor, Lesser Sunda Islands, Indonesia.

During a preliminary study of specimens of *Culex* which accumulated at the Southeast Asia Mosquito Project during 1968–1971, 3 new species of *Culiciomyia* Theobald were discovered, but the descriptions presented herein have long been postponed because of a plan to include them with other species in a single revision. However, as such as extensive work has not been carried on, it appears appropriate to describe these species now so that they can be recognized and identified in the field by fellow workers who have been collaborating with the Project in collecting and sending specimens from various parts of Southeast Asia. As these species exhibit a great deal of morphological differentation from other known members of *Culiciomyia* the descriptions given below will, accordingly draw attention to certain taxonomic characters for consideration in a future attempt to characterize the subgenus as well as to develop a scheme of internal classification within the subgenus. In addition to the descriptions of 3 new species, *C. tricuspis* Edwards (which has been removed from *Neoculex* Dyar to *Culiciomyia* (Sirivanakarn, 1971)) is redescribed for comparative purposes and for clarification of its identity, affinity, and taxonomic status.

The descriptions of the news species are based on specimens collected by the U.S. Army Medical Component, SEATO Laboratory in Thailand, by M. D. Delfinado and the Noona Dan Expedition in the Philippines, and by S. Ramalingam's team of collectors in West Malaysia. The redescription of *C. tricuspis* from Alor, Lesser Sunda Islands, Indonesia, is based on a single type male at the British Museum (N.H.).

[1] This work was supported by Research Contact No. DA 49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D.C.

All designated holotypes and allotypes will be deposited in the U.S. National Museum (USNM), Washington, D.C. The paratypes and other identified specimens will be placed for future reference in the Southeast Asia Mosquito Project (SEAMP), Smithsonian Institution.

The format and terminology used in the descriptions and illustrations follow the preceding papers on *Culex* by Bram (1967), Sirivanakarn (1972), and others in the series of publications by the Southeast Asia Mosquito Project. In facilitating identification, a taxonomic discussion summarizing the best diagnostic features and the means for separating the species from other previously known forms is provided.

Culex (*Culiciomyia*) *lampangensis* n. sp

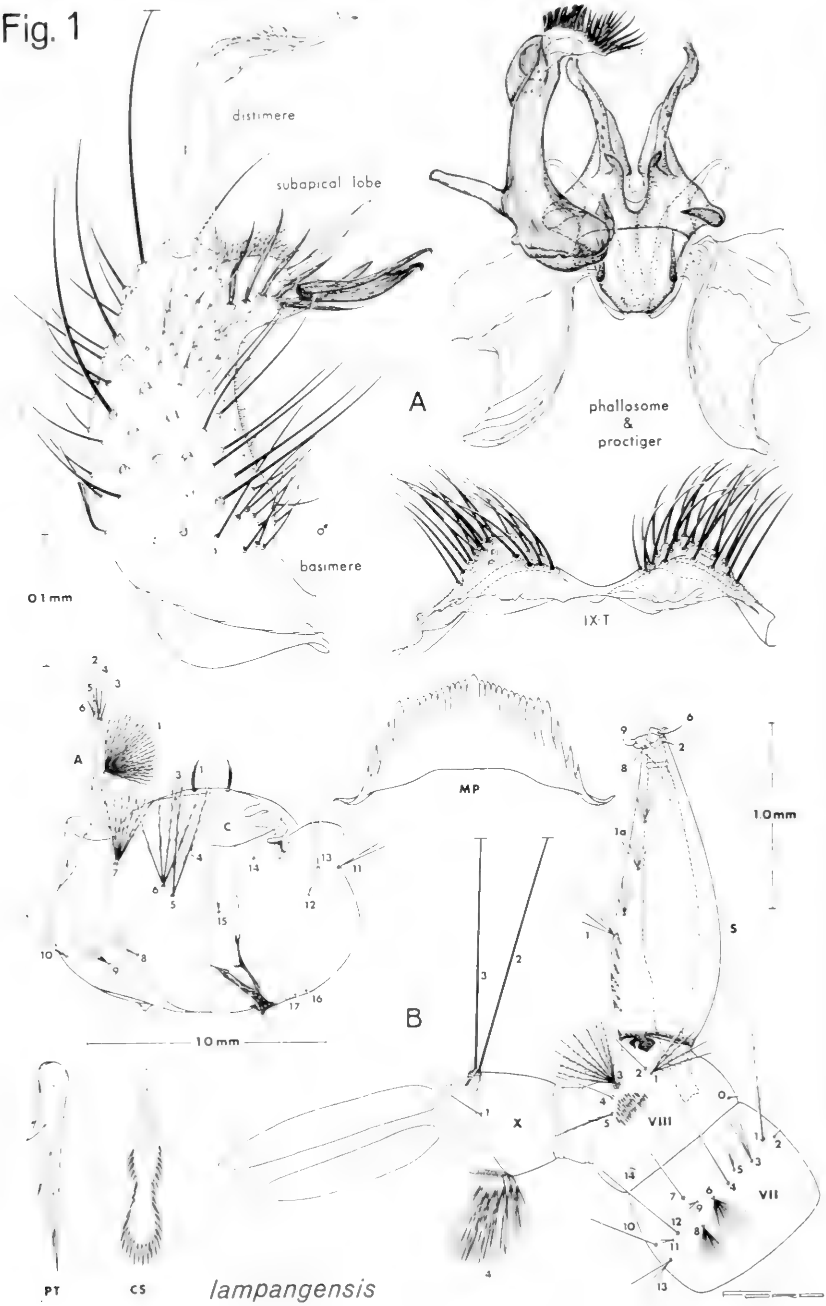
fig. 1A, ♂ terminalia; 1B, larva

Female: Wing 4.0–4.5 mm, fore femur 2.1–2.3 mm, proboscis 2.3–2.5 mm, abdomen 3.0–3.5 mm. Medium to large in size, general facies resembling *C. pallidothorax* as described and figured by Bram (1967:137–143; 144). *Head.* Decumbent scales on dorsum of vertex narrow and pale yellowish, coarser and darker on lateral and posterolateral areas; scales on both sides of eyes broad, forming distinct lateral white patches; erect scales numerous, dark to black, sometimes slightly pale towards apices; palpus and proboscis dark scaled; proboscis with 4–6 dark labial basal setae, 2 lateral ones longest, about as long as palpus. *Thorax.* Scutum and scutellum dark greenish; scutal scales dark, numerous and very dense, all narrow and fine, producing a smooth appearance; pleuron same color as scutum, without definite dark band or spot on upper half; 1 or 2 lower mesepimeral bristles present; scales practically absent. *Legs* and *Wings.* Without marked coloration. *Abdomen.* Terga II–VII with pale basal bands; sterna pale yellowish scaled.

Male: In general as described in female. *Head.* Palpus longer than proboscis by the length of terminal segment; palpal segment 3 with ventral lateral row of 8–10 transparent scales; segments 4, 5 strongly plumose; proboscis with submedian false joint and median ventral tuft of 10 long and dark setae; antennal flagellum strongly plumose. *Terminalia* (fig. 1A). Very similar to *pallidothorax* and *papuensis*, differing strikingly in the following features; tergal lobe of segment IX large and prominent with 20 or more very strong setae; subapical lobe of basimere elongate; number of strong setae on distal division fewer than in the 2 species mentioned; leaflet absent; sternal apical spiculose lobe reduced or poorly developed; lateral plate of phallosome with 1 large inner basal denticle and a series of very weak denticles towards apex, latter sometimes not developed or absent; basal sternal process of proctiger slender and long, as in *papuensis*, but longer than in *pallidothorax*.

Pupa: Abdomen 3.2 mm, paddle 0.8 mm, trumpet 0.58 mm, index about 5. Extremely similar to *pallidothorax* and *papuensis* as figured by Bram (1967: 146, 152), differing in the combination of following chaetotaxy. *Cephalothorax.* Hair 8-C usually triple (2–4); 9-C single or double. *Abdomen.* Hairs 7-I-II usually double (2–3); 5-IV 3–4 branched (2–4).

Fig. 1



lampangensis

Larva: (Fig. 1B). Head 1.0 mm, siphon 1.7 mm, saddle 0.5 mm. Extremely similar to *pallidothorax* and *papuensis* as described and figured by Bram (1967: 148, 154), differing from both as follows: *Head.* Hair 1-C flat, dark, spiniform and usually with lateral barb of fine spicules, sometimes divided into 2 distal spines; hair 5-C double; 6-C usually triple (3–4). *Thorax.* Hair 1-P triple; 2-P single; 3-P double; 7,8-P triple. *Abdomen.* Ventral brush (hair 4-X) of saddle consisting of 5–6 pairs of hairs.

Type Data. Holotype, male (01888-8) with associated pupal and larval skins and slide of terminalia (69/795), Ban Pha Daeng, Lampang, THAILAND, elevation 500 meters, pool in dry streambed, 31 March 1967, K. Mongkolpanya (USNM). Allotype, female (01888-1) with associated pupal and larval skins, same data as holotype (USNM). Paratypes, 9 males (01888-2,3,4,5,6,9,10,11,15) with associated pupal and larval skins, 3 females (01888-7,13,14) with associated pupal and larval skins, same data as holo- and allotypes (SEAMP).

Distribution: Material examined: 243 adults (121 males, 122 females), 71 individual rearings (21 pupal, 50 larval), 69 whole larvae. THAILAND. Chiang Mai, Doi Sutep; 2 males (terminalia only). Nan, Pha Daeng Khawi; 2 males, 2 lp. Lampang, Ngao, Ban Pha Daeng; 117 males, 122 females, 47 lp, 21 p, 69L.

Taxonomic Discussion: *C. lampangensis* is extremely similar to *pallidothorax* Theobald and *papuensis* (Taylor) in all stages and apparently falls into a complex with these 2 species. The adults are generally separated from *pallidothorax* by the absence of dark band or spots on the upper part of the pleura and from *papuensis* by the presence of basal transverse white bands on the abdominal terga. The male terminalia are most diagnostic and are readily distinguished from the other 2 species by (1) a larger and more prominent tergal lobe of segment IX; (2) more strong setae on the tergal lobe; (3) fewer setae and smaller sternal apical spiculose lobe on the distal part of the subapical lobe and (4) fewer and considerably weaker denticles on the distal tergal surface of lateral plate of the phallosome. The pupa is not clearly distinguished from *pallidothorax* or *papuensis* except for the combination of diagnostic hair branches as indicated in the above description. The larva resembles the other 2 species in most features of the chaetotaxy and in the shape of the siphon and appears to show a great deal of overlap with *papuensis*. It can, however, be recognized by the dark, flat, spinelike head hair 1-C and by the presence of 5–6 pairs of hairs in ventral brush of the saddle (4 pairs in *pallidothorax* and usually 4 pairs in *papuensis*).

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Fig. 1. *Culex* (*Culiciomyia*) *lampangensis* n. sp. A, male terminalia: basimere and distimere; phallosome and proctiger; IX-T, lobes of ninth tergum. B, fourth instar larva: head; MP, mental plate; PT, pecten tooth; CS, comb scale; terminal segments.

Biology: *C. lampangensis* is fairly common in the locality where it was found and appears to be restricted to a high elevation in the northern part of Thailand. Most of the adults were obtained from rearing the larvae or pupae collected in ground pools in a dry stream-bed or along a stream margin under heavy shade of forest.

Culex (*Culiciomyia*) ***tricuspis*** Edwards
fig. 2A, ♂ terminalia

Culex ***trifidus*** Edwards 1926, Bull. Entomol. Res. 17:108 (♂). Rejected as a junior homonym of *C.* (*Melanoconion*) ***trifidus*** Dyar 1921 by Edwards (1930).

Culex ***tricuspis*** Edwards 1930, Bull. Entomol. Res. 21:294. New name for *C.* ***trifidus*** Edwards (1926).

Culex (*Neoculex*) ***tricuspis***, Edwards 1932, in Wytsman Genera Insect. 194:194 (taxonomy); Mattingly and Marks 1955, Proc. Linn. Soc. New South Wales, 80:163 (♂*).

Culex (*Culiciomyia*) ***tricuspis***, Sirivanakarn 1971, Contrib. Amer. Entomol. Inst. 7:62–85 (taxonomy).

Female: Unknown.

Male: Wing 3.3 mm, fore femur 2.1 mm, proboscis 2.6 mm. In general similar to most forms of *Culiciomyia* except for the following. *Head.* Decumbent scales on dorsum of vertex predominantly broad and pale; erect scales moderately dense, all dark; palpus exceeding proboscis length by nearly the full length of segment 5, segment 2 thick, swollen at middle, segment 3 without ventral lateral row of transparent scales, segments 4 and 5 very weakly plumose; proboscis without submedian false joint, median ventral tuft of setae absent. *Thorax.* Scutum and scutellum light brown; pleuron same color as scutum, scales practically absent, 1 lower mesepimeral bristle present. *Legs* and *wings.* Without marked coloration. *Abdomen.* Terga II-VII with narrow pale apical bands; sterna entirely pale. *Terminalia* (fig. 2A). Basimere abnormally large, basal half swollen, distal half narrow, 5 scales present; subapical lobe strongly modified, with elongate stemlike proximal and distal divisions, projecting mesad; stem of proximal division with broad truncate apex, bearing a close-set row of dark and flat spicules, dorsal surface of main stem with 2 dark strongly curved rods distad, 2 dark stout distally curved rods and 2–3 strong flattened setae basad; stem of distal division shorter and smaller than proximal one, with 1 stout club-shaped leaf and 1 blade on its apex; distimere divided into 2 arms, dorsal arm bears tiny ventral seta and similar seta dorsally just beyond middle and slender claw subapically, dorsal subapical crest of spines absent; ventral arm with oblique truncate apex and perpendicular process projecting dorsad; phallosome vaselike, similar to most forms of *Culiciomyia*; lateral plate with strong basal denticle, distal tergal surface entirely bare; proctiger with large crown consisting of close-set row of flat and blunt spicules laterally and profuse tuft of filaments internally, the latter projecting from both crowns and meshed together in the middle; lateral paraproct well

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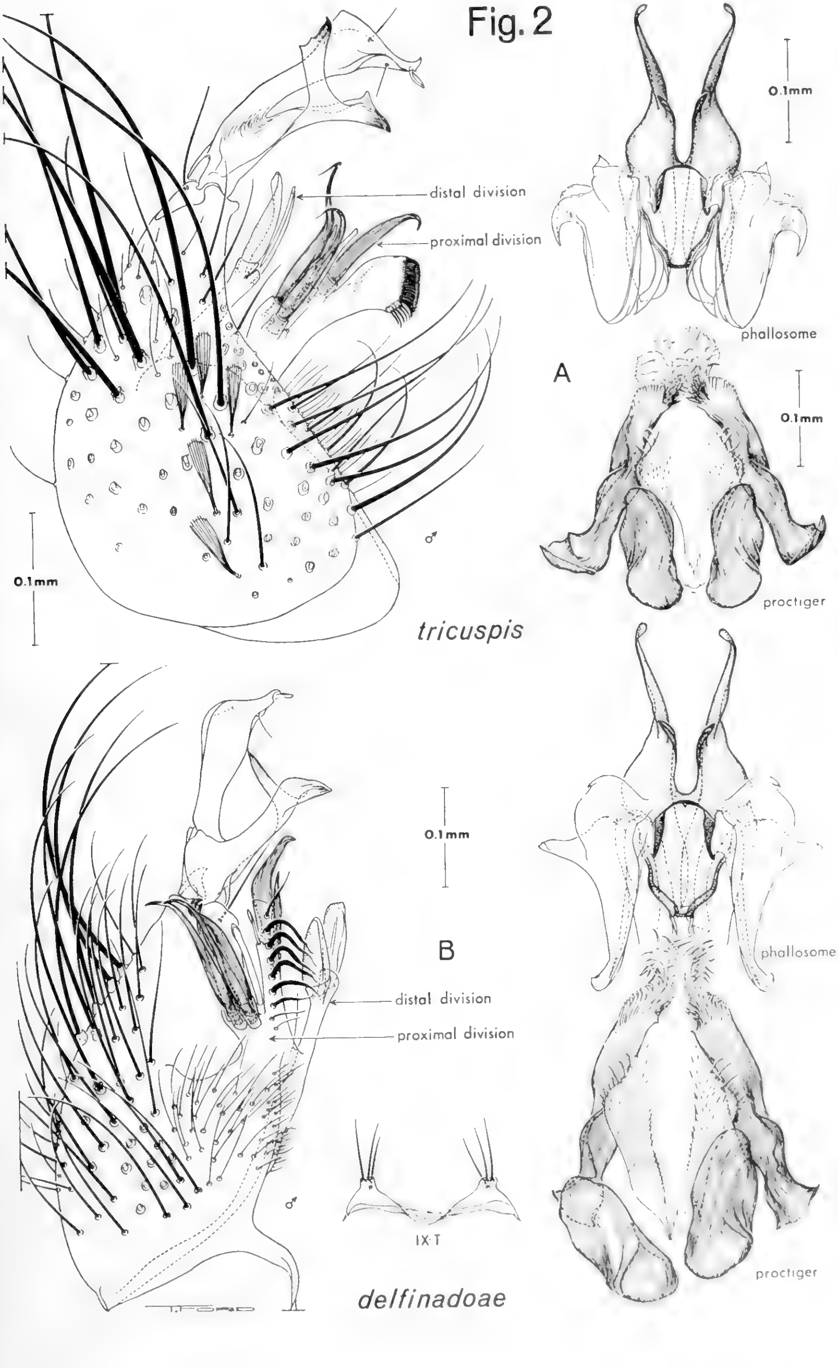
Fig. 2. Male terminalia. A, *Culex* (*Culiciomyia*) *tricuspis* Edwards, basimere and distimere; phallosome; proctiger. B, *Culex* (*Culiciomyia*) *delfinadoae* n. sp., basimere and distimere; phallosome; proctiger; IX-T, lobes of ninth tergum.

Fig. 2


distal division
proximal division
0.1mm
phallosome
A
0.1mm
proctiger
0.1mm
♂
tricuspis
0.1mm
B
distal division
proximal division
phallosome
IX-T
proctiger
♂
T. FORD
delfinadoae

sclerotized, basal sternal process absent; cercal sclerite membranous, with a large patch of strong spicules in center, 3–4 minute cercal setae.

Pupa and Larva: Unknown.

Type Data: Holotype, male (10.046), Alor, Lesser Sunda Islands, INDONESIA, January 1926, Dr. Rodenwaldt; deposited in the British Museum (N.H.).

Distribution: Known only from the type locality.

Taxonomic Discussion: *C. tricuspis* was previously assigned to the subgenus *Neoculex* by Edwards (1932) on the basis of the absence of transparent scales in the distal part of palpal segment 3 and the presence of pale apical bands on the abdominal terga. This was later followed by Mattingly and Marks (1955) who interpreted it to be an annectant between *Culiciomyia* and *Neoculex*. However, for the same reasons as given by Edwards, they were justified in retaining it with the latter subgenus. In the current study (Sirivanakarn, 1971), I re-examined the type and transferred this species to *Culiciomyia*. On the basis of detailed comparative morphology, particularly the type of the male phallosome, I am quite convinced that this is correct and that it indicates a more accurate affinity for this species than in the previous treatments.

C. tricuspis as described here is generally very similar to most forms of *Culiciomyia* but differs in the complete absence of a ventral lateral row of transparent scales on male palpal segment 3 and in the absence of a ventral tuft of setae in the middle of labium. The male terminalia are strikingly different from any other known form of *Culiciomyia* in the spectacular modifications of the subapical lobe of the basimere, distimere, and proctiger. The phallosome is similar to all other *Culiciomyia* except for the absence of denticles on the distal tergal surface of the lateral plate. It shows the closest affinity with *delfinadoae* n. sp. described below, and with the latter it apparently forms a distinct group within the subgenus *Culiciomyia*.

Biology: Nothing is known about its biology.

Culex (*Culiciomyia*) *delfinadoae* n. sp.

fig. 2B, ♂ Terminalia

Female: Wing 3.8 mm, fore femur 2.3 mm, proboscis 2.3 mm. In general similar to *C. tricuspis*, differing from it as follows: *Head.* Decumbent scales on dorsum of vertex narrower, occupying a broader area in center. *Abdomen.* Terga II-VII entirely dark or sometimes with indistinct pale apical bands on terga III-VII.

Male: Extremely similar to *C. tricuspis* in general and in the absence of a ventral lateral row of transparent scales in the distal half of palpal segment 3, differing as follows: *Head.* Palpus longer, exceeding proboscis by little more than the length of segment 5; segment 2 uniformly slender, middle part not swollen. *Terminalia* (fig 2B). Extremely similar to *tricuspis*, differing chiefly in the following: basimere apparently without scales; proximal division of subapical lobe with slender elongate stem bearing on its apex 2 dark, stout rods and row of 5–8 kinked setae extending from base to near apex, its base with cluster of 4 dark stout rods and 1 bladelike seta; distal division with slender stem bearing 2 equal club-shaped leaves apically; distimere furcates as in *tricuspis*, dorsal arm (sometimes appearing to be ventral) more or less uniformly thick from point of furcation to about 0.75 of length, distal 0.25 abruptly tapered to pointed apex, 1 tiny ventral and a similar dorsal seta present subapically; ventral arm (sometimes appearing to be dorsal) terminates in sharp point apically, with perpendicular process ending in acute angle; phallosome and proctiger essentially similar to *tricuspis* in most details; apical part of lateral plate of phallosome usually entirely bare, sometimes with a few extremely weak denticles.

Pupa and Larva: Unknown.

Type Data: Holotype, male with terminalia slide (69/601), Tawi Tawi, Sanga Island, PHILIPPINES, crabhole, April 1967, M. D. Delfinado (USNM). Allotype, female (USNM) and paratypes (13 males and 1 female), same locality and data as holotype (SEAMP). This species is named in honor of Dr. M. D. Delfinado, former taxonomist at the Southeast Asia Mosquito Project, who collected the specimens of this species.

Distribution: Material examined: 15 males, 2 females. PHILIPPINES, Palawan, Balabac, Dalawan Bay; 1 male with terminalia slide (SEAMP 66-657), 9 Oct 61, Noona Dan Expedition. Sanga Sanga Island, Tawi Tawi; 14 males, 2 females, as indicated in the type data.

Taxonomic Discussion: *C. delfinadoae* is very closely related to *tricuspis*. It is distinguished from the latter species by the details of the subapical lobe of the basimere and by a few other features as given above. As in *tricuspis*, it is similar to other forms of *Culiciomyia* in the type of the male phallosome and in several external features, but is strongly differentiated in several features of the basimere, distimere, and proctiger as described and illustrated.

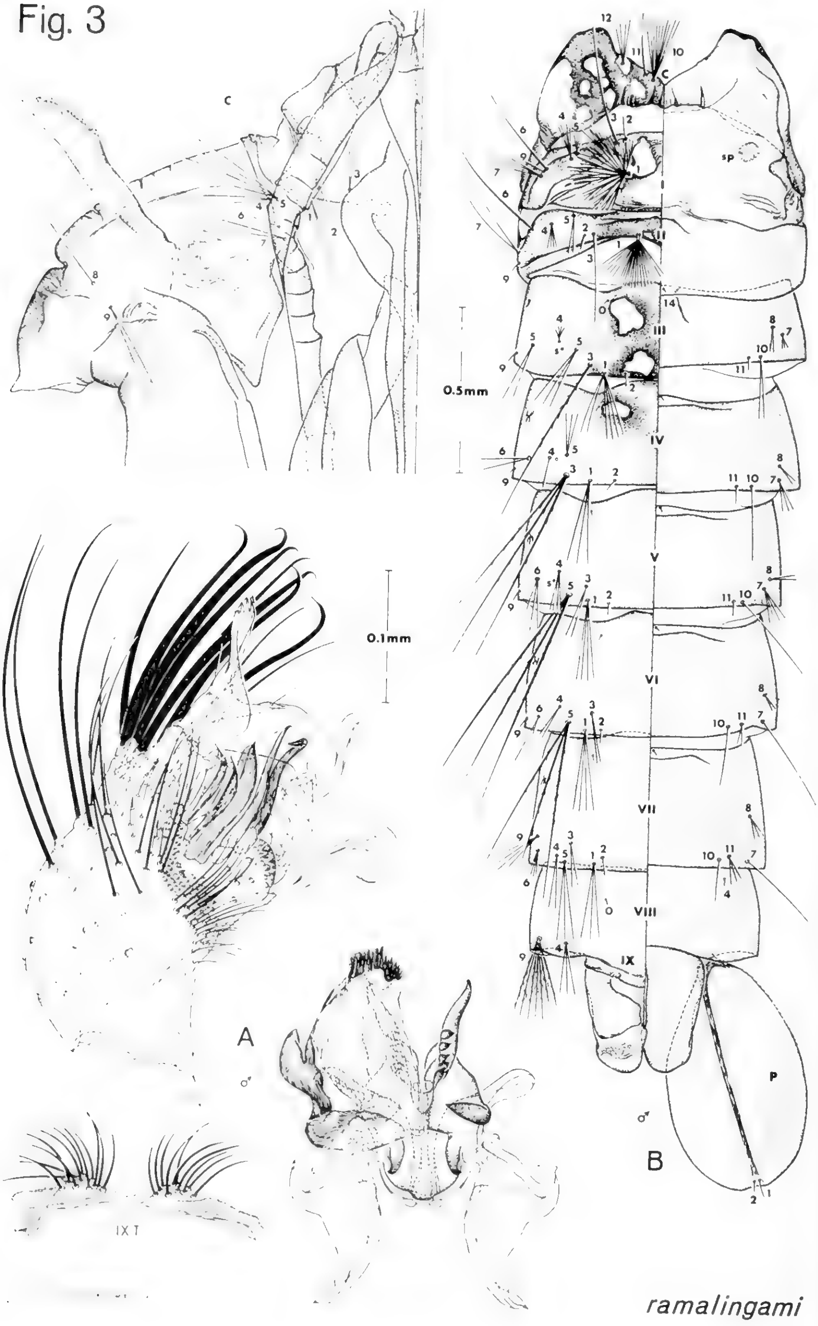
Biology: The adults of this species were collected from 2 localities in the Philippines and those from the type locality were reported to be collected from a crabhole, suggesting that it may breed in this habitat. Nothing more is known about its biology.

Culex (*Culiciomyia*) *ramalingami* n. sp.

fig. 3A, ♂ Terminalia; 3B, Pupa; 4, Larva

Female: Wing 3.0 mm, fore femur 1.6 mm, proboscis 1.9 mm. Small to medium sized, brownish species; in general similar to most forms of *Culiciomyia*; differing chiefly in the following. *Thorax.* Scutum, scutellum and pleuron dark brown; scutal scales narrow, dark, rather sparse, more or less resembling *Lophoceraomyia* species. *Abdomen.* Terga very dark to black scaled dorsally, slightly

Fig. 3



ramalingami

pale laterally, terga V-VII sometimes with lateral pale scaling extending dorsad; sterna entirely pale scaled.

Male: In general similar to female; differs from other *Culiciomyia* species in the following. *Head.* Distal half of palpal segment 3 with ventral lateral row of about 8 shorter transparent scales; proboscis slender, submedian false joint absent, median ventral tuft of setae absent. *Terminalia* (fig. 3A). Strongly modified; basimere abnormally large, broad oval, with prominent tuft of about 10 very long, flattened golden brown bristles towards apex laterally; all setae covering lateral tergal surface strong, bristlelike; subapical lobe as detailed in figure; distimere odd-shaped, with bifurcation as figured; phallosome and proctiger essentially similar to most forms of *Culiciomyia*; lateral plate with 1 large inner basal denticle, followed distally by row of 5 smaller denticles; paraproct of proctiger with short basal sternal process; cercal sclerite well sclerotized; 1 or 2 cercal setae.

Pupa: (fig. 3B). Abdomen 2.7 mm, paddle 0.76 mm, trumpet 0.7 mm. Differing from most forms of *Culiciomyia* in the following. Trumpet lightly to strongly swollen at middle, basal and distal parts narrowed. *Cephalothorax.* Integument of metanotum with striking pattern of dark sclerotized areas and pale unsclerotized spots; hair 1-C strong, double; 5-C strong, 5-8b. *Abdomen.* Segments I-IV dark, each with pair of clear, unsclerotized spots along dorsal midline; other segments without such spots; hairs 5-IV-VI dark and long, double or triple; 6-IV-VI usually double (2–3). *Paddle.* Pale, distal external margin indistinct; apical hairs 1, 2-P minute; male genital lobe large, about 0.5 of paddle length.

Larva: (fig. 4). Head 0.78 mm, siphon 1.3 mm, index 9–10, saddle 0.26 mm, siphon/saddle ratio about 5. In general resembling most forms of *Culiciomyia*, with the following distinctive features: *Head.* Antenna short, about 0.5 of length of head; head hair 1-C apparently flat, simple or sometimes with lateral barb of fine spicules; hairs 5,6-C with 5–6 pectinate branches; 7-C strongly plumose, 10–12b. *Thorax.* Spiculation not developed; hairs 1,2-P equally long, single; 3-P slightly shorter than 1,2-P, 3–5b; 7-P 3b; 8-P usually double (1–2); 1-M,T very strong, single or double. *Abdomen.* Segments II–VI with distinct patches of fine spicules on ventral surface; all hairs strong; about 30 comb scales, all with fringe of fine spicules; siphon slender and long, distally tapering; 15–20 pecten teeth; 8 strong siphonal tufts, arranged in 4 regular pairs, each tuft 4–6b, most proximal one 3–4 times as long as siphon width at point of attachment, the rest gradually shorter. *Anal segment.* Dorsal subapical margin of saddle moderately spiculated; hair 1-X strong, about 2 times as long as saddle; ventral brush (4-X) with 4 pairs of hairs; anal papillae slender, distally tapering, about 2 times as long as saddle.

Type Data: Holotype, male (814-28) with associated pupal and larval skins and slide of terminalia, leaf axil of a plant, elevation sea level, 8 mi. north of Tanjong, Tualang, Perak, WEST MALAYSIA,

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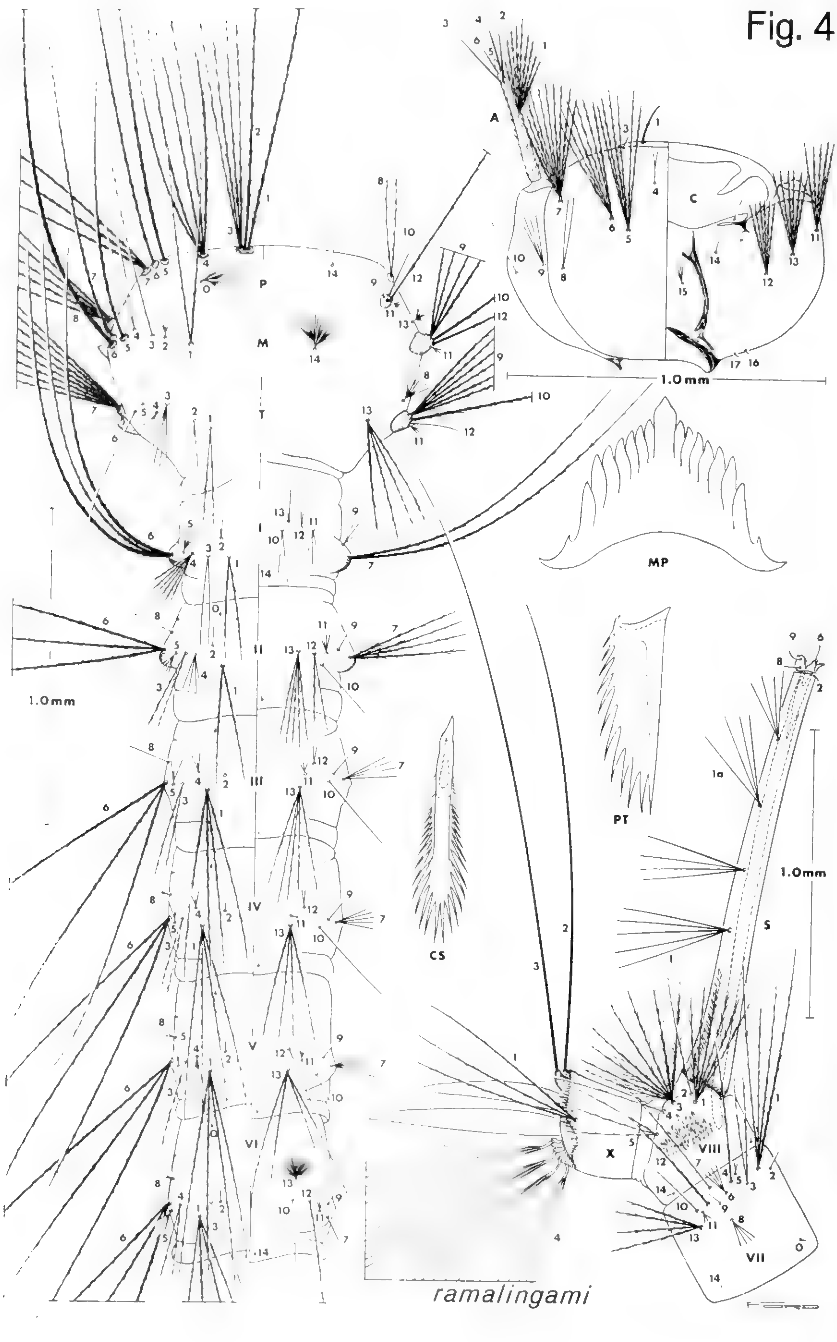
Fig. 3. *Culex* (*Culiciomyia*) *ramalingami* n. sp. A, male terminalia: basimere and distimere; phallosome and proctiger; IX-T, lobes of ninth tergum. B, pupa: cephalothorax, dorsal view; metanotum and abdomen, dorsal view.

Fig. 4



ramalingami

19 October 1967, S. Ramalingam's team of collectors, Univ. Malaysia, Kuala Lumpur (USNM). Allotype, female (814-33) with associated pupal and larval skins, same data as holotype (USNM). Paratypes, 5 males (814-11,14,18,22,27) with associated pupal and larval skins and terminalia slides; 6 males (814-13,15,17,21,24,30) with associated pupal and larval skins; 7 females (814-10,12,16,19,20,23,25) with associated pupal and larval skins; 1 female (814-102) with associated pupal skin, same data as holotype (SEAMP). This species is named in honor of Dr. S. Ramalingam, Dept. Parasitology, Univ. Malaysia who provided the specimens for study.

Distribution: Material examined: 12 males, 9 females, 21 individual rearings (1 pupal, 20 larval), 6 whole larvae, all from Perak, WEST MALAYSIA, as indicated in the type data.

Taxonomic Discussion: This is one of the most distinct forms of *Culiciomyia* and can be easily recognized by the unique male terminalia and by several features of the pupa and larva. The female and general adult features are apparently quite similar to *Lophoceraomyia* Theobald but can be readily distinguished from most members of this subgenus in the female by lateral pale scaling of the abdominal terga and in the male by the features of the palpus and antenna. The unique male terminalia shows spectacular modification in several features of basimere and distimere but resembles most *Culiciomyia* species in the type of phallosome and proctiger. The pupa, unlike other *Culiciomyia* species, is most distinct in coloration pattern and in the presence of unsclerotized clear spots on the metanotum and abdominal segments I–IV. The larva is superficially similar to *C. fragilis* Ludlow and *bailyi* Barraud as described and figured by Bram (1967), but is clearly distinguished from them by several features of the chaetotaxy and siphon as described and illustrated.

Biology: All specimens of *ramalingami* in the type series were collected from leaf axils of a plant at the height of about 1 meter above the ground in open swamp at sea level. The adult biology is practically unknown.

Acknowledgments

I am indebted to Dr. Botha de Meillon, Principal Investigator of the Southeast Asia Mosquito Project for reviewing the manuscript and for suggesting some improvements. I also wish to thank Dr. Peter F. Mattingly for the loan of the type of *C. tricuspis* at the British Museum (N.H.), and Miss Thelma Ford at the Southeast Asia Mosquito Project for preparing the illustration.

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Fig. 4. *Culex* (*Culiciomyia*) *ramalingami* n. sp., fourth instar larva. Head; thorax and abdomen; terminal segment; CS, comb scale; PT, pecten tooth; MP, mental plate.

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DEEP PINNING BOTTOMS FOR FRESHLY PINNED SPECIMENS

When insect specimens are pinned, either fresh in the field or in the laboratory from relaxed specimens, there is often need to prop up legs or abdomens until they are dry, to keep them from hanging down too far. This is sometimes done with pins and sometimes by running a rectangle of stiff paper or light cardboard up on to the pin to hold up the sagging members. The advent of very soft pinning bottoms made of plastic foam has made a much easier method possible. Boxes, trays, or pinning boards with especially thick pinning bottoms can be used. If there are sagging parts on some specimens to be supported, the pins of those specimens can be pushed deeper into the pinning material until the parts are held up at the proper level.

Plastic foam for pinning bottoms is usually ⅜ inch (9.5 mm) thick. Two layers rather than one should be used for boxes receiving freshly pinned specimens, the total depth thus being increased to ¾ inch (19 mm). This is deep enough to support sagging legs, antennae, or abdomens while they are drying, if the pins are pushed in deep. The foam is soft enough to insert pins easily to the full depth and to withdraw them easily when specimens are ready for removal. It would be possible, also, with a triple-thick bottom, to push pins in deep enough to hold Hemiptera and Coleoptera horizontal on point mounts until the glue dries, keeping them from tipping or from pulling off at the points.

Henry Townes, *American Entomological Institute, 5950 Warren Road, Ann Arbor, Michigan 48105.*

NOMENCLATORIAL NOTES ON THE TACHYINI
(COLEOPTERA: CARABIDAE)

The purpose of this note is to provide a synonymical list for the species *Tachys vittiger* LeConte, in order that H. Reichardt of São Paulo, Brazil, can use the name in his carabid fauna of the Galapagos Islands. *Tachys vittiger* LeConte (1851, Ann. Lyc. Nat. Hist. New York, 5:193) equals *Tachys beebei* Mutchler (1924, Zoologica, 5(20):223) NEW SYNONYMY, equals *Tachys ensenadae* Mutchler (1934, Am. Mus. Novitates, No. 686:3) NEW SYNONYMY. Further statements on this species will be made in my forthcoming revision of the genus.

TERRY L. ERWIN, *Department of Entomology, Smithsonian Institution, Washington, D. C. 20560.*

A NEW RECORD OF AEDES (STEGOMYIA) ALCASIDI HUANG
(DIPTERA: CULICIDAE)[1]

The receipt of additional material in SEAMP now allows me to report the presence of *Aedes (Stegomyia) alcasidi* Huang in Sabah, East Malaysia. Previously it was only known from the Philippines as far south as Palawan, Sulu Archipelago, and Kepulauan Sangi. This southern extension into Sabah is of some importance to biologists and epidemiologists because of the ease with which it can be confused with *Aedes (Stegomyia) scutellaris* (Walker).

Aedes (Stegomyia) alcasidi Huang

Aedes (Stegomyia) scutellaris (Walker), Knight & Hull 1952, Pacif. Sci. 6(2): 180. (♂*, ♀, L) (misidentification).

Aedes (Stegomyia) alcasidi Huang 1972, Contrib. Amer. Ent. Inst. 9(1):37. (♂*, ♀*, P*, L*).

Distribution: 117 specimens examined: 27 ♂, 28 ♀, 10♂ terminalia, 26 individual rearings (26 l, 26 p).

MALAYSIA. East Malaysia: Sabah—Kota Belud (IV-1970, Ramalingam's team), 4 ♂, 4 ♀, 1 ♂ terminalia, 2 individual rearings (2 l, 2 p). Pulau Banggi (V-1970, Ramalingam's team), 19 ♂, 22 ♀, 7 ♂ terminalia, 23 individual rearings (23 l, 23 p). Kudat (V-1970, Ramalingam's team), 4 ♂, 2 ♀, 2 ♂ terminalia, 1 individual rearing (1 l, 1 p).

Biology: The immature stages of *alcasidi* were collected in rock pools, tree holes, in a bamboo stump, coconut spathe, and areca-nut spathe in Sabah. The immature stages were associated with *Aedes (Stegomyia) paullusi* Stone & Farner.

YIAU-MIN HUANG, *Southeast Asia Mosquito Project, Department of Entomology, Smithsonian Institution, Washington, D. C. 20560.*

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[1] This work was supported by Research Contract No. DA-49-193-MD-2672 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Wahington, D. C.

SOCIETY MEETINGS

793rd Regular Meeting—January 6, 1972

The 793rd regular meeting of the Entomological Society of Washington was called to order by President Curtis W. Sabrosky on January 6, 1972 in Room 43, USNM. Thirty-seven members and 13 guests were in attendance. The December minutes were read and approved.

Membership Chairman Rainwater presented 3 names for membership: Mike Hastriter of Provo, Utah; Terry L. Erwin of Ent. Dept., Smithsonian; and André Larochelle of Bourget College, Quebec, Canada.

The first note of the evening was by M. D. Leonard who read portions of an article from the Oakland Tribune concerning P. H. Timberlake, uncle of President Richard Nixon. The article mentioned the taxonomic endeavors of Timberlake. Ted Bissell added a personal story of a meeting he had with Timberlake in Hawaii.

Frank Campbell reported that Dwight Delong had suffered a fractured pelvis but was apparently only slightly slowed down. President Sabrosky informed the members of the death of C. M. Packard, a past member.

The first half of the program was the address of Past President Edson J. Hambleton. He spoke about "Studies on the Mealy bug genus *Rhizoecus*." He related how he became interested in mealy bugs in Brazil and discussed their morphology, biology, and the taxonomic status of the genus *Rhizoecus*. A number of taxonomic characteristics were illustrated.

The film, "Insects vs Alligator Weed," concluded the program. Jack Coulson of USDA, IIPI Branch introduced the film. After viewing, he answered several questions relating to the very excellent film.

The meeting was adjourned at 9:45 P.M. Refreshments were served.

DEWEY M. CARON, *Recording Secretary.*

794th Regular Meeting—February 3, 1972

The 794th Regular Meeting of the Entomological Society of Washington was called to order by President Curtis W. Sabrosky on a rainy February 3, 1972 in Room 43, USNM. Thirty-four members and 18 guests were in attendance. The January minutes were read and approved.

Membership Chairman Rainwater presented 2 names for membership: Robert G. Bellinger an undergraduate Entomology major at University of Maryland and Elwood R. Hart of the Entomology Dept., Texas A. & M. University.

President-Elect Burditt reported that plans are underway for the ESW-ISW June banquet. Tentatively, it will be June 1 at the National 4-H Center on Connecticut Avenue.

The first note of the evening was by Mrs. Robert Snodgrass. She read excerpts of a letter from McGraw Hill Book Publishers asking her permission to use the text of Snodgrass "Principles of Insect Morphology" in a reprint program that is designed to lower the cost of text books to non-U. S. and Canadian students and to help combat piracy of popular texts. She displayed a copy of such a volume.

Louise Russell reported on 12 unusual aphid specimens that represent a new North American record of a rare European species. The specimens came from a student at the University of Tennessee who is operating pit-fall traps on a grassy bald, Roan Mtn., Tennessee. Reference to the Grassy Bald collection site lead to a number of comments from members regarding this unusual habitat.

President Sabrosky reported receiving a letter from Mrs. A. L. Melander. She indicated that at 93 she was enjoying good health and was active.

Dr. Sabrosky announced the passing of two well known Dipterists, C. H. Curran and W. R. Thompson.

President Sabrosky introduced the main speaker for the evening Dr. Terry L. Erwin of the Department of Entomology, Smithsonian Institution.

Carabid Beetles, Mountain Tops, and Trees

The common name "Predaceous ground beetles" is a misnomer! Not only are many Carabidae omnivorous, scavengers, or vegetarians (seeds), but fully ⅓ or more of the tropical species live on trees, foliage, or at least off the ground. I propose the common name be regarded as (the sometimes now used) "carabid beetles." It is apparent that certain characteristics of member species are widespread within faunal elements. Generally, species of mountain tops share similar character states (e.g. dark color, loss of flight, compact bodies) even though the species are unrelated, and even though the mountains may be on different sides of the world. The same can be seen in arboreal elements (e.g. large eyes, padded tarsi, elongate lateral setae of the elytra) and subepigean elements (e.g. small eyes, pale colors, asymmetric anterior tarsi of males). Some of these infrataxa character states within faunal elements are obviously selected by the environment through species energy conservation (e.g. small eyes in lightless subepigean microhabitats, wing loss on mountain tops) while others have no apparent relationships. It should be possible to characterize faunas by "shared character states" and then predict habitats for "apparently" rare species known from only old specimens with poor data. The only realistic way to study these character functions is to pursue observational field work. Plans for studies on arboreal faunas are now well underway and results should be forthcoming soon.—Terry L. Erwin, *Entomology Department, Smithsonian Institution, Washington, D. C., 20560.*

Following introduction of guests the meeting was adjourned at 9:30 P.M. Refreshments were served.

Dewey M. Caron, *Recording Secretary.*

795th Regular Meeting—March 3, 1972

The 795th Regular Meeting of the Entomological Society of Washington was called to order by President Curtis W. Sabrosky March 3, 1972 in Room 43, USNM. Forty-five members and 32 guests were in attendance. Minutes of the February meeting were read and approved.

President-Elect Burditt announced that the annual ESW-ISW banquet will be June 1 at the 4-H Center. The speaker has not yet been selected; Mr. Burditt welcomed suggestions.

President Sabrosky discussed the recent executive committee meeting and indicated the financial problems facing the society. Several changes affecting the Proceedings, all designed to strengthen the finances were mentioned. One additional change recommended by the executive committee to the members in attendance was presented in writing as provided by the By-laws. It was proposed that Article 4 (Dues) Section 1 be revised to read 7 in place of 6. (The annual dues shall be 7 dollars payable January 1).

The first note of the evening was presented by Ted Bissell who introduced members to a new book, "Tortricid Fauna of Apple in New York," by Chapman and Lienk.

George Steyskal presented an interesting note on the frequency of language use in the years 1913, 1958, and 1965 for entomological publications listed in the Zoological Record and the Review of Applied Entomology. As expected, English was the most frequently used and rose to about 60% during 1965. French and German both decreased greatly over that time span to around 10% at present, while Spanish, Italian and Russian showed less decrease.

G. G. Rohwer, Acting Assistant Administrator, briefly mentioned some current activities of the USDA Animal and Plant Health Services (APHIS). He indicated that the pest management program will be increased for cotton and tobacco this year and some new work will be started on additional crops. He also reported the capture of a Mexican fruit fly in Florida.

President Sabrosky recounted a fascinating story of the probable identification of a bot fly collection that disappeared over 100 years ago. A number of connections between published information on the flies and the recent examination of the newly discovered collection were recounted and individual pieces of information that add up to the collection indeed being the missing specimens were presented.

Mort Leonard reported that fellow member Lou Davis was out of the hospital and at last report resting comfortably.

Dr. Sabrosky introduced the speaker for the evening, Dr. Donald H. Messersmith, Professor of Entomology, University of Maryland.

Dr. Messersmith presented a richly illustrated tour entitled "Insect Collecting in South Africa." His abstract:

In July and August, 1970, I had the opportunity to collect insects in southern Africa while leading a nature study tour consisting of 12 people. In Southwest Africa we traveled from Windhoek to the Atlantic coast and return, traversing the Kalahari and very desolate Namib desserts. The only collecting was at a well, and near the coast. A new ephydrid and a rare lygaeid were collected in the Namib near Swakopmund.

I also collected near Capetown, but it was cold there on the Cape Peninsula. Ants were the commonest.

I did better in the game reserves in Natal and Zululand, but they were experiencing a severe drought there. The same was true in Swaziland and Mozambique. Kruger National Park was very dry, but I was able to collect at lights.

All in all collecting was not good because of very dry conditions. Nonetheless, I obtained over 1500 specimens from 14 orders and a good variety of families. Ants and Diptera were most numerous, followed by Orthoptera and Homoptera. I also collected a variety of non-insectan arthropods, especially spiders. Perhaps one of my biggest surprises was that among the insects I collected, most belonged to familiar families and very few specimens looked particularly exotic. This was not true for the specimens I collected in Colombia; many there looked very exotic. However, southern Africa is at best subtropical which I suppose accounts for their "normal" appearance. All specimens are being donated to the Smithsonian.

There followed the introduction of several guests, including a student contingent from the University of Maryland. The meeting was adjourned at 10 P.M. Refreshments were served.

DEWEY M. CARON, *Recording Secretary.*

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of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

DEPARTMENT OF ENTOMOLOGY
SMITHSONIAN INSTITUTION
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PUBLISHED QUARTERLY

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Title of Publication: Proceedings of the Entomological Society of Washington.

Frequency of Issue: Quarterly (March, June, September, December).

Location of Office of Publication, Business Office of Publisher and Owner: The Entomological Society of Washington, c/o Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.

Editor: Dr. Lloyd Knutson, same address as above.

Managing Editor and Known Bondholders or other Security Holders: none.

This issue was mailed July 10, 1973

Second Class Postage Paid at Lawrence, Kansas, U. S. A. 66044

ALLEN PRESS, INC. PRINTED IN U.S.A. LAWRENCE, KANSAS 66044

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Vol. 75 JUNE 1973 No. 2

KEYS TO LARVAE AND PUPAE OF THE GYMNETRINAE OF AMERICA NORTH OF MEXICO (COLEOPTERA: CURCULIONIDAE)

D. M. ANDERSON

Systematic Entomology Laboratory, Agricultural Research Service, USDA, c/o U. S. National Museum, Washington, D.C. 20560

ABSTRACT—Keys to the larvae and pupae of 6 of the 7 species representing the genera *Gymnetron, Miarus,* and *Mecinus* in North America are presented.

The curculionid subfamily Gymnetrinae (Mecininae of some authors) is represented in North America by 4 species of *Gymnetron* Schoenherr, 2 species of *Miarus* Schoenherr, and 1 species of *Mecinus* Germar. With exception of the *Miarus* species, all of these have been introduced from Europe into North America (Buchanan 1937, Sleeper 1954, Warner 1955), where they have become more and more widely distributed, following the earlier dispersal of their introduced host-plants. The larvae and pupae of all except the Mexican *Miarus erebus* Casey have become available to me and I have prepared the keys set forth here to aid in their identification. It would seem likely that the need for these keys will increase as studies of various species of Gymnetrinae associated with certain noxious weeds (e.g. Smith 1959, Harris 1961) continue. The identification of the adults of the species treated here has already been facilitated by a key to the 3 genera (Kissinger 1964), a review of specific names in *Miarus* (Anderson 1964), and a key to the 4 species of *Gymnetron* (Hatch 1971).

The larval terminology used in this paper follows that set forth by Anderson (1947). The terms applied to the pupae are in agreement with those used by Burke (1968).

The spelling of *Gymnetron* used here follows that used by Schoenherr (1825) in his original description of the genus and by many other authors in subsequent papers, rather than his 1826 spelling (*Gymnaetron*), which was used by some recent authors (e.g. Kissinger 1964, Hatch 1971) who were evidently not aware of Schoenherr's 1825 paper. The latter publication was not cited in the Junk catalogue (Klima 1934).

The larvae of the Gymnetrinae can be distinguished (under the name Mecininae) from those of all other subfamilies of Curculionidae through use of van Emden's (1938) "Key to the subfamilies and tribes of weevil-larvae with two [abdominal] tergal folds." In other keys (loc. cit.) van Emden separated the 3 genera of Gymnetrinae, but was able to treat only 2 of the species treated in this paper. Scherf (1964) provided keys that distinguish the larvae of the European Gymnetrinae included here from those of many other European Curculionidae, primarily on the basis of host-plants and type of feeding damage, but he did not separate the larvae of *Gymnetron antirrhini* (Paykull) and *G. netum* (Germar), as is done here.

Most larvae of species included in the following key will have to be dissected and mounted under a cover-slip to permit examination of such features as antennae and spiracles through a compound microscope. Some clearing may also be necessary, depending on the condition of the specimen.

Key to Larvae

1. Thorax bearing rounded, sclerotized lightly pigmented areas on pedal lobes and epipleura (fig. 1, scl); thoracic spiracle bicameral but abdominal spiracles unicameral; postdorsal folds of abdominal segments I-V distinctly more prominent than prodorsal folds (fig. 1, PsD); head dark brown with only an indication of lightly pigmented area on each side; in roots of *Plantago* spp. .... *Mecinus pyraster* (Herbst)

— Thorax bearing no sclerotized or pigmented areas on sides; spiracles either entirely bicameral or entirely unicameral (except in *Gymnetron antirrhini*); postdorsal folds of abdominal segments I-V not distinctly more prominent than prodorsal folds (slightly more prominent in *Gymnetron pascuorum*); head light brown or, if dark brown, with distinct unpigmented areas at sides; in seed capsules of their hosts 2

2. Spiracles of thorax and abdomen all bicameral (fig. 6); anal opening X-shaped; accessory sensory appendage of antenna elongate (fig. 7); hosts are Campanulaceae, usually *Lobelia* spp. .... *Miarus hispidulus* LeConte[1]

— Spiracles all unicameral (fig. 2), or thoracic spiracle bicameral and abdominal spiracles unicameral; anal opening transverse or rounded; accessory sensory appendage of antenna shorter than in fig. 7; in seed capsules of Scrophulariaceae or Plantaginaceae .... 3 (*Gymnetron* spp.)

3. Abdomen with 7 pairs of spiracles (fig. 3); head light brown with irregular unpigmented lateral stripe running from posterior end of epicranium to base of mandible (fig. 5); base of frons bearing prominent transverse ridge (figs. 4, 5); in seed capsules of *Verbascum* spp. .... *Gymnetron tetrum* (Fabricius)

— Abdomen with 8 pairs of spiracles; head dark to pale brown but never

[1] *Miarus hispidulus* does not have a paired ventral sclerome on the prothorax and therefore will not key to *Miarus* in the key to genera of Mecininae that van Emden (1938) devised on the basis of European species.

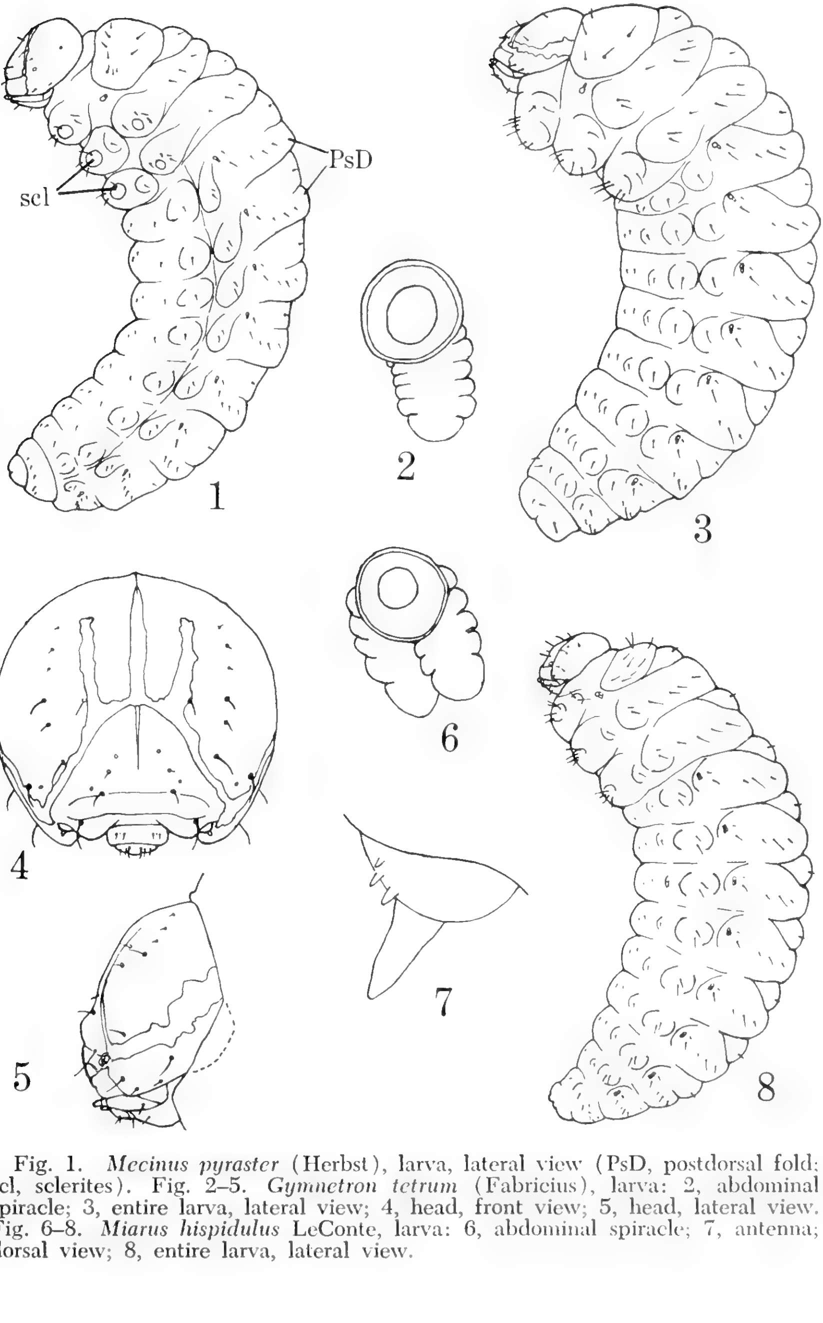

Fig. 1. *Mecinus pyraster* (Herbst), larva, lateral view (PsD, postdorsal fold; scl, sclerites). Fig. 2–5. *Gymnetron tetrum* (Fabricius), larva: 2, abdominal spiracle; 3, entire larva, lateral view; 4, head, front view; 5, head, lateral view. Fig. 6–8. *Miarus hispidulus* LeConte, larva: 6, abdominal spiracle; 7, antenna; dorsal view; 8, entire larva, lateral view.

bearing *complete* unpigmented lateral stripe on epicranium; transverse ridge at base of frons not prominent if present; in seed capsules of Scrophulariaceae other than *Verbascum* or in capsules of *Plantago* 4

4. Basal article of maxillary palpus incompletely sclerotized on inner side (fig. 13); head so lightly pigmented that epicranial and frontal sutures are difficult to distinguish; asperities of body large, causing skin to appear granulate (fig. 14); host *Plantago lanceolata* Linnaeus .... *Gymnetron pascuorum* (Gyllenhal)

— Basal article of maxillary palpus completely sclerotised on inner side (fig. 9); frontal and epicranial sutures of head clearly visible as unpigmented lines; asperities of body relatively small, not conspicuous (fig. 11); hosts usually *Linaria* spp. 5

5. Head dark brown to black, usually bearing short unpigmented lateral stripe on posterior ½ of epicranium; frons without asperities; abdominal epipleura with 2 short setae (fig. 10) .... *Gymnetron antirrhini* (Paykull)

— Head medium to light brown, slightly mottled posteriorly but bearing no unpigmented lateral stripe; frons covered with transversely oriented asperities (fig. 12); abdominal epipleura bearing 3 setae, which are longer than those in fig. 10 .... *Gymnetron netum* (Germar)

Key to Pupae

No keys are available for the identification of the pupal Gymnetrinae of Europe or other regions of the Old World. Scherf (1964) provided descriptions of the pupae of 2 species (*Mecinus pyraster* and *Gymnetron antirrhini*) included in this key.

1. Both head and prothorax bearing a pair of transversely flattened, darkly pigmented tubercles (figs. 15–17); found in seed capsules of Scrophulariaceae 2

— Either head or prothorax bearing 1 or more pairs of rounded, lightly pigmented tubercles (figs. 18, 23, 26); hosts not Scrophulariaceae 4

2. Tergum of 9th abdominal segment bearing a fleshy median tubercle, which projects posteriorly (fig. 19); abdominal segments 3–7 bearing 1 or 2 laterosternal setae (fig. 20) 3

— Tergum of 9th abdominal segment without any median tubercle; abdominal segments 3–7 bearing 3 laterosternal setae, hosts usually *Linaria* spp. .... *Gymnetron netum* (Germar)

3. Tubercle of 9th abdominal tergum rather elongate, slightly constricted near midlength (fig. 20); abdominal segments 3–7 bearing 1 laterosternal seta; tubercles of prothorax distinctly granulate (fig. 15); hosts are species of *Verbascum* .... *Gymnetron tetrum* (Fabricius)

— Tubercle of 9th abdominal tergum short, not constricted (fig. 21); abdominal segments 3–7 bearing 2 laterosternal setae; tubercles of prothorax not granulate; hosts usually *Linaria* spp. .... *Gymnetron antirrhini* (Paykull)

4. Head bearing pair of rounded tubercles but prothorax without tubercles (fig. 23); body form elongate (fig. 25); posterior processes of abdomen oriented posterolaterally (fig. 24); in roots of *Plantago lanceolata* .... *Mecinus pyraster* (Herbst)

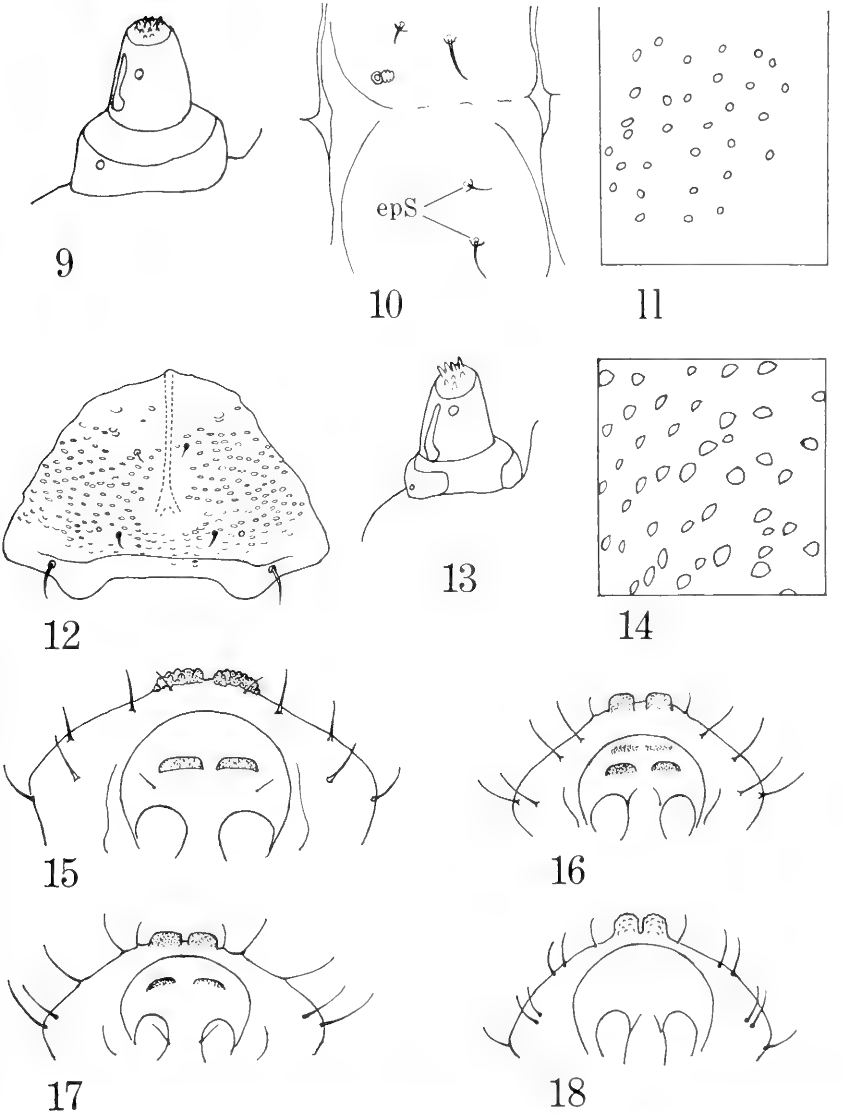

Fig. 9–11. *Gymnetron antirrhini* (Paykull), larva: 9, maxillary palpus, dorsal view; 10, side of abdominal segment 3, showing epipleural setae (epS); 11, asperities of body integument, ×137. Fig. 12. *Gymnetron netum* (Germar), frons of larva, showing asperities. Fig. 13–14. *Gymnetron pascuorum* (Gyllenhal), larva: 13, maxillary palpus, dorsal view; 14, asperities of body integument, ×137. Fig. 15–18. *Gymnetron* spp., pupae, vertex of head and prothorax, ventral view: 15, *G. tetrum* (Fabricius); 16, *G. antirrhini* (Paykull); 17, *G. netum* (Germar); 18, *G. pascuorum* (Gyllenhal).

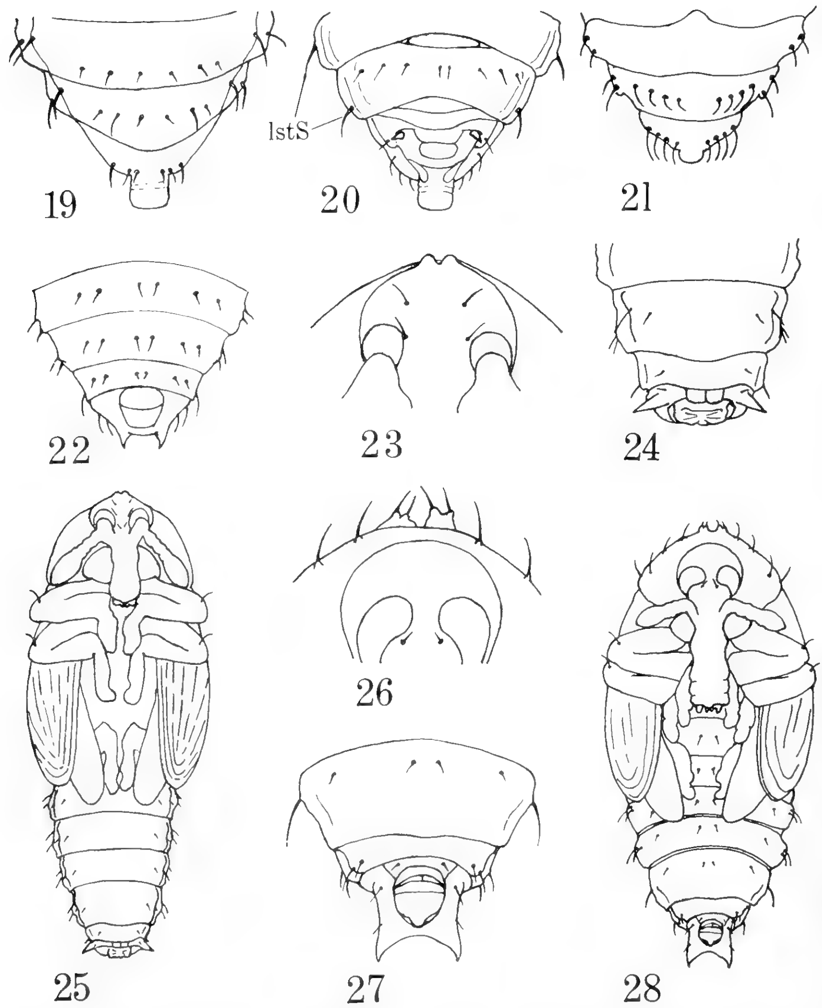

Fig. 19–22. *Gymnetron* spp. pupae, terminal abdominal segments: 19, *G. tetrum* (Fabricius), dorsal view; 20, ventral view (lstS, laterosternal setae); 21, *G. antirrhini* (Paykull), dorsal view; 22, *G. pascuorum* (Gyllenhal), ventral view. Fig. 23–25. *Mecinus pyraster* (Herbst), pupa, ventral view: 23, vertex of head and prothorax; 24, terminal segments of abdomen; 25, entire pupa. Fig. 26–28. *Miarus hispidulus* LeConte, pupa, ventral view: 26, vertex of head and prothorax; 27, terminal segments of abdomen; 28, entire pupa.

— Head without tubercles but prothorax bearing pair of single or double tubercles near anterior margin (figs. 18, 26); body form more ovate (fig. 28); posterior processes of abdomen oriented posteriorly; in seed capsules of hosts 5

5. Prothorax bearing pair of double tubercles, each with 2 setae, toward anterior margin (fig. 26); posterior processes of abdomen fused at their bases, forming fish-tail shaped structure (fig. 27); in seed capsules of *Lobelia* spp. .... *Miarus hispidulus* LeConte
— Prothorax bearing pair of single tubercles without setae (fig. 18); posterior processes of abdomen not fused at base (fig. 22); in seed capsules of *Plantago lanceolata* .... *Gymnetron pascuorum* (Gyllenhal)

Material Examined

The specimens upon which the preceding keys are based are labelled with the following data. Numbers of larvae (L) refer to the total of slide-mounted and unmounted specimens. All pupae (P) examined were unmounted. Except those noted otherwise, the larvae and pupae are associated with adult weevils. All of the material is in the Coleoptera collection of the U. S. National Museum of Natural History, Washington, D. C.

Gymnetron antirrhini: Hyannis, Mass., 28–VIII–'43, seed capsules of *Linaria*, W. H. Anderson, Colr. (18 L, 23 P). Six Mile Creek, Ithaca, N. Y., Aug. 26, 1954, Sept. 10 & 15, 1955, from seed capsules of *Linaria vulgaris*, D. M. Anderson, Colr. (65 L, 88 P). Gile Hollow Rd., nr. Hinsdale, N. Y. Sept. 1, 1963, ex fruit of *Linaria vulgaris*, D. M. Anderson, Colr. (22 L, 42 P). Gentofte?, Seeland, Denmark, 8 – 1917, on *Linaria*, J. P. Kryger (4 L, 1 P).

Gymnetron netum: Mystic, Conn., 29–IX–'44, in seed pods *Linaria vulgaris* [USDA] Spec. Surv. 20136 (8 L) [no adults seen]. Flushing, L. I., N. Y., Aug. 5, 1944, [USDA] Spec. Surv. 17729 (7 L). Va.-W. Va. State Line, south of Charleston, W. Va., 26 Aug. 1939, ex seed capsules of *Linaria vulgaris*, Wm. H. Anderson Colr. (37 L, 19 P). Toledo, Wash., 19–IX–'44, in seed pods wild snapdragon, [USDA] Spec. Surv. 19871 (8 L, 20 P).

Gymnetron pascuorum: Bethesda, Maryland July 2, 1956, taken from seeds of *Plantago lanceolata*, J. A. Anderson, Colr. (62 L, 81 P). Marrebaek [Denmark], 24–7–1944, *Plantago lanceolata* seeds, J. P. Kryger Coll. (13 L, 73 P).

Gymnetron tetrum: Hard Scrabble Rd., nr. Ischua, N. Y., Sept. 4, 1961, ex seed capsules of *Verbascum thapsus*, D. M. Anderson, Colr. (41 L, 68 P). New York, N. Y., 11–VIII–'44, in seed capsules *Verbascum thapsus*, [USDA] Spec. Surv. 18035 (17 P).

Mecinus pyraster: University Park, Maryland, June, 1958, *Plantago lanceolata*, T. L. Bissell [collector], ad. det. R. E. W[arner] (1 L). Fuglangs Mose, Denmark, 25–VII–1939, *Plantago lanceolata*, [collected and determined by] Kryger (5 L, 2 P) [no adults seen].

Miarus hispidulus: Orange, Conn. 16–IX–'44, in seed capsules *Lobelia inflata*, [USDA] Spec. Surv. 19716 (6 L, 1 P) [no adults seen]. Snow Hill, Md., 21–VIII–1942, ex seed capsules of *Lobelia cardinalis*, W. H. Anderson, Colr. (18 L, 20 P). South River, Md., Sept. 12, 1939, seed capsules–*Lobelia cardinalis*, Wm. H. Anderson, Colr. (3 L, 6 P).

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BIOLOGY OF PHERBELLIA PREFIXA (DIPTERA: SCIOMYZIDAE), A PARASITOID-PREDATOR OF THE OPERCULATE SNAIL VALVATA SINCERA (GASTROPODA: VALVATIDAE)[1]

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ABSTRACT—Information is presented on the life cycle of *Pherbellia prefixa* Steyskal (Diptera: Sciomyzidae), a parasitoid-predator of the marsh-inhabiting operculate snail *Valvata sincera* Say (Gastropoda: Valvatidae). Eggs are deposited near stranded individuals of the host snail. Larval development can be completed on 1 snail, and the host is always killed by the feeding of the larva. The larval period requires 9–13 days, and the entire life cycle is completed in 33–43 days. There are at least 3 generations a year in northwestern Montana, with overwintering probably occurring as pupae in a state of temperature-induced quiescence. Discovery of the ability of *P. prefixa* to attack operculate snails indicates a wider degree of adaptive radiation in the larval feeding habits of *Pherbellia* than was previously suspected.

Knowledge of the natural history of snail-killing flies belonging to the genus *Pherbellia* rests largely on the comprehensive study by Bratt *et al.* (1969) which presented life cycles, elucidated larval feeding habits, and described the immature stages of 28 species of the genus. Larvae of *Pherbellia* were reported to feed on aquatic, hygrophilous, or terrestrial snails belonging to a great variety of families and genera. However, none of the species was reported to utilize operculate snails. In fact, the only sciomyzid known to attack operculate snails in nature is *Hoplodictya setosa* (Coquillett) whose larvae prey upon *Littorina littorea* (L.), a common species on New England beaches (Neff and Berg 1962). In laboratory rearings third-stage larvae of *Knutsonia trifaria* (Loew), a European species, killed and ate the operculate snails *Hydrobia* sp. and *Melanopsis algerica* (Pilsbry) if the snails were removed from water (Knutson and Berg 1967).

During the summer of 1966, larvae of *Pherbellia prefixa* Steyskal were found to be intimately associated with stranded individuals of the operculate snail *Valvata sincera* Say. The discovery of yet another species of Sciomyzidae that attacks operculate snails suggests that members of this family could be useful in controlling the several operculate snail hosts of *Schistosoma japonicum* Katsurada, the causative organism of schistosomiasis in the Orient.

The purposes of the present paper are to elucidate the life cycle and larval feeding habits of *P. prefixa* and to indicate its position in

[1] This research was supported by grants from the National Institute of Allergy and Infectious Diseases, U. S. Public Health Service, and the American Philosophical Society.

the taxonomic and nutritional spectrum represented within the genus *Pherbellia.*

Life History

Pherbellia prefixa is a small, 3.0–3.8 mm long, bluish-gray fly that has been placed in the subgenus *Oxytaenia* (Steyskal, 1966). Adults have a long, tapering midfrontal stripe; 2 pairs of fronto-orbital bristles, with the anterior pair being smaller; a short-haired arista; and unmarked wings. The male genitalia are highly diagnostic and have been illustrated by Steyskal (1966).

Pherbellia prefixa apparently has a rather limited distribution in North America, having been recorded only from western Alaska (Lower Yukon River), western Montana (Swan Lake, Lima), and southeastern Idaho (Bear Lake). Doubtlessly it occurs elsewhere in the northwestern States and Provinces but has been overlooked by collectors. Its larval host, the operculate snail *Valvata sincera,* is transcontinental, and the distribution of the fly obviously is limited by factors other than the mere presence or absence of suitable prey.

Adults were collected only in open, unshaded marshes that became progressively drier as summer advanced. In southeastern Idaho, they were taken abundantly in the low-lying, poorly drained floodplain that borders Bear River just north of Bear Lake. This habitat consists of an extensive sedge marsh dominated by various species of spike rush (*Eleocharis* spp.). The water depth rarely exceeds 1 ft. and recedes steadily as summer progresses. The dropping water level exposes large numbers of aquatic snails and fingernail clams. At this site, *P. prefixa* occurred with numerous other species of Sciomyzidae such as *Sciomyza simplex* Fallén, *Atrichomelina pubera* (Loew), *P. argyra* Verbeke, *P. schoenherri maculata* (Cresson), *P. propages* Steyskal, *P. griseola* (Fallén), *Pteromicra siskiyouensis* Fisher and Orth, *Dictya expansa* Steyskal, *D. montana* Steyskal, *Sepedon armipes* Loew, *Tetanocera unicolor* Loew, and *T. plebeia* Loew. Many of these species are typical inhabitants of vernal grass-sedge marshes.

In northwestern Montana, *P. prefixa* was abundant in an extensive *Eleocharis-Carex* marsh that borders the inlet of Swan Lake in Lake County and in 2 small sedge marshes bordering the Swan River. Associated with *P. prefixa* in these habitats were the following sciomyzids: *P. argyra, P. griseola, P. quadrata* Steyskal, *P. schoenherri maculata, P. vitalis* (Cresson), *Pteromicra leucothrix* Melander, *P. siskiyouensis, S. simplex, D. montana, Renocera cyathiformis* Melander, *T. latifibula* Frey, *T. mesopora* Steyskal, *T. plebeia,* and *T. unicolor.* Adults of *P. prefixa* were rarely or never found in cattail marshes, in stands of aquatic and semi-aquatic grasses, or in wooded swamps. In all marshes where *P. prefixa* occurred, high populations of *Valvata sincera,* the larval host, were present and were continually being stranded as the marshes dried. In middle and late summer, after the marshes had lost most of their water, the retracted and inactive snails were found under litter or in the heavy growths of moss that covered the soil surface. This sodden layer undoubtedly protected the snails from desiccation and permitted many of them to survive until the marshes were flooded again in late fall.

The host snail, *V. sincera,* belongs to the family Valvatidae of the molluscan subclass Ctenobranchiata. Members of this operculate group are entirely aquatic and all possess gills. Species of *Valvata* are restricted to freshwater situations and have been reported from a wide variety of aquatic habitats. Apparently an ability to aestivate allows them to survive in marshes having fluctuating water levels (Baker 1928, Pennack 1953).

Biological observations were initiated with adults collected at the Swan Lake marsh on July 1, 1966. Additional rearings were carried out during the summers of 1967 and 1969 from material collected at the same marsh and at a small *Carex* marsh situated approximately 4 miles east of Big Fork, Flathead Co., Montana.

At least in northwestern Montana, adult populations of *P. prefixa* seemed largest during late June and July. Relatively few flies were swept from marshes during August and none was taken in September. Because of the relatively great longevity of the adults (up to 45 days) and the extended oviposition period of the females, no distinct generations could be discerned in nature. Doubtlessly generations overlap, and eggs, larvae and puparia probably can be found at any time during the summer season.

During mid-day, adults were seen most commonly on sedge stems fairly close to the substrate. During the late afternoon and evening hours they became more abundant at higher levels in the vegetation, apparently in response to decreasing temperatures and increasing humidities. They were more active during cooler periods, and during the hottest time of the day generally remained relatively inactive near the soil or water surface. Their flight was usually short and swift, rarely exceeding a few inches. Non-mating individuals remained quite alert and quickly decamped when approached too closely. In contrast, mating pairs were lethargic and could be collected easily in a shell vial.

The premating period of adults held in laboratory breeding jars varied from 2 to 5 days. No overt courtship behavior was observed, and males attempted to mate with any nearby female with little or no preparatory movements. They were also seen to approach similar sized females of other species, although no actual copulations were observed. A responsive female spread her wings slightly when a male positioned himself on her dorsum, thus allowing the male to make contact with her genitalia. In contrast, a disinterested female did not spread her wings and attempted to dislodge the male by rapid body movements and vigorous upward kicking movements of the hind legs. Males attempting to mate with non-responsive females quickly abandoned the effort and flew to the walls of the breeding jar.

Mating was seen most commonly in nature during the late afternoon and evening hours, although mating occurred also at mid-day during cloudy, cool weather. Mating pairs usually remained stationary on sedge stems or leaves. Each copulation lasted from a few minutes to well over an hour. The mating position resembled closely that described for other species of the genus (Bratt *et al.* 1969). Mating was seen most frequently in recently emerged adults, and mating frequency declined steadily as females aged. Very few matings were observed in females that were older than 35 days. Surprisingly, virgin females isolated without males for several days rarely mated when newly emerged or older males were finally introduced into the breeding jars.

The pre-oviposition period of laboratory-reared females was 7 or 8 days. Eggs were attached loosely to projecting sprigs of peat moss in the breeding jars. Most were scattered, although a few clusters of 3 or 4 eggs were found occasionally. Eggs were not found in nature, but it is reasonable to assume that they were deposited into the moss that harbored *Valvata* snails. Fecundity records are incomplete, but most of the field-collected females deposited between 75 and 200 eggs in the breeding jars. Females that were allowed access to decaying snails always produced more eggs than those that were given a straight honey and brewer's yeast diet. The presence of *Valvata* snails in the breeding jars definitely stimulated oviposition. For example, a female collected in nature on August 13, 1966, deposited only 2 eggs during the 4 days she was held in a breeding jar containing living and dead snails of the genus *Lymnaea*. However, when 2 living *Valvata* were added, she deposited 29 eggs within a 12-hour period. Egg production/day declined steadily as females aged, and those older than 30 days rarely oviposited.

The incubation period of eggs held on moist peat moss at room temperatures (22–26 C) varied between 1 and 4 days and averaged 3 days. Many eggs that were placed on sodden peat moss became covered with a film of water and hatched more slowly, many requiring 5 to 8 days. Newly hatched larvae were highly host specific and only attacked individuals of the operculate snail *Valvata sincera*. Larvae investigated but did not attack small snails of the genera *Discus*, *Gyraulus*, *Aplexa*, *Physa*, *Lymnaea*, and *Oxyloma*. They showed no interest in the slug *Deroceras laeve* (Müller) or in snail egg masses. Whether they will attack other species of *Valvata* is unknown, as only *V. sincera* was available during the course of the rearings.

Newly hatched larvae were very active and continuously crawled over and into the peat moss in the bottom of the breeding jars. Larvae seemed to discover snails by random searching efforts, and no evidence of olfactory attraction to prey was obtained. Larvae attacked only when they came in direct contact with *Valvata* and frequently passed within a few millimeters of a suitable snail without responding. They showed little inclination to move up vertical surfaces, and in nature probably confine their searching activities to the soil surface and overlying carpet of moss. Upon contacting a living, retracted *Valvata,* the larva crawled over the shell until it reached the operculum covering the aperture. It then moved quickly to 1 edge of the operculum and slowly forced its way between the edge of the operculum and the wall of the aperture. The point of entry into the body whorl of the snail varied greatly and no particular site seemed to be preferred. The operculum is soft and rather pliable. It bent up around the penetrating larva and did not seem to present much of an obstacle. The larva came to rest between the fleshy mantle of the snail and the wall of the shell, with its posterior spiracles projecting slightly between the edge of the operculum and the wall of the aperture. It usually remained in this position throughout the larval period.

Generally only 1 first-stage larva was found in each *Valvata,* but frequently 2 occurred together, and on 1 occasion 3 larvae were found within 1 shell. Larvae occurring singly usually were able to complete development within the 1 snail and form puparia. However, 2 larvae were never able to remain throughout larval life within the originally infested snail. In one case, only 8 puparia were formed by 20 larvae that doubly infested 10 *Valvata.* Twelve larvae abandoned their still living hosts as second instars and soon died. In another rearing, 4 *Valvata* were attacked by 6 newly hatched larvae. Five of the larvae eventually formed puparia, but all were forced to attack a second snail. On the 1 occasion when 3 first instars were found in a snail, all 3 larvae abandoned the dead snail as second instars and succumbed a few days later. Most natural infestations probably are of the 1 larva: 1 snail variety.

As long as infested snails were held on relatively dry to moist peat moss, first-stage larvae remained in place and rarely shifted position within the shell. However, if the bottom of the rearing dish was flooded, allowing a film of water to cover the operculum of the shells, the larvae quickly abandoned the snails and could be found a few minutes later wandering over the peat moss. Most of these larvae later attacked other, more exposed *Valvata* and thus were able to complete development. Apparently larvae within retracted snails are poorly resistant to flooding of the marsh by unusually heavy summer rains. However, in the vernal marshes preferred by *P. prefixa* flooding rarely occurs after the water level begins receding in early summer.

Snails infested by single larvae commonly remained alive for 3 to 5 days and usually were not killed until the larva reached the third stadium. A snail remained retracted and did not crawl about, although its pulsating heart could be seen through the shell. In contrast, snails infested by 2 larvae nearly always died within 2 or 3 days. Larvae apparently fed by scraping away bits of flesh with their mouthhooks and in the earlier instars apparently restricted their feeding to nonvital tissues. Following death of the host, the larva rapidly fed upon and soon consumed nearly all of the soft parts. Interestingly, however, the muscle attaching the operculum to the body of the snail was rarely destroyed, and the operculum usually remained in place throughout the 6 to 13 days that the larvae remained within the shell.

Older larvae also were highly host specific for *Valvata*. Attempts to feed second and third-stage larvae on small specimens of *Gyraulus*, *Lymnaea*, and *Physa* were completely unsuccessful. If not provided with *Valvata*, older larvae soon succumbed. The third, and probably the second, instars can attack other *Valvata* if they leave their original host before completing development. A third instar was seen to abandon its original snail, wander about the rearing dish for a few minutes, and then attack another retracted *Valvata* by pushing its way between the edge of the operculum and the wall of the aperture. It killed the second snail within 2 hours and formed a puparium 3 days later.

The relationship of a larva to its host was that of a parasitoid. Typically only 1 larva invaded each *Valvata*, and 1 snail satisfied the nutritional requirements of 1 larva. The larva apparently did little damage during the first 2 instars. It was only as a maturing third instar that it killed its host and consumed the tissues. The feeding behavior was somewhat plastic, however, and larvae acted more like predators under crowded conditions in which 2 or more larvae infested a single snail. When that occurred, 1 or more of the larvae frequently left the original host and attacked and soon killed another snail.

The first stadium lasted 3 to 5 days; the second, 2 to 3 days; and the third, 4 to 5 days. The total larval period ranged between 9 and 13 days. Molting occurred within the host, and exuviae of the first and second instars usually could be found appressed against the columellar wall of the body whorl of the shell. Most puparia were formed outside of the snail in peat moss, but several larvae pupated within the body whorl of their hosts. Of 40 puparia obtained during the laboratory rearings, 31 were formed in peat moss, and 9 were situated within cleaned-out shells of *Valvata*. Shells containing puparia still had the operculum in place across the aperture. Thus, pupation within shells seemed to offer some protection from possible predators and parasitoid wasps.

Larvae that pupated away from the host buried themselves in peat moss for 2 or 3 days before forming puparia. The prepupal period, from formation of the puparium to the actual appearance of the pupa, lasted about 24 hours. The pupal period for males was 15–16 days; females, 16–18 days. Puparia formed in *Valvata* shells were curved slightly to fit within the body whorl, although the anterior end of the puparium was not flattened. The anterior end always faced the aperture, and puparia were formed within 1 or 2 mm of the operculum. Puparia formed in peat moss showed no body curvature.

In nature, most puparia probably were formed in or below the thick layer of moss that carpeted the floor of the drying marshes. Puparia buried in moss must gain considerable protection from desiccation because the moss remains moist long after the marsh has become dry. Probably the moss acts also as a protective layer against the intense insolation that strikes the floor of the marsh during July and August. Possibly it also acts as a sponge during heavy summer rains and prevents the puparia from becoming water-logged. A water film developing around puparia would be quickly absorbed by the drying moss once the rain ceased. Puparia of *P. prefixa* are not covered with a layer of hydrofuge material as are those of certain other species of *Pherbellia* that attack stranded aquatic snails (Bratt *et al.* 1969).

No indication of diapause was observed for any stage of the life cycle, and overwintering probably occurs in a state of temperature-induced quiescence. The overwintering stage was not determined, but based on overwintering habits of other species of *Pherbellia* it is probably the pupa. With a pre-oviposition period of 7 or 8 days, an incubation period of 2 to 4 days, a larval period of 9 to 13 days, and a pupal period of 15 to 18 days, the entire life cycle in the laboratory can be completed in 33 to 43 days. This implies that in northwestern Montana at least 3 generations a year can be produced during a warm season of some 150 days (mid-May to mid-October).

Discussion

It seems reasonable to ask whether the utilization of an operculate snail by larvae of *P. prefixa* could have arisen through competition among various species of *Pherbellia* for the stranded aquatic or shoreline snail resource in marshy habitats. At the present time in freshwater marshes having fluctuating water levels, 3 to 6 species of *Pherbellia* whose larvae prey on stranded pulmonate gastropods can be collected on any 1 date. Competition for pulmonate snails must have been, and probably still is, rather fierce, and a species that shifted its larval feeding to a previously non-utilized operculate snail would have enjoyed a significant release from competition. In the marshes sampled in northwestern Montana, *P. prefixa* frequently was the most commonly collected species. As far as could be determined, no other insect species was attacking *Valvata* snails in those habitats.

The advantages of utilizing operculate snails rather than non-operculate species would seem to be two-fold. The species apparently has escaped from competition from other species of *Pherbellia*. Secondly, it appears that the developing larva gains considerable protection from desiccation in the drying marsh and is somewhat protected from attack by possible predators and parasitoids. The major disadvantage as far as *P. prefixa* is concerned is that it has become host specific for *Valvata* snails and has lost the ability to attack other species of stranded gastropods. Therefore, an environmental change that adversely affected populations of *Valvata* would have concomitant deleterious effects on *P. prefixa*. However, this danger may be more apparent than real, as a deteriorating marsh environment undoubtedly would have adverse effects also on pulmonate snail populations so that all species of *Pherbellia* that utilize stranded aquatic gastropods would decline in numbers.

On the basis of adult characters alone, Steyskal (1966) placed *P. prefixa* in the subgenus *Oxytaenia* (Sack 1939) along with such other Nearctic species as *P. beatricis* Steyskal, *P. bryanti* Steyskal, and *P. propages* Steyskal. Of the Palearctic species of *Pherbellia*, Roskošný (1967) and Bratt *et al.* (1969) placed *P. brunnipes* (Meigen), *P. knutsoni* Verbeke, *P. lichtwardti* (Hendel), *P. mikiana* (Hendel), *P. nigrifrons* (Bigot), *P. strobli* (Czerny), and possibly *P. uliginosa* (Enderlein) in this subgenus. Information on larval feeding habits and morphology is available only for *P. beatricis, P. brunnipes, P. knutsoni,* and *P. propages* (Bratt *et al.* 1969).

Biologically, *P. prefixa* does not fit well within the subgenus *Oxytaenia*, because all of the other reared species of this group apparently feed solely on stranded pulmonate gastropods. None is known to attack operculate snails, although there is a slight possibility that larvae of *P. beatricis* have this ability. Adults of that species were collected abundantly from the marshy banks of a small, highly alkaline stream in central Ohio (Bratt *et al.* 1969). The most abundant snail in the stream and stranded on the shores was a species of the operculate genus *Goniobasis*. Specimens of *Goniobasis* were added to rearing dishes containing newly hatched larvae of *P. beatricis*, but no feeding was observed. However, the rearing took place before it was known that larvae of *P. prefixa* could utilize operculate snails, and it is possible that due to the very intimate relationship between developing larvae and their operculate hosts the association was overlooked. Larvae of *P. beatricis* were reared on the pulmonate snails *Aplexa hypnorum* (L.) and *Physa* sp., but very few reached the third instar and only 1 formed a puparium. Thus it is possible that the "wrong" host was being utilized. Interestingly, Steyskal

(1966) on the basis of adult morphology felt that *P. prefixa* and *P. beatricis* were very closely related. Probably *P. prefixa* and possibly *P. beatricis* should be considered as highly specialized species of *Oxytaenia.*

Acknowledgments

I am indebted to A. H. Clarke, National Museum of Natural Sciences, Ottawa for the determination of the host snail.

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GLUTOPS SINGULARIS BURGESS ON LONG ISLAND, N. Y. (DIPTERA: PELECORHYNCHIDAE)

At the meeting of the New York Entomological Society of 19 May, 1931, C. Howard Curran reported the capture of this rare fly at Cold Spring Harbor, Long Island, N. Y. (Jour. N. Y. Entomol. Soc. 40:267, 1932). He later wrote to me that 2 females were collected by him on 9 May, 1931. This is the first record for Long Island and is the most southerly point for this species. Curran's record has not been noticed in subsequent literature.

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NEW SPECIES OF CLEARWING MOTHS (LEPIDOPTERA: SESIIDAE) FROM NORTH AMERICA

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ABSTRACT—Five new species of Clearwing moths from North America are described: *Melittia* **calabaza**, *Synanthedon* **arkansasensis**, *S.* **canadensis**, *S.* **dominicki**, and *Carmenta* **engelhardti**. Relationships with previously described species are discussed and distribution patterns are presented.

During the course of revisionary studies currently being conducted by the authors on the Western Hemisphere Sesiidae (= Aegeriidae), a number of new species have been discovered from North America. In addition to the revisionary studies, a fascicle on the family is being prepared by the authors for publication in *The Moths of America North of Mexico*. In order to treat the new species from North America without making major alterations in format and to allow full discussion, when necessary, of relationships with species that occur outside the scope of the North American fascicle, the present paper was prepared.

Although the North American sesiids have been the subject of 2 previous monographs, Beutenmüller (1901) and Engelhardt (1946), the fauna is still imperfectly known, as evidenced by the new species herein described. Even more troublesome, the paucity of distribution records for many species seriously restricts our knowledge of species' ranges and extent of variation in populations throughout the range. It is the authors' hope that this publication and others planned for the immediate future will stimulate interest on the part of collectors to assist in improving our knowledge of this unique family.

The authors wish to thank the following individuals and institutions who have provided specimens used in the present study: Dr. J. A. Powell, University of California, Berkeley; Dr. Roland L. Fisher, Michigan State University; Dr. Francisco Fernandez Yepez, Facultad de Agronomia, Universidad Central de Venezuela, Maracay; Dr. Paul H. Arnaud, Jr., California Academy of Science; Dr. Harry K. Clench, Carnegie Museum, Pittsburgh; Dr. John M. Burns, Museum of Comparative Zoology, Harvard University; Dr. Charles L. Remington, Dr. Kirby Brown, Peabody Museum, Yale University; Dr. Abraham Willink, Instituto Miguel Lillo, Tucuman, Argentina; Mr. Richard L. Brown, University of Arkansas; Mr. Julian P. Donahue, Los Angeles County Museum; Dr. Saul Frommer, University of California, Riverside; Dr. Dale H. Habeck, University of Florida; Dr. P. E. Vanzolini and Mr. Nelson Bernardi, Museu de Zoologia da Universidade de

São Paulo, Brasil; Mr. Bryant Mather, Clinton, Mississippi; Mr. J. R. Heitzman, Independence, Missouri; Museu Nacional, Rio de Janeiro, Brasil, and Dr. J. G. Franclemont, Cornell University.

The authors also wish to acknowledge the aid of Mr. George Venable, Departmental Illustrator, for the artwork; and Mr. Tim Friedlander, Summer Fellow, for technical assistance.

Genus *Melittia* Hübner

Melittia calabaza n. sp.

figs. 3a, 6; Map 1

Male: Antenna not pectinate but strongly ciliate ventrally, olive-green, dorsally weakly powdered white or pale yellow on apical ⅓. Proboscis well developed. Labial palpus roughened, orange, white on basal segment and mixed ventrally on second segment, often with line of black setaceous scales subventrally. Head with vertex olive-green with specialized, setaceous scales (chaetosema) posteriorly and medially; flat olive-green scales projecting shelflike from beneath antennae, extending over middle of eyes; front white, often with gray dorsomesad; occipital fringe setaceous, brown-black mixed with white, eyes margined with white scales. Thorax olive-green with lateral tufts of long, setaceous, pale yellow or white scales posteriorly, often projecting ventrally as well as posteriorly. Forewing olive-green, opaque but for narrow hyaline streak at base below vein *Cu* and another shorter hyaline streak in cell; costal edge pale orange; fringe fuscous, tipped with white; wing ventrally with some pale yellow basally. Hindwing hyaline except for very narrow band of brown-black on margins, brown-black on veins, often some white on anal margin basally. Legs with coxae of prothoracic legs orange, some white basally; femora of all legs orange at least dorso-apically, often brown-black ventrobasally; tibiae of mesothoracic legs orange with white on basal half; metathoracic legs with tibiae very strongly tufted with erect, brown-black scales dorsomesally, orange-red dorsally and dorsolaterally, some white dorsomedially; spurs brown-black with white tufting on posterior margin on both lateral spurs; first tarsal segment tufted similar to tibiae, but with less orange-red; all remaining tarsi alternately ringed with brown-black and white. Abdomen dorsally olive-green; segment 2 orange, with orange medially at least on segments 3–7, usually with black spot medially on anterior ½ of segments 2–6 and sometimes 7; abdomen ventrally orange with some white; anal tuft weakly defined, rounded, mostly orange with some black mixed. Male genitalia as in figure 3a. Inner margin of apical processes of uncus relatively sharply angled. On valva, saccular ridge narrows abruptly toward apex, broadened and somewhat excavated on basal ½ ventrad. Saccus elongate, slender and bulbous at apex. Wing length of male, 13–15 mm.

Female: Maculation essentially the same as for the male with the following exceptions: most olive-green coloration somewhat darker; small black scale tuft present on labial palpus of male is lacking on female; abdomen mostly orange except for dark olive-green on first segment and variously olive-green on segments 3–4, black spot dorsomedially on all segments except first; only 1 hyaline streak on forewing. Female genitalia as in figure 6. Wing length of female, 12–15 mm.

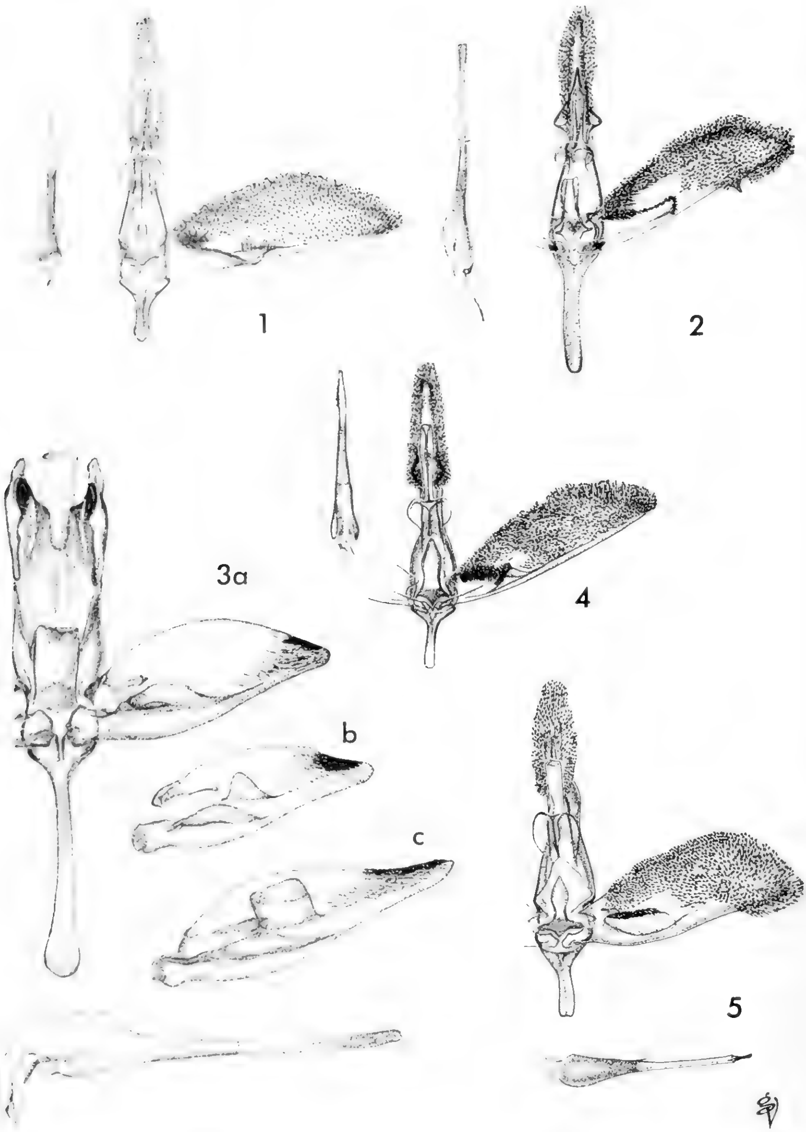
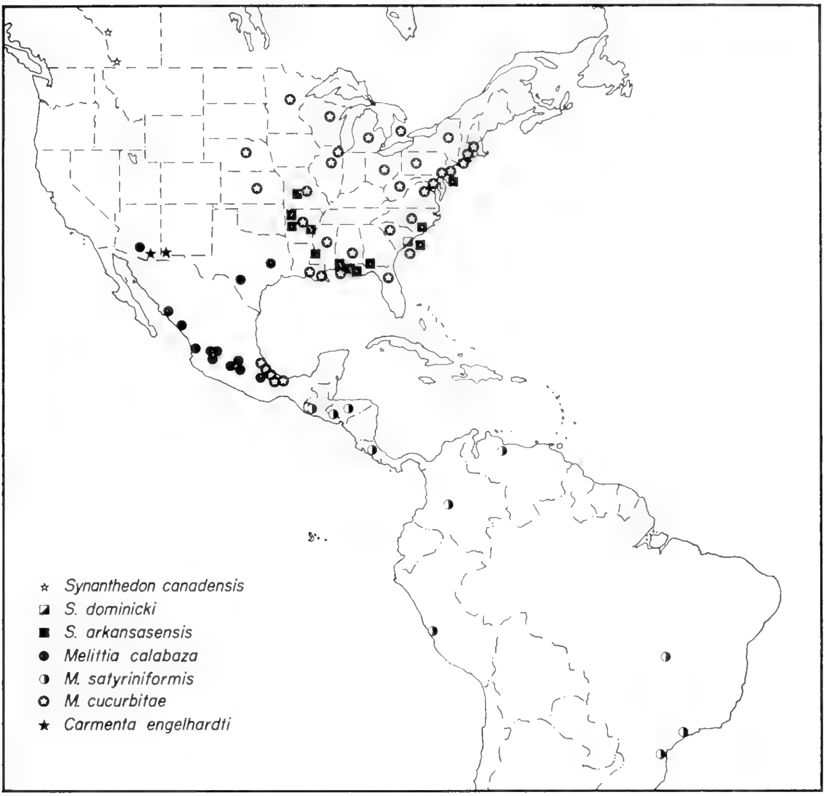


Fig. 1–5. Male genitalia: 1, *Synanthedon dominicki;* 2, *Carmenta engelhardti;* 3a, *Melittia calabaza;* 3b, *M. cucurbitae* (right valva); 3c, *M. satyriniformis* (right valva); 4, *Synanthedon arkansasensis;* 5, *S. canadensis.*



Map 1. Distribution of sesiid species.

Host: Species of Cucurbitaceae. No specific records could be found regarding host species, but a few specimens of the moth were labeled as having been reared from calabaza, the Spanish vernacular for a number of cucurbitaceous plants.

Distribution (map 1): Present records are from Texas and Arizona, southward into Mexico in the Sierra Madre Occidental, then eastward across central Mexico as far as Orizaba in the State of Veracruz.

Types: Holotype: ♂, Mexico: Mex., Teotihuacan, July 1, 1965, O. S. Flint, (USNM No. 72384). Four paratypes: 1 ♂, College Station, Tex., 9–11–19, T.D.E. slide no. 76063; 1 ♀, Tucson (Ariz.), 8–20–25, H. F. Tate collector; 2 ♀, Los Reyes, Mex., VII–1957, larva entre tallo de calabaza, larvae col. VII–1957, pupacion VIII–'57, emerg. de al VI–'58, Wm. W. Gibson collector; all deposited in the USNM. One paratype: ♂, Tucson, Pima Co., Arizona, Aug. 8 · 43, R. L. Chermock

Collection, deposited in the Cornell University Collection, Ithaca, New York.

Discussion: This species is very similar to *Melittia cucurbitae* (Harris) and *Melittia satyriniformis* Hübner and together with them forms a complex of apparently closely related species associated with plants of the genus *Cucurbita* and related genera in the Cucurbitaceae. Superficially, *M. calabaza* is readily distinguished by having the second abdominal segment orange dorsally rather than olive-green as is the case in the other 2 species. The males of *M. satyriniformis* are additionally distinguishable from *M. calabaza* by having the abdomen entirely olive-green dorsally, and by possessing a small hyaline streak on the apical area of the forewing that is not present in the other 2 species.

The male genitalia of *M. calabaza* differ from the other 2 species in the complex in the following characters (compare figs. 3a, b, c): the inner margins of the apical uncal processes are sharply angled relative to the other species; the saccus is narrow for most of its length, bulbous at the apex, but thicker in the other species and only slightly expanded apically; *M. calabaza* lacks the additional expanded process in the center of the valva dorsad of the saccular ridge, a character present on *M. cucurbitae* (rounded) and *M. satyriniformis* (quadrate) and useful in separating the latter two species; the saccular ridge is abruptly narrowed toward its apex in the other 2 species; the saccular ridge is widened and variously concave ventrad on its basal ½, though only slightly widened and depressed on *M. cucurbitae* and essentially unwidened on *M. satyriniformis*.

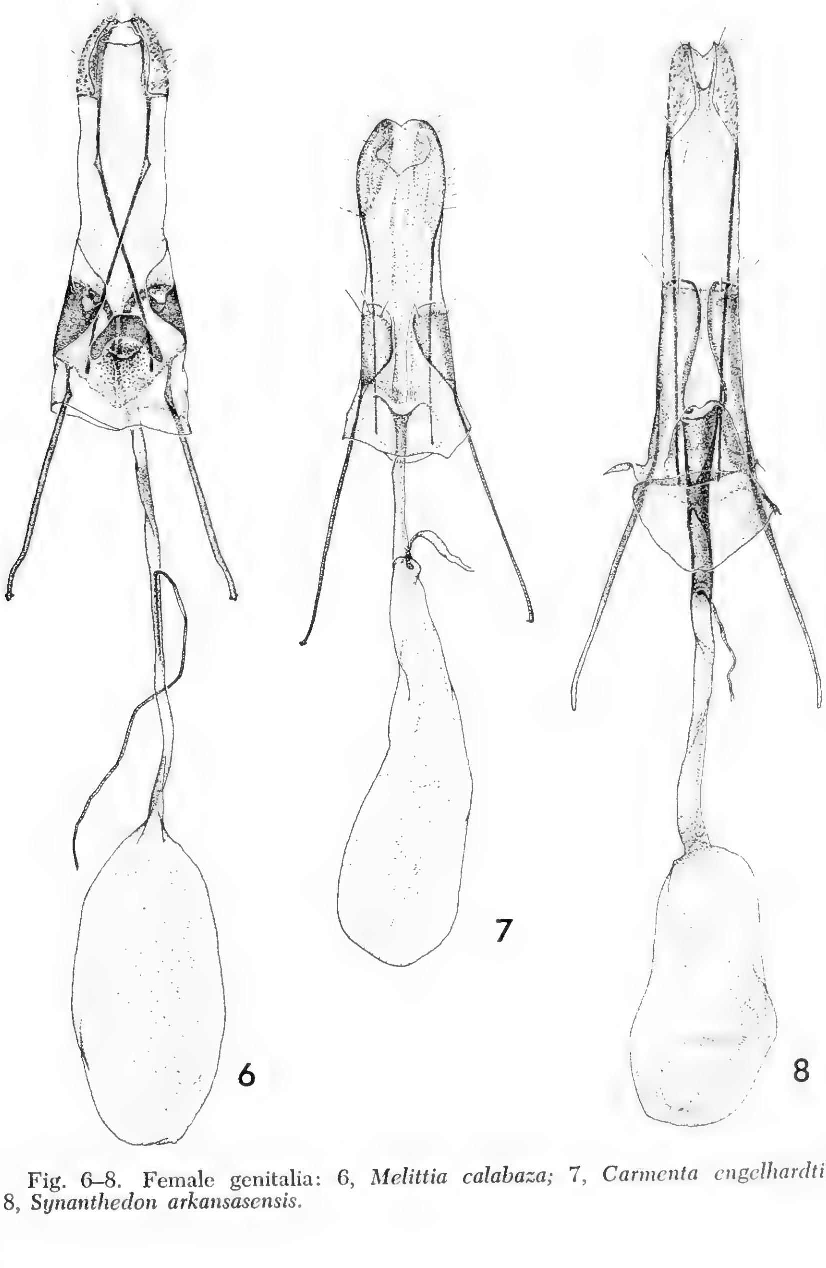
The known distributions of the 3 species, *M. calabaza, M. cucurbitae, M. satyriniformis,* are indicated in Map 1. The current distribution patterns suggest that the species involved in this complex may be sympatric in certain portions of their ranges. This cannot be demonstrated until additional material can be examined from such critical zones as Texas, the eastern coastal and inland areas and the southern half of Mexico, assuming the ecological requirements of each species do not prevent their occurring in the same localities. The range of variation of the differentiating characters has not been observed to overlap from species to species, based on the examination of long series of each species from an area covering most of the Americas.

Genus *Synanthedon* Hübner

Synanthedon arkansasensis n. sp.

figs. 4, 8; map 1

Male: Antenna blue-black, clavate, tufted with scales apically, ciliate ventrally, ventral side of scape yellow. Proboscis well developed. Labial palpus pale yellow and smoothly scaled ventrally. Head with vertex blue-black, front mostly blue-



6

7

8

Fig. 6–8. Female genitalia: 6, *Melittia calabaza;* 7, *Carmenta engelhardti;* 8, *Synanthedon arkansasensis.*

black with white laterally, some pale yellow dorsolaterally beneath scape, occipital fringe yellow. Thorax blue-black dorsally with 2 subdorsal, longitudinal yellow bands, a transverse yellow band on posterior margin; mostly yellow ventrally. Forewing approximately ⅔ hyaline, dorsally with costal and anal margins, discal spot, veins and fringe brown-black, with orange or yellow-orange on wing apex between veins and often outlining discal spot. Forewing ventrally powdered with orange or yellow-orange on veins and in apical region between veins. Hindwing hyaline except for brown-black on veins and fringe with some orange powdered on costal margin. Prothoracic leg laterally with coxa mostly yellow with blue-black on mesal margin, femur blue-black, tibia and tarsi yellow, mesally all legs mostly yellow. Mesothoracic leg with coxa and femur blue-black, tibia yellow with blue-black at spurs, and tarsi yellow ventrally, blue-black dorsally. Metathoracic leg with coxa and femur blue-black, tibia blue-black dorsolaterally, yellow ventrally and at spurs, tarsi blue-black dorsally, yellow ventrally and in ring around distal end of first and fifth segments. Abdomen and anal tuft mostly blue-black, dorsally all segments except first edged posteriorly with yellow; ventrally all segments except third may be edged posteriorly with yellow, yellow on edge of anal tuft laterally and on apices of valvi. Male genitalia as in figure 4. The genitalia are typical of the species included by Engelhardt (1946) in the genus *Ramosia*, having the saccular ridge of the valva with a ventrally projecting area covered with dark scales, beyond which the saccular ridge is naked to the apex. The medioventral plate of gnathos wide but relatively short. The aedeagus with small spines apically, minute cornuti on vesica. Wing length of male, 7–9 mm.

Female: Antenna as for male but lacking ventral cilia. Maculation as for male except forewing powdered orange on veins basad of discal cell; hindwing powdered orange along costal margin and wing fringe; abdominal bands of yellow wider than on male; anal tuft mostly yellow with blue-black laterally and medially. Female genitalia as in figure 8. Ductus bursae elongate, slender and sclerotized on posterior ⅓ to ½. Ductus seminalis arises from sclerotized portion of ductus bursae slightly posterior to membraneous portion. Wing length of female, 7–10 mm.

Host: Unknown.

Distribution (map 1): Present records are from Missouri, Arkansas, Mississippi, Alabama, panhandle region of Florida, Georgia, coastal North and South Carolina, and New Jersey.

Types: Holotype, ♂, Devil's Den St. Pk., Washington Co., Arkansas, 17–VII–1966, R. W. Hodges, (USNM No. 72382). Fourteen paratypes with same locality and collector as holotype; 1 ♀, 8–VI–1966, 1 ♂, 3–VII–1966, 1 ♀, 5–VII–1966, 1 ♂ 2 ♀, 7–VII–1966, 2 ♂ 1 ♀, 9–VII–1966, and 1 ♂, 13–VII–1966; all deposited in the USNM. Paratypes: 1 ♂, 4–VI–1966, 1 ♂ 1 ♀, 6–VII–1966, and 1 ♀, 9–VII–1966 are deposited in the collection of the University of Arkansas, Fayetteville. One ♂ paratype: Wrangle Brook Rd., Lakehurst, N. J., 25 July, 1955, J. G. Franclemont, is deposited in the collection of Dr. J. G. Franclemont, Ithaca, New York.

Discussion: Most, if not all, of the specimens of this species studied were collected at light. Although sesiids are generally considered to be diurnal or crepuscular in adult activity periods, the consistency with which a few species, including S. *arkansasensis*, are captured at lights suggests that they may be primarily nocturnal in habits.

Synanthedon canadensis n. sp.
fig. 5; map 1

Male: Antenna dorsally powdered pale yellow for entire length, clavate, ciliate ventrally, with scale tuft apically. Proboscis well developed. Labial palpus roughened ventrally, brown-black dorsally and laterally, yellow-orange ventrally and mesally. Head with vertex blue-black, front blue-black with white laterally, occipital fringe dorsally black mixed with yellow or yellow-orange, dorsolaterally yellow or yellow-orange becoming white ventrolaterally. Thorax dorsally blue-black apparently without lighter scaling, ventrolaterally with orange spot anterior on mesothorax and pale yellow posterior to spot. Wings mostly hyaline with blue-black on veins. Forewing dorsally with apical area dull orange between veins, discal spot and costal margin blue-black; ventrally with apical area, costal margin and fringe powdered dull orange. Hindwing ventrally with costal margin and fringe powdered dull orange. Prothoracic leg with coxa mostly white, tinted pale yellow ventrad, femur and tibia pale yellow ventrally, blue-black dorsally, tarsi pale yellow. Mesothoracic leg with coxa white, femur blue-black, tibia blue-black except for white medial tuft and white tuft around spurs, tarsi mostly yellow-orange, blue-black dorsally. Metathoracic leg with coxa black basally, white apically, femur blue-black, tibia blue-black with much white in tufts around medial and apical spurs, tarsi yellow-orange with blue-black dorsally. Abdomen entirely blue-black dorsally, orange with white on posterior half ventrally, anal tuft orange except medio-basally. Male genitalia as in figure 5. Saccular ridge of valva very wide, nearly straight, edge lined with short, dark, simple scales. Wing length of male, 7–8 mm.

Female: Unknown.

Distribution (map 1): Present records from Alberta, Canada.

Type: Holotype: ♂, Waterton, Alberta, 10–VII–1923, H. Strickland, T.D.E. slide no. 76021, (USNM No. 72381), deposited in the USNM. One paratype: ♂, Banff, Alberta, 27–VII–1935, A. L. Melander, deposited in the collection of the University of California, Riverside.

Discussion: On the basis of the form of the saccular ridge, S. *canadensis* resembles those species considered by Engelhardt (1946) to be in the genus *Thamnosphecia* Spuler. In our current revisionary studies of the family Sesiidae, we treat *Thamnosphecia* as a synonym of *Synanthedon*.

S. *canadensis* is known only from the type series of 2 males, both only in fair condition. The species superficially resembles the female of *Synanthedon richardsi* (Engelhardt) from the eastern United States. The males of S. *richardsi* have orange on the anal tuft restricted to the base, and the antennae of both sexes of S. *richardsi* have pale yellow, when present, only near the apices. Additionally, the tibia of the metathoracic leg of *S. richardsi* is mostly yellow, whereas in *S. canadensis* the tibia are blue-black ringed with white tufts. *Synanthedon fulvipes* (Harris) occurs in Alberta and also resembles *S. canadensis*; however, the orange anal tuft of *S. canadensis* easily distinguishes it from *S. fulvipes* and a few other species with which it might be confused.

Synanthedon dominicki n. sp.

fig. 1; map 1

Male: Antenna blue-black, spotted white near apex, clavate, tufted with scales apically and ciliate ventrally. Proboscis well developed. Labial palpus smoothly scaled, orange with brown-black apically and in narrow band dorsally. Head with vertex blue-black, front blue-black, occipital fringe orange. Thorax dorsally blue-black with subdorsal, longitudinal, orange stripe, orange ventrally. Forewing nearly ⅔ hyaline with brown-black on costal margin, broad discal spot, strongly diffused in apical area, some yellow ventrally toward wing base. Hindwing hyaline except for brown-black on fringe and narrow discal spot. Legs mostly blue-black except for orange on epiphysis of prothoracic leg and some white on mesal surface of the tibiae and ventrally on tarsi. Abdomen blue-black except for some pale orange powdering ventrally on segments 4–7, anal tuft mostly orange-red except for blue-black on basal ⅓ dorsally. Exposed portions of genitalia also orange-red with keel of orange-red scales ventrad. Male genitalia as in figure 1. Wing length of male, 8 mm.

Female: Unknown.

Host: Unknown.

Distribution (map 1): South Carolina.

Type: Holotype: ♂, Wedge Plantation, South Santee River, Charleston Co., S. C., March 27, 1967, Douglas C. Ferguson, T.D.E. slide no. 76089, (USNM No. 72383), deposited in the USNM.

Discussion: This species is known only from the male holotype. We take pleasure in dedicating this species to Dr. Richard B. Dominick. It was on Dr. Dominick's plantation where his guest, Dr. Ferguson, collected the specimen at black light. More significantly, Dr. Dominick is contributing to the study of Lepidoptera as one of the prime movers behind the production of *The Moths of America North of Mexico*, for which series we are currently preparing the manuscript of the Sesiidae, Fascicle 5b.

Genus *Carmenta* Hy. Edwards

Carmenta engelhardti n. sp.

figs. 2, 7; map 1

Male: Antenna blue-black with apical scale tuft, clavate, ciliate ventrally. Proboscis well developed. Labial palpus smoothly scaled ventrally, white basally, brown-black dorsolaterally on apical half, pale yellow ventrally and mesally. Head with vertex blue-black, front gray-black with white laterally, occipital fringe dorsally pale yellow becoming white lateroventrally. Thorax dorsally blue-black with subdorsal, narrow, longitudinal, yellow stripes, sublaterally with large patches of pale yellow. Wings mostly hyaline, blue-black on wing margins, veins, discal spot and apical area, slightly powdered with yellow on some veins, between veins in apical area and in small patch on distal margin of discal spot, yellow more extensive ventrad on wings. Wing fringe blue-black and tipped with white especially on hindwings. Prothoracic leg with coxa white and blue-black, femur blue-black laterally, white mesally, tibia black and white dorsally, pale yellow ventrally, tarsi white at joints and ventrally, black dorsally. Mesothoracic leg mostly blue-black with white mesally on femur and basal 1/2 of tibia, white band at tibial spurs, tarsi white ventrally and around joints. Metathoracic leg blue-black and white mesally on femur, banded white at tibial spurs, white ventrally and at joints on tarsi. Abdomen and anal tuft blue-black with weak, pale yellow bands on posterior margin of segments two and four. Male genitalia as in figure 2. The presence of a spine projecting from the ventral margin of the valva is a unique structure in the North American Sesiidae. Saccular ridge at its apex sharply recurved and continued to ventral margin of valva. Wing length of male, 8–9 mm.

Female: Antenna as for male but lacking ventral cilia. Maculation as for male, occasionally coxa of prothoracic leg slightly tinted with pale yellow on the white. Female genitalia as in figure 7. Ductus bursae somewhat atypical of *Carmenta* species in that it is very weakly sclerotized and expanded from origin of ductus seminalis to corpus bursae. Wing length of female, 8 mm.

Host: Unknown.

Distribution (map 1): Presently known from Arizona and New Mexico.

Types: Holotype: ♂, Garden Canyon, 5300 ft., Huachuca Mts., Cochise Co., Arizona, 14–VIII–1969, R. R. Snelling, T.D.E. slide no. 75975, deposited in the Los Angeles County Museum (Natural History), California. Two paratypes: 1 ♂, Skeleton Canyon, 5400 ft., Hidalgo Co., New Mexico, 12–VIII–1965, G. Ballmer, deposited in the collection of the University of California, Riverside; and 1 ♀, floor of Carr Canyon, 5400 ft., Huachuca Mts., Cochise Co., Arizona, 8–9.VIII.1952, H. B. Leech and J. W. Green, deposited in the California Academy of Natural Sciences, San Francisco.

Discussion: This species superficially resembles several species of *Carmenta* and *Synanthedon*, and an examination of the genitalia may be necessary for positive identification. The species is named for George P. Engelhardt, who devoted more than 40 years of his life to the study of the clearwing moths of North America.

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NOTES ON THE GROWTH OF TAXONOMIC KNOWLEDGE OF THE PSOCOPTERA AND ON THE GRAMMAR OF THE NOMENCLATURE OF THE ORDER

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ABSTRACT—A growth curve is plotted for the accumulation of species descriptions in the Psocoptera, resulting in an indication that about half the total number of extant species has been described. The number of species per genus is also plotted against the number of genera with each number of species. The average number of species per genus is 8.27. The grammar of the nomenclature of the latest general catalog is discussed.

The data in the world catalogue of the Psocoptera by Smithers (1967) were made the subject of a trend curve analysis according to a method I have described (Steyskal, 1965), whereby an attempt is made to gain an insight by statistical means into the relative completeness of our knowledge of the existing species of a taxonomic group. I have shown that when a group is well known, that is, when the primary work of species description is nearly completed, the plotting of accumulated numbers of presently valid species against periods of years (decades) within which the species were described will usually yield a smooth sigmoid curve. Many groups of insects, when thus analyzed, give a smooth curve, but one that is only the lower 1/2 of a sigma. This may be taken to indicate that the rate of species description has not begun to slacken, and that many species (very roughly 1/2 of those extant) remain undescribed. The larger the group analyzed the smoother is the resulting curve. The Psocoptera, with a total of 1565 recent species described and held valid in 1965, are of a size that may be expected to produce a good curve, one with no dots far from a smoothly curved line.

Starting with the 2 species described by Linnaeus in 1758, the Psocoptera give the curve shown in Figure 1, one that is smooth but far from sigmoid. It is evident therefrom that species description has not yet definitely passed midpoint, beyond which, as shown by the extrapolated broken line, the curve should start to turn to the right as accumulated numbers of species lessen. The extrapolated curve may be considered minimal, inasmuch as one of the effects of the publication of a catalogue is often that of increased taxonomic activity. It is not at all surprising that the alpha taxonomy of insects as delicate and inconspicuous as the Psocoptera should have been so slow in gaining impetus. Even the workers most familiar with any particular group cannot with any degree of exactness tell at what

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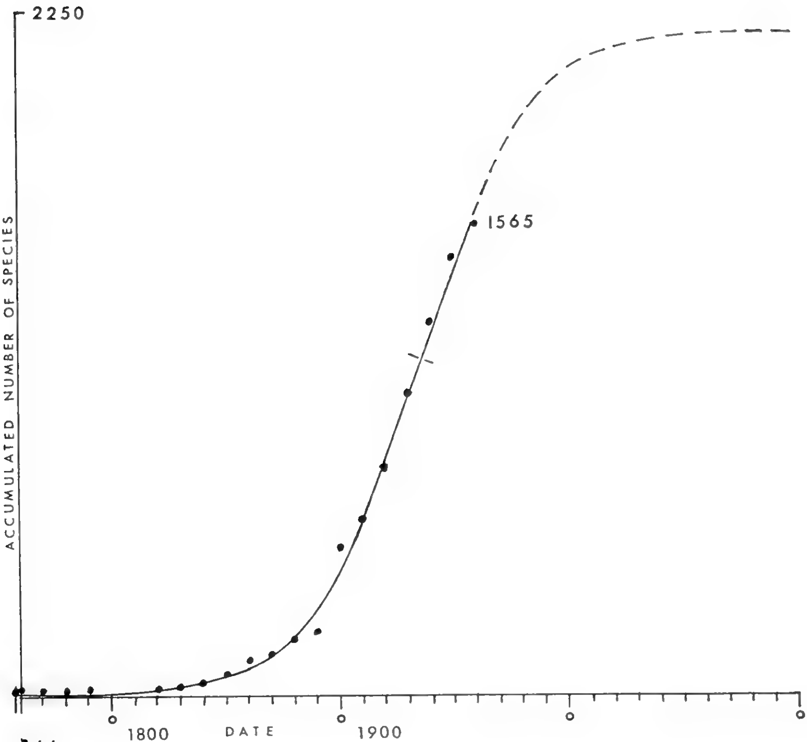

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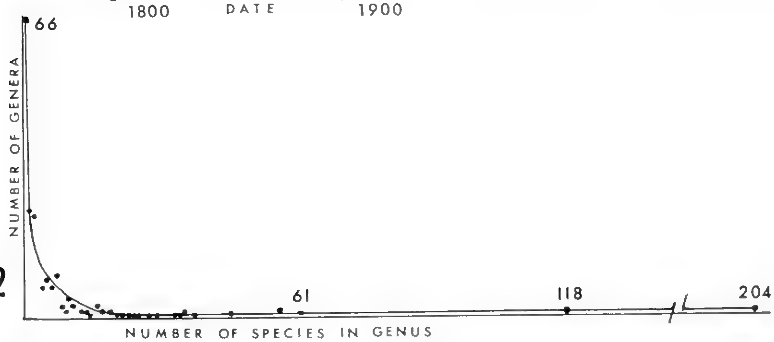

Fig. 1. Trend curve of the rate of species description in the recent Psocoptera. The number of species is given at the upper end of the curve; the bottom line (decades) begins with 1758, then 1760 and succeeding decades, with the zeroes at 1800 and 1900. Fig. 2. Species-per-genus curve for recent Psocoptera.

point the progress of their group stands, and only an analysis such as this will give a firm basis for its expression.

Another analysis, one first suggested by Willis (1922), deals with the number of species per genus. This matter was also briefly treated by me (Steyskal, 1946). The numbers of species per genus plotted against the numbers of genera including each number of species yields a characteristic 'hollow curve' that has so far not been explained. Analysis of several groups in this manner shows that moderately large groups (families, orders) have many monotypic genera (those including but one species) and but 1 or few very large genera. The number of monotypic genera is often very roughly equal to the number of species in the largest genus. The number of species per genus as an arithmetic mean will vary from about 6 to 12, but very few genera are found to be of average size. Smith (1956) also gave averages for a number of groups of animals, reporting an average of 4 species per genus in 584 genera of insects.

The species-per-genus curve for recent Psocoptera is shown in Figure 2. The numbers of species per genus, followed in parentheses by the number of genera including each number of species are: 1 (66), 2 (24), 3 (23), 4 (7), 5 (9), 6 (7), 7 (10), 8 (3), 9 (2), 10 (4), 11 (3), 12 (2), 13 (2), 14 (1), 15 (1), 16 (3), 17 (2), 19 (2), 20, 21, 23, 24, 25, 27, 29, 33, 34 (1 each), 35 (2), 37, 45 (1 each), 56 (2), 61, 118, 204 (1 each). The average number of species per genus is 8.27. If any conclusion may be drawn from this, it is that a few genera are too large.

The nomenclatural grammar of Smithers' catalogue is better than that of many recent works, but in the interest of maximum accuracy in a work as important as a general catalogue, the following notes are offered.

1. Generic names formed with the ending *-opsis*, according to the International Code of Zoological Nomenclature (herein after referred to as "the Code"), Article 30.a.i. are of feminine gender. Therefore, the names *Seopsis, Sphaeropsocopsis, Epipsocopsis, Amphipsocopsis, Ectopsocopsis,* and *Neopsocopsis* should be feminine, and several species-names should be altered as follows: *Seopsis pavonia* and *S. termitophila* (p. 20); *Sphaeropsocopsis argentina* (p. 30); *Epipsocopsis spatulata* (p. 31); *Amphipsocopsis surculosa* (p. 54); *Ectopsocopsis annulata, E. aneura, E. mozambica, E. spathulata* (p. 63); *Neopsocopsis pyrenaica* (p. 95). The species-name *pavonius* is not classical, but it may be considered a Neo-Latin adjective derived from the noun *pavo* in a manner analogous to that of classical *praedonius* (from *praedo*) and *phrygionius* (from *phrygio*).

2. The following generic names are properly of the gender indicated and the species-names should be changed to the form shown below:

Thylax, m. (classical proper noun); *T. fimbriatus* (p. 3).
Nepticulomima, f.; *N. chrysomelaena* (p. 4). The form *chrysomelas* ('golden-black' is masculine.

Pteroxanium, n.; *P. funebre* (p. 9).
Psocatropos (*Psocus* + *Atropos*), f.; *P. floridana* (p. 14).
Paramphientomum, n.; *P. tristigatum* (p. 19).
Embidopsocus, m.; *E. oleaginus* (p. 23). The word *oleaginus* is a classical variant of *oleagineus* or *oleaginius*.
Neurosema (from Greek *sēma*), n.; *N. apicale* (p. 35).
Mepleres, m.; *M. solitarius* (p. 50).
Cladioneura, f.; *C. coriacea* (p. 72).
Archipsocus, m.; *A. aneurus* (p. 76).
Palmicola (see the Code, Art. 30.a.i.2, examples), m.; *P. solitarius* (p. 82).
Psocus triangulum (p. 87). The species-name *triangulum* is a classical alternative form of *triangulus* and is a noun in apposition; it therefore should not be changed to *triangulus*.
Hexacyrtoma (from Greek *kyrtōma*), n.; *H. capense* (p. 88).
Blaste, f.; *B. lithina* (p. 93).
Steleops, m.; *S. pedunculatus* (p. 114). Because the original author did not make an indication of the gender of *Steleops* (see the Code, Art. 30.a.i.2), the gender must be masculine, regardless of what its author or anyone else may have done later.
Trichadenotecnum, n.; *T. trigonosceneum* (p. 117). The species-name is evidently derived from Greek *skēnē*, and with the final *-ea* it must be an adjective. Compare the genus-name *Anopistoscena*, also by Enderlein, wherein the final eta has been changed in the classical transcriptional manner to *a*.
Thyrsopsocus, m.; *T. pulcher* (p. 119).
Phlotodes, m.; *P. corticosus*, *P. lichenosus*, *P. lyriifer* (p. 122). For the reason given above under *Steleops*, this genus-name must be masculine. It would seem that the species-name *lyriifer* ought to be *lyrifer*, but there are no rules in the Code for such a change. The species-name *longigena*, incidentally, may be considered a compound noun in apposition, formed with the noun *gena*.

3. The following family-group names require correction:

Prionoglaridae to Prionoglarididae (p. 16). The genitive of *Prionoglaris* (from Greek *glaris* 'chisel') is *prionoglaridis*.
Plaumannidae to Plaumanniidae (p. 21).
Neurostigminae to Neurostigmatinae (p. 31). The genitive of *Neurostigma* is *neurostigmatis*.
Kolbeinae to Kolbiinae (p. 57). See *Kolbia*, below.

4. Miscellaneous errors:

Stigmatopathus horvarthi (p. 20) should be *S. horvathi* (originally written with an accent mark: *horváthi*).
Kolbia Bertkau (p. 57) was needlessly and invalidly emended to

Kolbea by Enderlein. The original spelling should be preserved and the subfamily-name based upon it should be Kolbiinae.

Pearmania usambarana (Enderlein) is the correct citation (p. 105) because Badonnel, although he used "n. sp.," did cite the Enderlein name and merely changed the status of the variety to species and described it in further detail.

5. The following notes, not calling for changes, are added by way of comment only:

Caecilius nigroticta (p. 44) is probably an error for *C. nigrotinctus*, but in the lack of a statement regarding its derivation in the original publication there is the possibility that it could be based upon a putative noun *ticta*. It should be considered a noun in apposition, as it apparently has been.

Kilauella criniger (p. 81). Names in *-ger* are sometimes, as in this case and in the classical word *armiger*, considered nouns.

Valenzuela, m. (p. 124). This genus-name is dedicated to a man, En Rafel Valenzuela, and therefore, in spite of its appearance, is masculine in gender, as its author treated it in making the name of its type-species *V. marianus*.

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A NEW SPECIES OF ACROBASIS FROM THE TRANS-PECOS REGION OF TEXAS (LEPIDOPTERA: PYRALIDAE)[1]

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ABSTRACT—*Acrobasis* **blanchardorum**, n. sp., is described from west Texas where it has been collected at elevations of approximately 5,000 to 7,000 ft. This species appears to be most closely related to *Acrobasis minimella* Ragonot.

This paper provides a name for a new species of *Acrobasis*, so that it can be included by A. and M. E. Blanchard in an annotated list of the moths of Texas.

I wish to express my thanks to the Blanchards for the opportunity to examine this material, and for permission to describe the following new species.

Acrobasis blanchardorum, new species
fig. 1–6

Wing expanse 18–21 mm.

Head usually reddish brown, varying from pale brown to reddish brown suffused with purple. Labial palpi reddish brown, or reddish brown with black, becoming white on inner surfaces and at basal 1/5. Basal segment of antenna fuscous and reddish brown.

Collar reddish brown to pale brown. Dorsum of thorax fuscous with pale brown and/or reddish-brown scales. No sex-scaling on thorax.

Primaries fuscous, conspicuously irrorate with white, white concentrated on basal area near raised-scale ridge and extending anteriorly to costa, on median area, and in terminal area beyond subterminal line; basal area with brownish-red scales anteriorly and medially, and ochreous patch near posterior margin; antemedial line obscure; a black, or black and reddish brown, triangular costal patch following antemedial line; raised-scale ridge distinct reddish brown (with some black scales in a few specimens, but reddish-brown scales predominating); area between scale ridge and antemedial line ochreous; discal spots usually distinct; subterminal line distinct at costa becoming indistinct elsewhere; scattered, somewhat obscure, reddish-brown scales between subterminal line and whitish terminal area and below discal spots; undersurface of male with sex-scaling consisting of long black streak just below costa which is covered for about 1/3 of its length at base with yellowish-white to white scales. Secondaries pale smoky fuscous; undersurface of male with sex-scaling consisting of long black streak just below costa.

Male genitalia with gnathos terminating in simple hook; transtilla with posterior

[1] Paper no. 3734 of the Journal Series of the North Carolina State University Experiment Station, Raleigh.

Fig. 1, 2. *Acrobasis blanchardorum.* 1, male (holotype). 2, female.

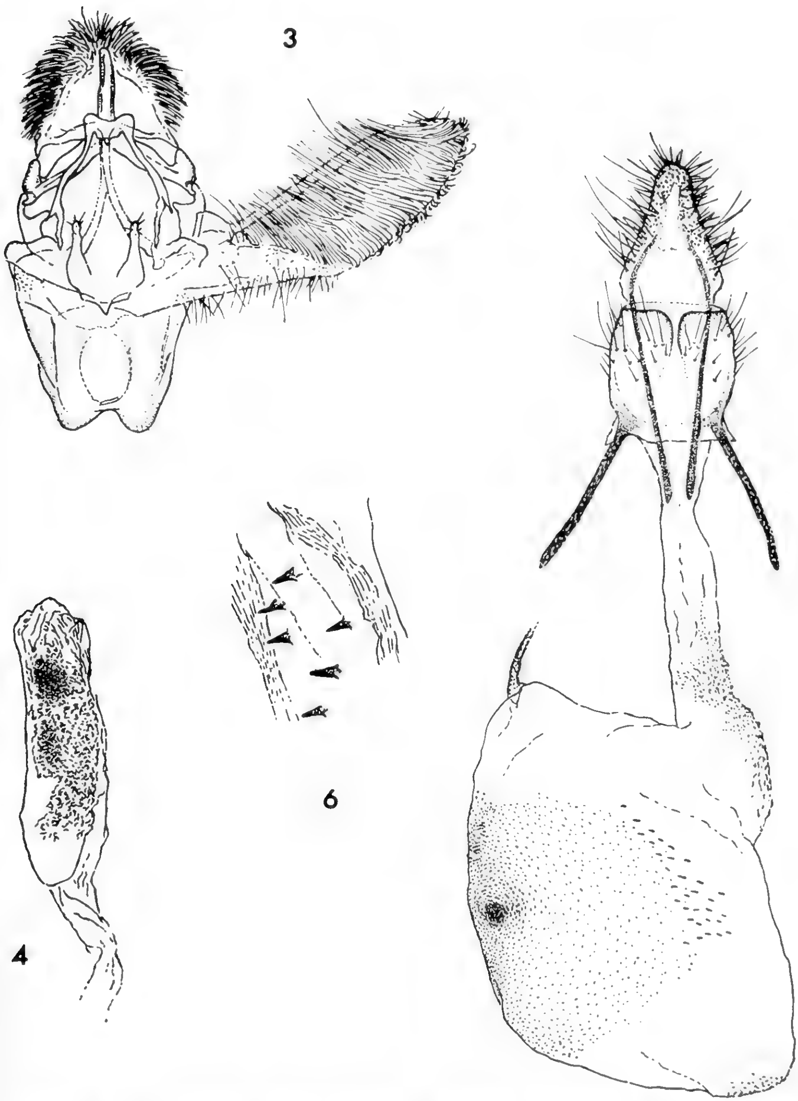

Fig. 3–6. *Acrobasis blanchardorum.* 3, 4, male genitalia. 5, female genitalia. 6, enlarged portion of inner wall of corpus showing a few of the inwardly projecting spines.

terminal margins rounded and distinctly concave; anellus a U-shaped plate; aedeagus simple.

Female genitalia with ductus bursae elongate, membranous, and minutely scobinate near union with corpus; corpus bursae with 2 distinct groups of 30–40 small inwardly projecting spines and numerous minute scobinations covering about 1/2 of the corpus and surrounding a single signum.

Holotype: Sierra Diablo Wildlife Management Area, 6000′, Culberson Co., Texas, ♂, 5–VI–69, A. & M. E. Blanchard, USNM type no. 72179, ♂ genitalia slide HHN 168; in the United States National Museum (USNM).

Paratypes: TEXAS: Sierra Diablo Wildlife Management Area, 6000′, Culberson Co., 5 ♂, 3 ♀, 5–VI–69, A. & M. E. Blanchard. Guadalupe Mts., Nickel Creek, 5000′, 1 ♂, 10–VII–68, A. & M. E. Blanchard. Davis Mountains, Mount Locke, 6700′, 1 ♂, 4–VII–69, A. & M. E. Blanchard. Davis Mountains, 5 mi. SE Livermore, 6000′, 1 ♀, 29–VIII–70, A. & M. E. Blanchard.

The paratypes have been deposited as follows: 1 ♂, 2 ♀, from Sierra Diablo in the USNM; 1 ♂ from Sierra Diablo and 1 ♀ from Davis Mountains, Livermore, in the North Carolina State University Museum; remaining paratypes in the collection of A. Blanchard.

Larval Host: Unknown.

Distribution: Presently known only from the Trans-Pecos Region of Texas. Collected at elevations of 5000–6700 feet.

Discussion: *Acrobasis blanchardorum* appears to be most closely related to *Acrobasis minimella* Ragonot. Both *A. blanchardorum* and *A. minimella* have a raised-scale ridge on the primaries and a gnathos with its apical process a simple hook. This is a combination of characters previously recorded, in the North American species of *Acrobasis*, only for *A. minimella*. All other known species of the genus, in North America, either have smooth primaries and a gnathos with the apical process a simple hook, or they possess a raised-scale ridge on the primaries and a gnathos with the apical process trifurcate.

In addition, the location and amount of male sex-scaling is similar in *A. blanchardorum* and *A. minimella*, and the presence of distinct groups of inwardly projecting spines on the female corpus bursae is common to both species.

Acrobasis blanchardorum, can be most easily distinguished from *A. minimella* on the basis of size and coloration. *Acrobasis blanchardorum* is larger (*A. minimella* has a wing expanse of only 13–16 mm) and is, in general, much lighter in color than *A. minimella* (white scaling is very evident on *A. blanchardorum* and obscure on *A. minimella*. Also, the raised-scale ridge of *A. blanchardorum* is reddish brown, or predominately reddish brown, and the scale ridge of *A. minimella* is black).

Differences in genitalia between the 2 species appear to be slight. With the male genitalia, the lateral arms of the gnathos of *A. minimella* are uniformly stout with the basal posteriorly projecting elements short. *Acrobasis blanchardorum* has the lateral arms of the gnathos becoming more slender basally and the posteriorly projecting elements more elongate. Also the posterior margins of the transtilla are more angulate in *A. minimella* than in *A. blanchardorum.*

No differences have been detected in the female genitalia.

Acrobasis minimella occurs from New Jersey south to Florida and west to east Texas. It has not been collected in the Trans-Pecos Region of Texas where *A. blanchardorum* is present.

Acrobasis blanchardorum is named after Andre and M. E. Blanchard who collected the species.

CECIDOMYIIDAE FROM MEXICAN TERTIARY AMBER (DIPTERA)

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ABSTRACT—Nine species of Cecidomyiidae from Tertiary Mexican amber are found to belong in or near extant genera and, in some cases, to be close to or indistinguishable from extant species.

This report is based on 12 cecidomyiids preserved in 11 pieces of Mexican amber, dated Upper Oligocene to Lower Miocene, and includes the first fossil adult records of the supertribe Cecidomyiidi. Some of the specimens are close to extant species, and all can be referred at least questionably to extant genera. Although the sample is very small, there is nothing to indicate that the cecidomyiid fauna of ca. 30 million years ago was generically different from today's: present were *Contarinia,* one of the largest extant cecidomyiid genera which contains closely host-specific gall-makers, the predaceous *Lestodiplosis,* the selectively mycophagous *Clinodiplosis* and *Bremia,* and a porricondyline of the tribe Heteropezini, all recent species of which exhibit paedogenesis.

Although 3 of the species listed here are new, in the sense that they are unlike extant species known to me, I think there would be no advantage in describing them formally. Naming them would tell us no more than we already know and would require detailed future

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I wish to thank Dr. Joseph H. Peck, Jr., of the Department of Paleontology, University of California, Berkeley, for the loan of the specimens, and all those who acquired, prepared, or made available these fossils for study. The specimens are deposited in the University of California Museum of Paleontology, Berkeley, California.

comparison between these imperfect specimens (as are most fossils) and subsequent finds, not only fossil but recent.

Lestremiinae

? *Monardia* sp.

This male specimen is probably a *Monardia* but the genitalia are covered on 1 side by an air bubble caught between the wings and abdomen and on the other by an inclusion. The head, wings, and legs are in excellent condition, the last with most of its setae and scales intact.

Upper Oligocene to Lower Miocene. U. C. Mus. Paleo. No. 13001, loc. B–7456, purchased in Chiapas area, Chiapas, Mexico.

Porricondylinae

Heteropezini

? *Henria* sp.

Although 4 male specimens from 4 pieces of amber belong here, a few details needed for generic separation are not visible, viz. the eyes, palpi, and extra-setal antennal sensoria. The species definitely fits within the tribe Heteropezini, members of which exhibit paedogenesis. This species has 11 flagellomeres, 5-segmented tarsi with ratios of each segment to first about: 1.0, 1.8, 1.1, 1.0, and 1.5. The wing is narrow, pointed apically, and surrounded by a long fringe of setae; R5 reaches the costa at the wing apex. The genitalia are simple: the lobes of tergum IX are triangular, setose; the edge of the ventral plate is concave except for a small, medial triangular projection; and the telomeres are cylindrical, rounded apically, untoothed.

Upper Oligocene to Lower Miocene. U. C. Mus. Paleo. Nos. 12819, 12821, loc. B–5100, collected from sandstone blocks at base of Las Cruces slide, ca. 23 km. e.-se. Simojovel; No. 12954, loc. B–7453, Santa Lucia; and No. 12959, loc. B–7454, Simojovel, Chiapas, Mexico.

Cecidomyiinae

Oligotrophidi

Phaenolauthia (s.l.) sp.

This female is placed in *Phaenolauthia* sensu lato; when the generic limits of recent species are agreed upon, it may be placed more precisely. The antenna has 9 pyriform flagellomeres, the short R5 wing vein lies close to the costa and the 2 veins join anteriad of the wing apex, the small claws are abruptly curved at about 1/3 the distance from the base, and the short, telescoped abdomen is terminated by 2 bilaterally flattened cerci. This specimen is in the same piece of amber as the specimen of *Contarinia* sp. below.

Date unknown; possibly within the range of the other pieces of amber treated here, i.e., late Oligocene to early Miocene. U. C. Mus. Paleo. No. 12617A, exact loc. unknown, from Simojovel area, Chiapas, Mexico.

Cecidomyiidi

Contarinia sp.

This female specimen is a typical *Contarinia*.

Date unknown; possibly Upper Oligocene to Late Miocene. U. C. Mus. Paleo. No. 12617B, exact loc. unknown, from Simojovel area, Chiapas, Mexico.

Lestodiplosis sp.

This excellent female specimen is a typical *Lestodiplosis*: even the blunt setae of the cerci are visible. It is not possible to separate it from recent *Lestodiplosis* females, many of which are themselves indistinguishable from one another.

Date unknown; possibly Upper Oligocene to Later Miocene. U. C. Mus. Paleo. No. 12616, exact loc. unknown, from Simojovel area, Chiapas, Mexico.

Lestodiplosis (sensu lato) sp.

Details of the genitalia of this male specimen are difficult to see because of the size of the piece of amber it shares with other insects. The basimeres, telomeres, and aedeagus are long and narrow, and the tergum and sternum are short and rounded, but basimeral lobes are not apparent. The tarsal claws are broadly curved near midlength and node II of each flagellomere is pear-shaped, as in *Lestodiplosis*. The labella are unusually long but the head is not preserved well enough to see details.

Upper Oligocene to Lower Miocene. U. C. Mus. Paleo. No. 12822, loc. B–5100, collected from sandstone blocks at base of Las Cruces slide, ca. 23 km. e.-se. Simojovel, Chiapas, Mexico.

? *Lestodiplosis* sp.

Although the genitalia are not clear on the male specimen, the outline of the basimere and telomere, the wings, antennae (of which only the basal flagellomeres are present), and claws are characteristic of *Lestodiplosis*.

Upper Oligocene to Lower Miocene, U. C. Mus. Paleo. No. 13000, loc. B–7456, purchased in Chiapas, Mexico.

Clinodiplosis sp. nr. *terrestris* (Felt)

The head, wings, legs, and genitalia of this male specimen are exceptionally well preserved. The only apparent difference between this fossil and *Clinodiplosis terrestris* (Felt) [new combination] is the width of the lobes on tergum X which are wider in *terrestris*.

Date unknown; possibly Upper Oligocene to Late Miocene. U. C. Mus. Paleo. No. 12620, exact loc. unknown, from Simojovel area, Chiapas, Mexico.

Bremia sp.

The genitalia of this male specimen are fairly well displayed. Sternum X is typically elongate and narrow but the aedeagus is shorter, dorsoventrally flattened, wide for most of its length, and tapers abruptly to a pointed apex. It is unlike any recent species of which I am aware. Most of the legs, and the wings and head are well preserved: circumfila I and III of the antennal flagellomeres have loops that are longer than their respective flagellomeres but the loops of circumfilum II are very short.

Probably Miocene, U. C. Mus. Paleo. No. 12703, loc. B–5103, Las Cruces slide Simojovel area, Chiapas, Mexico.

A NEW NOCTUID FROM ARIZONA (LEPIDOPTERA: NOCTUIDAE: CUCULLIINAE)

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ABSTRACT—**Apsaphida eremna** is a new species of noctuid that has been taken in the mountains of southeastern Arizona. The larva has been reared from the egg; the accepted food plants were *Quercus arizonica* Sargent and *Quercus hypoleucoides* A. Camus.

The description of this moth has been promised to collectors for some time. The name is now needed by E. L. Todd because he will be referring to the species in a forthcoming paper on a group of moths from Mexico, Central America, and South America.

Apsaphida n. gen.

Type-species: *Apsaphida eremna* n. sp.

This genus has the facies of *Copivaleria* and *Psaphida,* but it differs by the absence of a "claw" on the apex of the fore tibia. The genus is probably related to "*Paramiana*" *viridescens* Barnes and McDunnough and related species. ("*P.*" *viridescens* is misplaced in *Paramiana;* it lacks the enlarged fore tarsal claws (ungues) that are present in *P. lactabilis* (Smith), the type of *Paramiana,* and in all related species and genera.) The eyes are strongly lashed in *Apsaphida* as in *Psaphida* and *Copivaleria;* they are not lashed in *viridescens.* The external tympanal structure is the same in all the genera referred to above, including a raised ridge (nodular sclerite) on the face of the tympanal membrane. This ridge is strongly tri-crenulate in *viridescens* but weakly so in *eremna.*

Description: Head with frontal area enlarged, projecting outward from vertex to about level of upper ⅓ of eye, then gradually rounded inward to clypeal region; palpi porrect, slightly ascending, clothed with rough scales and hairlike scales; proboscis well developed; front clothed with hairlike scales, upper area of front and vertex clothed with rough, dentate scales; eyes with conspicuous lashes in front and behind; antennal scape with spreading tuft of narrow scales; antennae strongly fasciculate in male, in female simple and pubescent. Thorax rough scaled; patagia with flat dentate scales in front and narrow, feathery scales behind; tegulae with broad dentate scales in middle and narrow scales on inner and outer margins; disk of thorax clothed with dentate scales forming longitudinal crest behind patagia and a double crest, 1 on each side of mid-dorsal line, on caudal ⅓. Wings with the venation as illustrated; R_5 short stalked with R_{3+4} in the forewing; M_2 of hindwing weak; outer margin of both wings crenulate; general appearance of wings rough, scales tending to curve upward.

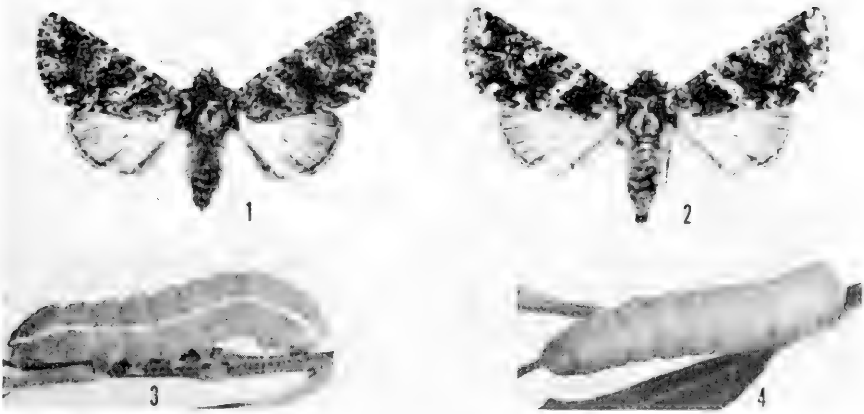

Fig. 1–4. *Apsaphida eremna* Franclemont. 1, paratype, male, Madera Canyon 4880′, Santa Rita Mountains, Santa Cruz Co., Arizona, 29 March 1963, J. G. Franclemont (Franclemont Collection). 2. paratype, female, Madera Canyon 4880′, Santa Rita Mountains, Santa Cruz Co., Arizona, 9 April 1963, J. G. Franclemont (Franclemont Collection). 3. larva, lateral view, Onion Saddle 7600′, Chiricahua Mountains, Cochise Co., Arizona, August 1967, reared from the egg by G. L. Godfrey. 4. Larva, dorsal view, same individual as figure 3.

Legs with all tarsal segments with 3 well defined rows of well developed, ventral spines. Abdomen clothed with hair and scales, with dorsal basal tuft and conspicuous tufts on the dorsum of the second and third abdominal segments.

Male genitalia as figured; the valves simple with a reduced corona of about 3 spines, no clasper; vesica with 2 groups of cornuti, 1 group of stout spines, few in number, the other of many fine spines.

Female genitalia as figured; the ductus seminalis from the apex of the bursa as in *"P." viridescens* and *Paramiana laetabilis.*

Apsaphida eremna n. sp.

A dark gray and black appearing moth with most of the pattern indicated by white or lighter scales and by black scales. There is actually a considerable admixture of dark olive green scales which fade to dark brown. The moth has somewhat the appearance of *Copivaleria grotei,* but it may be readily separated from that species by the absence of a fore tibial claw and the arrangement of the spines on the tarsi; in *grotei* they are dense and irregular, and in the present species they are in 3 regular rows.

Description: Male. Head with palpi black on the outer sides, a few white scales intermixed; vestiture of front and vertex mostly of dark gray and olive scales with white and with a few black scales intermixed. Thoracic vestiture much like that of head in general aspect; patagia with band of broad, white tipped, olive scales; tegulae black with central grayish white area; disk of thorax grayish white. Forewings appearing dark gray, almost black, with lighter

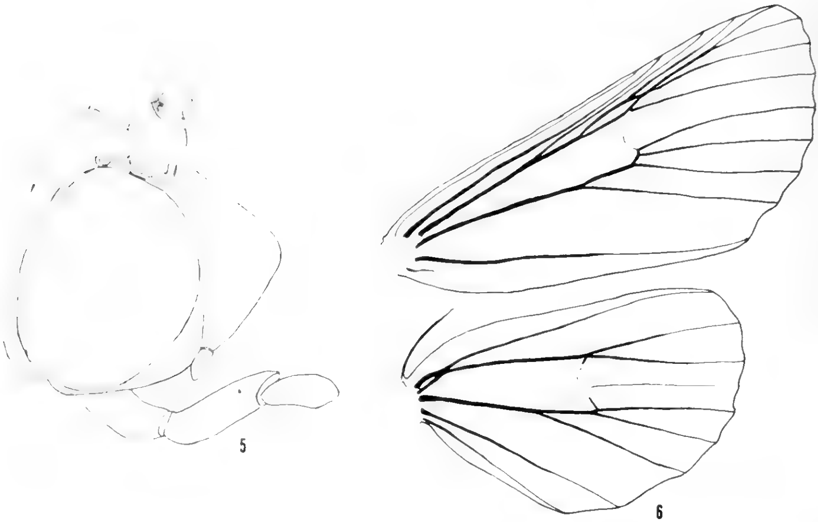

Fig. 5, 6. *Apsaphida eremna.* 5. Outline of lateral view of head, proboscis omitted. 6. Venation of forewing and hindwing.

gray and white and black scales delineating the somewhat ill-defined pattern, a great part of scales actually dark olive green; basal line indicated as double black line with lighter filling; t. a. line angled obliquely outward from costa to inner margin, vague, composed of pale lunules, defined on inner side by black and on outer side by a few black scales; t. p. line curved outward from costa, then inward to submedian fold and then outward to inner margin, defined by black dots on inner side; subterminal and terminal lines ill-defined; a series of black terminal dots in interspaces between veins; fringe concolorous, with white points at ends of veins; orbicular subcircular, indicated by narrow, pale line; reniform narrow, constricted in middle, defined by pale line; conspicuous patch of pale scales in tornal area. Hindwings dark gray, darker toward outer margin; a vague dark discal bar; veins narrowly defined by black scales; terminal line black; fringe checkered. Abdomen clothed with mixture of black, gray, and white scales and hairs. Tarsi black, segments with white apical bands. Below, forewings dark gray with vague t. p. line; hindwings white with evident t. p. line, vague discal bar, and short, dark shade near base of wing in position of t. a. line, some dark scales along costa and outer margin. Female similar to male, but often with markings more sharply defined by white; discal bar of hindwing less evident.

Male genitalia as figured.

Female genitalia as figured.

Type: Male. Madera Canyon 5600′, Santa Rita Mountains, Santa Cruz Co., Arizona, 29 July 1960, J. G. Franclemont. Genitalia slide 4804. (Franclemont Collection).

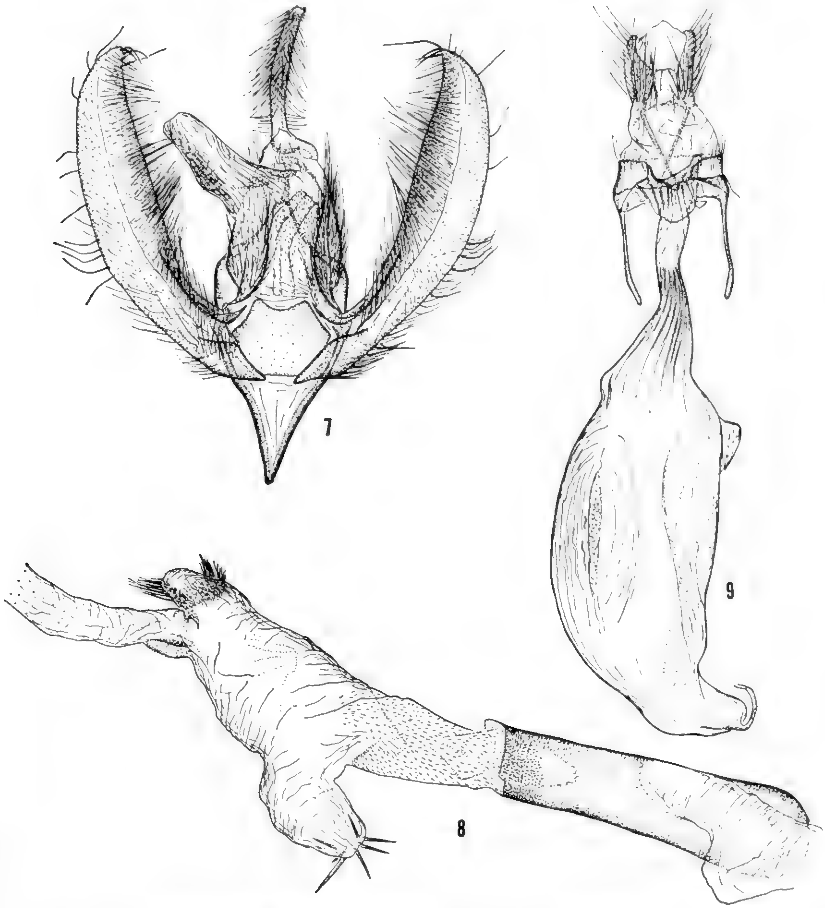

Fig. 7–9. *Apsaphida eremna.* 7. Male genitalia with aedeagus removed, holotype, genitalia slide JGF 4804. 8. Aedeagus of male genitalia, holotype, genitalia slide JGF 4804. 9. Female genitalia, paratype, Madera Canyon 5600′, Santa Rita Mountains, Santa Cruz Co., Arizona, 29 July 1960, J. G. Franclemont, genitalia slide JGF 4805.

Paratypes: Santa Rita Mountains, Santa Cruz Co., Arizona: Madera Canyon 4880′ and 5600′, 91♂, 40 ♀, 29 March–30 April, 1963; 49 ♂, 14♀, 2 July–8 August, 1959 and 1960, J. G. Franclemont. Chiricahua Mountains, Cochise Co., Arizona: 4 ♂, 1 ♀, Cave Creek 5400′, 2–11 April, 1966; 1 ♂, 1♀, East Turkey Creek 6400′, 25 July, 1966; 21 ♂, 5 ♀, Onion Saddle 7600′, 28 June–15 July, 1967. J. G. Franclemont. Part of these paratypes will be distributed to other collections; 4 are already in the collection of the United States National Museum of

Natural History. The following six paratypes are in the Collection of the Los Angeles County Museum of Natural History: 1 ♂, Madera Canyon, Santa Rita Mountains, Arizona, July 19–20, 1955, J. A. Comstock, 1 [illegible], Miller Canyon, Old Palmerlee, Huachuca Mountains, Cochise Co., Arizona, July 23–24, 1955, J. A. Comstock; 2 ♂, 2 ♀, Upper Camp Ground, Pinery Canyon [7000′], Chiricahua Mountains, Cochise Co., July 5–9, 1956, Lloyd M. Martin, John A. Comstock, William A. Rees.

Larva: Light apple green with overall pattern of small white dots; only stigmatal line present, from immediately behind head, complete to around margin of anal shield, white with pinkish suffusion on first and second thoracic segments to all pink, more intense on thoracic segments; spiracles deep pink with pale margins, all included within stigmatal line; when full grown 32–34 mm long. The larvae were reared by George L. Godfrey from eggs obtained from females taken at light at Onion Saddle 7600′, Chiricahua Mountains, Cochise Co., Arizona, in mid July of 1967. The larvae accepted *Quercus arizonica* Sargent and *Quercus hypoleucoides* A. Camus, but the latter appeared to be preferred; it is the oak upon which the larva was resting when photographed.

In the 2 locations where I have collected the moth there are 2 flight periods, 1 in early spring and a second in early to middle summer.

Acknowledgments

The collecting in Arizona in 1960 was supported by Grant No. 303, Johnson Fund, American Philosophical Society, and in 1963 by Grant No. 3339, Penrose Fund, American Philosophical, Society. The rearing of lepidopterous larvae in Arizona in 1967 was supported by U.S.D.A.-ARS Grant No. 12–14–100–8031(33). The genitalia drawings are by Mrs. Linda Lai; the other drawings and the photographs are by the author. The photographs of the larvae are copies of Kodachrome slides. I wish to express my appreciation to Robert E. Dietz, IV, and George L. Godfrey for their assistance during the summers of 1966 and 1967 respectively.

PSEUDOSTILOBEZZIA, A NEW GENUS OF BITING MIDGE FROM VIET NAM (DIPTERA: CERATOPOGONIDAE)

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ABSTRACT—**Pseudostilobezzia macclurei,** new genus and new species, are described from Viet Nam. The genus is closely related to *Stilobezzia* in the tribe Stilobezziini.

In the course of our revisionary study of the genera of Ceratopogonidae of the world, we found in the collections of the U. S. National Museum a specimen from Viet Nam which represents a new genus closely related to *Stilobezzia* Kieffer in the tribe Stilobezziini. The Oriental species of *Stilobezzia* were recently revised by Das Gupta and Wirth (1968) to whom the reader is referred for a full explanation of terminology.

Genus *Pseudostilobezzia* Wirth and Ratanaworabhan, new genus

Type-species, *Pseudostilobezzia macclurei* Wirth and Ratanaworabhan, new species.

Diagnosis (female): A moderately small, slender midge with unmarked legs and wings. Eyes (fig. 1g) separated by space equal to diameter of 1 facet; with fine interfacetal pubescence. Interocular space with transverse suture, below this a moderately long seta. Antenna (fig. 1a) moderately long and slender, proximal flagellar segments slightly fusiform, distal segments moderately elongated. Palpus (fig. 1b) slender, five-segmented; third segment bearing several elongate hyaline sensilla in small, round, sensory pit. Proboscis (fig. 1g) moderately elongate; mandible (fig. 1e) with 8 moderately strong teeth. Thorax moderately elongate, mesonotum moderately convex cephalad, without anterior spine or tubercle. Legs (fig. 1i) slender, vestiture of inconspicuous hairs; femora unarmed; fore tibia slightly swollen distally; hind tibial comb (fig. 1h) with 7 spines. Tarsi (fig. 1j) slender, without strong ventral spines; fourth tarsomeres cordiform; fifth unarmed ventrally. Claws (fig. 1k) large and moderately unequal on fore leg; small and equal on mid and hind legs; claws slender with sharp tips. Wing (fig. 1c) with coarse microtrichia; macrotrichia absent. Two radial cells, the first rhomboidal as typical for *Stilobezzia;* second elongate, well formed, 3.9 as long as first; costa moderately elongate, extending to 0.76 of wing length; r-m crossvein moderately elongate, nearly perpendicular to axis of wing; medial fork with short petiole, vein M2 faint at base. Abdomen (fig. 1f) moderately stout; genital opening flanked by pair of short, rounded lobes. Two large, ovoid,

[1] Acknowledgment is gratefully made to the Southeast Asia Treaty Organization of Bangkok for financial assistance for study at the U. S. National Museum.

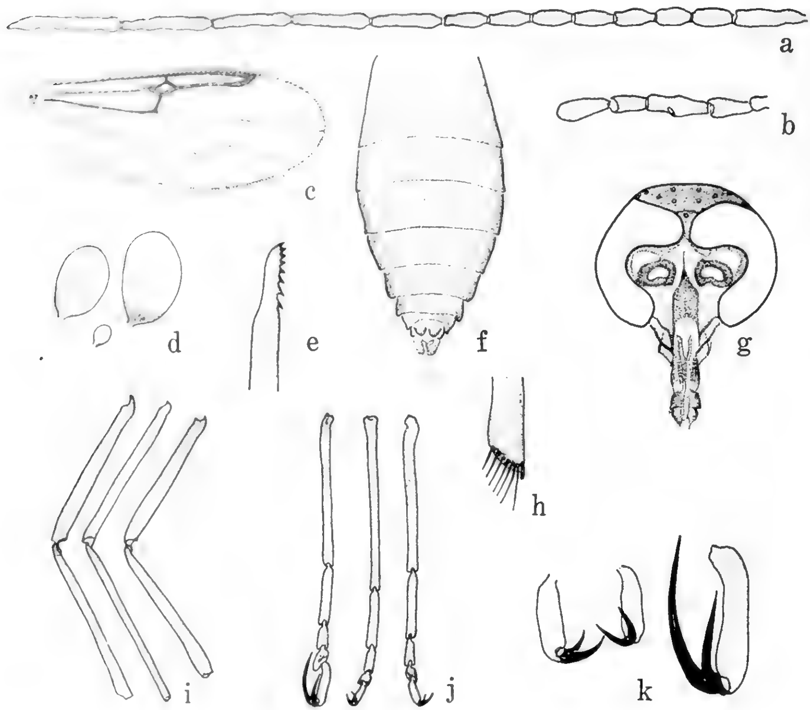

Fig. 1. *Pseudostilobezzia macclurei*, female: a, antenna; b, palpus; c, wing; d, spermathecae; e, mandible; f, abdomen, ventral view; g, head, anterior view; h, hind tibial comb; i, femora and tibiae, left to right, of hind, mid, and fore legs; j, tarsi, left to right, of fore, mid, and hind legs; k, fifth tarsomere and claws, left to right, of hind, mid, and fore legs.

functional spermathecae (fig. 1d) plus a small rudimentary third. Male and immature stages unknown.

Pseudostilobezzia macclurei Wirth and Ratanaworabhan, new species
fig. 1

Female: Wing length 1.30 mm. A uniformly dark brown species; mesonotum slightly darker and scutellum paler; halter brownish. Antenna with lengths of flagellar segments in proportion of 50–30–30–30–30–30–30–33–56–60–62–70–90; antennal ratio 1.41. Palpal segments with lengths in proportion of 10–23–33–20–30; third segment with length to breadth ratio 3.3. Legs with proportions of segments from femur to T5 as 65–65–40–16–6–5–12 on fore leg, 70–70–46–16–6–3–6 on mid leg, and 70–72–40–18–7–3–6 on hind leg. Spermathecae measuring 0.072 by 0.043 mm, 0.057 by 0.036 mm, and 0.019 by 0.014 mm.

Distribution: Viet Nam.

Type: Holotype, female, Dalat, Dralac Prov., Viet Nam, 12–14 November 1959, N. R. Spencer, light trap (Type no. 71178, USNM).

Discussion: *Pseudostilobezzia* appears to be closely related to *Stilobezzia,* subgenus *Stilobezzia,* as evident from the general appearance, wing venation, head and antennal structure, but differs in the condition of the tarsi and claws. In females of *Stilobezzia* the fifth tarsomeres bear strong ventral spines if the wing lacks macrotrichia (subgenus *Stilobezzia*), or if spines are lacking the wing bears macrotrichia (subgenus *Neostilobezzia*). In *Stilobezzia* the female tarsal claws are large and unequal on all legs, or reduced to a single long claw with a small basal barb. In the genus *Monohelea,* which differs considerably in general features and wing venation from *Pseudostilobezzia,* the female tarsal claws are sometimes small and equal on the fore and mid legs, but are very unequal, or reduced to a single long claw with a basal barb, on the hind leg.

We are very pleased to name this species in honor of Dr. H. Elliott McClure of the Migratory Animal Pathological Survey, Bangkok, Thailand, in appreciation of his long and enthusiastic help and guidance in our studies of Southeast Asian Ceratopogonidae.

Reference

Das Gupta, S. K., and W. W. Wirth. 1968. Revision of the Oriental Species of *Stilobezzia* Kieffer (Diptera, Ceratopogonidae). Bull. U. S. Nat. Mus. 283: 1–149.

STUDIES ON IDIOCERINAE LEAFHOPPERS: X. IDIOSCOPUS NITIDULUS (WALKER), NEW COMBINATION (HOMOPTERA: CICADELLIDAE)

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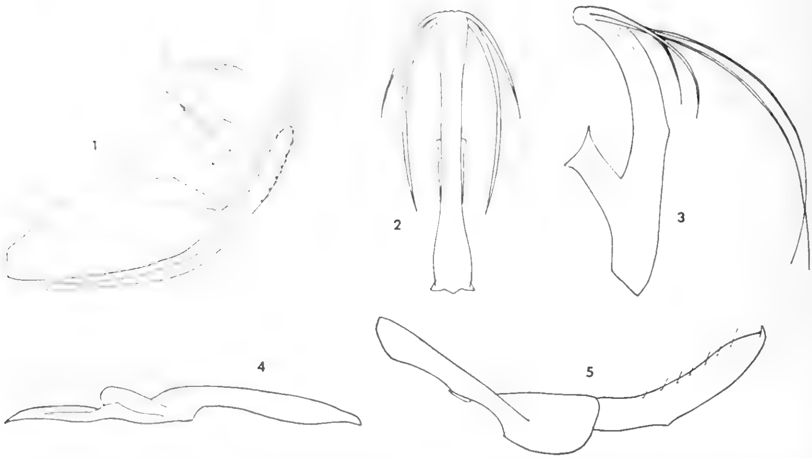
ABSTRACT—*Idiocerus nitidulus* Walker is transferred to the genus *Idioscopus* Baker, and the male genitalia are illustrated.

Among specimens recently obtained for study from the Leiden Museum, The Netherlands, there were some that I suspected to be *Idiocerus nitidulus* Walker 1870 because they were collected in Java. Dr. W. J. Knight at the British Museum (N.H.) kindly agreed to compare a female and a male with Walker's type. After examining



Idioscopus nitidulus (Walker), male. 1, genital capsule, lateral view; 2, aedeagus, caudal view; 3, same, lateral view; 4, style, ventral view; 5, same, lateral view.

the specimens he reported, "I have compared your female specimens of *Idiocerus nitidulus* Walker with the type and although it is a female and the type is a male they are identical externally". "The genitalia of your male are identical although much smaller than the type which is approximately the same size as your female specimen".

In my paper on the Indian and Philippine species of *Idiocerus* (Maldonado-Capriles 1964) I moved to *Idioscopus* Baker several species of the latter. On page 93 I wrote, about *Idioscopus incertus* (Baker), "Very close to *Idioscopus niveosparsus,* perhaps only a subspecies or an extreme variety". *Idioscopus niveosparsus* Lethierry 1889 is very variable in coloration, judging from the many specimens studied before and the few at hand; this is to be expected of a very prolific species with such a wide range of distribution. The genitalia of *I. nitidulus* are very close to those of *I. niveosparsus* and *I. incertus.* The seventh sternum of the female is similar to that of *niveosparsus.* Thus, probably *I. nitidulus* is also a subspecies or just another extreme form of *niveosparsus.* Unfortunately, *nitidulus* has priority over *niveosparsus.* Because *I. niveosparsus* is of economic importance the name has been used in many papers and, therefore, a change of name would cause much inconvenience. Therefore, at the present time I am only moving *nitidulus* to the correct genus and leaving the problem of priority until more evidence, preferably biological, can be obtained to clearly establish the synonymy. In such event the name *niveosparsus* should be conserved.

Idioscopus nitidulus (Walker), new combination

Idiocerus nitidulus Walker 1870. Linn. Soc. London Jour. Zool. 10:322

Study of the male type of this species shows that it properly belongs in *Idioscopus.* The genitalia of a specimen labeled J. Sonneveldt, Makasser, compared with that of the type, are illustrated in figures 1 to 5. A female labeled Tijomas, W. Java, has been also compared with the type. Both specimens are in the Leiden Museum. This species runs to *I. incertus* and *I. niveosparsus* in my paper of 1964.

Reference

Maldonado-Capriles, J. 1964. Studies on Idiocerinae leafhoppers: II. The Indian and Philippine species of *Idiocerus* and the genus *Idioscopus* (Homoptera: Cicadellidae). Proc. Entomol. Soc. Wash. 66:89–100.

TWO NEW SPECIES OF ANTS OF THE GENERA TAPINOMA FOERSTER AND PARATRECHINA MOTSCHOULSKY FROM PUERTO RICO (HYMENOPTERA: FORMICIDAE)

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ABSTRACT—Two new species of ants from Puerto Rico are described, the worker and male of *Tapinoma* **resenum**, n. sp., and each caste of Paratrechina (*Nylanderia*) **cisipa**, n. sp.

No new species of ants have been described from Puerto Rico since M. R. Smith (1936) described *Prenolepis microps* (a species now placed in the genus *Paratrechina*). He listed and keyed 66 species of ants and referred to the previous literature concerning ants of Puerto Rico. Wolcott (1948) summarized the available information on their habits, and provided additional locality records.

During a year's sojourn (1969–1970) in Puerto Rico while working for the Puerto Rico Nuclear Center, the junior author had the opportunity to collect ants, along with other insects, at various localities around the island. Among the ants collected were 2 species not only new to Puerto Rico, but so far as we can determine, undescribed. These species, representing a new *Paratrechina* and a new *Tapinoma*, are described herein.

Tapinoma rasenum, n. sp.
fig. 1–6

Diagnosis: The vestigial petiolar node, many toothed mandibles, and male genitalia place this species in the genus *Tapinoma*. Its large size, coloration, and long antennal scapes which surpass the posterior border of the head separate this species from *melanocephalum* (Fabricius) and *litorale* Wheeler, the only other known species of *Tapinoma* from Puerto Rico, and also from other *Tapinoma* species known to us.

Holotype worker: Length, 3.1 mm; head width, 0.63 mm; head length, 0.65 mm; length of antennal scape, 0.65 mm; eye length, 0.1 mm. Head, thorax and legs pale yellow with head slightly darker; gaster light gray. Moderately shining with vestiture of moderately appressed white pubescence; without erect hairs except for row on posterior margin of each segment of gaster and row on anterior clypeal margin.

Antennal scape surpassing posterior margin of head by distance equal to length of first 2 funicular segments; antenna 12-segmented. Eye small, its length equal to ⅔ distance between mandibular insertion and eye: 9 facets in greatest diameter and 6 facets in shortest diameter. Clypeus broadly, circularly, and very shallowly emarginated on central ⅓ of anterior margin. Maxillary palpus long, 6-segmented. Each mandible with 4 large apical teeth and 10 to 12 smaller basal teeth. Thorax evenly curved in profile, interrupted only by shallow meso-epinotal depression. Petiole a slender stalk, without dorsal node. Anal slit ventroapical.

Female: Unknown.

Paratype male: Length, 3.9 mm; head width, including eyes, 0.73 mm; head length, 0.6 mm; eye length, 0.31 mm; length of antennal scape, 0.6 mm; forewing length, 3.6 mm. Color pale yellow, head slightly darker; gaster pale gray; genitalia reddish brown; interocellar area black; dorsum of thorax with 2 submesal light gray longitudinal lines. Moderately shining with vestiture of moderately appressed whitish pubescence; erect hairs only on clypeus, apical sternite and genitalia.

Antenna 13-segmented; length of scape equal to first 4½ funicular segments; all funicular segments longer than broad. Each mandible long, with 25 or more small teeth, all of similar size. Anterior border of clypeus without emargination. Eyes large, oval, greatly protruding from side of head in frontal view; ocelli large. No Mayrian furrows. Forewing with radial and cubital cell, no discoidal cell. Petiole low, stout, without dorsal node. Cerci short. Genitalia prominent; parameres separated, each large and rectangular; volsella with triangular lateral flap with many erect hairs and with 2 spinelike inner processes; penis valve pointed at apex, ventral margin with 15 long, curved spines. Ninth sternite densely clothed with hairs, with apical triangular projection at center.

Holotype: Worker, Maricao Forest Reserve, Rte. 120 (K5, H2), Puerto Rico, 18 March 1970 (R. J. Lavigne), Type No. 72174 in the United States National Museum (USNM).

Paratypes: All from same nest sample as holotype, 310 workers, 54 males including male described above. In USNM, University of Wyoming, and University of Puerto Rico, San Juan.

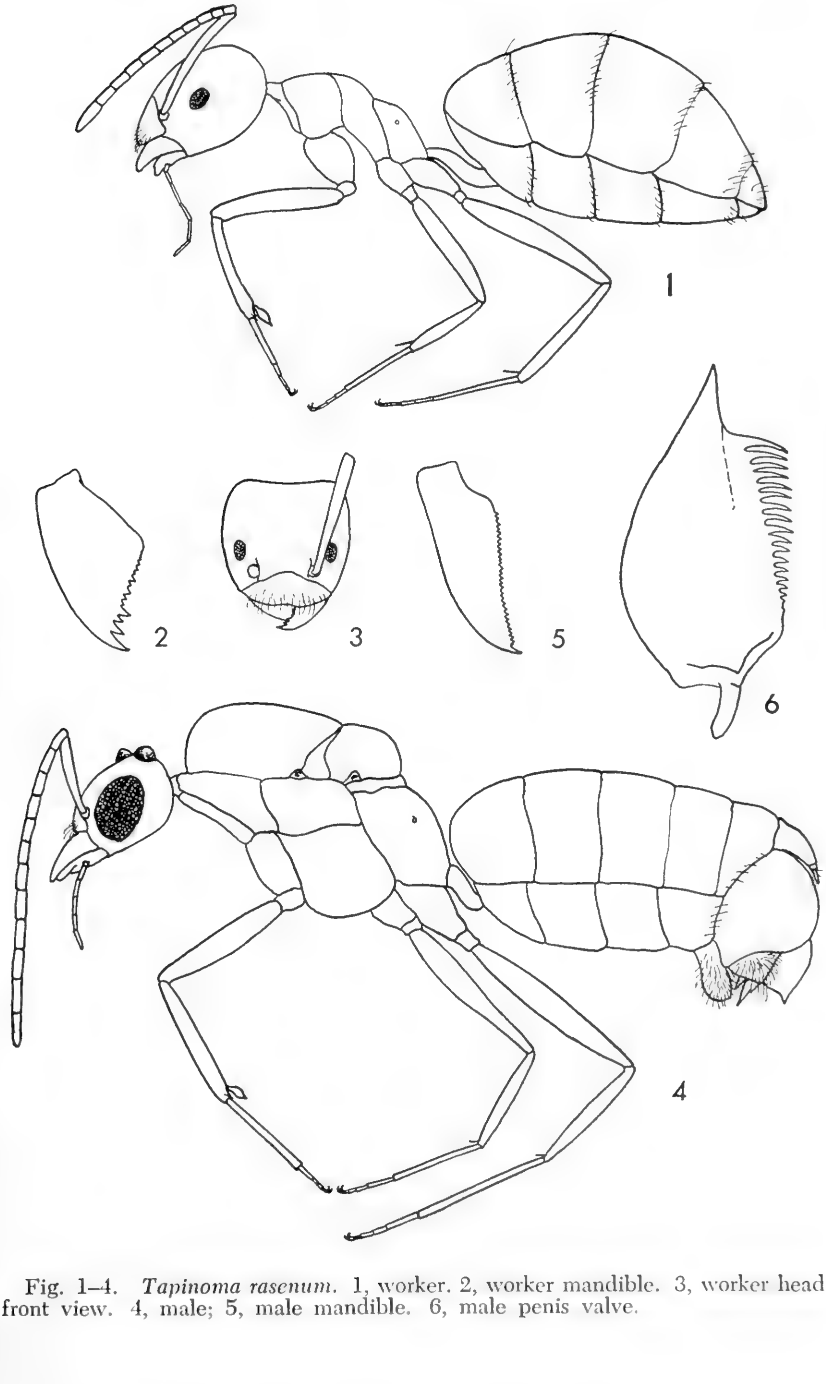

Fig. 1–4. *Tapinoma rasenum.* 1, worker. 2, worker mandible. 3, worker head, front view. 4, male; 5, male mandible. 6, male penis valve.

Habitat: The ants were located on a dead limb of a living tree of unknown species (3′ hgt.) on the mountainside just over the edge of an embankment. The ants had established their colony under the bark of the dead limb apparently by using tunnels and chambers originally constructed by termites or carpenter ants. The colony was first discovered during March and workers were collected by pounding on the limb with a steel knife, which elicited an alarm reaction. Pieces of bark were removed from the limb and chambers containing winged males, larvae, and pupae, both worker and reproductive, were uncovered. Eleven large and 3 medium sized workers of *Camponotus ustus* Forel were collected from the same chambers as *T. rasenum* workers when the nest was examined again on 27 May 1970.

Discussion: There was little variation in the nest sample examined; the gaster of both the worker and male was pale gray to almost black.

The species name is an arbitrary combination of letters and is to be treated as a noun.

Paratrechina (*Nylanderia*) *cisipa*, n. sp.
fig. 7–12

Diagnosis: The long antenna of *P. cisipa* resembles that of *Paratrechina* (*Paratrechina*) *longicornis* (Latreille), but we are placing this species in the subgenus *Nylanderia* because of the 6-toothed mandibles and presence of suberect hairs on the antennal scapes and tibiae. It is separated from other species of *Nylanderia* by the long antenna, suberect hairs on all surfaces of the antennal scapes and tibiae, presence of 2 pairs of macrochetae on the pronotum, and the pale yellow coloration. By these characters it is distinguished from *fulva* (Mayr), *vividula* (Nylander), *steinheili* (Forel), and *microps* (M. R. Smith), the only other species of this subgenus known from Puerto Rico. The large eyes will also separate *cisipa* from *microps*.

Holotype worker: Length, 3.3 mm; head width, 0.6 mm; head length, 0.7 mm; length of antennal scape, 1.1 mm; eye length, 0.19 mm. Head, thorax and legs pale yellow, head slightly darker; gaster pale gray, darker than head and thorax. Shining, with dilute, whitish, appressed pubescence; antennal scape with suberect, whitish hairs on all surfaces, not bristlelike as other erect hairs of head and body; macrochetae of head mostly on clypeus, frons and vertex; pronotum with 2 pairs of macrochetae, mesonotum with 2 pairs of macrochetae; each femur with few macrochetae, mostly on inner surfaces; each tibia with fine, suberect hairs on all surfaces, similar to those of antennal scapes; macrochetae on gaster rather evenly distributed on segments.

Antenna 12-segmented; scape long, surpassing posterior margin of head by nearly ½ its own length. Eye with about 11 facets in greatest diameter, 8 facets in shortest diameter; separated from mandibular insertion by distance of about

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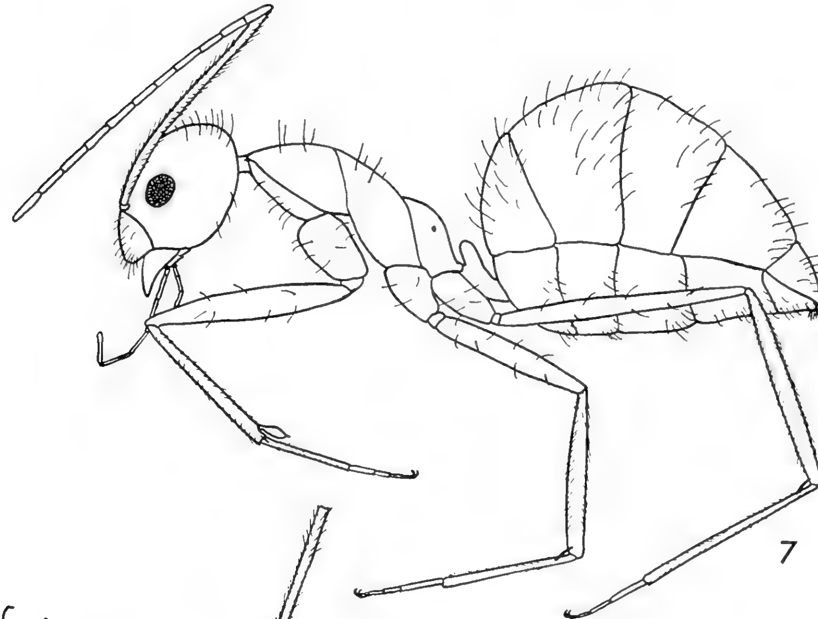
Fig. 7–12. *Paratrechina* (*Nylanderia*) *cisipa*, 7, worker. 8, worker mandible. 9, worker head, front view. 10, male. 11, male mandible. 12, male penis valve.



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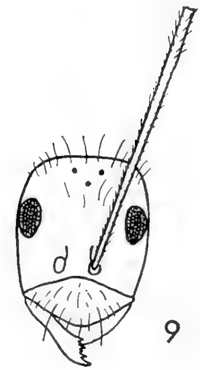

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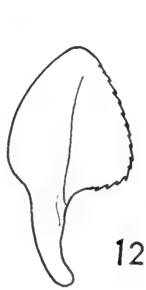

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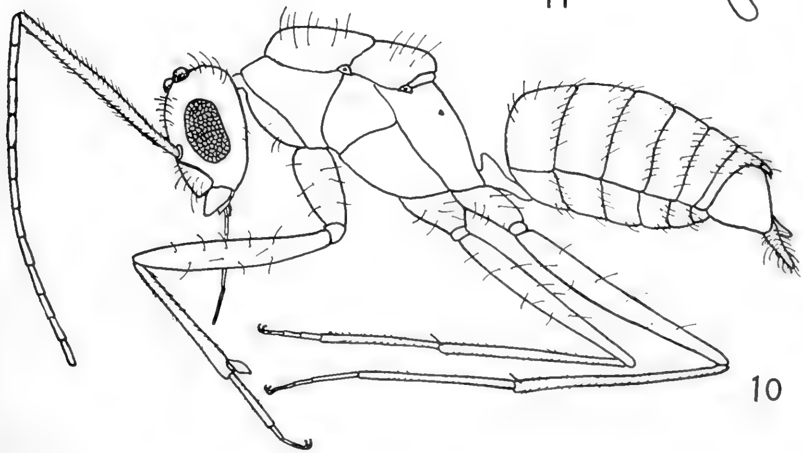

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1¼ its greatest diameter. Clypeal border entire, not emarginated; each mandible with 6 teeth; maxillary palpus long, 6-segmented; ocelli distinct. Thorax in profile with mesonotum and pronotum evenly curved; meso-epinotal depression distinct. Petiolar node distinct, inclined.

Paratype female: Length, 5.7 mm; head width, 0.8 mm; head length, 0.7 mm; length of antennal scape, 1.1 mm; eye length, 0.31 mm; eye width, 0.21 mm; forewing length, 5.5 mm. Mostly pale, dirty yellow to orange with gaster a little darker than head and thorax and antenna and legs nearly whitish. Faintly shining, somewhat dulled by appressed whitish pubescence. Bristlelike macrochetae absent. Suberect hairs present on all surfaces of each antennal scape and tibia; longer erect hairs moderately abundant on head, thorax and gaster and a few on inner surface of each femur.

Antenna 12-segmented; scape long, surpassing posterior margin of head by nearly ½ its own length. Distance between mandibular insertion and eye slightly less than greatest eye length. Forewing with a radial and a cubital cell; no discoidal cell. Most other features as for worker.

Paratype male: Length, 2.6 mm; head width, 0.5 mm; head length, 0.5 mm; length of antennal scape, 0.9 mm; eye length, 0.21 mm; eye width, 1.8 mm; forewing length, 2.8 mm. Pale yellow with head and gaster a little darker than thorax. Moderately shining, somewhat dulled by whitish appressed pubescence. Suberect hairs on all surfaces of each antennal scape and tibia. Macrochetae short, mostly confined to clypeus, frons, vertex of head, dorsum of thorax, posterior margin of each segment of gaster, each coxa, and few on inner surface of each femur.

Antenna 13-segmented; scape long, surpassing posterior margin of head by ½ its own length; funicular segments each longer than broad; scape equal to length of first 5 to 6 funicular segments combined. Anterior border of clypeus entire; each mandible narrow and curved, pointed at apex, without teeth. No Mayrian furrows. Forewing with radial and cubital cell; no discoidal cell. Petiolar node present, inclined; base of gaster with impression for reception of petiole. No cerci. Genitalia rather prominent; parameres fused, apically slender, digitform; with hairs; volsella with 2 digitform processes; penis valve oblong, with serrated ventral margin.

Holotype: Worker, Luquillo Experimental Forest, El Verde Field Station (PRNC), Puerto Rico, 1500′ alt., 1 July 1970 (R. J. Lavigne), Type No. 72175 in USNM.

Paratypes: All from same nest sample as holotype, 415 workers, 9 females, 5 males, including male and female described above. In USNM, University of Wyoming, and University of Puerto Rico, San Juan.

Habitat: The colony was established inside a hollow in the trunk of a living tree (*Roystonea borinqueña* O. F. Cook) at a height of 4 feet. The hollow was partly filled with sawdust and/or frass, and the workers had constructed tunnels within. The colony was composed of several hundred workers, probably exceeding a thousand.

Discussion: Little variation is present in the specimens from the nest sample examined.

The species name is an arbitrary combination of letters and is to be treated as a noun.

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THE LARVA OF PLATYSENTA ALBOLABES (GROTE) (LEPIDOPTERA: NOCTUIDAE)

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ABSTRACT—A description and illustrations of the last larval instar of *Platysenta albolabes* (Grote) are given for the first time. Brief notes on the life history and color descriptions of other larval instars of this species also are provided.

Thirteen species of noctuid moths belonging to the genus *Platysenta* occur in America north of Mexico according to McDunnough (1938). Larvae of 5 of these have been associated with the adult form and described by Crumb (1956) as well as 1 designated by Crumb as "*Platysenta* sp. No. 29." While working in the Chiricahua Mountains, Cochise Co., Arizona during the summer of 1967, Dr. John G. Franclemont and I successfully reared the larva of *Platysenta albolabes* (Grote). The following notes and description of the caterpillar of *P. albolabes* are offered to promote a better understanding of the classification of the Noctuidae through a greater familiarity of the larval forms.

All line illustrations were drawn to scale with the aid of a stereomicroscope and a grid system. The scale lines represent 0.5 mm. The terminology and relative measurements used in this paper are explained in Godfrey (1972). Figures 1 and 2 are copies of Kodachrome transparencies taken by Dr. Franclemont.

Platysenta albolabes (Grote)
fig. 1–6

A gravid female of *Platysenta albolabes* collected at Onion Saddle, 7600 ft., Chiricahua Mountains, Cochise Co., Arizona, on the night

Fig. 1–2. *Platysenta albolabes* (Grote). 1, dorsal view. 2, lateral view.

of July 29, 1967, randomly deposited several green eggs inside an ovipositional jar. The eggs hatched on August 5. The resulting larvae passed through 5 instars in confinement, and the first prepupae were observed August 25. The newly hatched larvae were offered leaves of *Solidago* sp., *Artemisia* sp., and *Brickellia* sp., all Compositae. Only the last plant was eaten, and it was provided for the duration of the rearing.

Early Instars

The coloration of the first and second instars is similar: head opaque, body pale green with white lateral area, white dorsal and subdorsal lines; setae and setal insertions black. The third instar is characterized by: head green with black setal insertions; body green with blackish dorsal thoracic setal insertions and white dorsal abdominal setal insertions; white mid-dorsal line more distinct than subdorsal lines. The coloration of the fourth and fifth instars is similar; it is described below.

Last Instar

General: Head 2.5–2.7 mm wide. Total length 32–33 mm. Abdominal prolegs present on third through sixth segments, about equally developed. Head and body

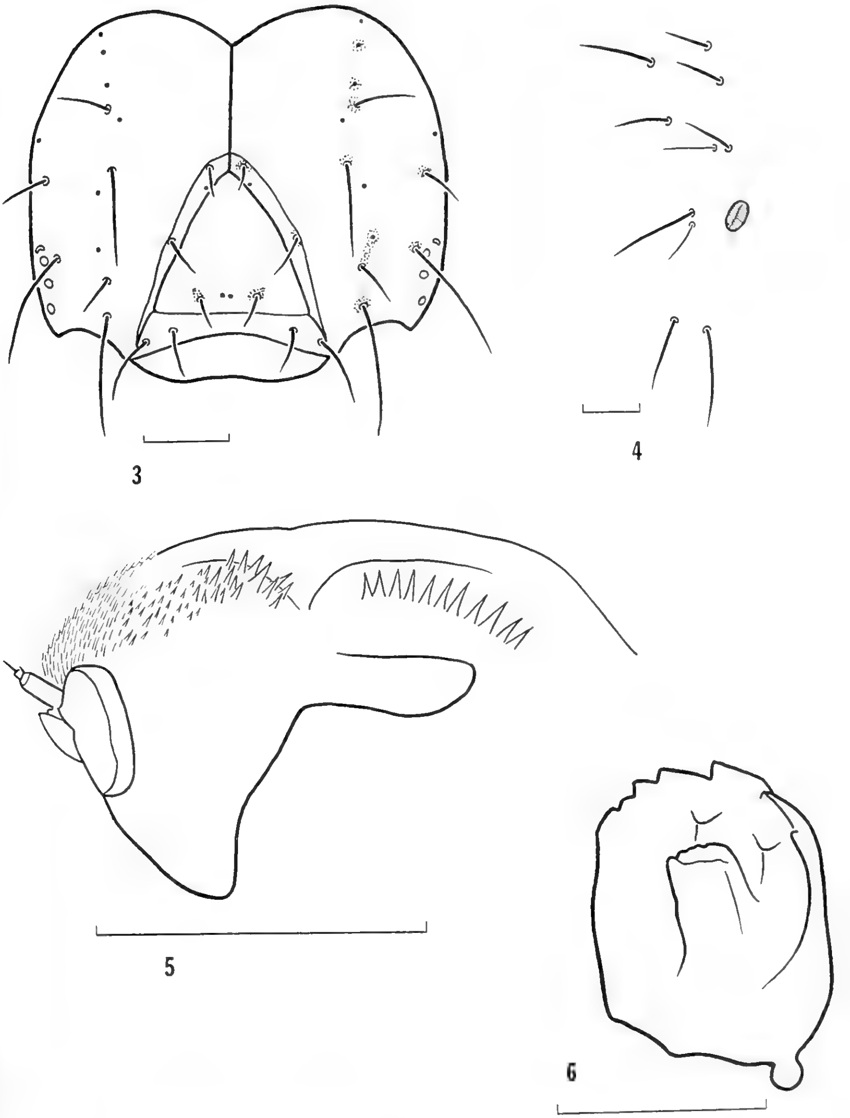

Fig. 3–6. *Platysenta albolabes* (Grote). 3, head capsule. 4, prothoracic segment. 5, hypopharyngeal complex. 6, oral surface of left mandible.

smooth. Dorsal abdominal setae simple, no more than 3 times height of seventh abdominal spiracle. Setal bases minute.

Head: Postgenal sutures straight, parallel to each other; epicranial suture 0.88 times height of frons (fig. 3); distance from seta F-1 to frontoclypeal suture about 0.27 times distance between F-1's; AFa cephalad and AF-2 caudad of apex of frons; setae A 1–3 forming obtuse angle; seta L nearly on transverse line formed by AF-2's; seta P-1 transversely aligned with juncture of adfrontal sutures; ocellar interspaces Oc 1—Oc 2 and Oc 3—Oc 4 subequal, less than ocellar interspace Oc 2—Oc 3.

Mouthparts: Oral surface of labrum lacking spines. Hypopharyngeal complex (fig. 5): spinneret short, extending barely beyond base of Lps-1; stipular seta extremely minute; Lps-1 about 2.3 times length of Lp-2; Lps-2 and Lp-1 subequal; distal region with numerous short, thin spines above spinneret, spines becoming stouter proximolaterad; transverse cleft evident between lobe of distal region and proximolateral region; proximomedial region lacking spines; proximolateral region bearing row of 10–11 stout spines; proximal ends of premental arms broadly rounded. Mandible (fig. 6) characterized by an elongate inner tooth, length of inner tooth greater than its basal width; inner ridges terminating before reaching cutting edges; outer teeth 1–5 triangular; sixth outer tooth rounded but notched medially.

Thorax: Segment T-1 (fig. 4): seta D-2 caudad of line formed by D-1 and XD-2; major axis of spiracle passing caudad of SD 1–2 and between SV 1–2; SD-1 transversely slightly cephalad of D 1–2. Segments T 2–3: seta L-1 located dorsad and slightly caudad of L-2. Basal process of tarsal claw broadly rounded; third tarsal seta slightly expanded medially before tapering distad.

Abdomen: Segment Ab-1: 3 subventral setae present; SV-1 located posterolaterad of line formed by setae V and SV-3. Segments Ab 2–6: 3 subventral setae present. Segment Ab-8: only 1 seta in each subventral group. Segment Ab-9: seta SD-1 similar in structure to setae D 1–2. Anal and subanal setae no larger than lateral setae on anal proleg. Crochets uniordinal.

Coloration: Head green, lacking reticulation or freckling; setal insertions enclosed by narrow purple zone (fig. 3). Body (figs. 1, 2) generally green, conspicuously speckled with whitish-yellow dots; intersegmental boundaries faintly yellow; middorsal line white, continuous; subdorsal line white, discontinuous, extremely faint, often absent; lateral area indicated only by whitish dorsal margin continuing to distal end of anal proleg; setal bases white, frequently associated with purple spot; purple spots especially distinct between D-1 abdominal setal bases and middorsal line and in subdorsal area between SD-1 setal bases and spiracles; spiracles and peritremes pale.

Material examined. 5 specimens: Onion Saddle, 7600 ft., Chiricahua Mountains, Cochise Co., Arizona, August 1967. Reared by G. L. Godfrey on *Brickellia* sp. from eggs of female identified by J. G. Franclemont. Hypopharyngeal complex on slide G-0202 (Franclemont Collection).

Comments

Published information on the larvae of other species of the genus *Platysenta* reveals that they most frequently feed on plants of the family Compositae (Crumb, 1956; Kimball, 1965). However, *P. sutor* (Guenée) also feeds on celery (Umbelliferae) (Stoner and Wisecup, 1930). Inasmuch as *P. albolabes* fed only on *Brickellia* sp. and rejected *Solidago* sp. and *Artemisia* sp. the species may have a narrow range of foodplants within the Compositae.

Some of the larval characters of *P. albolabes* are very similar to those of other larvae of the genus described by Crumb (1956). The characters include 3 subventral setae on the first abdominal segment, the reduced condition of the spinneret, and the large inner tooth on the mandible. *Platysenta albolabes* is not the same as Crumb's "*Platysenta* sp. No. 29" that also was described from Arizona specimens. The latter had black reticulation on the head (Crumb, 1956), quite unlike the head of *P. albolabes*.

Acknowledgments

This research was supported by USDA AGR RMA Grant No. 12–14–100–8031(33) awarded to Dr. John G. Franclemont of Cornell University and funds supplied by the Illinois Natural History Survey, the Illinois Agricultural Experiment Station, and the Office of International Agriculture, College of Agriculture, University of Illinois, Urbana. I thank Dr. Franclemont for reviewing the manuscript.

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THE IDENTITY OF CALYCOMYZA JUCUNDA (WULP) (DIPTERA, AGROMYZIDAE)

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ABSTRACT—*Calycomyza jucunda* (Wulp), described in the genus *Agromyza*, is further described and its relationships established on the basis of examination of the type specimen.

In his introductory paragraphs to the treatment of the genus *Calycomyza* Hendel, Spencer (1969) stated that, "Differences between many of the species are extremely slight and many involve color, male

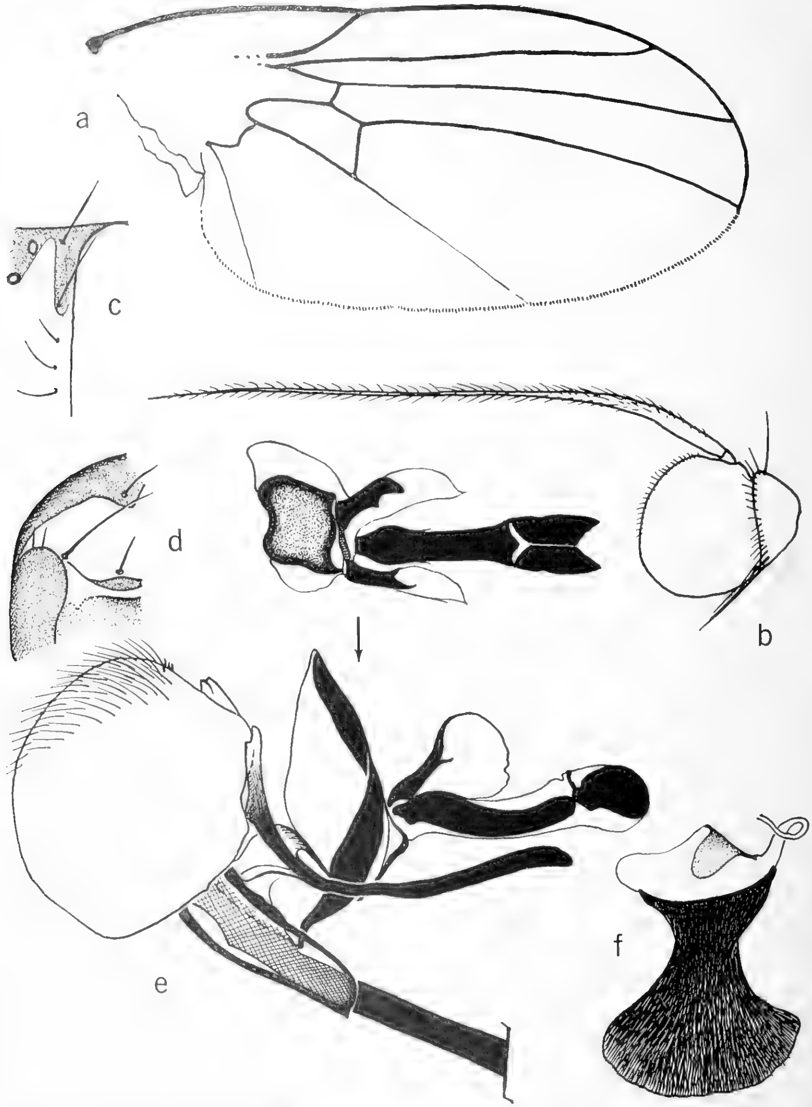

Fig. 1. *Calycomyza jucunda* (Wulp) male holotype. a. wing. b, left antenna. c, left top of head, showing 2 *sfo* and 3 *ifo* bristles. d, left anterodorsal part of thorax, lateral view. e, left lateral view of postabdomen, with ventral view (in direction of arrow) of aedeagus; f, sperm pump.

genitalia, or larvae together with feeding habit, i.e. leaf mines. For example, in *jucunda* (Wulp) and *promissa* Frick the adults and male genitalia are not satisfactorily distinguishable. . ." He further stated that *jucunda* had been misidentified by Frick (1956, 1959). In order to establish the identity of the species described by Wulp as *Agromyza jucunda* (1867), I dissected the postabdomen of the male holotype through the kindness of Dr. P. J. van Helsdingen, of the Rijksmuseum van Natuurlijke Historie, in Leiden, Netherlands.

The sex of the holotype has hitherto been questionable. It was stated by Wulp to be a female, but in the report by Frick (1956: 289) on the examination of it by Dr. Diakonoff it is cited as "sex?" My examination revealed that it is, fortunately, a male. The labels with the specimen are "TYPE (red label)/Kumlien Wisconsin (white label)/TYPE Agromiza (sic) jucunda v. d. Wulp (white label)." The word 'Kumlien' apparently refers to one Ludwig Kumlien, who is known to have collected in North America.

The species is correctly placed by Spencer as a *Calycomyza* close to *promissa* Frick. It runs in the key to Canadian *Calycomyza* species by Spencer (1969: 145) to couplet 5, where the species *C. menthae* Spencer and *C. promissa* Frick are differentiated by characters of the larvae and male genitalia (aedeagus). In Frick (1956, 1959) the species will run to *C. promissa.* The identity of the species treated by Frick as *jucunda* must await examination of the genitalia of the species Frick considered as synonyms of *jucunda* (*platyptera* Thomson and *coronata* Loew) as well as of material Frick had before him.

Figure 1 shows various details of the type of *Agromyza jucunda.* The face is yellowish with the antennal grooves brown; the fore femur is wholly black; the 2nd dorsocentral bristle is nearly as long as the 3rd (hindmost) bristle; the acrostichal bristles are in 6 rows. Comparison of the aedeagus (fig. 1e) with the figures of that structure in *C. menthae* Spencer (1969: 154, fig. 261, 262) shows a close similarity and at the same time distinct differences in detail. The figure of the aedeagus of *C. promissa* Frick (Spencer, 1969: 154, fig. 265) is somewhat less similar to that of *C. jucunda.*

Calycomyza jucunda (Wulp) is therefore a species that has apparently not been subsequently referred to correctly in the literature, and one whose biology remains wholly unknown.

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FURTHER STUDIES ON SOUTH AMERICAN BETHYLIDAE (HYMENOPTERA)

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ABSTRACT—In the subfamily Pristocerinae, *Xestobethylus* Cameron is placed in the synonymy of *Pseudisobrachium* Kieffer; the specific names *flaviventris* Kieffer and *argentinicum* Evans are placed in the synonymy of *P. pallidipes* (Cameron), new combination. Two new species of this genus are described: *P.* **chacoense** (Argentina) and *P.* **erythrocephalum** (Chile). In the subfamily Epyrinae, 2 new genera are described: **Nothepyris**, type-species **N. brasiliensis**, n. sp. (Brazil), and **Thlastepyris**, type-species **T. pertenuis**, n. sp. (Brazil). Two additional new species are described: *Rhabdepyris* (*Chlorepyris*) **cyanosoma** (Argentina, Surinam) and *Epyris* **nigrivirens** (Bolivia). New distribution records are presented for species of *Bakeriella*, *Aspidepyris*, and *Laelius*.

This paper is a supplement to my Synopsis of the American Bethylidae (Evans 1964) and to several subsequent generic revisions (Evans 1965, 1967, 1969, 1970). Its purpose is to dispose of 1 generic name, previously listed as unrecognizable, to describe 2 new genera, to present several new distribution records, and to describe several distinctive new species in material sent to me for identification. The genera and species considered belong to the subfamilies Pristocerinae and Epyrinae. Terminology is the same as that used in the Synopsis; for standard abbreviations of body parts, see that paper and also this journal, 72: 341 (1970).

Subfamily Pristocerinae

Genus *Pseudisobrachium* Kieffer

Pseudisobrachium Kieffer, 1904: 368 (type-species: *P. laticeps* Kieffer). Evans, 1964: 62 (generic description and synonymy). Evans, 1970: 45–65 (spp. of Argentina and Chile).

Xestobethylus Cameron, 1909: 450 (type-species: *X. pallidipes* Cameron) (new synonymy). Evans, 1964: 17 (listed as unrecognized).

This is a large and difficult genus, and for the present it is possible to recognize only the males of some of the more common and distinctive species. The species treated here all belong to the subgenus *Pseudisobrachium,* the other subgenus, *Edapholigon* Ogloblin, being known from 3 female specimens.

Pseudisobrachium pallidipes (Cameron) new combination

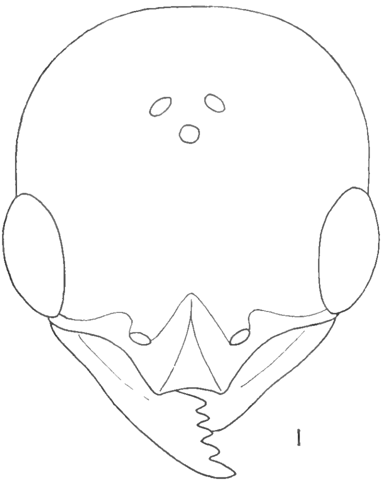
Xestobethylus pallidipes Cameron, 1909: 450 (type: ♂, ARGENTINA: Mendoza; in British Museum).
Plutobethylus flaviventris Kieffer, 1910: 53 (type: ♂, ARGENTINA: Mendoza; in Berlin Museum) (new synonymy).
Pseudisobrachium argentinicum Evans, 1964: 82 (new name for *flaviventris* Kieffer, preoccupied in *Pseudisobrachium*) (new synonymy). Evans, 1970: 58.

When I visited the British Museum in 1961, I was unable to find the type of Cameron's *pallidipes*, a species unrecognizable from its description. On a more recent visit I was able to find and study it. Agreement with the type of Kieffer's *flaviventris* is virtually perfect, and the type locality is the same. This is one of the commoner bethylids of Argentina, often being taken in light traps.

Pseudisobrachium chacoense, n. sp.
fig. 2

Holotype: ♂, ARGENTINA: 11 km W Las Cejas, Tucumán, 8–30 Dec. 1967 (L. Stange) [Inst. Miguel Lillo, Tucumán].

Description of male type: Length 5 mm; LFW 4 mm. Head and thorax black; abdomen dark castaneous, irregularly banded with lighter brown at apical margin of each segment; mandibles mostly light brown; antennae testaceous except weakly infuscated on apical ½; legs stramineous, including coxae; wings subhyaline, veins light brown, stigma dark brown. Mandibles with 5 teeth, basal 3 teeth small and close together. Clypeus broad basally, sides strongly convergent to a truncate apex. First 4 antennal segments in a ratio of 17:4:7:7, segment 3 twice as long as wide; flagellar pubescence short, subappressed, a few longer, fully erect setae rising above pubescence. Eyes hairy, bulging from sides of head, removed from vertex crest by approximately their own height. Head approximately as wide as high, subquadrate, sides subparallel behind eyes and then suddenly contracted to broadly rounded vertex; WF 1.45 × HE; ocelli slightly enlarged, DAO 0.15 × WF; anterior ocellus very slightly above level of eye tops, ocellar triangle compact, WOT and OOL subequal. Occipital carina absent dorsally. Front alutaceous, moderately shining, punctures shallow, for the most part separated by more than their own diameters. Thoracic dorsum dull, inconspicuously punctate; notauli absent. Propodeum, in dorsal view, 1.4 × as long as wide, with median carina which nearly reaches crest of declivity and with several short, irregular basal carinae. Mesopleurum with shallow punctures anteriorly, callus poorly defined, alutaceous. Discoidal vein of fore wing lightly pigmented, arising a short distance down on transverse median vein. Subgenital plate rounded apically, hirsute, without a signum.



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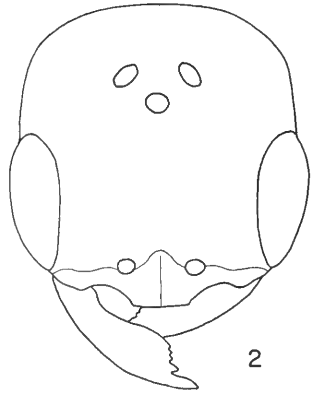

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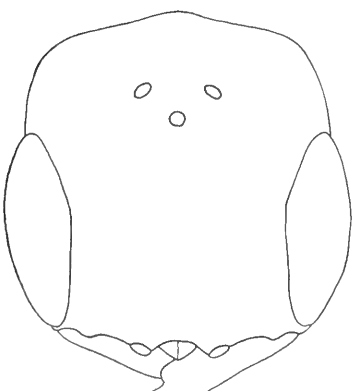

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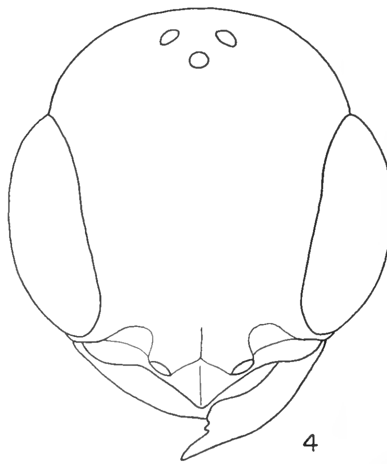

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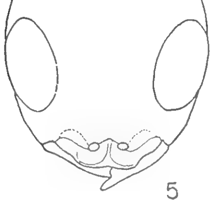

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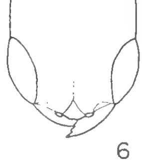

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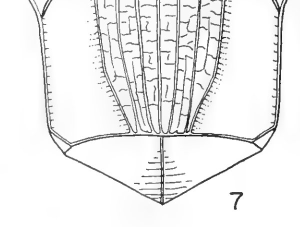

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Paratypes: 26 ♂♂, same data as type but various dates Dec. 1967–May 1968 (L. Stange); 4♂♂, Las Cejas, Tucumán, Jan.–Apr. 1968 (C. C. Porter) [Inst. Miguel Lillo, Mus. Comp. Zool., USNM].

Variation: The paratypes vary in size from 3.5 to 5.5 mm, LFW from 2.5 to 4.5 mm. There is little variation in color or in standard measurements except for minor variation in ocellar size. In specimens with unusually small ocelli DAO is 0.14 × WF, OOL very slightly greater than WOT; in the male with the largest ocelli, DAO is 0.20 × WF, WOT 1.3 × OOL. In the smaller males the wing veins tend to be very lightly pigmented and the discoidal vein interstitial with media or nearly so. The smaller males also have only 4 teeth on the mandibles and the third and following antennal segments only slightly longer than wide.

Remarks: In my key to the species occuring in Argentina and Chile (Evans, 1970), *chacoense* runs to couplet 15; it differs from the five species keying out beyond that point in its subquadrate head and characteristically shaped clypeus.

Pseudisobrachium erythrocephalum, n. sp.

fig. 1

Holotype: ♂, CHILE: La Fusta, C. Lonquimay, Malleco, 14 Feb. 1962 (L. E. Peña) [Canadian Nat. Coll., Ottawa].

Description of male type: Length 6 mm; LFW 4.2 mm. Entire head, including mandibles, bright orange; thorax and abdomen piceous; antennae light brown; legs piceous except tarsi light brown; wings wholly lightly infuscated, veins and stigma dark brown. Mandibles broad apically, with 5 strong, sharp teeth. Clypeus with a Y-shaped ridge, arms of which terminate in small lateral extensions of apical margin. First 4 antennal segments in a ratio of 19:4:9:8, segment 3 twice as long as wide; flagellar pubescence short, subappressed, a few longer, fully erect setae rising above pubescence. Eyes hairy, bulging from sides of head, removed from vertex crest by a distance considerably exceeding their own height. Head slightly higher than wide, sides of head roundly convergent from just behind eyes; WF 2.0 × HE; OOL 1.2 × HE; ocelli in compact triangle well above eye tops and far removed from top of vertex; DAO only 0.11 × WF; OOL 1.8 × WOT; occipital carina complete. Front shining, non-alutaceous, with small and shallow but rather close-set punctures. Thoracic dorsum also shining, non-alutaceous; pronotum transversely striatopunctate; mesoscutum wholly and uniformly punctate, notauli complete; scutellar groove very strong; propodeal disc barely longer than wide, with complete median carina and some-

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Fig. 1–6. Heads of holotypes of new species of Bethylidae, drawn to same scale. 1, *Pseudisobrachium erythrocephalum*. 2, *P. chacoense*. 3, *Rhabdepyris* (*Chlorepyris*) *cyanosoma*. 4, *Epyris nigrivirens*. 5, *Nothepyris brasiliensis*. 6, *Thlastepyris pertenuis*. Fig. 7. Propodeum of holotype of *Epyris nigrivirens*.

what irregular transverse carina margining disc behind. Mesopleural callus strongly elevated, polished and impunctate, mesopleurum otherwise with strong punctures. Fore wing with discoidal cell faintly outlined by pigmented streaks. Subgenital plate rounded apically.

Paratype: ♂, CHILE: Quebrada de La Plata, 550 m, Rinconada, Prov. Santiago, 22 March 1966 (M. E. Irwin; Malaise trap) [Univ. Calif. Riverside].

Variation: The paratype is similar in size to the type and apparently of similar color, although it is somewhat greasy. In this specimen the head is produced even farther above the eyes, measuring 1.05 × as long as wide; the ocellar triangle is slightly broader, so that OOL is only 1.6 × WOT and barely greater than HE.

Remarks: This is one of the most striking species of the genus known to me, not only because of its color but because of the unusual form of the clypeus, the thoracic sculpturing, and the transverse carina margining the propodeal disc. Only 1 other species of *Pseudisobrachium* is known from Chile (*chilense* Evans); this is also a very distinctive species, but in quite different respects.

Subfamily Epyrinae

Genus *Rhabdepyris* Kieffer

Rhabdepyris (*Chlorepyris*) *cyanosoma*, n. sp.

fig. 3

Holotype: ♀, ARGENTINA: 11 km W of Las Cejas, Tucumán, 1–15 Sept. 1967 (L. Stange) [Inst. Miguel Lillo, Tucumán].

Description of female type: Length 6 mm; LFW 3.8 mm. Head and thorax deep blue, propodeum also of this color but with coppery tints medially; abdomen a somewhat darker shade of blue, suffused with brownish apically; mandibles dark blue except rufous apically; scape dark blue, remainder of antenna dark brown, testaceous beneath; legs dark blue except tarsi brown; wings subhyaline, fore wing weakly clouded along radial vein, veins and stigma dark brown. Mandibles with unusually large tooth on inferior margin. Median lobe of clypeus barely extending beyond interantennal portion of front; antennae short, first four segments in a ratio of 19:5:5:7, segment 3 wider than long. Head subquadrate, WH and LH subequal; WF 1.2 × HE; front angle of ocellar triangle exceeding a right angle, OOL very slightly exceeding WOT. Vertex slightly gibbous behind ocelli; distance from eye tops to vertex crest equal to slightly less than ½ HE. Front moderately alutaceous, shining, with strong punctures which are separated by 1–2 × their own diameters. Pronotal disc similar, but punctures slightly more widely spaced; mesoscutum weakly punctate on posterior ⅓, notauli broadened and convergent here; scutellar pits small, connected by narrow but deep groove. Propodeal disc 1.2 × as wide as long, center with 5 longitudinal carinae which are connected by numerous cross-ridges; sides of disc shining and with weak surface sculpturing; side-pieces finely, longitudinally striate. Mesopleurum shining, weakly alutaceous, punctate; upper fovea deep, elongate; lower fovea broadly incomplete above. Front femora 2.1 × as long as wide; claws somewhat trifid, with small basal swelling followed by 2 longer rays. Transverse median vein of fore wing weakly curved. Abdomen depressed apically.

Paratype: ♀, SURINAM: Kwatta Road to sea, mangrove forest, 3–6 March 1964 (D. C. Geijskes; Malaise trap) [Leiden Museum].

Variation: Although the paratype is from a place far from the type locality and apparently from a very different habitat, it is closely similar to the type. The propodeum lacks coppery tints, but in color and size it is otherwise identical. WF is 1.35 × HE, OOL 1.35 × WOT. Sculpturing is in every respect closely similar to that of the type. One assumes that this species is widely distributed in South America.

Remarks: This is the only *Rhabdepyris* known in which the entire body, including the abdomen and legs to the tibiae, is blue in color. In my key (Evans 1965: 113) it runs to couplet 12, but it differs from *violaceus* and *tricolor* not only in color but in the more elongate head, much broader ocellar triangle, more elongate propodeum, and several other features.

Genus *Epyris* Westwood

Epyris nigrivirens, n. sp.

figs. 4, 7

Holotype: ♀, BOLIVIA: Dept. Beni, Rio Itenez at mouth of Rio Baures, 10 Oct. 1964 (J. K. Bouseman & J. Lussenhop) [Amer. Mus. Nat. Hist., New York].

Description of female type: Length 6.5 mm; LFW 4.5 mm. Black, head and thorax (but not propodeum) reflecting dark green, apical ⅓ of abdomen suffused with reddish brown; mandibles ferruginous, antennae also of this color except flagellum somewhat infuscated on upper surface; legs fuscous to femora (front femora reflecting dark green), tibiae and tarsi ferruginous; wings lightly tinged with yellowish brown. Mandibles tridentate; clypeus broadly subangular. First 4 antennal segments in a ratio of 25:6:7:8, segment 3 slightly longer than wide. Eyes sparsely hairy, slightly bulging from sides of head; vertex forming an even arc above eye tops; front narrow, WF 0.90 × HE; ocelli in a compact triangle, front angle less than a right angle, OOL 1.25 × WOT. Front shining, barely alutaceous, covered with strong punctures which are separated by about their own diameters. Thoracic dorsum slightly more evidently alutaceous than front; pronotal disc with punctures somewhat weaker and more widely spaced than on front; mesoscutum punctate on posterior ½ only; scutellar pits slender, oblique, separated by 1.5 × their own maximum length. Propodeal disc 1.5 × as wide as long, with 7 strong carinae in the center; sides of disc shining, weakly sculptured; posterior angles foveolate. Mesopleurum alutaceous and punctate, the fovea ill-defined above. Middle tibiae strongly spinose for most of their length. Transverse median vein of fore wing strongly curved below.

Allotype: ♂, BOLIVIA: Dept. Beni, Romansos, 1 km N Junction Rio Itenez and Rio Paragua, 30 July 1964 (J. K. Bouseman & J. Lussenhop) [Amer. Mus. Nat. Hist.].

Description of male allotype: Length 5.5 mm; LFW 4.2 mm. Black, head with dark blue reflections, thorax more weakly reflecting dark blue (but not propodeum); antennae wholly testaceous beneath, dark brown above; legs black to femora, tibiae brownish, tarsi testaceous; wings lightly suffused with brownish. Mandibles bidentate, upper tooth broad and blunt. First 4 antennal segments in a ratio of 9:4:5:6, segment 3 1.4 × as long as wide, segment 11 3 × as long as wide. Median lobe of clypeus obtusely angulate; eyes sparsely hairy; vertex broadly rounded off a short distance above eye tops. WH 0.96 × LH; WF 0.95 × HE; front angle of ocellar triangle less than a right angle, OOL 1.4 × WOT. Front and thoracic dorsum polished, non-alutaceous, strongly punctate; notauli convergent and widened behind, separated there by twice their own width; scutellar pits separated by twice their own length. Propodeal disc 1.6 × as wide as long, with 11 somewhat irregular longitudinal carinae, some of them incomplete; sides of disc shining, with weak surface sculpturing; posterior angles foveolate. Mesopleurum and fore wing as in female.

Remarks: This species is a member of the *Subspinosus* species-group and is the first member of the group to be described from the female sex and the first known species of the group of metallic coloration. The male will run to *subspinosus* in my key (Evans 1969: 198), although the propodeal sculpturing is much more like *willinki*; the scutellar pits are more widely separated than in either of those species, and of course the coloration is different. The female will not key out, since no females of this group have previously been known. In the key to species-groups (p. 188) it runs to couplet 6 but differs in having a much shorter and broader propodeum. The tridentate mandibles are also distinctive, although this feature is shared by 2 members of the *tricostatus* group.

Genus *Bakeriella* Kieffer
Bakeriella cristata Evans

This is the only known species of the genus in which the scutellar pits are separated by a broad, flat-topped ridge. I described it from males from Bolivia and Brazil. Three additional males before me represent the first records for this genus from Argentina: 1 ♂, Eldorado, Misiones, 13 Oct. 1964 (A. Kovacs) [Amer. Mus. Nat. Hist.]; 2 ♂♂, Pocitos, Gral. Sn. Martin, Salta, Jan. 1971 (Fritz & Martinez) [Coll. M. Fritz].

I also have a specimen that very probably represents the female of this species. It is from Nova Teutonia, Santa Catarina, Brazil, collected by Fritz Plaumann on 18 April 1941 [Coll. R. D. Shenefelt]. It is, like the male, immediately separable from other *Bakeriella* by virtue of having the scutellar pits elliptical and separated by a broad, flat-topped ridge; it is also unique in the genus in having the front dark, metallic green. The pronotum has the median carina weakly developed on the posterior ⅓, otherwise absent. The mandibles have 2 large apical teeth, the upper 1 very broad; OOL is 1.1 × WOT; LFW is 2.7 mm. The body is black, without metallic reflections except on the front; the antennae, apical parts of the legs, and tip of the abdomen are ferruginous.

Genus *Aspidepyris* Evans

This unusual genus has been known from 3 specimens representing 2 species. Hence a new record seems worth noting.

Aspidepyris austrinus Evans

This species was described from Brazil and Bolivia (Evans 1967). The following specimen represents a considerable northwestward range extension: 1 ♂, Santo Domingo, Ecuador, 19 June 1965 (Luis Peña) [Coll. H. K. Townes].

Genus *Laelius* Ashmead

This genus has not been reported from the southern hemisphere, but since the species attack dermestid beetles, it is not surprising that it does occur in South America, probably by introduction in commerce.

Laelius pedatus (Say)

Two females from Brazil appear identical to females from eastern North America. They bear the following data: 1 ♀, São Paulo, 15 Jan. 1966 (W. W. Kempf) [Mus. Zool. Univ. São Paulo]; 1 ♀, Nova Teutonia, Santa Catarina, March 1967 (F. Plaumann) [Museum of Comparative Zoology].

Genus *Thlastepyris* new genus

Type species: *Thlastepyris pertenuis*, n. sp.

Generic characters (of female; male unknown): Known species about 2.5 mm in length, fuscous, entire body extremely flattened; wings fully developed. Head much longer than wide, eyes situated well forward, far removed from vertex; eyes sparsely covered with short setae, slightly bulging from side of head; labial palpi short, with 3 segments; maxillary palpi with 6 segments; mandibles slender, terminating in 4 teeth; clypeus protruding only a short distance beyond base of antennae, with shallow median emargination, overhung laterally by antennal insertions; antennae slender, elongate, 13-segmented, arising slightly below bottoms of eyes; malar space very short; temples not at all developed, head broadly flattened immediately behind eyes; occipital carina absent.

Pronotum simple, very flat, much longer than very short mesoscutum; propleura angularly projecting anterolaterally of pronotum, in dorsal view; notauli absent; parapsidal furrows thin, not reaching anterior margin of mesoscutum; scutellum with pair of slender basal pits connected by very thin line; propodeum elongate, disc weakly margined laterally and posteriorly, also with median carina which does not quite reach posterior margin. Femora slightly incrassate, legs otherwise simple,

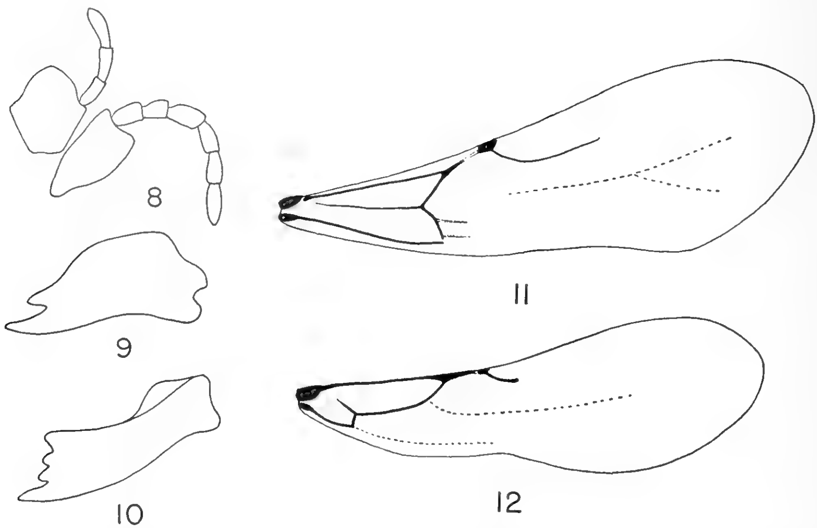

Fig. 8. Maxilla and labium of *Nothepyris brasiliensis*, n. sp. Fig. 9. Mandible of *N. brasiliensis*, n. sp. Fig. 10. Mandible of *Thlastepyris pertenuis*, n. sp. Fig. 11. Fore wing of *Nothepyris brasiliensis*, n. sp. Fig. 12. Fore wing of *Thlastepyris pertenuis*, n. sp.

not spinose; claws simple. Wings rather slender, fore wing with very small stigma and short radial vein, basal cells of unusual shape and incompletely divided (fig. 12). Abdomen exceedingly strongly depressed.

Remarks: This genus bears much resemblance to *Cephalonomia* and *Plastanoxus*, but it cannot be placed in the Cephalonomiini because of the 13-segmented antennae and elongate, fully segmented palpi. It is perhaps best placed in the Sclerodermini because of the reduced venation and very short clypeus, although the eyes are more lateral and somewhat more protruding than is usually the case in that tribe.

Thlastepyris pertenuis, n. sp.
fig. 6, 10, 12

Holotype: ♀, BRAZIL: Nova Teutonia, Santa Catarina, 2 May 1941 (F. Plaumann) [Mus. Comp. Zool.].

Description of female type: Length 2.8 mm; fore wing 1.6 mm. Head and thorax black, abdomen shining reddish brown; antennae and legs dark brown except tibiae and tarsi testaceous; wings hyaline. First 4 antennal segments in a ratio of 10:4:3:3, segment 3 barely longer than wide, segment 11 1.3 × as long as wide. Head 1.15 × as long as wide; WF 0.60 × WH, 1.25 × HE; distance from eye tops to vertex crest 1.3 × HE; OOL 2 × WOT, ocelli far above eye tops and close to vertex crest. Front strongly alutaceous although moderately shining, with median streak which is slightly elevated below, slightly depressed just before anterior ocellus. Thoracic dorsum also alutaceous, moderately shining, very sparsely and inconspicuously punctate; propodeum similarly alutaceous. Venation of fore wing as figured.

Remarks: This striking species is known from a single specimen, which I have held on to for several years in the hope of finding others like it. The extremely depressed form suggests that it attacks an insect living under bark.

Genus *Nothepyris* new genus

Type species: *Nothepyris brasiliensis*, n. sp.

Generic characters (of female; male unknown): Known species 3–4 mm long, testaceous to piceous in color, wings fully developed. Head slightly wider than maximum width of thorax, slightly wider than high (exclusive of mouthparts); head very convex in front, vertex broadly rounded; eyes with sparse, short hairs, well removed from crest of vertex and from posterior margin of head (i.e., temples broad); labial palpi with 3 segments, maxillary palpi with 6; mandibles broad basally, tapering to bidentate apex; clypeus short, broadly truncate, deeply sunken at each antennal socket; antennae slender, 13-segmented, arising well below bottoms of eyes; malar space about as long as width of mandibles at their base; occipital carina absent.

Pronotum with smooth contours, somewhat longer than mesoscutum, latter with both notauli and parapsidal grooves complete, linear; scutellum with transverse, basal groove which is curved backward at each end; propodeal disc margined with carinae laterally and posteriorly and with complete median carina. Femora only slightly incrassate; middle tibiae somewhat broadened and bearing many short, spinelike setae above; claws simple. Wing venation as figured (fig. 11), differing in no important details from that of *Nesepyris* except that the radial vein is somewhat thinner than other veins. Abdomen robust, the sternites with tripartite apical plates similar to those of *Lepidosternopsis* although much shorter.

Remarks: This genus fits readily in the Sclerodermini, running to couplet 2 in my key to genera (Evans 1964: 161) but differing from both *Nesepyris* and *Chilepyris* in head shape and form of the mandibles, from the latter genus in venation, and from the former in palpal segmentation.

Nothepyris brasiliensis, n. sp.

figs. 5, 8, 9, 11

Holotype: ♀, BRAZIL: Nova Teutonia, Santa Catarina, 11 April 1941 (F. Plaumann) [Mus. Comp. Zool.].

Description of type: Length 3.9 mm; fore wing 2.7 mm. Dark reddish brown, thorax almost black, but head fading to light brown anteriorly, especially clypeus and mouthparts; antennae and legs medium brown; wings hyaline except fore wing weakly clouded on apical ½. First 4 antennal segments in a ratio of 15:6:5: 4, segment 3 1.7 × as long as wide, segment 11 1.3 × as long as wide. Front narrow, WF 1.08 × HE; ocelli in a compact triangle opposite tops of eyes, front angle less than a right angle; OOL 1.3 × WOT; distance from posterior ocelli to top of vertex slightly exceeding WOT. Temples, in lateral view, approximately as wide as maximum width of eye. Head shining, weakly alutaceous, with sparse, shallow setigerous punctures. Thoracic dorsum moderately alutaceous, pronotum somewhat more closely punctate than head, but mesoscutum impunctate. Propodeal disc with weak surface sculpturing except for pair of sharp carinae between median and lateral carinae which extend for 0.7 the length of the disc.

Paratypes: 10 ♀♀, same data as type but dated March–June 1941, 2 of them undated but evidently collected more recently [Mus. Comp. Zool., USNM, Coll. R. D. Shenefelt].

Variation: The paratypes vary in length from 3.2 to 4.0 mm. Several are somewhat paler than the type, somewhat ferruginous, but in every case the thorax is darker than the head or abdomen. There seem to be no important differences in sculpture or in standard measurements.

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COSMOPHORUS CAPEKI N. SP., FROM NEW YORK (HYMENOPTERA: BRACONIDAE: EUPHORINAE)

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ABSTRACT—*Cosmophorus* **capeki**, n. sp., is the fifth known Nearctic species of *Cosmophorus* Ratzeburg. It is a parasite of the scolytid *Pityophthorus rhois* Swaine breeding in *Rhus typhina* L.

Species of *Cosmophorus* Ratzeburg 1848 are rare braconids parasitic on adult scolytids (Coleoptera). *C. capeki* new species was reared and host-associated by the second author in 1967 during a biological survey of Huyck Preserve near Rensselaerville, N. Y. It is the fifth known Nearctic species of *Cosmophorus.* Following Capek (1970) and Tobias (1971), the subfamily Cosmophorinae is not recognized and *Cosmophorus* is placed in the Euphorinae chiefly on ethological and larval characters.

The holotype of *C. capeki* is deposited in the U. S. National Museum, Washington, D. C. (USNM).

Cosmophorus capeki, n. sp.
fig. 1–3

Holotype: Female. Length about 1.9 mm excluding antennae and ovipositor sheaths. Piceous. Flagellar segment 1 pale, succeeding segments dusky, scape and pedicel not as dark as flagellar segments 2–12 but darker than 1; mandibles (except apices) and face reddish brown; front wing venation pale grey; femur and tibia of each leg deeply infuscated. Head about 1.4 times as wide as long, 1.2 times as wide as thorax; eye not much longer than wide, its length to width of face between eyes 1:1.6; ocular-ocellar line = basal width of mandible, slightly more than 2.0 times as long as postocellar line; flagellum 12-segmented (fig. 3), about 2.0 times as long as head width, 1+2 only slightly more than combined length of pedicel +1. Mesonotum smooth, polished, apparently glabrous from above but in side view bearing very short, widely-spaced setae; mesepisternum generally rounded and smooth medially, thickly punctulate above and below. Stigma (fig. 1) 3 times as long as wide, inner side somewhat longer than outer; radial cell measured on wing margin 0.7 times as long as stigma, second abscissa of radius almost complete to wing margin; first abscissa of radius short but distinct. Hind wing as in fig. 2. Tibia of hind leg 0.36 mm long, 3 times as long as hind

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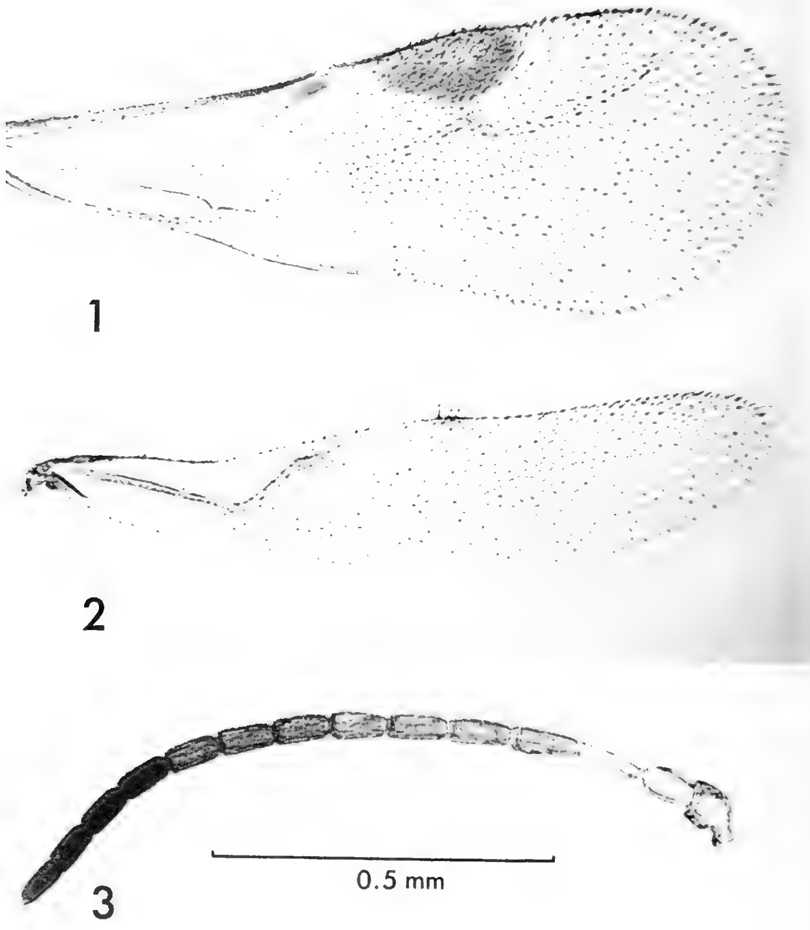

Fig. 1–3. *Cosmophorus capeki* new species. 1, front wing. 2, hind wing. 3, antenna of female.

tarsal segment 1. Tergite 1 of gaster 1.4 times as long as wide at apex (length measured from spiracles to apex), dorsum evenly granulose; ovipositor sheaths about as long as thorax and propodeum combined, 2.4 times as long as tergite 1.

Males and females: In the type series, the antennal flagellum is 11-segmented in males, and 12-segmented in females. Color variation of basal antennal segments: scape and pedicel of some male and female specimens are as dark as flagellar segment 2 or as pale as segment 1, or pedicel is pale and scape dark; flagellar segment 1 of female pale in all specimens whereas that of male may be pale only at base.

No significant sexual differences were found for the dimensions of the eye, width of face, dimensions of the stigma, length of the hind tibia, nor width of the apex of tergite 1 of the gaster (student's t test for unpaired data).

Dimensions (mm) of some body structures of *C. capeki* (means and standard errors) are as follows:

	Eye		Face
	Length	Width	Width
♂, ♀ N = 20	0.15 ± 0.099	0.12 ± 0.010	0.23 ± 0.012

Tergite 1 Apex Width	Hind Tibia Length		Ovipositor Sheaths L.
0.16 ± 0.12	0.37 ± 0.12	N = 15	0.57 ± 0.025

Type: Holotype: ♀, United States. New York, Albany Co., near Rensselaerville, Huyck Preserve, VIII.3, 1967 reared ex *Pityophthorus rhois* Swaine in *Rhus typhina* L. (R. & J. Matthews). Type deposited in USNM (USNM No. 72154).

Paratypes: 15 ♀♀, 19 ♂♂, same data as type but reared from VIII-2-18, 1967. 3 ♀♀, 3 ♂♂ British Museum (Natural History), London; 5 ♀♀, 5 ♂♂ Canadian National Collection, Ottawa; 1 ♀, 1 ♂ Forest Research Institute, Banská Štiavnica, ČSSR; all others in USNM.

Diagnosis of *C. capeki* and key to related Nearctic species

C. capeki is characterized by a narrow apex of tergite 1, black body, and deeply infuscated legs. Characters for the 4 other species included in the following key are based on a study of the types of each species.

1. Flagellum 11-segmented (♂), 12-segmented (♀) 2
— Flagellum 13-segmented (♂), 14-segmented (♀) 4
2. Tergite 1 of gaster 1.8 times as wide at apex as eye length; flagellum light reddish brown with all segments more or less concolorous; legs greyish yellow; hind tibia 0.51 mm long .... *Cosmophorus pityophthori* Ashmead
— Tergite 1 1.0–1.3 times as wide at apex as eye length; flagellum dark reddish brown or piceous, segment 1 pale; hind tibia not over 0.41 mm long 3
3. Head, thorax, abdomen light reddish brown, legs light testaceous .... *Cosmophorus hypothenemi* Brues
— Head, thorax, abdomen black; legs deeply infuscated .... *Cosmophorus capeki* n. sp.
4. Flagellar segments 1–5 distinctly yellow, succeeding segments dusky .... *Cosmophorus dendroctoni* Viereck
— Flagellar segments 1–2 yellow, 3 yellow basally, succeeding segments dusky .... *Cosmophorus hopkinsii* Ashmead

Biology: The main details of *Cosmophorous* biology were reported by Seitner and Notzl (1925) for *C. henscheli* Ruschka, the only species to be comparatively well studied. Wasps enter host galleries and seize adult beetles in their jaws and oviposit into their thoraces.

Comments: *Cosmophorus capeki* emerged from branches (25 mm diameter or less) of red sumac (*Rhus typhina* L.) heavily infested by the bark beetle *Pityophthorus rhois* Swaine. Branches collected and placed in rearing containers on 5 July 1967 were maintained at room temperature until 12 September 1967; beetles and parasites that emerged were removed daily. There were 51 male- and 76 female-reared parasites, the first emerging on 29 July, then daily until 18 August. Examination of the branches from which the wasps emerged failed to reveal any parasite exit holes suggesting that *Cosmophorus* emerges via the entrance galleries of the host scolytid. This is interesting as most braconids parasitic on bark beetles chew out through the bark overlying their host. Adult parasites provided with soaked raisins and kept in plastic containers survived up to 3 weeks. However, attempts to obtain life history data by inducing parasitism of beetles in other heavily infested sumac stems were unsuccessful.

This species is named for Dr. Miroslav Čapek, Forest Research Institute, VS Banská Štiavnica, ČSSR.

Acknowledgments

For generous assistance in matters of type material we thank Dr. Paul Marsh, Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington; Dr. Selwyn Roback, Academy of Sciences, Phildelphia; and Dr. R. D. Shenefelt, Department of Entomology, University of Wisconsin, Madison. We also express appreciation to Dr. K.-J. Hedqvist, Department of Entomology, Swedish Museum of Natural History, Stockholm, for taxonomic information. Dr. Donald E. Bright of the Entomology Research Institute, Ottawa, Canada, kindly identified the scolytid host.

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APHIDS COLLECTED IN THE LOS ANGELES STATE AND COUNTY ARBORETUM (HOMOPTERA: APHIDIDAE)

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ABSTRACT—An alphabetical list of aphids collected from plants in the Los Angeles State and County Arboretum from March, 1966 through October, 1971, with an indication of their relative abundance at the time of collection, is presented. About 111 species and subspecies are listed, with several others identified to genus only.

Aphids which have been identified from plants in the Los Angeles State and County Arboretum, Arcadia, California, from March, 1966 through October, 1971, are listed alphabetically with an indication of their relative abundance at the time of collection. This expressed by *A* (Abundant), *M* (Moderate), and *S* (Scarce). The figures represent the number of collections. About 111 species and subspecies are listed with several others identified to genus only.

Leonard, et al. (1972) recorded 95 species of aphids (and 7 others identified to genus) collected at the Los Angeles State and County Arboretum during 1966 and 1967. In the present paper, 16 species are included which are in addition to those in the previous paper; these are marked with an asterisk.

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	A	M	S	Total
Acyrthosiphon				
pelargonii (Kalt.)	7	6		13
A. *pisum* (Harris)	9	4	2	15
A. *solani* (Kalt.)	44	6	6	56
Amphorophora sp.	4	3		7
A. *agathonica* Hottes	1			1
*A. *brevitarsis* (G. & P.)	1			1
A. *rubitoxica* Knlt.	1			1
Aphis sp.	184	56	50	290
A. *ceanothi* Clarke	1			1
*A. *cephalanthi* Thos.	2			2
A. *cerocarpi* G. & P.	1	1		2

	A	M	S	Total
A. corcopsidis Ths.	2			2
A. craccivora Koch	17	5	3	25
A. eriogoni Cowen			1	1
A. fabae Scop.	12	2	1	15
A. gossypii Glover	136	50	36	222
A. hederae L.	1			1
A. helianthi Mon.	1			1
A. nasturtii Kalt.	1			1
A. nerii Fonsc.	2			2
A. oestlundi Gill.	1			1
A. pomi DeG.	26	2	1	29
**A. sambucifoliae* Fitch	2			2
A. spiraecola Patch	38	11	6	55
Brachycaudus crataegifoliae Fitch	2			2
**B. helichrysi* (Kalt.)		1		1
B. maidiradicis (Forbes)			1	1
Brachycolus atriplicis (L.)	1			1
Brevicoryne brassicae (L.)	1			1
Calaphis sp.	4			4
C. betulella Walsh	1			1
C. castaneae Fitch		1		1
C. granovskyi Palmer	9			9
Cavariella aegopodii (Scop.)	2			2
**C. pustula* Essig	1			1
Chaetosiphon fragaefolii (Ckll.)	1			1
Chaitophorus sp.	1		1	2
C. viminalis Mon.	1			1
**Chromaphis jugandicola* Kalt.			1	1
Cinara sp.	4			4
*? *C. apini* G. & P.	1			1
C. atra G. & P.	1			1
C. carolina Tissot	2			2
C. cupressi Buckton	3			3
C. curvipes Patch	1			1
C. juniperina Mordv.	15	2	1	18
C. tujafilina Del G.	9	4	2	15
Coloradoa rufomaculata Wlsn.		2		2
Dactynotus spp.	10	4	1	15
D. ambrosiae (Ths.) complex	2			2
D. erigeronensis baccharidis (Clarke)			1	1
**Dysaphis tulipae* (Fonsc.)			1	1
Erisoma crataegi (Oestl.)	1			1

	A	M	S	Total
E. lanigerum (Hausmann)	1			1
Essigella sp. close to *patchiae* Hottes	1			1
E. californica Essig	4			4
E. pini Wilson	2			2
Euceraphis gillettei Dvdsn.	1		1	2
E. punctipennis Zett.	3			3
Eulachnus agilis (Kalt.) &/or *rileyi* (Wms.)	12	1	1	14
**Euthoracaphis umbelliferae* (Essig)	1			1
Hyadaphis foeniculi Pass.	1		1	3
H. pseudobrassicae (Davis)	1			1
Kakimia essigi G. & P.	1			1
Macrosiphoniella ludovicianae (Oestl.)	1			1
M. sanborni Gill.	1	1		2
Macrosiphum sp.	14	4	3	21
M. avenae (Fab.)	1			1
M. californicum (Clarke)	6	2		8
M. euphorbiae (Thos.)	72	37	18	128
M. fragariae (Wlk.)	1			1
M. geranii (Oestl.)			1	1
M. pennsylvanicum Pepper	1			1
M. pteridis Wilson	1			1
M. rhamni (Clarke)	7	3	2	12
M. rosae (L.)	1	1	1	3
Masonaphis spp.	14	4		18
M. lambersi Mac G.	2		1	3
M. morrisoni (Swain)	26	6	3	35
Melanocallis cartaefoliae Davis	1			1
**Monellia caryella* Fitch	1			1
M. costalis Fitch	1			1
**Monelliopsis bisetosa* Richards		1		1
M. californica (Essig)	2	2		4
Myzocallis spp.	1		1	2
M. discolor (Mon.)	1			1
M. punctata (Mon.)	7		6	13
M. walshii (Mon.)	2			2
**Myzus certus* (Wlk.)	2	3		5
M. hemerocallis Tak.	2			2
M. lythri Schr.	1			1
M. ornatus Laing	58	38	23	119
M. persicae (Sulz.)	333	146	116	595
M. varians Dvdsn.	1		1	2

	A	M	S	Total
Nasonovia lactucae (L.)	1			1
Neoceruraphis viburnicola (Gill.)	3			3
Neophyllaphis podocarpi Tak.	1		1	2
Neotoxoptera violae (Perg.)	3	2		5
Ovatus crataegarius (Wlk.)	3	2	1	6
**O. phloxae* (Sampson)	1			1
Pentalonia nigronervosa Coq.	4	1		5
**Pleotrichophorus glandulosus* (Kalt.)	1			1
P. gnapholodes (Kalt.)	1			1
Pterocomma salicis (L.)	2			2
P. smithiae (Mon.)	1			1
**Rhopalosiphum maidis* (Fitch)	1			1
R. padi (L.)	1			1
Siphonotrophia cupressi Swain	6	1		7
Stegophylla quercifoliae Gill.	1	1		2
Takecallis arundicolens (Clarke)	5	1	1	7
T. arundinariae (Essig)	14	15	6	35
Tamalia coweni (Ckll.)	1			1
Tinocallis alnifolii (Mon.)	2			2
Toxoptera aurantii Fonsc.	37	7	3	47
Tuberculoides maureri (Swain)	4			4
T. (Pacificallis) n. sp. Dickson in MS	1			1
T. platani (Kalt.)		1		1
Tuberolachnus salignus Gmelin	5			5
Wahlgreniella nervata Gill.	3	1		4
W. nervata arbuti Dvdsn.	1			1

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RECOGNITION OF ZEMIOTES (HYMENOPTERA: BRACONIDAE)

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ABSTRACT—*Zemiotes* Foerster is accorded generic rank and is distinguished from *Meteorus* Haliday. Phylogenetic relationships in *Zemiotes* and *Meteorus* are discussed. Several new transfers to *Zemiotes* and new combinations in *Zemiotes* are made.

The genus *Zemiotes* Foerster has generally been regarded as a minor segregate of *Meteorus* Haliday, at best a subgenus. I have recently concluded that it is neither. In fact it is a distinct genus related to *Zele* Curtis but showing convergence toward *Meteorus* in the structure of tergite I.

Zemiotes differs from *Meteorus* by the following characters: 1, radiellan cell broadening apically; 2, a transverse pigmented vein, (sometimes reduced to a crease or missing) dividing the radiellan cell; 3, tarsal claws with a large basal tooth; 4, apical ½ or more of tergites 3–6, (also more or less of tergite 2) uniformly hairy, never with only a single, subapical, transverse row on each tergite; 5, the cocoon covered with fine, fluffy whitish silk and never suspended on a cord or covered in coarse brown silk as typically in *Meteorus*. All these characters are the same in *Zele* except that a few species of that genus have simple tarsal claws. The only difference I can find between *Zele* and *Zemiotes* is in the petiolate abdomen of the latter.

The possibility of *Zemiotes* being ancestral to *Meteorus* or vice versa must be considered. Since all *Meteorus* have the hairs on all tergites (except the first) arranged in subapical rows and have the interanal vein reduced to a tiny stub, an unpigmented crease, or entirely absent, they cannot serve as ancestors to *Zemiotes*, which have more or less evenly scattered tergite hairs and a well-developed interanal vein. This is because both organs exhibit the plesiomorphic condition in *Zemiotes*, and an apomorphic condition in *Meteorus*.

In order to study the possibility of *Zemiotes* being ancestral to such a large and varied genus as *Meteorus* we must first determine which species are primitive in *Meteorus*. There is a group of species in *Meteorus* that is characterized by having a comparatively short and broad petiole with ventral margins of tergite 1 widely separated, the sternite free, glymmae present, large dorsal pits, and the spiracles near the middle of the segment. All these characters are plesiomorphic for the genus. Most of the species have the additional plesiomorphic characters of a small third joint on the labial palpus, making it 4-jointed, and a vestige of the interanal vein. This group includes *M. obfuscatus* Nees, *hypophloei* Cushman, *tibialis* Muesebeck, *betulini* Mason, and *orchesiae* Ashmead, all of which have been reared from sub-cortical- or fungus-boring Coleoptera larvae. It also includes *M. humilis* Cresson, a species associated with stored products and reared from *Tinea granella* L., and other species such as *M. politus* Provancher and *fumipennis* Muesebeck, whose hosts are unknown. The cocoons, as far as known, are stalkless and found within the beetle burrows.

The most strikingly plesiomorphic members of the above group are *M. cognatus* Muesebeck, *insignis* Muesebeck, and some undescribed species from Japan and North America. These species have an exceptionally short and broad petiole with spiracles in front of the middle, a sculptured second tergite and simple untwisted mandibles with the teeth lying in a horizontal plane when closed. In addition the intercubitella is more or less developed and some species show a weak interanella. *Meteorus cognatus,* the only species with a known host, is parasitic on larvae of Cerambycidae.

Thus we have a substantial group of *Meteorus* showing such a concentration of plesiomorphic features that they can by no means be derived from *Zemiotes.* In fact, these characters together with their choice of coleopterous hosts strongly suggests that *Meteorus* evolved from an extinct group that would find a natural position in our classification in Diospilini or Helconini. I cannot suggest any extant members of these tribes as ancestral to *Meteorus* because all have lost all traces of the intercubitella.

The largest part of *Meteorus,* containing most of the familiar species, has evolved from this group by further petiolization of the abdomen, which involves fusion of the first tergite and sternite, disappearance of glymmae and dorsal pits, and elongation of the petiole. At the same time there has been a transfer of host affiliation from Coleoptera to Lepidoptera, probably by way of larvae burrowing in fungi, then to larvae in other concealed habitats, and finally to free-living larvae. Concomitantly they evolved the familiar pendant cocoon.

I believe that the traditional *Meteorus* is a diphyletic assemblage of convergent genera that should be placed in separate tribes. *Meteorus* s. str. can be placed in Euphorini or Meteorini; which tribe to use is a question beyond the scope of this paper. *Zemiotes* should be transferred to Zelini. *Zele albiditarsus* Curtis, *Meteorus caligatus* Haliday, *Perilitus deceptor* Wesmael, *M. nigricollis* Thomson, *M. rufulus* Thomson, *M. separandus* Fischer, are here restored to *Zemiotes. Dyscoletes alaskensis* Ashmead, *M. crassifemur* Muesebeck, *M. levis* Muesebeck, *M. maximus* Muesebeck, *P. niveitarsis* Cresson, *P. pallitarsis* Cresson, and *M. reticulatus* Muesebeck are here transferred to *Zemiotes*, where they make new combinations. There may be more described Palearctic species in *Zemiotes*, but the Nearctic list is complete. I know of no *Zemiotes* from outside the Holarctic region.

AN ANOMALOUS HINDLEG IN CALOSOMA FRIGIDUM KIRBY (COLEOPTERA : CARABIDAE)

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ABSTRACT—An anomalous specimen of *Calosoma frigidum* Kirby, in which the left hindleg has a bifurcate metatarsus and an additional metatarsus, is described and figured.

On May 25, 1967, while collecting insects in a deciduous forest near the Bourget College campus, Mr. Jean-Pierre Lebel captured a specimen of *Calosoma frigidum* Kirby in which the left hindleg is grossly misshapen (Fig. 1). The metatarsus is bifurcate beyond the second segment, and there is an additional metatarsus arising from the outer face of the tibia near the apex.

The apex of the left metatibia is noticeably thicker than that of the right metatibia. The auxilliary metatarsus arises from the outer face of the apical thickening proximad to the tibial spurs. The 2 basal segments of the principal metatarsus are greatly enlarged and triangular. In place of the third segment, there are 2 parallel segments. The inner of these bears a fourth segment. At the time of capture,

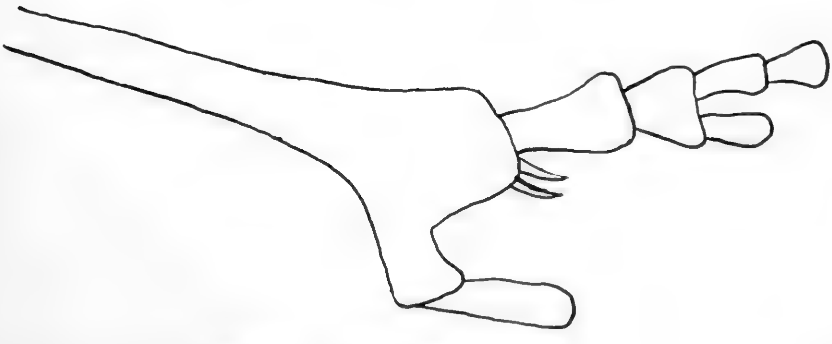

Fig. 1. Abnormal hindleg of *Calosoma frigidum* Kirby.

the fifth segment of the inner ramus, the fourth and fifth segment of the inner ramus, the fourth and fifth segment of the outer ramus, and segments 3–5 of the auxiliary tarsus were missing. Bifurcate and trifurcate legs have been occasionally reported in Coleoptera (Jayne 1880, Scudder 1891, Wickham 1904, Balazuc 1948, and Graves 1969).

I would like to express my appreciation to Jean-Pierre Lebel for giving me the specimen, and to Ross T. Bell for revising the manuscript.

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TWO ICHNEUMONIDS (HYMENOPTERA) FROM THE EARLY CRETACEOUS

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ABSTRACT—**Tanychora petiolata** and **T. sessilis** are described from the lower Cretaceous of Siberia. *Tanychora* has a divided discocubital cell and a very large areolet, both of which are primitive features.

In 1968, I visited the Paleontological Institute of the Academy of Sciences of the USSR in Moscow for a few hours and was shown some of their fossil Hymenoptera by Dr. A. Rasnitsyn. Among them were 2 relatively well preserved specimens of Ichneumonidae from the early Cretaceous. Since these were the oldest fossils of Ichneumonidae known and also because they showed some definitely primitive features, I was much interested in them. Dr. Rasnitsyn agreed to lend them for study. Descriptions and figures of them have been prepared and are presented below.

Tanychora, n. gen.

Discocubital cell subdivided by complete vein into first cubital and first discal cell. Areolet very large and wide. First tergite short and wide, its spiracle a

Fig. 1. *Tanychora petiolata,* drawn from the type.

little in front of the middle. Bullae not discernible in venation of fossil specimens at hand, but they are presumed to be present, at least narrow ones.

Type-species: *Tanychora petiolata,* new species.

The generic name is from τανυ- (long), plus χώρα (space), referring to the very wide areolet.

Tanychora petiolata, n. sp.

fig. 1

Front wing 4.6 mm long. Structure as figured. Microtrichia on wing moderately dense. Punctures on mesopleurum and on side of pronotum moderately large and dense.

Type: From an early Cretaceous deposit (Neocomian) on the Zaza River, Zaza formation. The Zaza River is a tributary of the upper Vitim River, Transbaikalia. Specimen no. 292/8 of the Paleontological Institute, Moscow.

A second specimen, no. 3145/1075 of the Paleontological Institute, Moscow, is very similar to the type and is conceivably conspecific. It is from an early Cretaceous deposit at Anda-Khuduk (=Ondai Sair), Mongolia. I have not seen the specimen but I have seen a photograph and drawing of it.

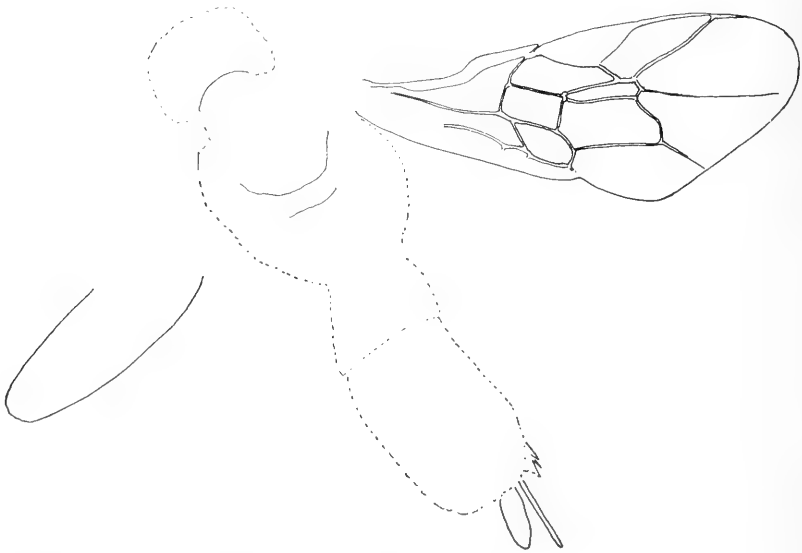

Fig. 2. *Tanychora sessilis*, drawn from the type.

Tanychora sessilis, n. sp.

fig. 2

Front wing 3.7 mm long. Structure as figured. The specimen has the right hind wing beneath the front wing. This wing is drawn to the left to show its shape. Its venation is not distinct. Present also is the left front wing. This is more distorted and less complete than the right wing. Microtrichia on wings moderately dense.

Type: From an early Cretaceous deposit (Neocomian) at Baissa (about 20 km down the Vitim River from the mouth of the Zaza River and about 100 km up the Vitim River from the village of Romanovka). Specimen no. 1989/2594 of the Paleontological Institute, Moscow.

Discussion

These 3 specimens differ from modern ichneumonids in having the first cubital and first discal cells separated by a complete vein. In many modern ichneumonids there is a stub (= ramulus) of this vein on the discocubital vein. On the basal vein there is often a small node which is the remnant of the former junction of the complete ramulus with the basal vein. I have seen an atavistic specimen of *Coccygomimus pedalis* in which the vein was complete, as it is in *Tanychora*. It should be noted that this vein, complete in the fossil *Tanychora* and as indicated by remnants in modern ichneumonids, is horizontal, and not slanted as in braconids.

The areolet in *Tanychora* is larger than in any modern ichneumonids. Its shape indicates that the second intercubitus has dropped out, leaving the first and third intercubiti as the boundaries of the areola. This being so, the 2 intercubiti present in modern ichneumonids would also be the first and third, rather than the first and second as commonly stated. In *Tanychora sessilis* there seem to be 2 remnant stubs of anal veins on submedius and in *T. petiolata* a small stub in 1 wing but not in the other. If they are true remnants of anal veins these are features shared by no other Apocrita except some braconids. The stubs, however, may be artifacts, or secondary developments as in the modern genus *Absyrtus*.

Except for the venational features discussed above, these ancient fossils seem to be typical ichneumonids. The costa and subcosta are fused as in modern ichneumonids, the stigma is large, and the hind wing venation is identical with that of modern genera. The propodeal areolation is typical of that of many modern genera. The multi-segmented flagellum is also a typical ichneumonid character. *Tanychora* could be ancestral to all of the modern Ichneumonidae, it could represent an extinct phyletic line, or it could be a primitive representative of 1 of the modern subfamilies. There is not sufficient evidence to eliminate any of these 3 possibilities.

No new light is shed on the relationships of the ichneumonids to other families of Hymenoptera. The front wing venation of *Tanychora* is very similar to that of trigonalids, whether because of relationship or of convergence it is too early to state.

A REPLACEMENT NAME FOR SMICRIDEA (R.) MINIMA FLINT

(TRICHOPTERA: HYDROPSYCHIDAE)

In a recent paper in Trichoptera collected in northern Argentina (Proc. Biol. Soc. Wash. 85:241, 1972) I described a new species of *Smicridea* (subgenus *Rhyacophylax*) as *minima*, unfortunately overlooking the fact that I had earlier used *minima* for a species of *Smicridea* (subgenus *Smicridea*) from Jamaica (Bull. Inst. Jam., Sci. Ser. 19:27, 1968). *Smicridea* (*R.*) *minima* Flint, 1972, is thus a homonym and must be renamed. I here propose the name *minuscula* as a replacement name for *minima* Flint, 1972.

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A NEW SPECIES OF CULEX, SUBGENUS CULICIOMYIA THEOBALD FROM CERAM, INDONESIA (DIPTERA: CULICIDAE)[1]

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ABSTRACT—The female, male, pupa, and fourth instar larva of *Culex* (*Culiciomyia*) **ceramensis** n. sp. from Ceram, Indonesia are described. The main diagnostic features of this new species are summarized and its relationship with the other known forms in the Oriental and Australasian regions is discussed.

The following description of all stages of *Culex* (*Culiciomyia*) *ceramensis* n. sp. is based on specimens collected by the junior author during a general field survey of the mosquitoes of Ceram during March, 1972. This species is apparently closely related to *C. papuensis* (Taylor) from the Australasian region and *C. pallidothorax* Theobald from the Oriental region but is distinct from both in several details of the male terminalia and in certain larval features as described below.

The holotype and allotype will be deposited in the U.S. National Museum (USNM), Washington, D.C. The paratypes will be deposited in the Department of Entomology, National Science Museum, Tokyo, Japan, and in the collection of Southeast Asia Mosquito Project (SEAMP), Smithsonian Institution, Washington, D.C., U.S.A.

Culex (*Culiciomyia*) *ceramensis*, new species
fig. 1–6, larva; 7–10, ♂ genitalia

Female: Wing 3.8–4.0 mm, fore femur 2.3 mm, proboscis 2.2 mm, palpus 0.4 mm, abdomen 3.0 mm. Medium to large in size, very dark to nearly black species; abdominal terga without basal transverse white bands. *Head.* Decumbent scales on dorsal surface of vertex predominantly broad and dark; narrow decumbent scales yellowish brown, very sparse, restricted to dorsal midline in center and occiput; all erect forked scales entirely black; lateral part of vertex with distinct bluish-white patch of broad appressed scales; palpus and proboscis dark scaled; palpus about 0.25 of proboscis length. *Thorax.* Integument of scutum and scutellum dark brown to black; scutal and scutellar scales numerous, fine, dark brown to black; integument of pronotum and paratergite same color as scutum; pleural integument paler except for *ppl*, *psp*, upper and lower *stp* which are as

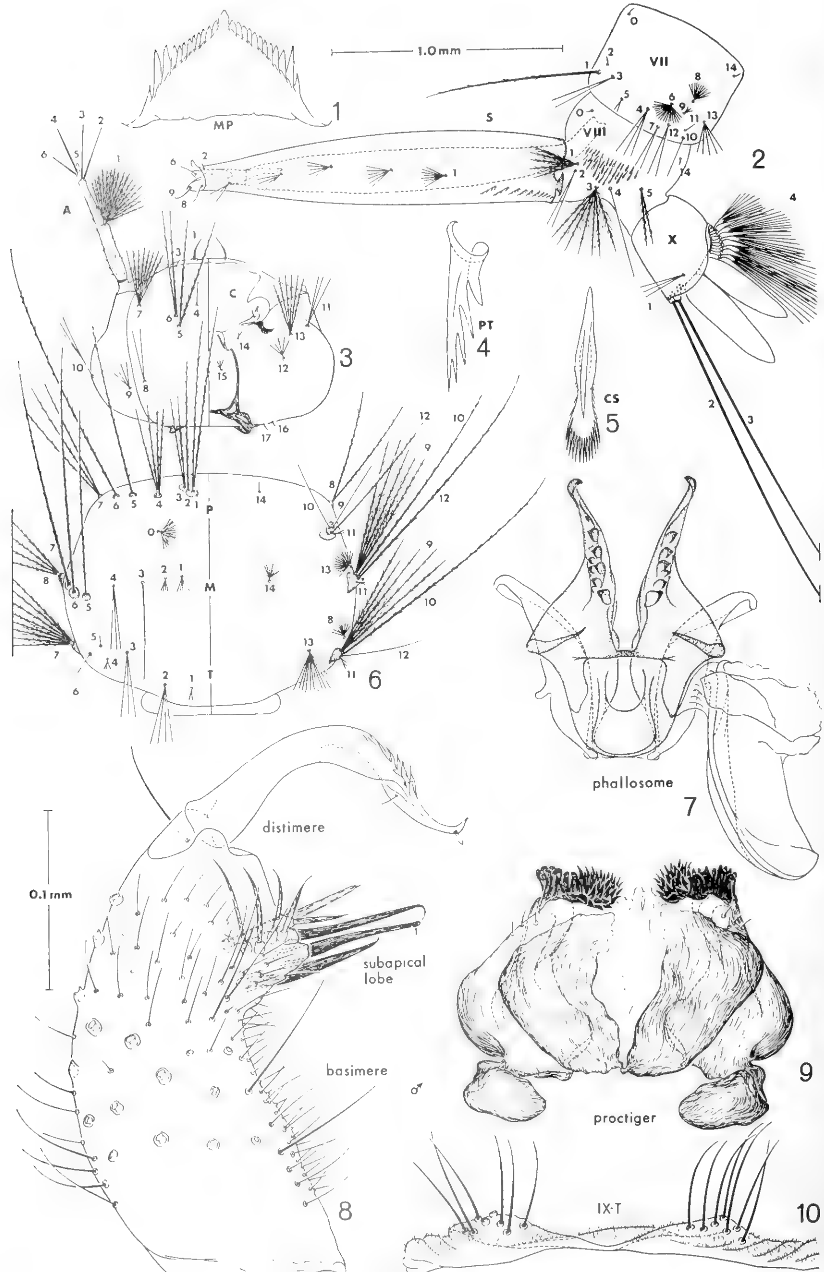
[1]This work was supported by Research Contract No. DA-49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General and by a grant to the junior author from the U.S.-Japan Cooperative Medical Science Program.

dark as scutum; 1 lower mesepimeral bristle present, sometimes 2. *Legs.* Fore and mid femora dark scaled anteriorly and dorsally, white scaled ventrally; anterior surface of hind femur with white stripe extending from base to 0.5–0.75 of length; all tibiae and tarsi dark scaled. *Wing.* All scales narrow, dark and moderately to very dense on all veins. *Abdomen.* Terga completely dark to black scaled; sterna pale yellowish scaled.

Male: In general as described for female, differing slightly in smaller size and in the following sexual characters: *Head.* Palpus longer than proboscis by about length of segment 5; segment 3 with lateral ventral row of 5–6 transparent lanceolate scales on distal ½, apex with 2–3 dark bristles laterally; segments 4 and 5 weakly plumose, bristles and hairs rather sparse; flagellar whorls of antennae densely plumose. Terminalia (fig. 7–10). Tergal lobe of segment IX small, with 1–2 irregular rows of 6–8 moderately strong setae; subapical lobe of basimere without sterno-apical spiculose lobe, proximal division with 2 lateral and 1 mesal rodlike setae, followed distally by 1 strong spinelike seta and laterally by a row of 3–4 flattened bristlelike setae, none of which is foliate; sternal mesal portion with small lobe bearing 1 long bladelike seta; distimere with dorsal subapical crest of 4–5 strong spinelike spicules and a very small ventral and dorsal seta; subapical claw short and small; aedeagus of phallosome vaselike, lateral plate broad proximally, tapered distally to a point, its inner tergal surface with 1 large basal denticle followed distally by 2 rows of 4–5 strong and 4 weak denticles; proctiger crown large and dark, composed of about 10 flat and blunt spicules laterally and dense tuft of several fine, pointed spicules internally; paraproct broad, without basal sternal process; cercal sclerite broad, well sclerotized; 3–4 tiny cercal setae present.

Pupa: Abdomen 3.0–3.5 mm, paddle 0.75–0.78 mm, trumpet 0.53–0.7 mm, index about 7. Integument of cephalothorax pale yellowish or whitish except for dark area along posterior mid-dorsal ridge and middle part of metanotum; trumpet with oblique pinna; meatus narrow at extreme base, more or less cylindrical distally; abdominal terga of segments I-IV dark in middle, pale laterally; other abdominal segments entirely pale. *Cephalothorax.* Hair 8-C usually double (2–3); 9-C usually single (1–2); 10-C 3–4b; 11-C double; 12-C 3–4b. *Abdomen.* Hair 1-III-VII double or triple; 5-IV, V double or triple, 1–1.5 times as long as segment following; 5-VI single, about twice as long as segment following; 6-III-VI all single, rarely double. *Paddle.* Broad, semispherical in shape and very pale; external margin distinct except apically; midrib weak and lightly pigmented; apical hairs 1, 2-P present, minute.

Larva (fig. 1–6): Head 0.75 mm, siphon 1.7 mm, index about 5. *Head.* Antennal shaft entirely pale, with several weak spicules; head hair 1-C fine, filiform; 5, 6-C double; 7-C 7–8b. *Thorax.* Without distinct spicules; prothoracic hair 1-P single or double; 2-P single; 3-P 2, 3b; 4-P 3, 4b; 7-P 2, 3b; 8-P double. *Abdomen.* Spiculation absent; hairs 6-I, II usually triple, sometimes 4b; 6-III single and very long; 6-IV, V shorter, double; 6-VI single, as long as 6-III; 1-IV-VI single and very long, about the same magnitude as 6-III or 6-VI; about 40 comb scales, all similar in size and each with rounded apical fringe of fine spicules. *Siphon.* More or less elliptical in shape, middle part swollen, basal and distal parts narrowed; basal 0.4 with a close-set row of 10–12 pecten teeth; siphonal hairs 10 in number, all weak, 4–6b each, irregularly paired, inserted more or less laterally. *Anal segment.* Ventral brush with 5 pairs of hairs (total 10); anal papillae tubular, with blunt apices, slightly longer than saddle.


1.0 mm
MP
1
2
S
VII
VIII
X
A
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3
PT
4
CS
5
P
M
T
6
phallosome
7
distimere
0.1 mm
subapical lobe
basimere
8
proctiger
9
IX-T
10

ceramensis

Type Data: Holotype: male (110) with slide of terminalia (SEAMP 72/855); allotype: female (110–03) with associated pupal and larval skins, decayed sago trunk lying on the ground, Piru, *Ceram, Maluku* Province, INDONESIA, 10 March 1972, T. Kurihara; deposited in USNM. Paratypes: 1 male (110) with terminalia slide (SEAMP 72/856); 2 females (110); 4 pupal skins; 4 larvae, 1 larval skin, all in collection No. 110, deposited in SEAMP; 3 males (110–06, 07, 08) with associated pupal and larval skins and terminalia slides; 1 female (110–04), 3 females (110), same data as holotype, deposited in Dept. Entomology, National Science Museum, Tokyo, Japan.

Distribution: Material examined: 6 males, 7 females, 4 pupae, 5 larvae; 4 individual larval rearings, 9 from mass rearing. Known only from Piru and Hatnulu, Ceram, Maluku Province, INDONESIA.

Taxonomic Discussion: *Culex ceramensis* is most closely related to *C. papuensis* (Taylor), which is dominant and widely distributed in the Oriental region (Delfinado 1966, Bram 1967), in the Papuan part of the Australasian region (King and Hoogstraal 1946), and in the South Pacific (Belkin 1962), and to *C. pallidothorax* Theobald from the Oriental region (Delfinado 1966, Bram 1967). Adults of *ceramensis* are exceedingly similar to *papuensis* in lacking basal transverse pale bands on the abdominal terga, and, as in the latter species, *ceramensis* can be readily separated from *pallidothorax* by this negative feature. In external sexual characters of the male, *ceramensis* is distinguished from *papuensis* by the fewer transparent lanceolate scales in the distal ½ of palpal segment 3 and by the fewer bristles on palpal segments 4 and 5. The male terminalia differ from *papuensis* and *pallidothorax* strikingly in the following features: (1) absence of sterno-apical spiculose lobe and reduction in number of setae on subapical lobe of basimere and, (2) absence of basal sternal process of the paraproct of the proctiger. The pupae cannot be separated with certainty. The larva resembles the other 2 forms in the shape of the siphon, but is readily separated by the following combination: (1) filiform head hair 1-C; (2) double branched head hairs 5 and 6-C; (3) prothoracic hair 4-P 3–4 branched; (4) more slender and longer siphon and presence of more pecten teeth which extend from extreme base to about 0.25 of total length and (5) ventral brush (4-X) of saddle with 5 pairs of hairs.

This species, with *papuensis* (Taylor), *pallidothorax* Theobald, and

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Fig. 1–10, *Culex* (*Culiciomyia*) *ceramensis* n. sp. Larva: 1, mental plate (MP); 2, terminal segments; 3, head; 4, pecten tooth (PT); 5, comb scales (CS); 6, thorax. Male terminalia: 7, phallosome; 8, basimere and distimere; 9, proctiger; 10, lobes of ninth tergum.

barrinus Bram (1967), apparently falls into a distinct complex of closely related forms within the subgenus *Culiciomyia*.

Biology: The adults of *C. ceramensis* were obtained from individual and mass rearings from several larvae and pupae collected from a decayed sago trunk lying on the ground. On another occasion, immatures were collected from a hole in the ground in association with specimens of *C.* (*Lutzia*) *halifaxii* Theobald. The biology of the adults is unknown.

Acknowledgments

We are indebted to Dr. Botha de Meillon, Principal Investigator of the Southeast Asia Mosquito Project for help in the preparation of the manuscript. We also express our thanks to Miss Thelma Ford, artist at the Southeast Asia Mosquito Project, for preparing the illustrations.

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A NEW SPECIES OF AEDES (STEGOMYIA) FROM THAILAND AND NOTES ON THE MEDIOPUNCTATUS SUBGROUP

(Diptera: Culicidae)[1]

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ABSTRACT—The male, larva and pupa of *Aedes* (*Stegomyia*) **malikuli** n. sp., from Thailand are described and illustrated. Notes on the *mediopunctatus* subgroup are given.

Recently, two closely related species of the *Aedes* (*Stegomyia*) *mediopunctatus* subgroup were received from Thailand. One is here described as a new species and the other is *perplexus* (Leicester).

[1] This work was supported by Research Contract No. DA-49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D.C.

Both species were collected as larvae in the same tree hole from Chiang Mai area. Unfortunately, they are extremely similar and appear to be inseparable in all stages except male terminalia which are strikingly different.

It is considered desirable to describe the new species at the earliest opportunity, and point out once again that closely similar *Stegomyia* species are not infrequently found in the same larval habitat, such as in the same tree hole.

The following notes on the *mediopunctatus* subgroup demonstrate the necessity to confirm identifications by examination of male terminalia, particular care being taken to study the claspette of the basimere. Gaps in our knowledge of this subgroup and the need for material from the entire Oriental region, particularly material from Peradeniya, Ceylon, the type locality of *mediopunctatus* (Theobald), are obvious.

Aedes (*Stegomyia*) *malikuli*, n. sp.

figs. 1, 2

This species is named for Mr. Vichai Malikul, Scientific Illustrator in the Southeast Asia Mosquito Project, in appreciation of his help in making the drawings for my continued studies on the *Stegomyia* mosquitoes.

MALE. *Head.* Proboscis dark scaled, sometimes with a white patch at base and a few pale scales on ventral side, as long as fore femur; palpus dark, slightly longer than proboscis, with white basal band on each of segments 2–5; those on segments 4, 5 incomplete dorsally; segments 4, 5 subequal, slender, upturned, and with only a few short hairs; antenna plumose, shorter than proboscis; clypeus bare; torus covered with white scales except on dorsal side; decumbent scales of vertex all broad and flat; erect forked scales dark, not numerous, restricted to occiput; vertex with a broad median stripe of broad white scales, with broad dark ones on each side interrupted by a lateral stripe of broad white scales followed by a patch of similar scales ventrally. *Thorax.* Scutum with narrow dark scales and a broad median longitudinal stripe of similar white ones which reaches from anterior margin, tapers posteriorly and forks at beginning of prescutellar space; prescutellar space surrounded by white narrow scales; a patch of broad white scales on the lateral margin just before the level of the wing root, extending forward over the paratergite and the mesothoracic spiracle toward scutal angle and backward over the wing root toward scutellum; acrostichal and dorsocentral bristles absent; scutellum with broad white scales on mid lobe and broad dark scales on side lobe, sometimes side lobe with few pale broad scales as well; anterior pronotum with broad white scales; posterior prontum with broad white scales and a few dark ones dorsally; paratergite with broad white scales; patches of broad white scales on propleuron, on the subspiracular and postspiracular areas, on the upper and lower portions of sternopleuron and on the mesepimeron; lower mesepimeron without bristles; metameron bare. *Wing.* With dark scales on all veins, sometimes with a minute basal spot of white scales on the costa; first forked cell twice as long as its stem. *Halter.* With dark scales. *Legs.* Coxae with patches of white scales; knee-spot absent on fore femur, present on mid and hind femora;

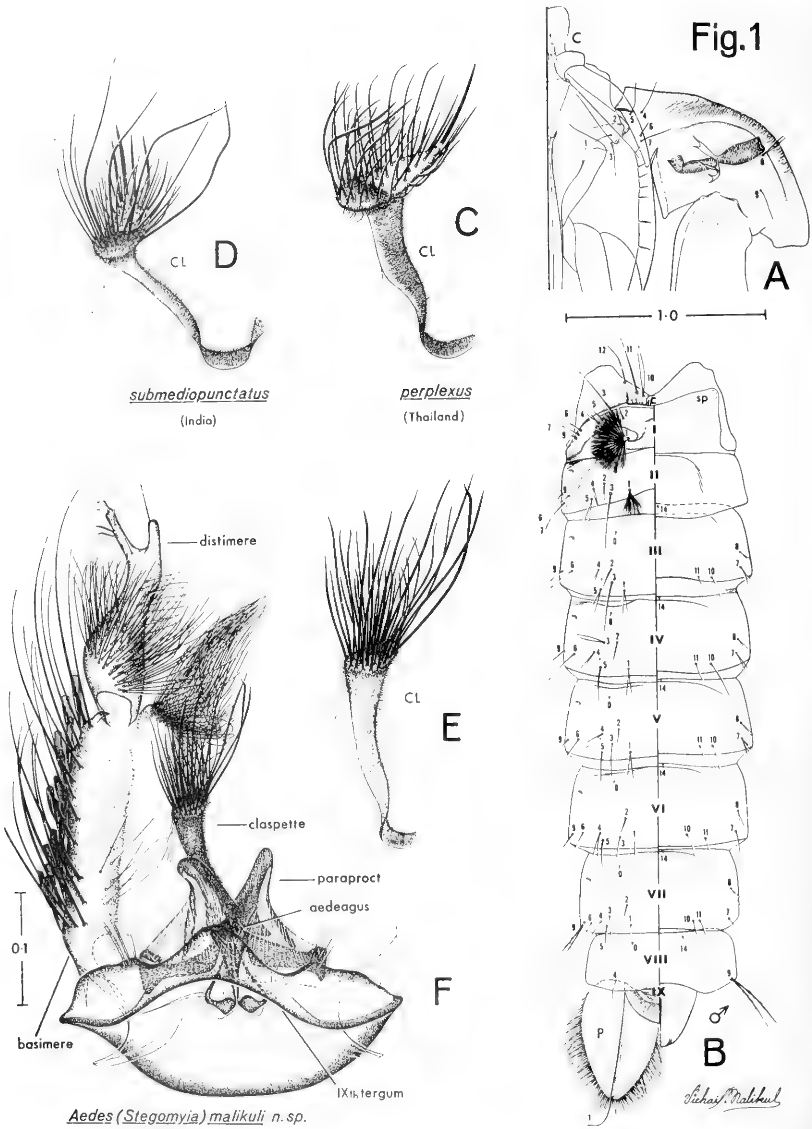

Fig. 1. A, B and F, *Aedes* (*Stegomyia*) *malikuli*, n. sp.: A, B, dorsoventral aspect of the male pupa; F, tergal aspect of the male terminalia. C-E, tergal aspects of the claspette: C, *A.* (*S.*) *perplexus* (Leicester); D, *A.* (*S.*) *submediopunctatus* (Theobald); E, *A.* (*S.*) *malikuli*, n. sp.

fore and mid femora anteriorly dark; hind femur anteriorly with basal ⅔ white, a complete dark band present which separates the basal white stripe from the apical white scale patch, sometimes the dark band not complete on the lower portion of anterior surface; all tibiae anteriorly dark; hind tibia with white stripe on basal-ventral ¼; fore tarsus with basal white band on tarsomere 1; mid tarsus with basal white bands on tarsomeres 1, 2; hind tarsus with basal white bands on tarsomeres 1, 2; tarsomere 3 all dark; tarsomere 4 all white, sometimes dark at tip; tarsomere 5 all dark, sometimes with a few white scales on basal area, or sometimes with basal ½ white; fore and mid legs with tarsal claws unequal, all toothed; hind leg with tarsal claws equal, simple. *Abdomen.* Abdominal segment I with white scales on laterotergite; terga II-VI with large basal lateral white spots; tergum II with or without a small basal median white spot; terga III-VI each with a basal white band which is not connected with the lateral spots. *Terminalia.* Basimere short and broad, about twice as long as wide; its scales restricted to lateral and ventral areas; with numerous long setae on apicomesal area; with a patch of hairs (3–10) on basomesal area of dorsal surface; claspette simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side; distimere complex, expanded at base and forked apically, with hairs and spiniform process; aedeagus with a distinct sclerotized lateral toothed plate on each side; paraproct without ventral arms; cercal setae absent; tergum IX with middle part produced into a large rounded lobe and with a small hairy lobe on each side.

FEMALE. Unknown.

PUPA. *Cephalothorax.* Trumpet short, about 2.5 times as long as wide at the middle; hair 1, 3-C single, slightly longer than 2-C; 2-C single; 4, 5-C single; 6-C single, shorter than 7-C; 7-C single; 10-C 2-branched, mesad and caudad of 11-C; 11-C single, stout. *Abdomen.* Hair 1-I well developed, with more than 10 branches, dendritic; 2-I single; 3-I single, long; 2, 3-I not widely separated, distance between them as distance between 4, 5-I; hair 1-II with many branches, dendritic; hair 2-II laterad of hair 3-II; hair 2-IV, V laterad of hair 1-IV, V; hair 1-III usually with 2 branches (2–4); hair 1-IV usually double (2–3); 3-II, III single, shorter than segment III; 5-IV-VI single, or sometimes 5-IV, V with 2 branches, short, not reaching beyond posterior margin of following segment; hair 9-I-VI small, single, simple; 9-VII 2-branched, barbed; 9-VIII with 2 branches and barbed, reaching beyond fringe of paddle. *Paddle.* Margins with fringe; hair 1-P single.

LARVA. *Head.* Antenna 0.5 length of head, without spicules; 1-A inserted near middle of shaft, single, small, spine-like; inner mouth brushes pectinate at tip; head hair 4-C well developed, with 5–7 branches, closer to 6-C than 5-C, cephalad and mesad of 6-C; 5-C single, long; 6-C double; 7-C with 2 branches; 8, 10 and 13-C single; 9-C with 2 branches; 11-C 3-branched; 12-C with 3–4 branches; 14-C double; 15-C usually double (2–3); mentum with 10–11 teeth on each side. *Thorax.* Hair 1-P usually 3-branched (2–3); 2-P single; 3-P double; 4-P single; 5, 7-P usually double (1–2); 6-P single; 9-P single; 11-P single; 5, 7-M single; 6-M 2-branched; 8-M with 2–3 branches; 9-M single, long, stout and barbed; 10, 12-M single, long, more slender than 9-M, barbed; 11-M single; 7-T with 2–3 branches; 9, 10 and 11-T similar to those on mesothorax; 12-T much reduced; basal spine of meso- and metapleural hairs long, straight and pointed at tip. *Abdomen.* Hair 6-I, II 2-branched; 7-I single; 7-II 2-branched;

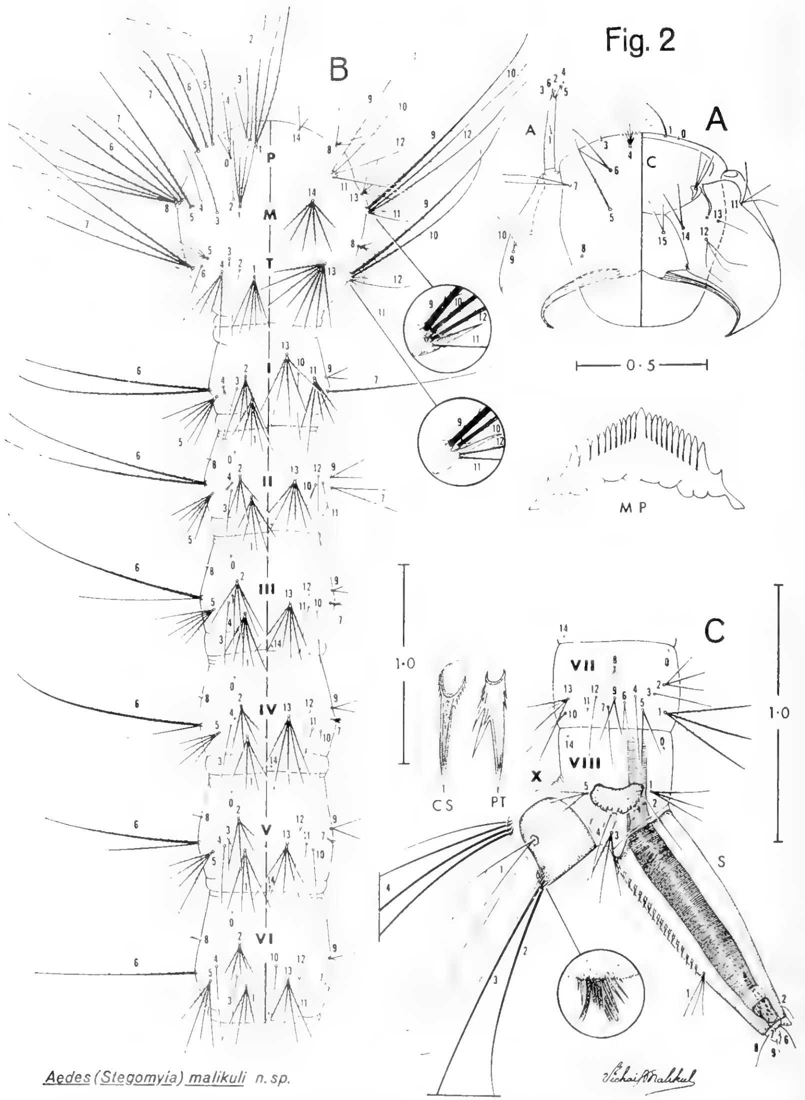

Fig. 2. *Aedes* (*Stegomyia*) *malikuli* n. sp. fourth instar larva: A, dorsoventral aspect of the head; B, dorsoventral aspect of the thorax and abdomen; C, lateral aspect of the terminal abdominal segments.

6-III-V 2-branched, one more slender than the other; 7-III with 4–5 branches; 6-VI single; 1-VII usually with 3 branches, barbed; 2-VII 3-branched; comb of 5 scales in a row, arising from a sclerotized plate, each scale with fine denticles at the base of the apical spine; pentad hair 2-VIII distant from 1-VIII; 1, 5-VIII

3-branched; 3-VIII with 3–4 branches; 2, 4-VIII single; siphon about 3 times as long as wide, acus absent; pecten teeth 10–18 in number, evenly spaced, each tooth with 3–5 basal denticles; 1-S with 2–3 branches, inserted beyond last tooth and in line with the teeth; saddle incomplete; marginal spicules long and conspicuous; 1-X 2-branched; 2-X single; 3-X single; ventral brush with 4 pairs of hairs on grid, each hair single; no precratal tufts; anal papillae about 3 times as long as saddle, sausage-like.

TYPE DATA. Holotype male (04482–10) with associated larval and pupal skins and terminalia slide (73/103), Huai Phrao, *Chiang Mai*, THAILAND, collected as a larva in a small tree hole, partially shaded, in a secondary deciduous forest in the mountains, altitude 1290 ft., VII-10-1970 (Chaliou & Anun). Deposited in the U.S. National Museum. Paratypes: 7 males as follows: 1 male (04482–14) with associated larval and pupal skins and terminalia slide (73/105), with same data as holotype; 1 male (00136–22) with associated larval and pupal skins and terminalia slide (68/161), Huai Mae Nam Noi, *Kanchanaburi*, THAILAND, collected as a larva in a bamboo internode, on ground, heavily shaded, in a bamboo grove in the mountains, altitude 350 ft., V-25-1965 (Peyton); 2 males (00314–102, 103) with associated pupal skins and terminalia slides (68/1013, 68/433), Doi Sam Sao, *Tak*, THAILAND, collected as pupae in a bamboo internode, 3 ft. above ground level, in a primary rain forest in the mountains, altitude 1500 ft., VIII-1-1965 (Somboon); 1 male (00315–102) with associated pupal skin and terminalia slide (68/432), Khao Salak Phra, *Tak*, THAILAND, collected as a pupa in a bamboo stump, 6 ft. above ground level, partially shaded, near the stream, in a primary rain forest in the mountains, altitude 1500 ft., VIII-1-1965 (Somboon); 2 males (00320–2, 100) with associated larval and pupal skins and terminalia slides (68/434, 68/485), Doi Sam Sao, *Tak*, THAILAND, collected as a larva or pupa in a small stream pool, with abundant dead leaves, partially shaded, in a primary rain forest in the mountains, altitude 2400 ft., VIII-2-1965 (Kol). Deposited in the U.S. National Museum and British Museum.

DISTRIBUTION. 30 specimens examined: 9♂, 9♂ terminalia, 8 individual rearings (4 l, 8 p).

THAILAND. *Chiang Mai*: Huai Phrao (VII-1970, Chaliou & Anun), 2♂, 2♂ terminalia, 2 individual rearings (2 l, 2 p); *Kanchanaburi*: Huai Mae Nam Noi (V-1965, Peyton), 1♂, 1♂ terminalia, 1 individual rearing (1 l, 1 p); *Tak*: Doi Sam Sao (VIII-1965, Somboon), 2♂, 2♂ terminalia, 2 individual rearings (2 p); (VIII-1965, Kol), 2♂, 2♂ terminalia, 2 individual rearings (1 l, 2 p); Khao Salak Phra (VIII-1965, Somboon), 1♂, 1♂ terminalia, 1 individual rearing (1 p).

TAIWAN. *Taichung*: Sun Moon Lake (VI-1-1948), 1♂, 1♂ terminalia.

TAXONOMIC DISCUSSION. *Aedes* (*Stegomyia*) *malikuli* n. sp., a member of the *mediopunctatus* subgroup, is extremely similar to other members of the subgroup. However, the male terminalia of *malikuli*, having the claspette of the basimere simple with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side, are different from all other species that have been described.

Based on the present collection data *malikuli* is a mountain species extremely similar to *perplexus* (Leicester) which is widespread in Thailand. Both species have been collected as larvae in the same tree hole from Chiang Mai area. At present, I am unable to find any reliable characters to separate them in all stages except male terminalia. It is hoped that more material will be available to us and that further reliable diagnostic characters might be found.

BIOLOGY. The immature stages of *malikuli* were collected in bamboo internodes, in a bamboo stump, in a tree hole and in a stream pool in Thailand. The larvae from Chiang Mai were associated with other members of the *w-albus* group (*mediopunctatus* subgroup and *annandalei* subgroup).

Notes on the *mediopunctatus* Subgroup

Aedes (*Stegomyia*) *mediopunctatus* (Theobald) was originally assigned to Group C (*scutellaris* group) by Edwards (1932). Knight & Hurlbut (1949) subdivided the *scutellaris* group into 3 subgroups known as Subgroup 1 (*scutellaris* s. str.), Subgroup II (*albopictus*), and Subgroup III (*mediopunctatus*). Mattingly (1965) transferred *mediopunctatus* from Group C to Group B (*w-albus* group). Based on the rather strikingly differentiated characters the *mediopunctatus* subgroup can easily be separated from all the members of the *scutellaris* and *albopictus* subgroups in all stages. Therefore it should be recognized as a distinct subgroup and placed under a different group. I am following Mattingly (1965) in considering *mediopunctatus* as belonging to the *w-albus* group.

The *mediopunctatus* subgroup can be distinguished from other *Stegomyia* by the following combination of characters: palpi with white scales; scutum with the median longitudinal white stripe broader than usual, extending from anterior margin, tapering posteriorly and forking at the beginning of prescutellar space; hind tarsus with tarsomere 3 all dark.

Members of the *mediopunctatus* subgroup are extremely variable and difficult to separate in all stages except for the male terminalia. At present, three distinct forms of the claspette are found: (1) *perplexus* form, (2) *submediopunctatus* form; and (3) *malikuli* form. Thus, at least three species are recognizable within this subgroup and all are found within the Southeast Asia area. The diagnostic characters and known distribution (based on the specimens which have been examined by me) of the species of the *mediopunctatus* subgroup are summarized below.

SPECIES	MALE DIAGONSTIC CHARACTERS	DISTRIBUTION
mediopunctatus (Theobald) 1905	Male unknown.	Ceylon (Peradeniya) type locality only.
perplexus (Leicester) 1908	Claspette bilobed with setae on sternal portion shorter and flattened, one of them stouter than the rest.	West Malaysia, Thailand.
submediopunctatus (Barraud) 1923	Claspette as *perplexus* form except tergal portion with several distinctly long and stout setae.	India, Philippines.
malikuli n. sp.	Claspette simple, with numerous long setae on the slightly expanded distal part and with few shorter ones on sternal side.	Thailand, Taiwan.

Theobald (1905) described *mediopunctatus* species from a single female from Peradeniya, Ceylon. Thus, the true identity of this species cannot be ascertained until a topotype male becomes available.

The Indian specimens previously described as *mediopunctatus* (Theobald), *mediopunctatus* var. *submediopunctatus* (Barraud) and *mediopunctatus* var. *sureilensis* Barraud by Barraud (1923, 1934) as well as the Philippine specimens previously described as *mediopunctatus* var. *perplexus* (Leicester) by Knight & Hull (1952) are all *submediopunctatus*. However, when the topotypic male of *mediopunctatus* from Ceylon becomes available, it may well prove that *submediopunctatus* is a synonym. The discontinuous distribution of this species is rather unusual. Specimens of this subgroup from parts of Southeast Asia such as China (S. of Yangtze Kiang), Hong Kong, Hainan, Viet Nam, Laos, Cambodia and Burma, which are totally lacking in all collections, may help to answer the question if they become available.

Stegomyia perplexus was originally described by Leicester (1908: 83) as a distinct species from Kuala Lumpur, Malaya. Barraud (1934: 231) considered it to be a variety of *mediopunctatus* (Theobald) in having the 4th and 5th hind tarsal segments entirely white and

Mattingly (1965:46) treated as a subspecies. It is here elevated back to full species rank.

It is now difficult to say what Lien's (1962) record of *mediopunctatus* var. *perplexus* (Leicester) represents. My only Taiwan male specimen (from the Bishop Museum) of the subgroup is *malikuli* n. sp. It is possible that either *submediopunctatus* or *perplexus* is also present in Taiwan. However, no conclusion can be made without examination of Taiwan specimens which are not available to us.

Acknowledgments

I am grateful to Dr. Botha de Meillon, Principal Investigator, Southeast Asia Mosquito Project (SEAMP), for the helpful assistance in connection with this paper and for critical review of the manuscript. I also extend my thanks to Mr. Vichai Malikul of SEAMP for his help in making the drawings.

I also wish to express my gratitude to Dr. P. F. Mattingly, Department of Entomology, British Museum (Natural History), London, for several types and other material in the British Museum; to Dr. W. A. Steffan, Department of Entomology, Bishop Museum, Honolulu, Hawaii, for the Taiwan specimen. The receipt of Thailand material from Dr. D. J. Gould and his staff of the SEATO Medical Research Laboratory, Bangkok; the Malayan and Indian material from Dr. S. Ramalingam and his staff, Department of Parasitology, the University of Malaya, Kuala Lumpur, and the Philippine material from U.S. National Museum is acknowledged with sincere appreciation.

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BIOLOGY AND IMMATURE STAGES OF DESMOPACHRIA CONVEXA (AUBÉ) (COLEOPTERA: DYTISCIDAE)

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ABSTRACT—In central New York, larvae and adults of *Desmopachria convexa* are found in habitats supporting dense growths of aquatic vegetation. Eggs are deposited externally on aquatic plants and probably onto bottom sediments. The incubation period lasts 4–5 days. Larvae fed exclusively on ostracods in the laboratory and refused small larvae of Chironomidae late in the third stadium. Larval development requires 13–20 days, including a prepupal period of about 1 day. Pupation occurred in imperfectly constructed earthen cells. The pupal period lasts 3–4 days, and the entire life cycle can be completed in 20–29 days under laboratory conditions (21–25 C). The egg, 3 larval instars and pupa are described and illustrated.

At least 8 species of *Desmopachria* occur in the United States (Young, 1951; 1955). This genus is best represented in the United States in the southwest and southeast, and apparently *Desmopachria convexa* (Aubé) is the only species occurring in the midwest and northeast. Blatchley (1910) stated that it is eastern in distribution, and the range given for it by Young (1951) is Canada and New York to Indiana. Specimens of this species from Michigan, Maine, Massachusetts, New Jersey, and Maryland have been examined in this study.

No information is available on the immature stages of species in the genus *Desmopachria*. This study of *D. convexa* includes life cycle data, observations on larval feeding habits, and descriptions of the egg, 3 larval instars, and pupa.

LIFE HISTORY

Biological observations are based on adults and larvae collected at the Lloyd-Cornell Ringwood Wildlife Preserve, on County Road 164 (Ringwood Road) 3.2 km northeast of Ellis Hollow, Dryden, Tompkins Co., New York. Specific collection sites were Ringwood Pond and Overflow Swamp. The pond, a kettle hole located on the northwest side of Ringwood Road, contains water throughout the year. Dominant vegetation is duckweed (*Lemna minor* L.) and watermeal (*Wolffia columbiana* Karst.) with some cattail (*Typha latifolia* L.). The swamp is located southwest of the pond and has a depth of 0.7 to 1.0 m in the spring, but it consists of a few pools covered with duckweed and watermeal during the summer. Both areas characteristically have dense growths of filamentous algae and large amounts of detrital material. Conditions at other localities where adults of this species are found in abundance are similar to those in the pond and swamp at Ringwood.

Adults and larvae of *Laccophilus maculosus* Say, *L. biguttatus* Kirby, and *Hydrotus sayi* J. Balfour-Brown were frequently collected along with *D. convexa* at both sites. Larvae of an undetermined species of *Agabus* were also taken. Adults of *Hygrotus laccophilinus* LeConte, *Agabus erichsoni* Gemminger and Harold, and *Acilius semisulcatus* Aubé were collected occasionally at both Ringwood sites.

Adults observed in the laboratory were relatively inactive, usually resting among gravel and bits of plants. Beetles were seen swimming slowly near the bottom with frequent pauses. A limited amount of feeding on ostracods and a commercial fish food was observed. It was possible to maintain adults in the laboratory for only 6 to 7 days.

Eggs were obtained from a group of 12 adults within 48 hr after they were collected on 13 June 1971. The eggs, encased in a gelatinous matrix, were attached to the stems of *Elodea canadensis* and to the bottom and sites of breeding containers. Most of the 15 eggs collected were located on the bottom and sides of the containers. Torn gelatinous matrices, some of which appeared to have bits of egg still in them when they were examined under the microscope, indicated that a number of eggs had been consumed. The incubation period for the 15 eggs was 4 to 5 days.

The numbers of eggs obtained were less than expected. Data presented by Korschelt (1924) indicate that oviposition of an individual *Dytiscus* extends over a period ranging from several days to several weeks. It is possible that females were exposed to adverse environmental conditions in the laboratory, causing premature cessation of egg production and resulting in deposition of only small numbers of eggs. Failure to obtain oviposition after beetles were held in the laboratory for more than a week, even when the holding period coincided with initiation of reproduction in field populations indicates that laboratory conditions were unsuitable for successful production of eggs. It is also possible that females produced few eggs because they were collected near the end of their oviposition period.

Larvae collected at Ringwood on 28 July 1969 exhibited behavior similar to that of those hatched in the laboratory. The larvae were sedentary for most of the time and remained in the corners of the rearing containers or among the bits of *Elodea*. They were capable of crawling with great rapidity when disturbed but were seldom seen swimming. The larvae were fed entirely on ostracods from hatching to the beginning of the prepupal period. Small chironomids added near the end of the last stadium were not consumed, but the larvae were near maturity and may have ceased feeding.

The larval stadia were: first stadium, range 3 to 4 days (average 3.6 days); second stadium, range 3 to 5 days (average 4.1 days); third stadium, range 7 to 11 days (average 8.7 days). Increased activity indicated that the third-instar larvae were ready to leave the water in preparation for pupation. The larvae appeared to have some difficulty in constructing pupation cells from soil provided, and none of the cells seemed to be complete at pupation. The cell construction was carried out on or very near the soil surface in the vicinity of some irregularity on the surface. A period of about 1 day passed between removal from the water and pupation, and the pupal stage ranged from 3 to 4 days (average 3.6 days).

Descriptions of Immature Stages

Egg: Yellowish-white, minutely reticulate, nearly perfectly spherical; diameter 0.32 to 0.35 mm ($\bar{x} = 0.33$ mm). Enclosed in gelantinous matrix approximately equal in depth to egg radius. (based on 12 specimens)

First-instar larva: Length 1.28 to 1.35 mm ($\bar{x} = 1.31$ mm). Body spindle-shaped to gibbous; narrowed anteriorly and more strongly posteriorly. Sclerotized areas dark brown, with regions on midline and near epicranial suture lighter brown.

Head pear-shaped in dorsal view, widest posterior to ocular region. Length 0.32 to 0.35 mm ($\bar{x} = 0.33$ mm), width 0.20 to 0.24 mm ($\bar{x} = 0.22$ mm). Occipital suture and temporal spines absent. Stem of epicranial suture distinct; suture forked anteriorly with arms divergent basally, converging and then extending outward as feeble lines almost to bases of antennae. Fronto-clypeus prolonged into a long, bluntly rounded nasale extending well beyond bases of antennae; ventro-anterior margin with clavate setae. Nasale about ½ length of head, without notches but with 5 toothlike spines on ventro-lateral margin. Ocelli in two parallel rows of 3 ocelli each. Antennae 4-segmented, about ½ as long as head; segment I about ½ as long as II; II and III subequal; segment IV bifurcate, less than ½ length of penultimate segment. Mandibles falcate. Maxillary palp 3-segmented: first 2 segments subequal; terminal segment ⅙ length of second segment; stipes short and only little wider than palp. Labium long and narrow, more than twice as long as wide; bases of 2-segmented palps approximate; segments subequal in length, terminal segment slightly club shaped.

Pronotum widest about ⅔ distance from anterior margin, with long, hairlike setae generally confined to anterior and lateral margins. Mesonotum about ½ as long as pronotum but slightly wider, with 3 hairlike setae on lateral margins and remaining setae shorter and irregularly distributed. Metanotum wider than mesonotum but subequal to it in length, with long setae confined to lateral and posterior margins. No spiracles on mesothorax.

Legs slender, coxae shorter than femora. Profemur about 2 times as long as protibia; femora of remaining appendages less than twice as long as tibiae. Protarsus and protibia subequal; tarsi on remaining segments little less than 1½ times as long as remaining tibiae. Natatory hairs absent.

Abdominal segment 8 completely sclerotized; segments 6 and 7 incompletely sclerotized but with dorsal and ventral plates; other segments with dorsal plates only. Segments 1 to 6 shorter than mesonotum, segment 7 about as long as mesonotum; eighth segment 3 times as long as mesonotum, with long, acute siphon. Segment 8 with strong setae on siphon; segments 1 to 7 with 4 strong setae and 4 to 6 long, hairlike setae on posterior margins dorsally. Ventral plates on segments 6 and 7 with 4 to 6 strong setae on posterior margins. No spiracles on abdominal segments. Cerci 2-segmented: first segment stout, extending beyond apex of siphon with primary setae only; second segment long and hairlike. (based on 10 specimens)

Second-instar larva: Length, 1.82 to 2.18 mm ($\bar{x} = 1.98$ mm). Pigmentation and general form similar to first-instar larva.

Head pear-shaped in dorsal view, widest posterior to ocular regions. Length, 0.41 to 0.44 mm ($\bar{x} = 0.43$ mm); width 0.31 to 0.33 mm ($\bar{x} = 0.32$ mm). Epicranial suture distinct, arms convergent and then divergent. Nasale well formed, without notches but with distinct toothlike spines. Single temporal spine at each apex of well developed occipital suture. Ocelli in two parallel rows of 3 ocelli each. Antennae 4-segmented, about ½ as long as head; segment I about ½ as long as II; II and III subequal; segment IV bifurcate, less than ½ length of penultimate segment. Mandibles falcate. Maxillary palp 3-segmented: first 2 segments subequal; terminal segment ⅙ length of second segment; stipes short and only little wider than palp. Labium long and narrow, more than twice as long as wide; bases of 2-segmented palps approximate; segments subequal in length, terminal segment slightly club shaped.

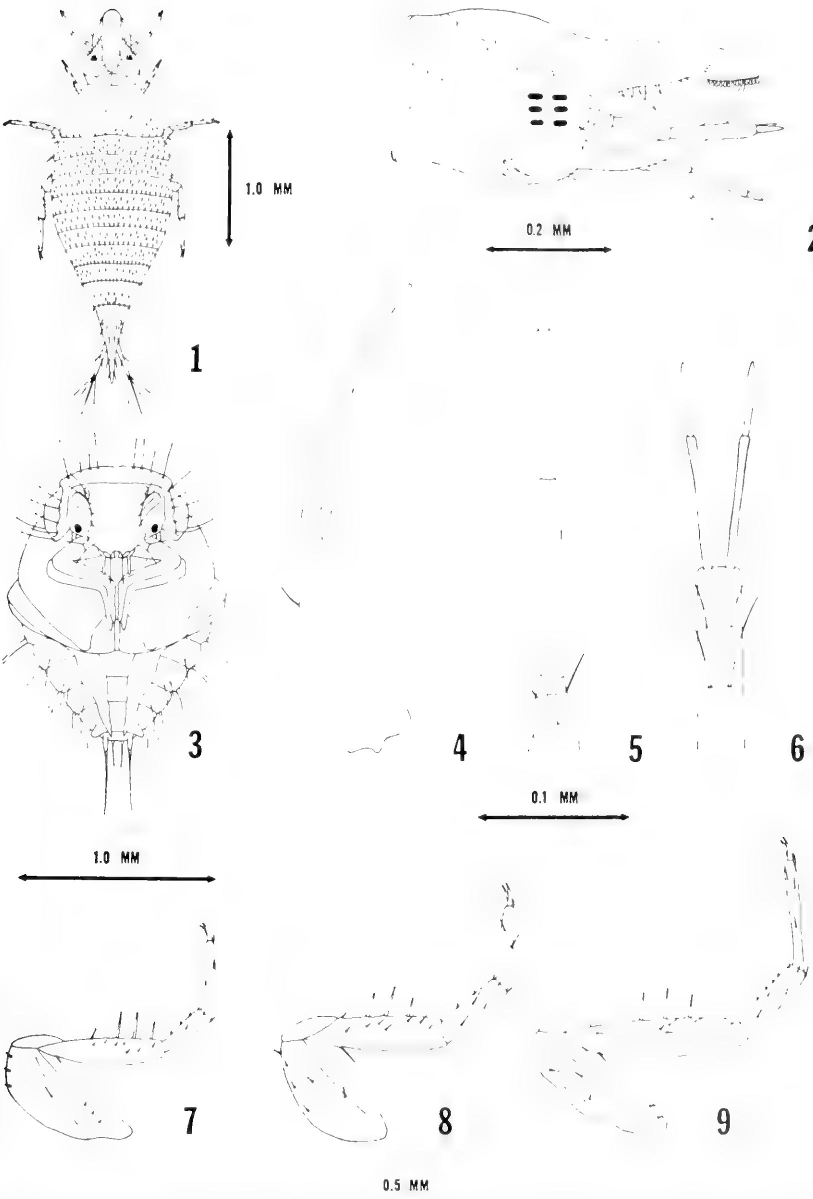
Proportions of thoracic segments as in first-instar larva. Long hairlike setae on posterior as well as anterior and lateral margins of prothorax. Meso- and metanotum with long setae on each lateral margin and on posterior margins. Mesothorax without spiracles.

Legs slender, coxae less than ⅓ length of femora. Femora longer than tibiae on all segments; tibiae and tarsi about equal on pro- and mesothorax, tarsus longer than tibia on metathorax. Legs without natatory hairs.

Abdominal segment 8 completely sclerotized, terminating in long acute siphon; segment 7 with separate but approximate dorsal and ventral plates. Segments 5 and 6 with well sclerotized ventral plates; ventral plates of segments 3 and 4 distinctly but less heavily sclerotized than posterior segments; remaining segments with dorsal plates only. Dorsum of abdominal segments 1 to 7 with row of strong setae, half as long as segment, on posterior margins; single strong setae on each lateral margin. Segment 8 irregularly setose, including siphon. No spiracles on abdominal segments 1 to 7. Cerci 2-segmented; first segment stout, extending beyond apex of siphon and bearing primary setae; second segment long and hairlike. (based on 5 specimens)

Third-instar larva: Length 2.99 to 3.68 mm ($\bar{x} = 3.29$ mm). Body spindle-shaped to gibbous; narrowed anteriorly and more strongly posteriorly (fig. 1). Sclerotized areas reddish brown, with regions on midline and near epicranial suture lighter brown.

Head pear-shaped in dorsal view, widest posterior to ocular region. Length 0.55 to 0.58 mm ($\bar{x} = 0.57$ mm); width 0.41 to 0.44 mm ($\bar{x} = 0.42$ mm). Cervical region lacking. Stem or epicranial suture distinct; arms convergent and then divergent. Occipital suture and temporal spines present; 1 strong spine with 5 to



Figs. 1–9. *Desmopachria convexa* (Aubé): 1, mature larva, dorsal; 2, head of mature larva, lateral; 3, pupa, ventral; 4, right mandible of mature larva, ventral; 5, left maxilla of mature larva, ventral; 6, labium of mature larva, dorsal; 7, right proleg of mature larva; 8, right mesothoracic leg of mature larva; 9, right metathoracic leg of mature larva.

6 weak spines at apices of occipital suture. Fronto-clypeus prolonged into long, bluntly rounded nasale extending well beyond bases of antennae; ventro-anterior margin with clavate setae. Nasale without notches and little less than ½ as long as head. Each ventro-lateral margin of nasale with 7 toothlike spines posterior to clavate setae, as follows: 2 small spines near apex followed by stronger one; fourth spine very stout, flanked medially by longer, more slender ones; series terminating in 2 strong spines (fig. 2). Ocelli in two parallel rows of three ocelli each. Antennae 4-segmented, more than half as long as head, segment I half as long as II, II shorter than III, IV bifurcate, less than half as long as III. Mandible slender, falciform, with hairlike seta ⅓ distance from base (fig. 4). Stipes of maxillary palp short, armed with hairlike setae, little wider than palp; palp 3-segmented, with ratio of relative length (proximal to distal) approximately 4:3:1 (fig. 5). Labium long and narrow, greater than 2 times as wide as long; 2 short setae near base on ventral side, and 4 long setae on dorsal surface (fig. 6).

Pronotum widest posteriorly, narrower than but about twice as long as mesonotum. Metanotum wider than mesonotum but subequal to it in length. Pronotum setose laterally, posteriorly, and discally; meso- and metanotum irregularly setose. Spiracle present in pleural region near each antero-lateral corner of mesonotum.

Legs with coxae long and stout, as long as or longer than femora. Femora longer than tibiae and tarsi longer than tibiae on all segments. Natatory hairs absent (figs. 7, 8, 9).

Abdominal segments 7 and 8 completely sclerotized, segment 6 incompletely sclerotized but with dorsal and ventral plates approximate. Abdominal segments 2 to 5 with strongly sclerotized dorsal and ventral plates; segment 1 membranous beneath. Segments 1 to 6 shorter than mesonotum, 7 longer than it. Segment 8 more than 3 times as long as mesonotum and tapering to acute apex; siphon more than half as long as mesonotum. Dorsal sclerites of abdominal segments 1 to 5 setose along posterior margins, with short setae irregularly distributed; setation of ventral plates similar to that of dorsal sclerites. Setal pattern of segment 7 similar to that of preceding segments; segment 8 irregularly setose, with few setae extending onto siphon. Spiracles present, in lateral margins of tergites 1 to 6 and on lateral aspects of segment 7. Cerci 2-segmented; first segment shorter than siphon, bearing primary setae only; second segment long and hairlike. (based on 8 specimens)

Pupa: Yellowish white with eyes darker; ovate and widest near junction of thorax and abdomen. Length 1.36 to 1.41 mm; width 0.95 to 1.13 mm. Head withdrawn into prothorax. Origin of antennae beneath eyes, antennae extending posteriorly beneath front legs. Femora at right to long axis of body, with tibiae reflexed against femora and tarsi meeting at midline (fig. 3).

Face with projection on each side of head originating between eye and origin of mandible, extending latero-posteriorly. Each facial projection bearing 2 long styli on each distal corner. Head with ridge between midline and each eye, extending from facial projection to near anterior margin of prothorax; ridge bearing 4 long styli.

Prothorax with 36 to 38 long styli arranged along anterior, lateral, and posterior margins, medial area without styli. Styli on remaining body segments variable in number and position. Cerci longer than eighth abdominal segment in dorsal view. (based on 3 specimens)

ACKNOWLEDGMENTS

This investigation was supported by NIH Training Grant no. TO1 ES00099 from the National Institute of Health Sciences. I am indebted to Professor Clifford O. Berg of the Department of Entomology, Cornell University and Dr. Paul J. Spangler, Smithsonian Institution, for their critical review of this manuscript.

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DOLICHOPUS RETICULUS VAN DUZEE A SYNONYM OF D. OCCIDENTALIS ALDRICH (DIPTERA: DOLICHOPODIDAE)

Dolichopus reticulus Van Duzee, 1926 (Canad. Entomol. 58:231) was described from 29 specimens taken by its author at Olney and Newport, Oregon, and 1 from Nanaimo, British Columbia, with the type (not specifically designated) cited as in the California Academy of Sciences. The species was stated to have the "first antennal joint yellow, very narrowly black on upper edge." The first couplet of keys to group I of *Dolichopus* separates 2 groups on whether the 1st antennal segment is wholly yellow or whether it is yellow below (and black above). If carried through the keys as having the 1st antennal segment wholly yellow, *D. reticulus* will agree entirely with *D. occidentalis* Aldrich, 1893 (Kans. Univ. Quart. 2:19), which is a common species in the Northwest.

Material collected by me in Oregon during the last 2 years and that in the collections of Oregon State University at Corvallis, including a number from the type localities of *D. reticulus*, indicate that a fair percentage of *D. occidentalis* show a 1st antennal segment with a narrow black stripe above. The fact that only variations of *D. occidentalis* have been taken by others than Van Duzee along the Oregon coast makes it seem obvious that *D. reticulus* should be considered a synonym of *D. occidentalis*.

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CAMPTOZYGUM AEQUALE (VILLERS), A PINE-FEEDING MIRID NEW TO NORTH AMERICA

(HEMIPTERA: MIRIDAE)

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ABSTRACT—The European mirid *Camptozygum aequale* (Villers) (formerly *pinastri* (Fallén)) is reported in North America from 11 counties in central and western Pennsylvania in 1971 and 1972. Characters are given and figures are provided for distinguishing this species from native mirids. Adults and nymphs were among the most abundant insects on Scotch pine, *Pinus sylvestris* L., seedlings and trees from June to early August. Nymphs also were collected on seedlings of Austrian pine, *P. nigra* Arnold, red pine, *P. resinosa* Ait., Mugho pine, *P. mugo* Turra, and western yellow pine, *P. ponderosa* Douglas. Overwintering occurred as eggs inserted in stems of Scotch pine seedlings; early instar nymphs were observed first in early June, adults in late June. There was a single generation in 1971 and 1972. From its distribution *C. aequale* appears to be an introduced species in North America. Since eggs are inserted in stems of Scotch pine seedlings, introduction with imported plant materials is considered likely.

In 1971 we initiated a survey of the Miridae associated with conifers in Pennsylvania. One species collected commonly on Scotch pine, *Pinus sylvestris* L., in western Pennsylvania proved impossible to run to genus in the available North American keys. The eventual identification of this species as the European *Camptozygum aequale* (Villers) (formerly *pinastri* (Fallén)) was made by Dr. Jon L. Herring, Systematic Entomology Laboratory, USDA, Washington, D. C. Subsequently, we found two additional specimens among unsorted material in the U. S. National Museum collection, both bearing the label: Chestnut Hill, Pa., VI-29-1938, J. C. Lutz. Recently, we reported this species as new to North America (Wheeler and Henry, 1973).

C. aequale was described as a *Cimex* by Villers in 1789, but was synonymized under *pinastri* Fallén 1807 by Reuter in 1888. In his "Catalog of the Miridae of the World", Carvalho (1959), with a question, placed *aequale* as a synonym of *pinastri*. Although the name *pinastri* has been used extensively in the European literature, we are following Stichel (1958) and Kerzhner (1964) by using the older name *aequale*.

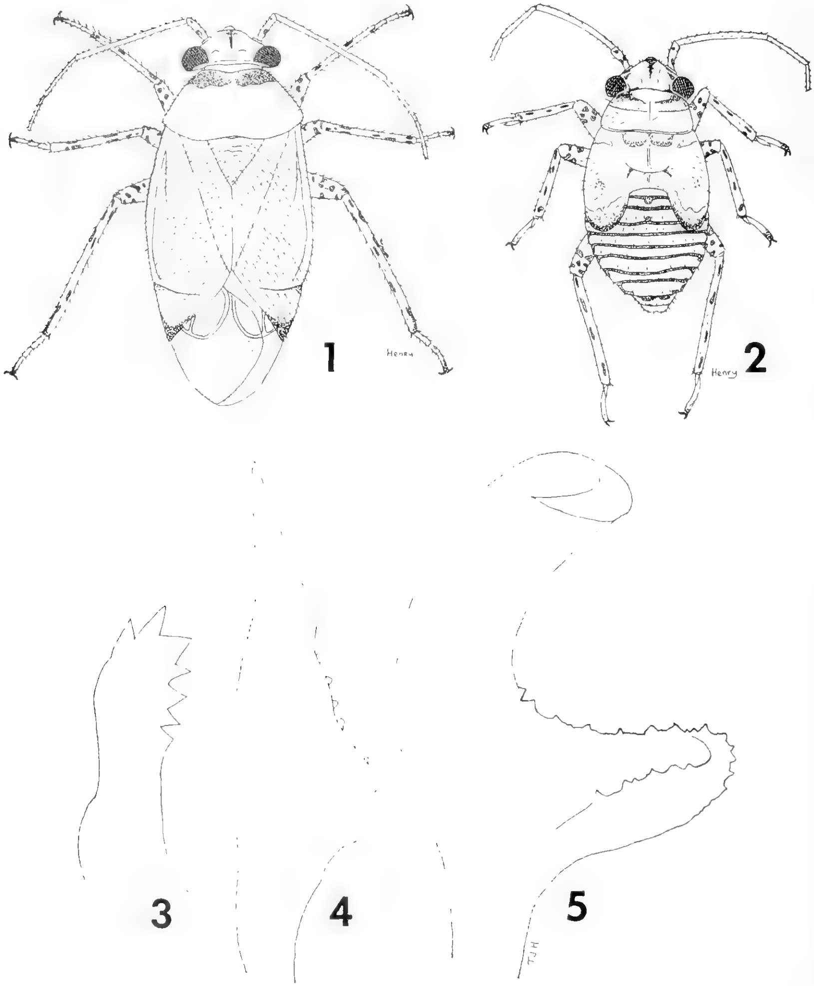
In Blatchley (1926:752) specimens of *C. aequale*, if they are said to be "distinctly punctate in front of [? posterior to] collar and between calli," will key to *Tropidosteptes*. This genus may be eliminated since it is characterized as being red and black. Since some specimens are not distinctly punctate posterior to collar, it is possible to run them to *Platylygus* or *Lygus*. *Platylygus* is disqualified because in *aequale* the upper surface is pubescent; *Lygus* because in *aequale* the rostrum surpasses the hind coxae. Specimens may be keyed in Knight (1941:136) to *Tropidosteptes* or *Neoborus*. *C. aequale* differs from *Neoborus* by having the first antennal joint thickened. Specimens may be keyed to *Camptozygum* in Carvalho and Leston (1952) and in Carvalho's (1955) key to the world genera of the Miridae.

C. aequale does not resemble any of the other mirid species associated with conifers found in Pennsylvania. It may be separated from all other mirids in our area by the following combination of characters: head smooth, shining with vertex wide, nearly ⅓ width of base of pronotum; eyes protruding well beyond lateral margin of pronotum; rostrum surpassing hind coxae; pronotum and scutellum deeply punctured, corium and cuneus less so; coloration testaceous (except for occasional specimens of the darker forms or varieties) with characteristic red markings on tylus, lorum, antennal bases, base of rostrum, propleura, and apices of femora and tibia. For Pennsylvania specimens, measurements are as follows: Adult.—length ♂, 3.8–4.2 mm; ♀, 4.0–4.6 mm; width vertex, 0.5 mm; width pronotum at base, 1.6 mm; length antennal segment I, 1.4 mm; II, 1.3 mm; III, 0.6 mm; IV, 0.5 mm. Nymph, instar V.—length, 2.5–3.4 mm.

Nearly all the Pennsylvania specimens we collected are testaceous and refer to the var. *maculicollis* Mulsant in Wagner's ([1941–56]) key to varieties or forms. Southwood and Leston (1959) note that this form is also most common in Britain, but that nearly black specimens are not uncommon in Europe. Occasionally, we have collected the var. *fieberi* Stichel and *pinastri* Fallén (Wagner's nominate form). We have taken a single black specimen which is the nominate form (= *aequalis* Villers in Wagner's key).

Hüeber (1901) gives a detailed description of the adult, while Saunders (1892, pl. 23, fig. 8) figures the adult. The last instar nymph is described by Reuter (1875) and Butler (1923); the egg by Butler (1923) and Kullenberg (1942). Male genitalia are figured by Wagner (1952) (as printed, the figures were reversed) and ([1941–56]). To facilitate recognition of *C. aequale*, we are providing figures of the adult (fig. 1), last instar nymph (fig. 2), and male genitalia (figs. 3–5).

C. aequale occurs in England, throughout Europe, and south to Algeria (Carvalho, 1959). In Europe it is found most often on Scotch pine (Kullenberg, 1944), and has been said to be possibly restricted to this pine (Reuter, 1908). Others, however, have taken specimens from spruce, larch, fir, juniper, and other pines (Reuter, 1908; Butler, 1923; Kullenberg, 1944). Kaltenbach (1874) listed this mirid (cited as *Capsus pinastri*) as an enemy of conifers but gave no other information. In central Europe *C. aequale* var. *maculicollis* has been reported



Figs. 1–5. *Camptozygum aequale* (Villers): 1, adult; 2, fifth instar nymph; 3–5, ♂ genitalia: 3, vesica; 4, right clasper; 5, left clasper.

to injure Scotch pine by piercing the needles which, as a result of this feeding, are discolored and break off (Krausse, 1923). This premature dropping of the needles is also cited by Reh (1929) and Otten (1956). In England and Europe overwintering eggs inserted in young shoots of pine hatch the following spring. Adults are found from late June or early July to September (Butler, 1923; Southwood and Leston, 1959; Kullenberg, 1944).

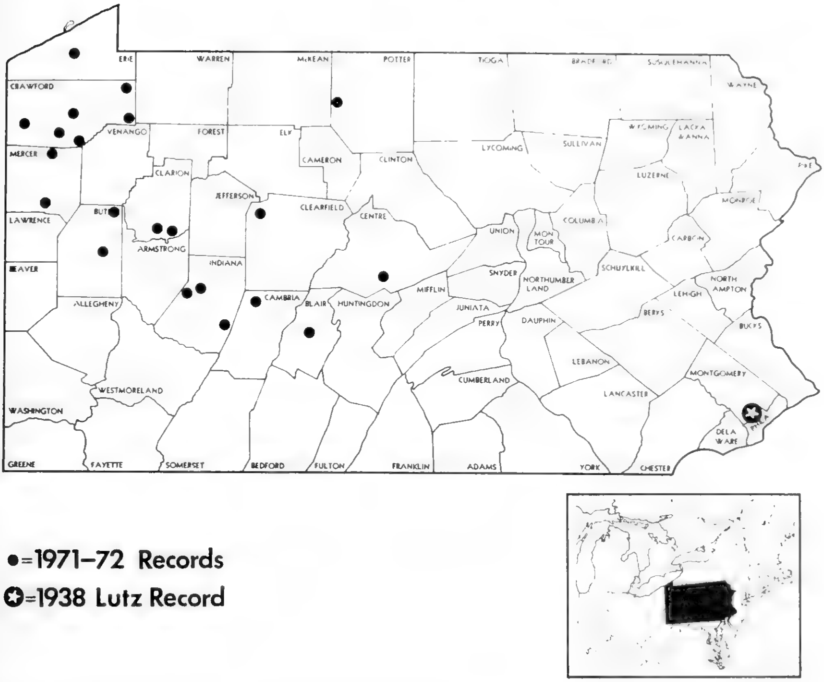


Fig. 6. Distribution of *Camptozygum aequale* (Villers) in North America. All known records are from Pennsylvania.

In Pennsylvania *C. aequale* was collected in 1 central and 10 western counties (fig. 6). It was one of the most abundant insects on Scotch pine seedlings in nurseries and on mature trees in Christmas tree plantations and ornamental plantings. The life history in Pennsylvania is not completely known and is currently under study. Overwintering occurs as eggs inserted in Scotch pine seedlings and probably also in young shoots on large trees. Eggs on third-year Scotch pine seedlings collected in a nursery in Indiana County on 20 March 1973 began to hatch in the laboratory on 5 April 1973. We found early instar nymphs on third-year Scotch pine seedlings in a nursery in Indiana County on 5 June 1972; late instars became abundant on these seedlings by mid-June. Late instars were still abundant and a few adults were present on 27–28 June. At the same time, late instars and adults were less abundant on 8′ Scotch pine trees in a nearby plantation. Adults were common throughout July but their numbers declined sharply during August, the latest record being 21 August. In Pennsylvania there was a single generation in 1971 and 1972.

While Scotch pine appeared to be the preferred host, nymphs were also found on Austrian pine, *P. nigra* Arnold, red pine, *P. resinosa* Ait., Mugho pine, *P. mugo* Turra, and western yellow pine, *P. ponderosa* Douglas. In the same nursery where nymphs were abundant on Scotch pine seedlings during June, nymphs were common on third-year Austrian and western yellow pine seedlings. Only an occasional adult and nymph, however, were found on the adjacent third-year red pine seedlings.

Adults of *C. aequale* also were taken on mature pitch pine, *P. rigida* Mill., red pine, Norway spruce, *Picea abies* (L.) Karst., Colorado blue spruce, *P. pungens* var. *glauca* Regel, and arborvitae, *Thuja* sp. It is unlikely, however, that these plants serve as hosts.

Since the known distribution fits Lindroth's (1957) criteria of an introduced species, it appears unlikely that *aequale* represents a true Holarctic species. Recently, several European species of Heteroptera have been shown to have a ballast origin in North America. For example, Lattin (1966) presented a good case for a ballast introduction of the nabid *Stalia major* (Costa) into the Pacific Northwest. A ballast means of introduction of *C. aequale*, however, appears improbable. The Great Lakes region was not an important dumping ground for European ballast materials, and most of the Heteroptera found associated with ballast sites in British ports have been species of ground-dwelling habits (Lindroth, 1957).

Introduction via imported plant materials is another possible means of entry into North America. European Heteroptera for which a nursery stock origin has been suggested include the lygaeid *Megalonotus chiragra* (F.) (Slater and Sweet, 1958) and the pentatomid *Picromerus bidens* (L.) (Kelton, 1972). Since eggs of *aequale* are inserted in stems of Scotch pine seedlings, an accidental importation with Scotch pine nursery stock would appear probable. However, the possibility of a legal importation into the United States on European nursery stock is unlikely since the shipment of two and three-needled pines into this country has been prohibited by quarantine since 1915 (H. I. Rainwater, Plant Quarantine Division, USDA, Hyattsville, Md., personal communication). A clandestine introduction on nursery stock subsequent to the quarantine is possible as is a legal importation on Scotch or some other pine prior to 1915. If, however, this mirid had been introduced before 1915 and had soon become well established, it should have been taken by some of the early hemipterists. In addition, we did not find any specimens among unsorted Miridae in the Carnegie Museum, Academy of Natural Sciences of Philadelphia, Pennsylvania State University, or Cornell University collections. It is not known whether the 1938 specimens collected in the Chestnut Hill area of Philadelphia (fig. 6) by the amateur hemipterist J. C. Lutz were from an established population.

During 1971 and 1972, we collected extensively from conifers in eastern Pennsylvania and failed to take any specimens of this mirid.[1] Perhaps the relatively large numbers of this mirid now found in western Pennsylvania are the result of a second introduction.

C. aequale is well established in western Pennsylvania. Further spread of this mirid is possible since eggs are inserted in stems of Scotch pine seedlings. While its economic importance in this country has not been determined, collectors are encouraged to report the spread of this species to other areas.

Acknowledgments

We are grateful to Dr. Jon L. Herring, Systematic Entomology Laboratory, USDA, Washington, D.C., for identifying *Camptozygum aequale* and for his helpful advice during the preparation of this report. We also thank Dr. Richard C. Froeschner, Smithsonian Institution, Washington, D.C., for his suggestions and advice. Dr. L. L. Pechuman, Cornell University, and our colleagues at the Bureau of Plant Industry, F. B. Negley and K. R. Valley, kindly read the manuscript and offered suggestions for its improvement. Finally, we thank our regional Bureau of Plant Industry personnel for their valuable collections of *C. aequale* and Mark Evans and Newton Teichmann, Jr. for their collections and observations in Indiana County during summer 1972.

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[1] We now have taken 3 specimens of this species in Philadelphia and neighboring Montgomery Co., beginning with a third instar nymph collected on 22 May 1973.

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NEW SYNONYMY IN LANGURIIDAE (COLEOPTERA)

Casey described *Planismus* in the Cucujidae (1890, Ann. N.Y. Acad. Sci. 5:500) with his new species *floridanus* from Florida as the only included species. Both Dr. Roy Crowson and Dr. J. F. Lawrence called my attention to the fact that this genus is synonymous with *Pharaxonotha*, which was described in the Cryptophagidae and was transferred to the Languriidae by Crowson (1955, The Natural Classification of the Families of Coleoptera, p. 106). Further comparison of the type of *floridanus* shows that it is a senior synonym of *Pharaxonotha zamiae* Blake (1928, Psyche. 30:111), also described from Florida. The following synonymy results:

Pharaxonotha Reitter, 1875 (Deut. Ent. Z. 19:84) Type-species: *Pharaxonotha kirschi* Reitter (Ibid, p. 84). Monotypic.
Planismus Casey, 1890 (Ibid, p. 500) Type-species: *Planismus floridanus* Casey, 1890 (Ibid, p. 501). Monotypic. NEW SYNONYMY.
floridanus Casey, 1890 (Ibid, p. 501) (*Planismus*). FL, Biscayne Bay; FL.
zamiae Blake, 1928 (Psyche 30:111). FL, Homestead. NEW SYNONYMY.

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ON THE FAMILY-GROUP NAMES BASED UPON THE GENERA BUCCULATRIX ZELLER AND STENOMA ZELLER (LEPIDOPTERA)

There has been some use of the family name Bucculatrigidae recently and the family Stenomidae has apparently usually been so designated.

The genus-name *Bucculatrix* is not classical, but is Latin in form. Its base may be considered as the noun *buccula*, but the remainder of the name is a suffix usually applied to verbal bases to form feminine agent nouns such as *bellatrix* and *venatrix*. These have the genitive stem *-tric-*, and family-group names based upon *Bucculatrix* would therefore be Bucculatricidae, Bucculatricinae, etc.

The genus-name *Stenoma* is a classical Greek word whose genitive stem is *stenomat-*. Family-group names based thereupon should therefore be Stenomatidae, Stenomatinae, etc.

GEORGE C. STEYSKAL, Systematic Entomology Laboratory, Agricultural Research Service, USDA, c/o U.S. National Museum, Washington, D.C. 20560.

REASSIGNMENT OF PSEUDODRILUS MOTS. FROM ANOBIIDAE TO DRILIDAE (COLEOPTERA)

The Central Asian genus *Pseudodrilus* Motschulsky was included among the incertae sedis by Pic (1912, Coleopterorum Catalogus, Pars 48, p. 79). In the original description Motschulsky (1869, Bull. Soc. Imp. Nat. Moscou, 42:272) made the following statement, "Forme intermédiaire entre *Drilus, Anobium* et *Xyletinus*." This is probably the reason for the assignment of the genus to Anobiidae.

Although *Pseudodrilus* has not appeared in catalogs of Drilidae (Olivier 1910, Coleop. Cat., Pars 10; Wittmer 1944, Rev. Soc. Entomol. Arg. 12(3):203; 1948, Ibid., 14(1–2):115) the description agrees more closely with the Drilidae than with the Anobiidae. During this work I have examined specimens of the family Drilidae, but attempts to acquire a specimen of *Pseudodrilus mamillatus* Mots. for examination have been unsuccessful.

Portions of the description of *Pseudodrilus* that lead me to believe that it belongs in Drilidae rather than to Anobiidae include a reference to the form of the elytra, ". . . celle des élytres rappelle les *Lampyris*.", to the prothorax, "Corselet transversal, un peu convex et incliné, presque tronqué antérièurement, en demicercle postérieurement, bord faiblement en relief, les latéraux arrondis; sur le dos deux impressions peu apparentes.", and to the abdomen, "Abdomen de six segments; le 1-ier trés-court, le 3-ème et le 6-ème les plus longs; vers le bord de chacun on distingue facilement une fovéole respiratoire." The elytra of the Anobiidae fit quite tightly against the body; those of the Drilidae are much looser and comparable to those of the Lampyridae. The pronotum of the Anobiidae is quite distinctly convex and never truncate anteriorly; that of the Drilidae agrees much more closely with the above description. The abdomen of the Anobiidae has but 5 (sometimes apparently 4) segments and respiratory pits are never visible. The abdomen of members of Drilidae that I have seen consists of 6 segments and respiratory pits at the side of the abdomen are quite distinct.

RICHARD E. WHITE, *Systematic Entomology Laboratory, Agricultural Research Service, USDA, c/o U.S. National Museum, Washington, D.C.* 20560.

BOOK REVIEWS

Chopard, L. 1969. Orthoptera, vol. 2, Grylloidea. 421 pp., 284 figs. *In* The Fauna of India and Adjacent Countries. Issued by The Zoological Survey of India, Calcutta. Published by the Government of India, Delhi. Price: Wheldon & Wesley, Hitchin, Herts., SG4 8TE, England, $7.29.

This valuable and long-awaited book is one of the latest volumes in the series begun in 1888 under the general title "Fauna of British India, . . ."; the title and management of the series were modified when India became independent. By 1950 there had been 81 volumes issued. This volume is thoroughly monographic in scope and includes a suitable introduction, identification keys, descriptions, a moderate number of illustrations, a bibliography, and an index. It is highly useful for the area extending from West Pakistan to Malaya and Indochina, including Ceylon.

The author, Dr. Lucien Chopard, is listed as an Honorary Professor at the Muséum National d'Histoire Naturelle, Paris. He was born in 1885 and died Nov. 15, 1971. Since before World War I he was a distinguished contributor to the systematics and biology of Orthoptera (broad sense). Although he was active in all groups of Orthoptera, and the author of several book-size volumes covering the order as a whole, Grylloidea (true crickets) was his favorite group, and in 1967–68 he published a systematic catalogue for the world cricket fauna (Orthopterorum Catalogus, Pars 10, 12). For years it has been a personal feeling with me that the most accomplished contributors of their generation to the world fauna of Orthoptera were Uvarov, Chopard, Rehn, Hebard, and Bey-Bienko; Hebard died in 1946, the others from 1965 to 1971.

Chopard pays high tribute to Henri de Saussure, who in a classic 1877–78 work (Mèlanges Orthoptérologiques) established the classification of crickets which is still basic today in spite of the many contributions made since Saussure's time. In Chopard's monograph there are 355 species treated belonging to 84 genera; 5 genera and 82 species are described here as new. An indication of Dr. Chopard's preëminence in the field of cricket taxonomy is the fact that 220 of the 355 described species were named by him. He reports that the Indian fauna (from India, Pakistan, and Ceylon) is reasonably different from that in Burma and Malaya. Various species occur in both areas, but several cricket groups are especially well represented in the Indian fauna and other groups are much richer in Malaya than in India.

The publication of this book culminated a long-term effort. In the mid and late 1920's Chopard wrote extensive basic papers on the crickets of India and of Ceylon. In 1937 he accepted the assignment of preparing the "Fauna" volume, but World War II and other events intervened. April, 1969 is the announced publication date, but the manuscript had been submitted as early as 1963. The book was scarcely seen outside of India until 1970, and even later some deliveries were very slow. The long interval between manuscript completion and publication not only was very disappointing to Dr. Chopard and to entomologists waiting to use the book, but numerous changes occurred meanwhile. A notable example is that generic division has occurred in *Gryllus* (broad sense), so that the 33 species referred to *Gryllus* in the book now fall in 8 genera. Chopard's 1967–68 Catalogue appeared in the interim, reflecting a more modern disposition of species, and it is often necessary to use it to check the nomenclatural accuracy of names in the 1969 book.

In spite of these and other handicaps attendant to a work so large and so long delayed, the book is a tremendous source of information on Oriental crickets. I find it very helpful during attempts to identify interceptions from S.E. Asia. There is no doubt that more detailed collecting and refined studies of behavior will require modifications in lists and concepts of relationship, but this final major volume by Dr. Chopard will remain an invaluable fundamental contribution.

ASHLEY B. GURNEY, *Systematic Entomology Laboratory, Agricultural Research Service, USDA, c/o U.S. National Museum, Washington, D.C. 20560.*

The African Campsomerinae (Hymenoptera, Scoliidae). By J. G. Betrem. 1972 (1971). Monografieën van de Nederlandse Entomologische Vereniging No. 6. Sold by the Society at Zeeburgerdijk 21, Amsterdam-O, Netherlands. 326 pp., 6 pls., 55 text figs., 47 maps. 120 guilders.

Members of this subfamily of economically important scarabaeid larval parasites have always posed extremely difficult problems in systematics because of the marked sexual dimorphism in both color and form. Betrem has already published classical contributions on the Indo-Australian, western Palaearctic and Sino-Japanese species. This latest study, in which J. C. Bradley collaborated, conforms to the meticulous, detailed treatment established in those earlier monographs, and maintains the same high quality. The keys, descriptions emphasizing the salient characters, and the illustrations will greatly facilitate identification. Localities are listed for all specimens examined, and maps illustrate the range of many of the species.

The area treated is continental Africa so that most species of the Ethiopian faunal region are considered as well as many southern Palaearctic species. Regrettably, not all of the Ethiopian species are considered. Most of the species from Madagascar and other offshore islands are not mentioned except two which are type-species of subgenera; neither of these subgenera occurs in continental Africa.

In keeping with the philosophy manifest in his most recent contributions, Betrem has established a number of new genera and subgenera. Unquestionably these represent natural groupings, being supported by combinations of characters. A more conservative worker would undoubtedly have retained the traditional separation into just a few genera and subgenera, recognizing most of the new subgenera as species groups. However, judged from my experience with the Melanesian fauna, where Betrem has established a similarly weighted hierarchy, I am confident that the reclassification of higher categories established for the African fauna represents a natural ordering and merits adoption by aculeate hymenopterists.

This outstanding monograph, together with Bradley's earlier work on most taxa of the Scoliinae, provides us with a complete treatment of the scoliids of continental Africa except for the many species belonging to the typical genus *Scolia* (*sensu* Betrem).

KARL V. KROMBEIN, *Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.*

SOCIETY MEETINGS

796th Regular Meeting—April 6, 1972

The meeting was called to order by President Curtis W. Sabrosky in Room 43, USNM. Thirty-seven members and 20 guests were present.

Chairman Burditt of the Annual Banquet committee announced that tickets for the Banquet on June 1, 1972, would be $5.00 each and would be available by the next meeting. Victor Adler would be Ticket Chairman. The price would include potato chips and dinner. Hopefully, various industries would furnish liquid refreshments to accompany the potato chips.

Dr. Sabrosky showed several mementoes of his recent trip to Russia, including a calling card with Russian on 1 side and English on the other, and several popular Russian natural history guides.

Dr. Krombein circulated a Festschrift printed in honor of Professor Yasumatsu from Japan on the occasion of the latter's retirement at the age of 63.

Dr. Bickley circulated *Six-legged Science* by Brian Hocking, a collection of popular talks given by Hocking on the subject of entomology.

Mr. T. J. Spilman showed photographic slides of *Hemipeplus mexicanus* Grouvelle, a cucujid beetle, that is intercepted at Texan ports of entry in palm fronds coming from some of the northern states of Mexico. The beetles are small, being about 5.5 mm long, elongate, and very flat; they are perfectly adapted to live in the confined spaces between the bladelike leaflets of palms. Because the beetles are intercepted 2 or 3 weeks before the religious services of Palm Sunday, they could be called the Palm Sunday Beetle.

The Speaker of the evening, President C. W. Sabrosky, discussed his one-month survey visit to Moscow and Leningrad during May-June, 1971 as part of the exchange program between the American and Russian Academies of Science. Special emphasis was placed on the Zoological Institute of the Academy of Science in Leningrad, which is the principal center for systematic entomology in the USSR. Color slides were shown of institutes, museums, and entomologists.

After a question and answer period, the meeting was adjourned and refreshments were served.

DEWEY M. CARON, *Recording Secretary.*

797th Regular Meeting—May 4, 1972

The meeting was called to order by President Curtis W. Sabrosky in Room 43, USNM. Thirty-seven members and 17 guests were present.

Membership Chairman Rainwater read 2 names for membership. They were Richard Lee Berry of the Ohio Dept. of Health, and Shripat T. Kamble of the Entomology Department, North Dakota State University.

President-elect Burditt and Ticket Chairman Adler gave a pep talk for the annual banquet to be held June 1 at the National 4-H Center, Chevy Chase.

In accord with the announced proposal to change Article IV, Section I of the Constitution to read, "The annual dues shall be seven dollars payable January 1", President Sabrosky called for discussion. The motion on acceptance of the proposed change passed.

In the first note of the evening Ted Bissell introduced members to a new book *Woody Plants of Maryland* by Brown and Brown. He also indicated that insects infesting the willow oak catkins, described in a note last year as literally covering his automobile, have been captured by caging.

Mort Leonard presented a short notice on the safe and successful Viet Nam tour of Steve Hammond, son of Eastern Branch President Bob Hammond.

Bob Nelson introduced Henry H. Richardson, a fellow worker of several years ago. He presented slides on his experience and views of Australia and especially Canberra, site of the International Congress of Entomology this summer.

Don Davis introduced visitor Julian Jumalon of San Carlos University, Cebu, Philippines. Dr. Jumalon showed photographs of some of his exquisite and deft butterfly mosaics.

President Sabrosky introduced the speaker Dr. W. G. Robinson, Jr. of the Department of Biology, University of Virginia, Charlottesville. Dr. Robinson addressed the members on "Insect Sperm Ultrastructure, evolution and cell motion". His remarks were excellently presented and illustrated with photomicrographs. His abstract:

Coccid insects (Homoptera: Coccoidea) are highly specialized parasites of plants, and as such they have attracted the interest of many scientists, from those concerned with economic control to those involved in basic research on biomedical problems of humans. Hughes-Schrader, through her comprehensive review of the cytology of the coccids in 1948 (Advances in Genetics 2:127), opened the way for the use of coccids for investigations on basic biological problems in heredity, development, and evolution. Our interest was inspired by her discovery that the sperm of coccids undergo an extremely unusual development. This results in a sperm which, unlike typical sperm, is not divisible into head, middlepiece and tail, and has no acrosome, centrioles, mitochondria, or typical flagellum.

In lieu of the $9 + 2$ pattern of microtubules found in the flagellum of most sperm, the motile apparatus of most coccid sperm have 1 to several concentric rings of microtubules surrounding acentrically located crescents of microtubules. A straight line drawn to connect the 2 terminal microtubules of the crescent defines a plane in which bisection of the spermatozoon divides it into halves with unequal numbers of microtubules. The asymmetry that can be demonstrated in this manner relates the 16 different patterns found so far in coccid sperm to the $9 + 2$ pattern, which is asymmetric also.

The results suggest that the ability of a cell filament to effect the two-dimensional component of flagellar and flagellalike motility depends, not on a $9 + 2$ arrangement of microtubules as previously believed, but on the organization of microtubules into asymmetric patterns. It is clear that general theories on mechanisms of flagellar motion or on the evolution of cell motility should include a consideration of coccid spermatozoa. Also, information on sperm and sperm bundle structure may provide significant help in unraveling the phylogeny and taxonomic status in the more "difficult" groups of coccids.

Before adjournment at 10 o'clock President Sabrosky invited all to the banquet and bid all a summer farewell.

DEWEY M. CARON, *Recording Secretary.*

798th Regular Meeting—June 1, 1972

The 798th meeting of the Entomological Society of Washington was the annual banquet. 152 members and guests gathered June 1 at the National 4-H center, Chevy Chase, Maryland. The second reading for membership of Shripat T. Kamble, North Dakota State University, and Richard Lee Berry, Ohio Department of Health, plus the first reading of T. J. Shortino, ARS, Beltsville, constituted the business of the Society by toastmaster, Lou Davis. The speaker for the evening was Mr. Phil M. Schroeder, APHIS. His remarks, "Reflections on India", were supplemented with numerous slides of his recent assignment and travels on the Indian subcontinent.

DEWEY M. CARON, *Recording Secretary.*

799th Regular Meeting—October 5, 1972

The meeting was called to order by Treasurer T. J. Spilman, in the absence of other officers, in Room 43, USNM. Thirty-one members and 15 guests were present.

Membership Chairman Rainwater read 4 names for membership. They were: Joan D. Chapin, Department of Entomology, Louisiana State College, Ralph E. Harbach, Department of Biological Science, Western Illinois University, Robert W. Husband, Biology Department, Adrian College, and Charles Shapiro, Chevy Chase, Maryland.

The Treasurer gave a financial report of the annual banquet meeting held during June, and reported a surplus.

Mrs. R. E. Snodgrass noted that a book by the late R. E. Snodgrass, *Insects, Their Ways and Means of Living*, originally published in volume 5 of the Smithsonian Scientific series in 1930, has been reprinted.

Robert T. Mitchell exhibited a rough sketch and specimen of a curious, tiny, antlike parasitic Hymenopteran, which, Karl Krombein determined at a glance as a Dryinid. Following this lead, the exhibitor has since found interesting and detailed accounts in C. P. Clausen's *Entomophagous Insects* of parasitism of leafhoppers by Dryinidae and observed specimens of parasitized leafhoppers in the sweeping samples in which this and other Dryinidae were taken.

George C. Steyskal exhibited a sample of a McPhail trap and gave some account of its history and use in fruitfly survey work. He also told about results in gathering unexpected Diptera of several families from 1 of the traps hung in a tree in his backyard in Bethesda, including over 200 specimens of the chloropid genus *Gaurax*.

R. I. Sailer presented an 8-minute color film on G. E. Bohart's research with *Odynerus* wasps at the Bee Pollination Laboratory, ARS, USDA, Logan, Utah. Insecticide applications for control of alfalfa weevils kill pollinating megachilid bees; the *Odynerus* wasps may be useful biological control agents as they provision their nests with alfalfa weevil larvae.

Treasurer Spilman introduced the speaker for the evening, Dr. Ernest C. Bay, Chairman of the Entomology Department, University of Maryland, who spoke on "People, Mosquitos, and Little Fishes of Northern Nigeria". His comments and slides on mosquito problems and the people of Northern Nigeria were appreciated and elicited several questions.

Following introduction of guests, the meeting closed at 10 P.M., and refreshments were served.

DEWEY M. CARON, *Recording Secretary.*

800th Regular Meeting—November 2, 1972

The meeting was called to order by President Curtis W. Sabrosky in Room 43, USNM. Forty-six members and 15 guests were present.

Membership Chairman Rainwater presented 8 names for membership. They were: Lawrence H. Rolston, Dept. of Entomology, Louisiana State University; Tirzah M. Clark, Washington, D.C.; Georgann L. Kates, Hyattsville, Md; John F. Burger, Rockville, Md.; Douglas William Sutherland, Adelphi, Md.; Robert C. Pordan, Phillipsburg, New Jersey; M. W. Boesel, Zoology Dept., Miami University; and Richard W. Baumann, Dept. of Entomology, Smithsonian Institution.

Nominating Committee Chairman Dr. Krombein presented the slate of officers for the 1973 year. The officers nominated by Dr. Krombein and his committee of Steinhauer and Stone were: President-elect, Victor E. Adler; Recording Secretary, Raymond J. Gagné; Corresponding Secretary, Terry Erwin; Treasurer, T. J. Spilman; Editor, Lloyd Knutson; Custodian, Doug Miller; Program Chairman, F. Eugene Wood; Membership Chairman, Ivan Rainwater.

Treasurer Spilman announced a gift to the publication fund from Alan Stone.

Under the category, for the good of the Society, Lou Davis passed an umbrella to its owner, Lloyd Knutson. The umbrella was homeless from the October meeting.

The first note of the evening was presented by President Sabrosky. He introduced members to the book by R. L. Usinger, *Autobiography of an Entomologist.*

Frank Campbell also displayed a book, *The Insect Societies,* by E. O. Wilson. Dr. Campbell conducted an informal poll regarding Alan Stone's double-crosstik puzzle in the September issue of the ESA bulletin. The difficulty of the puzzle was apparent.

John Horne presented a note on ant lions. He demonstrated and circulated a fascinating natural habitat display that he had constructed to show the life history of ant lions.

President Sabrosky showed a poster from France that pictured some endangered species of insects.

Vic Adler and Mort Leonard spoke about the recent passing of Dr. H. R. Haller.

President Sabrosky introduced the first of the 3 program speakers. Dr. Donald Duckworth of the Smithsonian Institution illustrated his comments on the 14th International Congress of Entomology of this past summer in Australia with some excellent slides. The second speaker, Louise Russell, Systematic Entomology Laboratory, USDA, spoke about the 21st conference of the New Zealand Entomological Society held following the International Congress this past year. Dr. Sabrosky added a few slides of the 2 meetings and his later travels in Monaco. Dr. Wallace Murdoch, Executive Secretary of the Entomological Society of America, completed the program by presenting comments on the 15th International Congress to be held in Washington, D.C. in 1976. He outlined efforts to arrange the meeting and progress on plans to date.

Following introduction of guests, including Mr. Eda, First Secretary of the Japanese Embassy, the meeting was adjourned.

Dewey M. Caron, *Recording Secretary.*

801st Regular Meeting—December 7, 1972

The meeting was called to order by President Curtis W. Sabrosky in Room 43, USNM. Forty-eight members and 18 guests were present.

President Sabrosky gave a summary of the annual reports of all the officers except the Treasurer. The assembled members and guests rose for a moment of silence in honor of the 3 members and 1 associate who died in 1972. Treasurer Ted Spilman gave his annual report on the finances of the Society.

The names of the new slate of officers for 1973 nominated at the November meeting by the committee of Chairman Krombein and members Stone and Steinhauer were read. These were:

President-elect, Victor Adler
Recording Secretary, R. J. Gagné
Corresponding Secretary, Terry Erwin
Treasurer, T. J. Spilman
Editor, Lloyd Knutson
Custodian, Doug Miller
Program Chairman, F. E. Wood
Membership Chairman, Ivan Rainwater

President Sabrosky asked if there were nominations from the floor. There was none, and Pres. Sabrosky requested a motion to ask the secretary to record a unanimous ballot for the entire slate of officers. This was moved, seconded, and carried. The 1973 slate of officers was declared elected, effective at the close of the meeting.

Mr. and Mrs. Ramsey introduced their collection of fabrics with natural history motifs. They exhibited samples following the meeting.

George Steyskal identified an interesting collection of Tephritidae made by President Sabrosky near Ayre's Rock in Australia.

The film on Alfalfa Leafcutter Beekeeping scheduled for the meeting was cancelled. Dr. W. E. Bickley held forth on the other main topic of the evening, an illustrated account, slightly entomological, of his travels to Australia and Japan.

T. J. Spilman exhibited pictures of *Stromatium fulvum* (Villers), a cerambycid beetle, and damaged wooden legs of a chest of drawers. The legs had been carved from an unknown wood in Spain in 1960 and attached to the chest which originated in the United States. In 1964 the chest with legs was sent to the United States and stored in a warehouse in Hyattsville, Maryland. When the piece of furniture was removed from storage in 1972 fine powder fell from the legs. The legs had been severly tunneled and a larvae and adult beetle were found in the tunnels. The legs had undoubtedly been carved from infested wood. A long life cycle, in this case 12 years, is typical of this species. The beetle is found in the Mediterranean region and is said to have become established in the West Indies and South America. Though often accidently introduced into the United States, it has apparently not become established.

Introduction of visitors followed.

President Sabrosky thanked his officers and committees for their fine work during his tenure as President and called Art Burditt forward to accept the gavel. President Burditt accepted with pleasure, but explained that because of the ARS reorganization, he had been transferred to Miami, and would have to resign as President of the Society. As his single official act during his tenure, he appointed a committee of Chairman Krombein and members Stone and Steinhauer to nominate a President-Elect. Pres. Burditt then regretfully resigned and asked Vic Adler, President-Elect for 1973, to take the gavel.

President Adler called upon the nominating committee to select a new President-Elect. The Committee, in the absence of member Steinhauer, nominated B. D. Burks. President Adler asked Helen Sollers-Reidel to continue as head of the Hospitality Committee, and adjourned the meeting at 9:50.

A holiday punch and cookies were served.

R. J. GAGNÉ for DEWEY M. CARON, *Recording Secretary.*

802nd Regular Meeting—January 4, 1973

The meeting was called to order by Recording Secretary R. J. Gagné, in the absence of President Adler, in Room 43, USNM. Forty-one members and 11 guests were in attendance. A special election for a new President-Elect was held. Dr. B. D. Burks had been nominated at the previous meeting. There were no other nominations from the floor. A motion was made, seconded, and carried to record a unanimous ballot for B. D. Burks as President-Elect. Dr. Burks then came forward to preside over the meeting.

Ivan Rainwater read the names of applicants for membership, Phil Perkins, College Park, Maryland, and E. C. Bay, University of Maryland, for the first time. B. D. Burks read the Committee Assignments for 1973.

The featured speaker of the evening was Curtis Sabrosky, whose topic was "Biosystematics of the Bird Blow Flies, *Protocalliphora*." A synopsis follows.

Bird blow flies (*Protocalliphora*) are, in the larval stage, obligatory blood sucking parasites of nestling birds. The group is Holarctic, extending as far north as birds nest and south to central Mexico, North Africa, and temperate Eurasia at least as far south as Szechuan in South China. Until the 1920's, dipterists had considered that there were only 2 species in both Europe and North America, or 1 species and a variety. Successive revisions by Shannon and Dobroscky (1924) and Hall (1948) raised the Nearctic total to 10 species, and recent studies have found a dozen or more new ones in addition. European dipterists have also added a number of species in the last 10 years. Taxonomic characters such as color, sexual dichromatism, width of frons, chaetotaxy, male genitalia, and features of the immature stages were discussed and illustrated. The life history was outlined, including overwintering of the adults, eggs laying in the nests, feeding habits of the larvae, length of stages, longevity of adults, etc. The ecology was discussed, with a conclusion that the flies showed habitat preference rather than preference for species of birds or types of nests. In general, the larvae do not cause the death of nestlings, although they may do so in certain cases.

George Steyskal introduced a book entitled *Challenging Biological Problems.*

Floyd Smith presented a note on the subject of the earliest known reference to an American insect, the periodical cicada, in the first volume of *Philosophical Transactions*, published in 1666.

Frank Campbell called attention to the book, *Leaf Cutting Ants*, by N. Webber.

Doug Sutherland exhibited volume 3 of the new EPA compendium of registered pesticides.

John Davidson presented photos of minute sensory organs of a coccid taken with an electron microscope. He showed also photos of the sensory pits in the antennae of Dineutes (Gyrinidae: Coleoptera).

After the introduction of guests, the meeting was adjourned. Coffee and cake were served.

R. J. GAGNÉ, *Recording Secretary.*

803rd Regular Meeting—February 1, 1973

The meeting was called to order by President Adler in Room 43, USNM. Thirty-eight members and 12 guests were in attendance.

Membership Chairman Rainwater read the names of Kathleen K. Smith and George E. Camin for the first time. B. D. Burks, co-chairman of the annual banquet, announced that the banquet would be held Thursday, May 31st, at the National 4-H Club Center. The cost of tickets was not yet known.

Helen Sollers-Reidel introduced 2 books by David Gillette: *The Mosquito* and *Common African Mosquitos.* Ralph Bram spoke of an introduction to the U.S. of *Hippobosca longipennis* in a shipment of cheetahs to the San Diego Zoo. This hippoboscid is a pest of domestic dogs and cats in South Africa, its area of origin.

In the first half of the regular program, Ashley B. Gurney discussed exploration in Nevada and adjacent States during June 1972, in search of the Nevada sage grasshopper, *Melanoplus rugglesi* Gurney. Solitary populations were found in 5 States, mainly at sites where he last collected it in 1953. This demonstrated the permanence of the solitary phase. No specimens of the migratory phase, which attracted much attention in the late 1940's and early 1950's, were seen. He showed kodachrome pictures of scenes photographed by his son, Richard D. Gurney, during the last part of the trip. The latter also showed two sequences of close-up insect photographs, one a series of the European mantis, including feeding and oviposition. The second series was of the life history of an ambush bug, *Phymata fasciata* (Gray), reared from nymphs and displaying the various stages and feeding activity.

In the second half of the evening, Douglas Sutherland gave a well-illustrated talk on the variety of biomes in Idaho and on certain insect problems relating to the changing ecosystem.

Following the introduction of visitors, the meeting was adjourned, and refreshments were served.

R. J. GAGNÉ, *Recording Secretary.*

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1972
CORRESPONDING SECRETARY

(1 November, 1971 to 31 October, 1972)

Membership on 1 November, 1971	507
Membership on 31 October, 1972	503
Circulation and distribution of *Proceedings* (September, 1972 issue)	839

The membership is distributed among 46 States, the District of Columbia, 2 Territories, and 16 foreign countries. The *Proceedings* go to members and subscribers in 49 States, the District of Columbia, 2 Territories, and 43 foreign countries. A detailed report is on file with the Recording Secretary. DAVID R. SMITH, *Corresponding Secretary.*

CUSTODIAN

(1 November 1971 to 31 October 1972)

The value of publications sold by the Custodian's office amounted to $227.00. Of this, $148.00 was for 14 copies of the *Memoirs,* $7.00 for 5 copies of Weld's gall papers and $72.00 for miscellaneous numbers of the *Proceedings.* A copy of the complete detailed report is on file with the Recording Secretary. ROBERT D. GORDON, *Custodian.*

TREASURER

(1 November 1971 to 31 October 1972)

	General Fund*	Special Publication Fund**
On hand, Nov. 1, 1971	$ 1,131.32	$9,889.37
Credits		
Receipts	7,900.91	908.40
Transfer from Publ. Fund	75.00	
Loan from Publ. Fund	3,543.85	
Debits		
Disbursements	12,651.08	212.19
Transfer to Gen. Fund		75.00
Loan to Gen. Fund		3,543.85
On hand, Oct. 31, 1972	$ 136.66	$6,966.73

LOAN
from Special Publication Fund
to General Fund

Balance, 11/1/71	$1,785.11
Additional loan	3,543.85
Payments	0.00
Balance, 10/31/72	$5,329.46

*In National Bank of Washington, a checking account. **In Columbia Federal Savings and Loan Association: $5,000.00 in a certificate of deposit, $1,966.73 in a passbook account. Because of increased operating costs, we have once again had to borrow from the Special Publication Fund to meet expenses in the General Fund. A detailed report is on file with the recording secretary. THEODORE J. SPILMAN, *Treasurer.*

EDITOR

(Calendar year 1972)

Four numbers of the *Proceedings* were published in 1972. All of the 480 pages were devoted to scientific papers, notes, book reviews, minutes of meetings, announcements, and obituaries. Ninety-nine scientific papers and notes were published. The Society and the *Proceedings* benefitted from 9 fully paid papers of 57 pages which did not cause the articles of regular contributors to be delayed. In order to eliminate problems about billing procedures, a new policy was started whereby reprints are ordered from the Society, not from the press. This new procedure is working very well and will be continued indefinitely. Several changes in publication charges were instituted by the Executive and Editorial Committees in order to offset increased printing costs. These were: an increase in the cost of reprints; an increase in page charges; a limit set on the number of nonpaid papers per issue; and the addition of charges for notes of 1 page or less beginning in 1973. PAUL M. MARSH, *Editor*.

HERBERT L. J. HALLER
1894–1972

Herbert Haller, national and world leader in research on agricultural chemicals and expert on methods for the chemical control of insect pests, died in Suburban Hospital near Washington, D.C., on November 1, 1972. His contributions to agriculture in the United States and other countries around the world will remain a lasting monument to his ability, energy, and forceful character.

Dr. Haller was born at 2213 Victor Street, Cincinnati, Ohio, August 15, 1894. His boyhood in Cincinnati was notable for thrift and hard work. His several jobs while he was working his way through school included helping with prescriptions in a local drugstore, an experience that kindled in him a growing interest in chemistry and biology. After graduation from Fairview Heights School and East Night High School he entered the University of Cincinnati working alternate 2 weeks at an industrial plant, shop or laboratory; he thus completed his undergraduate studies, receiving the degree of Ch.E. in June of 1918. He immediately enlisted in the Corps of Engineers, U.S. Army, and was assigned to the Color Investigations Laboratory of the United States Department of Agriculture in Washington, D.C. There he developed new photosensitive dyes to replace dyestuffs not obtainable from Germany during World War I. He was promoted rapidly in the USDA from Junior Chemist to Assistant and to Associate Chemist. In 1923 he accepted an offer to join the staff of the Rockefeller Institute for Medical Research in New York City where he worked in the laboratory of the internationally known biochemist, Dr. P. A. Levene. During this period Herbert Haller continued his studies at Columbia University and was awarded the Ph.D. degree in Biochemistry in 1926. In 1929 he returned to public service in the USDA where he devoted himself to research on pesticides including DDT, rotenone, the pyrethrins, allethrin, and the first synergists for pyrethrins; he was particularly interested in exploring naturally-occurring insecticides. His rise in responsibility for direction of research was rapid from senior to principal chemist, Insecticide Division, 1927–47; Assistant Bureau Chief, Bureau of Entomology and Plant Quarantine, 1947–53; Assistant Director, Crops Research Division, 1954–57; Assistant to the Administrator, Farm Research, 1957–60; Assistant Administrator, Farm Research, 1960 until retirement in 1964.

He was widely known and highly esteemed in the United States and abroad among scientific and industrial groups for superior qualities as a leader. As an inspiring teacher and a friend ever willing to encourage and assist others, he influenced many young scientists entering the fields of agricultural research in chemistry and entomology. His outstanding personal qualities enabled him to bring together the representatives of government and industry to promote the most effective control of the pests of agriculture and insect pests of medical importance. Most characteristic of Dr. Haller was his readiness to listen to others sympathetically and always to help another person if he could. He liked to visit field stations of the Bureau of Entomology and Plant Quarantine where he would take a lively interest in the problems encountered by the entomologist; he never failed to follow up on the chemical aspects of a problem. Often these discussions with the entomologist bore fruit. On one such occasion, Dr. Haller was asked by a field entomologist in Texas to explain the reason for superior performance of the insecticide pyrethrins when dissolved in sesame oil in comparison with other types of oils that were then in general use. Dr. Haller encouraged the entomologist to publish his findings. Subsequent investigations on sesame oil resulted in the discovery of the key to the chemical structure of the powerful pyrethrins synergists that were later taken up by industry and manufactured for worldwide use.

Dr. Haller's publications, in cooperation with colleagues, include bulletins, circulars, scientific papers, and popular articles numbering more than 200 titles. In addition he applied for and obtained 43 United States Public Service Patents on pesticides and other useful chemicals covering photosensitizing dyes, rotenone, methods of purifying pyrethrum extract, mothproofing compositions, synergists, and DDT formulations.

Dr. Haller was a leader and active member of the following scientific organizations: American Chemical Society (Councilor, 5 years), Entomological Society of America, American Association for the Advancement of Science, Entomological Society of Washington, Washington Academy of Sciences, Washington Chemical Society (President, 1941), Association of Official Agricultural Chemists, Insecticide Society of Washington (Charter Member and Past President), Alpha Chi Sigma (President, 1947), and Sigma Xi. Some of the honors conferred were the following: Hillebrand prize for 1932 presented by the Chemical Society of Washington in recognition (with F. B. LaForge) of meritorious work on the structure of rotenone; Certificate of Merit from the War Department (1946) for the direction and coordination of studies on pesticide chemicals (including DDT and insect repellents) for the prevention of disease and protection of property in military operations; U.S. Department of Agriculture, Distinguished Service Award (1960), "For National and World Leadership in research on agricultural chemicals and for outstanding scientific contributions to the chemical control of agricultural pests"; member of the Expert Advisory Panel on Insecticides of the World Health Organization; and Technical Advisor to the Office of Scientific Research and Development, National Research Council, during World War II.

Dr. Haller examined the first sample of DDT received in the United States from Switzerland in 1942 with no other identity than the name "Gesarol". He soon determined its structure and synthesized a sample. He advised and assisted commercial companies in the United States in promptly establishing under wartime conditions the manufacture of DDT. He also played a leading role in the introduction and use in this country of benzene hexachloride (BHC), and of the organic phosphorus insecticides.

In 1961 he was selected by the Kansas City Section of the American Chemical Society to receive the Charles F. Spencer Award for outstanding achievement in agricultural chemistry and was presented a gold medallion and an honorarium of $1000. In addition to his work as a member of the World Health Organization, Dr. Haller was engeged in many other international activities among which are the folllowing: United States Representative on the Expert Panel on Uses of Pesticides in Agriculture convened by the world Food and Agriculture Organization, Rome, Italy; member of the Applied Chemistry Committee of the International Union of Pure and Applied Chemistry; member of a U.S. team of specialists on insect and other pest control measures for a visit to the Soviet Union (1959) for review of methods used for the chemical and biological control of arthropods and other pests. In 1959 he also visited Poland, Israel, and Yugoslavia to evaluate pest control projects. Since retirement he served as a consultant to the National Agricultural Chemicals Association.

In his many and varied scientific inquires, Dr. Haller ever maintained a healthy degree of skepticism. This discipline in his character was appreciated by his colleagues who placed a deservedly high value on his conclusions and opinions knowing that they were invariably rooted in the facts. It is impossible to summarize in a few words the total impact of his long, useful, and adventurous career. As an administrator and organizer of research and operations in the dual fields of chemistry and entomology, Dr. Haller had no superior.

Dr. Haller is survived by his wife, Iva Haller, of the home, 4407 38th Street, N.W., Washington, D.C. 20016; a son, Herbert A., of Kensington, Md.; a daughter, Mrs. Jean Jones, Roanoke, Va.; and seven grandchildren.

STANLEY A. HALL
WILLIAM N. SULLIVAN
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PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

DEPARTMENT OF ENTOMOLOGY
SMITHSONIAN INSTITUTION
WASHINGTON, D.C. 20560

PUBLISHED QUARTERLY

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THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

ORGANIZED MARCH 12, 1884

OFFICERS FOR 1973

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Entomological Society of Washington
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STATEMENT OF OWNERSHIP

Title of Publication: Proceedings of the Entomological Society of Washington.
Frequency of Issue: Quarterly (March, June, September, December).
Location of Office of Publication, Business Office of Publisher and Owner: The Entomological Society of Washington, c/o Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.
Editor: Dr. Lloyd Knutson, same address as above.
Managing Editor and Known Bondholders or other Security Holders: none.

This issue was mailed October 5, 1973

Second Class Postage Paid at Washington, D.C. and additional mailing office.

ALLEN PRESS, INC. PRINTED IN U.S.A. LAWRENCE, KANSAS 66044

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Vol. 75 SEPTEMBER 1973 No. 3

TAXONOMIC AND DISTRIBUTIONAL NOTES ON SOME SPECIES OF NYSTALEA GUENÉE, WITH SPECIAL EMPHASIS ON THE SPECIES OF THE CONTINENTAL UNITED STATES (LEPIDOPTERA: NOTODONTIDAE)

E. L. TODD

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ABSTRACT—The species of the notodontid genus *Nystalea* Guenée known to occur in the United States are discussed. The 3 species treated include *N. collaris* Schaus which is recorded from Texas. A key for the separation of the species is provided, known distribution is recorded, and food plants are listed. *N. quaesita* Draudt is treated as a new synonym of *N. collaris* Schaus and *N. biumbrata* Schaus as a new synonym of *N. nyseus* (Cramer). A lectotype is selected for *Nystalea biumbrata* Schaus. The status of *Nystalea eutalanta* Dyar is changed from a species to a subspecies of *Nystalea ebalea* (Cramer).

Two species of the genus *Nystalea* Guenée have been previously reported from the continental United States of America. A third species, *N. collaris* Schaus, is now recorded from southern Texas. The species related to *N. nyseus* (Cramer), including *N. indiana* Grote and *N. collaris* Schaus from the United States, are extremely similar in pattern of maculation. Consequently, there have been many misidentifications and erroneous statements of distributional range. The primary purpose of this paper, therefore, is to present in keys and/or in illustrations the distinguishing characters of the species of the United States and of some other species with which they have been or might be confused. The food plants of the species treated, in so far as they are known, include some plants of economic importance.

Nystalea Guenée

Nystalea Guenée, 1852, p. 122. Type-species: *Phal.* [*aena*] *Noct.* [*ua*] *ebalea* Cramer, 1780. Designated by Schaus, 1901, p. 268.

Cyrrhesta Walker, 1857, p. 633. Type-species: *Phal.* [*aena*] *Noct.* [*ua*] *nyseus* Cramer, 1775. Monotypy.

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Eunystalea Grote, 1895, p. 47. Type-species: *Nystalea indiana* Grote, 1884. Monotypy.
Congruia Dyar, 1908, p. 45. Type-species: *Congruia congrua* Dyar, 1908. Monotypy.

The following combination of characters will permit the separation of species of *Nystalea* from species of other North American notodontid genera. Male antenna with basal ½–⅔ fasciculate, female antenna simple; inner margin of forewing nearly straight, lacking a scale-tooth; scape of antenna with a large, erect, dorsally-pointed scale tuft.

In a key to the North American notodontid genera, Neumoegen and Dyar, 1894, p. 182, separate *Nystalea* from *Datana* Walker on the supposed presence or absence of an accessory cell of the forewing. According to those authors *Nystalea* species lack an accessory cell. That is incorrect. An accessory cell is present in the forewing of the species of *Nystalea*, it is elongate and usually very narrow, but even so, easily observable.

Forbes, 1948, does not treat the genus *Nystalea* Guenée, but uses a tribal name, *Nystaleini*, in his classification of the family. In the diagnosis of the tribe, page 206, he indicates that the antennae of the male are pectinate to ⅔ or more, with simple apex. That statement is true for the 2 genera he included, *Symmerista* Hübner and *Dasylophia* Packard, but *Nystalea* males have the antennae fasciculate.

Key to U.S. species of *Nystalea*

1. Apex of forewing rather truncate, termen angled at M_2; costal margin of forewing lacking contrasting pale spots; sclerotized structure at base of costa of valva of male genitalia either broad and shieldlike with a pointed lobe on ventral margin or crescent-shaped, terminating in 1 or 2 sharp dentations at either end; 8th abdominal segment of female with a pair of heavily-sclerotized, free, sharply-pointed, lateral processes 2
— Apex of forewing more produced, termen evenly convex or rarely slightly angled at M_2; costal margin of forewing with contrasting median and apical pale spots; sclerotized structure at base of costa of valva of male a large, dorsally-directed, elongate, spatulate process; female genitalia with a large lamellae postvaginalis, 8th abdominal segment lacking free, sclerotized, sharp-pointed lateral processes 3
2. Area of forewing between basal and antemedial bands distinctly darker than most of remainder of wing and delimited distally by a distinct transverse line; sclerotized structure at base of costa of male valva crescent-shaped; lateral process of 8th abdominal segment of female fairly stout, about 4 times as long as wide, nearly straight .... *N. indiana* Grote
— Area of forewing between basal and antemedial bands not distinctly darker than remainder of wing, distinct transverse lines lacking; sclerotized structure at base of costa of male valva broad, circular or oval, shieldlike; lateral process of 8th abdominal segment of female slender, about 6 or 7 times as long as wide, sinuous .... *N. collaris* Schaus

3. Reniform spot of forewing indicated by 2 black points in a pale oval spot .... *N. ebalea eutalanta* Dyar
— Reniform spot of forewing apparently not marked *N. ebalea ebalea* (Cramer)

Nystalea indiana Grote
fig. 1, 2, 11 and 15

Nystalea indiana Grote, 1884, p. 7. Smith, 1891, p. 50; 1893, p. 231. Neumoegen and Dyar, 1894a, p. 116, 1894b, p. 199. Packard, 1895, p. 173. Dyar, 1897, p. 10. Schaus, 1928, p. 71. Draudt, 1932, p. 911, pl. 143, row. h. Gaede, 1934, p. 207. Torre and Alayo, 1959, p. 10, pl. 1, fig. 3, pl. 10, fig. 3–4.

Eunystalea indiana (Grote). Grote, 1895, p. 47 (Separat-Abdruck p. 7). Schaus, 1901, p. 326. Dyar, 1903, p. 252. Holland, 1904, p. 295, fig. 179. Grossbeck, 1917, p. 83. Barnes and McDunnough, 1917, p. 93. McDunnough, 1938, p. 133. Kimball, 1965, p. 152.

Nystalea guttulata Schaus, 1904, p. 143; 1928, p. 71 (= *indiana* Grote).

Cyrrhesta nyseus (Cramer), *nec* Cramer. Gundlach, 1881, p. 280 [partim ?]. Anonymous, 1895, p. 67 [partim ?]. [Misidentifications.]

Nystalea nyseus (Cramer), *nec* Cramer. Bruner, Scaramuzza and Otero, 1945, pp. 73, 149, 150 [partim ?]. [Misidentification.]

The characters given in the key will separate *indiana* from the other 2 species occurring in the continental United States. However, the presence in the Antilles of other closely-related, undescribed species that may resemble *indiana* in maculation necessitates genitalic examination for identification. Some of them may have been misidentified in Cuba and elsewhere as *Nystalea nyseus* (Cramer) by some of the earlier workers. The undescribed species will be treated in a separate paper on the Notodontidae of the Antilles.

Distribution: Originally described from Indian River, Florida, it is known primarily from Fort Lauderdale, Florida, south into the Keys, and from Cuba. Most Cuban records are from Oriente Province, but this may be only a reflection of collecting activity.

Food Plants: In Cuba, *Eucalyptus* sp., *Psidium guajava* L. (Common Guava) and *Psidium molle* Bertol. (Guisaro Guava) have been recorded as foodplants of *indiana*. Possibly, some of the records refer to undescribed species.

Nystalea collaris Schaus, new status
fig. 3, 4, 10, 12, and 16

Nystalea nyseus collaris Schaus, 1910, p. 576.

Nystalea nyseus f. *collaris* Schaus. Draudt, 1932, p. 912, pl. 143, row i.

Nystalea nyseus var. *collaris* Schaus. Gaede, 1934, p. 208.

Nystalea quaesita Draudt, 1932, p. 912, pl. 144, row a. Gaede, 1934, p. 208. [New synonymy.]

The occurrence of this species in the continental United States was discovered a number of years ago with the receipt of a specimen collected by J. M. McGough at Brownsville, Texas in October, 1953.

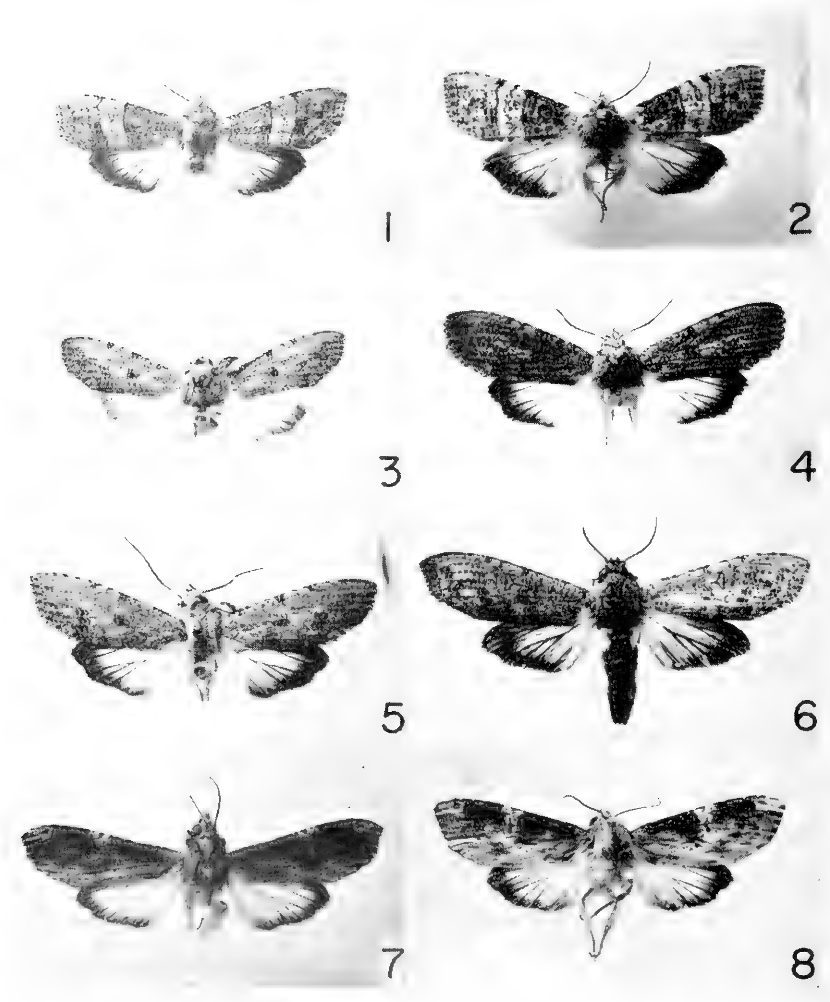

Fig. 1–8, dorsal aspect of adults of *Nystalea* species. 1, *N. indiana* male, Miami, Florida. 2, *N. indiana*, female, Vero Beach, Florida. 3, *N. collaris*, male, Mercedes, Texas. 4, *N. collaris*, female, Brownsville, Texas. 5, *N. nyseus*, male, Hansa Humbolt, Santa Caterina, Brazil. 6, *N. discalis*, male, Juan Viñas, Costa Rica. 7, *N. ebalea ebalea*, male, San Salvador, El Salvador. 8, *N. e. eutalanta*, female, Paradise Key, Florida.

Other specimens collected by P. T. Riherd at Mercedes, Texas in July, 1957 were subsequently submitted for identification. More recently R. O. Kendall, San Antonio, Texas has sent a specimen and reported others (1 in the collection of André Blanchard, Houston, Texas) from Brownsville, Texas.

Investigation in the 1950's revealed this to be *Nystalea collaris* Schaus. This name was found to represent a distinct species and not a form or variety of *N. nyseus* (Cramer). It is my opinion that *Nystalea quaesita* Draudt is a synonym of *collaris*. The name proposed by Draudt was based on an example with yellowish-brown vestiture of the front of the thorax and the head whereas the type of *collaris* has the vestiture of those parts dark brown, nearly black. In this group of notodontids, as in *Datana* and other genera, the coloration of those parts is apparently variable and not of specific significance. In some species this color variation may not be so great or 1 color may predominate, but the species still exhibit a great range of variation. The examples from Texas have the vestiture colored as in *quaesita*, but the genitalia agree with *collaris*.

This species resembles *nyseus* in maculation, but tends to be slightly smaller and has quite distinctive genitalia. It is the only species of the genus presently known to occur in Texas. The characters given in the key will separate it from the other species from the United States.

Nystalea discalis Schaus, 1910, p. 575, is another species of the *nyseus* complex that occurs with *collaris* in Costa Rica and with *nyseus* in South America. It may be easily separated from both by its slightly larger size, distinctive reniform spot of forewing (see fig. 6), and by differences in the male genitalia. The sclerotized process at the base of the costal margin of the valve is only slightly developed and the process from the left side of the aedeagus is very large (see fig. 13), longer than greatest diameter of aedeagus.

Distribution: Known from southern Texas (Brownsville and Mercedes) to Juan Viñas, Costa Rica.

Food Plants: J. M. McGough in correspondence reported this species as defoliating "*Myrtus compacta*" in 1953; P. T. Riherd reared it on *Myrtus communis* L. (Myrtle) in 1957 and R. O. Kendall reared it on *Psidium guajava* L. (Common Guava) in 1969.

Nystalea nyseus (Cramer)

fig. 5 and 9

Phal. [*aena*] *Noct.* [*ua*] *nyseus* Cramer, 1776, pp. 119, 154 (Index), pl. 75, fig. E.

Cyrrhesta nyseus (Cramer). Walker, 1857, p. 633. Kirby, 1892, p. 617.

Nystalea nyseus (Cramer). Moeschler, 1890, p. 123 (in part). Schaus, 1901, p. 268. Dyar, 1915, p. 223. Draudt, 1932, p. 912, pl. 143, row i. Gaede, 1934, p. 208. Hambleton and Forbes, 1935, p. 244. d'Araújo, *et al.*, 1968, p. 242.[2]

Nystalea guttiplena Walker, 1857, p. 635. Druce, 1887, p. 218. Kirby, 1892, p. 618. Schaus, 1901, p. 268 (= nyseus Cram.).

Nystalea biumbrata Schaus, 1928, p. 1. Draudt, 1932, p. 911. Gaede, 1934, p. 206. [New synonymy.]

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[2] The authors of this paper cite 13 other references to this species. The references cited occur in the Brazilian literature and are not of a taxonomic nature.

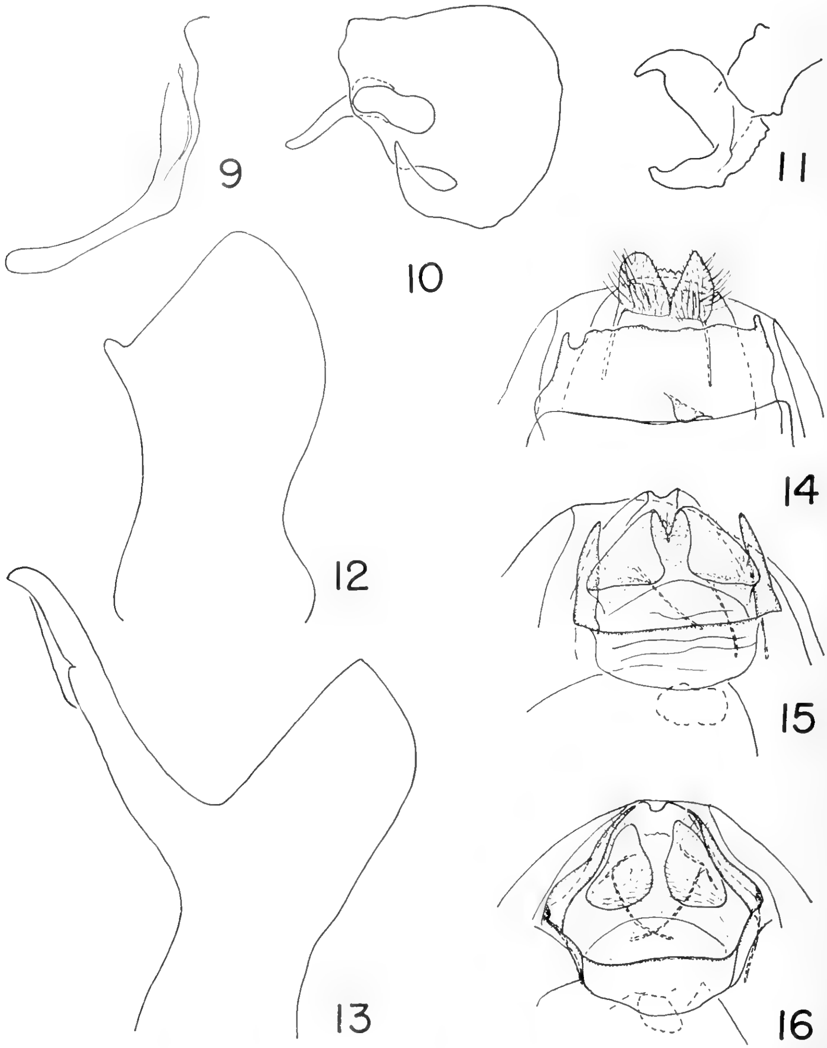

Fig. 9–16, male and female genitalic structures of *Nystalca* species. 9–11, sclerotized basal, costal process of male valva. 9, *N. nyseus*. 10, *N. collaris*. 11, *N. indiana*. 12–13, apical half of aedeagus of male. 12, *N. collaris*. 13, *N. discalis*. 14–16, female genitalia. 14, *N. ebalca eutalanta*. 15, *N. indiana*. 16, *N. collaris*.

This species does not occur in the continental United States, but 2 of the species that do occur there have been misidentified as this species. For that reason, a brief discussion of the characters by which it may be identified and a statement of its distribution is given.

The maculation is essentially identical to that of *collaris* and thus it is not surprising that Schaus described it as a subspecies of *nyseus*, but the genitalia of both sexes are different. The male genitalia of *nyseus* have the sclerotized process from the base of the costal margin of the valve developed in the form of an elongate clavate projection. In *collaris* the sclerotized process is a broad shieldlike structure with a pointed thumblike projection from the ventral margin of the shieldlike part. The species *indiana* has a crescent-shaped process from the base of the valve with the ventral tip and sometimes the dorsal tip also slightly bifid. In the female genitalia, the sclerotized lateral process of the eighth segment of the abdomen is very small, being less than ½ the length of the ovipositor lobe while in *collaris* and *indiana* the lateral process is as long as or longer than the lobe of the ovipositor.

Distribution: Judging from the material in the United States National Museum it would appear that the geographic distribution previously cited for this species is in part erroneous. I have been unable to locate any specimens from north of Panamá on the continent. The only valid records from the Antilles appear to be 5 specimens recently collected on Dominica and the one published record, Hampson, 1898, p. 259, from Dominica and St. Lucia as *N. guttiplena* Walker.

Food Plants: In Brazil the following foodplants have been reported. *Eucalyptus* sp.; *Psidium araça* Raddi (Araçazeiro); *P. guajava* L. (common Guava, Goiabeira or Guayabo) and Camboatá (*Cupania vernalis* Cambess. or *Trichilia excelsa* Benth.?).

Types: The present location of the type of *nyseus* is not known. The original description was based on a specimen from Surinam from the cabinet of M. le Baron Rengens. It may be in the Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands. The species has been identified from the illustration accompanying the original description and by means of the type locality. The type of *Nystalea guttiplena* Walker is a female in the British Museum (Natural History), London. The name was placed as a junior synonym of *nyseus* by Schaus, 1901, p. 268. I believe that this synonymy should be accepted because the type has had a false abdomen applied and the original locality is unknown. Mr. D. S. Fletcher has sent me colored photographic slides of the type and a sketch and photographic negative of the genitalia from Notodontid genitalia slide No. 310 (BMNH). The genitalia are those of a species of the *ebalea* group, but the photos are of an adult of the *nyseus* complex. Mr. Fletcher was unable to find any indication that the abdomen was attached with glue, but such evidence could have been destroyed when the abdomen was removed for genitalic preparation. The abdomen has been badly damaged by dermestids at some time in the past, but the lamella antevaginalis is mostly intact and is characteristic. Schaus, 1928, pp. 1 and 2, obviously based his description of *Nystalea biumbrata* on a male, 50 mm in expanse, from Tucumán, Argentina, and labeled Type No. 33292 U.S.N.M. In my opinion that is sufficient indication that he considered the specimen to be the holotype, but he did have other examples as indicated by his statement, "In a series of specimens there is variability in the intensity of the markings." There are nine similarly-labeled specimens in the collection of the United States National Museum that were probably before Schaus at the time of the original description. Accordingly, I have selected, labeled, and now designate the male bearing the following labels as lectotype, "Nystalea biumbrata Schs, Type ♂"; "Tucuman, Argentina"; "R. Schreiter Coll."; "Collection Wm. Schaus"; "Type No. 33292 U.S.N.M."; "♂ genitalia on slide, June, 1958, E. L. Todd 847" and "Lectotype, Nystalea biumbrata Schaus by E. L. Todd." The 9 specimens from Tucumán, Argentina are extremely variable as Schaus indicated. In the darker examples the anterior ½ of the antemedial and, to a lesser extent, the postmedial band of the forewing are more conspicuously marked than in typical *nyseus* and the area between the antemedial and basal bands is darker, but the genitalia agree with those of *nyseus*. Three of the 9 specimens from Tucumán, including the lectotype, have the head and thorax very dark brown, but in the other six it is yellowish or yellow brown.

Nystalea ebalea ebalea (Cramer)

fig. 7

Phal. [*aena*] *Noct.* [*ua*] *ebalea* Cramer, 1780, p. 41, 249 (Index), pl. 310, fig. C.

Nystalea ebalea (Cramer). Guenée, 1852, p. 122. Walker, 1857, p. 634. Dewitz, 1877, p. 96; 1879, p. 170. Gundlach, 1881, p. 282. Druce, 1887, p. 248. Möschler, 1890, p. 123. Gundlach, 1891, p. 163. Kirby, 1892, p. 617. Druce, 1898, p. 466. Schaus, 1901, p. 268. Wolcott, 1923, p. 179. Forbes, 1930, p. 45. Draudt, 1932, p. 909, pl. 143, row e. Hoffman, 1933, p. 275. Gaede, 1934, p. 206. Wolcott, 1936, p. 444. Bruner, Scaramuzza and Otero, 1945, pp. 12, 58, 175, pl. 6, fig. 2, pl. 7, fig. 5. Wolcott, 1948, p. 624.

Nystalea ebalea (Stoll). Gowdey, 1926, p. 57. Torre and Alayo, 1959, p. 9, pl. 1, fig. 1, pl. 10, fig. 1–2.

Nystalea conchyfera Guenée, 1852, p. 122, pl. 9, fig. 2. Walker, 1857, p. 634. Herrich-Schäffer, 1866, p. 134. Dewitz, 1877, p. 96 (= *ebalea* Cramer). Kirby, 1892, p. 618.

Nyctalea (sic) *conchifera* (sic) Guenée. Anonymous, 1895, p. 67.

Typical *Nystalea ebalea* (Cramer) probably does not occur in the continental United States, but it is common in Cuba, México, and elsewhere in Central and South America at least south to Santa Catarina, Brazil. There is 1 specimen in the collection of the U.S. National Museum labeled, "Everglades"; "Collection Wm. Schaus" and "Barnes Collection." The locality could be authentic, but should be questioned until other examples known to be from Florida are available.

The typical subspecies may be distinguished from *N. ebalea cutalanta* Dyar by the characters given in the key.

Food Plants: *Anacardium occidentale* L. (Common Cashew); *Comocladia dentata* Jacq. (Guaoprieto or Guao de sabana); and *Spondius* spp. (Tussac, Yellow Mombin and Purple Mombin).

Nystalea ebalea cutalanta Dyar new status
fig. 8 and 14

Nystalea cutalanta Dyar, 1921, p. 142. Draudt, 1932, p. 909. Gaede, 1934, p. 206.
Eunystalea cutalanta (Dyar). McDunnough, 1938, p. 133. Kimball, 1965, p. 152, pl. 19, fig. 32 (as *indiana* Grt. in error).

The Floridian population of *ebalea* is easily separated from the typical subspecies by the paler coloration and the distinctly-marked reniform spot of the forewing. Until now it has been considered to be a distinct species, but the genitalia are identical to those of *ebalea*. For this reason, I herein treat the population in Florida as a subspecies of the widely distributed *ebalea*.

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THE GRAMMAR OF NAMES IN SLATER'S CATALOGUE OF LYGAEIDAE OF THE WORLD (HETEROPTERA)

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ABSTRACT—Corrections in grammar of names listed in Slater's Catalogue of the Lygaeidae of the World (1964) are listed.

Because of the importance of the family treated and because there is little doubt that the work will be relied upon for many years, the following notes on the grammar of some of the names included among the 2,748 species listed in the great catalogue of the Lygaeidae of the world by J. A. Slater (1964), together with pertinent comment, are offered in a purely constructive spirit in an effort to make the work even more valuable and reliable. Dr. Slater has most graciously agreed to the publication of these notes with the remark that, "I think it will be helpful to all of us."

No attempt will be made here to deal with the legalistic or zoological aspect of the use of lygaeid names, but only to treat the purely grammatical aspects of the requirements of the International Code of Zoological Nomenclature, and then only insofar as the cases seem to me clearcut. Names will be referred to in the form I consider correct, followed by a page reference in the catalogue. No reference will be made to cross-references nor to nomina nuda.

One of the more obvious errors is in regard to species-group names ending in *-cola*, a Latin word-element meaning 'inhabitant of.' These have been regularly changed in the catalogue in masculine genera to *-colus*, although their proposers have been uniformly correct in treating them as nouns in apposition and therefore invariable. The following instances should revert to the form shown: *insulicola* (247), *alticola* (278), *lichenicola* (286), *monticola* (288), *paludicola* (290), *graminicola* (312), *arboricola* (325) *nubicola* (327), *pteridicola* (328), *deserticola* (544), *muscicola* (874), *monticola* (907), *conicola* (923), *agricola* (1025), *capicola* (1117), *sabulicola* (1365), *alticola* (1466).

In several further cases nouns have had their endings changed as though they were adjectives. Such are the following: *aurora* (20), *melanostoma* (24), *simla* (100), *monostigma* (133), *furcula* (196), *talpa* (463), *leucoderma* (496), *striola* (586), *erythrocephala* (606), *flavicosta* (757), *mimula* (1132), *sororcula* (1142), *merula* (1237), *chiragra* (1358), *apicimacula* (1382).

Two cases somewhat similar to those in the preceding paragraph

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are: *nesiota* (495), which should be considered a noun transcribed from Greek *nēsiotēs* in the same manner as Greek *nautēs* was transcribed as *nauta* by the Romans, and the analogous *annamita* (499).

Four generic names ending in *-dema* were treated as feminine by their authors, in 2 cases with stated derivation from Greek *dēmas* (neuter). Because there is a change of ending here, the genera should be treated as of feminine gender. Therefore *Cymodema* (387), *Bathydema* (1004, correct), *Lamprodema* (1344), and *Macrodema* (1450) should all be feminine. The following changes in species-group names in these genera are in order: *Cymodema tabida* (388), *Lamprodema inermis, L. maura* (1345), *L. m. nitidula, L. minuscula, L. rufipes femorata* (1348), *Macrodema microptera* (1451).

Generic names in *-plax* are to be derived from the Greek word of that spelling, one which is of feminine gender. *Macroplax* (644) is correctly treated as feminine, but the following changes are in order: *Microplax albofasciata* (661), *M. interrupta* (663), *M. limbata, M. plagiata* (665), *Platyplax fuscata* (770), *Lamproplax membranea, L. picea* (942).

As all other names in *-coris, Cryptocoris* and *Telocoris* should be masculine. The following changes in species names are in order: *Cryptocoris fasciatus* (1058), *Telocoris vittatus* (1063).

The generic name *Neseis* is a classical personal name and therefore according to the Code (Art. 30a.i) is feminine. Species-group names should be changed as follows: *N. pallida* (243), *N. ampliata, N. alternata* (244), *N. crypta, N. fasciata, N. fulgida, N. hiloensis approximata, N. h. intermedia* (245), *N. h. interoculata, N. h. jugata* (246), *N. nitida, N. n. consummata* (247), *N. saundersiana* (248), *N. whitei brachyptera* (249).

Inasmuch as names in *-gaster* should be feminine (see Code, Art. 30a.i), the generic name *Heterogaster* should be feminine and certain of the species-group names in it should be changed: *H. affinis rubricata, H. albida* (750), *H. cathariae cinnamomea* (756), *H. distincta, H. flavicosta* (757; the latter a noun), *H. nasuta* (757), *H. semicruciata* (759).

The generic name *Esuris* is feminine, as originally indicated by Stål in his use of the combination *Esuris tergina* (821).

The generic name *Myocara* can only be derived from Greek *myo* + *cara*. The latter word means 'face' and is unusual in being of neuter gender. The species-names should therefore be *M. acuminatum* and *M. australe* (836).

The generic name *Daerlac* (1058), one of Signoret's anagrams, according to the Code (Art. 30b.ii) should be masculine and the correct form for one of its species is *D. picturatus* (1059).

The binomen *Arocatus suboeneus* (30) was indeed published in that form, but it seems evident that the species-name may be considered a typographical error for *subaeneus,* inasmuch as the generic name *Lygaeus*, appears in the same paper once as *Lygoeus,* and once as *Lygoegus* and the title of the paper appears in capital letters as LYGŒIDES EXOTIQUES.

The following changes, requiring little special comment, seem mostly to be inadvertent errors among many correct forms:

Astacops maior (36), the originally proposed form, is merely earlier (more classical) Latin than the later variant *major.*

Lygaeosoma argillaceum, L. bipunctatum (65)

L. contaminatum, L. laterale (66)

L. modestum, L. neglectum (67)

L. sardeum (68) may be considered a neo-Latin adjective meaning 'Sardinian' and formed on the pattern of *Tartareus* or *Sophocleus.*

L. erythropterum (71)

L. sardeum numidicum, L. sordidum, L. timorense, L. villosulum (72)

Pylorgus femurmaculosum (380) is a case similar to that of *Melanoplus femurrubrum* (De Geer), the name of the North American red-legged grasshopper. The names refer to the coloration of the femur, which is a neuter noun, and not to the whole insect, and the species-names are noun phrases in apposition.

Holcocranum sculpturatum (707)

Tomocoris ornatus (868)

Ligyrocoris piliger (1092). Names in *-ger* and *-fer*, used as adjectives, have the gender forms *-ger, -fer*, m.; *-gera, -fera*, f.; *-gerum, -ferum*, n.; there is no form in *-us*.

Myodocha inermibus (1101) can hardly be considered an adjective. In form it is the plural dative (any gender) of *inermis.* If accepted at all, it should be considered a non-classical noun.

Neosuris fulgida (1107)

Pachybrachius afer (1110); adj., *afer, afra, afrum.*

P. maculifer (1131)

Sisamnes claviger (1177)

Elasmolomus v-album (1227). According to the Code (Art. 26b), one of the few cases where a hyphen is permitted is in a construction such as this.

Rhyparochromus albiger (1275)

R. alboacuminatus niger (1316)

Megalonotus albipilis (1371). There is no objection to the *-is* form.

Aoploscelis bivirgatus niger (1400)

Emblethis horvathianus (1432); incidentally, *Emblethis* is passive aorist participle of Greek *emballō*, masculine form.

Nysius vecula (1508). I can find no way to derive *vecula* in classical dictionaries. It should be treated as a noun in apposition.

Heterogaster antiqua, H. famosa, H. radobojana, H. rediviva (1510)

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A NEW SPECIES OF CLINIDIUM FROM GUATEMALA (COLEOPTERA, CARABIDAE OR RHYSODIDAE)

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ABSTRACT—*Clinidium* (*s. str.*) **sulcigaster** n. sp. is described and illustrated.

Through the courtesy of Dr. E. C. Becker I have been permitted to examine and describe the following new species of *Clinidium*. It represents the most northern record for the subgenus *Clinidium s. str.* on the mainland of Central America.

Clinidium sulcigaster Bell, new species
fig. 1–4

Holotype: Canadian National Collection Holotype 12,700. Male. Finca Mocha, Santa Barbara, Department of Suchitepéquez, Guatemala, altitude 3000 ft, June 23, 1966, collector J. M. Campbell. The locality is in southwestern Guatemala near Lake Atitlán. The elevation is much less than those recorded for the other species recorded from Guatemala, *Clinidium* (*Arctoclinidium*) *guatemalenum* Sharp.

Description: Length 5.5 mm; dark reddish brown; body narrower and more parallel sided than in the most similar species, *Clinidium incis* Bell; apical segment of antenna unusually large, approximately equal in length to the 3 preceding segments, broader than 10th segment; apical stylet long, stout; antennal segments 4–10 twice as broad as long; head relatively small, narrow, elongate; frontal grooves deep; both inner and outer margins of temporal lobes nearly parallel; occipital groove narrow, relatively long; 3 temporal setae on each side, most anterior one longest; eye small, elongate, without lenslike structure seen in *C. incis.*

Sides of pronotum more parallel than in *C. incis*; pronotum relatively narrow, greatest width about 65% of median length; median groove very broad, deep, its anterior end expanded to form oval pit about ⅓ width of pronotum at that level; groove narrowing posteriorly but with slight secondary widening just anterior to level of basal impressions; discal setae entirely absent; pronotum with 3 marginal setae on each side; angular seta absent; 1 basal seta present on each side, varying in position (medial to basal impression on 1 side and lateral to it on the other); basal impression continued anteriorly by narrow shallow discal stria which reaches anterior to middle of pronotum; prothoracic sternopleural sutures obsolete; propleural suture deeply channeled, continuous.

Each elytron with 6 striae (including submarginal); 3 inner striae deep, not evidently punctate; 3rd stria merging posteriorly with 2nd, and combined 3rd and 2nd merging with 1st stria; 1st interval as wide and as convex as 2nd interval; 3rd and 4th intervals also convex; 4th stria deep posteriorly, reduced to row of punctures at middle 3rd, absent in anterior 3rd; no trace of any stria between 4th and 5th (marginal) striae; latter deep, entire, becoming narrower anteriorly; 1st and 2nd striae without setae; 3rd stria with 4 setae, including 1 at base; 4th stria with 2 setae near apex; 5th (marginal) stria with 6 or 7 setae in posterior half; subapical tubercle without setae; apical tubercle with 3 setae.

Metasternum without median sulcus, posterior median pit of metasternum divided into 2 pits by median ridge; abdomen with sulcus in median line bounded laterally by paired carinae, this sulcus including entire median part of sternum I, most distinct on sternum II + III, but continuing across sternum IV, ending on sternum V; transverse sulci of abdomen broadly interrupted medially, not evidently punctured; sternum VI as in male of *C. incis*, with 2 setae; femora grooved, each with 1 dorsal seta.

Male without proximal tooth on anterior tibia; calcars only slightly notched proximally; calcar of third tibia thicker but not longer than that of second tibia.

Female unknown. The median abdominal groove might be a secondary sexual character and be lacking in the female.

This species traces in Bell (1970) to *C. incis* Bell. The latter species differs in lacking the median sulcus and the longitudinal carinae on the abdomen, and has an entirely different eye, with a round protruding lens seemingly derived from the genal lamina. *Clinidium incis* also has a complete 4th stria and traces of an additional stria between the 4th and marginal striae. The transverse sulci of the abdomen are not interrupted. The antennae have segments 4–10 less transverse and more beadlike, while the apical stylet is more slender. There are also many differences in chaetotaxy.

In the keys of Grouvelle (1903) and Arrow (1944) the new species will key to *Clinidium cavicolle* Chevrolat, 1873, from Colombia. The

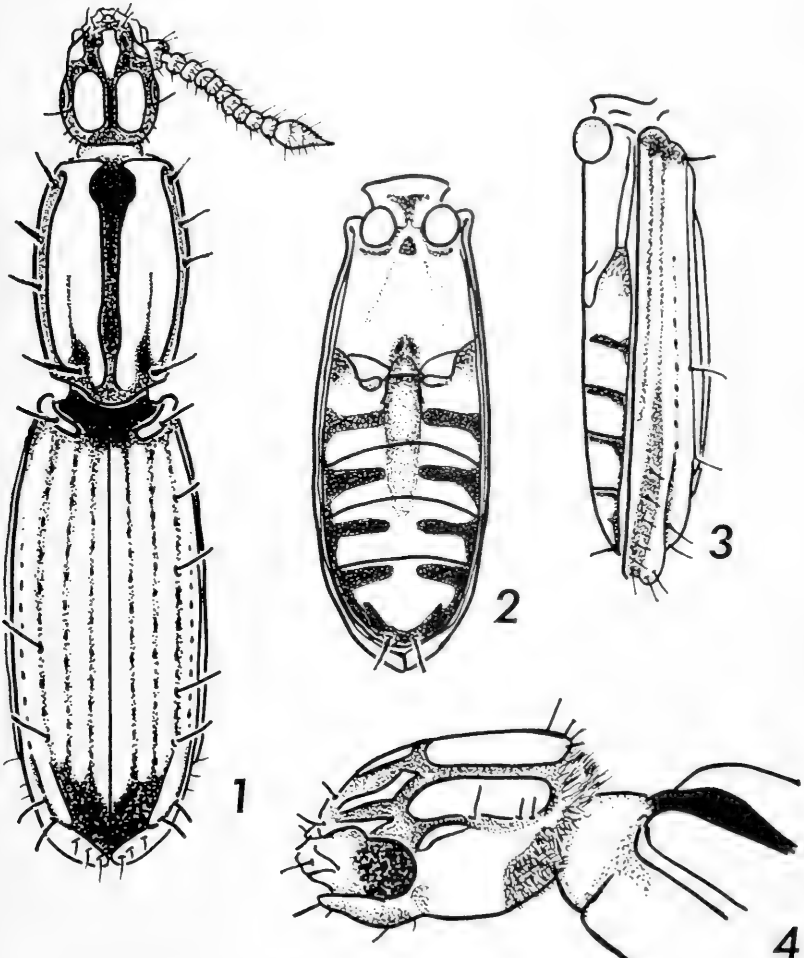

Fig. 1–4. *Clinidium sulcigaster* n. sp., male. 1. Dorsal view, legs removed. 2. Ventral view of pterothorax and abdomen. 3. Lateral view of pterothorax, abdomen, and elytra. 4. Dorsolateral view of head and anterior portion of prothorax, antenna removed.

original description of the latter species indicates that it has round eyes and shallow frontal grooves. *Clinidium sulcigaster* has elongate eyes and deep frontal grooves.

The only other *Clinidium* known from Guatemala, *C. guatemalenum* Sharp belongs to a different subgenus (*Arctoclinidium* Bell). In addition to the subgeneric characters, it differs from *C. sulcigaster* in lacking the enlarged median pit on the pronotum, in having 5 (rather than 4) striae medial to the marginal stria, and in having coarse punctures on the last abdominal sternum.

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THREE TRYPHONINE ICHNEUMONIDS FROM CRETACEOUS AMBER (HYMENOPTERA)

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ABSTRACT—The genera *Catachora*, *Urotryphon*, and *Eubaeus* are described from amber believed to be 80 to 90 million years old, collected on the Taimyr Peninsula, Siberia. These 3 genera are believed to be related to *Grypocentrus* and *Idiogramma*.

Fossil ichneumonids in 4 small pieces of amber have been received for study from the Paleontological Institute, Moscow, through Dr. A. Rasnitsyn. According to Dr. Rasnitsyn, their age is Cretaceous, Coniacian-Santonian, 80 to 90 million years old. They were collected in 1971 at Yantardakh Hill, East Taimyr Peninsula, 3 km up from the mouth of the Maimetcha River, which is a branch of the Kheta River. The Kheta River, in turn, is a branch of the Khatanga River.

The 4 specimens in amber represent 3 species in 3 genera. All 3 are small, stout-bodied ichneumonids with the propodeum areolated and the first tergum short and wide, with the spiracle in front of its middle and, at least in 2 of the genera, with the median dorsal carinae reaching about 0.75 the length of the tergum. The one female specimen has an ovipositor of moderate length with a distinct nodus and no subapical notch. The apex of the front tibia of all specimens is rounded on the outer side, without a projecting tooth. All specimens are very small, with the front wings 1.15 to 1.9 mm long. These sizes are at and below the lower size range of modern ichneumonids. Correlated with the small size, their antennae have few segments (13 to 15 segments), the stigma is large, radial cell short and deep, first brachial cell short, and discoidella weak or absent.

In general, these 3 Cretaceous genera resemble small stout bodied ichneumonids of several subfamilies, such as *Grypocentrus* and *Idiogramma* (Tryphoninae), *Adelognathus* (Adelognathinae), *Lysibia* and *Gnypetomorpha* (Gelinae), *Lathrolestes* (Scolobatinae), and *Earobia* and *Pygmaeolus* (Phrudinae). The true relationships of the 3 must be decided by using the small inconspicuous characters considered fundamental to the above subfamilies rather than general resemblances. All 3 have the spiracles of the first tergum in front of the middle. This rules out the possibility that they belong to the Adelognathinae or the Gelinae. The ovipositor of the single female is of the type used for external parasitism, with a distinct pre-apical nodus. This indicates relationships with the Tryphoninae or Gelinae. There is no tooth at the apex of the front tibia. This rules out placing them in the Scolobatinae. It therefore seems safe to assume that all 3 of the Cretaceous genera belong in the Tryphoninae. Among the living genera of Tryphoninae they show the greatest resemblance to *Grypocentrus* and *Idiogramma*. Probably they are part of a large complex of tryphonine genera, mostly extinct, which remain unknown except for these 3 fossils and a few genera surviving in the Holarctic Region.

As for their tribal placements, this is somewhat arbitrary, partly because all details of the specimens can not be seen, partly because only one of the specimens is a female, and partly because the classification of even the modern genera may be arbitrary. To assign them somewhere in the classification, however, I am referring *Catachora* and *Eubaeus* to the Tryphonini and *Urotryphon* to the Idiogrammatini. All 3 have the portion of the metacarpus distad of the radius unusually long. This could be a basis for placing all 3 in a new tribe, but such a classification does not seem necessary on the present evidence.

It is almost certain that these 3 Cretaceous genera were parasitic on sawflies, probably on xyelids. The modern genera most similar to them are *Grypocentrus*, which parasitizes leaf-mining sawflies (*Fenusa*), and *Idiogramma*, which attacks *Xyela* larvae in the staminate cones of *Pinus*. Since Xyelidae were relatively abundant in the Cretaceous, these are the most likely hosts. Larvae of modern xyelids tend to feed in buds or strobili. Their ancestors probably did the same.

The very small size of these specimens (front wing 1.15 to 1.9 mm long) is intriguing. Very few of the living ichneumonids have a front wing measurement below 2.0 mm. The smallest (dwarfed) specimens on record belong in the genera *Stenomacrus* and *Diaglyptidea*, with a wing length of 1.7 mm and there is a species of *Aneuclis* with the front wing 1.6 mm. A number of other genera have dwarfed individuals with a wing length as short as 1.8 mm. The average wing length of the fossils (1.62 mm) is so low that there has to be a special reason for it. Obviously, the hosts themselves had to be exceptionally small insects, as ichneumonids are nearly all solitary parasites which are only a little smaller than their hosts. The sawfly hosts of that period must have been smaller than any sawflies now living, and to have been so small they must have had unusually small feeding niches. They were either leaf miners or fed in very small buds or strobili, or in small flower parts or seeds.

The 4 fossil specimens are described below. All are from the locality mentioned in the opening paragraph and the specimens can be found in the Paleontological Institute in Moscow. The amber pieces are not numbered but the specimens can be recognized individually from the drawings and descriptions.

Catachora, Townes new genus

fig. 1A

Front wing 1.8 mm long. Structure as figured. On the propodeum, the areola is hexagonal and slightly longer than wide. The sculpture of the thorax and abdomen is not clearly visible. What can be seen is that the punctures are moderately small and not dense.

This genus appears to be related to *Grypocentrus*. It differs in the very deep radial cell, differently shaped areolet, and very short first brachial cell. No female is at hand but it is presumed that the ovipositor would not be of the specialized shape found in *Grypocentrus*.

The genera name is from κατά (downward), plus χώρα (space), referring to the downward projecting radial cell.

Genotype: *Catachora minor*, new species.

Catachora minor Townes, new species

fig. 1A

Structure as figured, and as described under the generic heading.

Type: ♂, in Cretaceous amber, collected on the Taimyr Peninsula, Siberia (Paleontological Institute, Moscow).

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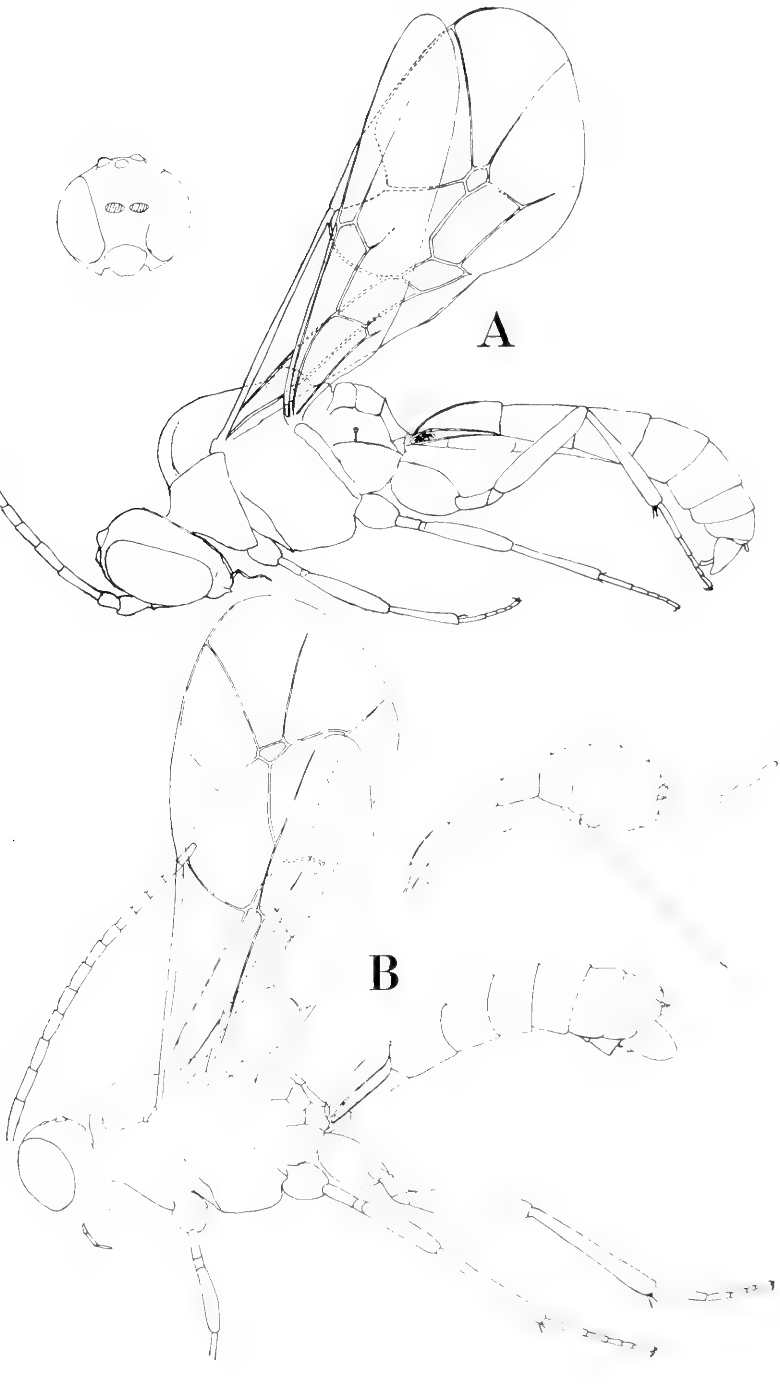
Fig. 1. A. *Catachora minor*, side view of type male and front view of head. B. *Urotryphon pusillus*, side view of type male and abdomen of paratype female.


A
B

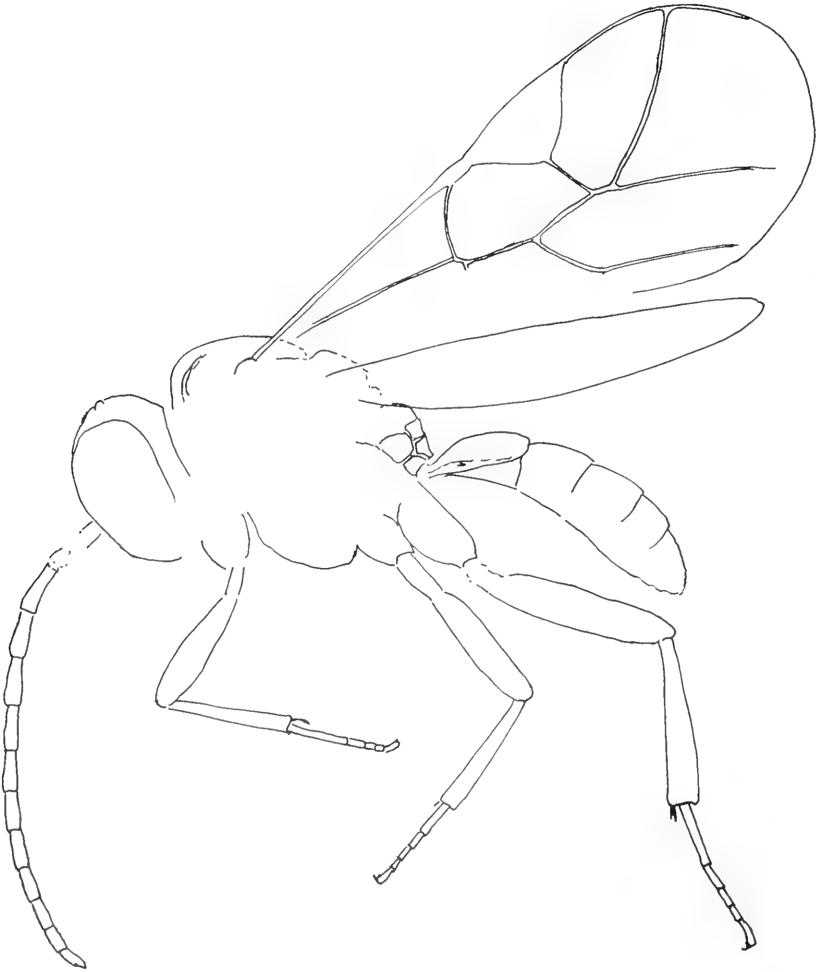


Fig. 2. *Eubaeus leiponeura*, side view of the unique specimen.

Urotryphon Townes, new genus

fig. 1B

Front wing 1.9 mm long. Structure as figured. On the propodeum, the areola and basal area are confluent. The occipital carina is apparently absent. The sculpture of the thorax and the abdomen is not clearly visible. What can be seen is that the punctures are moderately small and not dense. The front and lower parts of the head are lacking.

This genus seems to be related to *Idiogramma*. Points of resemblance are the relatively large head with eye relatively small, the venation, apparent lack of creases to separate the abdominal epipleura, and the long ovipositor. It differs from *Idiogramma* in the lack of a discoidella and in the nearly complete areolation of the propodeum.

The generic name is from οὐρά (tail) plus *Tryphon*, alluding to the long ovipositor.

Genotype: *Urotryphon pusillus*, new species.

Urotryphon pusillus Townes, new species

fig. 1B

Structure as figured, and as described under the generic heading.

Types: ♂ and ♀, from Cretaceous amber, collected on the Taimyr Peninsula, Siberia (Paleontological Institute, Moscow). The holotype male is figured. It lacks the front and lower part of the head. The paratype female, of which the abdomen is figured, consists of the abdomen, propodeum, middle and hind legs, and an indistinct piece of the front wing showing the nervellus and its juncture with the discoideus.

Eubaeus Townes, new genus

fig. 2

Front wing 1.15 mm long. Structure as figured. Front wing broad and hind wing very narrow. The venation on the only specimen available is very difficult to see. Dr. A. Rasnitsyn has sent enlarged photographs of the venation. The venation shown in the photographs, together with what I could see is represented in the drawing. In the hind wing, the mediellan and submediellan cells seem to be very small but these can not be seen distinctly. Only one spur was seen on the middle tibia, but there might be 2.

The absence of the second recurrent vein is a feature of several other very small ichneumonids as well as of *Eubaeus*, and is correlated with small size rather than with phyletic connections. Other ichneumonids that lack the second recurrent vein are *Gnypetomorpha*, *Neorhacodes*, *Polyauon stiavnicencis*, *Sathropterus* (usually), *Mesochorus obliterator*, and *Ophionellus*. Except for the last 2, these are very small species.

The generic name is from εὖ (very), plus βαιός (small).

Genotype: *Eubaeus leiponeura*, new species.

Eubaeus leiponeura Townes, new species

Structures as figured, and as described under the generic heading.

Type: ♂, in Cretaceous amber, collected on the Taimyr Peninsula, Siberia (Paleontological Institute, Moscow).

A KEY TO SOME NEW WORLD SPECIES OF TRICHOGRAMMA (HYMENOPTERA: TRICHOGRAMMATIDAE), WITH DESCRIPTIONS OF FOUR NEW SPECIES[1]

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Indian Station, Commonwealth Institute of Biological Control, Bangalore, India

Although *Trichogramma* spp. have been used for several decades for the biological control of a variety of lepidopterous pests, no serious exploratory surveys have apparently been made for new species occurring in different parts of the world. This is especially true of some continents, such as South America, Africa, and parts of Asia. In the course of a biosystematic study of the genus, circular letters sent to entomologists in various countries have drawn some response and as a result, 4 new species of *Trichogramma* have been found in the New World, and they are described in this paper. A key to most of the New World species has also been included. There is every likelihood of more being present not only in the continental areas, but also in the adjoining islands, and a thorough search may prove quite rewarding.

The need for a reliable key to identify *Trichogramma* spp. has always been felt by entomologists working with this group of insects. Not all characters dealt with in the following key are ideal (in the sense stated by Mayr *et al.*, 1953) inasmuch as some of the characters apply only to either the females or the males, even the most important ones cannot be observed directly, and some are not necessarily absolute. Nevertheless, this key will hopefully facilitate more reliable determination than hitherto. The following key and the descriptions are based on specimens that were reared on eggs of *Corcyra cephalonica* St. at 80° F. (± 2°) and 50% R. H. in the laboratory (with the exception of *T. bennetti* sp. nov., *T. semblidis* (Auriv.), and *T. retorridum* (Gir.), of which we did not have live cultures). For further details of the generalized male genitalia of *Trichogramma* and descriptions of the better known species, see Nagarkatti and Nagaraja, 1968 and 1971 respectively.

KEY TO THE NEW WORLD SPECIES OF *Trichogramma*[2]

1. Dorsal expansion of gonobase broad, without distinct side lobes but with rounded posterior extremity; aedeagus broad, shorter than apodemes, both together shorter than genitalia .... *T. bennetti* N. & N., n. sp.

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[1] This research has been financed in part by a grant made by the United States Department of Agriculture under PL-480. Manuscript submitted through Dr. R. H. Foote, Systematic Entomology Laboratory, Agr. Res. Ser., USDA.

[2] Although an attempt has been made to include in the key as many species as possible from the New World, we have necessarily had to omit mention of *T. helocharae* Perkins, *T. intermedium* How., and *T. koehleri* Blanchard, specimens of which we could not obtain for examination.

— Male genitalia not as above 2
2. Chelate structure almost reaching level of gonoforceps 3
— Chelate structure distinctly below level of gonoforceps 4
3. Antennal hairs nearly 4 times maximum width of flagellum; dorsal expansion of gonobase short, appearing cup-shaped when viewed from caudal end; wing remigium with regularly arranged trichiae .... *T. maltbyi* N. & N., n. sp.
— Antennal hairs about 2 times the maximum width of flagellum; dorsal expansion of gonobase triangular with slight constrictions at base; wing remigium with irregularly arranged trichiae .... *T. retorridum* (Girault)
4. Median ventral projection minute; tip of dorsal expansion of gonobase distinctly below level of chelate structure .... *T. rojasi* N. & N., n. sp.
— Median ventral projection small, but not minute; tip of dorsal expansion of gonobase reaching level of chelate structure or extending beyond it 5
5. Males dimorphic; apterous males with gynecoid antennae without body reduction, alate males with normal antennae .... *T. semblidis* (Aurivillius)
— Males monomorphic 6
6. Antennal hairs almost blunt, length of longest hair about 2 times maximum width of flagellum 7
— Antennal hairs sharply tapering, length of longest hair 2½ to 3 times maximum width of flagellum 8
7. Fringe on tornus of fore-wing about $\frac{1}{10}$ the width; male antenna with more than 50 hairs .... *T. californicum* N. & N., n. sp.
— Fringe on tornus of fore-wing ⅙ to ⅛ the width; male antenna with less than 50 hairs 9
8. Longest antennal hair about 2½ times the maximum width of flagellum; females with little or no black pigment; dorsal expansion of gonobase somewhat broad 10
— Longest antennal hair about 3 times the maximum width of flagellum; females dark colored; dorsal expansion of gonobase somewhat narrow; arrhenotokous and thelytokous strains present .... *T. semifumatum* (Perkins)
9. Chelate structure far below gonoforceps; median ventral projection almost reaching level of chelate structure; females moderately dark with blackish prothorax and abdomen .... *T. fasciatum* (Perkins)
— Chelate structure close to gonoforceps; median ventral projection not reaching level of chelate structure; females yellow occasionally with black pigment only in mesoscutum, sides of parapsides and anterior part of abdominal segments .... *T. perkinsi* Girault
10. Ovipositor distinctly longer than hind tibia; wing remigium with regularly arranged trichiae; females completely devoid of black pigment .... *T. minutum* Riley
— Ovipositor as long as or slightly shorter than hind tibia; wing remigium with somewhat irregularly arranged trichiae; females with anteriormost abdominal terga black .... *T. pretiosum* Riley

Trichogramma bennetti Nagaraja and Nagarkatti, new species
fig. 1–7

Male: Pigmentation based on a few available specimens, light yellow with blackish thoracic sclerites and abdomen. Fringe on tornus of fore-wing about

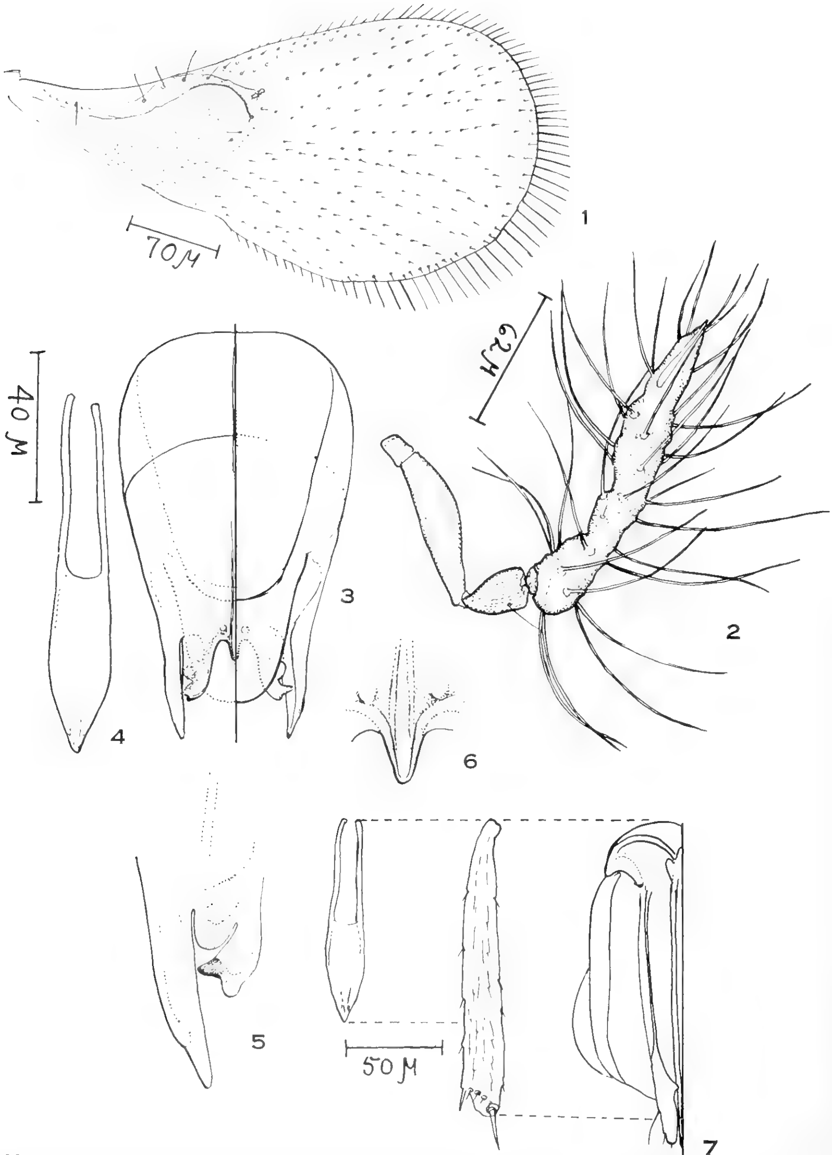

Fig. 1–7. *Trichogramma bennetti*, n. sp. 1, forewing. 2, antenna of male. 3, male genitalia. 4, aedeagus. 5, enlarged view of chelate structure. 6, enlarged view of median ventral projection. 7, relative lengths of aedeagus, hind tibia and ovipositor.

⅙ the width of wing (fig. 1). Antennal hairs finely tapering and long, the longest being nearly 3 times the maximum width of flagellum (fig. 2).

Genitalia (fig. 3): Dorsal expansion of gonobase highly chitinized and simple with characteristically rounded, bulbous posterior extremity reaching level of chelate structure. Sides of dorsal gonobase expansion nearly parallel. Chelate structure (fig. 5) appears bilobed and is located far below tips of gonoforceps. Median ventral projection (fig. 6) minute but visible. Median ventral ridge paired, extending to about one-third the entire length of genitalia. Aedeagus (fig. 4) stout but posterior end pointed, appearing somewhat spear-shaped; shorter than apodemes, both together slightly shorter than genitalia and distinctly shorter than hind tibia (fig. 7).

Female: Pigmentation same as of male. Ovipositor slightly longer than hind tibia (fig. 7).

Holotype: Male from Trinidad (West Indies); ex eggs of *Hypsipyla ferrealis* Hmps. on *Carapa guyanensis*; 1968 (F. D. Bennett coll.) in the U.S. National Museum, Washington, D.C., USNM no. 71352 mounted on slide. Male genitalia dissected and mounted on slide. Allotype female also mounted on slide. Paratypes in Commonwealth Institute of Biological Control, Indian Station, Bangalore, India.

Remarks: *T. bennetti* was received from Dr. F. D. Bennett, CIBC West Indian Station, Trinidad, who reared it from eggs of *H. ferrealis* on *Carapa guyanensis*. Myers (1932) mentions an unidentified species of *Trichogramma* from the same host in Guyana, which could very well be the same as *T. bennetti*. If this is true, it is possible that the species occurs on the South American continent as well as on the adjoining islands.

Trichogramma californicum Nagaraja and Nagarkatti, new species
fig. 8–14

Male: Dull yellow with blackish thorax and abdomen. Fringe on tornus in fore-wing about ⅒ the width of wing (fig. 8). Antennal hairs somewhat blunt and short, the longest hair being nearly twice the maximum width of flagellum (fig. 9).

Genitalia (fig. 10): Dorsal expansion of gonobase highly sclerotized and triangular with slight constrictions at base; posterior tip of dorsal expansion of gonobase reaching level of chelate structure. Chelate structure (fig. 12) well below tips of gonoforceps. Median ventral projection (fig. 13) distinct and pointed, below level of chelate structure. Median ventral ridge paired, extending anteriorly to about ½ the length of genitalia. Aedeagus (fig. 11) slightly longer than apodemes, both together distinctly shorter than hind tibia (fig. 14).

Female: Color same as male. Ovipositor almost equal in length to hind tibia (fig. 14).

Holotype: Male from Alturas, Modoc County, northeastern California, U.S.A.; ex eggs of *Hemerocampa pseudotsugata* (McD.); 1967 (R. D. Doutt coll.) in the U.S. National Museum, Washington, D.C., USNM no. 71353. Male and dissected male genitalia mounted on

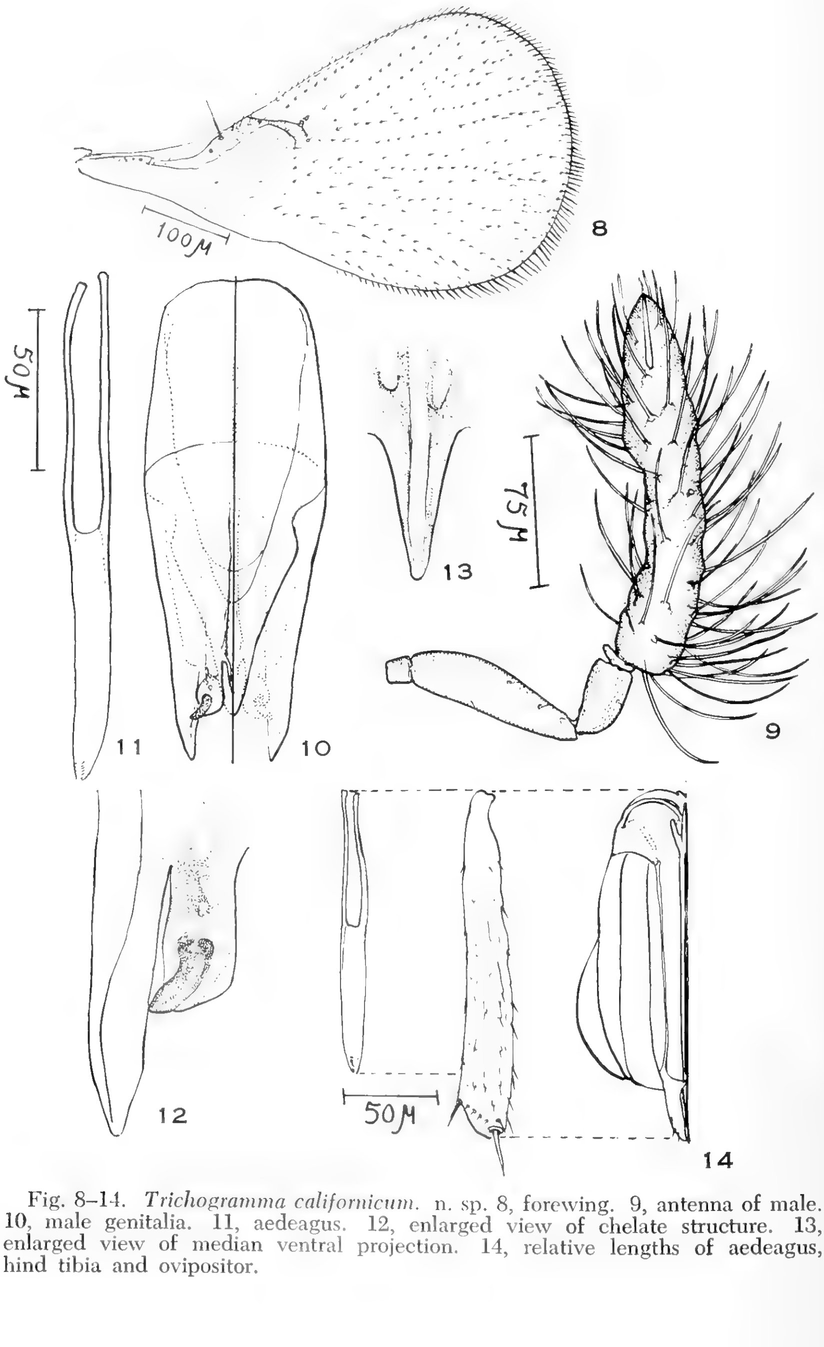

Fig. 8–14. *Trichogramma californicum.* n. sp. 8, forewing. 9, antenna of male. 10, male genitalia. 11, aedeagus. 12, enlarged view of chelate structure. 13, enlarged view of median ventral projection. 14, relative lengths of aedeagus, hind tibia and ovipositor.

slide. Allotype female on slide. Paratypes in the British Museum (Natural History), London.

Remarks: *Trichogramma californicum* was received from Dr. R. L. Doutt of the Division of Biological Control, University of California, Berkeley, and it had been suspected to be *T. euproctidis* (Girault).[3] Examination, however, revealed that the species is vastly different from *T. euproctidis*, which is of European origin. Moreover, the 2 species cross only to a very limited extent in the laboratory. *Trichogramma californicum* was reared from eggs of the Douglas fir tussock moth, *H. pseudotsugata*, in northeastern California. Although *T. californicum* appears to belong to the *T. minutum* Riley—*T. pretiosum* Riley complex, it can be differentiated from these species by the presence of short antennal hairs, the dark pigmentation, and the ovipositor to hind tibia ratio. *Trichogramma californicum* could be considered to bear semispecies status with respect to *T. semifumatum*, with which it crosses in both directions to a limited extent (Nagarkatti and Fazaluddin, in press). It may be pertinent to mention the receipt of a population of *Trichogramma* from the Netherlands (received from Dr. M. Gijswijt of the Agrobiologisch Laboratorium, 's Graveland) which closely resembles *T. californicum* in all respects except for the slightly darker pigmentation. Moreover, eggs of *C. cephalonica* when parasitized by *T. californicum* turn grayish brown in color on the 4th day, while those parasitized by the Netherlands population turn black in color, as is usual with other species. Laboratory crossing tests between the Netherlands population and *T. californicum* have shown that they are totally reproductively isolated.

Trichogramma maltbyi Nagaraja and Nagarkatti, new species
fig. 15–21

Male: Head yellow, thorax, abdomen and hind femur dark fuscous, except for light yellow intersclerital region and propodeum and basal part of abdomen. Fringe on tornus of fore-wing about 1/6 the width of wing (fig. 15). Antennal hairs finely tapering and very long, the longest hair being nearly 4 times the maximum width of flagellum (fig. 16).

Genitalia (fig. 17): Dorsal expansion of gonobase highly sclerotized with rounded sides, appearing cup-shaped when viewed from caudal end, constricted at base. Dorsal expansion of gonobase below tips of chelate structure. Chelate structure (fig. 19) almost reaching tips of gonoforceps. Median ventral projection (fig. 20) minute. Median ventral ridge paired, fused anteriorly, extending to

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[3] *Trichogramma euproctidis* (Girault) is reported by Dr. B. D. Burks (Systematic Entomology Laboratory, U.S. Dept. of Agriculture, Washington, D.C.) to be frequently encountered in material collected in the U.S.A. which he receives for identification. This species is not included in the key as it is believed to be of European origin and has been introduced into the U.S.A. *Trichogramma evanescens* Westwood frequently observed by the authors is also excluded for the same reason.

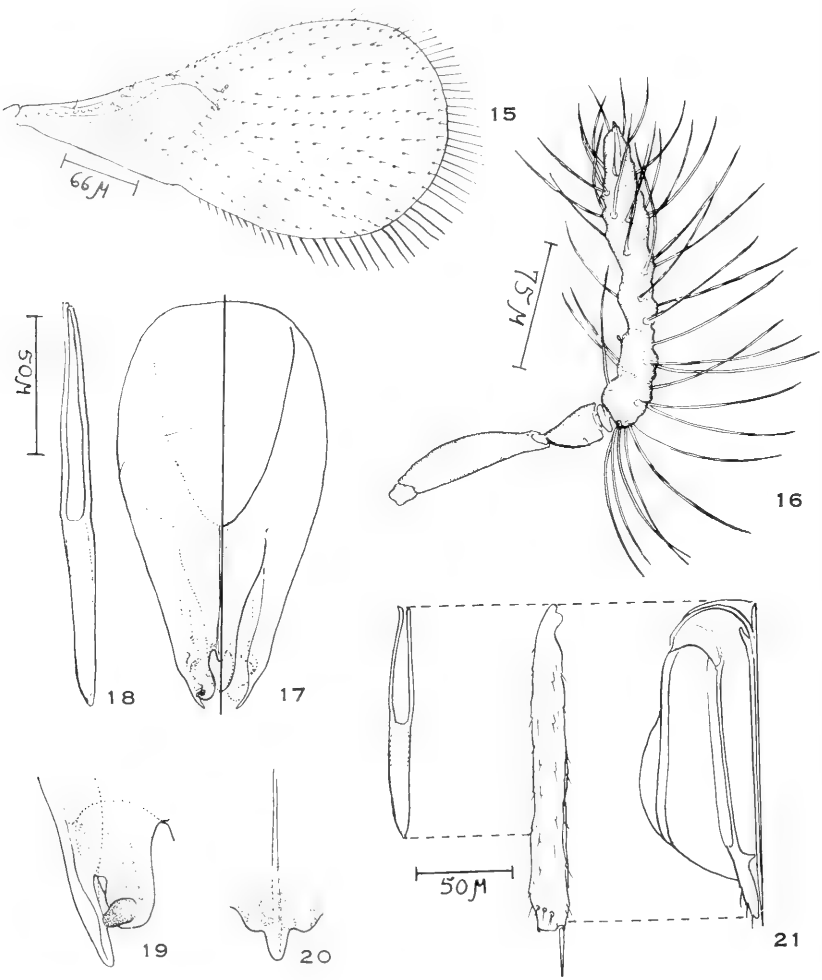

Fig. 15–21. *Trichogramma maltbyi.* n. sp. 15, forewing. 16, antenna of male. 17, male genitalia. 18, aedeagus. 19, enlarged view of chelate structure. 20, enlarged view of median ventral projection. 21, relative lengths of aedeagus, hind tibia and ovipositor.

about ⅘ the length of genitalia. Aedeagus (fig. 18) as long as apodemes, both together much shorter than hind tibia (fig. 21).

Female: Color same as male. Ovipositor nearly equal in length to hind tibia (fig. 21).

Holotype: Male from Berrien County, Niles, Michigan, U.S.A.; ex eggs of *Oulema melanopus* (L.) on oats; 1968 (H. Maltby coll.) in

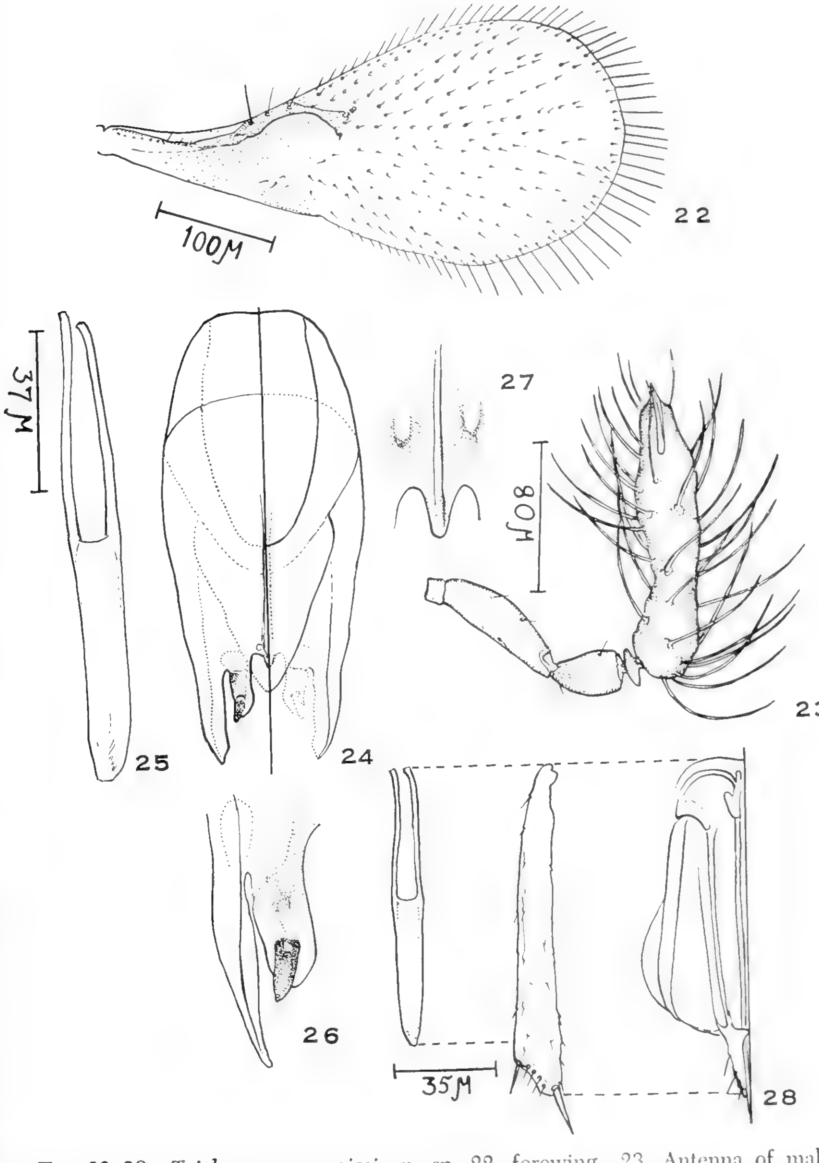

Fig. 22–28. *Trichogramma rojasi.* n. sp. 22, forewing. 23, Antenna of male. 24, male genitalia. 25, aedeagus. 26, enlarged view of chelate structure. 27, enlarged view of median ventral projection. 28, relative lengths of aedeagus, hind tibia and ovipositor.

the U.S. National Museum, Washington, D.C., USNM no. 71354. Male and dissected male genitalia mounted on slide. Allotype female on slide. Paratypes in the British Museum (Natural History), London.

Remarks: *Trichogramma maltbyi* was reared from eggs of *O. melanopus* and *Lema collaris* Say by Maltby *et al.* (1969). It was originally thought to be *T. evanescens*, a European species that has been introduced into the U.S.A., but crosses by the above authors proved that the 2 would not interbreed. Moreover, we have found that the male genitalia vastly differ in the 2 species, although the antennal hair length and pigmentation are comparable.

Trichogramma rojasi Nagaraja and Nagarkatti, new species
fig. 22–28

Male: Dull yellow with blackish thorax and abdomen. Fringe on tornus of fore-wing about ⅙ the width of wing (fig. 22). Antennal hairs rather blunt, short, the longest being slightly more than twice the maximum width of flagellum (fig. 23).

Genitalia (fig. 24): Dorsal expansion of gonobase highly chitinized, triangular with blunt apex and slightly constricted base. Chelate structure (fig. 26) slightly below tips of gonoforceps. Median ventral projection (fig. 27) short. Median ventral ridge paired, extending anteriorly to about ⅔ the length of genitalia. Aedeagus (fig. 25) as long as apodemes, both together shorter than hind tibia (fig. 28).

Female: Same color as male. Ovipositor slightly longer than hind tibia (fig. 28).

Holotype: Male from La Cruz, Chile; ex eggs of *Tatochila* sp. on *Trifolium* sp.; 1968 (Sergio Rojas coll.) in the U.S. National Museum, Washington, D. C., USNM no. 71355. Male and dissected male genitalia mounted on slide. Allotype female on slide. Paratype in the British Museum (Natural History), London and Collection of the Instituto de Investigaciones Agropecuarias, Sub-Estacion Experimental La Cruz, Chile.

Remarks: Dr. Sergio Rojas of the Sub-Estacion Experimental, Instituto de Investigaciones Agropecuarias, La Cruz, collected this species from eggs of *Tatochila* sp. on *Trifolium* and *Rachiplusia ou* Guén. on alfalfa and beans. This was originally believed to be either the same as or close to *T. semifumatum* (Perkins). Comparing it with specimens of *T. semifumatum* from U.S.A., we have found that they are distinct and hence consider *T. rojasi* as a distinct species.

Acknowledgments

The authors are grateful to Dr. F. D. Bennett, Dr. R. L. Doutt, Mr. H. Maltby, and Dr. S. Rojas for making specimens and live cultures of the *Trichogramma* spp. available for study. The guidance received from Dr. V. P. Rao, Entomologist-in-charge, CIBC Indian Station, is gratefully acknowledged.

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THE STATUS OF ENALLAGMA TRAVIATUM AND WESTFALLI (ODONATA: COENAGRIONIDAE)

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ABSTRACT—*Enallagma westfalli* is shown to be a subspecies of *E. traviatum*, differing in the character of the superior arm of the superior appendage of the male. The subspecies *westfalli* occurs west of the Appalachians from Pennsylvania and Michigan to Texas and Louisiana. The subspecies *traviatum* ranges from Massachusetts to northern Georgia, occurring east of the Appalachians. The extreme pale color of the type *westfalli* is not characteristic of the subspecies throughout most of its range.

In 1964 I described the new species *Enallagma westfalli* from eastern Texas, commenting that, ". . . clearly *westfalli* is congeneric with *traviatum* Selys and equally clearly with *pallidum* Root and *daeckii* (Calvert)." I also redefined the subgenus *Teleallagma* Kennedy, including in it *westfalli* with *pallidum* and *daeckii*. The principal criterion for the subgenus was reduction of the dark color in the 3 species.

Subsequent to this description several workers have commented to me on the similarity between *westfalli* and *traviatum* and have suggested the possible synonymy of the 2. To clarify this question I assembled a series of *Enallagma traviatum* which represents almost the entire geographic distribution of the species. The Leon County, Florida, specimens recorded by Byers (1930) were the only possibly critical specimens that I was not able to locate, and I studied no specimens from Illinois.

As a result of this investigation I conclude that *Enallagma westfalli* and *traviatum* are conspecific, that the structural differences between geographically extreme specimens require the recognition of 2 subspecies, and that the reduction of dark color in the typical *westfalli* is a relatively local phenomenon of limited taxonomic significance. There is a very slight tendency for southern populations of both *westfalli* (excepting the specimens from Texas, Oklahoma, and Louisiana, which stand apart in extreme reduction of dark color) and *traviatum* to be slightly paler than their northern counterparts, but a clinal variation cannot be convincingly demonstrated at this time. I also conclude that the subgenus *Teleallagma* should no longer be recognized because of the lack of a clear distinction among *traviatum* s.l., *pallidum*, and *daeckii*. I have already commented (1964) on the unreliability of the wing-venation characters for separating this taxon from *Enallagma*.

Enallagama traviatum traviatum Selys, new combination

Superior arm of male superior appendage long and thin, typically with distance from inferior arm to apical hook about 3 times the width of the superior arm in internal dorsolateral view (fig. 1). Specimens from North Carolina, South Carolina, and Georgia have arm perceptibly shorter and thicker (fig. 2) than typical specimens from the more northern part of the range, but with the ratio greater than about 2½ times. Distribution; east of Appalachians, Georgia to Massachusetts.

Enallagma traviatum westfalli, new combination

Superior arm of male superior appendage short and thick, typically with distance from inferior arm to apical hook about 2 times or less the width of this arm in internal dorsolateral view (fig. 4). Specimens from Indiana, Pennsylvania, and Tennessee have a slightly longer and thinner arm (fig. 3), but with the ratio less than 2½. Distribution: west of Appalachians, Texas to Michigan and western Pennsylvania.

One might well enquire as to why the impressive structural differences between typical *traviatum* and *westfalli* were not noticed previously. The answer may hinge somewhat on the history of the study

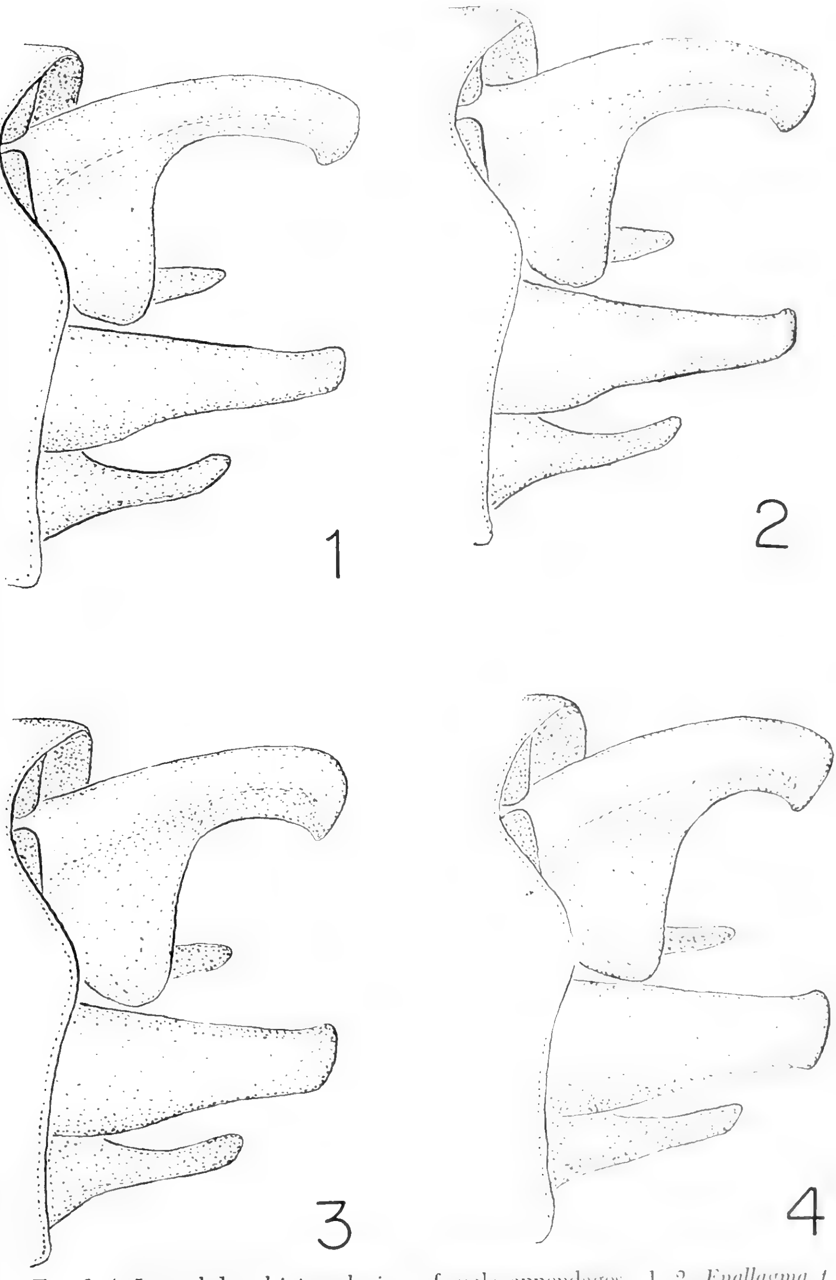

Fig. 1–4, Lateral-dorsal-internal view of male appendages. 1, 2, *Enallagma t. traviatum*: 1, Fruitland, Md.; 2, Wallace, S.C. Fig. 3, 4, *E. t. westfalli*: 3, Coffee Co., Tenn.; 4, Cleveland, Texas.

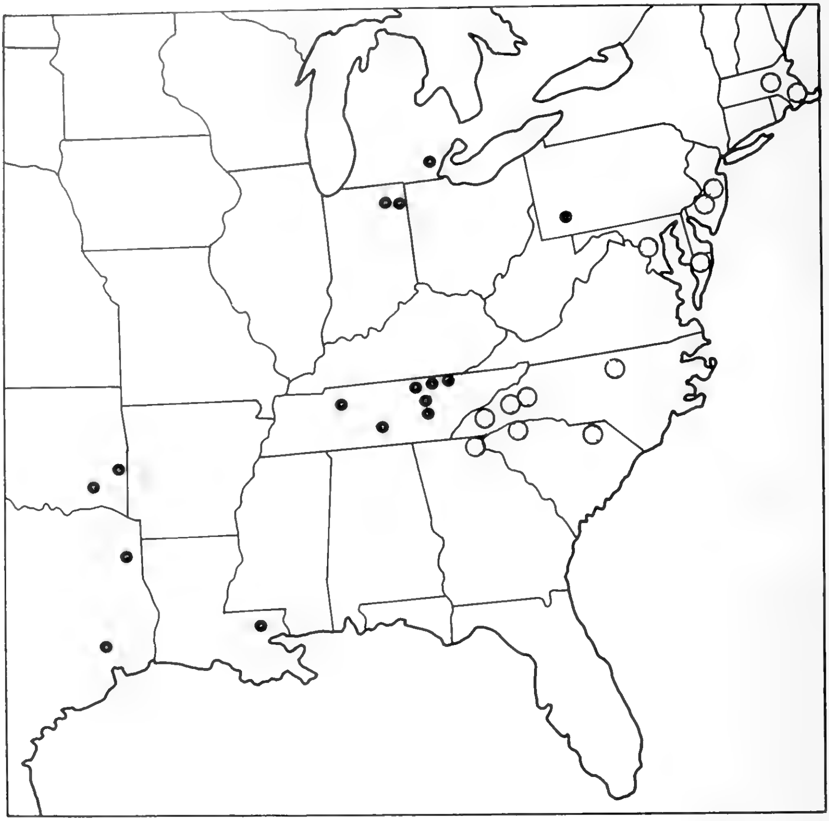

Fig. 5, Map showing localities of specimens studied. Open circles: *Enallagma t. traviatum*; solid circles: *E. t. westfalli*.

of Odonata in North America, which was confined almost entirely to the New England region between the Civil War and the end of the nineteenth century, but which shifted into the midwest in the early years of the twentieth century. After the turn of the century, acquaintance with the northeastern fauna diminished, a problem compounded by the apparent reluctance of American Odonatists to study those type specimens of northeastern Odonata that existed in the Hagen collection at the M.C.Z. (Montgomery, *in litt.*).

The series studied here (representing well over 100 male specimens), however, shows a nearly continuous variation in the character of the superior appendage. The greatest break in that series occurs between the North Carolina specimens and the Tennessee specimens, suggesting that the Appalachian Mountain system is the natural dividing line between the 2 forms. The variation, and the fact that only a very few specimens are difficult to assign to either taxon, establish the difference as typically subspecific. No differences could be found in female specimens, which are not included in the tabulation of specimens. The distinct tibial color pattern I noted (1964) in the nymph might also be an unreliable taxonomic criterion. Dennis Paulson (*in litt.*) has stated that a minority of *traviatum* nymphs he has studied in North Carolina have this stripe.

Material Studied

Collections designated as follows: MCZ, Museum of Comparative Zoology; ANSP, Academy of Natural Sciences, Philadelphia; TWD, Donnelly collection; UFla, University of Florida.

Enallagma t. traviatum

MASSACHUSETTS: Middlesex Co.; Sherborn, 16 July 1894, 1 ♂, Morse (MCZ); Lincoln, 4 July 1937, 1 ♂, C. H. Blake (MCZ); Plymouth Co.; Wareham, 8 July (yr?), 1 ♂ (MCZ). NEW JERSEY: Camden Co.; Clementon, 4 June 1908, 1 ♂, Calvert (ANSP); Gloucester Co.; Almonesson, 28 June 1916, 1 ♂, Calvert (ANSP). MARYLAND: Anne Arundel Co.; Waterford Mill, 10 June 1939, 1 ♂, E. G. Fisher (ANSP); Montgomery Co.; C & O Canal at Carderock, 9 July 1950, 3 ♂, Donnelly (TWD); Prince Georges Co.; Greenbelt Lake at Beltsville, 17 June 1951, 3 ♂, Cook (UFla); Wicomico Co.; Fruitland, 15 June 1954, 4 ♂, Donnelly (TWD). NORTH CAROLINA: Henderson Co.; Hendersonville, 13 June 1939, 1 ♂; 13 June 1940, 3 ♂; 18 June 1940, 3 ♂; 17 June 1941, 11 ♂; 18 June 1941, 1 ♂; 25 June 1941, 3 ♂, Westfall (UFla and Cornell); Jackson Co.; Cashiers, Cashiers Lake, 19 July 1967, 5 ♂, Westfall (UFla); Jackson Co.; Cashiers, Stevens-Magowan Ponds on US 64, 3 August 1967, 3 ♂, Westfall (UFla); McDowell Co.; Highway S-80, north of Pleasant Gardens, Lake Tahoma, 18 August 1967, 2 ♂, Westfall (UFla); Orange Co.; Glen Lennox Hill, Chapel Hill, 28 May 1965, 3 ♂, Paulson (UFla). SOUTH CAROLINA: Greenville Co.; Middle Saluda River nr. Marietta, 7 June 1958, Donnelly (TWD); Marlboro Co.; pond, 1.6 miles north of Wallace, 5 June 1966, 5 ♂, Paulson (TWD and UFla). GEORGIA: Rabun Co.; nr. Rabun Gap, roadside pond on US 23–441, 4 August 1967, 8 ♂, Westfall (UFla); Rabun Co.; Mountain City, lake at the "Playhouse," 4 August 1967, 3 ♂, Westfall (UFla); Rabun Co.; nr. Rabuns Gap, 3.5 miles west of US 23–441 on Wolfork Road, York's Fish pond, 15 August 1967, 1 ♂, Westfall (UFla); Rabun Co.; Pond 1.1 mile east of Satolah Post Office, 10 August 1967, 3 ♂, Westfall (UFla).

Enallagma t. westfalli

MICHIGAN: Washtenaw Co.; Third Sister Lake, 16 June 1934, 3 ♂, Gloyd (MCZ). INDIANA: Allen Co.; Viberg Lake, 14 June 1914, 1 ♂ (UFla), 24 July 1932, 1 ♂, Williamson (UFla); Whitley Co.; Round Lake, 24 June 1898, 1 ♂, Williamson (ANSP), 25 June 1898, 1 ♂, Williamson (ANSP). PENNSYLVANIA: Westmoreland Co.; Ligonier, 4 July 1960, 2 ♂, H. White (White). TENNESSEE: Blount Co.; Laurel Lake nr. Townsend, 2 July 1960, 6 ♂, Trogdon

(UFla); Campbell Co.; Cove Lake St. Pk., 13 June 1959, 2 ♂, Trogdon (UFla); Coffee Co.; Womack's Lake, 20 June 1959, 4 ♂, Trogdon (UFla); Cumberland Co.; Cumberland Mt. St. Pk., 14 June 1959, 2 ♂, Trogdon (UFla); Dickson Co.; Montgomery Bell St. Pk., 17 July 1959, 1 ♂, Trogdon (UFla); Overton Co.; Standing Stone St. Pk., 14 June 1959, 1 ♂, Trogdon (UFla); Pickett Co.; Pickett St. Pk., 23 August 1954, 1 ♂, Donnelly (TWD). OKLAHOMA: LeFlore Co.; Wister, 4 June 1907, 1 ♂ (MCZ); Pushmataha Co.; 1.5 miles north of Antlers, 13 June 1957, 1 ♂, Bick (Bick). TEXAS: Harrison Co., Sue Bell Lake, 30 May 1949, 1 ♂, J. E. Harwell (UFla); Liberty Co.; pond ½ mile west of Cleveland, (in addition to type series described by Donnelly (1964), 17 May 1964, 2 ♂, Donnelly (TWD).

Acknowledgments

I am extremely grateful to Dennis Paulson, Leonora Gloyd, B. Elwood Montgomery, Clifford Johnson, and Minter Westfall for discussions on the relationship of these species. I am further grateful to Paulson, Westfall, Harold White, and George Bick for the loan of specimens for this study.

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SIPHONAPTERA OF WISCONSIN

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ABSTRACT—Thirty-seven species of fleas (Siphonaptera) are listed for Wisconsin. Hosts and distribution by county are summarized for each species and any new records are presented in detail; primary references since Knipping et al. (1950) are listed in the synonymy under each species. *Chaetopsylla lotoris* (Stewart), *Conorhinopsylla stanfordi* Stewart, *Stenoponia americana* (Baker), *Tamiophila grandis* (Rothschild), *Peromyscopsylla scotti* Fox, and *Opisodasys pseudarctomys* (Baker) are recorded from the State for the first time.

Introduction

Knipping et al. (1950) listed 32 species of fleas from Wisconsin. Two probably were misdeterminations, 2 were synonyms, and 2 were undetermined. One of the last 2 is probably a species on their list. Johnson and Traub (1954), Haas and Dicke (1959), and Thompson (1966) each added a species new for the state. We have listed 107 records for some of these species and for 6 species not previously reported from the State. Thus, the present list has 37 species.

Distribution is summarized by counties, and unpublished records are presented in detail. Primary references are listed in the synonymy under each species starting with Knipping et al. (1950), except for earlier ones they missed. Genera and species of fleas are listed alphabetically under the presently accepted family names. Material listed for the first time is either in the collections of the authors, Milwaukee Public Museum (MPM), or University of Wisconsin (UW). The collector is not listed when it is Haas; it is unknown for a few collections from the Milwaukee Public Museum and University of Wisconsin.

The University of Wisconsin collection contains a male and a female *Malaraeus euphorbi* (Rothschild), labeled as "Ex Field Mouse, Madison, Wisc., 25 VIII 53, R. J. Dicke Coll." The specimens are excluded in the following list because we doubt the validity of the collection data.

Pulicidae

1. *Cediopsylla simplex* (Baker)

Cediopsylla simplex: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40: 199, 205, 206. Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:125–132, figs. 1, 2, 3. Steinhaus & Marsh, 1962, Hilgardia 33:465, 466.

Distribution. Adams, Brown, Columbia, Dane, Dodge, Door, Dunn, Forest, Grant, Green, Jackson, Jefferson, Juneau, Kenosha, La Crosse, La Fayette, Manitowoc, Marathon, Marinette, Milwaukee, Monroe, Pierce, Polk, St. Croix, Sauk, Trempealeau, Vernon, Waukesha, and Wood Counties.

Additional Record. Adams County (Adams): 1 ♂, 1 ♀, ex *Vulpes vulpes* L. 18.XII.1965, F. Easterman (MPM).

Hosts. *Canis familiaris* L. (dog), *Canis latrans* Say (coyote), *Felis catus* L. (cat), *Procyon lotor* (L.) (raccoon), *Sylvilagus floridanus* (Allen) (eastern cottontail), and *V. vulpes* (red fox).

2. *Ctenocephalides canis* (Curtis)

Ctenocephalus canis: Moll, 1917, J. Parasitol. 4:89.

Ctenocephalides canis: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:200, 205.

Distribution. Dane, Manitowoc, Milwaukee, and Rock Counties.

Additional Records. Dane County (Madison): 1 ♀, 29.V.1958, Carmody (UW). Manitowoc County (Two Rivers): 3 ♂♂, 3 ♀♀, ex garden soil, 18.VIII.1954, R. P. Rehnauer (UW).

Hosts. *C. familiaris*, *Rattus norvegicus* (Berkenhout) (Norway rat), and garden soil.

3. *Ctenocephalides felis felis* (Bouché)

Ctenocephalides felis: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:200, 205.

Ctenocephalides felis felis: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132.

Distribution. Dane, Grant, and Milwaukee Counties.

Additional Records. Dane County (Madison): 1 ♂, ex *Didelphis marsupialis* L., 2.X.1956, H. G. Cooke; 2 ♂♂, 1 ♀, ex *Homo sapiens* L., 2.IV.1954, R. J. Dicke (UW); 1 ♂, 1 ♀, in house, 11.IX.1951, R. J. Dicke (UW); 1 ♀, in house, 16.IX.1955, L. Smith; (Stoughton): 6 ♂♂, 1 ♀, ex *F. catus*, 15.VIII.1925, A. A. Granovsky (UW). Grant County: 1 ♂, 29.V.1960, R. Mergen (UW). Milwaukee County (Milwaukee): 1 ♀, ex *F. catus*, 10.III.1949, K. MacArthur (MPM); 1 ♂, 1 ♀, ex *H. sapiens*, 30.XI.1954, I. Hauke (MPM); 2 ♂♂, 1 ♀, ex *H. sapiens*, 10.VII.1956, T. Glendenning (MPM); 1 ♂, 1 ♀, ex *H. sapiens*, 17.IX.1957, C. Bagley (MPM); 1 ♀, ex *H. sapiens*, 27.X.1958, R. Ash (MPM); 1 ♂, 1 ♀, ex *H. sapiens*, 17.VIII.1959, J. C. Warner (MPM); (West Allis): 1 ♂, 1 ♀, ex *H. sapiens*, 15.X.1952, R. Wentzel (MPM).

Hosts. *D. marsupialis* (opossum), *F. catus*, *H. sapiens* (man), *S. floridanus*, and in house.

4. *Euhoplopsyllus glacialis affinis* (Baker)

Hoplopsyllus affinis: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:200, 206.

Distribution. Pierce County.

Host. *Lepus americanus* (lapsus for *L. townsendii*?).

Knipping et al. (1950) listed this rabbit flea from "Jack rabbit (*Lepus americanus*) Pierce County, 7/1/41, 4 males, 4 females." The white-tailed jack rabbit, *L. townsendii* Bachman, is the only species of *Lepus* recorded from Pierce County by Jackson (1961). *L. americanus* Erxleben is the snowshoe rabbit.

5. *Xenopsylla cheopis* (Rothschild)

Xenopsylla cheopis: Schiller & Morgan, 1949, J. Parasitol. 35(6, Sec. 2):40. Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:200, 206.

Distribution. Dane and Milwaukee Counties.

Additional Records. Milwaukee County (Milwaukee): 1 ♂, 1 ♀, ex *R. norvegicus*, 15.XI.1947, R. Larsen (MPM); 1 ♂, 4.XI.1947, R. L. & K. MacArthur (MPM).

Hosts. *Mesocricetus auratus* (Waterhouse) (golden hamster), *Mus musculus* L. (house mouse), and *R. norvegicus*.

Vermipsyllidae

6. *Chaetopsylla lotoris* (Stewart)

Distribution. Adams and Ozaukee Counties.

Records. Adams County (Adams): 1 ♂, 1 ♀, ex *V. vulpes*, 18.XII.1965, F. Easterman (MPM). Ozaukee County (Friedsburg?): 2 ♂♂, 3 ♀♀, ex *P. lotor*, 23.XI.1951, K. MacArthur (MPM).

Hosts. *P. lotor* and *V. vulpes*.

These are the first records for the species from Wisconsin.

Hystrichopsyllidae

7. *Conorhinopsylla stanfordi* Stewart

Distribution. Iowa County.

Records. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♀, ex *Peromyscus* sp. nest, 16.XI.1967, J. O. Jackson (UW); 1 ♀, same data except 30.XI.1967; 1 ♂, same data except 23.XII.1968.

Host. *Peromyscus* sp. nest.

These are the first records for the species from Wisconsin.

8. *Corrodopsylla curvata curvata* (Rothschild)

Doratopsylla curvata: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:205.

Distribution. Dane and Iowa Counties.

Additional Records. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♀, ex *Peromyscus* sp. nest, 14.X.1968, J. O. Jackson (UW). No locality: 1 ♂, ex *Peromyscus* sp. nest, 22.VII.1968, JOJ (UW).

Hosts. *Blarina brevicauda* (Say) (short-tailed shrew), *Sorex cinereus* Kerr (masked shrew), and nest of *Peromyscus* sp.

9. *Ctenophthalmus pseudagyrtes pseudagyrtes* Baker

Ctenopthalmus (sic) *pseudagyrtes*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:200, 205, 206.

Ctenophthalmus (*Nearctoctenophthalmus*) *pseudagyrtes pseudagyrtes*: Hopkins & Rothschild, 1966, An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) in the British Museum (Natural History), vol. IV, p. 535.

Distribution. Bayfield, Dane, Iowa, Jefferson, and Walworth Counties.

Additional Records. Dane County: 1 ♂, ex *Tamias striatus* (L.), 6.III.1956; 15 ♂♂, 22 ♀♀, ex ?*Microtus* nest, 21.IV.1957; 1 ♂, 1 ♀, same data except 25.IV.1957. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 2 ♀♀, ex 2 *Peromyscus leucopus* (Rafinesque), 4.VII.1967, J. O. Jackson (UW); 1 ♂, ex *P. leucopus* nest, 16.XI.1967, JOJ (UW); 1 ♂, same data except 3.II.1968. Walworth County (Lake Geneva): 1 ♀, ex *D. marsupialis*, 20.VII.1971, (UW).

Hosts. *B. brevicauda*, *D. marsupialis*, *Eutamias minimus* (Bachman) (least chipmunk), *Microtus pennsylvanicus* (Ord) (meadow vole), *Mustela frenata* Lichtenstein (long-tailed weasel), *Peromyscus* sp., *P. leucopus* (white-footed mouse), *S. cinereus*, *T. striatus* (eastern chipmunk), and nests of ?*Microtus* and *P. leucopus*.

10a. *Epitedia wenmanni wenmanni* (Rothschild)

Epitedia wenmani (sic): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 205, 206.

Epitedia wenmanni wenmanni: Benton, 1955, J. Parasitol. 41:493(fig. 2). Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132. Hopkins & Rothschild, 1962, An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) in the British Museum (Natural History), vol. III, p. 249.

Distribution. Dane County.

Additional Records. Dane County (Madison): 1 ♂, 1 ♀, ex *Peromyscus ?maniculatus* (Wagner), 12.XI.1956; 1 ♀, ex *T. striatus*, 18.IX.1956.

Hosts. *B. brevicauda*, *M. pennsylvanicus*, *Peromyscus* sp., *P. ?maniculatus* (deer mouse), *S. floridanus*, *T. striatus*, and nest of *?Microtus*.

10b. *Epitedia wenmanni testor* (Rothschild)

Distribution. Iowa County.

Records. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♂, ex *P. leucopus* nest, 15.III.1968, J. O. Jackson (UW); 1 ♂, 2 ♀♀, same data except 22.III.1968.

Hosts. *P. leucopus* nest.

These are the first records for the subspecies from Wisconsin.

Benton (1955) included southwestern Wisconsin within the range of *E. w. wenmanni* without indicating having seen specimens from the region. He examined an intergrade specimen from northeastern Iowa and included the area in the zone of intergradation. The Wisconsin specimens of *E. wenmanni* that we examined indicate the existence of a population of *E. w. testor* in Clyde Township, Iowa County, and suggest a zone of intergradation between that locality and Madison, Dane County, only about 64 km to the east.

Only males are considered here as females cannot be determined with assurance (see Holland and Benton, 1968). Males are separated on the basis of measurement "A," that is, the distance from the most dorsal margin of second lobe of fixed process of clasper to the most dorsal margin of condyle of movable process. Holland and Benton (1968) gave measurement "A" as 45 to 60 μ in *E. w. wenmanni* and 80 to 96 μ in *E. w. testor*. The male listed previously as *E. w. wenmanni* measured 58 μ, and the 2 males listed above as *E. w. testor* measured 82 and 96 μ. We examined an intergrade male with a measurement of 62 μ. This specimen and a female were collected in the University of Wisconsin Arboretum, Madison, Dane County, from a *P. leucopus* nest on 12.XI.1966 by Mertins & Klein (UW).

11. *Nearctopsylla genalis* (Baker)

Nearctopsylla genalis: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 205.

Distribution. Bayfield County.

Hosts. *B. brevicauda* and *S. cinereus*.

The subspecies is probably *N. g. hygini* (Rothschild).

12. *Rhadinopsylla fraterna* (Baker)

Rectofrontia fraterna: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203, 205.

Distribution. Dane County.

Hosts. *B. brevicauda* and *S. cinereus*.

The occurrence of this species in Wisconsin should be confirmed in view of Smit's (1957) recent work.

13. *Stenoponia americana* (Baker)

Distribution. Douglas County.

Records. Douglas County: 1 ♀, 27.XI.1943, (MPM); (Jct. Moose and St. Croix Rivers (ca. 13 km W of Gordon)): 2 ♀♀, ex *Clethrionomys gapperi* (Vigors), 27.XI.1943, W. Pelzer (MPM).

Host. *C. gapperi* (red-backed mouse).

These are the first records for the species from Wisconsin.

14. *Tamiophila grandis* (Rothschild)

Distribution. Walworth County.

Record. Walworth County: 1 ♀, ex *Sciurus niger* L., 27.IX.1956, T. Koerber.

Host. *S. niger* (fox squirrel).

This is the first record for the species from Wisconsin.

LEPTOPSYLLIDAE

15. *Odontopsyllus multispinosus* (Baker)

Odontopsyllus multispinosus: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:202, 206. Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48: 125, 126, 128, 129, 131, 132. Hopkins & Rothschild, 1971, An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) in the British Museum (Natural History), vol. V, p. 284.

Distribution. Buffalo, Dane, Grant, Jackson, Sauk, Trempealeau, and Vernon Counties.

Host. *S. floridanus*.

16. *Peromyscopsylla catatina* (Jordan)

?*Peromyscopsylla catatina*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:205, 206.

P. catatina no doubt occurs in northern Wisconsin since it was recorded from Iron County, Michigan (Lawrence et al., 1965) and northcentral Minnesota (Benton et al., 1971). Nevertheless, the record of Knipping et al. (1950) is questionable (see following discussion of *P. h. hamifer*).

17. *Peromyscopsylla hamifer hamifer* (Rothschild)

Peromyscopsylla catatina (3 not seen): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:205, 206.

Peromyscopsylla hamifer hamifer: Johnson & Traub, 1954, Smithson. Misc. Collns. 123(4):45.

Distribution. Bayfield County.

Host. *M. pennsylvanicus*.

Traub informed us (pers. comm., 1972) that the Wisconsin specimen of *P. h. hamifer* now in the National Museum of Natural History and listed by Johnson and Traub (1954) from *Microtus* sp. in Bayfield County had earlier been misdetermined as *P. catatina*. It was a female collected by "P.K." at Cable, Bayfield County, on 16 October 1948. Thus, it is probably 1 of 4 females collected in that county on the same day from *M. p. pennsylvanicus* and listed as *P. catatina* by Knipping et al. (1950). We were unsuccessful in locating the remaining specimens of this series.

18. *Peromyscopsylla scotti* Fox

Distribution. Iowa County.

Records. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 2 ♀♀, ex *P. leucopus*, 22.VIII.1967, J. O. Jackson (UW); 1 ♂, same data except 12.IX.1967.

Host. *P. leucopus*.

These are the first records for the species from Wisconsin.

CERATOPHYLLIDAE

19. *Ceratophyllus gallinae* (Schrank)

Ceratophyllus gallinae: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201.

Distribution. Door, Forest, Kewaunee, Manitowoc, Marinette, and Milwaukee Counties.

Additional Records. Door County (Egg Harbor): 3 ♀♀, ex *H. sapiens* in chicken house, 7.X.1946, (UW). Forest County (Crandon): 1 ♀, ex *H. sapiens*, 20.IV.1952, (MPM). Kewaunee County (Kewaunee): 2 ♂♂, 1 ♀, ex *H. sapiens*, 9.X.1944, F. Levy (MPM). Marinette County (Marinette): 1 ♂, 1 ♀, ex *H. sapiens* in chicken coop, 1.VI.1950, F. Goldstein (MPM). Milwaukee County (Hales Corners): 1 ♂, ex *H. sapiens*, 15.IV.1955, (MPM); (Milwaukee): 1 ♀, ex *H. sapiens*, 20.IV.1955, K. MacArthur (MPM); 1 ♀, ex *R. norvegicus*, 10.IV.1948, (MPM); (Wauwatosa): 1 ♀, ex *H. sapiens*, 4.I.1955, (MPM).

Hosts. *H. sapiens*, *R. norvegicus*, and *H. sapiens* in chicken coop and chicken house.

20. *Ceratophyllus garei* Rothschild

Ceratophyllus garei: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201, 206.

Distribution. Dane County.

Host. *Circus cyaneus* (L.) (marsh hawk).

21. *Ceratophyllus idius* Jordan and Rothschild

Ceratophyllus idius: Thompson, 1966, Proc. Ent. Soc. Wash. 68:45, 46.

Distribution. Dane County.

Hosts. *Passer domesticus* (L.) (nest) (house sparrow) and *Progne subis* (L.) (nest) (purple martin).

The nest materials were collected in late October from a purple martin house vacated by martins and occupied by house sparrows (Thompson, 1966).

22. *Ceratophyllus styx riparius* Jordan and Rothschild

Ceratophyllus riparius: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201, 206.

Ceratophyllus riparius riparius: Smit, 1956, Opusc. Ent. 21:141(fig. 12 (topotype)), 142(fig. 15 (topotype)), 143, 144.

Distribution. Milwaukee County (type locality: Bay View, Milwaukee).

Additional Record. Milwaukee County (Bay View, Milwaukee): 8 ♂♂, 4 ♀♀, ex *Riparia riparia* (L.), 13.V.1911, A. C. Burrill & R. A. Muttkowski (MPM) (topotypes).

Host. *Riparia riparia* (bank swallow) and nest.

Smit (1969) considered *C. riparius* to be a subspecies of *C. styx* Rothschild, a flea of *R. riparia. Ceratophyllus styx riparius* is the only subspecies in North America; 3 additional subspecies occur in Europe and Asia.

Jordan and Rothschild (1920) stated that their Wisconsin specimens were collected from a nest of *R. riparia* in May 1911 by R. A. Muttkowski. Smit (pers. comm., 1972) informed us that the specimens were collected on 9 May 1911, 4 days before the collection by Burrill and Muttkowski.

23. *Megabothris acerbus* (Jordan)

Megabothris acerbus: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201, 206.

Distribution. Vilas County.

Host. *Tamiasciurus hudsonicus* (Erxleben) (red squirrel).

24. *Megabothris asio megacolpus* (Jordan)

Megabothris asio: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201, 205, 206.

Megabothris asio megacolpus: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132.

Megabothris asio asio: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts. Let. 48:132.

Distribution. Dane and Iowa Counties.

Additional Records. Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♂, ex *Peromyscus* sp. nest, 7.XI.1967, J. O. Jackson (UW); 1 ♀, same data except 30.VI.1969.

Hosts. *M. pennsylvanicus*, *Mustela vison* Schreber (mink), *S. floridanus*, and nest of *Peromyscus* sp.

25. *Megabothris quirini* (Rothschild)

Megabothris quirini: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:201, 206.

Distribution. Bayfield County.

Host. *M. pennsylvanicus*.

26. *Monopsyllus eumolpi eumolpi* (Rothschild)

Monosopsyllus (sic) *eumolpi*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 206.

Distribution. Bayfield County.

Host. *E. minimus.*

27. *Monopsyllus vison* (Baker)

Monosopsyllus (sic) *vison*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 206.

Distribution. Bayfield, Dane, Florence, and Sheboygan Counties.

Additional Records. Bayfield County (Bayfield): 1 ♂, 1 ♀, ex weasel, 28.XI.1914, J. G. S. (UW). Florence County: 1 ♂, ex *T. hudsonicus*, X.1959, R. E. Mumford.

Hosts. *Mustela* sp. (weasel), *Peromyscus* sp., *Spermophilus franklinii* (Sabine) (Franklin's ground squirrel), and *T. hudsonicus.*

28. *Monopsyllus wagneri* (Baker)

Megabothris wagneri: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:202, 205, 206.

Monosopsyllus (sic) *wagneri*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 206.

Monopsyllus wagneri systaltus (Jordan): Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132.

Monopsyllus wagneri: Johnson, 1961, U.S. Dept. Agr. Tech. Bull. No. 1227:38. Haas, 1970, J. Mammal. 51:796.

Distribution. Dane, Iowa, Juneau, and Sheboygan Counties.

Additional Records. Dane County: 1 ♂, 1 ♀, ex *Peromyscus* sp., 12.VII.1956; 1 ♂, ex *P. ?maniculatus*, 4.XI.1956; 1 ♂, ex *?Microtus* nest, 21.IV.1957; (University of Wisconsin Arboretum): 6 ♂♂, 4 ♀♀, ex *P. leucopus* nest, 12.XI.1966, Mertins & Klein (UW). Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♀, ex *P. leucopus*, 11.VII.1967, J. O. Jackson (UW); 1 ♂, ex *P. leucopus* nest, 22.III.1968, JOJ. (UW).

Hosts. *B. brevicauda*, *Peromyscus* sp., *P. leucopus*, *P. ?maniculatus*, *S. floridanus*, nests of *?Microtus* and *P. leucopus*, and den of *V. vulpes.*

29. *Nosopsyllus fasciatus* (Bosc)

Ceratophyllus fasciatus: Moll, 1917, J. Parasitol. 4:89.

Nosopsylla fasciata: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40: 202.

Nosopsyllus fasciatus: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132.

Distribution. Dane and Milwaukee Counties.

Additional Record. Milwaukee County (Milwaukee): 1 ♂, 1 ♀, ex *R. norvegicus*, 15.XI.1947, R. Larsen (MPM).

Hosts. *R. norvegicus* and *S. floridanus.*

30. *Opisocrostis bruneri* (Baker)

Opisocrostis brunneri (sic): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:202, 205, 206.

Opisocrostis bruneri: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48: 131, 132. Steinhaus & Marsh, 1962, Hilgardia 33:465. Haas, 1965, J. Med. Ent. 2:140, fig. 1. Haas, 1970, J. Mammal. 51:796, 797.

Distribution. Dane, Fond du Lac, Jefferson, Juneau, Kenosha, Rock, and Waukesha Counties.

Additional Records. Dane County: 6 ♂♂, 1 ♀, ex *Spermophilus tridecemlineatus* (Mitchill), 22.VI.1956; 1 ♂, same data except 24.VI.1956; 1 ♀, ex *T. striatus*, 10.VIII.1956; 1 ♂, 1 ♀, same data except 17.VIII.1956; 2 ♂♂, same data except 23.IX.1956. Fond du Lac County: 2 ♀♀, ex *S. tridecemlineatus*, 30.IX.1956. Jefferson County (Aztalan State Park): 3 ♂♂, 6 ♀♀, ex *S. tridecemlineatus* burrow entrance, 2.VIII.1958. Rock County: 6 ♂♂, 6 ♀♀, ex 3 *S. tridecemlineatus*, 3.V.1956. Waukesha County: 5 ♂♂, 11 ♀♀, ex *S. tridecemlineatus*, 6.VI.1956; 3 ♂♂, 1 ♀, same data except 27.IX.1956.

Hosts. *S. franklinii*, *S. tridecemlineatus* (thirteen-lined ground squirrel), *S. floridanus*, *T. striatus*, burrow of *S. tridecemlineatus*, and den of *V. vulpes*.

31. *Opisodasys pseudarctomys* (Baker)

Distribution. Florence County.

Record. Florence County: 15 ♂♂, 6 ♀♀, ex *Glaucomys sabrinus* (Shaw), X.1959, R. E. Mumford.

Host. *G. sabrinus* (northern flying squirrel).

This species is recorded from Wisconsin for the first time.

32. *Orchopeas caedens caedens* (Jordan)

Orchopeas cadens (sic): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:202, 206.

Orchopeas howardi (1 not seen): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203, 206.

Distribution. Dane, Florence, Jackson, Manitowoc, and Sheboygan Counties.

Additional Record. Florence County: 1 ♂, ex *G. sabrinus*, X.1959, R. E. Mumford.

Hosts. *G. sabrinus*, *G. volans* (L.) (southern flying squirrel), *Peromyscus* sp., *Sciurus carolinensis* Gmelin (gray squirrel), and *T. hudsonicus*.

We have examined a specimen in the University of Wisconsin collection that is probably 1 of 2 females listed as *Orchopeas howardi* from northern flying squirrel in Jackson County by Knipping et al. (1950). They gave the scientific name as *Glaucomys volans*, the southern flying squirrel, and Jackson (1961) indicated that this is the species known to occur in Jackson County. The slide is labeled, "*Orchopeus cadens* (sic), No. 15 B.B.M." on the front and, "*Orchopeas howardi*" on the back. The specimen is an *O. c. caedens*. It has the sclerotized ridge on the lower lobe of sternum VII typical of this subspecies.

33. *Orchopeas howardii howardii* (Baker)

Orchopeas wickhami: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203, 205, 206.

?*Orchopeas howardi*: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203, 206.

Orchopeas howardii howardii: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132.

Distribution. Columbia, Dane, Iowa, Jackson, Milwaukee, and Walworth Counties.

Additional Records. Columbia County (Portage): 1 ♂, ex *S. niger*, 14.X.1951, W. J. Woodman (UW); same data except 11.I.1952 (UW). Dane County: 2 ♀♀, ex *D. marsupialis*, 30.III.1956; 1 ♀, same data except 9.VII.1956; 1 ♀, ex *Hylocichla ustulata* (Nuttall), 25.V.1957, J. Martz (UW); 3 ♂♂, 1 ♀, ex *S. carolinensis*, 4.V.1956; (Madison): 2 ♂♂, ex *S. niger*, 15.V.1955, D. Lupton (UW). Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♀, ex *Peromyscus* sp. nest, 4.V.1968, J. O. Jackson (UW). Milwaukee County (Milwaukee): 1 ♂, 4 ♀♀, in attic containing squirrel nest and dead squirrel, 3.V.1951, L. A. Penn (MPM). Walworth County: 1 ♂, 2 ♀♀, ex *S. niger*, 27.IX.1956, T. Koerber.

Hosts. *D. marsupialis*, *H. ustulata* (olive-backed thrush), *M. auratus*, *S. carolinensis*, *S. niger*, *S. floridanus*, nest of *Peromyscus* sp., and in attic.

Orchopeas howardi of Knipping et al. (1950) is listed questionably here because 1 of their 2 specimens is probably the *O. c. caedens* specimen in the University of Wisconsin collection (see previous discussion of *O. c. caedens*). We have not seen the other specimen.

34. *Orchopeas leucopus* (Baker)

?*Orchopeas* sp.: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203.

Orchopeas leucopus: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:202, 205, 206. Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48: 131, 132.

Distribution. Bayfield, Dane, Dodge, Door, Iowa, Jefferson, Sheboygan, and Walworth Counties.

Additional Records. Dane County: 3 ♂♂, 3 ♀♀, ex *Peromyscus* sp., 28.III.1956; 2 ♀♀, same data except 8.V.1956; 1 ♂, same data except 17.VI.1956; 1 ♀, ex *P. ?maniculatus*, 4.XI.1956; 2 ♀♀, same data except 12.XI.1956; 1 ♀, ex *T. striatus*, 8.VII.1956; (University of Wisconsin Arboretum): 7 ♂♂, 15 ♀♀, ex *P. leucopus* nest, 12.XI.1966, Mertins & Klein (UW). Iowa County (Clyde Twp., Sec. 12 (1.6–3.2 km S of Clyde)): 1 ♀, ex *P. leucopus*, 11.VII.1967, J. O. Jackson (UW); 1 ♂, 1 ♀, ex *P. leucopus* nest, 9.III.1968, JOJ (UW); 1 ♂, same data except 22.III.1968. Walworth County (Lake Geneva): 1 ♀, ex *D. marsupialis*, 20.VII.1971, (UW).

Hosts. *D. marsupialis*, *M. pennsylvanicus*, *M. frenata*, *Ondatra zibethicus* (L.) (muskrat), *Peromyscus* sp., *P. leucopus*, *P. ?maniculatus*, *S. floridanus*, *T. striatus*, *Zapus hudsonius* (Zimmermann) (meadow jumping mouse), and nest of *P. leucopus*.

35. *Oropsylla arctomys* (Baker)

Oropsylla arcotomys (sic): Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:203, 205.

Distribution. Adams, Crawford, Dane, and Pierce Counties.

Additional Records. Adams County (Adams): 1 ♀, ex *V. vulpes*, 18.XII.1965, F. Easterman (MPM). Dane County: 1 ♀, ex *Marmota monax* (L.), 6.VIII.1956; 1 ♀, ex *Mephitis mephitis* (Schreber), 15.X.1956. Pierce County (Prescott): 1 ♂, 1 ♀, ex *M. monax*, 16.VII.1910, (MPM).

Hosts. *D. marsupialis*, *M. monax* (woodchuck), *M. mephitis* (striped skunk), *Taxidea taxus* (Schreber) (badger), and *V. vulpes*.

The specimen from *M. mephitis* was found in a lock of its hair in the box trap after release of the host.

36. *Thrassis bacchi bacchi* (Rothschild)

Thrassis sp.: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:204, 205.
Thrassis bacchi bacchi: Haas & Dicke, 1959, Trans. Wisc. Acad. Sci. Arts Let. 48:131, 132. Haas, 1970, J. Mammal. 51:796. Stark, 1970, Univ. Calif. Pub. Ent. 53:98(map 6), 101, 103, 104, fig. 246.

Distribution. Dane County.

Additional Records. Dane County: 1 ♂, ex *S. tridecemlineatus*, 25.VI.1956; 2 ♂♂, same data except 22.VIII.1956; 3 ♂♂, 1 ♀, same data except 26.VIII.1956.

Hosts. *M. vison*, *S. tridecemlineatus*, *S. floridanus*, and den of *V. vulpes*.

Ischnopsyllidae

37. *Myodopsylla insignis* (Rothschild)

Myodopsylla insignis: Knipping et al., 1950, Trans. Wisc. Acad. Sci. Arts Let. 40:205. Smit, 1958, Proc. Ent. Soc. Wash. 60:176(fig. 5).

Distribution. Dane, Dodge, and Richland Counties.

Additional Records. Dane County (Madison): 1 ♀, ex *Myotis lucifugus* (Le Conte), 17.VIII.1956, T. Koerber; 1 ♀, ex bat, 5.VII.1960, M. L. Noller (UW); (Oregon): 2 ♀♀, ex bat, 22.IX.1966, R. D. Shenefelt (UW). Dodge County (Iron Ridge Mine): 1 ♀, ex *Myotis* sp., 17.IV.1971, N. D. Watts (UW). Richland County (Eagle Cave): 1 ♂, ex *M. lucifugus*, 6.XI.1954, R. E. Lewis (UW).

Host. *M. lucifugus* (little brown myotis).

Acknowledgments

We are grateful to K. MacArthur, Milwaukee Public Museum, Wisconsin; Dr. A. H. Benton, State University College, Fredonia, N.Y.; and L. J. Bayer, J. O. Jackson, and Dr. G. R. DeFoliart, University of Wisconsin, Madison, for loan of specimens and permission to publish on them. We thank Dr. R. Traub, University of Maryland, Baltimore, for information on *P. hamifer* and F. G. A. M. Smit, British Museum (Natural History), London, for information on *C. styx riparius*.

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PARAPYCNODERES, A NEW GENUS FOR PYCNODERES PORRECTUS (DISTANT) (HEMIPTERA: MIRIDAE)

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Examination of the genitalia of the male of *Pycnoderes porrectus* (Distant) shows that this species, although having the general appearance of a *Pycnoderes*, belongs in a separate genus herein described as new. The male studied, identified by J. C. M. Carvalho and deposited in the British Museum (N.H.) and kindly loaned to me by Mrs. G. M. Black, has been declared the type of the genus.

In the measurements that follow, 26 micrometer units are equivalent to 1.0 mm. Support for this study was made possible by National Science Foundation grant GB-7382.

Parapycnoderes Maldonado-Capriles, new genus

Type of the genus: *Pycnoderes porrectus* (Distant) 1893.

Bryocorinae, Bryocorini. Habitus as in fig. 9. Thorax and forewing with dense, silvery, decumbent, silky pubescence. Pronotum densely pitted. Head somewhat roundly produced between bases of antennae; vertex slightly convex, corrugate on each side of median line; eyes small, projecting laterally beyond anterior margin of pronotum, sessile, contiguous to collar. Beak reaching mesocoxa. Antenna inserted adjacent to eye on infero-frontal angle; slender, first segment thickest, others gradually thinner, first segment equal in length to interocular width, second slightly over 1.6 times as long as first, third 1.5 times as long as first, fourth as long as first and third combined. Pronotum with long collar, collar slightly longer than calli; calli developed, polished; posterior lobe inflated, bigibbous, gibbosities well separated; posterior margin slightly and broadly concave above scutellum. Scutellum triangular, shorter than wide, horizontal, medianly depressed. Hemelytra ornamented with grayish white; broadly oval, opaque, with broad flat embolium; cuneus wider than long; membrane semitranslucent, with 1 subquadrate cell. Legs long and slender, tarsi thickened toward apex; arolia absent, pseudoarolia arising from ventral surface of claws. Abdomen broad at base.

Parapycnoderes runs to couplet 48 in Carvalho's key to the Bryocorini genera of the world. Although it looks more like a *Pycnoderes*, the new genus keys out together with *Cyrtocapsus* on account of the silky pubescence of the latter. Carvalho's key can be modifed to include the new genus as follows:

48. Hemelytra with embolium narrow 48a
    Hemelytra with embolium broad 49
48a. Hemelytra and pronotum covered with silky pubescence; eyes reaching back to sides of anterior margins of pronotum .... *Cyrtocapsus* Reuter
    Hemelytra and pronotum with fine delicate pubescence; eyes produced laterally, not backwardly .... *Sixeonotus* Reuter
49. Collar longer than calli; margins of hemelytra broadly oval; cuneus wider than long; forewings and pronotum with silky pubescense .... *Parapycnoderes* n. gen.
    Collar shorter, inconspicuous; margins of hemelytra subparallel or slightly oval; cuneus longer than wide; forewings and pronotum with fine pubescence .... *Pycnoderes* G. & M.

Parapycnoderes porrectus (Distant) new combination

Pycnoderes porrectus (Distant) 1893. Biol. Cent. Amer. Rhync.:441.

Redescription of male: coloration typical of the genus, that is, blackish with grayish-white appendages and ornamentation of forewings. Head, thorax, and scutellum black; brown along vertex on each side of median line. First antennal segment dark brown with grayish-white base and apex; second segment pale stramineous and very slightly darkening towards apex, third slightly darker than second, fourth brownish. Beak grayish white. Legs including coxae grayish white; midfemur brownish on apical half; hind femur brownish except basally; hind tibia brown postbasally. Forewing blackish brown; embolium with a post-basal and an apical grayish-white spot; cuneus apically, apical 1/2 of cell of membrane, and remainder of membrane ivory. Freshly caught specimens probably have silvery areas on the forewing as the appearance of the wing is similar to old specimens of *Pycnoderes* in which these areas are lost.

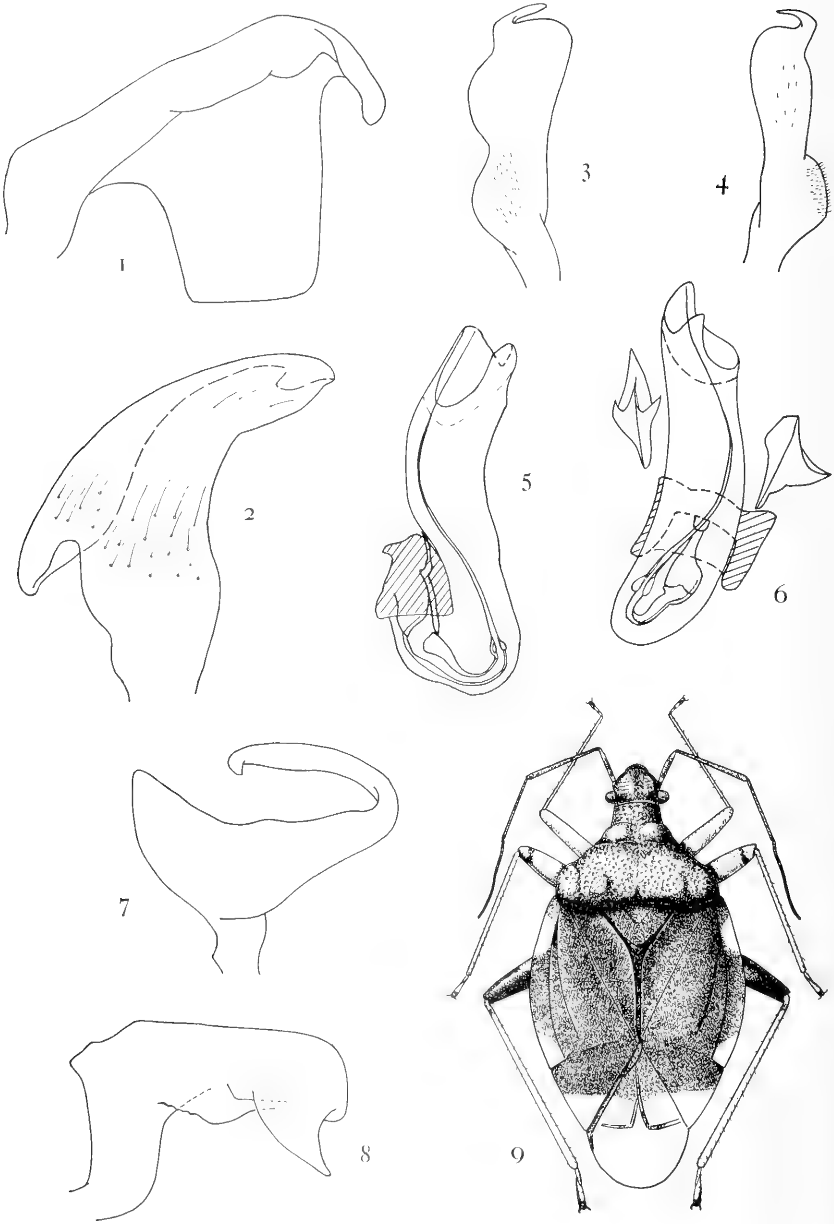

Fig. 1–6, 9, *Parapycnoderes porrectus*, male: 1, right clasper, lateral view; 2, same, dorsal view; 3, left clasper, ventral view; 4, same, lateral view; 5, penis, lateral view; 6, same, dorsal view; 9, habitus. Fig. 7–8, *Pycnoderes heidemanni*, male: 7, left clasper, lateral view; 8, right clasper, ventral view.

Vertex convex, with row of 6–8 transverse striations from midlength of eyes to before antennal base on each side of median line; tylus elevated, convex. Length of head 18, width across eyes 16, interocular space 9. Antennal segments 9:16:13:22. Eyes small. Collar slightly longer than calli (5.5:5), pitted. Calli polished. Pronotum as described for the genus; length 25, posterior width 36. Scutellum above level of forewings, as illustrated, apex of membrane surpassing tip of abdomen. Length 4.5 mm.

Genitalia as in fig. 1–6.

Holotype, ♂, Capetillo, Guatemala, Central America; G. C. Champion collector, Distant collection 1911–383, in the British Museum (N.H.), London.

The genus is monotypic. As stated above, this species has the general appearance of the broad-winged species of *Pycnoderes* but can be easily separated from these by the very broad oval forewings, longer collar, wider cuneus, silky pubescence, and the genitalia.

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A NEW SYNHALONIA FROM NEW MEXICO (ANTHOPHORIDAE)

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ABSTRACT—A new species, *Synhalonia* **bakeri**, is described from Aztec, New Mexico.

A new species of *Synhalonia* was collected by Carl F. Baker in 1899 at Aztec, New Mexico. In my key to the species of *Synhalonia* (Univ. Calif. Publ. Ent. 57:1–76) it runs to couplet 72, distinguishing *quadricincta* and *albescens*, and it agrees closely in aspect to the latter species. It differs in having the hair of the abdomen more uniformly distributed and the third joint of the antennae much longer.

Synhalonia bakeri Timberlake, new species

Male: Black, with dot at base of mandibles, labrum, and clypeus, and line on supraclypeal area pale yellow. Clypeal mark almost touching margin of eyes, almost squarely emarginate on each side and broadly truncate at summit. Antennae and legs dark, small joints of tarsi ferruginous. Tegulae ferruginous. Wings slightly dusky, more so than in *albescens*, nervures ferruginous, subcosta fuscous. Pubescence pale ochreous or whitish, moderately long and dense but concealing surface of mesonotum. Hair of abdomen depressed, nearly uniform in distribution, without distinct bands, and without black hair except on sterna 4 and 5.

Head much broader than long, with inner orbits diverging above. Cheeks strongly receding, about half as wide as eyes. Eyes oval, strongly convex, about twice as long as wide and strongly elevated at summit over surface of vertex. Posterior ocelli about their distance apart from margin of eyes. Proboscis long, galeae about as long as head, almost bare, very minutely shagreened on outer face and moderately shining. Antennae inserted at middle of face, reaching base of abdomen; flagellum only slightly compressed, with its first joint about ⅔ as long as second, and second somewhat longer than any of following 8 joints. Legs normal. Clypeus convex, broadly truncate at summit, and very narrowly separated from margin of eyes on each side. Second submarginal cell receiving recurrent nervure slightly less than ⅓ of its length from apex. Disk of wing with sparse, very short minute dusky bristles, fading out toward distal margin. Clypeus thinly hairy, shining, with moderately close, shallow punctures, leaving moderately wide impunctate median space. Mesonotum moderately shining, with close shallow punctures, interstices less than a puncture width and minutely tessellate. Sternum 6 shining, almost bare, rounded at apex, with oval impression on each side at middle of length, inner margin of impression ridged, lateral margin of plate forming outer margin of impression and very bluntly angulate. Sternum 7 with broad, thin, almost truncate apical lobes, narrowly separated, and with rounded sclerotized lateral margins almost even, except for 1 small rounded pre-apical notch, forming small acute lobe. Subgenital plate much as in *albescens*, but broader at apex, or about intermediate between figures 5 and 9, p. 73, in paper cited above.

Length 13.5 mm; anterior wing 9 mm; width of abdomen 4.6 mm.

Holotype, ♂, Aztec, San Juan County, New Mexico, April 28, 1899 (Carl F. Baker).

Type in U.S. National Museum, Washington.

NOTES ON NEOTROPICAL TABANIDAE (DIPTERA) XIV. TWO NEW SPECIES OF TABANUS FROM PANAMA AND COLOMBIA[1]

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ABSTRACT—A group of 6 coastal swamp inhabiting species of *Tabanus* (Dipt. Tabanidae) from Panama and Colombia is reviewed. All species are keyed and figured, and *T.* **nondescriptus** and *T.* **eldridgei** n. sp. are described.

The accumulation of much additional material from Pacific coastal areas of eastern Panama, due to the efforts of personnel of the Office of Interoceanic Canal Studies during 1967, clarified the interrelationships of a group of tidal swamp-inhabiting species. Four of these were previously described (Fairchild, 1943), and later (Fairchild, 1958) additional material of 3 of them was reported and variation discussed. With adequate material it now appears that at least 6 species form a closely similar group sharing the same general habitat, and ranging from Panama to Ecuador, though only in Panama has this habitat been at all explored for Tabanids. It is the purpose of this note to provide a key to the species, descriptions of the 2 new species, and figures and comparative notes on all species. The "frontal index" referred to in the key is obtained by dividing the length of the frons from a line joining the inner eye angles to the vertex, by the width at the base between the inner eye angles. The head should be positioned so that both base and vertex are in the same focal plane when measuring length of frons.

Key to Females

1. Wings greyish hyaline, including costal cell, without brown clouds or darkened vein margins. Frontal index 3 or less 2
— Wings with at least narrow brown margins on veins, costal cell sometimes darkened. Frontal index 3 or more 3
2. Frontal index about 2.3. Median callus absent. Mesonotum unstriped, it and scutellum dark steel grey, abdomen yellowish brown with 3 narrow indistinct pale-haired stripes. Eyes uniformly green in life .... *rhizophorae* Fairchild
— Frontal index about 3. Median callus usually present as a slender, sunken groove. Mesonotum striped, brownish grey, scutellum concolorous. Abdomen cinnamon brown with an obscure median row of small grey triangles and more prominent dorsolateral steplike broad grey stripes. Eyes bronzy with a narrow median dark stripe .... *praepilatus* Fairchild
3. Abdomen when undenuded with definite pale-haired dorsolateral stripes as well as a median stripe. Frontal index usually less than 4 4

[1] Florida Agricultural Experiment Stations Journal Series No. 4500.

— Abdomen when undenuded without dorsolateral stripes, yellow basally, contrasting with blackish mesonotum. Frontal index usually greater than 4, 5

4. Palpi very slender, almost clubbed at tip. Frontal callus drop-shaped. Basal plate of antenna only slightly longer than wide. Smaller species, wing length 8–10 mm. Eyes green with median stripe and lower margin dark purplish .... *nereus* Fairchild

— Palpi stouter, tapered. Frontal callus oblong or long oval. Basal plate markedly longer than wide. Larger species, wing length 9–12 mm. Eyes bronzy, unpatterned .... *nondescriptus* Fairchild, n. sp.

5. Frontal index about 4. Frontal callus drop-shaped. Basal plate of antennae less than twice as long as wide, the third segment about ½ height of frons. Abdomen with conspicuous broad pale middorsal stripe. Eye bronzy green, unstriped. Costal cell hyaline .... *rixator* Fairchild

— Frontal index about 5. Frontal callus oblong or long oval. Basal plate unusually slender, over twice as long as wide, the third segment over ½ height of frons. Abdomen with inconspicuous narrow middorsal pale stripe. Eye green with dark median stripe and lower margin. Costal cell dark yellow .... *eldridgei* Fairchild, n. sp.

Tabanus rhizophorae Fairchild
fig. 1

Tabanus rhizophorae Fairchild 1942, Ann. Ent. Soc. Amer. 35:449–450, fig. 6. ♀. Old Panama, R. de P.

The types consisted of 11 ♀ and 2 ♂, all collected sweeping marsh grass, or netted in the vicinity of tidal mud flats near Old Panama and Paitilla Point, on the outskirts of Panama City. Since then only a few specimens have been secured, as follows: 1 ♀, Old Panama, 10 May 1949, sweeping salt marsh grass; 1 ♀, San Francisco de la Caleta, between Old Panama and Paitilla Point, biting on beach, 6 February 1955; 1 ♀, Chame Bay, Panama Prov., netted near tidal flats, 15 April 1955; 1 ♀, Venado Beach, Ft. Kobbe, Canal Zone, 28 April 1959, W. J. Hanson coll. All localities are on the Pacific coast of Panama. A single ♀ specimen, El Maria, Coiba Island, Panama, 16 January 1950, P. Galindo coll. differs in having a tinted costal cell and slightly narrower frons, but lacks antennae. The locality is a large island off the coast of Chiriqui Prov., and this specimen may represent a distinct form. The male differs from males of *nondescriptus* and *praepilatus*, the only other species of this group whose males are known, in having the upper eye facets poorly differentiated and demarcated.

Tabanus praepilatus Fairchild
fig. 2

Tabanus praepilatus Fairchild 1943, Ann. Entomol. Soc. Amer. (1942) 35:445–446, Fig. 11, ♀. 1947, Ann. Entomol. Soc. Amer. (1946), 39:569. 1958, Ann. Entomol. Soc. Amer., 51:530, ♂.

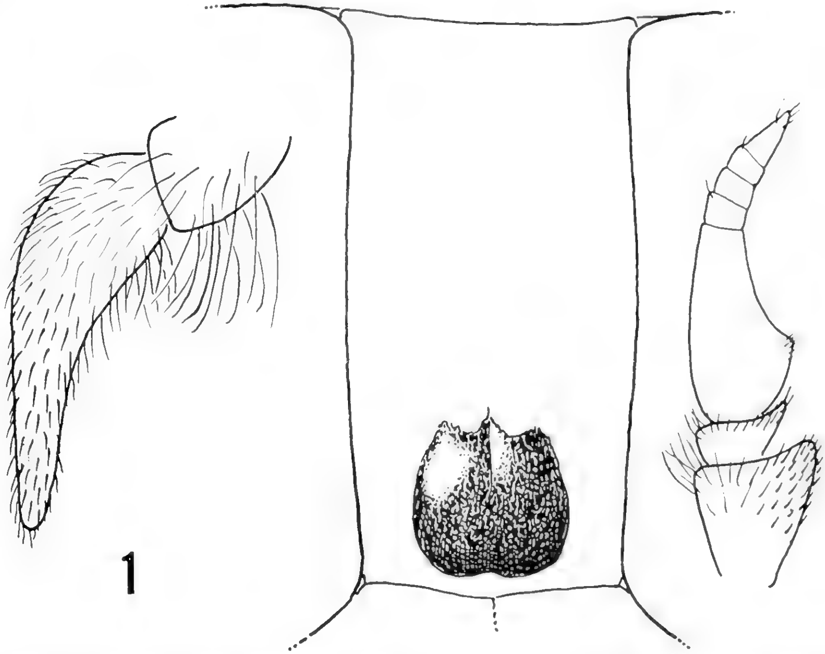

Fig. 1. *Tabanus rhizophorae* San Francisco de la Caleta, Panama, 6 Feb. 1955, biting on beach. All figures are to the same scale and all are of females.

The species occurs in or near coastal mangrove swamps on the Pacific coast of Panama from Guarachiné, Darien Prov. to Guararé and Tonosí, Los Santos Prov. Specimens have been taken from January to June and August, so it may fly throughout the year. The single ♂ was taken in a light trap at Guarachiné, together with 2 ♀. The eye in life is greenish bronze with a single narrow median dark stripe.

Tabanus rixator Fairchild

fig. 5

Tabanus rixator Fairchild 1943, Ann. Entomol. Soc. Amer., (1942) 35:448, Fig. 10, ♀. 1958, Ann. Entomol. Soc. Amer., 51:530 (in part).

The types are not now before me, and it is quite possible that specimens of *nondescriptus* formed part of the type series, as is intimated in the second reference above. At any rate, most of the specimens listed in 1958 seem to belong to *nondescriptus*, and I now have but 2 specimens of true *rixator*, one of which was compared with the holotype. This specimen is from Paitilla Point, Panama City, 13 September 1950. The other is also from vic. Panama City, taken in

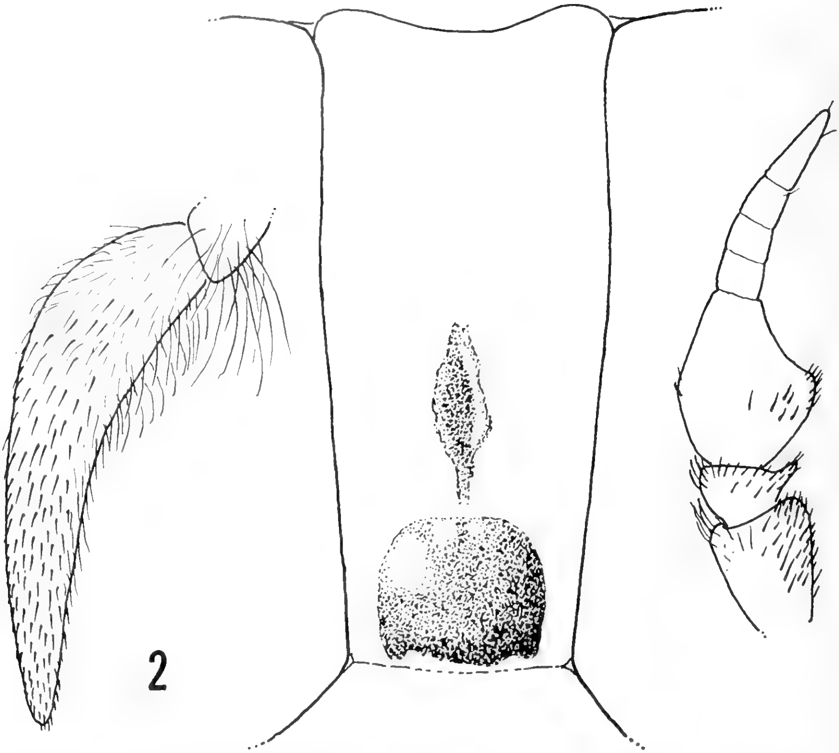

Fig. 2. *Tabanus praepilatus* Los Santos, Salinas, Panama, 13 Feb. 1964, Henriquez coll.

a mangrove swamp at the base of Paitilla Point, 3 December 1964. These localities are now entirely urbanized. Both specimens had bronzy green eyes without bands.

Tabanus nereus Fairchild

fig. 3

Tabanus nereus Fairchild 1943, Ann. Entomol. Soc. Amer., (1942) 35:446, fig. 9, ♀. 1958, Ann. Entomol. Soc. Amer., 51:530.

In addition to the specimens previously reported, I have now seen the following material. 12 ♀, Howard Field, Ft. Kobbe, C. Z., May, June, July, August, October, and December taken in horse-baited mosquito stable traps and 1 in a light trap; 25 ♀, Curiche River, Choco, Colombia, May, June, July, August, October, and November 1967, collected mostly in Malaise traps by personnel of the Office of Interoceanic Canal Studies. A somewhat defective specimen from

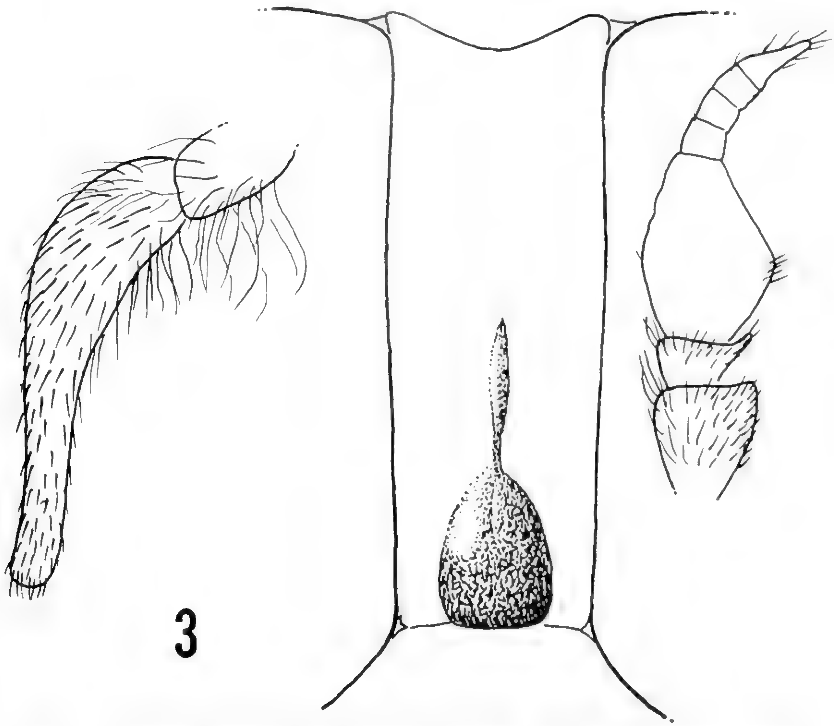

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Fig. 3. *Tabanus nereus* Old Panama, Panama, light trap 26 Sept. 1952.

Guayaquil, Ecuador, May–June 1913 is probably also *nereus*. The accumulated data thus indicate that this species occurs along the Pacific coast from Los Santos Prov., Panama to Guayaquil, Ecuador, and flies almost entirely during the rainy season.

Tabanus nondescriptus Fairchild, new species

fig. 4

Tabanus rixator, Fairchild, 1958, Ann. Entomol. Soc. Amer., 51:530, in part, nec Fairchild, 1943.

A small dull brownish species with 3 inconspicuous pale stripes on abdomen, wings with all veins narrowly brown margined, frontal callus brown, higher than wide, and eyes unpatterned.

Female. Length 13.5 mm, wings 12 mm. Eyes bare, bronzy green in life, without bands. Frons slightly over 4 times as high as basal width, about 1/3 wider at vertex than at base, pale brownish-grey pollinose with scattered short black hairs. Basal frontal callus yellowish brown, higher than wide, long oval or oblong, narrower than frons, usually separated from a small spindle-shaped median callus. Subcallus concolorous with frons, pollinose, without hairs. Frontoclypeus and

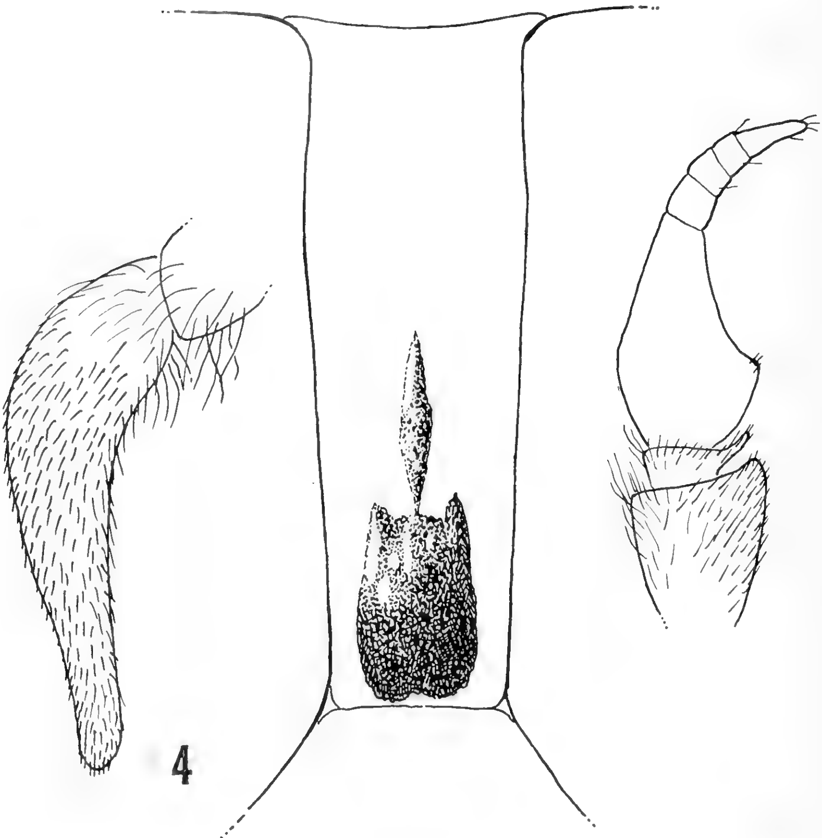

Fig. 4. *Tabanus nondescriptus* n. sp. Holotype.

genae paler and greyer, sparsely white-haired except area adjoining subcallus which is brown-haired. Beard white. Antennae wholly orange, the scape slightly narrower than width of basal plate, beset above with black hairs. Pedicel short, with moderate dorsal spur, black-haired. Basal plate longer than wide, longer than style, its dorsal angle prominent, at about ⅓ distance from base to apex of plate. Palpi white, the first and base of second white-haired, remainder black-haired, second segment slightly inflated basally, rather slender but blunt-pointed, subequal to antennae in length. Proboscis reddish brown, labella fleshy, sclerotized parts not much longer than palpi.

Mesonotum reddish brown, grey pollinose, beset with sparse short black and golden hairs, forming indistinct stripes. Notopleural lobes concolorous, with longer black hairs. Scutellum paler, more reddish, with sparse long black hairs dorsally, shorter pale hairs on sides. Pleura paler, white pollinose and white-haired.

Legs light reddish to yellowish brown, the femora and coxae white-haired, the tibiae mostly yellow-haired, but with black hairs apically on fore and hind pairs.

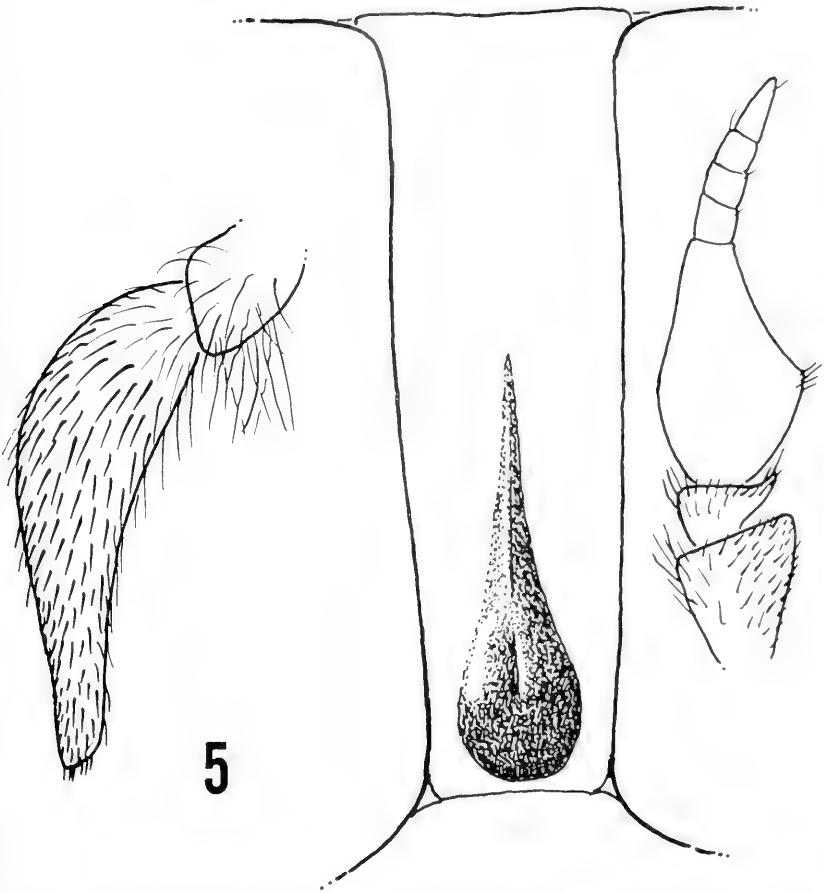

Fig. 5. *Tabanus rixator* Homotype. Paitilla Point, Panama, 13 Sept. 1950.

Tarsi slightly darker, black-haired dorsally, copper-haired ventrally. Wings with venation normal, short spur at sharp angle of fork of third vein, glass clear except for faint and very narrow browning along all veins. Stigma yellow. Halters pale yellow.

Abdomen dull light reddish brown, thinly greyish brown pollinose, dorsally clothed with short black hairs, except for middorsal series of narrow, contiguous, whitish or pale yellow-haired triangles on terga 1 to 6, and pair of dorsolateral pale-haired stripes on terga 2 to 5. Middorsal stripe underlaid by paler pollinosity, dorsolateral stripes less so. Tergum 7 wholly dark-haired. Sterna and extreme sides of terga white-haired.

Holotype ♀, vic. Old Panama, Panama prov., Republic of Panama, 10 June 1949, netted in mangrove swamp.

Male. Length 10 mm, wing 9 mm. Eyes holoptic, bare, larger facets well-differentiated and demarcated, forming patch in upper ½ of eye occupying about ½ total eye area, with border of small facets to vertex. Line between large and small facets not abrupt, size change occurring over several rows of facets, those in the center much the largest. Small flattened tubercle sunk between eyes at vertex. Antennae as in female, though third segment more slender. Palpi porrect, white haired, last segment oval, not mammillate.

Coloration as in female, abdomen with sparser, longer hairs in which pale hairs appear to predominate, though the specimen is not well enough preserved to discern a pattern.

Allotype ♂, Chame, Panama prov., Panama, 3 April 1951, light trap.

Paratypes: 6 ♀, same data as holotype, (some labelled IV–10–49, others VI–10–49, the April date probably the correct one): 1 ♂ 1 ♀, Chame, Panama prov., 3 April 1951, light trap; 1 ♀, Panama, R. Paessler, July–Aug. 1907; 1 ♀, vic. Panama City, 3 Dec. 1964, in mangrove swamp; 1 ♀, Libano, Panama prov., 27 Aug. 1963, Shannon trap; 2 ♀, Juan Diaz, Panama prov., 16 Dec. 1964, mangrove swamp; 2 ♀, Tocumen, Panama prov., 30 Nov. 1964; 2 ♀, San Jose Id., Pearl Islands, 23 March 1946, D. Jenkins coll.; 1 ♀, same locality, July 1944, Morrison coll.; 6 ♀, Patiño Point, Darien prov., 18 July, 17 Aug. 1952, light trap; 68 ♀, Santa Fé, Darien prov., Nov. 1966(2), Jan. 1967(1), Feb. 1967(12), Mark 1967(23), Apr. 1967(16), May 1967(8), July 1967(1), Sept. 1967(1), Oct. 1967(2), no date (2), mostly collected in Malaise trap, O.I.C.S. coll.; 8 ♀, Ft. Kobbe, Canal Zone, Jan., Feb., Apr., 1953, Oct. 1957, May, July 1968, and no date, in horse baited mosquito trap. 1 ♀, Camarón, Panama, nr. Ft. Kobbe, Dec. 1951, horse trap. 1 ♀, Albrook Field, C. Z., Aug. 1951. Types in my coll. pro tem.

The paratypes range in wing length from 9 to 12 mm, and there is a short stub at the fork of the third vein in about ½ the wings, the remainder usually having an angle at the point where an appendix would be. Fresh specimens are slightly darker than the holotype, which was selected because it shows especially well the abdominal pattern.

The species is exceedingly close to *nereus* Fairchild, but differs in having unbanded eyes, a higher, more rectangular callus, differently shaped antennae, more prominently striped abdomen and larger average size. The means and medians for wing lengths of available specimens of *nereus* are both 9.5 mm, and for *nondescriptus* 11.13 and 11.25 mm, for those from Sta. Fé, Darien, and 11.0 mm and 10.5 mm for those from all other localities. *Tabanus nondescriptus* differs from *rixator* in generally larger size, reddish scutellum, long oval or oblong callus, and in lacking a broad prominent yellow stripe on abdomen.

The species occurs near or in mangrove swamps along the Pacific coast from Darien Prov. to the Canal Zone area. Specimens have been taken flying about the collector, in horse-baited mosquito stable traps, and most abundantly, in Malaise traps. It appears to fly throughout the year, with perhaps a peak of abundance from February through May.

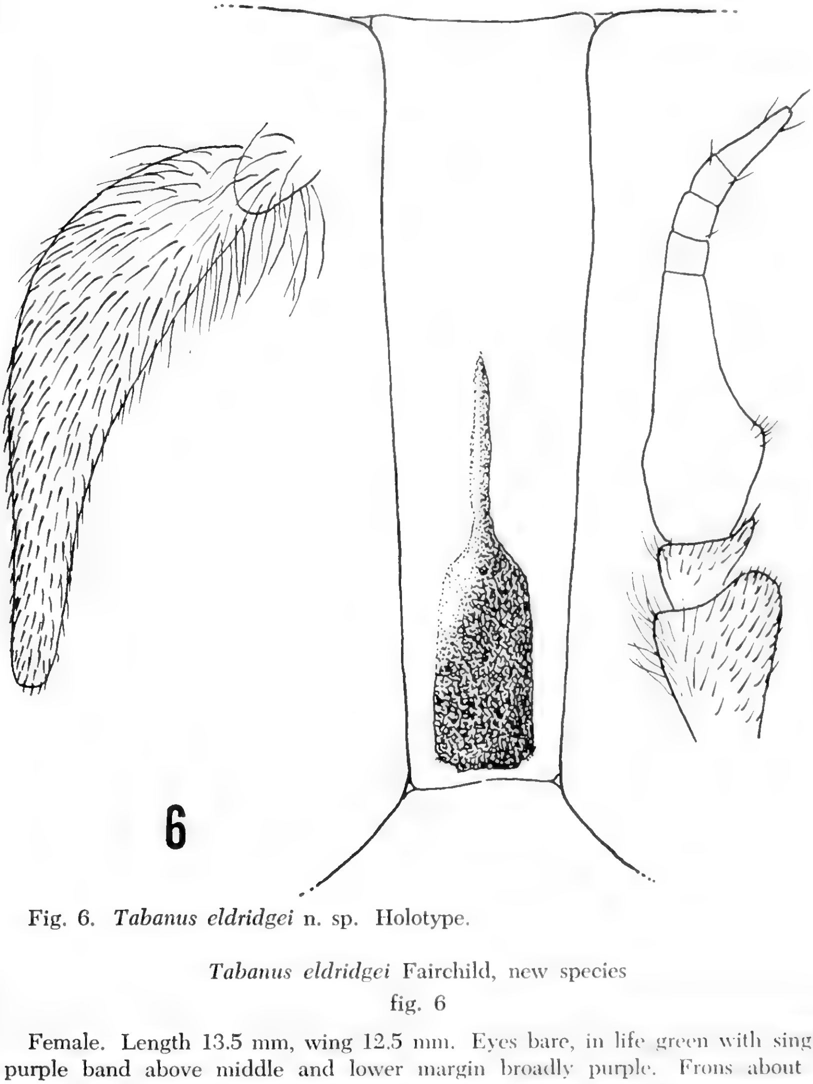

Fig. 6. *Tabanus eldridgei* n. sp. Holotype.

Tabanus eldridgei Fairchild, new species
fig. 6

Female. Length 13.5 mm, wing 12.5 mm. Eyes bare, in life green with single purple band above middle and lower margin broadly purple. Frons about 5 times as high as width at base, narrowed below, as figured, orange brown pollinose and with scattered erect dark hairs. Vertex with slightly paler, greyish discolored spot. Frontal callus narrower than frons, higher than wide, as figured, yellowish brown. Subcallus pollinose, slightly paler than frons. Frontoclypeus and genae yellowish grey pollinose, beard grey. Antennae as figured, orange yellow, first 2 segments beset with black hairs, third slightly darker, style dusky but not contrasting strongly with basal plate. Palpi moderately slender, as figured, yellowish white, beset with black hairs throughout.

Mesonotum and scutellum blackish brown, unstriped, notopleural lobes very slightly paler, thinly brown pollinose and thinly beset with mixed erect black hairs and semi-recumbent shiny golden hairs. Pleura steel grey, whitish pollinose and greyish-white-haired. Coxae pinkish grey, pale-haired. Femora yellowish brown, mainly black-haired, fore pair slightly darker. Fore tibiae obscurely bicolored, basal third yellowish brown, apical ⅔ blackish, all black-haired. Mid and hind tibiae concolorous with femora, black-haired, hind pair without conspicuous fringe. Tarsi dusky, but only fore pair black. Wings with normal venation, no appendix at fork of third vein. Costal cell deep yellow, stigma brown and all veins broadly and heavily brown margined, especially towards wing apex, wing otherwise dusky hyaline. Halters dull yellow.

Abdomen above with first 3 terga brownish yellow, remainder blackish, subshiny, clothed with black hairs except for narrow paler pollinose middorsal stripe from segments 1 to 6, which is beset with sparse orange hairs on terga 1 to 3. Posterior border of tergum 1 also bears orange hairs in the middle. Beneath the abdomen is yellowish on first 3 sterna, blackish on remainder, pale pollinose, pale haired on first 3 segments, becoming darker posteriorly, not noticeably banded.

Holotype ♀, Curiche River, Choco Dept., Colombia, 5 June 1967, I.O.C.S. No. 1401. In U.S. National Museum. Named in honor of Lt. Col. Bruce F. Eldridge, under whose able direction this and many other biting arthropods were collected during a biomedical survey of possible sea level canal routes through eastern Panama and adjacent Colombia.

Paratypes 38 ♀, same locality, April (4), May (10), June (7), July (2), Aug. (1), Sept. (1), Oct. (7), Nov. (4), Dec. (1), 1967. These paratypes range in wing length from 10 to 12.5 mm. 2 ♀, Rio Raposo, Dept. Valle, Colombia 14 Oct. and 18 Nov. 1965, V. H. Lee coll.; 1 ♀, Esmeraldas, Prov. Esmeraldas, Ecuador, no date, Luis A. Leon coll. These last 3 are the size of the smallest Choco specimens. Paratypes in U.S.N.M., M.C.Z. and my collection.

This species is closely related to *T. nondescriptus* Fairchild, *rixator* Fairchild, and *nereus* Fairchild. From the first it differs in having a yellow costal cell and more heavily dark-margined wing veins, more slender third antennal segment, narrower and more convergent frons, in lacking any vestiges of dorsolateral abdominal pale stripes, and in having banded eyes. From *rixator* it differs in more heavily marked wings and yellow costal cell, narrow mid-abdominal stripe, narrower frons, more slender antennae, banded eyes and generally larger size. From *nereus* it differs in narrower frons, taller callus, longer and more slender antennae, yellow costal cell, no dorsolateral stripes, and blackish scutellum.

An additional 5 ♀, 3 from Curiche River and 2 from Rio Raposo, are very similar, but have the costal cell not tinted, the veins less heavily margined, frons broader and callus wider, fore tibiae bicolored and mesonotum and scutellum blacker, with greyer pollinosity. I believe they are a different species, but since none is perfect and the specimens few, I refrain from describing them at this time.

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Fairchild, G. B. 1943. Notes on Tabanidae (Dipt.) from Panama. X. The genus *Tabanus* Linn., and resume of the Tabanidae of Panama. Ann. Entomol. Soc. Amer. 35:441–474. (1942)

————. 1958. Notes on Neotropical Tabanidae. II. Descriptions of new species and new records for Panama. Ann. Entomol. Soc. Amer. 51:517–530.

FOUR NEW SPECIES OF ONTHOPHAGUS FROM MEXICO AND THE UNITED STATES (COLEOPTERA; SCARABAEIDAE)

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ABSTRACT—Four new species of Mexican and United States *Onthophagus* Latreille are described: **cartwrighti** from Southern California and Baja California, **cuevensis** from Tamaulipas and San Luis Potosi, and **neomirabilis** and **subcancer** from Oaxaca.

In 1932 Boucomont published a paper entitled, "Synopsis des *Onthophagus* d'Amerique du Sud." The title is misleading, since the paper is an extensive review of the genus for the New World from Mexico southward. Common species north of Mexico were included, but obviously no careful study was made of the Canadian and United States species. This was rectified with the publication by Howden and Cartwright of the "Scarab beetles of the genus *Onthophagus* Latreille north of Mexico" (1963). Scattered descriptions of Central and South American species have appeared since 1932, but no one has radically altered the groupings established by Boucomont.

The present paper describes 1 species from Southern California and Baja California, not included in Howden and Cartwright's 1963 revision, and 3 from Mexico. None of the 3 Mexican species falls readily into groups established by Boucomont, and none is closely related to described North or Central American species.

Photographs used herein, except for figs. 8 and 12, were taken using a JEOL-U3 scanning electron microscope. Specimens were not coated or treated, specimen charging being largely eliminated by the use of low voltages (1.8 to 2.0 KV).

Onthophagus cartwrighti Howden, new species

fig. 3, 4, 5

Holotype: Male, major, length 7.0 mm, greatest width 3.8 mm. Very similar to *velutinus* Horn (see Howden and Cartwright, 1963, p. 105), differing from male majors of *velutinus* as follows: clypeus more reflexed anteriorly, most discal punctures discrete, posterior margin with distinct carina; frons coarsely punctate, a few punctures with minute setae; vertex (fig. 3) with 2 nearly vertical horns, horns more widely separated than is usual in *velutinus* (fig. 1, 2) and with inner basal swellings (fig. 3); pronotum with pronounced median swelling (fig. 4), surface behind swelling with numerous small tubercles overhanging small punctures, a few punctures with minute setae; pronotal surface between punctures very finely granulate, shining; elytra similar to *velutinus* but with tubercles on intervals less conspicuous and with very short setae, surface less dull; ventrally similar to *velutinus* but lacking long, conspicuous setae except near coxae.

Male minor: Unknown.

Allotype: Female, length 7.5 mm, greatest width 4.2 mm. Differing from male majors as follows: head (fig. 5) narrower; clypeus less reflexed anteriorly, disc transversely rugose, posterior marginal carina more elevated; vertex behind eyes with distinct carina (fig. 5), lacking horns; pronotum with more pronounced and wider swelling than in male (fig. 5) and much better developed than in female *velutinus* (fig. 6), the swelling highest laterally; forelegs less elongate than in male (a sexual character found in most North American *Onthophagus*).

Type Material: Holotype, male major, 20 mi. N. Comondu, L. (Baja) California, 23 July 1938, Michelbacher and Ross (CAS). Allotype, female, Triunfo, L. Cal., 13 July 1938, Michelbacher and Ross (CAS). Paratypes: 3 ♂, 1 ♀. 1 ♂, 5 mi. W. San Bartolo, L. Cal., 13 July 1938, Michelbacher and Ross (H.H.); 1 ♂, Cal. (no other data, Carnegie); 2 ♂, Calif., San Diego Co., Scissors Crossing, 30 and 31 July 1964, E. Kaen, J. Hammer (H.H., Sleeper).

Variation occurs mainly in size and in the degree of development of the horns in the males. In males length varies from 7.0 to 8.1 mm and greatest width from 3.7 to 4.3 mm. The 1 female paratype measures 6.4 mm in length and 3.6 mm in greatest width. Variation in the horns of the males is considerable. The horns vary in length, degree and angle of separation, and 2 of the males lack any indication of the inner basal swelling. In the latter 2 specimens the horns are similar to those of well developed males of *velutinus*, but are more widely separated.

Onthophagus cartwrighti can be separated from *velutinus* (to which it keys in Howden and Cartwright, 1963) by the following characters: pronotal swelling distinct in both sexes (fig. 4, 5), pronotal tubercles and accompanying punctures more numerous, and dorsal setae much less conspicuous. In males the more widely separated horns, often with an inner basal swelling, is an additional character.

It should be mentioned that males of *velutinus* from Arizona generally have the horns more widely separated than males from Texas (fig. 1, 2), but the slight development of the pronotum is constant. The pronotal development in females of *cartwrighti* could possibly cause them to be confused with male minors of *browni* H. & C. All New World male *Onthophagus* have the last abdominal segment narrowed medially to receive the pygidium, whereas females have the last abdominal segment the same width throughout. This character

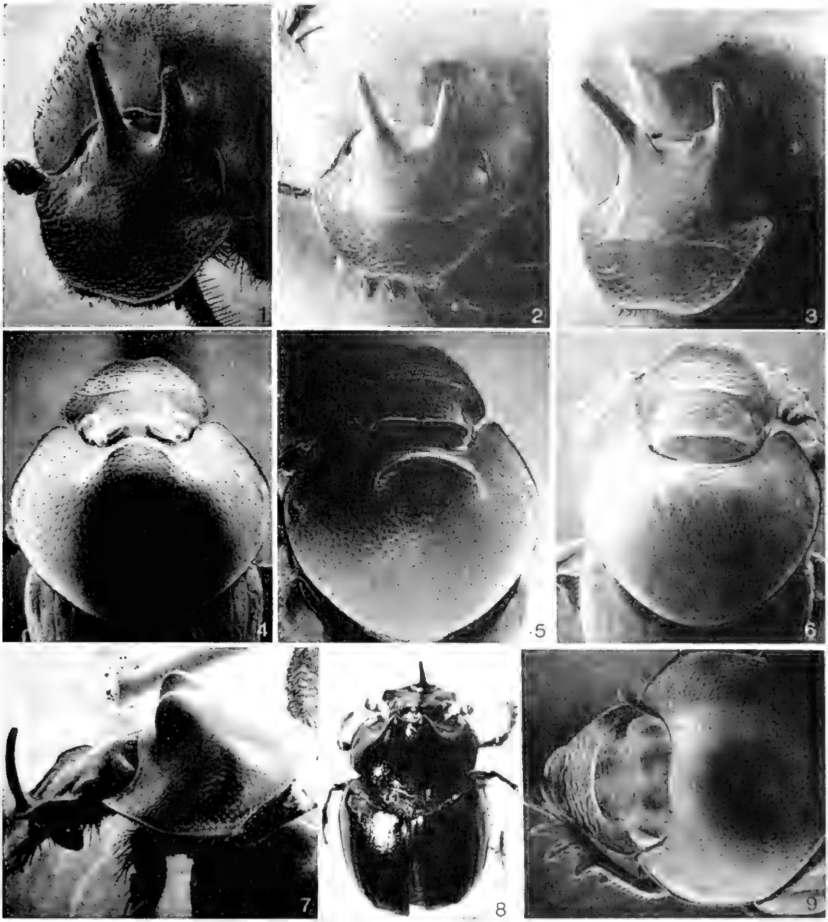

Fig. 1–9. *Onthophagus* spp.: 1, *O. velutinus*, male major from Del Rio, Texas. 2, *O. velutinus*, male major from Prescott, Arizona. 3–4, *O. cartwrighti*, male major from San Diego Co., California. 5, *O. cartwrighti* female. 6, *O. velutinus*, female. 7–8, *O. subcancer*, male major. 9, *O. subcancer*, female.

will prevent possible confusion between *cartwrighti* and *browni*. Also the range of *cartwrighti* alone will separate it from any presently known related species.

The species is named for O. L. Cartwright, who has done much to advance our knowledge of North American Scarabaeidae.

Onthophagus cuevensis Howden, new species

fig. 10, 11

Holotype: Male major, length 9.1 mm, greatest width 4.9 mm. Color dorsally black, vertex and pronotum dark green, sometimes appearing black depending on angle of light; ventrally black with tibiae and tarsi dark brown. Clypeus broadly arcuate, faintly emarginate medially, margin shallowly reflexed; surface of disc irregularly punctate, appearing rugose; clypeal-frontal junction delimited by 2 low carinae. Frons moderately convex with scattered small punctures, surface between punctures smooth and shining. Vertex (fig. 10) with abruptly elevated transverse carina between eyes, each side of carina terminating in a vertical horn; vertex behind carina impunctate, alutaceous laterally. Gena with sides rounded, evenly arcuate with clypeus; surface coarsely punctate. Pronotum (fig. 11) transversely swollen behind head, anterior face almost vertical above margin, laterally with concave notch on either side; pronotal disc coarsely punctate with fine secondary punctures interspersed; surface between punctures smooth and shining. Elytra with striae obsolete, indicated by a doubled line interrupted by vague punctures, punctures more distinct laterally; intervals with 2 irregular rows of small tubercles, each with minute seta at posterior margin; surface between tubercles slightly irregular, shining. Pygidium convex in apical ½, smooth and shining apically. Fore legs not noticeably elongate, tibial spur sharply bent inward. Metasternum coarsely punctate near margins, impunctate along midline. First 3 abdominal segments impunctate and smooth in median ⅓, coarsely punctate laterally; remaining segments coarsely punctate, most punctures with an erect seta.

Paratype: Male minor, length 6.6 mm, greatest width 3.5 mm. Differing from male major as follows: color dark brown, pronotum with greenish hue; clypeal-frontal carina only slightly elevated; transverse carina on vertex low, not abrupt, horns lacking, indicated by obtuse angle on each side half-way to midline; pronotal protuberance evident only as a slightly elevated, broad convexity behind head, lacking lateral concavities.

Allotype: Female, length 7.1 mm, greatest width 3.6 mm. Color as in male major. Characters of head as described for male minor. Pronotum with anterior protuberance slightly more pronounced than in male minor, slightly concave on either side of swelling; pronotal punctures more numerous than in male major; pygidium only slightly convex. Otherwise similar to male major except terminal abdominal segment of uniform width, not narrowed medially as in males.

Type Material: Holotype, male major, Mexico, San Luis Potosi, 3600 ft., 15 mi. W. El Naranja, 18 June 1971, A. Newton, #237, in trap baited with feces (H.H.). Allotype, ♀, Mexico, San Luis Potosi, Cueva de Los Avales, 16 April 1965, Reddell, Mekenzie (USNM). Paratypes, 5 ♂: 3, same data as Allotype; 2, Mexico, Tamaulipas, Cueva de Rancho del Cielo #7, 2 June 1964, J. Reddell, D. Mekenzie, L. Manire (USNM, H.H.).

Variation in the size of the 5 male paratypes is from 6.5 to 10.0 mm in length and from 3.5 to 5.5 mm in greatest width. Variation in the degree of development of the carinae of the head and of the pronotal protrusion is included in the descriptions of the male major and minor. The only unusual aspect is that the degree of development of the carina on the vertex does not seem to be correlated with body size. One male paratype measuring 8.7 mm in length has the carina of the vertex distinctly elevated but lacks any indication of the lateral horns.

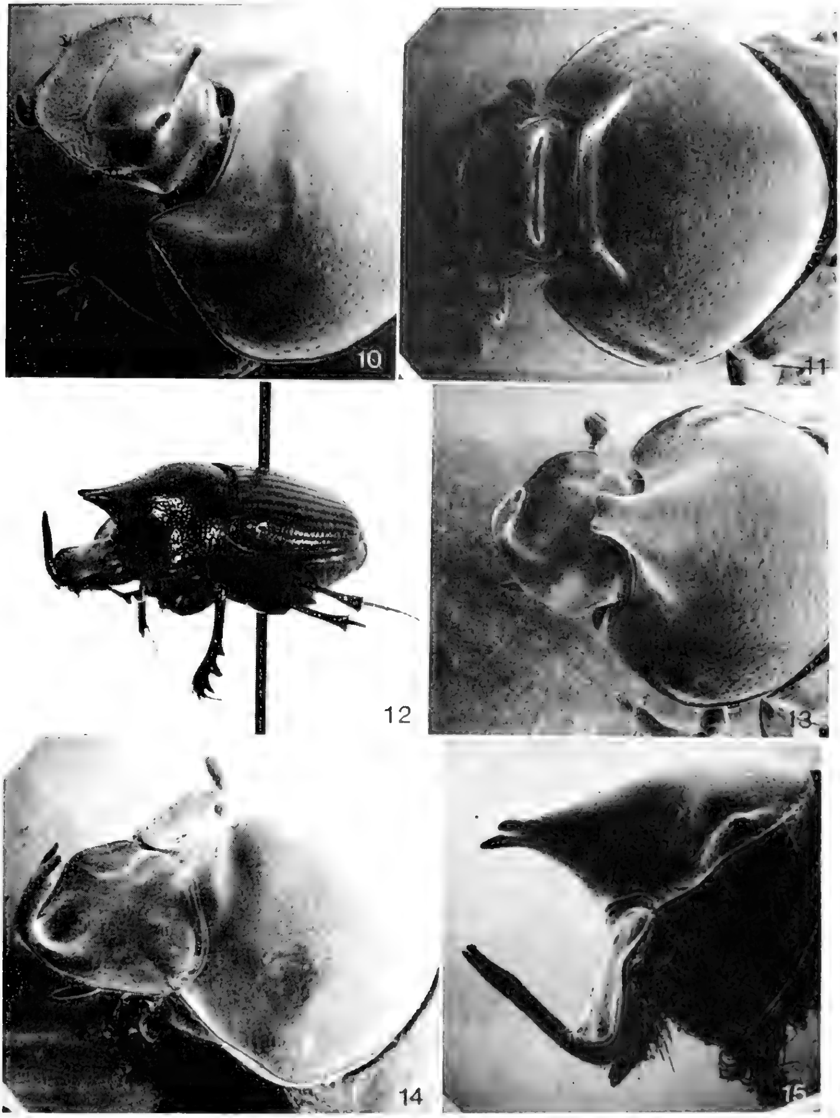

Fig. 10–15. *Onthophagus* spp.: 10–11, *O. cuevensis*, male major. 12–13, *O. neomirabilis*, male major. 14–15, *O. mirabilis*, male major.

A smaller specimen, measuring 7.5 mm in length, has the lateral horns on the carina relatively well developed. Usually the degree of development of the male sexual characters is correlated with size, at least in the genus *Onthophagus*.

Onthophagus cuevensis cannot readily be placed in any of Boucomont's (1932) groups. Males may key to group 5, but are more closely related to species in groups 1 and 9. Characters of the pronotum and elytra relate *cuevensis* to *brevifrons* Horn, *hypopotamus* Harold, etc., but the carina on the vertex with the lateral horns is closest to *coproides* Horn. The greenish color of the pronotum, horns and carina on the vertex of the males and the broad pronotal protrusion will separate *cuevensis* from any of these species. All of the related species occur in mammal nests or burrows and *cuevensis* seems, likewise, to have unusual habits. The majority of specimens were taken in caves, probably associated with bat guano. The Spanish word for cave is "cueva" and the name of the species is derived from the Spanish.

Onthophagus neomirabilis Howden, new species

fig. 12, 13

Holotype: Male major, length 10.3 mm, greatest width 5.7 mm. Color dark brown, pronotum noticeably darker. Clypeus with long, slender, vertical horn (fig. 12) at anterior margin, apex of horn rounded and flattened, slightly narrowed; disc of clypeus with a distinct concavity behind horn occupying ⅔ of clypeal width; posterior clypeal suture obsolete medially, marginal juncture of clypeus and gena broadly rounded. Frons and vertex nearly flat, with shallow transverse depression between eyes; surface finely punctate. Pronotum (fig. 13) with anterior, median conical projection extending over head; apex of projection flattened and emarginate, slightly bifurcate; pronotum on each side near margin at anterior ⅓ with low callosity; pronotal surface coarsely punctate, punctures separated by a distance approximately equal to their diameters; surface between smooth and shining. Elytra (fig. 12) with distinct striae, striae with large, distinct punctures separated by a distance equal to 2 or 3 times their diameters; intervals broadly convex, moderately, irregularly punctate, the numerous punctures giving intervals a roughened appearance; surface between punctures smooth and shining. Pygidium only slightly convex, heavily and coarsely punctate. Fore legs elongate, as is typical for males of many species in the genus. Prosternum laterally smooth, lacking punctures except near margins. Middle and hind femora with outer surfaces smooth, only a few vague fine punctures present. Metasternum with scattered coarse punctures except along midline. Abdominal segments each with transverse row of coarse punctures near anterior margin.

Male minor and female: Unknown.

Type Material. Holotype. Male major, 4000 ft., Km. 140 on Oaxaca Hwy. 140 (15 mi. S. of Valle Nacional), Oaxaca, Mexico, 22 May 1969. H. F. Howden, taken in trap baited with feces (H.H.).

This species is very close to *Onthophagus mirabilis* Bates (fig. 14, 15) which Boucomont (1932) places in his group 7. Bates (1887) based his description of *mirabilis* on a single male major taken at

Rio Morona, Ecuador. I have seen the type which is now in the Oberthur collection in the Museum National d'Histoire Naturelle, Paris. I also have examined a second specimen that I believe to be *mirabilis*, labeled "Volcan Chiriqui, Panama, 4000′, 19 July 1936" (USNM). Illustrations of *mirabilis* used in this paper are of the Panamanian specimen.

Onthophagus neomirabilis can be separated from *mirabilis* by the following characters: clypeal horn with apex rounded, not bifid as in *mirabilis* (fig. 14); pronotal protrusion as in fig. 13, not distinctly bifid with tips divergent as in *mirabilis* (fig. 14); punctures of elytral striae more pronounced than in *mirabilis*; prosternum laterally predominantly smooth (*mirabilis* has fine punctures); middle and hind femora with a few, vague fine punctures, in *mirabilis* numerous fine punctures are present.

Onthophagus subcancer Howden, new species

fig. 7, 8, 9

Holotype: Male major, length 6.5 mm, greatest width 3.7 mm. Color dorsally very dark brown; elytra vaguely mottled with reddish brown, apices and bases near humeri distinctly reddish brown; pygidium brown; ventrally dark brown except legs brown. Clypeal margin anteriorly shallowly emarginate, emarginate portion forming base of long, slender, upright, slightly curved, nearly cylindrical horn (fig. 7); sides of clypeus divergent to expanded and reflexed genae; clypeal disc concave behind horn, moderately punctate only near lateral margins; clypeal-frontal suture obsolete. Frons and vertex nearly flat, finely punctate, shining. Pronotum (fig. 7, 8) with an anteriorly directed biconical protrusion extending over anterior pronotal margin; width of protrusion slightly less than distance between eyes; pronotum on either side of protrusion concave to reflexed anterior angles; pronotal surface, except at apex of protrusion, with scattered shallow punctures, punctures separated by a distance equal to 3 to 4 diameters; each puncture with a very minute seta, surface between punctures with extremely fine secondary punctures, otherwise smooth and shining. Elytra with shallow striae, striae delimited by double lines interrupted by shallow punctures; intervals nearly flat, having numerous irregularly scattered punctures, each puncture with minute seta; surface between punctures smooth and shining. Pygidium slightly convex, surface heavily, coarsely punctate. Fore legs greatly elongated, with tuft of hairs at tibial apices. Metasternum centrally with punctures similar to those of pronotum, punctures becoming coarse laterally; metasternal midline indented in posterior ⅔. Abdominal segments each with transverse row of fine setose punctures near anterior margins; a few long setae present laterally on last 3 segments.

Paratype: Male minor, length 4.9 mm, greatest width 3.0 mm. Differing from male major in the following respects: clypeus truncate anteriorly, majority of truncate margin vertically elevated into a flat triangular horn, slightly wider than high; sides of clypeus behind truncate margin evenly diverging to slightly expanded genae; clypeal surface irregular medially, coarsely punctate laterally; genae, frons and anterior of vertex punctate, each puncture with minute seta; pronotum anteriorly with 2 slightly rounded humps 0.5 mm behind anterior margin, otherwise surface evenly convex and more conspicuously punctate than in male major; elytral intervals slightly less heavily punctate; pygidium less heavily punctate, setose near apex, surface between punctures shining; fore legs less elongate, but still more than in females.

Allotype: Female, length 5.9 mm, greatest width 3.3 mm. Differing from male major in the following respects: clypeus (fig. 9) narrowly emarginate anteriorly, shallowly reflexed; sides of clypeus evenly divergent to genae, sides of which are even with clypeus; clypeal disc transversely rugose; clypeal-frontal junction with low carina; frons and vertex slightly convex, surface punctate, punctures similar to those on pronotum; pronotum evenly convex, punctures more numerous than in male major, usually separated by a distance equal to less than 1 diameter, each puncture with minute seta; pygidium similar to male minor; fore legs not elongate, lacking tuft of setae at tibial apices; terminal abdominal segment of uniform width, not narrowed medially as in males.

Type Material: Holotype, male major, Mexico, Oaxaca, 4800′, 18 mi. S. Valle Nacional, 31 July 1971, A. Newton, #304 (H.H.). Allotype, ♀, Mexico, Oaxaca, 4000′, 15 mi. S. Valle Nacional, 12 August 1970, A. Newton, dung trap (H.H.). Paratypes, 15 ♂, 9 ♀. 13 ♂, 6 ♀, same data as Holotype; 2 ♂, 3 ♀, same data as Allotype (CAS, CNC, USNM, MCZ, HH, and Newton).

Variation is largely covered in the descriptions of the major and minor males and of the female. Males vary from 4.9 to 7.0 mm in length and from 3.0 to 4.0 mm in greatest width. Females vary from 5.4 to 6.6 mm in length and from 3.0 to 3.8 mm in greatest width. There is some variation in the extent of the reddish-brown markings on the elytra, but the basal and apical markings are present in the entire series.

Onthophagus subcancer will most readily key to Boucomont's (1932) group 3. It can be separated from the species in that group on the basis of the long, slender horn at the anterior clypeal margin in male majors, the biconical pronotal projection present on most males, and the overall dark brown color with bases and apices of the elytra reddish brown. The shape of the clypeal horn is not unlike that of *neomirabilis*, but the smaller size, color, and smoother elytra will readily separate *subcancer*.

Acknowledgments

A number of persons and institutions have assisted me with the present work. I am particularly indebted to Mr. A. Newton, Harvard University, Cambridge, Mass., who collected and gave me many of the specimens included herein. Other specimens were made available through loan by Dr. Robert Gordon, Systematic Entomology Laboratory, USDA, Washington, D.C., Mr. Hugh B. Leech, California Academy of Sciences, San Francisco, Calif., and Dr. Elbert L. Sleeper, California State College, Long Beach, Calif. Dr. A. Descarpentries and Mme. A. Bons, Museum National d'Histoire Naturelle, Paris, were most helpful with questions concerning the type of *Onthophagus mirabilis* Bates. Mr. Colin Jones, Staff Photographer, Carleton University, aided with the photography and Mr.

Lewis Ling, Carleton University, took the S.E.M. pictures. I am grateful to all of these individuals and institutions for their generous assistance. The work has been supported by an operating grant from the National Research Council of Canada.

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SAWFLIES OF THE SUBFAMILY HETERARTHRINAE IN SOUTH AMERICA (HYMENOPTERA: TENTHREDINIDAE)

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ABSTRACT—A key is given to the 3 genera of Heterarthrinae that occur in South America. *Caliroa* O. Costa is represented by an introduced species, *C. cerasi* (L.) that occurs in Chile, Argentina, and Uruguay. *Brasinusa* Malaise is known from southern Brazil and possibly northern Argentina and includes *B. plaumanni* Malaise. *Notofenusa* Benson is found in Chile and southern Argentina, and 4 species from Chile and includes: *N. surosa* (Konow), *N.* **asorusa**, n. sp., *N.* **flinti**, n. sp., and *N.* **nema**, n. sp. *Notofenusa cognata* (Spinola), new combination, is also included, but the species cannot be placed.

The Heterarthrinae are poorly represented in the Neotropical Region and are found only in the southern section of South America. Three genera are known, and one, *Caliroa* O. Costa of the tribe Caliroini, is represented by only the introduced species *C. cerasi* (L.). The other 2 genera, *Brasinusa* Malaise and *Notofenusa* Benson of the tribe Fenusini, are very closely related to several Nearctic genera. All members of this subfamily in South America are small and black, the smallest of the family Tenthredinidae. Hosts are not known for the South American species, but all the North American species of Fenusini are leafminers in the larval stage.

Key to Genera of Neotropical Heterarthrinae

1. Vein *2A* & *3A* of forewing complete, connected to *1A* by an anal crossvein [Caliroini] .... *Caliroa* O. Costa

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— Anal cell of forewing petiolate, basal section of vein *2A* & *3A* atrophied, only basal stub present which is either straight or curved up and meeting *1A* to form a small basal anal cell [Fenusini] 2

2. Tarsal claw bifid, with basal lobe; stub of vein *2A* & *3A* of forewing curved up and meeting *1A* to form a small basal anal cell; antenna stout, its length not much more than head width .... *Brasinusa* Malaise

— Tarsal claw simple, with basal lobe; stub of vein *2A* & *3A* of forewing straight; antenna slender, long, its length nearly twice width of head .... *Notofenusa* Benson

Caliroini

Caliroa O. Costa

Type-species: *Caliroa sebetia* O. Costa. Monotypic.

Caliroa cerasi (L.)

This species was treated in detail in my revision of the Nearctic Heterarthrinae (Smith, 1971). It is nearly a cosmopolitan species by introduction and has been recorded from Chile, Argentina, and Uruguay in South America. The larvae feed on pear and other rosaceous plants and are often pests in orchards.

Fenusini

Brasinusa Malaise

Brasinusa Malaise, 1964. Ent. Tidskr. 85:35.

Type-species: *Brasinusa plaumanni* Malaise. Orig. desig.

Antenna stout, its length subequal to head width; 9-segmented; third segment twice length of fourth segment. Clypeus truncate; malar space absent. No prepectus. Tarsal claw bifid, with basal lobe. Vein *2A* & *3A* of forewing atrophied at base, only basal stub present which is curved up and meets *1A* to form a small basal anal cell. Hindwing with radial cell open at apex; cells *Rs* and *M* both absent; anal cell present.

This genus is close to *Bidigitus* Smith, known only from California. *Bidigitus* and *Brasinusa* are the only 2 known genera of this tribe with bifid tarsal claws and a basal lobe. *Brasinusa* is distinct, however, by the presence of a basal anal cell in the forewing and stouter antennae. The genus includes only 1 species from Santa Catarina, Brazil and possibly Northern Argentina. I have seen 1 male specimen from Tucuman, Argentina which differs from *plaumanni* only by the slightly different shape of the harpe and valves of the genitalia. The differentiating characters are not sufficient at present to warrant describing it as new, and I am not including it in the distribution of *plaumanni*.

Brasinusa plaumanni Malaise

Brasinusa plaumanni Malaise, 1964. Ent. Tidskr. 85:36. ♀, ♂.

Female: Average length, 3.6 mm. All black except for each tibia which is sometimes brownish. Wings moderately, uniformly infuscated; veins and stigma black. Lancet as in fig. 7.

Male: Average length, 3.5 mm. Color as for female. Harpe and parapenis as in fig. 12; penis valve pointed at apex, fig. 13.

Distribution: Known only from Nova Teutonia, Santa Catarina, Brazil. I have seen specimens with the following collection dates: X–16–1949, X–22–1958, IV–10–1963, I–1966, II–1966, IV–13–1966, X–1969, II–1971, III–1971, IV–1971.

Type: At the Swedish Museum of Natural History, Stockholm. Type examined.

Discussion: The generic characters and genitalia of *plaumanni* as illustrated should distinguish this species from possible unknown species and from species of *Notofenusa*.

Notofenusa Benson

Notofenusa Benson, 1959. Proc. Roy. Entomol. Soc. London, Ser. B: Taxonomy 28:91. Type-species: *Scolioneura surosa* Konow. Orig. desig.

Antenna long and slender; 9-segmented; length about twice head width; third segment 1½ times length of fourth segment; apical 4 segments each longer than broad. Clypeus truncate; malar space absent; antennal crests distinct. No prepectus. Tarsal claw with 1 outer tooth and large acute basal lobe. Forewing with stub of vein *2A* & *3A* straight at apex. Hindwing with cell *R* open; cells *Rs* and *M* both absent; anal cell present, short and broad.

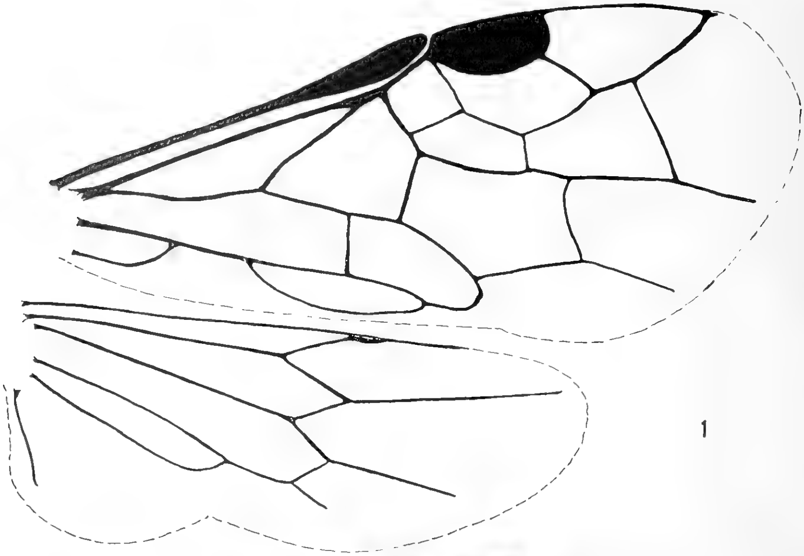
This genus most closely resembles the holarctic *Profenusa* Konow, but the longer and more slender antennae and more produced antennal crests will distinguish *Notofenusa*.

There are a number of species in this genus from central Chile south to Tierra del Feugo and southern Argentina. All are similar in size, external structure, and coloration and are difficult to distinguish. The genitalia of both sexes, however, provide good characters for species separation. The treatment below is based on females, because, unfortunately, the sexes could not be associated adequately. Though I examined several series which included both sexes from the same locality with the same collection dates, 2 or more species were represented in each series, and it was impossible to determine the correct association. The male genitalia do show good characters, and those of 2 of the forms are illustrated (fig. 14–17), but the problem of their correct identity will have to await further investigation.

I saw only 1 specimen (a male) from Argentina (Bariloche, Rio Negro, Nov. 1926). It is similar to some males from Chile but cannot be identified at this time.

Key to Species of *Notofenusa*—Females

1. Lancet short, with about 12 serrulae; each serrula low, rounded, and symmetrical (fig. 8) .... *flinti* Smith, n. sp.



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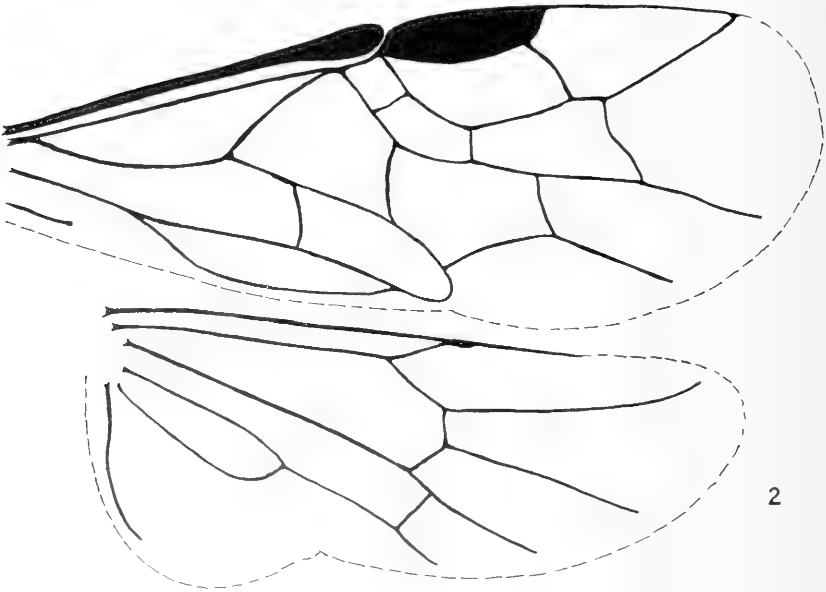

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— Lancet longer, with 15 or more serrulae; each serrula flat at apex or deeper and rounded at apex and asymmetrical 2

2. Each serrula rounded at apex, with at least 3 anterior subbasal teeth (fig. 11) .... *asorusa* Smith, n. sp.

— Each serrula flat at apex, at most with 1 anterior subbasal tooth (fig. 9, 10) 3

3. About 15 serrulae, each with 1 anterior and 3 or 4 posterior subbasal teeth (fig. 10) .... *surosa* (Konow)

— About 25 serrulae, each without anterior and with 1 posterior subbasal tooth (fig. 9) .... *nema* Smith, n. sp.

Notofenusa surosa (Konow)

Scolioneura surosa Konow, 1905. Ztschr. System. Hym. Dipt. 5:162. ♀.

Notofenusa surosa: Benson, 1959. Proc. Roy. Entomol. Soc. London, Ser. B, Taxonomy 28:92.

Female: Average length, 3.8 mm. Antenna and head black; apex of each mandible reddish. Thorax black. Legs black with extreme apex of each femur, each tibia entirely, and each tarsus basally white, each tarsus usually infuscated and blacker toward apex. Abdomen and sheath black. Wings moderately, uniformly infuscated; veins and stigma black.

Antenna rather short, only 1½ times head width. Hindtarsus about ⅔ length of hindtibia. Sheath straight above, slightly rounded below and at apex. Lancet with about 15 serrulae; each serrula low, broad, flattened at apex, and with 1 anterior and 4 or 5 posterior subbasal teeth; serrulae on basal ½ of lancet sometimes without anterior subbasal tooth (fig. 10).

Male: Unknown.

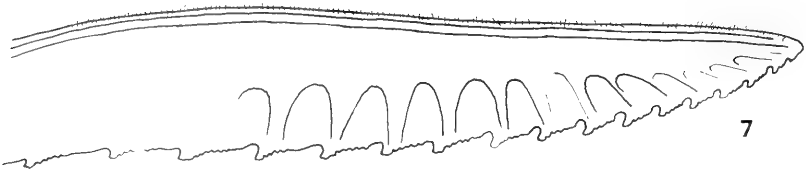
Distribution:—CHILE: Valdivia, I–1924. Sierra de Nahuelbuta, W. of Angol, 1200 m. I–3–51. Crest, Sierra Nahuelbuta, W. of Angol, I–2–1951. El Coigo, Cord. Curico, Oct.–Nov. 1959. Pichinahuel, Cord. Nahuelbuta, Jan. 10, 10–20, 20–28, 1959. Las Cruces, Cord. Parral, October 1958. Lago Icalma, 13/17–I–1962. Las Trancas, Cord. Chillan, 1/11–XII–1964. Angol, 29 Oct. 1956.

Type: Konow's type is at the Institut für Pflanzenschutzforschung, Eberswalde, Germany, a female, labeled "Chile, Concepc., 9.1903, P. Herbst," "Coll. Konow," "Type," and the name label "Scolioneura surosa Konow, Chile." Type examined.

Discussion: This species is separated from *flinti* by the deeper and apically truncated serrulae of the lancet and shorter antennae, the antennae of *flinti* being at least twice the head width. Characters of the lancet must be used to separate *surosa* from the other 2 species; the lancet of *nema* has many more serrulae and lacks anterior subbasal teeth, and that of *asorusa* has the serrulae slightly deeper, rounded at their apices, and with more anterior subbasal teeth.

←

Fig. 1, forewing and hindwing of *Brasinusa plaumanni*. Fig. 2, forewing and hindwing of *Notofenusa surosa*. Fig. 3, tarsal claw of *B. plaumanni*. Fig. 4, tarsal claw of *N. surosa*. Fig. 5, antenna of *B. plaumanni*. Fig. 6, antenna of *N. surosa*.



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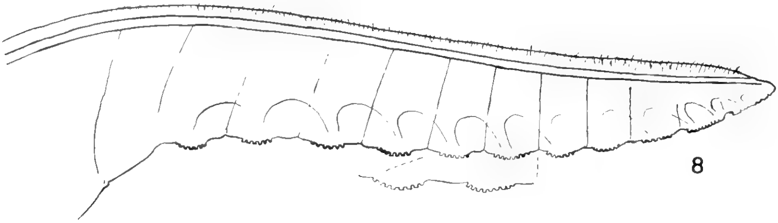

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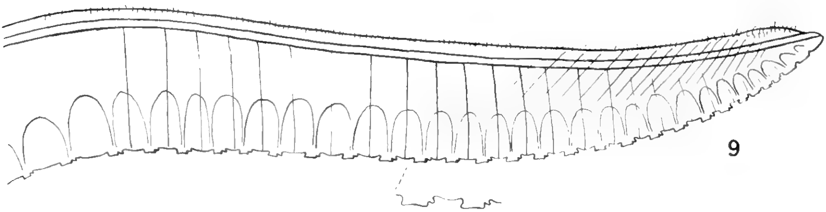

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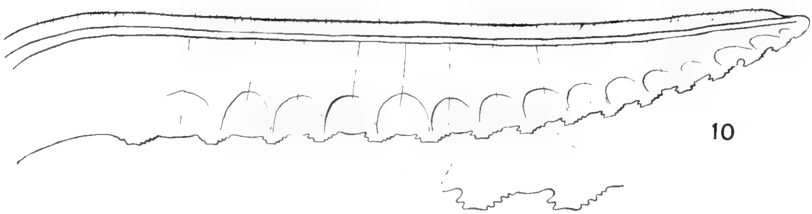

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Fig. 7, Lancet of *Brasinusa plaumanni*. Fig. 8, lancet of *Notofenusa flinti* n. sp. Fig. 9, lancet of *N. nema* n. sp. Fig. 10, lancet of *N. surosa* n. sp. Fig. 11, serrulae of *N. asorusa* n. sp.

Notofenusa asorusa Smith, new species

fig. 11

Female: Average length, 3.5 mm. Identical to *surosa* (Konow) except for characters of the female lancet as follows: about 15 serrulae; each serrula rounded at apex, not flat as in *surosa* and with 3 or 4 anterior and 5 or 6 posterior subbasal teeth (fig. 11); the serrulae are also slightly deeper than those of *surosa*.

Male: Unknown.

Holotype: Female, labeled "El Coigo, Chile, Cord. Curico, Oct.–Nov. 1959, Luis E. Pena." At the Illinois Natural History Survey.

Paratypes: CHILE: same data as for holotype (3 ♀♀). Las Cruces, Cord. Parral, October 1958, Luis E. Pena (7 ♀♀). Pichinahuel, Cord. Nahuelbuta, January 20–28, 1959, Luis E. Pena (1 ♀). 40 Km. E. of San Carlos, Nuble, XII–24–50, leg Ross and Michelbacher (1 ♀). 50 Km. E. of San Carlos, Nuble, XII–26–50, leg Ross and Michelbacher (1 ♀). Bio-Bio, El Abanico, XII–30–1950, leg Ross and Michelbacher (1 ♀). Nuble, 40 Km. E. of San Carlos, XII–23–1950, leg Ross and Michelbacher (1 ♀). At the Illinois Natural History Survey, California Academy of Sciences, and U.S. National Museum.

Discussion: It is unnecessary to describe this species more than above because of its similarity to *surosa* except for characters of the female lancet as stated. The species name is an arbitrary combination of letters and is to be treated as a noun.

Notofenusa flinti Smith, new species

fig. 8

Female: Average length, 3.6 mm. Antenna and head black; apex of each mandible reddish. Thorax black. Legs black with extreme apex of each femur and each tibia entirely whitish. Abdomen and sheath black. Wings moderately, uniformly infuscated; veins and stigma black.

Antenna long and slender, at least twice as long as head width. Hindtarsus slender, nearly as long as hindtibia. Sheath long, straight above and nearly straight below with obliquely truncated apex. Lancet short, with 12 serrulae, each serrula low and rounded with 7 or 8 coarse subbasal teeth (fig. 8).

Male: Unknown.

Holotype: Female, labeled "Chile: prov. Magallanes, Rio Las Minas, 10, 15 Jan. 1966, Flint and Cekalovic." U.S.N.M. Type no. 72353.

Paratypes: CHILE: same data as for holotype (5 ♀♀). Prov. Magallanes, Punta Arenas, 9–15 Jan. 1966, Flint and Cekalovic (1 ♀). Prov. Magallanes, Chor. Las Piedras, 11 Jan. 1966, Flint and Cekalovic (1 ♀). Prov. Magallanes, Rio Tres Brazoz, 9–13 Jan. 1966, Flint and Cekalovic (1 ♀). In the U.S. National Museum.

Discussion: The lancet is quite unlike that of other species of *Notofenusa* having fewer serrulae and these low and rounded. The antennae and hind tarsi are longer and more slender than in other species of the genus, but *flinti* is difficult to determine on this basis unless other species are available for comparison. This species is named after one of the collectors, Oliver S. Flint, Jr.

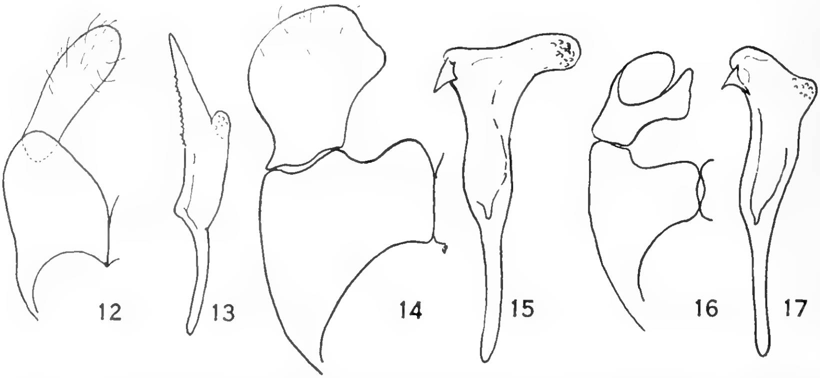

Fig. 12, Harpe and parapenis and, fig. 13, penis valve of *Brasinusa plaumanni*. Fig. 14, harpe and parapenis, and fig. 15, penis valve of *Notofenusa* sp. Fig. 16, harpe and parapenis, and fig. 17, penis valve of *Notofenusa* sp.

Notofenusa nema Smith, new species

fig. 9

Female: Average length, 3.6 mm. Head and antenna black; apex of each mandible reddish. Thorax black. Legs black with extreme apex of each femur and each tibia entirely whitish; inner surface of each tibia may be infuscated. Abdomen and sheath black. Wings moderately, uniformly infuscated; veins and stigma black.

Antenna slender, relatively short, about 1½ times head width. Hindtarsus stout, only about ⅔ length of hindtibia. Sheath straight above, rounded below and at apex. Lancet long, with about 25 serrulae, each serrula low, broad, flat at apex, without anterior subbasal teeth and with only 1 large posterior subbasal tooth; annuli parallel and close together (fig. 9).

Male: Unknown.

Holotype: Female, labeled "Pichinahuel, Chile, Cord. Nahuelbuta, January 20–28, 1959, Luis E. Pena." At the Illinois Natural History Survey.

Paratypes: CHILE: same data as for holotype (1 ♀). 40 km. E. of San Carlos, Nuble, XII–24–50, leg Ross and Michelbacher (1 ♀). El Coigo, Cord. Curico, Oct.–Nov. 1959, Luis E. Pena (1 ♀). Angol, 30 Dec. 1936, D. S. Bullock (1 ♀). At the Illinois Natural History Survey and California Academy of Sciences.

Discussion: Externally, this species is indistinguishable from *surosa* and *asorusa*; however, the lancet of *nema* is much longer, has more serrulae, and each serrula is flat and has only 1 subbasal tooth. The shorter antennae will help to separate this species from *flinti* in addition to the lancet characters. As devised, the species name is an arbitrary combination of letters and is to be treated as a noun.

Notofenusa cognata (Spinola), new combination

Tenthredo cognata Spinola, 1851. *In* Gay, Historia, fisica y politica de Chile, Zoologica, v. 6, p. 558.

This species must belong in *Notofenusa* because of its small size and coloration, and it may be one of the species described here. I was unable to locate the type, however, and because the classification of this genus is based on genitalia, the type will have to be examined for correct placement.

ACKNOWLEDGMENTS

The cooperation of the following has made this review possible: Per Inge Persson, Naturhistoriska Riksmuseum, Stockholm, Sweden; G. Morge, Institut für Pflanzenschutzforschung, Eberswalde, Germany; D. W. Webb, Illinois Natural History Survey, Urbana; and P. H. Arnaud, Jr., California Academy of Sciences, San Francisco.

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A REVIEW OF KARSCHOMYIA FELT WITH DESCRIPTIONS OF SEVEN NEW NEARCTIC SPECIES (DIPTERA: CECIDOMYIIDAE)

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ABSTRACT—*Karschomyia* Felt (Diptera: Cecidomyiidae) is redescribed and a key is given to the 10 Nearctic species. These are described and their genitalia are illustrated. The new species of *Karschomyia* described herein are **curiosa**, **ectopia**, **insolita**, **inusitata**, **mira**, **perissa**, and **praecipua**. The extra-Nearctic species are listed, with *elegans* Mamaev a new synonym of *ramosa* (Kieffer). *Karschomyia townsendi* Felt from Peru is transferred to *Coquillettomyia* Felt.

The genus *Karschomyia* Felt (Diptera: Cecidomyiidae: Cecidomyiidi) comprises a number of medium-sized, brown species which as adults are readily recognized by the transversely divided abdominal terga and sterna of segments II–VI. *Karschomyia* shares that char-

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acter with *Lobodiplosis* Felt, a closely related genus. The 2 genera differ only in the form of the male genitalia: in *Karschomyia* the basimere has glabrous, membranous mesal lobes of various bizarre shapes and the telomere is wide, mesally concave, and usually lobed; the basimere of *Lobodiplosis* has a setose apicoventral lobe and the telomere is elongate-attenuate. Females of these genera are neither separable to genus nor identifiable to species except in association with males.

The little that is known of the biology of *Karschomyia* indicates that the larvae are saprophagous. Most of the Nearctic species were either swept or caught in traps, but some were reared from such various sources as stems of Iceland poppy, a pig carcass [3 species from the same pig!], and pine bolts. Three Palaearctic species have been reared from decaying wood.

Karschomyia Felt

Karschomyia Felt 1908:398. Type-species, *Mycodiplosis viburni* Felt (orig. des.).

Male: Postvertical peak elongate. Eyes very large, broadly connate at vertex; eye facets hexagonoid. Antennal flagellomeres elongate, trinodal, trifilar; circumfila regular, not elongate, most loops not reaching to following node. Palpus long, 4 segmented. Wing: *Rs* faint, located approximately ⅓ distance from arculus to apex of R_1; R_5 not bent at *Rs*, strongly curved apically to join *C* posteriad of wing apex; *C* broken at juncture with R_5; *Cu*, M_{3+4}, and *PCu* strong. Tarsal claws strongly bent at basal ⅓, longer than empodia, simple or toothed either on all legs or only forelegs. Abdominal terga and sterna II–VI transversely divided cephalad of caudal setal row. Genitalia: basimere spherical, robust, with glabrous, membranous, mesal lobes; telomere of various shape, not elongate-attenuate, usually concave mesally and lobed; cerci short, quadrate; sternum X lobes triangular or quadrate, of same length as cerci, each lobe bisetose apically; aedeagus long, somewhat pigmented, of bizarre shape.

Female: Antennal flagellomeres elongate, usually slightly constricted near middle, circumfila with many closely-set bases. Ovipositor not protrusible; sternum VIII not sclerotized or setose; sternum IX covered with long setae; tergum IX naked; cerci truncate-ovoid with setae of approximately uniform length.

Larva (from Mamaev & Krivosheina (1965)): spatula clove-shaped. Postventral papillae without setae. Terminal papillae in 2 groups of 4 each, 3 papillae of each group with short, pointed setae, 1 with shorter, blunt seta.

As reported in Gagné (in press), *Metadiplosis* Felt (1908), *Plesiobremia* Kieffer (1912), and *Hiastatus* Marikovskij (1956) are synonyms of *Karschomyia*.

There are 10 Nearctic species, 7 of which are new to science and described herein. These are separated most easily by the shape of the male genitalia, but also by the setation of the male abdominal tergum VII and the presence or absence of teeth on the tarsal claws.

None of the species is Holarctic except possibly *caulicola*. In addition to the Nearctic species there are 8 Palaearctic and 1 Indian, as follows: *abnormis* (Mamaev, 1961b), *aceris* Mamaev (1960), *concinna* (Marikovskij, 1956), *curvidentata* (Mamaev, 1961b), *hemisphaerica* Kovalev & Mamaev (1966), *marikovskii* (Mamaev, 1961b), *orientalis* (Grover, 1965), *ramosa* (Kieffer, 1904; = *elegans* Mamaev (1961a), new synonym), and *xylophila* (Mamaev, 1961b).

In the Felt Collection, on loan to the Systematic Entomology Laboratory from the New York State Museum in Albany, there is a male specimen labeled, "*Bremia ramosa* Kieffer—from J. J. Kieffer," and it is apparently properly identified. Although Kieffer (1913) illustrated the male genitalia of *ramosa*, the drawing is meaningful only when compared with an actual specimen. The specimen also fits the illustration of *elegans* in Mamaev (1961a), and this is the reason for the above new synonymy.

Karschomyia townsendi Felt (1912) from Peru is here transferred to *Coquillettomyia* Felt. *New combination.* The male genitalia of *townsendi*, with the short, sclerotized, bifid aedeagus and elongate, linear, asetose sternum X, are characteristic of *Coquillettomyia*, and the abdominal terga and sterna are entire. The names I have chosen for the 7 new species described below all mean "peculiar," a reference to the bizarre male genitalia.

Key to adults of Nearctic *Karschomyia*

1. Foretarsal claw toothed, mid and hind claws toothed or simple 2
— Tarsal claws simple 7
2. All tarsal claws toothed .... *K. inusitata* Gagné, n. sp.
— Only foretarsal claws toothed 3
3. Caudal setal row of male tergum VII continuous 4
— Caudal setal row interrupted mesally 5
4. Aedeagus forked proximad of midlength; telomere rounded apically (fig. 4–6) .... *K. curiosa* Gagné, n. sp.
— Aedeagus forked apically; telomere acute apically (fig. 11) .... *K. perissa* Gagné, n. sp.
5. Aedeagus narrow, attenuate, sinuous in lateral view; telomere deeply lobed (fig. 16–18) .... *K. viburni* (Felt)
— Aedeagus wide, only weakly curved in lateral view; telomere entire 6
6. Aedeagus aspinulose, with 4 apical recurved hooks (fig. 25–26) .... *K. mira* Gagné, n. sp.
— Aedeagus spinulose, without hooks (fig. 1–2) .... *K. caulicola* (Coquillett)
7. Caudal setal row of male tergum VII continuous 8
— Caudal setal row interrupted mesally 9
8. Aedeagus palmately divided, lobes large; telomere widest near midlength, with 1 apical tooth (fig. 14–15) .... *K. spinosa* (Felt)
— Aedeagus trifid only apically; telomere widest apically, with 2 apical teeth (fig. 7–10) .... *K. ectopia* Gagné, n. sp.

9. Aedeagus trifid from base; telomere deeply bilobed, apical tooth narrow (fig. 22–24) .... *K. insolita* Gagné, n. sp.
— Aedeagus divided only apically, telomere not deeply lobed, apical tooth wide, discontinuous (fig. 12–13) .... *K. praecipua* Gagné, n. sp.

Karschomyia caulicola (Coquillett)
fig. 1–3

caulicola Coquillett 1895:401 (*Diplosis*).

Wing length: male, 1.7 mm; female, 2.1–2.3 mm. Foretarsal claw toothed, mid and hind claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 1–3.

Types: Lectotype, here designated, male, reared from larvae ex stem Iceland poppy, *Papaver nudicaule* L. (Papaveraceae), Isles of Shoals, N. H., emerged VII, 1893, USNM Type No. 6085. Paralectotypes, male and 10 females, same data as holotype.

The drawing accompanying the original description of the Palearctic *K. concinnus* (Marikovskij) (1956) shows some resemblance to this species in the trifoliate interparameral structure and the spinose aedeagus.

Karschomyia curiosa Gagné, new species
fig. 4–6

Wing length: male, 2.0 mm. Foretarsal claw toothed, mid and hind claws simple. Caudal row of setae of male tergum VII continuous. Male genitalia as in fig. 4–6. Female unknown.

Holotype, male, swept, Wheaton Park, Montgomery Co., Md., VIII–27–1970, R. J. Gagné, USNM Type No. 72373. Paratype, male, Robin Branch (near Wayah Bald), 4480′, Macon Co., N.C., 38° 10.1′ N, 83° 35.1′ W, VII–3–1958, J. L. Laffoon, in Laffoon Collection, Iowa State University.

Karschomyia ectopia Gagné, new species
fig. 7–10

Wing length: male, 1.7 mm. Tarsal claws simple. Caudal row of setae of male tergum VII continuous. Male genitalia as in fig. 7–10. Female unknown.

Holotype, male, Holmes Run, Va., VII–1–1960, W. W. Wirth, USNM Type No. 72374.

The genitalia of this species approach those of *K. perissa* in the general shape of the telomere and apically trifid aedeagus. *Karshomyia ectopia* differs, however, in other details of the genitalia, e.g. the apically narrower aedeagus and wider sternum X, and in the simple foretarsal claws.

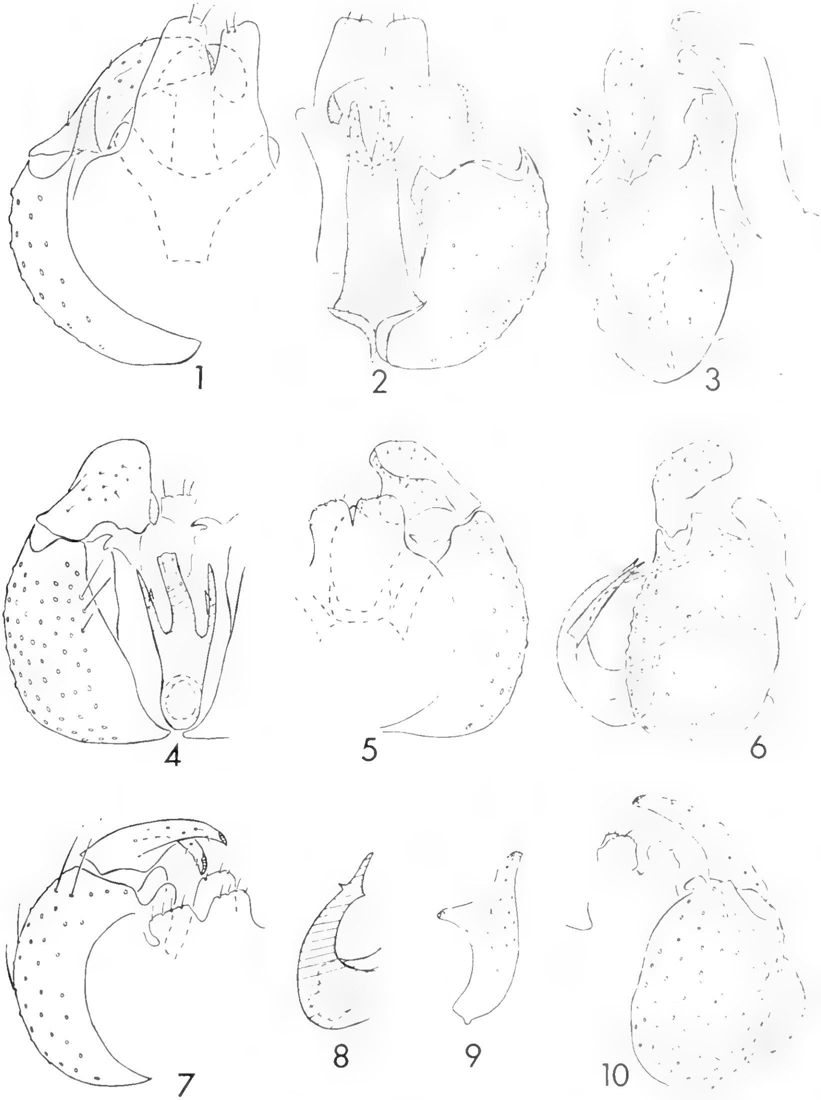

Plate 1

Fig. 1–10, male genitalia: 1, *Karschomyia caulicola* (dorsal). 2, same (ventral). 3, same (lateral). 4, *K. curiosa*, n. sp. (ventral). 5, same (dorsal). 6, same (lateral). 7, *K. ectopia*, n. sp. (dorsal). 8, same, aedeagus (lateral). 9, same, telomere (caudal). 10, same (lateral).

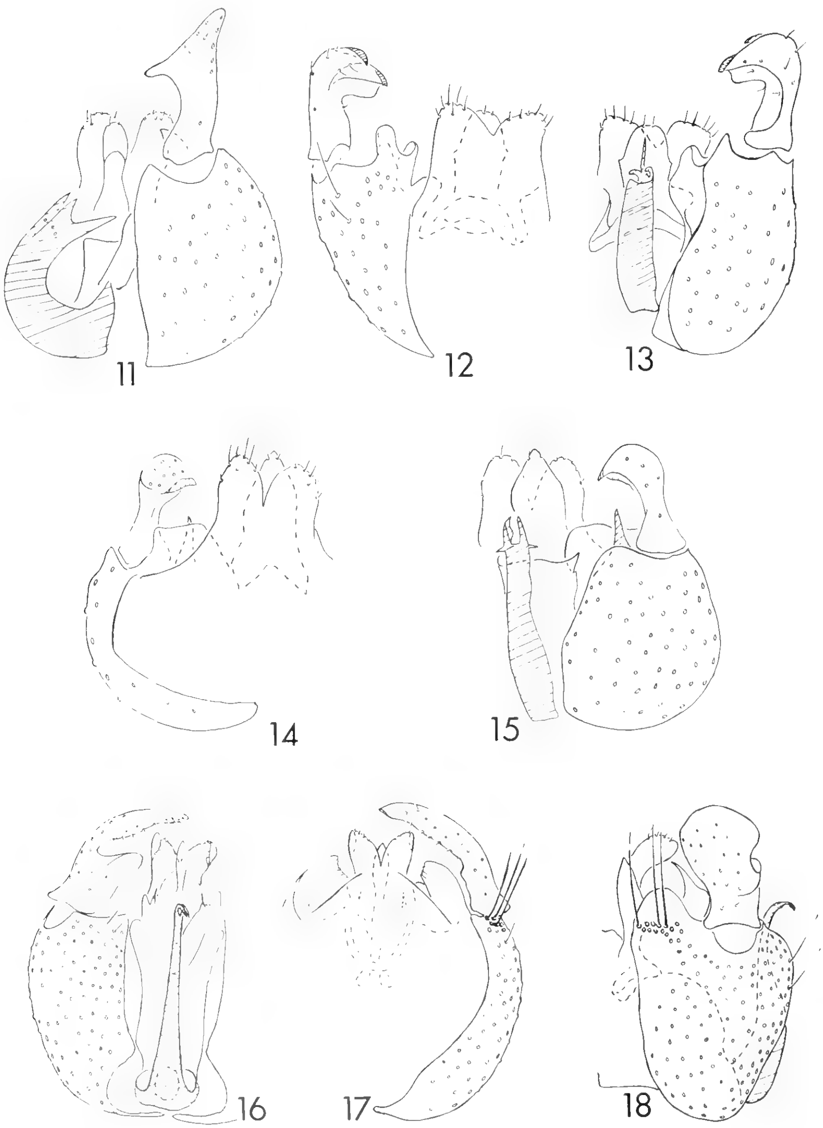

Plate 2

Fig. 11–18, male genitalia: 11, *Karschomyia perissa*, n. sp. (ventral view but aedeagus flattened to lateral view). 12, *K. praecipua*, n. sp. (dorsal). 13, same (ventral). 14, *K. spinosa* (dorsal). 15, same (ventral). 16, *K. viburni* (ventral). 17, same (dorsal). 18, same (lateral).

Karschomyia insolita Gagné, new species
fig. 22–24

Wing length: male, 2.0 mm; female, 2.3 mm. Tarsal claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 22–24.

Holotype, male, Black Lake, N. Burgess Township, Ontario, VII–27–1970, J. A. Downes, to be deposited in Canadian National Collection. Paratypes, 2 males, female, same data as holotype, deposited in USNM.

Karschomyia inusitata Gagné, new species
fig. 19–21

Wing length: male, 1.4–1.5 mm. Tarsal claws toothed. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 19–21. Female unknown.

Holotype, male, ex loblolly pine logs infested with *Dendroctonus frontalis* Zimm. (Coleoptera: Scolytidae), Elizabeth, La., VI–1968, L. S. Pickard, USNM Type No. 72376. Paratypes: 2 males, ex pig #7 (dry stage), Clemson, S.C., VIII–15–1966, J. A. Payne; 5 males, Silver Spring, Md., VIII–9–1972, W. W. Wirth.

Karschomyia mira Gagné, new species
fig. 25–26

Wing length: male, 1.7–2.9 mm. Foretarsal claw toothed, mid and hind claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 25–26. Female unknown.

Holotype, male, Silver Spring, Md., VIII–9–1972, W. W. Wirth, USNM Type No. 72375. Paratypes, 3 males, same data as holotype.

Karschomyia perissa Gagné, new species
fig. 11

Wing length: male, 1.7 mm. Foretarsal claw toothed, mid and hind claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 11. Female unknown.

Holotype, male, ex pig #7 (dry stage), Clemson, S.C., VIII–15–1966, J. A. Payne, USNM Type No. 72377.

Karschomyia praecipua Gagné, new species
fig. 12–13

Wing length: male, 1.9 mm. Tarsal claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 12–13. Female unknown.

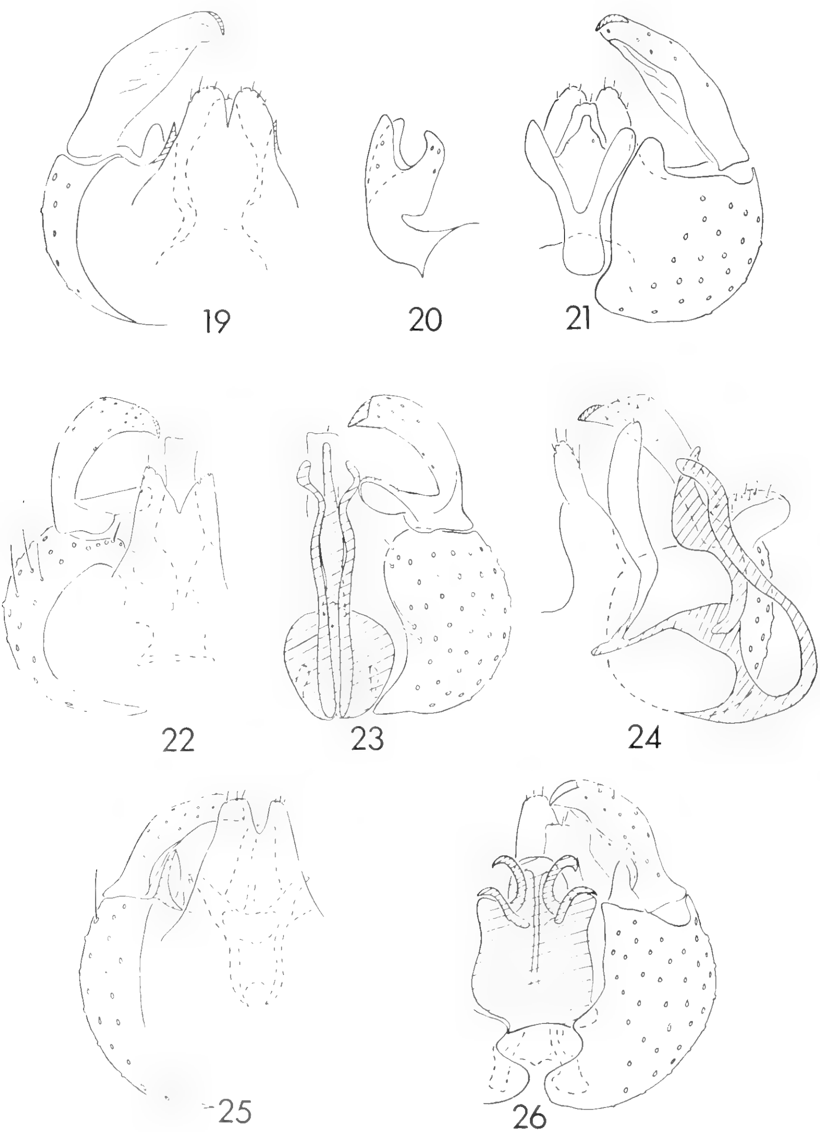

Plate 3

Fig. 19–26, male genitalia: 19, *Karschomyia inusitata*, n. sp. (dorsal). 20, same, aedeagus (lateral). 21, same (ventral). 22, *K. insolita*, n. sp. (dorsal). 23, same (ventral). 24, same (mesal). 25, *K. mira*, n. sp. (dorsal). 26, same (ventral).

Holotype, male, collected on *Salicornia virginica* L. (Chenopodiaceae), extracted by Berlese funnel, Sonoma Co., California, X–25–1968, G. N. Cameron, USNM Type No. 72378.

Karschomyia spinosa (Felt)
fig. 14–15

spinosa Felt 1908:406 (*Metadiplosis*).

Wing length: male, 1.8 mm. Tarsal claws simple. Caudal row of setae of male tergum VII continuous. Male genitalia as in fig. 14–15. Female unknown.

Holotype, male, Albany, N.Y., VII–14–1906, C 573, in Felt Collection.

Additional material examined: male, Wabasha, Minn., A. E. Pritchard.

Karschomyia viburni (Felt)
fig. 16–18

viburni Felt 1907:34 (*Mycodiplosis*).

Wing length: male, 1.7–2.2 mm; female, 1.9–3.0 mm. Foretarsal claw toothed, mid and hind claws simple. Caudal row of setae of male tergum VII interrupted mesally. Male genitalia as in fig. 16–18.

Holotype, male, Albany, N.Y., VI–1–1906, C 89, in Felt Collection.

Additional material examined: B.C.: Longford, IX–18–1963. CAL.: Mt. Home, San Bernardino Mts., San Bernardino Co., A. L. Melander. MD.: Silver Spring, VIII–9–1972, W. W. Wirth. MASS.: Mt. Greylock. ME.: Seal Harbor, VII–29–1930, A. L. Melander. N.Y.: Albany, VI–11–1906; Keene Valley, VIII–26–1917, H. Notman; Woodworth's Lake, Adirondack Mts., C. P. Alexander. ONT.: Webbwood, VII–24–1971, G. Muller. S.C.: Clemson, ex pig #7 (dry stage), VIII–15–1966, J. A. Payne. VA.: Holmes Run, Fairfax Co., VI–26 and VII–29, 1960, W. W. Wirth.

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DE GEER'S EXOTIC MUSCA SPECIES (DIPTERA: SYRPHIDAE AND CALLIPHORIDAE)

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ABSTRACT—*Musca surinamensis* De Geer, described from Surinam, is relegated to *nomen dubium* status in the family Syrphidae. *Musca erythrocephala* De Geer, also described from Surinam, is newly placed as a synonym of *Cochliomyia macellaria* (Fabricius).

De Geer, in his *Memoires pour servir a l'histoire des Insectes* (1776: 145, 146), described only 2 exotic species of *Musca, surinamensis* and *erythrocephala*, both from Surinam. Fabricius (1781:422, 424) synonymized both species (see below) although he indicated that the synonymy of *erythrocephala* was dubious. Since Fabricius' time both of De Geer's names have been considered to apply to syrphids and Fabricius' synonymies have been accepted almost without exception. However, while preparing the fascicle on the family Syrphidae for *A Catalogue of the Diptera of the Americas south of the United States*, I questioned both of Fabricius' synonymies and have decided that neither is correct.

Musca surinamensis De Geer

This species has been accepted as a synonym of *Palpada hortorum* (Fabricius) 1775, a West Indian species not known from the mainland. De Geer said that his species was very similar to *Eristalis horticola* (De Geer) and, among other things, that the wings, although transparent, nevertheless are tinged brownish yellow almost throughout and the legs are mixed yellow-ochre and brown (*"Les ailes, quoique transparentes, sont cependant teintes de brun jaunatre presque par-tout, . . . les pattes sont melees de jaune d'ocre* & *de brun."*). These characteristics, along with the type locality of *surinamensis*, clearly exclude *hortorum* as a synonym. Unfortunately the problem of the true identity of *surinamensis* is not as easily solved as the types are lost and the original description is inadequate. De Geer's reference to the similarity of his species to *Eristalis horticola* (De Geer) indicates that *surinamensis* should be placed in *Palpada*, and of the *Palpada* known to me the female of *vinetorum* seems to fit the description the best. However, rather than replace a well-known name with a dubious senior synonym, I feel *surinamensis* should be left as *nomen dubium*.

Musca erythrocephala De Geer

Fabricius synonymized this species with his *Ornidia obesa* but he indicated that the synonymy was dubious because of differences in body pile and head color. Kertész (1910:189) listed *erythrocephala* as a valid species of *Volucella*. Williston (1886:316) and Fluke (1957:68) did not list De Geer's species in their catalogs of Neotropical syrphids. However, van Doesburg (1963:50 & 1966:94) pointed out this omission, reprinted the original description, and later suggested that Fabricius' synonymy of *erythrocephala* should be accepted ". . . till the contrary has been proved." Apparently Fabricius and the other workers who have considered *erythrocephala* a syrphid have ignored the first line of De Geer's description, which states that his species is very similar to *Lucilia caesar* (Linnaeus), a well known species of Calliphoridae. The only reference to *erythrocephala* De Geer that I could find in the calliphorid literature was by Hall (1948:307, 308), who in a discussion of the usage of the original combination "*Musca erythrocephala*" by various authors mentions De Geer's species. Hall stated that for *erythrocephala* De Geer: 1) the type locality ". . . was not located"; 2) apparently the type ". . . is lost"; and 3) it ". . . may belong to *Rutilia*" (an Australasian genus of Tachinidae).

The "types" of *Musca erythrocephala* De Geer are still extant and are calliphorids, not syrphids or tachinids. Dr. Persson has kindly loaned me the 3 specimens under this name in the De Geer Collection (in the Swedish Museum of Natural History, Stockholm); 1 ♂ and 1 ♀ are *Chrysomyia megacephala* (Fabricius) 1805, and 1 ♀ is *Cochliomyia macellaria* (Fabricius) 1775. Since the type-locality of *erythrocephala* is Surinam this would exclude the specimens of *Ch.*

megacephala, an Oriental species, from being types and would restrict the name to the single specimen of *Co. macellaria*, a common and widespread New World species. However, to prevent any future uncertainty about the validity of this restriction, I hereby designate the single female specimen of *Co. macellaria* as the lectotype of *Musca erythrocephala* De Geer and have so labelled the specimen. Thus, the name *Musca erythrocephala* De Geer is removed from the family Syrphidae to the family Calliphoridae and synonymy under *Cochliomyia macellaria* (new synonymy).

Acknowledgments

I would like to thank the following: Dr. R. J. Gagné, Systematic Entomology Laboratory, USDA, Washington, D.C., for aiding in the identification of the calliphorid species; Dr. P. I. Persson, Naturhistoriska Riksmuseet, Stockholm, for the loan of the De Geer types; and Dr. P. Wygodzinsky, American Museum of Natural History, New York, for his critical reading of this manscript.

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ANOBIIDAE DESCRIBED BY M. HATCH, WITH NEW SYNONYMS (COLEOPTERA)

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ABSTRACT—Three holotypes of species described by Hatch have been examined with the following results: *Hadrobregmus nelsoni* Hatch and *H. roguensis* Hatch are synonymized with *H. gibbicollis* (Leconte); *Vrilletta fenderi* Hatch is synonymized with *Xyletinus grossus* Van Dyke. The types of *Oligomerus oregonensis* Hatch and *O. crestonensis* Hatch have not been located.

Melville Hatch described 8 species of Anobiidae as new in his "The Beetles of the Pacific Northwest" (1961). I have previously seen the holotypes of 3 of the species (*Catorama roguensis*, *C. nelsoni*, and *Xeranobium oregonum*) and reported on them (White, 1965, p. 313, p. 333, and 1971, p. 620). Of these three I found only *X. oregonum* to be valid. In another paper (1969) I presented reasons why I regarded the status of *Oligomerus oregonensis* Hatch as uncertain. Below are the results of my examination of the types of 3 of the 5 remaining species and my attempts to locate the types of the other 2.

Hemicoelus gibbicollis (Leconte)

Anobium gibbicollis Leconte, 1859, p. 284.
Hadrobregmus nelsoni Hatch, 1961, p. 318. NEW SYNONYM.
Hadrobregmus roguensis Hatch, 1961, p. 319. NEW SYNONYM.

The holotype of *nelsoni* (with the data, "College Place, VII–13–49 Wash, G. H. Nelson; To light; [light blue disk]; TYPE Hadrobregmus nelsoni 1958—M. Hatch; Hadrobregmus sp. n. Nelson collection," in University of Washington) exhibits a number of prothoracic differences from typical members of *gibbicollis*. These are as follows: in side view the pronotal crest is less distinctly produced; the lateral margin is obsolete at the center but the existing portions of the margin are longer and the anterior portion of the margin nearly attains the anterior angle and is more distinctly produced, thus making the pronotum wider; and the granules at the side are larger and more distinct. Figure 18 in Knutson (1963, p. 185) of the pronotal outline of a specimen Knutson assigned to *gibbicollis* almost exactly matches that of the holotype of *nelsoni*. Also, in the USNM series of over 60 specimens of *gibbicollis* there is a specimen from Sonoma, California, determined by Knutson as *gibbicollis*, which is in very good agreement with the type of *nelsoni*. The genitalia of this specimen of *gibbicollis* were dissected and placed in a microvial, but, unfortu-

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nately, these are fragmented and incomplete. However, it is clear that Knutson, during his revisionary work on *Hemicoelus* saw a specimen (-s?) of what corresponds to *nelsoni* and concluded that the specimen was a member of the variable *gibbicollis*. I am in agreewith this.

I have seen the holotype of *roguensis* (label data, "ORE.: Rogue Rv. N. F., Beaver Sulphur F. C., Aug. 10, 1959, K. M. Fender; TYPE ♀, Hadrobregmus roguensis 1957—M. H. Hatch," in University of Washington) and find the above change to be necessary. This specimen is a small example of the species *gibbicollis* (but within the normal size range) and does not differ significantly from it.

Xyletinus grossus Van Dyke

Xyletinus grossus Van Dyke, 1946, p. 86.
Vrilletta fenderi Hatch, 1961, p. 322. NEW SYNONYM.

The holotype of *fenderi* (bearing the data, "Siskyou Summit, Siskyou Mts. Cr., VI–8–47, K. M. Fender; *not* murrayi Lec., compared with type, M. H. Hatch 1958; TYPE, Vriletta fenderi, 1958-M. Hatch; Vriletta murrayi Lec., M. Hatch-1957" in University of Washington) is a member of the genus *Xyletinus*. It is in very close agreement with Van Dykes description of *X. grossus* and with illustrations of an antenna and the palpi of the holotype that I made some years ago.

Oligomerus oregonensis Hatch

Oligomerus oregonensis Hatch, 1961, p. 316.

In the original description the location of the holotype is given as the WSU collection. Dr. W. J. Turner of the Department of Entomology at Washington State University has informed me that the type is not to be found in their collection. Inquiries are still being made as to the location of the type.

Oligomerus crestonensis Hatch

Oligomerus crestonensis Hatch, 1961, p. 316.

In the original description the location of the type is given as the Stace Smith collection. Kathleen M. Stuart, Curator, Spencer Entomology Museum, The University of British Columbia, informs me that the type is not to be found in the Stace Smith collection. Inquiries are still being made as to the location of the type.

My thanks are offered to Melville Hatch, William Turner, and Kathleen Stuart.

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TABANIDAE (DIPTERA) OF TEXAS. I. COASTAL MARSH SPECIES, WEST GALVESTON BAY; INCIDENCE, FREQUENCY, ABUNDANCE AND SEASONAL DISTRIBUTION

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ABSTRACT—Collection of Tabanidae in estuarine marshes and meadows of West Galveston Bay, Brazoria County, Texas produced 16235 specimens of 20 species and subspecies in 3 genera; 3 in *Chrysops*, 1 in *Chlorotabanus*, and 16 in *Tabanus*. Nearly all material was collected with 6 modified Manitoba Traps and 3 modified Animal Traps. Routine collections were made weekly April 2–September 29. *Tabanus nigrovittatus* Macquart included 88% of the material taken and was found throughout most of the season (Apr. 19–Sept. 29). Six other dominants included most (89%) of the remaining 12% (in decreasing order of abundance): *Tabanus sulcifrons* Macquart, *T. texanus* Hine, *T. lineola* var. *hinellus* Philip, *T. subsimilis* Bellardi, *T. stygius* Say, and *Chrysops flavidus* Wiedemann.

The Tabanidae of Texas are known only from the work of Blume et al. (1972), Easton, Price, and Graham (1968), Gingrich and Hoffman (1967), Parman (1928), and Townsend (1898) (records of several species); of McGregor and Schomberg (1952, checklist); of L. L. Pechuman, C. B. Philip, and the Smithsonian Institution (unpublished records); and of Hine (1907) and Philip (1962) (descriptions from series collected in the state (*Tabanus texanus* and *T. eadsi*, respectively)).

Texas Coastal Marshes

The Texas coast line is a long crescent of barrier beaches and sand bars (e.g., Galveston and Padre Islands) enclosing bays and estuaries (e.g., Galveston and Baffin Bays). Inland from the beaches and dunes are salt marshes—low, intermittently flooded tidelands.

The geological formations underlying the marshes are broad belts of Pleistocene strata, 30 to 40 miles wide and paralleling the coast line from the Sabine River to the Rio Grande River or to Baffin Bay. These strata, the Houston Group, extend between the Pliocene deposits and the Recent coastal silts. The Lissie Sand formation, extending 50 miles inland, is composed of thick sand beds (60%), lentils of gravel (10%), and clay and silt (30%). It is 530 ft thick at the Hoskins Mound study area (Kennedy 1841, after Sellards, Adkins, and Plummer 1932). The Beaumont Clay formation, a stratum of 75–80% gray clay (the remainder, sand), lies over the Lissie and is overlain by Recent beach deposits. Salt domes are common on the coast east of Houston. These are young surface deposits pushed up by plugs of rock salt 1 mile wide and 4 to 5 miles deep; the domes are often capped with gypsum and sulfur and can overlay oil, as they do in the Hoskins Mound study area.

Study Area

The Hoskins Mound study area is a tract of coastal marshes and grasslands adjoining West Galveston Bay in Brazoria County. It lies 6 miles north of the western tip of Galveston Island and 11 miles east of Angleton. The intracoastal waterway borders the southern margin of the study area and lakes, bayous, ditches, tidewater pools, and stagnant ponds mark the marshes. Seahorse saltgrass (*Distichlis spicata* (L.) Greene) dominates the marshes, and such marshes are flooded under high tides. Patches of cordgrasses (*Spartina spartinae* (Trin.) Hitchc. and *S. patens* (Ait.) Muhl.) and toad rush (*Juncus bufonius* L.) are scattered intermittently throughout the *Distichlis*. A third cordgrass, *Spartina alterniflora* Loisel, forms extensive, often pure stands in lower areas of the marsh inundated by tidewaters, around the margins of lakes, bayous, and pools, and on the gently sloping shores of adjacent mud flats. A ridge traversing the marsh parallel to the intracoastal waterway (Hayes Ridge) and the lake south of it divide the marshes from higher ground inland. The ridge above the lake is approximately 2 miles long and 0.33 miles wide. *Spartina spartinae*, *S. patens*, *J. bufonius*, and an association of flowering plant species controlled by bluestem (*Andropogon glomeratus* (Walt.) B.S.P.) and three-awn (*Aristida oligantha* Michx.), compose the vegetation here. Areas of *S. patens* and *J. bufonius* in lower parts of the ridge are often flooded for long periods after rains and storm

Table 1.—Collection methods and catches (females) of Tabanidae taken at Hoskins Mound, Brazoria County, Texas, 1971.

	Manitoba Traps (6)	Animal Traps (3)	Grand Total	Seasonal Range
Chrysops				
brunneus Hine[a]		6	6	Aug 25–Sept 2
flavidus Wiedemann	108	2	110	Apr 30–Sept 29
niger Macquart[a b]		1	1	Jun 25
Chlorotabanus				
crepuscularis (Beq.)[a c]				Aug 14
Tabanus				
abdominalis F.[a d e]	22	1	23	Jun 18–Jul 18
acutus (Bigot)[a d]	12	31	43	Jun 18–Aug 25
americanus Forster	2		2	Jun 18
atratus Fabricius[a d]	4	1	5	Jun 18–Sept 29
cymatophorus Osten Sacken[a]	7	1	8	Jun 24–Jul 22
eadsi Philip[a]	1	3	4	Aug 25–Sept 29
lineola F.[a]	4	0	4	Jul 11–22
lineola var. *hinellus* Philip[d e]	334	56	390	Apr 19–Sept 29
mularis Stone[a]	14	44	58	Jun 4–Sept 29
nigrovittatus Macquart[a d e]	8340	5891	14231	Apr 19–Sept 29
nigrovittatus var. *fulvilineis* Philip	68	22	90	May 7–Sept 16
proximus Walker[a d]	15	1	16	June 18–Jul 18
stygius Say[a]	141	4	145	May 28–Sept 2
subsimilis Bellardi	124	22	146	Apr 2–Sept 16
sulcifrons Macquart[d]	424	42	466	Jun 4–Sept 2
texanus Hine[a]	40	373	413	Apr 19–Sept 29

[a] Brazoria County record.
[b] Identified from specimen fragments.
[c] Collected in 1970.
[d] Tabular figures do not include 52 male specimens (41 males for *T. lineola* var. *hinellus*, 1–5 males for others).
[e] Tabular figures do not include the following numbers of female specimens taken in miscellaneous collections: *T. abdominalis*, 1; *T. lineola* var. *hinellus*, 2; and *T. nigrovittatus*, 19.

tides. The gradually sloping high pastures and meadows north of the ridge are dominated by *S. spartinae*. Bermuda grass (*Cynodon dactylon* (L.) Pers.) is also comon in these pastures used for winter grazing of cattle. The pastures and meadows are unaffected by normal tides, being flooded only immediately after heavy rains. Water remains only after storms.

The information contained under this and the preceding headings was compiled from Harry and Harry (1971), Hunt (1967), Jurries (1970), Parker et al. (1971), and Sellards, Adkins, and Plummer (1932).

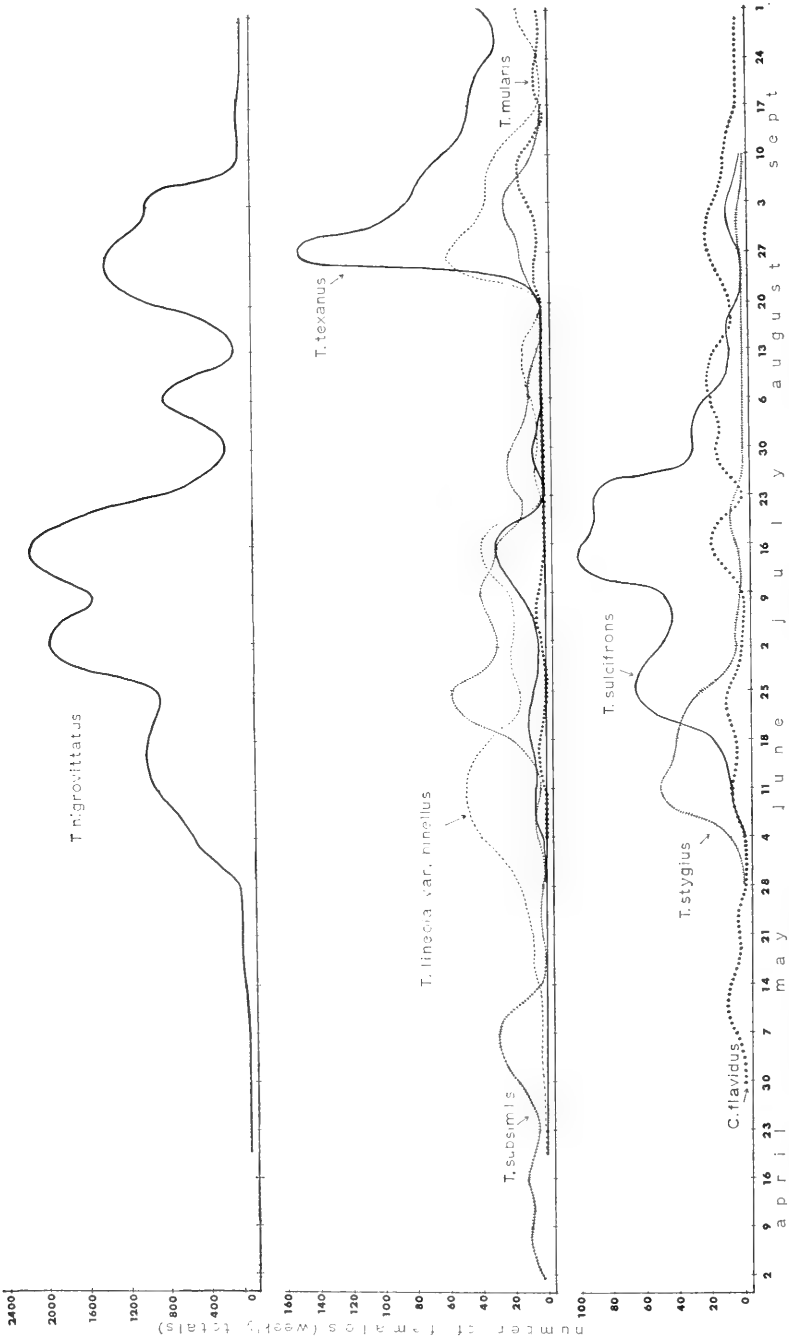

Fig. 1. Seasonal distribution of the dominant species of Tabanidae, Hoskins Mound, 1971.

Methods

Most flies were collected by the modified Animal Trap (AT) and the modified Manitoba Trap (MT). These traps were described in Thompson (1969); the most recent modifications were described in Thompson and Gregg (in press). Very small numbers of specimens were also collected from adhesive-treated asphalt shingles nailed to wooden stakes; from a gray, sedan delivery wagon; from above my head and from marsh vegetation or above it with an aerial net; and from 4 ten-ft lengths of white plastic PVC pipe (3 in. ID) treated with an adhesive and painted with black lines or bands (1 in. vertical, 1 pipe and 1 in. horizontal, 1; 3 in. vertical, 1; and unpainted, 1) (Table 1, miscellaneous collections). Catches were removed from traps weekly, April 2–Sept. 29, 1971. Three ATs and 6 MTs were erected in the marshes, in adjoining pastures, and on nearby ridges.

The Fauna

This study produced 16235 specimens of 20 species and subspecies in 3 genera; 3 in *Chrysops*, 1 in *Chlorotabanus*, and 16 in *Tabanus* (Table 1).

The fauna included species that were very abundant (*T. nigrovittatus*); abundant (50–100 specimens); common (10–50 specimens); and uncommon or rare (10 specimens or less (Table 1)). *Tabanus nigrovittatus* was the most abundant dominant species including 88% of the material. Eight other species included most (89%) of the remaining 12%: 1 deer fly (*C. flavidus*); 3 species of the *nigrovittatus-quinquevittatus* complex (*T. mularis*, *T. nigrovittatus* var. *fulvilineis*, and *T. texanus*); 2 species of the *T. lineola* complex (*T. lineola* var. *hinellus* and *T. subsimilis*); and 2 large horse flies (*T. stygius* and *T. sulcifrons*). Three other large or medium-sized horse flies (*T. abdominalis*, *T. acutus*, and *T. proximus*) were common. Eight species of the 3 genera represented were uncommon or rare.

The first species to appear was *T. subsimilis* (Apr 2). This species, *T. nigrovittatus*, *T. texanus*, *T. lineola* var. *hinellus*, and *C. flavidus* were the only species to appear in April; these 5 species were among the 7 most abundant forms collected. *T. nigrovittatus* var. *fulvilineis* appeared in May. The remaining species (but for *C. brunneus* and *T. eadsi*) were first collected in the first half of June. All common and abundant species continued into September, except *T. abdominalis*, *T. acutus*, and *T. proximus*. Catches indicated that populations of most species increased and decreased irregularly with no distinct peaks of abundance (Fig. 1). *Tabanus stygius* peaked in mid-June, and *T. sulcifrons* in mid-July. Catches dropped markedly after heavy rains.

Acknowledgments

I gratefully acknowledge the help of the following persons: Mr. Edward J. Gregg for conscientiously collecting catches and maintaining traps; and Doctors Alan Stone, L. L. Pechuman, and Harold W. Harry for editorial comments.

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ANOPHELES (AN.) REIDI, A NEW SPECIES OF THE BARBIROSTRIS SPECIES COMPLEX FROM SRI LANKA (DIPTERA:CULICIDAE)[1]

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ABSTRACT—The female of *Anopheles (Anopheles)* **reidi** n. sp. from Sri Lanka is described, illustrated and compared morphologically with the other members of the ***barbirostris*** species complex, and the members of the ***bancrofti*** species complex. Variations in the adult habitus of *An. barbirostris* Van der Wulp, and ***An. barbumbrosus*** Strickland and Choudhury are also discussed.

Carter (1925, 1950) discussed a species of *Anopheles* in the Ceylon fauna which he considered conspecific with *Anopheles pseudobarbirostris* Ludlow 1902. Reid (1962) examined two specimens seen by Carter and decided on the basis of morphological and zoogeographic differences that they were not conspecific with *pseudobarbirostris*, and probably represented a new species. However, since the two specimens were in poor condition, he chose not to describe them as new, but called them the "Ceylon species".

Recently, Smithsonian Institution personnel working under Smithsonian Research Foundation Grant SFG-0-2854, Biosystematic Studies of the Insects of Ceylon, collected a near perfect female specimen in Sri Lanka that I consider the same species as the specimens seen and discussed by Carter and Reid. I have been unable to borrow the two original specimens for comparison or those seen by Reid, but I am convinced of this association because this female has all of the characters described by Reid (1962) for the "Ceylon species". A comparison of this specimen with the lectotype and original description (Ludlow 1902) of *An. pseudobarbirostris* quickly confirmed Reid's opinion. This new species is very distinct from the other known species of the *barbirostris* and *bancrofti* complexes.

Anopheles (Anopheles) reidi, n. sp.

fig. 1

Anopheles (Anopheles) pseudobarbirostris of Carter 1925, Ceylon J. Sci. (D) 1: 69 (♀); Baisas 1931, Philippine J. Sci. 44: 429 (in part); Christophers 1933, Fauna of British India. Diptera, 4: 162 (in part); D'Abrera 1944, J.

[1] This work was supported in part by Research Contract No. DA-49-193-MD-2672 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, and carried out at the Southeast Asia Mosquito Project, Smithsonian Institution, USNM, Washington, D.C. 20560. This paper is contribution number 1194 from the Army Research Program on Malaria.

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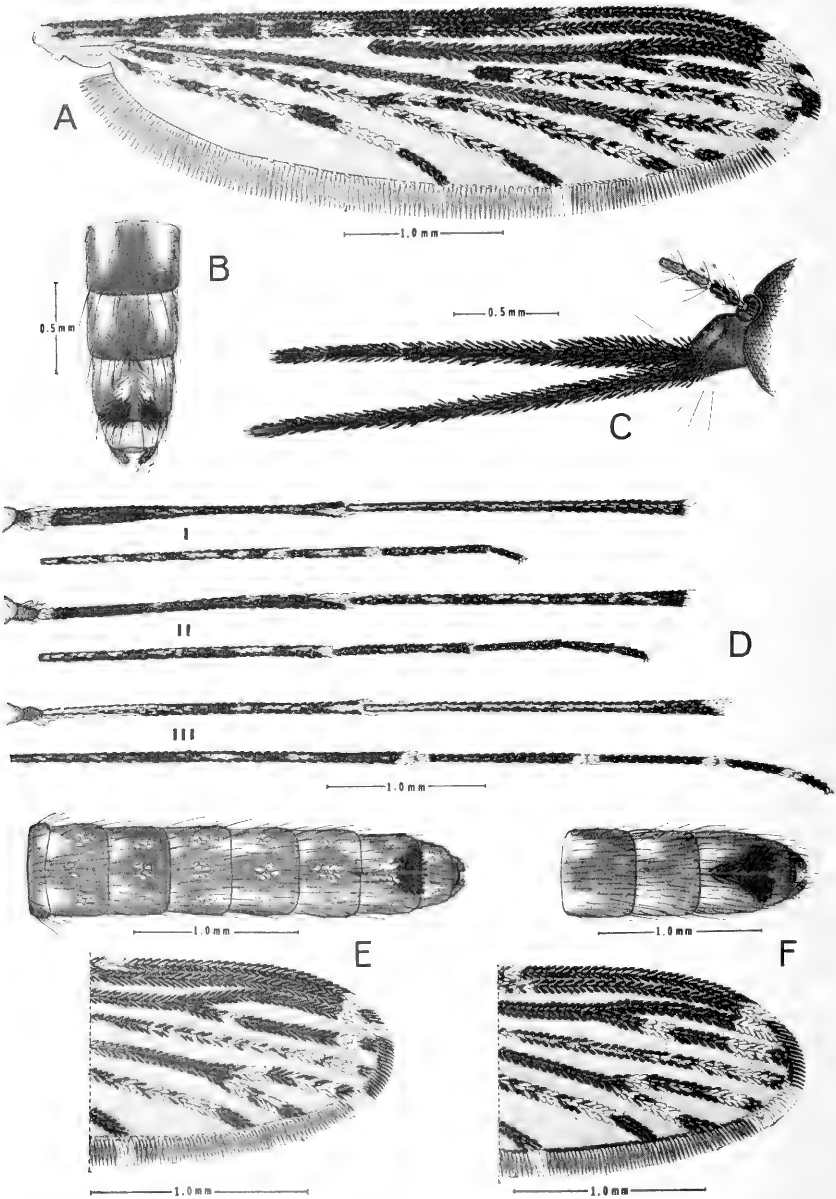

Fig. 1. *Anopheles* (*An.*) *reidi*, n. sp., holotype ♀: A, right wing; B, abdominal sterna V-VIII; C, head; D, fore, mid and hind legs, lateral view. *Anopheles* (*An.*) *pseudobarbirostris* Ludlow, lectotype ♀: E, abdominal sterna I-VIII, and distal half of right wing. *Anopheles* (*An.*) *barbumbrosus* Strickland and Choudhury, (Sri Lanka ♀): F, abdominal sterna V-VIII, and distal half of right wing.

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Anopheles (Anopheles) bancrofti of Covell 1927, Indian Med. Res. Mem. 7: 14 (in part); Edwards 1932, Genera Insect. 194: 40 (in part).

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Anopheles (Anopheles) "Ceylon species" of Reid 1962, Bull. Entomol. Res. 53: 38 (♀); Reid 1968, Stud. Inst. Med. Res. Malaysia 31: 120.

FEMALE (Fig. 1). *Head.* Palpus with very dense, erect black scales, most distal scales more decumbent; palpus slightly shorter than proboscis; proboscis with black scales, most distal scales more decumbent, labellum nearly bare; fore femur/proboscis ratio 1.01; clypeus without scales; vertex with erect broad dark brown-black scales except several broad white scales just above the interocular space; interocular space with short narrow white scales and long brown setae forming dark frontal tuft; antennal pedicel with small dark scales on upper and outer aspects; first antennal flagellomere with short black scales, remaining flagellomeres without scales. *Thorax.* Scutal integument frosty gray-brown, with dark longitudinal lines on the dorsocentral and supraalar bare areas; anterior promontory with narrow erect pale scales mesally, darker and broader scales laterally; scutum with short fine, pale curved scales, especially dense on acrostichal and prescutellar areas; scutal setae tan to dark brown, in anterior promontory, acrostichal, dorsocentral, lateral prescutal, fossal, antealar and supra-alar groups; scutellum with long brown setae and narrow pale curved scales; anterior pronotum with dark erect scales on cephalic half, pale short setae on caudal half; pleuron generally dark brown, with 1 pale scale on left propleuron, 1–4 pale scales on lower sternopleuron just cephalad of lower sternopleural setae, and 3–9 pale scales in median patch on mesepimeron; pleural setae number, 4–5 propleural, 6–7 spiracular, 3–4 upper and 6–8 lower sternopleural, 15–19 prealar, 10–12 upper and 0 lower mesepimeral. *Wing.* Costa mainly dark scaled, with small humeral pale spot, several scattered individual pale scales on basal ⅓, small subcostal pale spot and small preapical pale spot; subcosta with several pale scales adjacent to sector spot on vein R, and 1–2 pale scales at apex adjacent to subcostal pale spot on costa; preapical pale spot involves fringe scales and tip of vein R_1; remigium with dark scales except small central pale spot; humeral cross vein with 3–4 large dark scales; R–R_1 mostly dark scaled, with 3–4 small groups of pale scales proximal to more distinct pale sector spot, 15–20 scattered pale scales beyond sector spot out to level of subcostal pale spot on the costa, only 1–2 pale scales in preapical dark area beyond level of subcostal pale spot; tip of R_1 with pale scales; R_s with dark scales; R_{2+3} with dark scales to fork; R_2 with dark scales except pale scales on tip; R_3 with dark scales except small pale spot on basal half and slightly larger preapical pale spot, tip with dark scales; R_{4+5} with distinct dark basal spot, distinct pale preapical spot and tip with dark scales, remainder with mixed pale and dark scales; M with dark scales to fork; M_{1+2} base and tip with dark scales, mixed pale and dark scales in between; M_{3+4} base and tip with dark scales, mixed pale and dark scales in between; extreme base of Cu with pale scales and 1–2 dark scales, followed by distinct dark patch of scales, remainder to fork with mixed pale and dark scales; Cu_1 with small dark spots at base, M-Cu crossvein and tip, distinct pale spot between dark spots at base and M-Cu crossvein, remainder mixed pale and dark scales; Cu_2 with pale scales mixed with infrequent dark scales on basal ¾, apical ¼ with dark scales; 1A with mixed pale and dark scales on basal ½, distinct dark mark at midpoint followed by large preapical pale area, tip with dark scales; apical dark mark on Cu_2 longer than apical dark mark on 1A; primary, secondary and tertiary fringe scales dark except preapical pale fringe spot immediately above and down to level of R_1, small accessory pale apical fringe spot adjacent to R_2, long apical pale fringe spot from R_{4+5} caudally to slightly beyond M_{1+2}, and small pale fringe spot on caudal margin of wing adjacent to tip of Cu_2; *Halter.* With dark scales. *Legs.* Fore and mid coxae with upper and lower patches of pale scales, hind coxa with only lower scale patch; mid coxa with 1 upper coxal seta; hind coxa with 2 large caudo-mesally projecting setae. Fore leg: femur swollen on basal half and dark scaled except narrow basal band of pale scales, anterior and posterior apical pale spots and scattered, often grouped, pale scales along anterior and posterior surfaces; tibia with dark scales, without pale basal or apical band, with scattered, often grouped, pale scales along entire length of anterior and posterior surfaces; tarsomeres 1 and 2 with pale apical bands approximately equal to segment width and scattered, usually grouped pale scales; tarsomeres 3–5 with only dark scales. Mid leg: femur with dark scales except small basal pale band, anterior and posterior apical pale spots and scattered pale scales that nearly form continuous line on posterior surface; tibia with dark scales except scattered pale individual or groups of scales that form broken lines on anterior and posterior surfaces; tarsomere 1 with dark scales, apical pale band approximately equal width of segment, and scattered pale individual or groups of scales mostly on anterior and posterior surfaces; tarsomere 2 with dark scales, a small dorso-apical pale spot and several mostly anterior and posterior patches of scattered pale scales; tarsomeres 3–5 with dark scales. Hind leg: femur with dark scales except small basal pale band, anterior apical pale spot and scattered pale individual or groups of scales that form broken lines on anterior and posterior surfaces; tibia with dark scales except dorso-apical pale spot and scattered pale individual or groups of scales that form broken lines on anterior and posterior aspects; tarsomeres 1–5 with dark scales except tarsomere 1 with scattered individual or groups of pale scales on anterior and posterior surfaces, tarsomeres 1–4 with apical pale band approximately equal segment width, and tarsomeres 2–5 with basal pale band approximately equal or smaller than segment width. *Abdomen.* Integument light to dark brown, without tergal scales, but with numerous long dark setae; sterna without scales except 3 median black scales near caudal margin of sternum VI, and sternum VII with 15 median white scales on cephalic half and more than 20 median black scales on caudal half.

MALE, PUPA AND LARVA. Not known.

TYPE DATA. Holotype female, SRI LANKA (Ceylon): Central Province, Kandy District, Peradeniya Botanical Gardens, January 1971, Piyadasa & Somapala collectors. The holotype is deposited in the Smithsonian Institution, U.S. National Museum (Natural History), Washington, D.C., and is in excellent condition with all body parts present and only minor rubbing damage evident on the wings and legs.

DISTRIBUTION. SRI LANKA. Examined: Female holotype from Central Province, Kandy District, Peradeniya Botanical Gardens. Carter (1925) listed two females collected in Western Province, Colombo District, Colombo and Ganemulla, and Reid (1962) examined a female collected in 1936 in the Province of Uva, Badulla District. All previous records of *pseudobarbirostris* from the Indian subregion (Sri Lanka) probably apply to *reidi*. Accordingly, *pseudobarbirostris* Ludlow now has its western most extension in the Philippines and the Celebes.

BIOLOGY. No data.

TAXONOMIC DISCUSSION. Carter's (1925) association of specimens of this species with *pseudobarbirostris* was apparently based on both having spotted legs and a pale fringe spot adjacent to the tip of wing vein R_2. These similarities are superficial, for *reidi* belongs to the *barbirostris* species complex, while *pseudobarbirostris* is a member of the *bancrofti* species complex (Reid 1962). Adult members of the *barbirostris* complex have the following characters that will differentiate them from the *bancrofti* complex: wing with an apical pale fringe spot at vein R_{4+5} and often from R_{4+5} to M_{1+2}; wing without a prehumeral pale spot on the costa; wing with scattered pale scales on the basal half of the costa; and abdominal sternum VIII without pale scales. These two complexes also have distinct zoogeographical distributions, with only a small area of overlap. The *bancrofti* complex has basically an Australasian distribution with records from Australia, Celebes, Ceram, the Moluccas, New Guinea and the Philippines. The *barbirostris* complex has a distinct Oriental distribution that extends from India east to the Philippines, Ambon, Celebes, Ceram and the western tip of New Guinea. Only 4 of the 11 species in the latter complex are known to be sympatric with members of the *bancrofti* complex.

Besides the above species complex differences, *reidi* can be differentiated from *pseudobarbirostris* by having the following additional characters: pale spots on the legs formed by groups of scales; hind tarsomere 2 with a distinct basal pale band; and abdominal sterna II-VI without pale scales.

Anopheles reidi can be separated from all the other members of the *barbirostris* species complex by possessing the following primary characters: (1) spotted legs; (2) a pale basal band on hind tarsomere 2; and (3) pale bands crossing all 4 of the hind tarsal joints. Additional characters on *reidi* that have secondary value are: (1) wing with an accessory apical pale fringe spot at vein R_2; (2) wing with an apical pale fringe spot from vein R_{4+5} to M_{1+2}; and (3) abdominal sterna II-VI without pale scales. The possession of the two latter characters places *reidi* in Reid's (1962) *vanus* subgroup of the *barbirostris* complex, along with *ahomi* Choudhury (Assam), *barbum-*

brosus (Oriental), *manalangi* Mendoza (Philippines) and *vanus* Walker (Philippines, Borneo, Celebes and Moluccas).

Besides *reidi*, there are two other members of the *barbirostris* complex known from Sri Lanka. The first, *barbirostris* (*barbirostris* subgroup), possesses none of the primary or secondary characters listed for *reidi*. The second, *barbumbrosus* (*vanus* subgroup), lacks the accessory pale fringe spot at R_2 listed under the secondary characters, and all of the primary characters listed for *reidi*. Both *barbirostris* and *barbumbrosus* from Sri Lanka have adult characters that differ from *barbirostris* and *barbumbrosus* specimens from Southeast Asia, but these differences apparently reflect infraspecific geographical variation. Adult *barbirostris* from Sri Lanka typically have dark wings and numerous pale scales on the abdominal sterna, characters that are usually found on *An. campestris* Reid, in Malaysia and Thailand. Adults of *barbumbrosus* from Sri Lanka have only narrow apical pale bands on hind tarsomeres 3 and 4, and do not have an accessory pale fringe spot on the wing at R_2 (Fig. 1), while those from Indonesia (topotypic), Malaysia and Thailand have basal and apical pale bands on hind tarsomeres 3 and 4 and have a distinct accessory pale fringe spot at R_2. However, the larvae, pupae and male genitalia of *barbirostris* and *barbumbrosus* from Sri Lanka are essentially identical with Southeast Asian *barbirostris* and *barbumbrosus* specimens. Such disjunct adult and larval character associations and leg and wing variations have been previously noted by Reid (1963 and 1968) in *barbirostris* and other species.

The only other species in the *barbirostris* complex currently known from the Indian subregion is *ahomi* from Assam. This poorly known species does not have speckled legs, but does have a wide pale wing fringe spot from R_{4+5} to M_{1+2} and the abdominal sterna without pale scales, making it a member of the *vanus* subgroup. Currently, there is confusion regarding the presence or absence of an accessory pale wing fringe spot on *ahomi*. Wattal, Kalra and Gopal (1962) indicate *ahomi* has this pale spot, while Reid indicates it is absent. Reid (1962, p. 38 and personal communication) based his description of the *ahomi* wing on an excellent wing illustration drawn by Wattal who examined the wing of *ahomi* at Reid's request and sent him the illustration.

Anopheles vanus of Wattal, Kalra and Gopal (1962) reported from India, does not agree with the definition of *vanus* assigned by Reid (1962), after he examined Walker's type specimen. Reid (1968) considers the specimens seen by the above authors as variants of *barbirostris* sensu stricto.

The adult female of *reidi* is one of the most easily recognized members of the *barbirostris* complex. Hopefully, this will help in the discovery of other specimens, particularly the male and immatures.

The importance of the immature stages cannot be over stressed for Reid's (1962) revision of the *barbirostris* complex was based primarily on larval and pupal characters. The *barbirostris* complex in the Indian subregion needs re-evaluation in light of Reid's revision. The limited Indian material available for study consists almost entirely of adults without associated immature skins.

Anopheles reidi is named in honor of Dr. John A. Reid in recognition of his outstanding contributions to our understanding of anopheline systematics and human malaria and filarial epidemiology. His many faceted approach to anopheline taxonomy has been a major demonstration of the value of the biological species concept in taxonomy and medical entomology.

Acknowledgments

Special appreciation is due Mr. E. L. Peyton, Acting Principal Investigator, Southeast Asia Mosquito Project (SEAMP), and LTC Bruce F. Eldridge, Chief, and Dr. Ronald A. Ward, Department of Entomology, Walter Reed Army Institute of Research, for critically reviewing the manuscript. Appreciation is also due Dr. Karl V. Krombein, Project Coordinator-Biosystematic Studies of the Insects of Ceylon, Department of Entomology, Smithsonian Institution, for his assistance. I am also very grateful to Miss Gloria Gordon, SEAMP Illustrator, for preparing the illustrations.

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A FURTHER NOTE ON ACOMPHA COSTALIS (WIEDEMANN) (DIPTERA: RICHARDIIDAE)

Sepsis costalis Wiedemann was made the type of a new genus of Sepsidae, *Sepsisia*, by Curran (1934, Bull. Amer. Mus. Nat. Hist. 62:347). Later I placed it in the genus *Acompha* (Richardiidae) on the basis of examination of Wiedemann's type (Steyskal, 1971, Papéis Avulsos de Zool., São Paulo. 23:157). I was not at that time able to locate the specimen seen by Curran.

Through the courtesy of F. Christian Thompson, Curran's specimen was located in the American Museum of Natural History, New York, and made available to me. It is indeed conspecific with *Sepsis costalis* Wiedemann. The specimen lacks its head and all legs except one, the left foreleg with only the basitarsus remaining. It disagrees with Curran's description only in having the veins at the apex of the wing distinctly convergent, as in my drawing, and in that the femur of the foreleg, the tibia of which is closely drawn up against it, bears 2 anteroventral and 1 posteroventral subapical spinules. The mesoscutum bears a distinct posterior dorsocentral bristle at the end of a row of closely spaced, very small setae and a double median row of similar small setae mesally.

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BREVENNIA REHI (LINDINGER) A POTENTIAL PEST OF RICE IN THE U. S. (HOMOPTERA: COCCOIDEA: PSEUDOCOCCIDAE)

During the preparation of a revision of the mealybug genus *Heterococcus* Ferris, it has become apparent that *H. tuttlei* Miller and McKenzie (1970, Ann. Entomol. Soc. Amer. 63:438–453) should be treated as a junior synonym of *H. rehi* Lindinger (1943, Arb. Morph. Taxon. Entomol. 10:145–152) (NEW SYNONYMY). Furthermore, it is evident that *rehi* should be transferred to *Brevennia* Goux, the name becoming *Brevennia rehi* (Lindinger) (NEW COMBINATION).

It is important that this information be made available as soon as possible because *B. rehi* has been known only from Bangladesh, Burma, India, Java, Nepal, and Pakistan (Williams 1970, Bull. Entomol. Res. 60:109–188) where it is sometimes considered a pest of rice (Banerjee 1956, Proc. Zool. Soc. Calcutta 9:65–84; Trehan and Pringle 1946, Jour. Bombay Nat. Hist. Soc. 46:139–153). In the U.S., *B. rehi* has been reported as *H. tuttlei* from Yuma, Arizona, and Bard and El Centro, California (Miller and McKenzie 1970, Ann. Entomol. Soc. Amer. 63: 438–453). In these areas it is a pest of Bermuda grass, *Cynodon dactylon*, grown for seed. An additional infestation has been found at Pompano Beach, Florida on the same host. If *B. rehi* were introduced into the rice growing areas of the U.S., it might also become a pest of that host.

I wish to thank Dr. D. J. Williams, Commonwealth Institute of Entomology, London, and Miss L. M. Hanford, British Museum (N.H.) for providing specimens of *B. rehi* for study.

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A NEW CAMPSOMERIELLA FROM NEW IRELAND (HYMENOPTERA: SCOLIIDAE)

Only 1 female of *Campsomeriella manokwariensis* (Cameron) was available from New Ireland when I prepared my monograph of the scoliid wasps of New Guinea, Bismarck Archipelago and Solomon Islands (Krombein, K. V. 1963. The Scoliidae of New Guinea, Bismarck Archipelago and Solomon Islands. Nova Guinea, Zool. 22:543–651, 46 figs., 1 tab.). I mentioned (p. 603) that this specimen, collected along the lower Kait River, was unlike females of typical *manokwariensis* in that the apical setal fringes of the first 4 abdominal terga were drak brown rather than white. Two additional females are now at hand from Kandan, New Ireland. Their tergal fringes are black, suggesting that this dark coloration is not an individual variation, and that the New Ireland population merits description as a discrete subspecies. Males of the several subspecies of *manokwariensis* can be separated only on the basis of their provenance. Two males bearing New Ireland labels are considered to be the opposite sex of *m. kraussi.*

Campsomeriella (*Campsomeriella*) *manokwariensis kraussi* Krombein, new subspecies

Holotype: ♀, Kavieng, New Ireland, 0–50 m, October 1968, N. L. H. Krauss (Bishop Museum). BPBM type no. 9923.

Female: Length 15 mm, forewing 12 mm. Characters as described for typical *manokwariensis* except that all of the abdominal vestiture is black and the wings are more deeply infumated.

Allotype: ♂, Gilingil Plantation, southwest New Ireland, 2 m, 4 July 1956, J. L. Gressitt (Bishop Museum).

Male: Length 15 mm, forewing 12 mm. Characters as described for typical *manokwariensis.*

Paratypes: 1 ♀, same data as holotype (USNM). 1 ♀, lower Kait River, southwest New Ireland, 7 July 1956, E. J. Ford, Jr. (Bishop Museum). 1 ♂, Kandan, New Ireland, 24 December 1959, W. W. Brandt (USNM). The former female is like the holotype; the latter female has the first 4 tergal fringes dark brown except for the sides which are medium brown.

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BOOK REVIEW

The Classification and Phylogeny of the Psocoptera. 1972. Courtenay N. Smithers. Memoir 14, Australian Museum, 349 pp., 910 figs. Australian Museum, College St., Sydney 2000, Australia. Paper bound. Price: $7.00 (Australian).

This valuable book is the result of a thesis submitted to Rhodes University, Grahamstown, South Africa. The early chapters supply much concise and useful introductory material about the biology of psocids, and several classifications which have been current at different periods in the history of systematic work on these insects are compared. The largest section, of over 200 pages, defines and illustrates in considerable detail the world genera and higher categories in the arrangement as *currently* utilized by most Psocoptera specialists. It is a classification growing out of Pearman's 1936 outline, mainly as modified by Roesler in 1944 and Badonnel in 1951, and it now comprises 35 families. There follow sections on fossils, phylogeny and evolution, and zoogeography; near the end, a *new classification* is proposed. There are many morphological drawings, and numerous phylogenetic "trees" show group relations. Because of the availability of the bibliography and catalogue mentioned below, synonymous generic names (there are now 215 valid genera) are not listed in the index of the present volume, and its bibliography mainly includes recent publications.

Dr. Courtenay Smithers, who in 1972 served as the Secretary of the 14th International Congress of Entomology in Canberra, is now Principal Curator at the Australian Museum, Sydney, where he has been working since early 1960. Earlier his home was in Rhodesia, where he studied psocids for about 5 years. In the past he has published several dozen papers on psocids, the most important ones being a Bibliography of the Psocoptera (1965) and a Catalogue of the Psocoptera of the World (1967). Hence, the new volume is the third of his works to deal with the world fauna and its literature in a comprehensive way, and it clearly demonstrates his full grasp of this Order of insects.

Prior to 1936, psocid classifications, especially that of Enderlein, till then the outstanding describer, utilized chiefly superficial external characters, regardless of their fundamental importance. However, John Pearman of England was the first to develop a wide range of basic characters, some of them concerned with biology, and he had a deep influence on the work of his contemporaries. (It was my long-remembered pleasure to visit him at his country cottage near Tring, in 1965.) It is a pity that his hoped-for "Essay," planned to follow his preliminary 1936 classification, was apparently far short of completion when he died in late 1970. During recent decades a great many species and genera of Psocoptera have been described, especially from tropical and subtropical regions, so that the modified Pearman classification has undergone considerable testing at the same time the number of known species has grown to nearly 2,000 (1605 species in 1967; 136 species were known to Hagen in 1866).

In Smithers' new classification the emphasis is on an application of Hennig's system of selecting fundamental or plesiomorphous characters rather than derived or apomorphous ones. It is not always clear how the former are recognized, and there are no identification keys to the 25 families. Two suborders are recognized, and the suborder comprising the "lower" genera includes a large number of families, but the more advanced or "higher" genera in the other suborder are concentrated in a small number of families, unlike the situation with the pre-Smithers classification. In the formation of a classification for which permanence is hoped, the principle of seeking fundamental characters instead of arbitrarily selecting superficial ones is sound. After 18 years of experience with the world fauna, including the utilization of fossil genera insofar as possible, Smithers is well situated to make an appraisal of the principal group characters exhibited by Psocoptera. He feels that the Hennig method deserves a fair trial, and that here in a small but diverse order there is an opportunity to make that test. How well newly discovered genera will fit into the classification in the future will tell something of its naturalness and value. The eventual publication of a new key to families will be of great service.

In less than 40 years our knowledge of Psocoptera has advanced a great deal, due in part to the fact that about a half-dozen dedicated and skilled cooperating specialists were working at approximately the same time. The new volume by Smithers is a real landmark in the history of psocopterology.

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General and Applied Entomology. 3rd Edition. By V. A. Little. 1972. 527 pp., 315 figs. Harper & Row, 49 East 33rd St., New York, N. Y. 10016. $13.95.

This book, designed as an introductory textbook of entomology, is by an experienced teacher who knows that the majority of students using it will take only one course. Consequently, he has assembled here a broad spectrum of information intended to represent entomology fairly and give beginning students a worthwhile background. Dr. Little is a Professor Emeritus at Texas A. & M. University. The first edition of his book appeared in 1957, the second edition in 1963. The current edition has a few less pages and illustrations than the first, but some photographs in edition 1 seem clearer. Space devoted to literature references and a glossary of terms is somewhat greater in edition 3. Some subjects such as pheromones, ecology, and behavior now are discussed more fully. A key to the insect orders is kept, but keys to families are omitted. A chapter on control methods is near the end of the book, though in edition 1 it was located before the reviews of insect orders.

The contents and arrangement are well planned and I feel that they are largely adequate, especially for institutions where the emphasis is on economic aspects. However, several small orders of insects appear to be discussed more briefly than they deserve even in a beginning text, and more attention to them and to such considerations as phylogeny might stimulate a larger number of students. More comment on non-economic species and more examples of those with intriguing habits could help to make entomology an appealing or even exciting subject.

Though literature references in this type of book necessarily are selective and quite limited, there are gaps here which are disappointing. At least one 1970 work is cited, but such basic earlier books as the 1959 second edition of "Ward & Whipple," Uvarov's new 1966 book on grasshoppers and locusts, Arnett's 1960 and 1968 compilations on Coleoptera, and McKenzie's 1967 book on mealybugs are missing. A 1963 work by Tietz on insect families is cited, but it was withdrawn by the publisher after a few copies were distributed and so it is not generally available.

In spite of these shortcomings, this is a useful, substantial text, one which should be familiar to teachers concerned with a choice of which concise, understandable, reasonably brief book is best for a beginning course in entomology.

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SOCIETY MEETINGS

804th Regular Meeting—March 1, 1973

The meeting was called to order by President Adler in Room 43 of the U.S. National Museum of Natural History. Forty-seven members and 15 guests were present.

Membership Chairman Rainwater presented for membership the names of Joan R. Callahan of the University of Arizona and Dr. Robert La Vigne of the University of Wyoming.

Banquet Co-chairman Burks annouced that the price of tickets for the annual banquet would be set at $5.75 each. The Master of Ceremonies would be C. W. Sabrosky, but the Speaker was not yet selected.

John Kingsolver presented a note about a complex of bruchid beetles infesting the seed pods of *Cassia grandis*, a widely distributed Neotropical leguminous tree. He exhibited some beetles and a large seed pod of *Cassia grandis*.

Ashley Gurney discussed the late William R. Walton's interest in the Entomology of English Poetry. Mr. Walton's Presidential Address on that subject was published in 1922 (Proc. Entomol. Soc. Washington. 24:159–203). There is an extensive collection of his additional notes and poems in the Manuscript Division, Library of Congress.

John Osmun, Secretary General of the XVth International Congress of Entomology to be held in Washington, D.C. in 1976, announced that C. W. Sabrosky was elected President of the Congress by the Entomological Society of America. President Adler asked Maynard Ramsay to form a committee to study the part the Entomological Society of Washington could take in the Congress.

President Adler noted the presence at the meeting of Reece Sailer, recently retired from ARS, and wished him well in his new position with the University of Florida.

The Speaker of the evening was Dr. Allan Ashworth of North Dakota State University who gave a well-illustrated talk on fossil beetles as indicators of Pleistocene environments. A question and answer period followed.

Following the introduction of visitors the meeting was adjourned. Cake and coffee were served following the meeting.

R. J. GAGNÉ, Recording Secretary

805th Regular Meeting—April 5, 1973

The 805th Regular Meeting of the Entomological Society of Washington was called to order at 8 P.M. on April 5, 1973, by President Adler in Room 43 of the National Museum of Natural History. Thirty-seven members and 12 guests were present.

Treasurer Spilman announced the receipt of a third gift to the Publication Fund by member Alan Stone, a true benefactor of the Society.

Annual Banquet Co-chairman Burks announced that the speakers at the banquet would be Drs. Hobson and Early, who would represent the point of view of the chemical industry in relation to the current interest in environmental protection. A 35 mm sound and color film would be shown.

Kellie O'Neill showed color slides of thripid larvae to which minute, crustacea-like ectoparasites were attached. They were collected by Ramona Beshear on flowers in Georgia. B. D. Burks said that the ectoparasites are chalcidoid planidia probably of the family Eucharitidae, which are ordinarily known as ant parasites. It is not known whether they normally attack thrips. They are similar to those reported in Texas by Wilson and Cooley (Ann. Entomol. Soc. Amer. 65:414–418, 1972), in a well illustrated account that summarizes previous records of chalcidoid planidia attached to thripid larvae.

Don Messersmith exhibited a chunk of the outer shell of a magnetic termite mound.

President Adler introduced the main speaker of the evening, John V. Osmun, who gave a fascinating, well-illustrated account of his recent research on termites during an extended trip to Australia. He also showed an excellent film about Australian termites produced by the CSIRO. A lively question and answer period followed his presentation.

After the introduction of visitors, the meeting was adjourned at 10:05. Refreshments were served following the meeting.

R. J. Gagné, Recording Secretary

A TERM STRICTLY EQUIVALENT TO "TYPE-SPECIES"

The International Code of Zoological Nomenclature (Art. 67A) contains a recommendation that "only the term "type-species" or a strictly equivalent term in another language should be used in referring to the type of a genus. The term *genotype* should never be used for this purpose."

There is good reason for avoidance of the term "genotype" (from Greek *genos* + *typos*), because of confusion with the use of that term in a different sense in genetics. However, many languages must use a phrase as a strict equivalent of "type-species," and even in English the use of the term is attended with difficulties.

I would suggest that a compound based upon the Latin phrase *typus generis* or the Latin compound *generitypus* (not *generotypus*) is strictly equivalent to "type-species" and is sufficiently different from "genotype" to obviate any confusion. Generitype in English is thus "strictly equivalent" and synonymous to "type-species" and may be used in an adjectival form: generitypic or generitypical. The term may also be used in the manner of modern scientific terminology in any modern language, as for example in German (Generityp or Generitypus), Russian (transliterated: generitip), French (généritype), Spanish (generítipo), Italian (generitipo), etc.

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Prices quoted are U. S. currency. Dealers are allowed a discount of 10 per cent on all items. All orders should be placed with the Custodian, Entomological Society of Washington, c/o Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.

CORRECTION

WHEELER, G. C. and Jeanette WHEELER, the Subfamilies of Formicidae, 1972, Vol. 74, No. 1, p. 37, under CERAPACHYINAE: Delete the sentence reading "Promesonotal suture distinct; other thoracic sutures obsolete."

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

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Acceptance of papers is based only on their scientific merit without regard to the author's financial support.

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PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

DEPARTMENT OF ENTOMOLOGY
SMITHSONIAN INSTITUTION
WASHINGTON, D.C. 20560

PUBLISHED QUARTERLY

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STATEMENT OF OWNERSHIP

Title of Publication: Proceedings of the Entomological Society of Washington.
Frequency of Issue: Quarterly (March, June, September, December).
Location of Office of Publication, Business Office of Publisher and Owner: The Entomological Society of Washington, c/o Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.
Editor: Dr. Lloyd Knutson, same address as above.
Managing Editor and Known Bondholders or other Security Holders: none.

This issue was mailed February 12, 1974

Second Class Postage Paid at Washington, D.C. and additional mailing office.

ALLEN PRESS, INC. PRINTED IN U.S.A. LAWRENCE, KANSAS 66044

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

Vol. 75 DECEMBER 1973 No. 4

REVISION OF THE AMERICAN PLANTHOPPERS OF THE GENUS STOBAERA (HOMOPTERA: DELPHACIDAE) WITH NEW DISTRIBUTIONAL DATA AND HOST PLANT RECORDS

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ABSTRACT—This paper presents the first inclusive key to the 11 known species of *Stobaera* Stål. Two new species are described, S. **caldwelli** from the Southwest and S. **muiri** from coastal California. *Stobaera minuta* Osborn is synonymized with *S. concinna* (Stål), and *S. nigripennis* Crawford is synonymized with *S. tricarinata* (Say). *Stobaera testacea* (Fowler) is transferred to *Neoperkinsiella* Muir. All critical diagnostic structural features are illustrated. Many new distributional and host plant records are included. The economic significance of the included species rests on the fact that most feed on *Ambrosia* spp., ragweeds.

Species of the genus *Stobaera* Stål are common in North America, and almost any general collection of delphacids contains a scattering of specimens. Until now, their biological role was obscure at best. We now know, largely through the careful fieldwork of R. D. Goeden and D. W. Ricker at the University of California, Riverside, that *Stobaera* spp. are feeders on *Ambrosia* spp., ragweeds. What role these planthoppers may play in biological control is not yet known, but some may well transmit plant viruses useful in controlling ragweeds. Some of the *Ambrosia* spp. recorded here are usually found in *Franseria* in standard botanical references, but I am following the names provided by Drs. Goeden and Ricker. The purpose of this study, then, is to provide a tool for the separation of species and to expand the distributional knowledge and host food plant relationships of the species.

A survey of the existing taxonomic literature reveals no work treating all the described species of *Stobaera*. Thomas Say described the first species in 1825 and Edward P. Van Duzee, the last in 1917. Eight different taxonomists contributed species descriptions to the genus through the years, but there is no evidence in the literature that any of them ever studied types of earlier or contemporary workers.

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Crawford (1914a: 571–576) attempted the only revision of *Stobaera* and keyed 4 species of which one, *quadripustulata* Van Duzee, was later correctly transferred to *Pissonotus* Van Duzee (see Morgan and Beamer 1949, Journ. Kansas Ent. Soc. 22(3): 121–122). Except for *pallida* Osborn, the most easily recognized species in the genus, Crawford lumped all the names under *tricarinata* (Say). This action cleared a jumble of names from the existing literature, but Crawford unfortunately lumped together taxa that have since proved to be distinct species. He recognized the variation in size and color pattern in his version of *tricarinata* (Say) but then proceeded to describe a new species, *nigripennis* Crawford, on the basis of color and wing length. Van Duzee (1914b: 164) mildly objected to Crawford's list of syns. under *tricarinata* (Say) but presented no real evidence to refute this treatment. Two other keys to species exist: Van Duzee (1923b: 51) and Metcalf (1923a: 166). Van Duzee's key separates only *tricarinata* (Say) and *pallida* Osborn; this is no real task. Metcalf's key is probably the best of the lot but in it *concinna* (Stål) is erroneously identified, color of the frons is too heavily weighted, and references to figures do not always agree with the verbal statement. His figures of the male genitalia (fig. 622, *pallida* Osborn; 624, *tricarinata* (Say); and 625, *minuta* Osborn) are not detailed enough and appear to have been made from dry specimens. Even so, they are more useful than his fig. 623, *concinna* (Stål), which is obviously the female genitalia and not the male genitalia as labeled. Metcalf's key covered only the species of eastern North America.

Stobaera Stål

Stobaera Stål 1859a: 327. Type-species, *Delphax concinna* Stål.
Goniolcium Fowler 1905a: 132. Type-species, *Goniolcium granulosum* Fowler.

The genus can be recognized, at least in the North American fauna, by the following combination of characters. In dorsal view, vertex but slightly produced in front of eyes with frontal carina distinct, lateral carinae of pronotum bowed and usually fading before reaching hind margin, veins of forewings studded with dark pustules or granules often bearing setae. In facial view, frons strongly tricarinate for entire length, central carina not forked before reaching vertex, scape and pedicel large, scape flattened, subtriangular, its distal edge oblique, pedicel terete and papillate, eyes deeply indented ventrally. Ground color of head, thorax, and legs varies from stramineous to light brown, marked, mottled, shaded, or washed with contrasting hues of tan to fuscus or black; legs usually ringed with fuscus, face usually appearing bicolored or tricolored with shades of tan to black, forewing hyaline and typically with dark, more or less crescent shaped marking from costal margin on distal crossveins to apex of clavus and curving around distal margin of apical cells. Male genitalia with variably setose style having more or less porrect basal ventral process, diaphragm poorly developed, aedeagus extruded through a ringlike structure suspended from anal segment, aedeagus at least partly asymmetrical with much intraspecific variation in dentation. Distribution: Southern Canada, United States, Mexico, Central America, and West Indies. Host/food plants usually *Ambrosia* spp., ragweeds.

Key to species of *Stobaera*

1. Lateral carinae of frons distinctly bowed; frons tan, marked with creamy flecks. Atlantic Coast, Fla., Mexico .... *pallida* Osborn
— Lateral carinae of frons straight or nearly so; frons not marked as above 2
2. Pro- and mesonotum strongly bicolored, central area yellow to orange and lateral areas fuscus to black. Southwestern U. S. ...... *caldwelli* Kramer, n. sp.
— Pro- and mesonotum not strongly bicolored, general color yellowish brown to fuscus with variable shading 3
3. Style with lateral margin near apex smoothly rounded (fig. 21). So. Calif. .... *bilobata* Van Duzee
— Style with lateral margin near apex angular or angularly produced 4
4. Style with keel near base (fig. 33) 5
— Style without keel near base 6
5. Antennae, eyes, and interocular portion of frons predominately fuscus to black. Found on silver beachweed, *Ambrosia chamissonis*, in California .... *muiri* Kramer, n. sp.
— Antennae, eyes, and interocular portion of frons predominately tan to medium brown. Found on *Ambrosia confertiflora* and widespread .... *concinna* (Stål)
6. Style with outer apical angulation much shorter than inner apical angulation (fig. 48, 51) 7
— Style with outer apical angulation equal to or longer than inner apical angulation (fig. 64, 73), Mexico, Cent. Am. 9
7. Style broadest across middle with inner basal projection minute (fig. 43). Calif., Oregon .... *giffardi* Van Duzee
— Style broadest across apex with inner basal projection long 8
8. Inner basal projection of style slender, acute apically, and appearing to arise near base (fig. 52); aedeagus broad, stout, and acute or subacute at apex (fig. 50). Widespread. .... *tricarinata* (Say)
— Inner basal projection of style not so slender, blunt or subacute apically, and appearing to arise above base (fig. 48); aedeagus elongate and broadly capitate at apex (fig. 45). Florida. .... *affinis* Van Duzee
9. Process of anal segment in posterior view broad at tip, bearing 1 or more acute projections on each side of central prolongation (fig. 67, 69) .... *granulosa* (Fowler)
— Process of anal segment in posterior view narrow at tip, lacking acute projections or with only exceedingly minute ones on each side of acute central prolongation 10
10. Process of anal segment in posterior view slender and without distinct preapical constriction (fig. 74–76), in lateral view not sharply bent ventrally (fig. 74–76) .... *azteca* Muir
— Process of anal segment in posterior view broad with distinct preapical constriction (fig. 79, 80), in lateral view sharply bent ventrally (fig. 79, 80) .... *koebeli* Muir

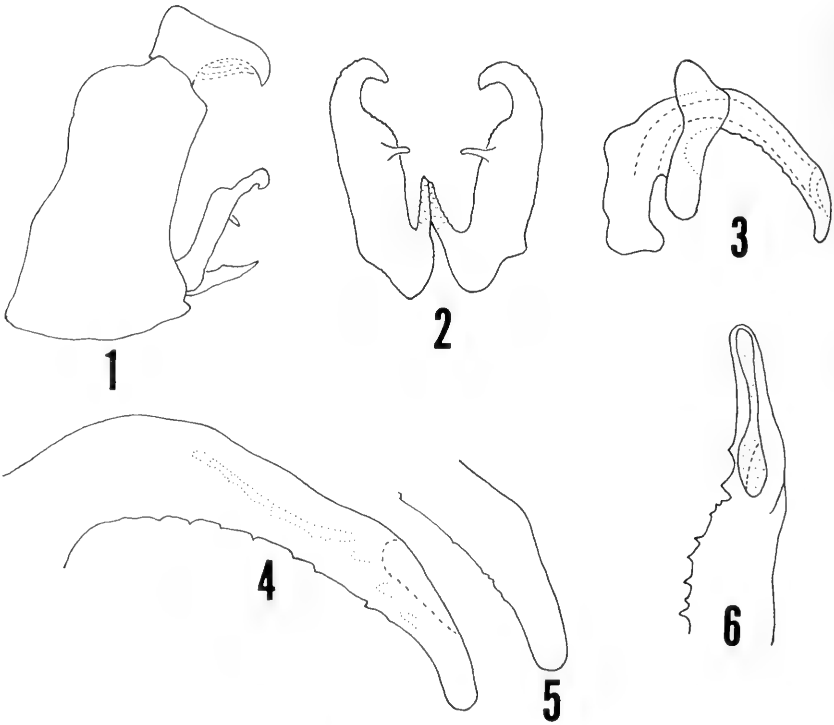


Fig. 1–6, *Stobaera pallida.* 1, male genital capsule in lateral view; 2, styles in posterior view; 3, aedeagus in lateral view; 4, distal portion of aedeagal shaft in lateral view (Piney Point, Md.); 5, aedeagal apex in lateral view (La Belle, Fla.); 6, aedeagal apex in dorsal view.

Stobaera pallida Osborn
fig. 1–6

Stobaera pallida Osborn 1905b: 375.

Salient features: Males, 3.2–4.0 mm; females, 3.5–4.8 mm. The frons with its bowed lateral carinae and tan ground color marked with creamy flecks makes *pallida* the most easily recognized species in the genus. The flecks may be transverse or round. Unlike other species in the genus, except *bilobata*, the interocular portion of the frons is not conspicuously darker than the rest of the frons, and the legs are not ringed with brown. The dark markings of the forewings are usually absent in females but distinct in males. No specimens with conspicuously shortened forewings were seen.

Male genitalia: Style in posterior view (fig. 2) with slender mesally directed process near midpoint of inner margin, apex narrowed and curved inward to produce a large hook, inner basal process moderately long. Aedeagus in lateral view (fig. 3) comparatively slender and in form of inverted "U" with ventral margin dentate. Gonopore (fig. 6) large and irregular at the dorsal apex. Process of anal ring in lateral view (fig. 1) appears as a moderately stout hook.

Type: No lectotype selected. Three males and 3 females (O.S.U.), Cold Spring Harbor, N. Y., Aug. 18, 1904 with red paratype labels were studied. These were not mentioned in the original description.

Specimens studied: UNITED STATES: FLORIDA, Cape Sable, Dade Co., Daytona, Ft. Myers, Gainesville, Homestead, Key West, La Belle, Sanford, Tampa, Venice; MARYLAND, Chesapeake Beach, Piney Point; NEW YORK, Bayville, Cold Spring Harbor, Nassau, Oyster Bay, Riverhead; VIRGINIA, Cape Henry, Chincoteaque Island, Deep Creek. MEXICO: DISTRITO FEDERAL; MEXICO, Toluca; PUEBLA, Huauchinango. Total specimens studied, over 200.

Host data: The host plant of *Stobaera pallida* is *Baccharis halimifolia*, groundsel-bush. Many of the specimens studied were collected from this plant in New York, Maryland, and Florida. Although most specimens were collected without host data, we can safely assume that they were associated with groundsel-bush because the distribution of the insect and plant coincide in large part. *Baccharis halimifolia* is known from Massachusetts south to Florida and west to Texas and south to Mexico in shore hammocks, sea beaches, salt marshes, and low ground inland.

Notes: *Stobaera pallida* stands well apart from its congeners on the basis of the characters noted above and in the key. The shape of the aedeagus in lateral view (fig. 3) resembles that of the Pacific coastal *bilobata* (fig. 18); but in other characters, the 2 species differ markedly. The Mexican records are new to the literature, and additional new state records for both the United States and Mexico will undoubtedly be added with further collecting.

Stobaera caldwelli Kramer, new species
fig. 7–17

Salient features: Males, 3.0–3.5 mm; females, 3.2–3.9 mm. The characteristic which distinguishes *caldwelli* at once from all its congeners is the coloration of the pro- and mesonotum. The areas mesad of the outer carinae are unmarked yellow to deep orange, and the areas laterad of the carinae are darkly fuscus to black. The dark markings of the forewings, typical of the genus, are distinct in both sexes. The frons is darkened between the eyes, the central portion stramineous, at times washed vaguely with pink, and basally unmarked or with a small touch of fuscus on each side of central carina. The clypeus varies from lightly fuscus to almost black. The legs are banded with fuscus. No specimens with conspicuously shortened forewings were seen.

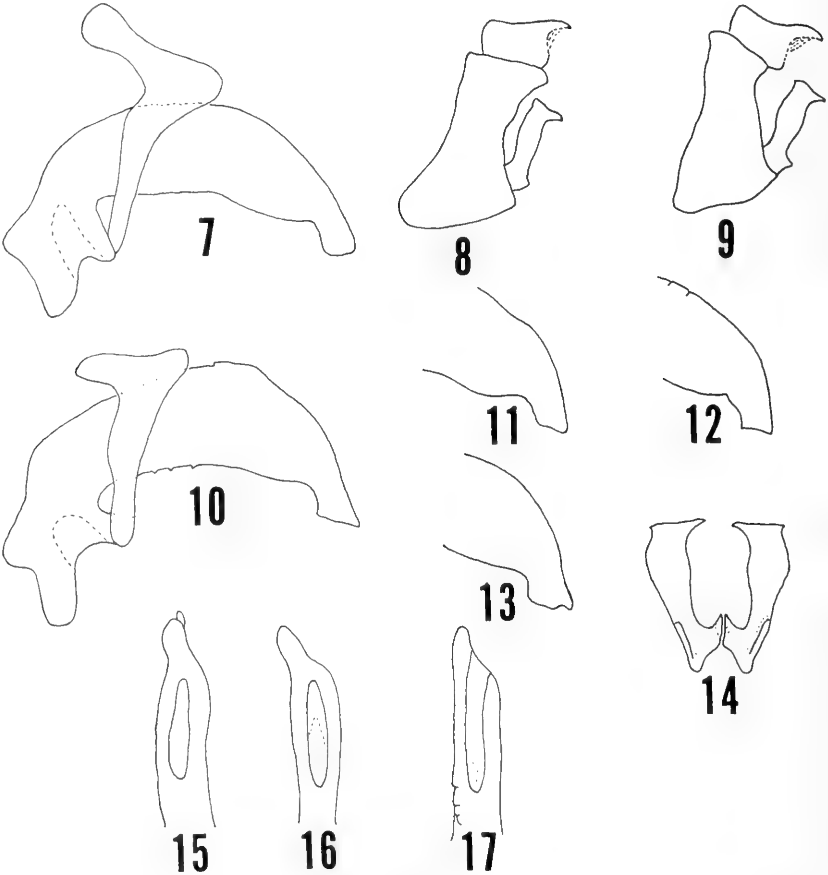


Fig. 7–17, *Stobaera caldwelli.* 7, aedeagus in lateral view (Twin Pines, Calif.); 8, male genital capsule in lateral view (Ariz.); 9, same (Nev.); 10, aedeagus in lateral view (Borrego Springs, Calif.); 11, aedeagal apex in lateral view (Nev.); 12, same (Nev.); 13, same (Ariz.); 14, styles in posterior view; 15, aedeagal apex in dorsal view (Ariz.); 16, same (Calif.); 17, aedeagal apex in dorso-anterior view (Nev.).

Male genitalia: Style in posterior view (fig. 14) with apex subtruncate, outer apical angulation minute, inner apical angulation moderately long and distinct, with narrow keel on lateral margin near base, inner basal process short. Aedeagus in lateral view (fig. 7, 10) moderately stout and somewhat decurved with apex quadrately produced. Shape of aedeagal apex in lateral view (fig. 11–13) variable. Dorsal and ventral margins of aedeagus in lateral view smooth or sparsely dentate. Gonopore (fig. 15–17) of moderate size at dorsal apex. Process of anal ring in lateral view (fig. 8–9) appears as a short hook.

Type: Male (USNM type no. 72355) Palm Desert, California, Riverside County, 14 May 1970, R. D. Goeden and D. W. Ricker, field collected on *Ambrosia dumosa*, burrow-weed or bur-sage.

Specimens studied: UNITED STATES: ARIZONA, Ashfork, Atascosa Mt., Baboquivari Mts., Bisbee, Chiricahua Mts., Congress Junction, Dome, Ft. Huachuca, Galiuro Mt., Gila Bend, Glendale, Granite Dell, Huachuca Mts., Hualpai Mt., Kaibab, Kirkland Junction, Littlefield, Mustang Mt., Nogales, Patagonia, Phoenix, Prescott, Sabino Canyon, Santa Rita Mts., Sedona, Tinajas Atlas, Tombstone, Tumacacori Mt., Tuscon, Wickenburg, Yuma; CALIFORNIA, Borrego Springs, Boulevard, Cabazon, Cedar Canyon, Desert Center, Fillmore, Indio, Jacumba, Joshua Tree Nat. Mon., Kelso, Lake View Terrace, Lytle Creek, Mohave, Morongo Valley, Needles, Niland, Oak Grove, Ocotillo, Palm Desert, Palm Springs, Riverside, San Diego, Twentynine Palms, Twin Pines, Victorville, Yucca Valley; NEVADA, Glendale, Mercury, Mesquite, Overton, Las Vegas, Riverside; NEW MEXICO, Carlsbad Cavern, Las Cruces, Mesilla Park; TEXAS, Alpine, Ft. Davis, Davis Mts.; UTAH, Modena, St. George. MEXICO: BAJA CALIFORNIA NORTE, Tijuana; SONORA, Hermosillo. Total specimens studied, 589.

Host Data: Most specimens were collected without plant associations. The following list includes the plants and numbers of specimens of *caldwelli* collected from them: *Ambrosia dumosa*, burrow-weed or bur-sage, 49 (16♂♂, 33♀♀); *Hymenoclea salsola*, a burrowbrush, 11 (8♂♂, 3♀♀); *Ambrosia confertiflora* 9 (7♂♂, 2♀♀); *Ambrosia eriocentra* 8 (1♂, 7♀♀); *Ambrosia acanthicarpa*, *sandbur*, 2 (2♂♂); *Ambrosia psilostachya*, western ragweed, 1 (1♀). If we can assume that the greatest number of specimens were collected on the primary host, then the distribution of the insect and host plant coincide quite well. *Ambrosia dumosa* is known from southern California, Arizona, Utah, Lower California, and Sonora. *Stobaera caldwelli* is known from So. California, Arizona, New Mexico, W. Texas, Sonora, Nevada, and Utah. *Stobaera caldwelli* may be catholic in its host food plant choices with other factors of the environment limiting its distribution.

Notes: Color pattern, as noted in the key, separates this most common Southwestern species at once from its congeners. The styles are close to those of *concinna* and *muiri*. In *caldwelli* the stylar keel is narrow (fig. 14), but in those 2 species it is wider (fig. 25, 33). However, the aedeagus in lateral view (fig. 7, 10) is not greatly different from that of *muiri* (fig. 22) and some of the varients of *concinna* (fig. 32). This species in named for Dr. John S. Caldwell whose general studies of the fulgoroids and all the auchenorhynchous Homoptera of Puerto Rico comprise major contributions to the taxonomy of this order of insects.

Stobaera bilobata Van Duzee
fig. 18–21

Stobaera bilobata Van Duzee 1914a: 44.

Salient features: Males, 2.0–3.3 mm; females, 2.5–3.8 mm. Normal longwinged and shortwinged forms occur in both sexes. The shorter winged form appears more common in the series at hand. In males, the forewings are largely dark except for irregular hyaline areas in the outer apical cells and central portions of the costal and preapical cells. In females, the forewings vary from nearly unmarked except for a dark spot distally on costal cell to marked like males. The interocular portion of the frons is not conspicuously darker than the rest of the frons, and the legs are not ringed with brown. The head tends to be more acute apically and generally narrower than in its congeners.

Male genitalia: Style in posterior view (fig. 21) stout and somewhat sigmoid in outline, apex smoothly turned inward to acute tip, inner basal process obscure. Aedeagus in lateral view (fig. 18) comparatively slender and in form of inverted "U" with dentation on dorsal and lateral margins. Gonopore (fig. 19) at apex of aedeagal dorsum. Process of anal segment in lateral view (fig. 20) acute apically with ventral tooth.

Type: Lectotype male (labeled but unpublished by Van Duzee) with labels "San Diego Co., California, 6-6-14, E. P. Van Duzee" and "LECTOTYPE bilobata" (red label); and "E. P. Van Duzee Collection" (yellow label). Repository of lectotype: California Academy of Sciences.

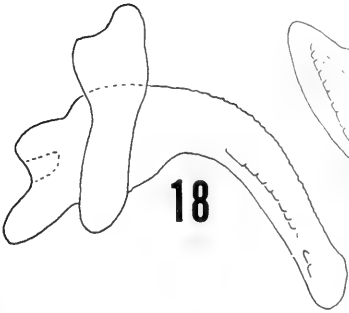
Specimens studied: UNITED STATES: CALIFORNIA, Del Mar, La Jolla, Niles Canyon, San Diego Co. Total specimens studied, 68, including lectotype and 12 specimens labeled paratypes.

Host data: Several of the specimens seen were taken on *Hazardia squarrosus* now *Haplopappus squarrosus.*

Notes: *Stobaera bilobata* is best distinguished by the shape of the styles. It is known only from San Diego County in southernmost California.

Stobaera muiri Kramer, new species
fig. 22–26

Salient features: Males, 2.0–3.0 mm; females, 2.7–3.8 mm. Normal longwinged and shortwinged forms occur in both sexes. All but 1 male and 4 females of the series before me are of the shorter winged form. The forewings are similarly marked in both sexes. The color of the forewing varies from darkened apically in the form of a crescent along the inner margin and an irregular mark on outer apical cells with additional dark areas at center of corium and on clavus to unmarked except for a dark spot distally on costal cell and irregular infuscations on inner apical cells. In facial view the antennae, eyes, and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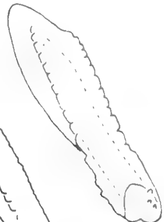
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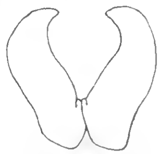
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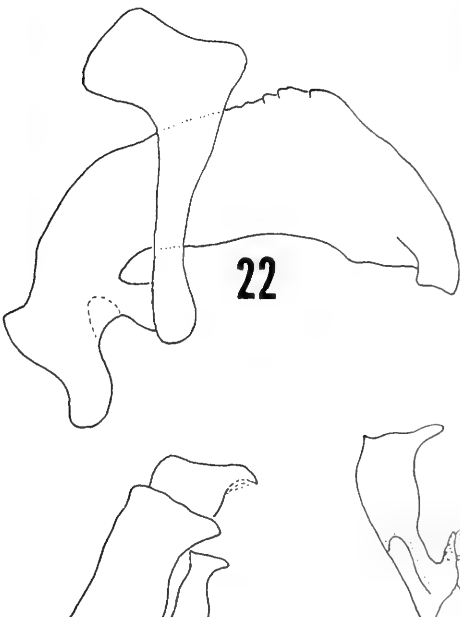
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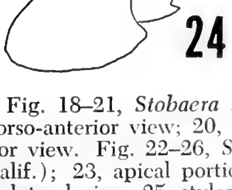
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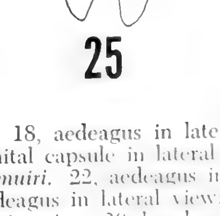
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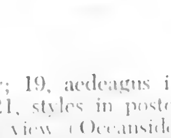
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Fig. 18–21, *Stobaera bilobata*. 18, aedeagus in lateral view; 19, aedeagus in dorso-anterior view; 20, male genital capsule in lateral view; 21, styles in posterior view. Fig. 22–26, *Stobaera muiri*. 22, aedeagus in lateral view (Oceanside Calif.); 23, apical portion of aedeagus in lateral view; 24, male genital capsule in lateral view; 25, styles in posterior view; 26, basal portion of styles in posterior view, variation.

interocular portion of the frons appear nearly a unicolorous fuscus to black. However, there are pale spots in the interocular portion of the frons, and the bases of the antennal segments are sometimes paler. The rest of the frons is either unmarked or has fuscus areas on each side of central carina at the base. The clypeus is variably infuscated, and the legs are ringed with brown or fuscus.

Male genitalia: Style in posterior view (fig. 25) with apex subtruncate, outer apical angulation minute, inner apical angulation moderately long, with broad keel on lateral margin near base, and inner basal process fairly short. Aedeagus in lateral view (fig. 22–23) moderately stout and somewhat decurved with apex quadrately produced, dorsal margin variably dentate. Process of anal segment in lateral view (fig. 24) appears as a short hook.

Type: Male (USNM type no. 72356) Sunset Beach, California, Orange County, 2 Feb. 1970, R. D. Goeden & D. W. Ricker, insectary reared on *Ambrosia chamissonis*, silver beachweed.

Specimens studied: UNITED STATES: CALIFORNIA, Goleta, Imperial Beach, Long Beach, Malibu River, Newport Beach, Oceanside, San Clemente, San Diego, Santa Barbara, Sunset Beach, Ventura. Total specimens studied, 98.

Host data: Except for 4 specimens taken without data, all examples of *muiri* were collected on or reared from *Ambrosia chamissonis*, silver beachweed. Because the distribution of silver beachweed includes all of coastal California and scattered points northward to British Columbia, *muiri* more than likely has a greater distribution than here recorded. Silver beachweed occurs on coastal dunes and sandy beaches from sea level to 50 ft.

Notes: *Stobaera muiri* is structurally close to both *caldwelli* and *concinna* but differs from these species in color pattern, as noted in the key, and host/food plants. It is a littoral species of the U.S. Pacific coast. The species is named for Frederick A. G. Muir whose collected works form the major contribution to our knowledge of the Delphacidae.

Stobaera concinna (Stål)
fig. 27–40

Delphax concinna Stål 1854b: 246.
Stobaera concinna (Stål), Stål 1859a: 327.
Stobaera minuta Osborn 1905b: 376. N. Syn.

Salient features: Males, 2.5–4.0 mm; females, 3.2–4.5 mm. Normal longwinged and shortwinged forms occur in both sexes, and the longer winged form is more common. The forewing is marked like that of *muiri* except the brown or fuscus crescent is usually more strongly developed across the distal crossvein to the costal margin. In facial view the antennae, eyes, and interocular portion of the frons appear

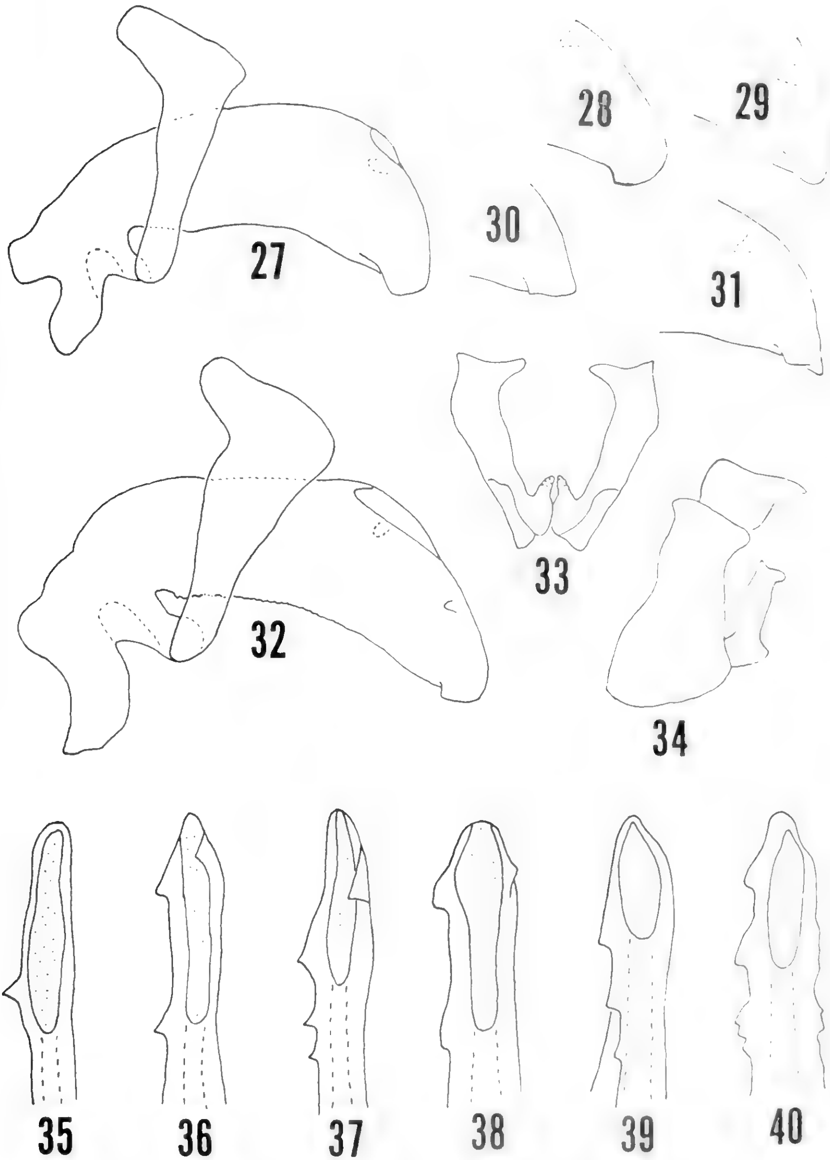


Fig. 27–40, *Stobaera concinna.* 27, aedeagus in lateral view (Sanford, Fla.); 28, aedeagal apex in lateral view (Superior, Ariz.); 29, same (Sanford, Fla.); 30, same (Brownsville, Tex.); 31, same (Haiti); 32, aedeagus in lateral view (Arcadia, Calif.); 33, styles in posterior view; 34, male genital capsule in lateral view; 35, aedeagal apex in dorsal view (Superior, Ariz.); 36, same (Ariz.); 37, same (Sanford, Fla.); 38, same (Miami, Fla.); 39, same (Fla.); 40, same (Sanford, Fla.).

tan to medium brown. However, there are pale spots in the interocular portion of the frons, and the edges of the antennal segments are variably paler. The rest of the frons is either unmarked or has variable embrowning on each side of the central carina at the base. The clypeus is unmarked or variably infuscated, and the legs are ringed with brown or fuscus.

Male genitalia: Style in posterior view (fig. 33) similar to that of *muiri* with a broad keel on lateral margin near base. Aedeagus in lateral view (fig. 27–32) moderately stout, somewhat decurved, broadest in distal half, venter at apex with a variably developed tooth, dorsal and ventral margins largely smooth. Distal portion of aedeagus in dorsal view (fig. 35–40) highly variable in number and development of lateral teeth, gonopore large. Process of anal segment in lateral view (fig. 34) appears as a short hook.

Type: Lectotype male with labels: "Mexico" (handwritten) and "concinna" (handwritten) and "255 72" (red label) and "Riksmuseum Stockholm" (green label). Repository of lectotype: Riksmuseum, Stockholm. A lectotype male is also selected here for *Stobaera minuta* Osborn with labels: "Cameron, La., Aug. 14–28, 1903" and "Herbert Osborn Collection" and "PARATYPE" (red label). Repository of lectotype: Department of Entomology, Ohio State University, Columbus, Ohio.

The lectotype of *concinna* is in nearly perfect condition but the left antenna is missing and the form is somewhat distorted by the pin through the mesonotum. It is the longer winged form (3.75 mm); the base of the frons is lightly embrowned; the clypeus is tan and lightly embrowned distally and vaguely laterally. The lectotype of *minuta* is in perfect condition and represents the shorter winged form (2.5 mm) of *concinna* and differs only in its smaller size and in the pale unmarked basal portion of the frons.

Specimens studied: UNITED STATES: ARIZONA, Ajo Mts., Atascosa Mt., Baboquivari Mts., Benson, Catal Spring, Chiricahua Mts. Congress Junction, Ft. Huachuca, Globe, Granite Dell, Huachuca Mts., Nogales, Patagonia, Phoenix, Sabino Canyon, Sta. Catarina Mts., Tankeut, Tempe, Tinajas Altas, Tucson; CALIFORNIA, Arcadia, Chula Vista, Hollywood, Indio, Los Angeles, Oakgrove, Oxnard, Palomar Mt., Refugio Canyon; COLORADO, Ft. Collins; FLORIDA, Belle Glade, Cedar Keys, Coco, Elfers, Ft. Myers, Gainesville, Islamoranda, La Belle, Miami, New Port Ritchy, Orlando, Ormond Beach, Palm Beach, Sanford, Tampa; LOUISIANA, Cameron; TEXAS, Brownsville, Catarina, Comstock, Cotulla, Edna, Ft. Davis, Laredo, Sanderson, Tyler, Uvalde Co., Webb Co.; UTAH, Leeds. MEXICO: OAXACA, Santa Engracia; SONORA, Guaymas; VERACRUZ, Fortin. WEST INDIES: CUBA, Ermita, Havana, Jobabo; DOMINICAN REPUBLIC, La Romana; HAITI, Port-au-Prince. Total specimens studied, 441.

Host data: Only 47 of the specimens studied have data which show plant associations. The following are Californian records of the host/food plant with the number of specimens of *concinna* collected from them: *Ambrosia confertiflora* 28 (9♂♂, 19♀♀) field collected; and *Ambrosia psilostachya*, Western ragweed, 11(5♂♂, 6♀♀) insectary reared. Eight specimens from Florida are labeled "Amb" [rosia] or "rag w" [eed]. Judging from the data at hand, it appears that *Ambrosia confertiflora* is the host plant of *S. concinna* with *A. psilostachya* an alternate host or food plant. *Ambrosia confertiflora* occurs mainly in dry plains and wastelands from So. California eastward to Kansas, Texas, Tennessee, and probably Florida. It is known from Puerto Rico and as far south as the Mexican state of Guerrero. The records for *S. concinna* (So. California, Utah, Arizona, Colorado, Texas, Louisiana, Florida, and Vera Cruz) coincide reasonably well with the distribution of *A. confertiflora*.

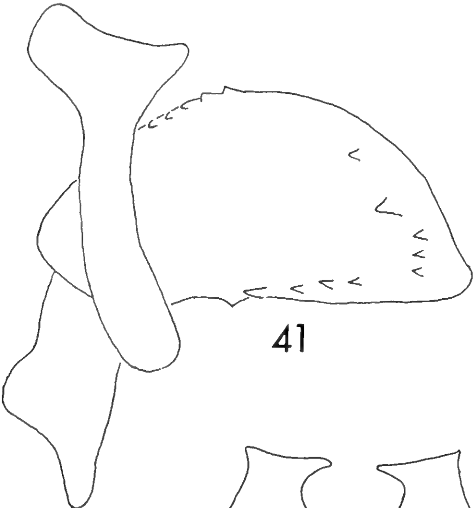
Notes: *Stobaera concinna* is structurally close to both *caldwelli* and *muiri* but can be separated from those species by the characters noted in the key and by host plants. Information gleaned from the literature and from determined specimens in collections shows that no one since the original description has correctly determined the species.

Stobaera giffardi Van Duzee
fig. 41–44

Stobaera giffardi Van Duzee 1917a: 313.

Salient features: Males, 2.4–2.8 mm; females 3.0–3.5 mm. No truly longwinged form occurs in the series before me. The forewing is lightly marked and bears a fuscus patch distally on the costal cell and on the first apical cell from the inner margin. Some specimens have irregular infuscations at the middle of the forewing. In still others, the entire proximal half of the forewing is largely dark. The interocular portion of the frons is often darker than the rest of the frons and bears pale spots. There is at times a distinct pale band across the frons just below the eyes with the lower portion of the frons lightly or heavily mottled with tan to fuscus. In other specimens, the band is absent and all of the frons below the eyes is mottled. The clypeus is either essentially unmarked or clearly infuscated, and the legs are ringed with brown or fuscus.

Male genitalia: Style in posterior view (fig. 43) similar to that of *tricarinata* but convexly expanded at middle on both margins with inner basal process exceedingly short. Aedeagus in lateral view (fig. 41) not clearly distinguishable from that of *tricarinata*. Gonopore (fig. 44) elongate and apical at aedeagal dorsum. Process of anal segment in lateral view (fig. 42) appears as a short hook.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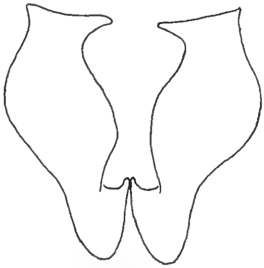
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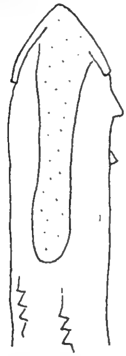
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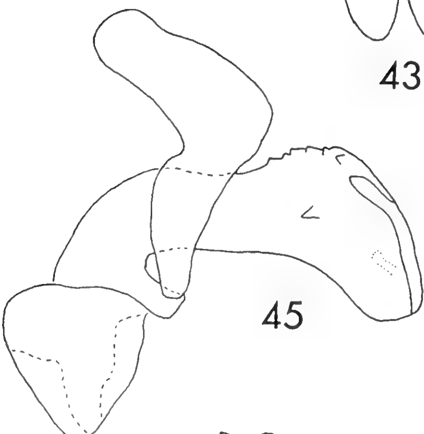
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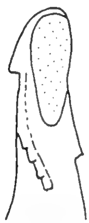
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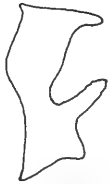
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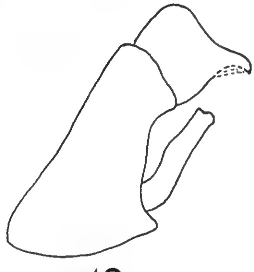
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Type: Male (No. 379) Niles Canyon, California, Alameda Co., 11 May 1916, Wm. Gifford, on wormwood. Respository of type: California Academy of Sciences.

Specimens studied: UNITED STATES: CALIFORNIA, Alameda Co. (Leona Hts); San Mateo Co. (Portola Valley); Santa Clara Co. (Los Altos, Saratoga); Santa Cruz Co.; Tuolumne Co. (Yosemite); OREGON, Jackson Co. (near Siskiyou Pass). Total specimens studied, 162.

Host data: The original type series was collected on wormwood or sagebrush, *Artemisia* sp., and there are no additional data to add at this time.

Notes: *Stobaera giffardi* is structurally closest to *tricarinata* but differs in characters of the style as noted in the key. Additional field work is needed to establish its host food plants and distribution. These are presently known as *Artemisia* sp. and central California to southern Oregon.

Stobaera tricarinata (Say)
fig. 50–62

Delphax tricarinata Say 1825a: 337.
Delphax bifasciata Provancher 1890b: 337.
Stobaera nigripennis Crawford 1914a: 576. N. Syn.

Salient features: Males, 2.8–4.6 mm; females 2.9–4.8 mm. Normal longwinged and shortwinged forms occur in both sexes. The longer wing form outnumbers the shorter wing form about 10:1. The forewing varies from nearly immaculate to strongly marked with fuscus like *concinna* or rarely nearly entirely fuscus. The interocular portion of the frons is tan to fuscus with pale spots; the central portion of the frons is pale and unmarked; the basal portion of the frons on each side of the central carina is almost always darkened with fuscus or black. The clypeus is either unmarked or lightly marked with fuscus. The legs are ringed with fuscus to black.

Male genitalia: Style in posterior view (fig. 51, 52) similar to that of *giffardi* but only slightly convex on inner and outer margins at middle and with inner basal process long. Aedeagus in lateral view (fig. 50, 55, 58) approximately hemicircular in outline with variable number of teeth on or near dorsal and ventral margins. Gonopore (fig. 59–62) elongate and apical at aedeagal dorsum. Process of anal segment in lateral view (fig. 54) somewhat variable in length but usually appearing as a slender hook.

←

Fig. 41–44, *Stobaera giffardi*. 41, aedeagus in lateral view; 42, male genital capsule in lateral view; 43, styles in posterior view; 44, aedeagal apex in dorsal view. Figs. 45–49, *Stobaera affinis*. 45, aedeagus in lateral view; 46, aedeagal apex in dorsal view; 47, right style in broad view; 48, styles in posterior view; 49, male genitalia capsule in lateral view.

Type: The type locality of *tricarinata* is Missouri, but Say's specimen is lost. No neotype is selected because there is no problem in recognizing this species. The type of *nigripennis* (USNM type no. 15975) from the Argus Mts. of California was found to be a short and fuscus winged form of *tricarinata*.

Specimens studied: UNITED STATES: ALABAMA, Selma; ARIZONA, Flagstaff, Grand Canyon, Granite Dell, Oak Creek Canyon, Phoenix, Prescott, Sedona, White Mts., Yarnell Mts.; CALIFORNIA, Alpine, Argus Mts., Beaumont, Carpinteria, Chatsworth, Chino, El Toro, Encinitas, Fillmore, Goleta, Jamul, La Mesa, Los Angeles, Mill Creek Park, Oakgrove, Ontario, Palm Canyon, Palm Springs, Pasadena, Pela, Pine Valley, Piru, Poway Rainbow, San Bernadino, San Juan Capistrano, Santa Barbara, South San Gabriel, Valley Center, Ventura, Wildomar, Yorba Linda, Yosemite; COLORADO, Ft. Collins, Grand Junction, Gunnison, Palisade, Palmer Lake, Snyder, Sterling; FLORIDA, Florida Caverns St. Park (Jackson Co.); GEORGIA, Athens, DeWitt, Thomasville; IDAHO, Crater of the Moon Nat. Mon.; ILLINOIS, Algonquin, Elgin, Havanna, Muncie, Nord, Rocky Branch; INDIANA, Indianapolis, Lafayette, Martinsville; IOWA, Ames; KANSAS, Baldwin, Garnett, Onaga, Popenoe, Topeka, Wellington; LOUISIANA, Opelousas, Shreveport, Tallulah; MARYLAND, Bell, Beltsville, Glen Echo Park, Hyattsville, Lakeland, Laurel, Plum Point; MASSACHUSETTS, Chicopee; MINNESOTA, Chisago Co., Washington Co.; MISSOURI, Langdon, Wellston; MISSISSIPPI, State College; NEBRASKA, Beemer, Omaha, Schurler; NEVADA, Caliente, Dixie, Las Vegas, Overton; NEW JERSEY, Angelsea, Fort Lee, Lakehurst, Riverton; NEW MEXICO, Albuquerque, Espanola, Mesilla Park; NEW YORK, Babylon, Ithaca; NORTH CAROLINA, Rutherford Co.; NORTH DAKOTA, Tower City; OHIO, Cedar Swamp, Columbus, Cuyahoga Falls; OREGON, Bend, Silver Lake, Unity; PENNSYLVANIA, Philadelphia, State College; SOUTH CAROLINA, Columbia; TENNESSEE, Nashville; TEXAS, Clifton, Cotulla, Lubbock, Plano, San Antonio, Spur, Uvalde; UTAH, Cedar, Dixie, Fish Lake, Hurricane, Kanab, Logan, Marysvale, Moab, Monroe, Orderville, Promontory, Provo, Richfield, St. George, St. Clara, Salt Lake City, Sigurd, Smithfield, Soldier; VIRGINIA, Arlington, Falls Church, Great Falls, Herndon, Peach Grove Hill. MEXICO: BAJA CALIFORNIA NORTE, Tijuana. Total specimens studied, 627.

Host data: Most specimens were collected without plant associations. The following list includes the plants and number of specimens of *tricarinata* collected from them: California—*Ambrosia psilostachya*, western ragweed, 36 (10♂♂, 26♀♀); *Ambrosia confertiflora* 2 (2♂♂); *Ambrosia chamissonis*, silver beachweed, 1 (1♀); Maryland—*Helianthus argophyllus*, silverleaf sunflower, 5 (5♀♀). If, as before, we assume the favored host is the plant species from which most of the insects were collected, then the distribution of the insect and its probable host plant coincide well. Western ragweed occurs in uncultivated land and is recorded for most of the United States and southern Canada and all of the 32 states from which *tricarinata* is known.

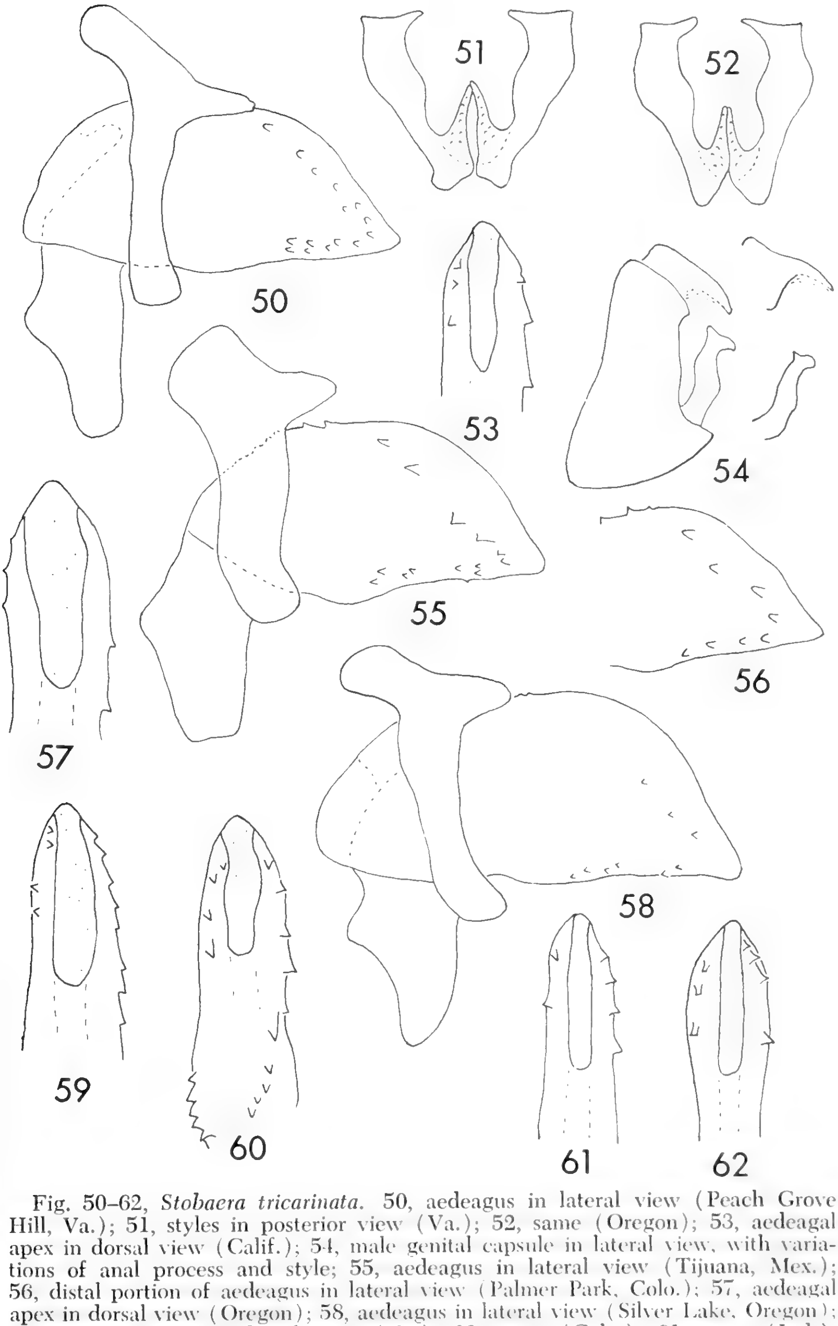

Fig. 50–62, *Stobaera tricarinata*. 50, aedeagus in lateral view (Peach Grove Hill, Va.); 51, styles in posterior view (Va.); 52, same (Oregon); 53, aedeagal apex in dorsal view (Calif.); 54, male genital capsule in lateral view, with variations of anal process and style; 55, aedeagus in lateral view (Tijuana, Mex.); 56, distal portion of aedeagus in lateral view (Palmer Park, Colo.); 57, aedeagal apex in dorsal view (Oregon); 58, aedeagus in lateral view (Silver Lake, Oregon); 59, aedeagal apex in dorsal view (Va.); 60, same (Colo.); 61, same (Ind.); 62, same (Minn.).

Notes: This is the most common species of *Stobaera* in the United States, based on the records at hand. We have studied specimens from upper New York south to western Florida and westward to California and Oregon. Structurally *tricarinata* is closest to *giffardi* (see notes under this species).

Stobaera affinis Van Duzee
fig. 45–49

Stobaera affinis Van Duzee 1909a: 199.

Salient features: Males, 3.0–3.4 mm; females, 3.0–3.9 mm. Because of damage to the distal portions of the forewings in some of the specimens at hand, it is difficult to state the total length of these specimens and to ascertain their true wing length. However, all seem to be of the longer winged form. The forewing is marked like that of *tricarinata*. The frons is similar in markings to that of *tricarinata* except for the central portion which is usually, but not always, mottled with brown. The markings of the clypeus and legs are not distinguishable from those of *tricarinata*.

Male genitalia: Style in posterior view and broad view (fig. 47, 48) similar to that of *tricarinata* except for inner basal process arising above base, process usually broader and blunter as well. Aedeagus in lateral view (fig. 45) elongate, decurved, and distinctly capitate, variably toothed marginally and submarginally distally. Gonopore (fig. 46) elongate at aedeagal apex dorsally. Process of anal segment in lateral view (fig. 49) produced as a moderately short hook.

Type: Lectotype male with labels: "Crescent City, Fla., Apr. '08, Van Duzee" and "LECTOTYPE affinis" (red label), and "E. P. Van Duzee Collection" (yellow label). Repository of lectotype: California Academy of Sciences.

Specimens studied: UNITED STATES: FLORIDA, Cedar Keys, Crescent City, Dunedin, Ft. Myers, Gadsden Co., Gainesville, Miami, New Smyrna, Reddick, St. Augustine, Sanford. Total specimens studied, 80.

Host data: Only 1 specimen, a male from Sanford, was taken on "Amb" [rosia] sp.

Notes: The aedeagus of *affinis* is unlike that of any other species in *Stobaera*, and the form of this structure distinguishes it at once from its congeners. *Stobaera affinis* is presently known only from Florida on *Ambrosia* sp.

Stobaera granulosa (Fowler)
fig. 63–69

Goniolcium granulosa Fowler 1905a: 132.

Salient features: Males, 4.3–4.5 mm; females, 4.8–5.0 mm. Only longwinged forms of this species were seen. The forewing is marked

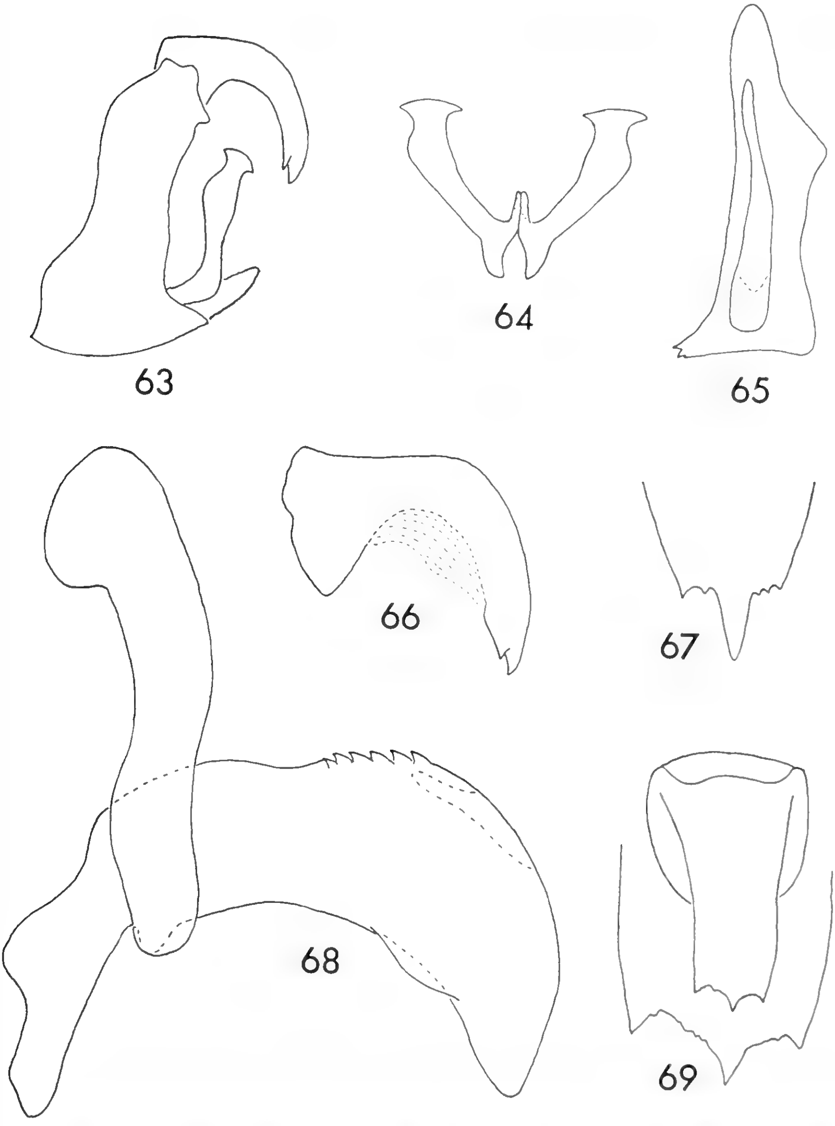

Fig. 63–69, *Stobaera granulosa*. 63, male genital capsule in lateral view; 64, styles in posterior view; 65, aedeagus in dorsal view; 66, male anal segment in lateral view; 67, apex of process of male anal segment in posterior view (Guatemala); 68, aedeagus in lateral view; 69, male anal segment in posterior view, with enlarged apical portion below (Mexico).

like that of *concinna.* The frons, clypeus, and legs are marked like those of *tricarinata.*

Male genitalia: Style in posterior view (fig. 64) with both outer and inner apical angulations distinctly produced, acute, and approximately of the same size, inner basal process of moderate length. Aedeagus in lateral view (fig. 68) stout, decurved, apically subacute, and with a partly toothed crest on dorsal margin. Gonopore (fig. 65) irregularly elongate and seeming to occupy most of aedeagal dorsum. Process of anal segment in posterior view (fig. 67, 69) broad apically with 1 or more teeth on each side of longer central tooth, in lateral view (fig. 66) strongly decurved and broad for most of length with both preapical and apical tooth.

Type: Lectotype male with labels: "♂" and "Type H. T." and "Goniolcium granulosum Fowler" (handwritten) and "Chilpancingo, Guerrero, 4600 ft, June, H. H. Smith" and "B. C. A. Hompt. I Goniolcium granulosum, Fowl." This appears to be the specimen illustrated with the original description (Fowler 1905a: Pl. 13, figs. 7 & 8). Repository of lectotype: British Museum (Nat. Hist.).

Specimens studied: MEXICO: GUERRERO, Chilpancingo; OAXACA, Santa Engracia; VERACRUZ, Jalapa, Cordoba, Orizaba. GUATEMALA, Chichicastenango. Total specimens studied, 22.

Host data: None.

Notes: The shape of the anal process of the male provides the best characters for the identification of *granulosa*, a species known from southern Mexico and Guatemala.

Stobaera azteca Muir
fig. 70–76

Stobaera azteca Muir 1913b: 242.

Salient features: Males, 4.0–4.2 mm; females, 4.2–4.8 mm. Only longwinged forms of this species were seen. Markings of forewings, frons, clypeus, and legs like those of *granulosa.*

Male genitalia: Style in posterior view (fig. 73) similar to that of *granulosa* except with a slight convexity on inner margin below inner apical angulation. Aedeagus in lateral view (fig. 70) essentially like that of *granulosa* except slightly blunter apically. Gonopore (fig. 71) irregularly elongate and occupying most of aedeagal dorsum. Process of anal segment in posterior view (fig. 74–76) smoothly tapering to acute apex or tapering broadly at apex, in lateral view (fig. 74–76) not strongly decurved but variably tapering to acute apex.

Type: Lectotype male with label: "Mexico, Morelos, Koebele 07". Repository of lectotype: Bernice P. Bishop Museum.

Specimens studied: MEXICO: GUERRERO, Chilpancingo; MORELOS; PUEBLA, Necata; SAN LUIS POTOSI, Valles; VERACRUZ, Orizaba, Pueblo Viejo. GUATEMALA, Yepocapa. NICARAGUA, San Marcos. Total specimens studied, 13.

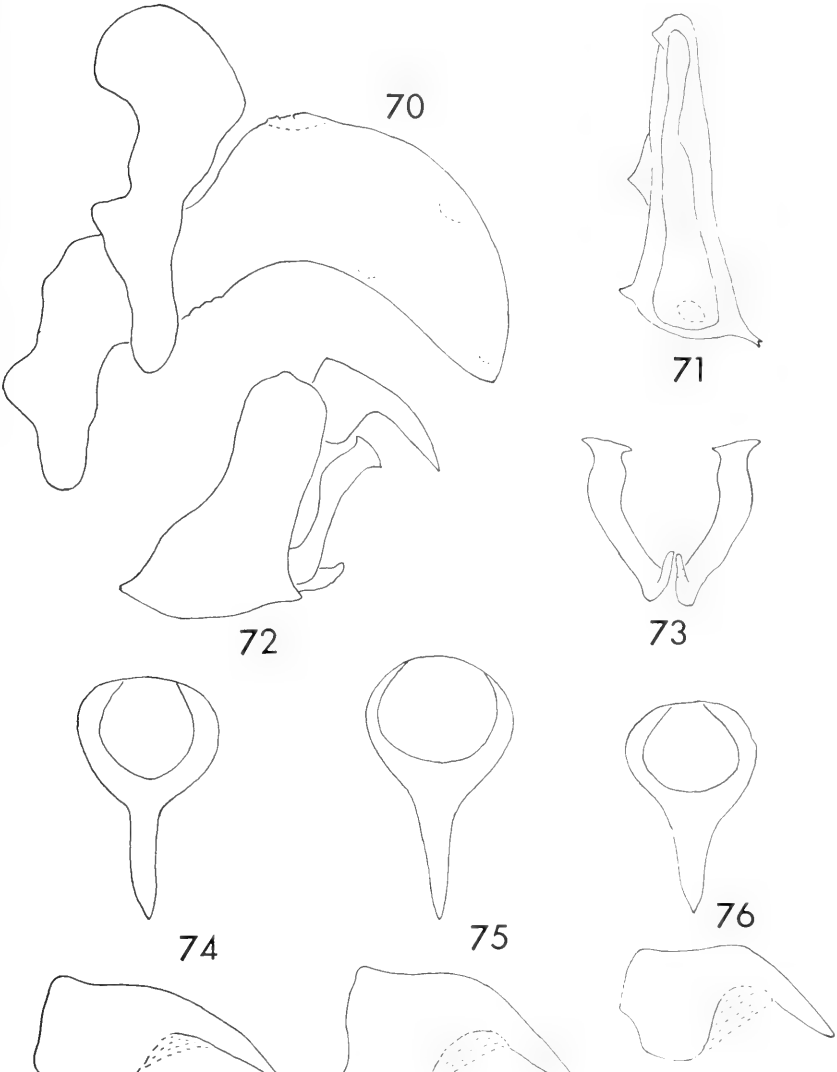

Fig. 70–76, *Stobaera azteca*. 70, aedeagus in lateral view; 71, aedeagus in dorsal view; 72, male genital capsule in lateral view; 73, styles in posterior view; 74, male anal segment in posterior view above and lateral view below (Veracruz); 75, same (Guerrero); 76, same (San Luis Potosi).

Host data: None.

Notes: The shape of the anal process of the male provides the best character for the recognition of *azteca*, a species known from central Mexico south to Nicaragua. It is closely related to both *granulosa* and *koebeli*.

Stobaera koebeli Muir
fig. 77–81

Stobaera koebeli Muir 1913b: 242.

Salient features: Males, 4.0–4.3 mm; females, 4.3–5.1 mm. Only longwinged forms of this species were seen. Markings of forewing, frons, clypeus, and legs like those of *granulosa*.

Male genitalia: Style in posterior view close to that of *azteca* except without convexity on inner margin below inner apical angulation. Aedeagus in lateral view (fig. 81) similar to that of *azteca* except distinctly broader in middle third. Gonopore (fig. 77, 78) elongate and occupying most of aedeagal dorsum. Process of anal segment in posterior view (fig. 79, 80) broadly tapering to near apex where sharp constriction produces acute apical tooth, at times edges of constriction sharp and asymmetrical, in lateral view (fig. 79, 80) strongly decurved and variably tapering to acute apex.

Type: Lectotype male with labels: "Morelos" and "Tantepec" and "A. Koebele Collector". Repository of lectotype: Bernice P. Bishop Museum.

Specimens studied: MEXICO: DISTRITO FEDERAL, Mexico City; MORELOS, Tantepec, Yautepec; VERACRUZ, Cordoba, Orizaba. GUATEMALA, Guatemala City. Total specimens studied, 12.

Host data: None.

Notes: The shape of the anal process of the male provides the best characters for the recognition of *koebeli*, a species known from southern Mexico and Guatemala.

Species removed from *Stobaera*

Neoperkinsiella testacea (Fowler), New Combination

Goniolcium testaceum Fowler 1905a: 133.
Stobaera testaceum (Fowler), Crawford 1914a: 576.
Neoperkinsiella williamsi Muir 1926b: 17. N. Syn.

Dr. R. G. Fennah of the Commonwealth Institute of Entomology most kindly informed me of the new synonymy above. Fowler published an excellent habitus illustration with the original description,

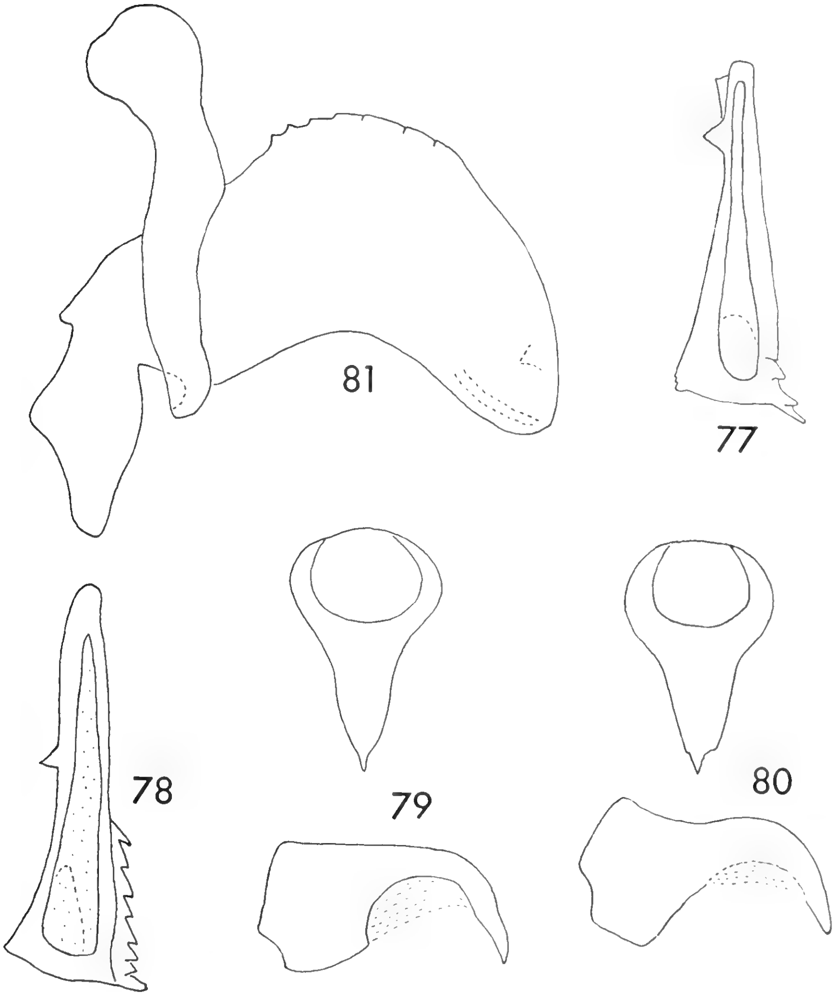

Fig. 77–81, *Stobaera koebeli.* 77, aedeagus in dorsal view (Orizaba); 78, same (Yautepec); 79, male anal segment in posterior view above and lateral view below (Yautepec); 80, same (Orizaba); 81, aedeagus in lateral view (Orizaba).

and Muir provided fine figures of the critical features of the male genitalia with his description of *N. williamsi.*

Type: Lectotype male with labels: "♂" and "Cerro Zunil" and "B. C. A. Homopt. I. Goniolcium testaceum, Fowl." and "Goniolcium testaceum" (handwritten). Repository of lectotype: British Museum (Nat. Hist.).

ACKNOWLEDGMENTS

Without the most generous cooperation of the persons and their institutions listed here, this study would not have been possible. To all of them I express my sincere thanks and deep gratitude for loans of type material and information vital to this study. Dr. Paul H. Arnaud, Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, California; Drs. R. D. Goeden and D. W. Ricker, Department of Entomology, Division of Biological Control, University of California, Riverside, California; Dr. J. Linsley Gressitt and Mrs. Carol Higa, Entomology Department, Bernice P. Bishop Museum, Honolulu, Hawaii; Dr. W. J. Knight and Dr. R. G. Fennah, Department of Entomology, British Museum (Nat. Hist.), London; Dr. Per Inge Persson, Department of Entomology, Swedish Museum of Natural History, Stockholm; and Dr. Charles A. Triplehorn, Department of Entomology, Ohio State University, Columbus, Ohio.

REFERENCES

All citations can be found in Metcalf, Z. P. 1944. Author's list, A–Z. A bibliography of the Homoptera (Auchenorhyncha) 1: 1–886.

SAWFLIES OF CHILE: A NEW GENUS AND SPECIES AND KEY TO GENERA OF TENTHREDINIDAE (HYMENOPTERA: SYMPHYTA)

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ABSTRACT—**Ucona acaenae**, new genus and new species, is described from Chile. This species was recorded under the name "*Antholcus varinervis* (Spinola)" in the literature relating to its importation into New Zealand where it was used as a biological control agent for *Acaena* spp. A key to the six genera of the family Tenthredinidae known from Chile is also included.

The sawfly family Tenthredinidae is not well represented in Chile. About 10 species are known, 3 of which are very similar in size and coloration and have often been confused. These species have the head and thorax shining black and most of the abdomen a contrasting red or orange. One species has long, erect black hairs covering the head, thorax and legs and has trifid tarsal claws. This is the species I am treating as *Trichotaxonus coquimbensis* (Spinola) (Smith, 1973). The other two species, both with short, inconspicuous hairs and bifid tarsal claws, are the main subject of this paper.

In 1851, Spinola described *Tenthredo varinervia* from Chile, a species

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which Konow (1904) recognized as belonging to a distinct genus which he called *Antholcus*. Konow also emended the species name to *varinervis*. In the late 1920's, a sawfly was found in Chile feeding on *Acaena*, a troublesome weed in New Zealand. This sawfly was imported to New Zealand for use as a biological control agent under the name *Antholcus varinervis* (Spinola). (The species name *varinervia* is an adjective and in combination with *Antholcus* it should be *A. varinervius*.)

While studying certain South American sawflies and attempting to identify some collections from Chile, I found that the name *varinervis* was incorrectly applied to the *Acaena*-feeding species. Though I was unable to locate the type of *varinervia* Spinola, it is evident from Spinola's description that the *Acaena*-feeding species is not the species he described. In *varinervia*, the abdomen is orange, the legs are orange except for each coxa, trochanter, and hindtarsus, the clypeus is emarginated, the third antennal segment is longer than the fourth segment, and, in the forewing, the second cubital cell receives both recurrent veins. In the *Acaena*-feeding species, the apex of the abdomen is black, the legs are mostly black except for the reddish hindtibia, the clypeus is truncated, the third antennal segment is the same length as the fourth segment, and, in the forewing, the second and third cubital cells each receive 1 recurrent vein. The only character mentioned by Spinola not in perfect agreement with my interpretation of *varinervia* is the petiolate anal cell of the forewing. However, after examining a number of specimens, I found that this character could apply to both species, but less so to *varinervia*. In the forewing of *varinervia*, vein 2A & 3A is complete, connected to 1A by an oblique crossvein, but, in some specimens, the portion of 2A & 3A basal to the crossvein is partially obliterated and the anal cell appears petiolate. Spinola may have seen specimens in which this vein was not evident. The *Acaena*-feeding species always has a petiolate anal cell in the forewing and vein 2A & 3A is atrophied with only the basal stub present, and this is curved up at its apex.

The sawfly imported into New Zealand represents a new genus and species and is described below. All references to the species feeding on *Acaena* and its importation into New Zealand apply to this new species.

Ucona Smith, new genus

Antenna long, slender, filiform, length about 3 times head width; first and second segments each longer than broad; third segment subequal in length to fourth segment; segments beyond third gradually decreasing in length. Clypeus truncate; malar space short, less than ½ diameter of front ocellus; no genal carina; postocellar area broader than long; each mandible bidentate; eyes small, far apart, scarcely converging below; distance between eyes below much greater than length of an eye. No prepectus; cenchri separated by distance greater than breadth of one.

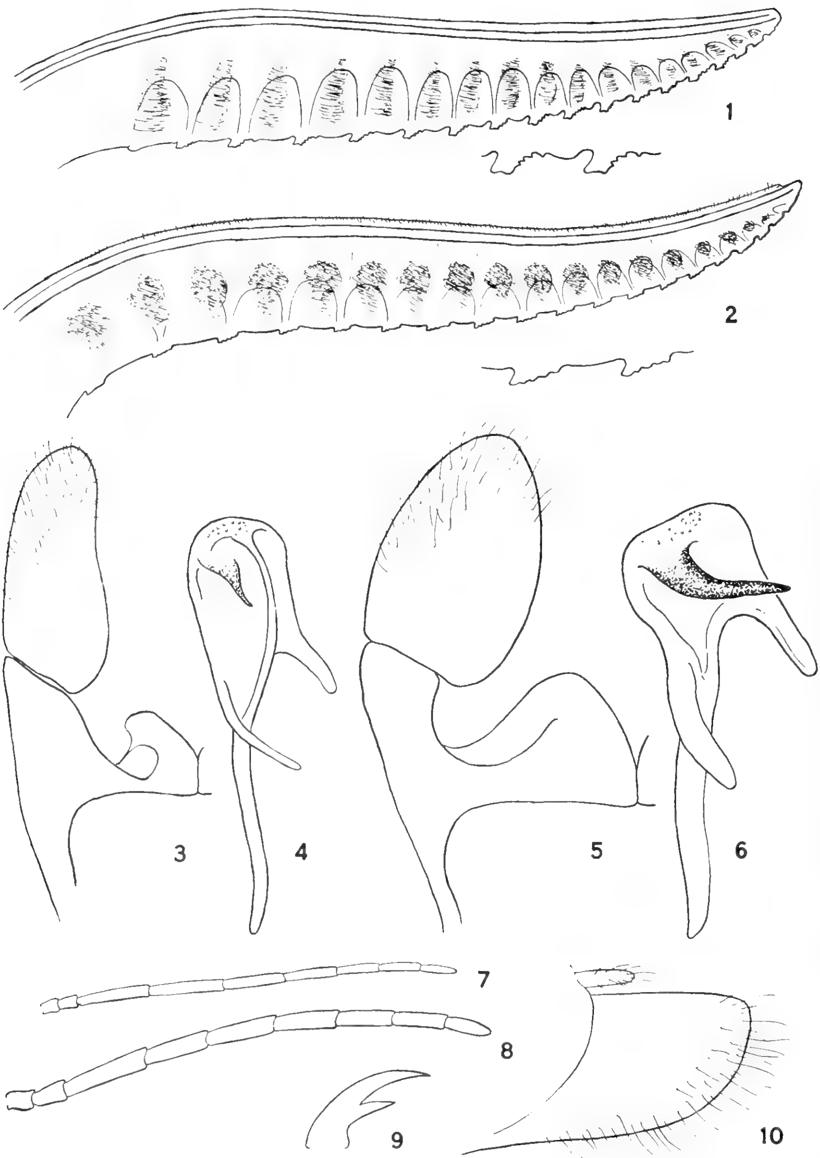


Fig. 1, lancet of *Ucona acaenae*. Fig. 2, lancet of *Antholcus varinervius*. Fig. 3, harpe and parapenis of *U. acaenae*. Fig. 4, penis valve of *U. acaenae*. Fig. 5, harpe and parapenis of *A. varinervius*. Fig. 6, penis valve of *A. varinervius*. Fig. 7, antenna of *U. acaenae*. Fig. 8, antenna of *A. varinervius*. Fig. 9, tarsal claw of *U. acaenae*. Fig. 10, sheath of *U. acaenae*.

Tarsal claw bifid, inner tooth shorter than outer tooth; no basal lobe; hindbasitarsus subequal in length to remaining segments combined; hindtibial spurs equal to width of hindtibia at apex. Basal plates separated on meson, leaving triangularly shaped membranous area. Forewing with anal cell petiolate, basal stub of vein 2A & 3A curved up at apex; second and third cubital cells each receiving 1 recurrent vein. Hindwing of female without cell M; anal cell petiolate with petiole subequal to cell width; apex of radial cell close to apical margin of wing. Hindwing of male with partial peripheral vein, open only between cells R and M.

Type–species: *Ucona acaenae*, new species. The only known species.

This genus is properly placed in the subfamily Blennocampinae of the Tenthredinidae where it resembles the genus *Periclista* Konow. *Periclista*, however, has the third antennal segment longer than the fourth segment, the clypeus usually emarginated, usually a longer malar space, the eyes closer together with the distance between them equal to or shorter than the length of an eye, the tarsal claws with a basal lobe, and the male with a complete peripheral vein in the hindwing. The genus *Antholcus* in the subfamily Allantinae has stouter antennae with the third segment longer than the fourth segment, an emarginated clypeus, postocellar area at least as long as broad, usually complete vein 2A & 3A in the forewing connected to 1A by an oblique crossvein, a distinct acute basal lobe on the tarsal claws, sometimes appearing as a third tooth, hindwing of female with cell M, and of male with complete peripheral vein.

The name is an arbitrary combination of letters. Gender, feminine.

Ucona acaenae Smith, new species

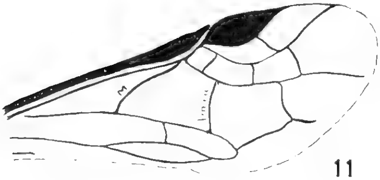
Female.—Length, 7.2 mm. Antenna and head black. Thorax black with tegula and paraptera brownish. Legs black with extreme apex of front and middle femora and base and outer surfaces of front and middle tibiae whitish; hindtibia orange. Abdomen orange with basal plates, apical 2 segments, and sheath black. Wings darkly, uniformly infuscated; veins and stigma black.

Sheath uniformly slender from above, in lateral view, dorsal and ventral margins nearly straight with apex broadly rounded (fig. 10). Serrulae of lancet each truncate at apex, directed anteriorly, with no anterior and 7 or 8 posterior subbasal teeth; distance between serrulae longer than breadth of a serrula (fig. 1).

Male.—Length, 7.0 mm. Color as for female. Structure as for female except for hindwing which has a partial peripheral vein, absent only between cells R and M. Genitalia as in figs. 3, 4; penis valve with short lateral, anteriorly projecting spine and long, slender dorsal membranous lobe.

Holotype.—Female, labeled "Temuco, Chile, Bro. C. Joseph," "Nelson, N. Z., em. April 1931." U.S.N.M. type no. 72352.

Paratypes.—Same data as for holotype (2 ♀♀); Nelson, N. Z., 3-5-37 (1 ♀, 3 ♂♂); Nelson, N. Z., 10-37 (2 ♀♀); from piripiri, –/6/43, Nelson No. 927 (4 ♀♀). In the U. S. National Museum and Department of Scientific and Industrial Research, Entomology Division, Nelson, New Zealand.



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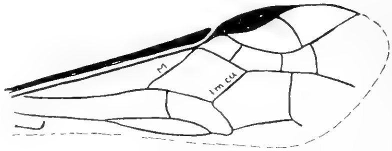

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Fig. 11, forewing of *Notofenusa surosa.* Fig. 12, forewing of *Ucona acaenae.* Fig. 13, anal cell of forewing of *Trichotaxonus coquimbensis.* Fig. 14, anal cell of forewing of *Antholcus varinervius.*

Discussion.—This sawfly feeds on species of *Acaena* (Rosaceae), the majority of species of which are found in South America and New Zealand. The host is also known in New Zealand as piripiri, hutiwai, and bidibidi. In the late 1920's, this sawfly from Chile was found feeding on this plant, and, because it could be easily transported and reared in large numbers, it was introduced into New Zealand in 1928 for use in biological control. Several introductions were carried out up to 1940, and in some areas populations persisted up to four years after release. However, it is not known to have survived in the country.

Following are a list of papers dealing with this insect under the name *Antholcus varinervis:*

Miller, D. 1928. New Zealand Jour. Agr. 37: 49 (note on S. Amer. study for eventual introduction).

Joseph, C. 1929. Rev. Univ. Santiago, 14: 708–726 (biology).

Miller, D. 1929. Rpt. Dept. Sci. Indus. Res., New Zealand, p. 19 (note on introduction).

Joseph, C. 1930. Rev. Univ. Santiago 15: 862–867 (transport to N. Z.).

Miller, D. 1930. Rpt. Dept. Sci. Indus. Res., New Zealand, p. 35.

Miller, D. 1931. Rpt. Dept. Sci. Indus. Res., New Zealand, p. 20.

Miller, D. 1932. Rpt. Dept. Sci. Indus. Res., New Zealand, p. 17.

Janvier, H. 1933. Ann. Sci. Nat., Zool. 16: 256–268 (biology).

Miller, D. 1933. Rpt. Dept. Sci. Indus. Res., New Zealand, p. 4.

Anonymous. 1933. Nature 131: 283–284 (note on importation).

Miller, D. 1936. New Zealand Jour. Sci. Tech. 18: 584.

Miller, D. 1938. Rpt. Cawthron Institute, p. 29.

Valentine, E. W. 1970. New Zealand Ent. 4: 52–62 (list of phytophagous Hymenoptera of New Zealand).

Miller, D. 1970. New Zealand, Dept. Sci. Indus. Res., Inf. Ser. No. 74, pp. 60–67 (insects of *Acaena;* biology and history of "*A. varinervis*" in New Zealand).

The species name, *acaenae*, is taken from its host plant.

Genera of Tenthredinidae in Chile

Six genera of Tenthredinidae are now known from Chile. Strangely, members of the subfamily Selandriinae are absent, yet it is the dominant group in South America. The genera bear a closer resemblance to Nearctic forms than to the sawflies of other parts of South America. The following key will distinguish the genera of this family known from Chile.

1. Veins M and 1m-cu of forewing divergent (fig. 11) [small black species less than 5 mm in length; tarsal claws with 1 or 2 outer teeth and basal lobe] 2
— Veins M and 1m-cu of forewing parallel (fig. 12) [larger, bicolored species; tarsal claw bifid or trifid, with or without basal lobe] 3
2. Antenna stout, apical 4 segments reduced, together about as long as third segment; vein 2A & 3A of forewing complete, connected to 1A by crossvein (as in fig. 14) [1 introduced species, *C. cerasi* (L.), on pear and other Rosaceae] .... *Caliroa* O. Costa
— Antenna slender, segments gradually decreasing in length; vein 2A & 3A of forewing atrophied, leaving anal cell petiolate (fig. 11) [minute species, less than 4 mm long; possibly leafminers; *N. surosa* (Konow) and several unidentified species] .... *Notofenusa* Benson
3. Vein 2A & 3A of forewing complete, either fused to 1A at center or connected to 1A by an oblique crossvein (figs. 13, 14) 4
— Vein 2A & 3A of forewing atrophied, leaving anal cell petiolate; only basal stub of 2A & 3A present which is curved up at apex (fig. 12) 5
4. Head, thorax, and legs covered with long, erect, black hairs; tarsal claws trifid [*T. coquimbensis* (Spinola)] .... *Trichotaxonus* Rohwer
— Hairs of body short, inconspicuous; tarsal claws bifid, with basal lobe [*A. varinervius* (Spinola)] .... *Antholcus* Konow
5. Tarsal claws with basal lobe; antenna stout, less than twice head width [species yellowish and black; includes *P. lorata* Konow, *P. limbata* (Enderlein), *P. antarctica* (Malaise), and several unidentified species] .... *Periclista* Konow
— Tarsal claws without basal lobe; antenna long, slender, nearly three times width of head [red and black species; *U. acaenae* Smith] .... *Ucona* Smith

Acknowledgments

The cooperation of the following made this paper possible: E. W. Valentine, Department of Scientific and Industrial Research, Entomology Division, Nelson, New Zealand, for providing specimens, references, and information on *Ucona acaenae*; D. W. Webb, Illinois Natural History Survey, Urbana, and P. Arnaud, Jr., California Academy of Sciences, San Francisco, for providing additional specimens of Chilean sawflies.

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TWO NEW SPECIES OF THE GENUS METACHROMA CHEVROLAT (COLEOPTERA: CHRYSOMELIDAE)

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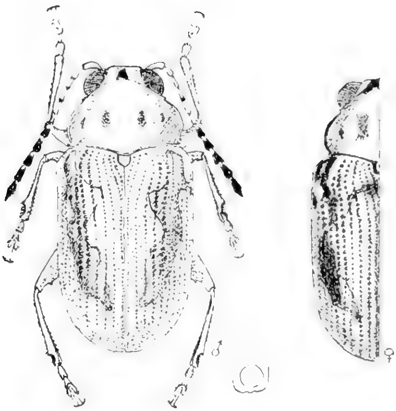
ABSTRACT—*Metachroma* **rhizophorae** from the Panama Canal Zone and British Honduras and *M.* **angusticolle** from Illinois, new species, are described.

Since my revision of the genus *Metachroma* was published in December 1970, 2 new species of that genus have come to light; 1 from Chicago, Illinois and the other collected by Dr. Daniel Simberloff of Florida State University on mangrove (*Rhizophora mangle* L.) in the Panama Canal.

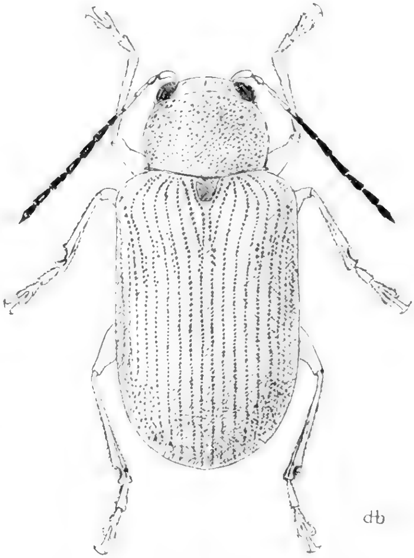
Metachroma rhizophorae Blake, new species
fig. 1

From 4 to 5 mm in length, elongate oblong oval, shining yellowish or reddish brown with dark occipital spot, 4 more or less elongate dark spots across pronotum, and irregular dark markings from humerus down along side of elytra, antennae with apical joints 7–11 mostly dark, pronotum finely punctate, elytra more coarsely and striately punctate.

Head with interocular space less than half width of head, eyes large, no sulcus separating front from clypeus, front indistinctly punctate, occiput more distinctly punctate, yellow brown with a dark occipital spot, in females covering more of back of head and down front and about eyes, clypeus shallowly emarginate over labrum, jaws large and shining piceous. Antennae with 5 apical joints wider and darker than basal joints and extending below humeri. Prothorax about a third wider than long, convex, with arcuate sides, a small tooth at each corner and narrow explanate margin, surface shining, finely and not densely punctate, varying from pale to deep yellowish brown with 4 more or less elongate piceous spots across, the two inner ones being larger and longer, margins in female dark.



1. Metachroma rhizophorae n.sp.



2. Metachroma angusticolle n.sp.

Scutellum varying in color from yellow brown to piceous. Elytra not much wider than pronotum and not quite 3 times as long, with parallel sides and striate punctures not reaching apex, larger along sides; yellowish brown varying from pale to darker, with irregular dark markings from humerus down along side to apical curve, in some specimens broken and in others extending half across elytra, these markings paler in male. Body beneath yellow brown with breast deeper reddish brown, legs pale yellow brown, hind femora toothed, and with emargination in both middle and hind tibiae. Length 3–4 mm; width 2–2.2 mm.

Type: male and 10 paratypes, USNM Type No. 71532.

Type locality: Diablo, Bt. (boat) ramp, Panama Canal, 21 January 1970, on common mangrove, *Rhizophora mangle* L., Daniel Simberloff.

Other locality: One male collected at Landifar, Berlize City, British Honduras, February 21, 1970 by D. Simberloff.

In this species, as in *M. angustulum* Crotch and *M. interruptum* (Say), the male and female show dimorphism in coloring. In this case the male is paler than the female. This color dimorphism may be fairly common in the genus but the scarcity of specimens in a given species prevents me from drawing conclusions. In the female of this species the elytral punctures are ringed with dark, giving them the appearance of being much coarser than in the male. As far as is known the larva of these Eumolpid beetles lives in the ground, and one wonders how this one survives in a mangrove swamp.

Metachroma angusticolle Blake, new species
fig. 2

From 6 to 6.5 mm in length, elongate oblong, shining yellow brown above, last 6 or 7 antennal joints dark, body beneath black with mid metasternum, breast and abdomen black; head and prothorax finely and not densely punctate, elytra with striate punctures fine and rather deeply impressed in basal half, producing a faint costate appearance of intervals, somewhat irregularly punctate on sides and at apex.

Head with interocular space half width of head, eyes large, occiput and front finely and not very densely punctate, median linear depression on front, clypeus with denser and coarser punctures, no groove between clypeus and front, anterior margin of clypeus over labrum slightly curved. Antennae extending well below humerus, basal 4 joints pale yellow brown, remainder wider and black. Prothorax moderately convex, not twice as wide as long, with slightly curved sides and very narrow explanate margin on sides and tiny tooth at each corner; pale yellow brown with reddish-brown margins, surface shiny, finely but not very densely punctate. Scutellum varying from yellow to reddish brown. Elytra more than 3 times as long as prothorax and considerably wider, with fine, close-set, striate punctures rather deeply impressed in basal half producing a slight costate effect of intervals, at apex punctures more shallowly set, on sides and at apex confused. Body beneath with middle of metasternum, breast and abdomen black. Middle and hind tibiae emarginate near apex. Length 6–6.5 mm; width 3–3.3 mm.

Type: female, USNM Type No. 72241 and 5 paratypes, 3 of which are in the Museum of Comparative Zoology, Harvard University.

Type locality: Chicago, Illinois, June 29, 1911, collected by E. Liljeblad, from the George Greene collection.

Probably because of its slightly costate appearing elytra, due to the deeply impressed striate punctures, the specimens were put with the yellow brown costate species of *Colaspis* both in the collection at the MCZ and in the USNM collection. In reality this species is very close to *M. longipenne* Blake described from southern Arizona. It is slightly larger and wider, being from 6 to 6.5 mm long in contrast to *M. longipenne* which is from 5.4 to 6 mm long, and correspondingly wider, being from 3 to 3.3 mm wide in contrast to *longipenne*'s 2.4 to 2.7 mm. Moreover the Chicago species is pale yellow brown above and black beneath, whereas *longipenne* has a deep reddish-brown head and prothorax, and is pale yellow brown beneath. It also has entirely pale antennae, whereas the Chicago species has the basal joints only pale, the remainder black. It is strange that no other collection of this beetle has been seen by the writer from such a well known place as Chicago.

A NEW GYMNODAMAEUS FROM WESTERN COLORADO (ACARINA: CRYPTOSTIGMATA, GYMNODAMAEIDAE)[1]

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ABSTRACT—A new species of oribatid mites, *Gymnodamaeus* **theliis**, is described, figured, and compared with *G. veriornatus* Higgins, 1961, *G. chalazionus* Woolley, 1972, and *G. leurolomasus* Woolley and Higgins, 1973. The new species is differentiated by a prominant median nipple on the posterior margin of the notogaster. General size categories are indicated for various species of *Gymnodamaeus.* Distribution of the new species includes locations in western Colorado, Washington, and South Dakota. A key to the species of *Gymnodamaeus* of North America is included.

As indicated in other articles (Woolley, 1972; Woolley and Higgins, 1973), the understanding of the complex of species of the genus *Gymnodamaeus* is expanding as the current research is extended and intensified in depth. The number of new species of this genus discovered in North America has doubled since Jacot (1937), Banks (1947), and Hammer (1952) published on them. Comparisons with the species described from Europe, viz. *Gymnodamaeus femoratus* (Koch), Schweitzer, 1922, *G. bicostatus* (C. L. Koch) Sellnick, 1928, *G. austriacus* Willman, 1935, *G. hispanicus* Grandjean, 1928, *G. tunicatus* Balogh, 1958, indicate 2 general size ranges for the species. These size ranges we have categorized provisionally as large and small, with respective average lengths of 550 μ and above for the larger species, 500 μ and below for the smaller ones. These arbitrary limits seem to hold for the 2 categories involved in most observations we have made. The new species described below falls in the category of larger species with *G. veriornatus* Higgins, 1961, *G. chalazionus* Woolley, 1972, and *G. leurolomasus* Woolley and Higgins, 1973.

It is our general opinion and conclusion, as a result of this part of our study, that intensified collecting over extensive areas and periods of time is necessary to disclose the details of a species complex. Initial results indicate that seasonal fluctuations may affect the presence of certain species as well.

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The status of such collecting in the science of oribatidology is minimal. All too few of the new species described are part of intensified studies. All too few of the new genera and species named are designated well within the limits of known familial arrangements; if hard to place in familial schemes, neither are they characterized in new families. All too few are compared extensively with other species from the local area or from other states or countries. Intensive studies need to be initiated by all concerned. Adoption of such practices would greatly improve the classification, the identification, and the knowledge of the biology and ecology of oribatids.

Discovery of this new larger species in such disjunct locations as western Colorado, South Dakota, and from the Olympic National Forest in Washington indicates that we need more intensive ecological and more extensive geographic investigations of the oribatids. Until we increase the intensity and extent of the collections, until we increase the numbers of investigators, *per se*, and increase the numbers willing to study in such an intensive manner, we will not understand well the ecology and distribution of oribatids, nor will we be able to determine or systematize their classification as effectively as we otherwise might.

The new species described in this paper is another one taken from the collections near Hayden, Colorado, in our study of the ecology in the environs of a coal-burning power plant.

Gymnodamaeus theliis, Woolley and Higgins, new species
fig. 1–4

Diagnosis: Distinguishing features of this new species are the prominent, median nipple on the posterior margin of the notogaster, the absence of a reticulate pattern on the dorsum compared to *G. veriornatus*, and the absence of teeth on the medial margins of the genital plates, as found in *G. veriornatus* and *G. chalazionus*, but of smaller size than both of these species. The trivial name is derived from the Greek, *thelion*, implying diminutive nipple or teat. The new species is about the same size as *G. leurolomasus*, but larger than *G. plokosus*.

Description: Color dark, reddish brown; prodorsum about as broad as long, rostrum blunt, rostral hairs about as long as lamellar hairs, covered with cerotegument, decurved; lamellar hairs inserted on lateral margins of prodorsum posterior to interrupted, dorsal transverse bar behind rostrum; interlamellar hairs very short, conical, inserted on anteriorly projecting point of curved, sclerotized bars arched anterior to pseudostigmata (fig. 1); a sclerotized, arched, transverse bar anterior to interlamellar hairs; pseudostigmata round, erected above surface of prodorsum; sensillum flattened, clavate, with many barbed flattened flanges on

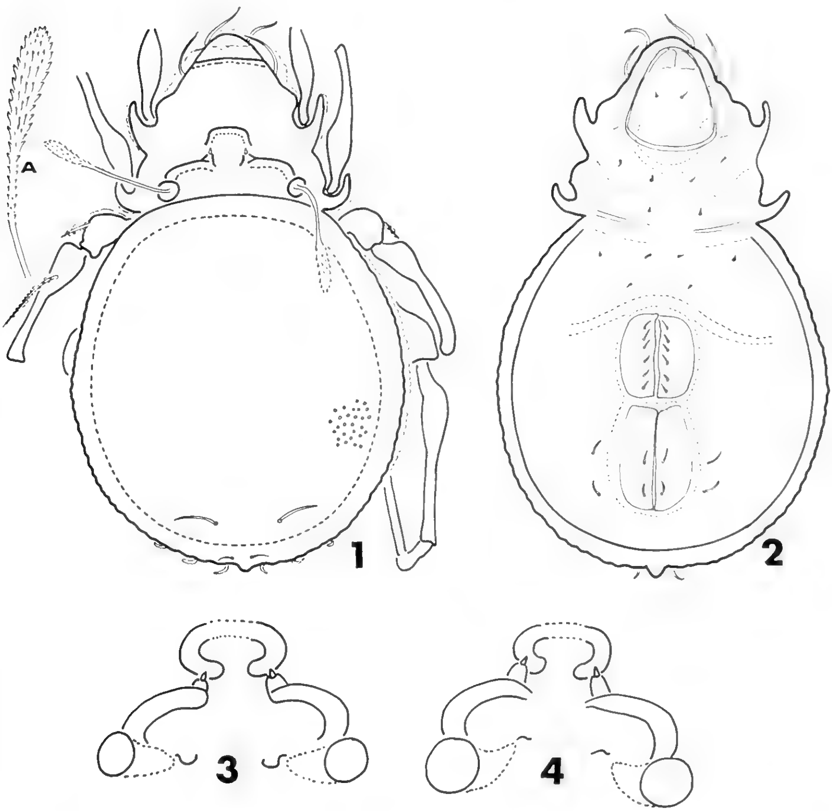

Fig. 1–4, *Gymnodamaeus theliis*. 1, dorsal aspect, legs partially omitted; A, enlarged view of left sensillum. 2, ventral aspect. 3, prodorsal sclerotization of male from Washington, showing variation in configuration of transverse bars. 4, prodorsal sclerotization of female from Washington, showing variation in configuration of transverse bars.

head, pedicel less barbed at base (fig. 1, 1A); cerotegument covering much of prodorsum, extended over sides, on legs, hairs of legs, tectopedia; tectopedia I and II as in Figure 1.

Notogaster slightly more than twice as long as prodorsum, somewhat circular in outline, surface covered with cerotegument and small tubercles; tubercles smaller than those of *G. chalazionus*; notogastral hairs as in figure 1, many obscured by cerotegument; posterior margin of notogaster with prominent median tubercle or nipple, with 3 hairs inserted each side, 2 pairs of hairs anterior to nipple on dorsum, 1 pair simple, short, nearest the nipple; other pair long, covered with cerotegument, inserted about their lengths anterolateral to nipple, as in figure 1; cerotegument over surface of notogaster applied to hairs as well.

Infracapitulum broadly triangular (fig. 2), mental hairs as in figure 2; ventral apodemata and coxisternal setae as in figure 2; apodemata IV typically arched anterior to genital opening, groovelike, with reticulations in groove; genital opening slightly shorter than anal aperture, each genital cover with 6 simple setae, medial margins of covers without teeth; a pre-anal piece anterior to anal covers, each anal cover with 2 setae; adanal setae as in figure 2.

Legs heterotridactylous, median claw much heavier than laterals.

Measurements: For the Colorado specimens, females are generally larger than males, with a range of 702 μ–636 μ $\times$ 416 μ–378 μ and an average length of 669 μ, average width of 402 μ. Males ranged in size from 672 μ–612 μ in length, 390 μ–360 μ in width, with average length of 636 μ and width of 378 μ. The 2 male specimens from South Dakota were 630 μ $\times$ 372 μ and 596 μ $\times$ 330 μ; 1 specimen was of undetermined sex. The specimens taken from Washington ranged from 630 μ to 558 μ in length, 396 μ–342 μ in width for females, 594 μ–528 μ in length, 342 μ–306 μ in width for males; averages were 600 μ length, 358 μ width for females and 568 μ length, 322 μ width for males. Two specimens of those collected measured were not identified as to sex, but their measurements are not included in the above calculations. Measurements of all specimens were taken for length from rostrum to the terminal end of the notogastral nipple and for width at the widest point of the notogaster posterior to legs IV, excluding the cerotegument in both instances. The cerotegument in all specimens was partially loosened and was not a good reference point for measurements of either length or width.

Collections and distribution: The type, a male, and 7 paratype males, 9 paratype females and 1 nymph were collected under aspens, 4 miles south Seneca Road, Hayden, Colorado, 8 June 1971, by T. A. Woolley and H. G. Higgins. Two males, and 1 female (1 specimen with sex undetermined) were collected under oak brush, Wolf Creek North, from a 1968 spoil bank, Hayden, Colorado, 8 June 1971, by T. A. Woolley and H. G. Higgins. Two males and 1 specimen of undetermined sex were taken from the litter, grass under oak and birch, from a picnic ground, E. Legion Lake, Custer State Park, S. D., 27 August 1968 by T. A. Woolley.

Five males, 3 females, 1 specimen of undetermined sex and 1 nymph were collected under hemlock and incense cedar at the site of Old Fort Townsend, Washington, 13 June 1972, by T. O. Thatcher. One female specimen was taken from hemlock limbs, Hoh River, 2 miles west of Olympic Park Boundary, Washington, 13 June 1972, by T. O. Thatcher.

The type and a paratype of each sex from the Colorado collections will be deposited in the U. S. National Museum.

Discussion: Although slightly smaller in size than the specimens from Colorado and South Dakota, the representatives of this new species from Washington have practically identical features. The structure that shows some variation is the sclerotized bar anterior to the interlamellar hairs. In the Washington specimens, this bar is more heavily sclerotized and has rounded tips near these hairs (fig. 3, 4). We consider these variations to be intraspecific, but not sufficient to erect a subspecies.

It is interesting that this species occurs in locations so widely separated, yet we would almost predict that the species will be found in the intervening areas when collections are intensified and extended. This is the first time in our own experience with oribatids that we have limited the areas of collection and extended collections over some time, but intensified our efforts to collect in certain limited habitats within a general area. We conclude that existing gaps in the geographic distribution of oribatids are only temporary and that these gaps will be closed when more extensive collecting is done.

Key To The North American Species Of *Gymnodamaeus*

1. Genital plates with teeth on medial margins 2
— Genital plates without teeth on medial margins 3
2. Dorsum of notogaster with reticulate pattern .... *veriornatus* Higgins
— Dorsum of notogaster without reticulate pattern, covered with tubercles .... *chalazionus* Woolley
3. Each genital plate with 7 setae .... *leurolomasus* Woolley and Higgins
— Each genital plate with 6 setae 4
4. Rostral and lamellar hairs about equal length 6
— Rostral hairs much shorter than lamellar hairs 5
5. Notogaster with 4 posterior nubbins and hairs .. *plokosus* Woolley and Higgins
— Notogaster without posterior nubbins .... *pearsei* Banks
6. Dorsum of notogaster with a distinct pattern of oval and crescentic-shaped areas .... *ornatus* Hammer
— Dorsum without a distinct pattern 7
7. Posterior edge of notogaster with projection or knob 8
— Posterior edge of notogaster smooth and rounded 9
8. Posterior edge of notogaster with 4 small, circular nubbins each bearing a stout hair .... *quadricaudiculus* Jacot
— Posterior edge of notogaster usually with single, large nipplelike knob, with 3 procumbent hairs each side .... *theliis* Woolley and Higgins
9. Six notogastral hairs on posterior margin .... *minor* Banks
— Four notogastral hairs on posterior margin .... *gildersleeveae* Hammer

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APHID BIRTHS (HOMOPTERA, APHIDIDAE)

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ABSTRACT—Thirteen viviparous births in 6 species of aphids, belonging to the Callaphidini, were observed. The newborn aphids bore on the anal end a round object assumed to be the remnant of the embryonic membrane. The nymph was seen to remove the remnant with its feet in most cases.

In the summer of 1971 observations were made on the bearing of aphids by viviparae of 3 species, indoors and under the microscope. This was under artificial light where the temperature was about 90F.

Aphids seem always to be born feet downward, although embryos in the adult may lie with dorsal or ventral surface, or a side, uppermost. The embryo's head is directed forward and the aphid is born tail-end first, as far as I have observed. Four births were recorded with varying details.

June 28. *Monelliopsis nigropunctata* (Granovsky) from pecan, Glenn Dale, Maryland. Female dropped a nymph, taking 5 minutes from the time the tip of the nymph could first be seen. Nymph motionless until free. On its anal end was a rounded wad about the size of its eye. On hitting the leaf the nymph backed a space of 7 or 8 mm, crossing a leaf vein much higher than itself in the journey, stopped, and kicked free the object on its tail. This took about 2 minutes. Then the nymph apparently began to feed.

June 28. *Monellia caryella* (Fitch) from *Carya cordiformis*. College Park, Maryland. Female observed bearing a nymph which had an object on the anal end. Birth took 3 minutes. Nymph stood in original position and spent 65 seconds kicking the object to the leaf, then it turned and walked away.

July 1. *Monellia microsetosa* Richards from *Carya glabra*, Hyattsville, Maryland. Nymph ready to drop from female, had object on anal end. Free from mother it backed 5 mm, then went forward 10 mm before feeding. Apparently object was dropped, though no kicking was observed.

July 20. *Monelliopsis nigropunctata* from *Carya tomentosa*, Washington, D.C. Female walked across leaf carrying nymph which was moving its legs and which bore an object on the anal end. Nymph dropped after 3 to 5 minutes had elapsed. It backed about 3 body lengths, having difficulty with the leaf pubescence. Stopped by a leaf vein. Nymph and object mounted on slide. No form could be seen in the object.

In July, 1973, 8 births were observed in *Protopterocallis canadensis* Richards and *P.* sp., undescribed, aphids that also infest hickories. In all the nymph upon extrusion from the mother aphid was seen to move its legs, alight on the leaf, and then kick away the wad or remnant of the embryonic envelope from its anal end. Most of the 8 individuals backed several lengths from the adult either before or after shedding the remnant.

Later the same process was observed in *Melanocallis caryaefoliae* (Davis).

The object seen in each case was doubtless the wadded remnant of the membrane which enclosed the embryo during development. Apparently the membrane splits at the head end of the embryo within the mother and is worked backward before birth.

I find nothing quite like this process in the literature. Burnett (1856) studied the embryology of *Aphis* (*Longistigma*) *caryae* Harris (again from hickory) in considerable detail. He had this brief report on birth: "When the young animal has reached its full development as an embryo, it bursts from its encasement and appears to escape from the abdomen of its parent through a small opening (*porus genitalis*) situated just above the anus. In the species under consideration, it generally remains clinging on the back of the parent until its external parts are dry, and it is able to begin life for itself."

Riley (1879) reported that in 3 species of gall aphids (Eriosomatinae) the young, deposited by winged migrants as "pseudova," were each enclosed in a "glossy pellicle." This was ruptured and "worked off in a few minutes."

Webster and Phillips (1912), writing of nymphs of the greenbug, *Schizaphis graminum* (Rondani), stated that the covering sac corresponds to the vitelline membrane in the true egg. "Normally in warm temperatures, the young *Toxoptera* frees itself from this enveloping sac during birth. At a temperature of about 60F. or below, the young are often times dropped before they free themselves from the sac. In the latter case, upon landing on the surface of the leaf, they expand and contract gently until the sac is ruptured at the cephalic extremity and they are freed from their prison."

Uichanco (1924), in his exhaustive work on the embryology of *Dactynotus tanaceti,* found that each egg or oocyte in the ovariole was early covered with a cellular follicle which gave nourishment and protection to the growing embryo. The follicle was later called a "membranous envelope." It "usually ruptures before extrusion of the young through the vaginal slit is completed."

I thank Miss Louise Russell, Systematic Entomology Laboratory, USDA, Beltsville, Maryland, and Henry L. G. Stroyan, Harpenden, England, for helpful suggestions.

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TWO NEW SPECIES OF ENLINIA FROM THE SOUTHWESTERN UNITED STATES (DIPTERA: DOLICHOPODIDAE)

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ABSTRACT—*Enlinia* **arizonica** H. Robinson and *E.* **texana** H. Robinson are described as new.

The minute flies of the Dolichopodid genus *Enlinia* have proven to be very numerous and widely distributed in the Western Hemisphere. More than 70 species are presently known, mostly from tropical regions (Robinson, 1969), and 5 species have been reported in North America north of Mexico (Robinson & Arnaud, 1970). Two additional species are described here from the southwestern United States on the basis of collections of Dr. Willis W. Wirth.

Enlinia arizonica H. Robinson, new species
fig. 6–9

Male. Length 1.1 mm; wing 1.0 mm by 0.5 mm. Face and front black dulled with brownish-black pollen; eyes contiguous below, anterior facets enlarged, surface with longer rather prominent pale hairs near mouth. Palpus and proboscis dark. Antenna black, all segments small, segment 3 blunt, arista only slightly longer than facial area.

Thorax dark metallic greenish or bluish black slightly dulled with blackish pollen above, denser brownish pollen on pleura; setae dark with pale reflections; about 8 pairs of acrostichals, about 10 pairs of rather small dorsocentrals; scutellum with hind margin evenly curved, with pair of widely separated bristles.

Legs mostly black with dark setae, segments 1 and 2 of fore tarsus whitish. Fore coxa without strong bristles; fore femur (fig. 8) rather broad and flat with series of long curving setae along antero- and postero-ventral margins, those near tip of femur up to twice as long as width of the femur; mid femur (fig. 9) with series of longer erect ventral setae near base with some as long as width of femur; hind femur and all tibiae nearly plain, fore tibia with a long sinuous seta ventrally at tip; hind tibia with a rather long apical ventrally. Fore tarsus (fig. 8) with basal 2 segments broad and compressed, segment 1 with very small black ventral spicule at tip, segment 3 flat and asymmetric, last 2 segments slender, lengths of segments from base as 4–2–2–2–4; mid tarsus plain, very elongate and slender, lengths of segments as 8–5–4–2–3; hind tarsus as 6–6–5–3–3, basitarsus with more erect slender hairs ventrally.

Wing (fig. 6) broadly oblong, clear with brown veins; costa rather arched beyond vein 1; vein 2 rather close to costa, scarcely turned forward at tip; vein 3 bending distinctly backward in distal half, ending before broad tip of wing; vein 4 straight, strongly divergent from 3; crossvein rather short, half as long as last of vein 5; vein 6 represented by slight fold well in from margin; setae of hind margin short. Knob of halter black.

Abdomen (fig. 7) slightly longer than thorax, cylindrical, blackish, setae dark; sternum 3 with slender erect projection from middle of hind margin. Hypopygium small, capping tip of preabdomen, brown; lamella very long slender, ribbonlike, with a crest of strong black setae near base and a few more further along on outer margin, fringes of finer pale hairs along both margins; a pair of inner appendages shorter, rodlike.

Holotype male and 1 male paratype: Arizona, Cochise Co., Portal, S.W. Res. Sta. 5–9 June 1972. W. W. Wirth. Malaise trap. USNM type no. 72434.

The new species is close to *Enlinia taeniocaudata* H. Robinson & P. H. Arnaud, but the male wing lacks the sinus in the hind margin, the ventral setae of the fore femur are longer and more irregular, the basal segments of the fore tarsus are white, and the hypopygial appendage is somewhat shorter with fewer setae in the basal crest.

Collected with *Enlinia arizonica* was a female that may belong to the species but has too many differences to be certain. The eyes are not contiguous, anterior facets are not enlarged and the lower surface does not have longer hairs; the face is as wide below as the width of the first antennal segment. The legs are wholly blackish; fore femur with only a series of short rather erect hairs ventrally; fore tarsus segments as 4–2–1.5–1.5–3; mid tarsus as 6–3–2.5–2–3; hind tarsus as 8–6–4–3–3, with ventral hairs of basitarsus not slender but rather erect. Wing more oval, with costa less arched; vein 2 more arched in basal half, straighter and further from costa in distal half; vein 3 nearly straight; vein 4 slightly bent at crossvein, very slightly arched in last part; crossvein about ⅔ as long as last of vein 5. Anal margin not as sharply rounded toward base. Abdomen more metallic dark greenish black.

Also collected at the same time were 3 male specimens of *Enlinia californica* H. Robinson & P. H. Arnaud, previously known only from San Mateo County, California.

Enlinia texana H. Robinson, new species
fig. 1–5

Male. Length 1.0 mm; wing 1.0 mm by 0.4 mm. Face and front greenish to bluish black dulled with slight pollen; eyes contiguous below, anterior facets enlarged. Palpus and proboscis dark. Antenna black, all segments small, segment 3 blunt, arista only slightly longer than facial area.

Thorax dark metallic bluish green with slight pollen, more blackish on pleura; setae dark with pale reflections; about 8 pairs of acrostichals, 9–10 pairs of rather small dorsocentrals; scutellum with hind margin evenly curved, with a pair of widely separated bristles.

Legs blackish with dark setae. Fore coxa with strong bristle on inner anterior surface; anteroventral surface of fore femur with series of rather erect short setae ¼–⅓ as long as width of femur, stouter erect seta at distal ⅓ on anterior sur-

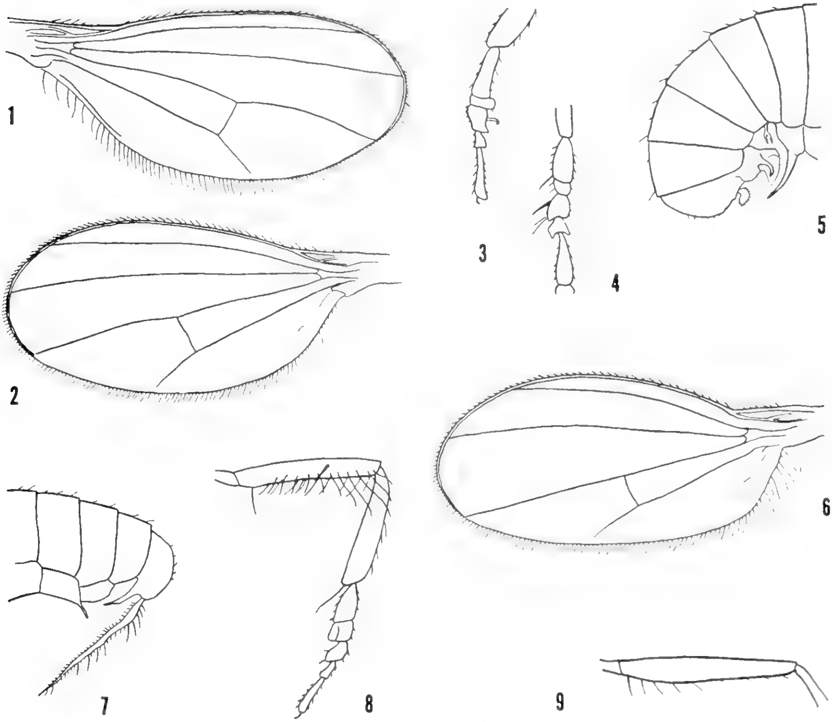

Fig. 1–9, *Enlinia* species. 1–5, *E. texana*: 1, male wing; 2, female wing; 3, male fore tarsus, lateral view; 4, male fore tarsus, anterior view; 5, male abdomen. Fig. 6–9, *E. arizonica*, male: 6, wing; 7, abdomen; 8, fore leg; 9, middle femur.

face; middle femur with 2–3 very long erect setae at base ventrally followed by 3–4 short small erect setae; hind femur and all tibiae plain, tibiae with only minute dorsal setae, mid tibia with series of close set short setae ventrally scarcely distinct from other rows. Fore tarsus (fig. 3–4) distorted, segment 1 broad with broader tip, segment 2 very short and slightly projecting ventrally, segment 3 set anteriorly at tip of segment 2, oblong and bulging anteriorly at base, with rather stout hooked pale seta ventrally, 1 long stout seta and 2–3 long slender setae on inner anterior surface, segment 4 small with short very narrow base, segment 5 with elongate slender base, lengths of segments from base as 4–1–3–1.5–4; mid tarsus plain, lengths of segments as 5–3–2.5–2.5–3; hind tarsus plain, segments as 7–5–4–3–4.

Wing broadly oval, more sharply rounded and longer fringed along middle of anal margin, wing clear with veins black; veins 2 and 3 slightly diverging, slightly curving backward, vein 2 more bulging near basal ⅓, nearly straight at tip; vein 4 with rather sharp angle at crossvein, more strongly arching in last part; crossvein perpendicular to base of vein 4, about as long as last of vein 5; vein 6 represented by faint streak along base of anal margin. Knob of halter black.

Abdomen (fig. 5) about as long as the thorax, stout, cylindrical but curving downward, metallic greenish black, setae dark; a long stout curved horn on middle of sternum 3, a slender forked appendage on sternum 4. Hypopygium dark brown, rounded with broad thin armatures bearing a forked appendage having curved branches; outer lamellae very small, white, covered with short pale hair.

Female. Plain. Face about as wide below as antennal segment 1, anterior eye facets not enlarged. Fore coxa and tarsus plain, segments of fore tarsus as 4–1.5–1.5–1.5–3; mid femur and tibia without distinctive ventral setae. Wing (fig. 2) similar to male but anal margin slightly broader with vein 6 in from edge. Abdomen plain, not curving downward.

Holotype male, allotype female, and 4 male and 2 female paratypes: Texas, Llano River, Kimble Co., 23 May 1972. W. W. Wirth. Malaise trap. USNM type no. 72435.

The new species is a member of the typical group as indicated by the seta on the fore coxae and the marginal sixth vein of the wing. The species is one of those having the larger sternal appendages and more metallic green abdomen but is distinct from close relatives by the lack of spots or notable vein distortion in the wings.

A single female collected at the same locality seems to represent another undescribed species. The tarsi of the female are whitish basally as in *Enlinia ciliata* H. Robinson but the face is broader and the abdomen is brown.

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NOTES ON THE MATING HABITS OF SOME CARABIDAE (COLEOPTERA)

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ABSTRACT—The mating habits of *Pterostichus chalcites* Say are described, and the duration of coitus is given for 20 species of ground beetles.

Mating Habits of *P. chalcites* Say

The literature contains little work on the mating activities of the family Carabidae. *Pterostichus chalcites* is distributed in eastern North America, north to Québec, west to Indiana, and south to Louisiana (Lindroth, 1966). Observations on the mating of 14 pairs of this species were made in May 1972. These individuals were collected from under stones and dead leaves, on a damp sandy field in Rigaud, Québec, and taken into the Collège Bourget laboratory for observation. The beetles were placed in a large terrarium with sandy soil.

Not till May 11 was any inclination towards mating shown, though the insects were very active in the daytime, and ate with voracity what was given to them. Males are quite aggressive and spend much time chasing the females to this purpose. When a male locates an apparently receptive female he directs his antennae forward. Then from a few centimeters away, he makes a quick dash and leaps onto the dorsum of the female from behind, pushes himself forward until his palpi touch the surface of the pronotum of his mate, clasps her between the pro- and mesothorax with his first pair of legs, and around her abdomen with his second pair of legs. The male supports himself with the last pair of legs. But the female does not always welcome the male's advances, sometimes succeeding by running, passing under debris or rolling upside down. Meanwhile, the male everts his aedeagus, which comprises a central penis and 2 lateral parameres; then the penis, which was drawn back within the abdomen, is brought into a central position pointing forward. The female rarely accepts sexual service without a struggle. If the female is receptive, i.e., opens the apex of the abdomen, mounting is quickly followed by insertion of the penis into the female's genital opening. At that time, the female's antennae are directed obliquely forward, while those of the male are pointed backwards. The sexual partners are, for the most part, motionless during the act of copulation. At times, however, the female walks about; furthermore, the mounted female cannot endure any approaching insect and drives him away at once. The duration of the coitus ranges from 6 to 17 minutes, and lasts 13 minutes in the average. After the male withdraws his penis, the pair may remain motionless over 2 minutes after which the female drives off the male in passing under a debris; then both beetles run away. In 1 instance, a male returned and mated with the same female after copulating 34 minutes before.

Duration of the Coitus of some Ground-beetles

Little is known of the duration of coitus in Carabidae. According to the entomological literature, the coitus of those insects may last from a few seconds to most of a day (Balduf, 1935). This list records observations made in the laboratory.

Agonum cupripenne Say—From 5 to 27 minutes (12 mating pairs).
Agonum extensicolle Say—From 1 to 2 minutes (3 mating pairs).
Amara patruelis Dejean—1 minute (for 1 case).
Anisodactylus harrisi Leconte—35 minutes (for 1 case).

Anisodactylus lugubris Dejean—10 minutes (for 1 case).
Carabus chamissonis Fischer—From 5 to 8 minutes (4 mating pairs).
Chlaenius pensylvanicus Say—2 minutes (for 1 case).
Chlaenius sericeus Forster—From 1 to 10 minutes (6 mating pairs).
Chlaenius tomentosus Say—9 minutes (for 1 case).
Chlaenius tricolor Dejean—22 minutes (for 1 case).
Harpalus affinis Schrank—From 45 to 101 minutes (8 mating pairs).
Harpalus herbivagus Say—From 7 to 15 minutes (2 mating pairs).
Harpalus rufipes De Geer—5 minutes (for 1 case).
Nebria gyllenhali Schönherr—8 minutes (for 1 case).
Pterostichus chalcites Say—From 6 to 17 minutes (5 mating pairs).
Pterostichus coracinus Newman—From 50 to 53 minutes (2 mating pairs).
Pterostichus lucublandus Say—From 20 to 121 minutes (5 mating pairs).
Pterostichus melanarius Illiger—51 minutes (for 1 case).
Pterostichus punctatissimus Randall—3 hours and 3 minutes (for 1 case).
Sphaeroderus nitidicollis Chevrolat—22 hours and 49 minutes (for 1 case).

The observations described in this paper have been made in Québec since 1969. I wish to express my deep appreciation to Mr. Jean-Pierre Lebel for his technical help, and to the "Ministère des Terres et Forêts du Québec" for its financial support.

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GROUND-BEETLES FLYING UNDER AN ELECTRIC LIGHT (COLEOPTERA: CARABIDAE)

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ABSTRACT—The present paper lists 107 species of Carabidae observed flying under an electric light; 41 species were not previously recorded in flight.

The capacity of flight is of great consequence for the dispersal of ground-beetles. In order to study their ability of flight, we employ a simple, non-expensive method. Living insects are collected by hand in the field and carried home in glass containers. Insect death may be somewhat avoided by putting in a piece of paper and by not overcrowding the specimens. Small holes in the cover of jars permit air circulation. In the laboratory, the containers are put in a dark room under a lighted electric lamp. The container's cover being removed, the insects fly readily to light. Then, one has only to capture them with the hand and put them into a killing jar before their identification.

Since 1970, 107 species of ground-beetles from Québec have been observed flying in this way. The following is a list of species observed flying which are identified by localities and the number of specimens in each species. An asterisk before a scientific name indicates that the species has not been previously recorded in flight in the entomological literature.

Species Accounts

* *Acupalpus canadensis* Casey—Rigaud (4).
Acupalpus carus Leconte—Choisy (1); Rigaud (10).
Acupalpus pauperculus Dejean—Choisy (1).
* *Acupalpus pumilus* Lindroth—Choisy (1); Rigaud (6).
Acupalpus rectangulus Chaudoir—Choisy (1).
Agonum aeruginosum Dejean—Rigaud (19).
Agonum affine Kirby—Rigaud (1).
Agonum anchomenoides Randall—Choisy (1); Mistassini (1); Rigaud (1).
* *Agonum canadense* Goulet—Choisy (1).
Agonum cupripenne Say—Rigaud (5).
* *Agonum excavatum* Dejean—Choisy (1); Rigaud (1).
* *Agonum extensicolle* Say—Rigaud (1).
Agonum harrisi Leconte—Choisy (1); Rigaud (16).
Agonum lutulentum Leconte—Rigaud (1).
Agonum melanarium Dejean—Amos (3); Choisy (9); Mistassini (1); Rigaud (63).
Agonum metallescens Leconte—Parc du Mont-Tremblant (1); Rigaud (1); Sainte-Monique (1).
Agonum muelleri Herbst—Amos (1).
Agonum octopunctatum Fabricius—Choisy (1).
* *Agonum palustre* Goulet—Choisy (8); Rigaud (6).
* *Agonum propinquum* Gemminger and Harold—Choisy (5); Rigaud (8).
Agonum sordens Kirby—Mistassini (1); Rigaud (1).
Amara aenea De Geer—Rigaud (7).
* *Amara angustata* Say—Rigaud (1).
* *Amara impuncticollis* Say—Rigaud (17).
* *Amara patruelis* Dejean—Amos (1); Rigaud (5).
Anisodactylus discoideus Dejean—Blandford (1); Choisy (18); Rigaud (1).
* *Anisodactylus harrisi* Leconte—Choisy (1); Rigaud (7).
* *Anisodactylus kirbyi* Lindroth—Choisy (3); Rigaud (3).
* *Anisodactylus lugubris* Dejean—Rigaud (6).
* *Anisodactylus nigrita* Dejean—Choisy (2); Rigaud (5).
* *Anisodactylus rusticus* Say—Rigaud (10).
Anisodactylus sanctaecrucis Fabricius—Choisy (15); Rigaud (6).
Anisodactylus sericeus Harris—Rigaud (1).
Badister grandiceps Casey—Rigaud (1).
* *Badister ocularis* Casey—Rigaud (4).
Bembidion bifossulatum Leconte—Blandford (1).
Bembidion bruxellense Wesmael—Mistassini (2).
Bembidion carinula Chaudoir—Mistassini (2); Sainte-Monique (2).

* *Bembidion castor* Lindroth—Bécancour (3); Blandford (15); Choisy (7); Rigaud (3).
Bembidion chalceum Dejean—Bécancour (1); Blandford (4).
Bembidion concretum Casey—Choisy (3); Rigaud (21).
Bembidion confusum Hayward—Choisy (4).
* *Bembidion frontale* Leconte—Choisy (44); Rigaud (6).
* *Bembidion graciliforme* Hayward—Choisy (22).
* *Bembidion immaturum* Lindroth—Amos (3); Mistassini (4); Parc du Mont-Tremblant (2).
Bembidion inaequale Say—Bécancour (1).
* *Bembidion incrematum* Leconte—Amos (3); Blandford (17).
Bembidion levettei Casey—Blandford (2); Choisy (2); Rigaud (12); Sainte-Monique (2).
Bembidion mimus Hayward—Choisy (11); Mistassini (1); Rigaud (20).
* *Bembidion muscicola* Hayward—Choisy (2); Rigaud (1).
* *Bembidion nigrum* Say—Bécancour (21).
* *Bembidion nitidum* Kirby—Rigaud (1).
* *Bembidion oberthueri* Hayward—Choisy (4).
Bembidion planum Haldeman—Bécancour (13).
Bembidion patruele Dejean—Blandford (1); Choisy (13); Mistassini (1); Rigaud (53); Sainte-Monique (3).
* *Bembidion petrosum* Gebler—Bécancour (2).
Bembidion punctatostriatum Say—Blandford (1).
Bembidion quadrimaculatum oppositum Say—Blandford (1); Choisy (2); Rigaud (9).
Bembidion salebratum Leconte—Choisy (3); Rigaud (1).
* *Bembidion semistriatum* Haldeman—Parc du Mont-Tremblant (1).
Bembidion stephensi Crotch—Rigaud (3).
Bembidion tetracolum Say—Rigaud (1).
Bembidion versicolor Leconte—Blandford (5); Rigaud (1).
Blethisa multipunctata Linné—Rigaud (2).
* *Bradycellus atrimedeus* Say—Choisy (4); Rigaud (3).
* *Bradycellus badipennis* Haldeman—Rigaud (108).
* *Bradycellus congener* Leconte—Rigaud (5).
Bradycellus kirbyi Horn—Rigaud (1).
Bradycellus lecontei Csiki—Héberville (1).
* *Bradycellus lugubris* Leconte—Amos (1); Rigaud (6).
* *Bradycellus neglectus* Leconte—Rigaud (1).
Bradycellus nigriceps Leconte—Choisy (1); Rigaud (9).
Bradycellus nigrinus Dejean—Héberville (5); Rigaud (9).
Bradycellus rupestris Say—Choisy (8); Rigaud (10).
* *Bradycellus semipubescens* Lindroth—Rigaud (32).
Chlaenius cordicollis Kirby—Bécancour (14).
* *Chlaenius lithophilus* Say—Choisy (1); Rigaud (1).
Chlaenius niger Randall—Rigaud (1).
Chlaenius pensylvanicus Say—Choisy (3); Rigaud (3).
Chlaenius tricolor Dejean—Rigaud (1).
Clivina americana Dejean—Rigaud (5).
Clivina fossor Linné—Choisy (1); Mistassini (2); Rigaud (3).

* *Dyschirius globulosus* Say—Rigaud (3).
Dyschirius integer Leconte—Choisy (6); Rigaud (1).
Dyschirius sphaericollis Say—Choisy (6).
* *Elaphrus americanus* Dejean—Choisy (6).
Elaphrus californicus Mannerheim—Bécancour (1); Choisy (34); Rigaud (4).
Elaphrus clairvillei Kirby—Choisy (3); Rigaud (5).
Harpalus affinis Schrank—Rigaud (2).
* *Harpalus herbivagus* Say—Choisy (8); Rigaud (22).
Lebia atriventris Say—Rigaud (2).
Lebia ornata Say—Rigaud (6).
Loricera pilicornis Fabricius—Amos (2); Rigaud (2).
* *Microlestes linearis* Leconte—Rigaud (2).
* *Olisthopus parmatus* Say—Rigaud (1).
* *Pterostichus chalcites* Say—Rigaud (4).
* *Pterostichus luctuosus* Dejean—Rigaud (1).
Pterostichus lucublandus Say—Rigaud (2).
Schizogenius lineolatus Say—Bécancour (7).
Stenolophus comma Fabricius—Blandford (1); Choisy (17); Mistassini (1); Rigaud (22).
Stenolophus conjunctus Say—Choisy (1); Rigaud (6).
Stenolophus fuliginosus Dejean—Choisy (3); Sainte-Monique (5); Rigaud (22).
Stenolophus ochropezus Say—Choisy (2); Rigaud (2).
Tachys incurvus Say—Choisy (1).
Tachys obliquus Casey—Choisy (53).
Tachys tripunctatus Say—Bécancour (1).
Trichocellus cognatus Gyllenhal—Rigaud (1).

THE GENUS DICTYODES MALLOCH (DIPTERA: SCIOMYZIDAE)

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ABSTRACT—*Dictyodes* Malloch is characterized by its place in a new key to the genera of the tribe Tetanocerini with vallar bristles. The specimen identified by Malloch with *Tetanocera dictyodes* Wiedemann and made type of the genus is shown to have been misdetermined and is described as *Dictyodes* **platensis**, new species. The genus is known only from southern Brazil to northern Argentina. *Pherbina cayennensis* Robineau-Desvoidy, from French Guiana, is treated as a nomen dubium that may possibly be referred to *Dictyodes*.

The genus *Dictyodes* was erected by Malloch (1933: 321), with the type and sole species *Tetanocera dictyodes* Wiedemann (1830: 583), from Rio de Janeiro, Brazil. Malloch characterized the genus very

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briefly: "Similar to *Protodictya*, but no hairs on hind side of hind coxae, and arista dark with moderately long black hairs." Inasmuch as all specimens examined, except the one seen by Malloch (in which the hindcoxae are very difficult to view), show distinct setae on the hind (or dorsal) margin of the hindcoxae, only the character of dark-colored arista remains. Among Tetanocerini with bristles on the vallum (ridge just below base of wing), the genus is, however, quite distinct, as shown in the following key.

Genera Of Tetanocerini With Vallar Bristles

1 (6) Arista with white pubescence or hairs; *tp* (posterior crossvein) sometimes strongly S-curved.

2 (3) Arista with longish white hairs; *tp* arcuate, only slightly S-curved; vallar bristles occasionally lacking (Holarctic) .... *Limnia* Robineau-Desvoidy

3 (2) Arista densely white-pubescent.

4 (5) Lunule at most very narrowly free; *tp* strongly S-curved; meso- and pteropleura with fine hairs only; face wholly whitish (Palaearctic) .... *Knutsonia* Verbeke

5 (4) Lunule broadly free; *tp* weakly to strongly S-curved; meso- and pteropleura with strong bristles; face with central black spot (South and Central America) .... *Protodictya* Malloch

6 (1) Arista with loose blackish hairs; *tp* seldom strongly S-curved.

7 (8) Nearly entire front between orbital bristles convex and glossy; 3 *dc* (Nearctic) .... *Poecilographa* Melander

8 (7) Front not convex and glossy; 2 *dc*.

9 (10) Midfrontal stripe tomentose; prosternum usually setose (Holarctic) .... *Trypetoptera* Hendel

10 (9) Midfrontal stripe glossy; prosternum usually bare.

11 (12) Meso- and pteropleura bare or with a few fine hairs (in addition to vallars) (Nearctic) .... *Pherbecta* Steyskal

12 (11) Meso- and pteropleura with at least 1 bristle each (in addition to vallars).

13 (14) Second antennal segment broader apically than at base, a little longer than high; mesoscutum with longitudinal stripes (Palaearctic .... *Pherbina* Robineau-Desvoidy

14 (13) Second antennal segment nearly parallel-sided, c 1.5 times as long as high; mesoscutum without distinct stripes (South American) .... *Dictyodes* Malloch

Malloch based his description of *Dictyodes dictyodes* (Wiedemann) on a specimen from Montevideo. That specimen is in the U.S. National Museum collections. It does not agree well with the original description, either in size or in color pattern of body and wing. Other specimens accumulated since Malloch's time fit the description much better. It has become obvious that 2 species are involved, which may be distinguished as below.

Either the misidentified species here described as new, or the species here identified as the Wiedemann species will fit the generic concept equally well. It therefore seems logical to continue the original type-designation (Art. 70.a.iii of the Code) and unnecessary to refer the case to the International Commission on Zoological Nomenclature.

Dictyodes dictyodes (Wiedemann)

Length of wing 7.5 mm; head with distinct brown orbito-antennal spot, parafacial with many conspicuous blackish setae above level of lower margin of eye and nearly to base of antenna, glossy midfrontal stripe evident in dull front; mesoscutum with more or less continuous sublateral brown stripes bearing postalar, supra-alar, and sublateral bristles and with irregular brown marks in dorsocentral areas running into blotch before scutellum; mesopleuron with 2 strong posterior bristles; wing dark brown with whitish spots uniformly distributed, brown color somewhat darker along costa, 3 squarish whitish spots in cell R_1 beyond tip of vein r_1; dorsum of abdomen with distinct median and lateral brown longitudinal stripes.

Material examined: ARGENTINA: 1 ♀, "Cap. Fed., IV, '24 P. P." (Shannon); 1 ♂, 28 km SW Buenos Aires, 7–8 July 1964 (C. O. Berg); 1 pair with puparia, same locality as preceding, no date, V6443 (laboratory reared by V. W. Kaczynski). BRAZIL: 1 ♂, Iguazu, 6 October (R. C. Shannon); all in U.S. National Museum.

Dictyodes platensis Steyskal, new species

Length of wing 4.3 mm; head without orbito-antennal spot, parafacial with only 4–6 inconspicuous fine hairs above level of lower margin of eye; midfrontal stripe not distinct in generally dull front; mesoscutum with pair of short longitudinal bars medially at anterior end and with X-shaped arrangement of dark brown spots (1 pair about base of posterior dorsocentral bristles, a single spot between anterior dorsocentrals, 1 pair just behind transverse suture, and 1 pair about and mesad of base of sublateral bristles); mesopleuron with 1 posterodorsal bristle; wing mottled dark and pale smoky brown, dark brown along costa interrupted in cell R_1 by 3 longer-than-wide whitish rectangular spots, area of discal cell and cell R_5 between *tp* crossveins largely filled by whitish blotch; abdomen dorsally uniformly tawny.

Holotype, male. URUGUAY: Montevideo (L. Tremoleras), no. 72407 in U.S. National Museum; paratype, male, ARGENTINA: S. S. Prinzessin, Buenos Aires, New Dock, 19.VI.1920 (Dr. W. C. C. Pakes), in British Museum (Natural History).

Another name that may possibly be referred to *Dictyodes* is *Pherbina cayennensis* Robineau-Desvoidy (1830: 689), the entire description of which is as follows: "4. *Pherbina cayennensis* R. D. Simillima *Ph. reticulatae;* magis flava; alae rete maculisque magis bruneis. Cette espèce, tout-à-fait semblable au *Ph. reticulata* d'Europe, a l'ensemble du corps plus fauve; les taches et le réseau des ailes sont d'un brun plus prononcé. Cette espèce, originaire de Cayenne, fait partie de la collection du comte Dejean." Efforts to locate the type have been fruitless, and it must be presumed lost. Comparison of the species by its author with the European *Pherbina reticulata* (= *P. coryleti*) is all that permits reference of the species to *Dictyodes*. Nothing resembling *P. coryleti* has been recovered from northern South America (Cayenne = French Guiana), and until such a specimen may be found and treated as a neotype the name *Pherbina cayennensis* must be considered a nomen dubium.

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TABANIDAE (DIPTERA) OF TEXAS. II. PINE BELT SPECIES, HUNTSVILLE STATE PARK; INCIDENCE, FREQUENCY, ABUNDANCE AND SEASONAL DISTRIBUTION

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ABSTRACT—Collection of Tabanidae in the Pine Belt of east Texas near Huntsville, Walker County, Texas, produced 1469 specimens (females) of 27 species in 5 genera: *Chrysops*, 10 species; *Chlorotabanus*, 1; *Leucotabanus*, 1; *Tabanus*, 14; and *Hybomitra*, 1. Weekly collections were made Apr. 7–Sept. 29, 1971, with modified Manitoba Traps and aerial insect nets used overhead. Six species comprised 80% of the total catch: *Chrysops callidus* Osten Sacken, 32%; *Tabanus melanocerus petiolatus* Hine, 14%; *C. pikei* Whitney, 13%; *T. lineola* F., 12%; *T. trimaculatus* Palisot de Beauvois, 5%; and *T. subsimilis* Bellardi, 4%. A pasture opening in an upland pine forest was the most qualitatively productive of 4 trap sites, producing 25 of the 27 species represented. Collections of 3 species of deer flies (*Chrysops*) represent State records.

This paper is the second in a series describing the Tabanidae of Texas and their relative abundance and seasonal distribution. Except for the records cited in the first paper of this series, the Tabanidae of the State are poorly known.

The Eastern Timberlands or Pine Belt ("Pineywoods")

The rolling hill country of east Texas is covered largely (70%) by forests interspersed with grasslands. This extension of the Southern Pine Forest of the Coastal Plain is a belt 75-125 mi. wide from the Red River to a point 25 mi. from the coast. This conifer forest provides 75% of the Texas lumber and pulpwood production; the remaining 25% is made up of hardwoods from this region. The geological formations in the region studied (Walker County) are Oligocene strata of the Gueydan Group. These strata extend in a belt 28–55 mi. wide from Newton County at the Louisiana line southwestward to Starr County at the Mexican border. The Trinity and San Jacinto Rivers provide the major drainage basins of the Pineywoods.

Study Area

This study was conducted in Huntsville State Park, 10 mi. south of Huntsville in southern Walker County. The park includes 2,122 acres bordering the western edge of the Sam Houston National Forest. Lake Raven is a 215-acre impoundment in the center of the park. Dominant forest trees are the native shortleaf pine (*P. echinata* Mill.) and loblolly pine (*P. taeda* L.). Dominant hardwoods are bitternut hickory (*Carya cordiformis* (Wang.) K. Koch), southern red oak (*Quercus falcata* Michx.), sweetgum (*Liquidambar styraciflua* L.), and sassafras (*Sassafras albidum* (Nutt.) Nees). Flowering dogwood (*Cornus florida* L.), redbud (*Cercis canadensis* L.), and yaupon (*Ilex vomitoria* Ait.) are the major shrubs and small trees. These flora are characteristic of the Pine Belt.

The information contained under this and the preceding headings was complied from Hunt (1967) and Sellards, Adkins, and Plummer (1932).

Methods

Most flies were collected by the modified Manitoba Trap (MT) initially described in Thompson (1969) and again modified (Thompson and Gregg, in press). One trap was located at each of 4 sites in the park grounds. Sites were chosen considering accessibility and factors previously shown to produce quantity and diversity of material (proximity to water, elevation, percentage of canopy cover; Thompson 1969, 1970). The first trap site (dam) was located in a sparsely wooded and swampy lowland forest at the southwestern margin of the lake. The second site (opening) was a pasture opening in a pine forest south and upland of the dam site. The third site (creek) was the sandy and barren bank of a small creek in the heart of the park's lowland forest. The fourth and last site (stable) was on a sandy oak-pine ridge next to a stable concession in the park. Overhead

Table 1.—Tabanidae (females) taken at Huntsville State Park, Walker County, Texas, 1971.

	Manitoba Traps					Over-head	Grand Total	Seasonal Range
	Dam	Opening	Creek	Stable	Total			
Chrysops								
callidus Osten Sacken	46	145	166	75	432	42	474	Apr. 7–July 21
cincticornis Walker			1		1		1	Apr. 15
flavidus Wiedemann	1	15	3	1	20	8	28	May 21–July 10
fulvistigma Hine[a]	1	1	1	2	5	3	8	Jun. 16–July 10
hinei Daecke[a]		2			2	1	3	May 21–Jun. 30
montanus Osten Sacken	9	15	1		25	8	33	May 21–July 10
pikei Whitney	44	69	2	3	118	86	204	Apr. 7–Aug.1
reicherti Fairchild	4			3	7	1	8	May 6–Jun. 16
upsilon Philip[a]	1	2		1	4	2	6	May 6–Aug. 25
vittatus Wiedemann	3				3	4	7	May 21–July 28
Chlorotabanus								
crepuscularis (Bequaert)	1	2			3		3	Jun. 2–Jun. 30
Leucotabanus								
annulatus (Say)		1	3	1	5		5	Jun. 16–July 7
Tabanus								
colon Thunberg		2			2		2	Jun. 16
fuscicostatus Hine		6			6		6	Jun. 16–Sept. 8
lineola F.	60	74	11	47	192		192	May 6–Aug. 18

Table 1.—(*Continued*)

	Manitoba Traps					Over-head	Grand Total	Seasonal Range
	Dam	Opening	Creek	Stable	Total			
longus Osten Sacken Group		2			2	1	3	Aug. 25–Sept. 1
melanocerus petiolatus Hine	51	63	108	12	234		234	May 12–Sept. 8
molestus Say	9	6	5	2	22		22	May 21–Sept. 8
nigripes Wiedemann	6	5	1		12		12	May 6–Jun. 30
proximus Walker	32	6			38		38	Jun. 16–Aug. 1
pumilis Macquart	2	4	1	1	8		8	May 6–Jun. 3
quaesitus Stone	1	3			4		4	May 12—Jun. 16
sparus var. *milleri* Whitney		11		2	13		13	May 21–Jun. 16
stygius Say		1			1		1	May 21
subsimilis Bellardi	1	34	5	25	65		65	Apr. 15–Sept. 8
trimaculatus Palisot de Beauvois	12	20	35	16	83		83	May 6–Aug. 25
Hybomitra								
trispila (Wiedemann)		6			6		6	May 6–21

[a] State record.

collections with an aerial net were also made at sites where deer flies (*Chrysops*) were observed. Several specimens were removed from automobiles and several were caught while biting me. Collections were made weekly, Apr. 7–Sept. 29, 1971.

The Fauna

The study produced 1469 specimens (all females) of 27 species in 5 genera: *Chrysops*, 10 species; *Chlorotabanus*, 1; *Leucotabanus*, 1; *Tabanus*, 14; and *Hybomitra*, 1 (Table 1). The most abundant species—those represented by 50 or more specimens—were *Chrysops callidus* (32% of the total catch), *Tabanus melanocerus petiolatus* (14%), *C. pikei* (13%), *T. lineola* (12%), *T. trimaculatus* (5%), and *T. subsimilis* (4%). These 6 species comprised 80% of the total catch; 21 species, the remaining 20%.

Several species were much more common in catches from some trap sites than in catches from others. Deer flies were not observed above my head in the sites found in the heart of the lowland hardwood forest (creek and stable); however, these species did fly above my head in the upland pines (opening) and at the base of this ridge near the lake (dam). Most species of deer flies were taken predominantly at the opening and dam sites; *Chrysops callidus* was abundant at all sites. *Tabanus proximus* predominated at the dam. *Tabanus melanocerus petiolatus* and *T. trimaculatus* were more numerous in the creek bed trap than in traps from the other sites. Catch differences of other species were not sufficient to suggest habitat specificity. Several sites were more qualitatively productive than others. Of the 27 species collected, 25 were taken at the opening, 18 at the dam, and 14 each at the creek and stable (MT catches, Table 1).

Chrysops callidus and *C. pikei* first appeared in early April, peaked in early May, and then declined greatly in mid-June. The dominant horse flies were most numerous in late May (*T. trimaculatus*), early June (*T. lineola* and *T. subsimilis*), or late June (*T. melanocerus petiolatus*).

Four of the 6 dominant species attacked man or livestock. *Chrysops callidus* annoyed men and horses on trails, bridle paths, firelanes, and in openings in the upland pines. *Tabanus lineola* and *T. subsimilis* were the species most annoying to horses in the corrals near the stables. One specimen each of *C. callidus*, *C. upsilon*, and *T. molestus* bit me during daytime collections in the park.

Acknowledgments

I gratefully acknowledge the help of the following persons: Mr. Edward J. Gregg, for conscientiously gathering catches and maintaining traps; and the Messrs. Jerry Oliver, Duane Hoff, and Johnny Smith, HSP, for suggesting trap sites and overcoming technical difficulties.

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STUDIES ON THE GENUS APHODIUS OF THE UNITED STATES AND CANADA (COLEOPTERA: SCARABAEIDAE): I. TWO NEW SPECIES FROM OREGON AND CALIFORNIA

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ABSTRACT—Two new species of *Aphodius* from the western United States are described. One of these species, *A.* **spermophili**, lives in the burrows of *Spermophilus beldingi* Merriam. The habitat of the other species, *A.* **perpolitus**, is not known.

This is the first of a proposed series of papers dealing with the genus *Aphodius* Illiger in the United States and Canada. The purpose of these papers is to make known information on the taxonomy, biology, and ecology of members of the genus, and to make it easier to identify them. There are presently many described species of *Aphodius*, but there are adequate keys to only a few small parts of the genus.

Horn (1887) produced the first comprehensive paper dealing with the genus *Aphodius* in North America. Nothing was done in the nature of a comprehensive treatment from 1887 to 1922 when Schmidt revised the Aphodiinae of the world. Schmidt described a few additional U.S. species and incorporated them in keys, but he did not add to or change Horn's classification to any degree except nomeclaturally.

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William J. Brown revised Horn's series I-b (1927), the subgenus *Platyderides* Schmidt (1928), and the subgenus *Diapterna* Horn (1929). In these papers Brown described several new species and made many changes in classification. With the publication of these papers it became possible, for the first time, to identify most North American specimens belonging in those groups. Hatch (1971) provided a key to the species of *Aphodius* occurring in the Pacific Northwest, this being the first comprehensive treatment of any consequence since Brown's papers.

Schmidt (1922) listed and gave a key to 74 subgenera of *Aphodius* for the world. Many of these include North American genera and it is usually possible to assign a species to a subgenus, but in my opinion many of these subgenera are not valid and others should be expanded, divided, or otherwise modified in order to be usable. The species in this and papers to follow are not assigned to subgenera, but the subgenus to which the species will go in Schmidt's key is indicated under remarks.

The present paper deals with 2 previously undescribed species from southern Oregon and northern California collected by Mr. Joe Schuh of Klamath Falls, Oregon. One of the species was collected from the burrows of *Spermophilus beldingi* Merriam (equals *Citellus beldingi*) and is a typical member of the subgenus *Platyderides*. The other has no host data and is probably not associated with a rodent burrow or nest.

Type material is deposited in the following collections: Joe Schuh collection, Klamath Falls, Oregon (JS); U.S. National Museum, Washington, D.C. (USNM); H. Howden collection, Ottawa, Canada (HH).

Thanks are due Henry Howden for taking the electron scanning photographs of the species herein described.

Aphodius spermophili Gordon, new species
fig. 1, 2, 5

Holotype: Male, length 5.65 mm, greatest width 2.60 mm. Form elongate, convex. Color reddish brown throughout. Head shining, posterior ¼ punctured, punctures nearly contiguous, anterior ¾ densely tuberculate, tubercles small, pointed; anterior margin of clypeus nearly truncate medially with sharp, upturned tooth on each side (fig. 2). Pronotum smooth, shining, punctures separated by the diameter of a puncture medially, becoming coarse and denser laterally; anterolateral angle abrupt, lateral margin explanate, feebly curved, posterolateral angle broadly rounded, concave internally, punctures becoming contiguous in concavity, posterior margin beaded, broadly rounded (fig. 1, 2). Elytron shining, punctures on intervals fine, arranged in 2 very irregular rows, striae distinctly impressed, intervals slightly convex. Ventral surface shining medially, alutaceous laterally; metasternum with irregularly scattered, coarse punctures medially.

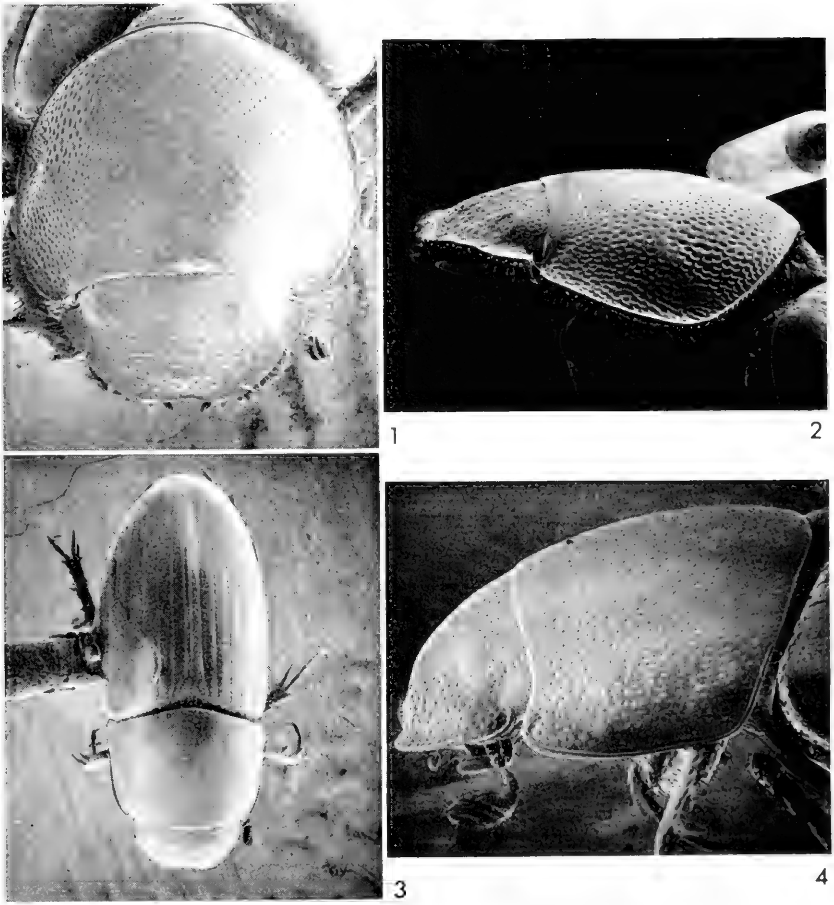

Fig. 1 and 2, *Aphodius spermophili*: 1, head and pronotum, dorsal view; 2, head and pronotum, lateral view. Fig. 3 and 4, *A. perpolitus*: 3, habitus view; 4, head and pronotum, lateral view.

Anterior tibia with outer teeth strong, posterior tooth basad of middle of tibia, apical spur small, tapered from base to pointed apex; middle and hind tibiae with apex fringed with unequal spines, outer spur ⅔ the length of inner, bluntly pointed, inner spur longer than first tarsal segment, pointed. Anterior tarsus with basal segment shorter than segment 2, segments 2–4 subequal, fifth segment as long as segments 3 and 4 combined; middle and hind tarsi with basal segment nearly as long as 2 and 3 combined, segments 2–4 subequal, fifth segment 1½ times as long as fourth. Abdominal sterna finely punctured, alutaceous, punctures becoming coarser laterally. Genitalia as in figure 5.

Allotype: Female, length 5.80 mm, greatest width 2.80 mm. Not separable from male on external characters.

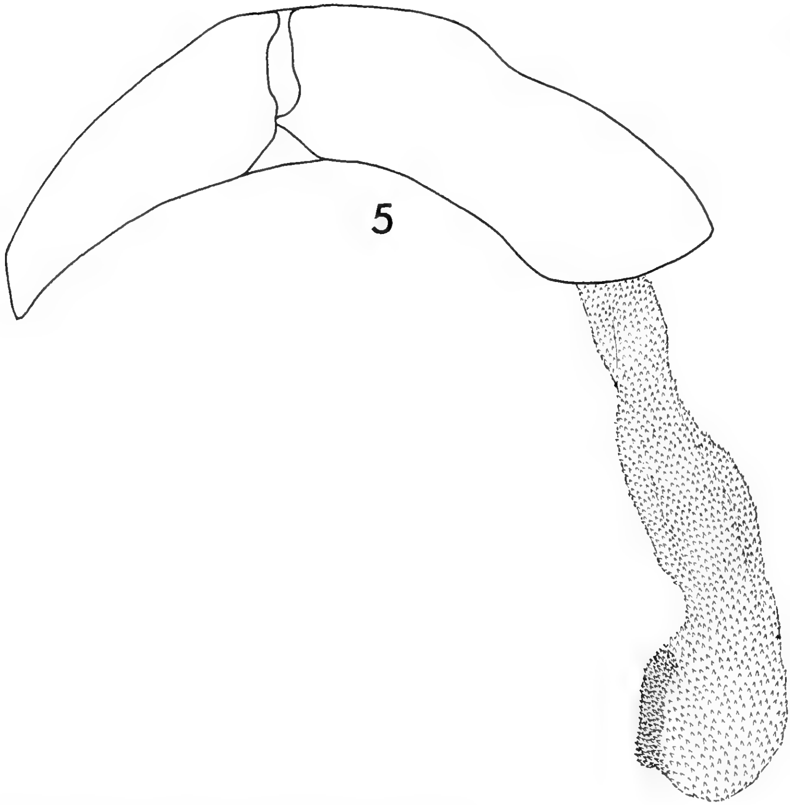

Fig. 5, *Aphodius spermophili*, male genitalia.

Type material: Holotype, male, California, Modoc Co., Saddle Blanket Flat, *Citellus beldingi* burrow, 5–10–71, Joe Schuh (USNM 72286). Allotype, female, same data as holotype (USNM). Paratypes, 49: 22 with same data as holotype; 27, California, Siskiyou Co., Macdoel, burrow of *Citellus beldingi*, May 17, 1971, Joe Schuh. (JS) (USNM) (HH).

Variation: Length ranges from 5.00 to 6.00 mm, width from 2.40 to 3.00 mm. The punctures in the posterolateral concavity of the pronotum are denser on some specimens than in figure 2, forming rows of elongate, contiguous punctures.

Remarks: *Aphodius spermophili* is very similar to *A. coquilletti* Linell at first glance and keys to that species in Brown (1928). *Aphodius coquilletti* has the head nearly smooth, tubercles (if present) only on the clypeus, the pronotum narrowed posteriorly, broadly explanate across the anterior angles and the posterolateral angle sinuately emarginate. *Aphodius spermophili* has the head entirely tuberculate except the posterior 1/4, the pronotum not narrowed posteriorly, narrowly explanate and not more so across the anterior angles and the posterolateral angle simply rounded, not emarginate.

Aphodius spermophili also resembles *A. militaris* LeConte superficially but *militaris* does not have an explanate pronotum and belongs in another group within the genus.

The type of *A. coquilletti* is USNM No. 560 bearing the following labels: "Los Angeles Co., Cal. Jan. 3284 collection Coquillette Aphodius coquilletti Linell Type Type No. 560 U.S.N.M.". Because Linell (1896) specifically stated that he had a single example from Los Angeles, California, this specimen must be considered the holotype of *coquilletti*.

Aphodius spermophili is a typical member of the subgenus *Platyderides* and, like all known members of this subgenus, is associated with a rodent. In this particular instance the rodent is *Spermophilus beldingi*, a common western ground squirrel.

Aphodius perpolitus Gordon, new species
fig. 3, 4

Holotype: Female, length 4.00 mm, greatest width 2.00 mm. Form elongate, oblong, sides of elytra parallel. Color black; legs and mouthparts reddish piceous; dorsal surface with faint greenish bronze sheen. Dorsal surface smooth, strongly shining except extreme apex of elytron roughly alutaceous. Head finely, evenly punctured, punctures separated by 1–3 times their diameter; anterior clypeal margin feebly, broadly emarginate medially, anterolateral angle broadly rounded (fig. 3). Pronotum finely, densely punctured medially, punctures separated by 2–3 times their diameter, punctures becoming slightly coarser and separated by their diameter or less toward lateral margin; anterolateral angle rounded, projecting forward, lateral margin nearly straight, indented slightly before posterior angle, appearing "pinched" (fig. 3), posterolateral angle abrupt, basal margin not beaded medially (fig. 4). Elytron with intervals flat, a row of very fine punctures on each side of interval near striae; striae distinctly, not deeply impressed. Ventral surface generally alutaceous; metasternum shining medially with a few coarse punctures present. Anterior tibia with apical spur long, robust, pointed, very slightly curved downward; middle and hind tibiae with short but apparently unequal spines, outer spur short, pointed, slightly sinuate, 2/3 as long as inner spur, inner spur longer than first tarsal segment. Anterior tarsus with first 4 segments subequal in length, fifth segment as long as 3 and 4 combined; middle and hind tarsi with first segment as long as 2 and 3 combined, segments 2–4 subequal in length, fifth segment nearly as long as 3 and 4 combined. Abdominal sterna strongly alutaceous, feebly, indistinctly punctured. Pygidium alutaceous, coarsely, densely punctured.

Type material: Holotype, male, Oregon, Klamath Co., Spring Creek, May 8, 1967, Joe Schuh (USNM 72287). Paratypes, 2, same data as holotype (JS).

Variation: Length ranges from 3.70 to 4.00 mm, width from 1.80 to 2.00 mm. One of the paratypes has a small, round, yellow spot on the fourth interval at the apical declivity of each elytron. The other paratype has a very obscure spot at the same location on one elytron, no spot visible on the other elytron.

Remarks: All 3 specimens in the type series are females. *Aphodius perpolitus* is difficult to place in Horn (1887) because the fringe of spines on the hind tibia is not clearly of equal or unequal spines. If it is assumed that they are unequal then it keys to *terminalis* Say, which is an eastern species having distinctly alutaceous elytra with a red elytral apex. If the choice of equal spines is taken, it keys to *alternatus* Horn, which does not have the sides of the pronotum indented and has the elytral intervals coarsely, densely, irregularly punctures. *Aphodius alternatus* also has the elytra in large part brown or yellow. In Hatch (1971), *perpolitus* keys to either the subgenus *Volinus* Mulsant or *Agrilinus* Mulsant but does not fit either very well. This is one of the species that points up the weakness of the subgeneric system used by Schmidt (1922). The extremely shining dorsum with greenish bronze sheen, indented lateral pronotal margin and each elytral interval with 2 rows of fine punctures distinguish *perpolitus* from any previously described species of *Aphodius*.

It is possible that the yellow elytral spots mentioned under variation above will prove to be more obvious and distinctive when additional specimens are found.

Figure 3, the habitus view of *perpolitus*, is somewhat distorted by the electron scanning microscope, something that not infrequently happens at magnifications of 8× to 10×. The specimen is actually shorter and more oblong than shown in the photograph but all characters other than shape are accurately represented.

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THE BIOLOGY OF LEPTOGASTER FLAVIPES LOEW IN MARYLAND (DIPTERA: ASILIDAE)

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ABSTRACT—The biology of *Leptogaster flavipes* Loew was studied in a wooded area of Baltimore County, Maryland and in the laboratory during the summers of 1971 and 1972. These predaceous flies are most abundant in the woods during July, and are restricted to the more humid areas which have a dense, herbaceous undergrowth. They begin foraging in mid-morning and continue until late afternoon. A list of prey and a description of predation are given. Matings are more common in early afternoon. The mean time *in copula* for 20 pairs of flies is 18.5 minutes. A description of mating and oviposition are given. Eggs are laid singly and hatch within 10–14 days at 28 C.

There are at least 50 species of the subfamily Leptogasterinae in the United States (Martin, 1957). Information on the biology of this group is limited and scattered at best. The most thorough report on a species of this group is that reported by Melin (1923) on *Leptogaster cylindrica* DeGeer in Sweden. Of the nearctic species, Malloch (1917) described an immature stage of *Leptogaster flavipes* Loew; Newkirk (1963) reported the feeding and mating habits of *Psilonyx annulatus* (Say) (as *Leptogaster annulatus*), and Lavigne (1963) described the eggs of *L. salvia* Martin.

Methods

This study was conducted in the field and laboratory during the summers of 1971 and 1972. The field study was conducted in a wooded area located between North Charles Street and Osler Drive in northern Baltimore County, Maryland. The wooded area, hereafter referred to as the Sheppard Pratt Woods (NE 4 Baltimore 15′ Quadrangle; Towson Quadrangle 70 37′20″ W, 39 23′22″ N), is approximately 20 acres in size, and is the remains of a more extensive forested area in the Towson quadrangle. The woods have undergone frequent irregular clearing and burning of the brush and understory. As a result the understory in some areas has not been re-established, and the soil in these areas is noticably dry throughout the summer. At the present time the upperstory consists primarily of *Fraxinus americana* L., *Quercus borealis* Micheaux, *Q. alba* L., *Fagus grandifolia* Ehrhart, and *Liriodendron tulipifera* L. The understory and forest floor is dominated by *Prunus serotina* Ehrh., *Prunus* spp., *F. americana*, *Viburnum acerifolium* L., *Lonicera* sp., *Rubus phoenicolasius* Maximowicz, *Podophyllum peltatum* L., *Circaea alpina* L., and *Arisaema* *triphyllum* (L.) Schott. We followed the classification of plants by Radford (1968).

In order to determine the seasonal distribution of this species, collections were taken from the same sections of the woods during the 2 summers. Collections were made with portable malaise traps and aerial insect nets. One trap was placed in an area of the woods which had a rank undergrowth. A second trap was placed at a site that was devoid of undergrowth. Routine collections were taken on Wednesdays and Saturdays from May 1 through October 1. For convenience, the data of the catches of the 2 days were combined and plotted on a weekly basis. The "daily catch" is the total number of specimens taken by both methods on a given date, although the data actually include specimens taken during the 6–7 days preceding.

Specimens were collected with aspirators in the field and transported to the laboratory for observations on reproduction and predation. Observations were also made in the field whenever possible. Twenty pairs of flies were used to study reproduction in the laboratory. These specimens were captured in the field in early morning, usually as soon as they became active. Observations were made in the afternoon at 2 hour intervals, usually between 1 and 3 PM. During these periods the flies were kept in collapsible insect cages, 12x12x12 in, at room temperature and lighting. Five mated females were placed in petri dishes lined with moist filter paper for oviposition. Ovipositing females and eggs were kept in an incubator at 28 C. Each dish was checked at 24-hour intervals, and the numbers of eggs recorded. Predation was observed by placing fruit flies, *Drosophila melanogaster* Meigen, in the cages as prey for the robber flies. The prey of these flies were determined by capturing feeding robber flies in the field with small snap top vials (Newkirk, 1963). The predator was released, and the prey taken to the laboratory for identification.

Results and Discussion

Foraging and predation. Leptogaster flavipes become active in mid-morning and continue until late afternoon. They perch on the terminals of dead stems, aerial shoots or on the under-surfaces of leaves at night and during early morning. When foraging begins, they usually fly at a height of 1 to 2 feet below and between branches of low plants covering the forest floor. In flight the body is parallel to the ground and the hind legs are more or less extended vertically. The first and second pair of legs are drawn up below the body and extended forward. They move slowly from plant to plant "inspecting" the tips of aerial shoots, often hovering momentarily, then landing or moving to another shoot. Adults seldom aggregate at 1 site to forage.

However, on 1 occasion we observed 5 individuals foraging at a small flowering plant, *Circaea alpina* L.

The flying asilid invariably captures resting prey. Under laboratory conditions, fruit flies were captured when resting on the sides or tops of the cages. In the field, prey were also taken when at rest on a stem, leaf or flower. We observed only 3 flies attacking prey in flight. However, none of the attacks was sucessful. Presumably this is typical for *Leptogaster* spp. (Melin, 1923; Newkirk, 1963).

The flies attack quickly after sighting prey. The attack may be direct without hesitation or indirectly by hovering slightly above the prey, moving backwards an inch or so, and then flying rapidly forward and 'leaping' on the prey. Few prey escaped their attacks in cages. The flies are less successful in the field. The predator firmly grasps the prey with all legs, dislodging it from the perch. One leg, usually a foreleg, is then used to grasp the substrate while the remaining legs quickly manipulate the prey. The proboscis is inserted and feeding begins within 3 to 4 seconds of capture. Examination of prey in the laboratory reveals that the proboscis is usually inserted in the dorsal or pleural areas of the thorax or abdomen. Feeding is usually completed at the capture site. If disturbed, *L. flavipes* flies into the low vegetation with the prey stuck on its proboscis. When feeding is completed, the prey is ordinarily pushed off the proboscis by the front tarsi at the feeding site. Occasionally a predator discards the prey in flight.

These flies also attack inanimate objects such as plant spikelets and seeds in the field and small pieces of paper in cages. *Leptogaster annulatus* (Newkirk, 1963) and *L. cylindrica* (Melin, 1923) exhibit similar behavior.

Prey taken by L. flavipes: ORTHOPTERA. Gryllidae: *Nemobius* sp. (nymph), VII-20-72. HOMOPTERA. Aphididae: *Rhopalosiphum maidis* (Fitch), VII-15-71, VII-20-71, 3 specimens VII-10-72; Cicadellidae: *Typhlocyba* sp. 3 specimens VII-12-72, 2 specimens VII-20-72. DIPTERA. Chironomidae: *Chironomus plumosus* (L.) VII-20-72. Sciaridae: *Sciara* sp. VII-7-72: Culicidae: *Aedes* sp. VII-15-71, VII-16-71, VI-19-72, 2 specimens VII-20-72; *Culex* sp. VII-20-72; *Mycetophila* sp. VI-26-72. The prey were identified by the senior author.

Mating. Numerous matings were observed in the field from 10:05 A.M. to 5:15 P.M., although most occurred in the early afternoon. Mating occurs among low-growing vegetation at heights from 1 to 3 feet. Males usually locate resting females although a few males were observed following females to perch sites. Upon sighting a female on a perch, the male attempts to land on her dorsum. An unreceptive female prevents landing of a male by simultaneously elevating and vibrating the wings above the body, slightly recurving the apex of the abdomen, and kicking at the male with her hind tarsi. The female often flies to another perch following unsuccessful mating attempts by males.

A receptive female remains at the perch site and allows the male to land. The male approaches from behind, hovers briefly, and lands either on her dorsum, or laterally on her dorsopleural surface. The male grasps the female's thorax just anterior to her wing bases with his fore tarsi. His middle tarsi grasp the proximal end of her thorax and or the base of her abdomen, and begin to stroke in this area. The hind tarsi grasp the anterior or mid-section of the abdomen. The male rotates the apical portion of his abdomen about 90° laterad to the female's genitalia. The apical portion of his abdomen is moved below the genitalia of the female; and the rotation of the abdomen is corrected with the dorsal surface below the female. The genitalia of the male is quickly rotated forward, below that of the female. Coupling occurs when the ventral surfaces of the genitalia come into contact. The pair form a rough figure eight arrangement in repose. The male then releases its grasp, falling laterally and below the female into a head-down position with the dorsal surface turned forward or slightly lateral (fig. 1). The wings of both flies are folded during copulation. The length of time *in copula* of 20 pairs in the laboratory varied from 5 to 34 minutes. The mean time was 18.5 minutes.

The entire mating sequence usually occurs at the original perch site of the female. If disturbed they move rapidly *in copula* to a nearby perch with both members taking part in the flight. The male is below the female in flight. The female ends copulation by simultaneously vibrating her wings above the body, arching her abdomen, and pushing at the male with her hind tarsi. The males usually move away following mating. The female may remain at the mating site or fly to a nearby perch. In either case she grooms the tip of her abdomen and genitalia with her hind tarsi.

Females may mate several times before ovipositing. In cages, females mate readily with a second or third male, often capturing prey and feeding between successive matings. Multiple matings were not observed under field conditions.

Oviposition. We observed females depositing eggs while perched on a leaf and at the base of a tree in the field, and on moistened filter paper in petri dishes in the laboratory. Under field conditions, females perch at heights of 1 to 2 feet with the abdomen slightly recurved and the wings folded above the dorsum. The front and hind legs support the body while the hind legs, singly or together, groom the distal portion of the abdomen. The female quickly elevates the mid-section of her abdomen, curving the distal portion down and forward. The wings vibrate and the abdomen undergoes contortions, releasing

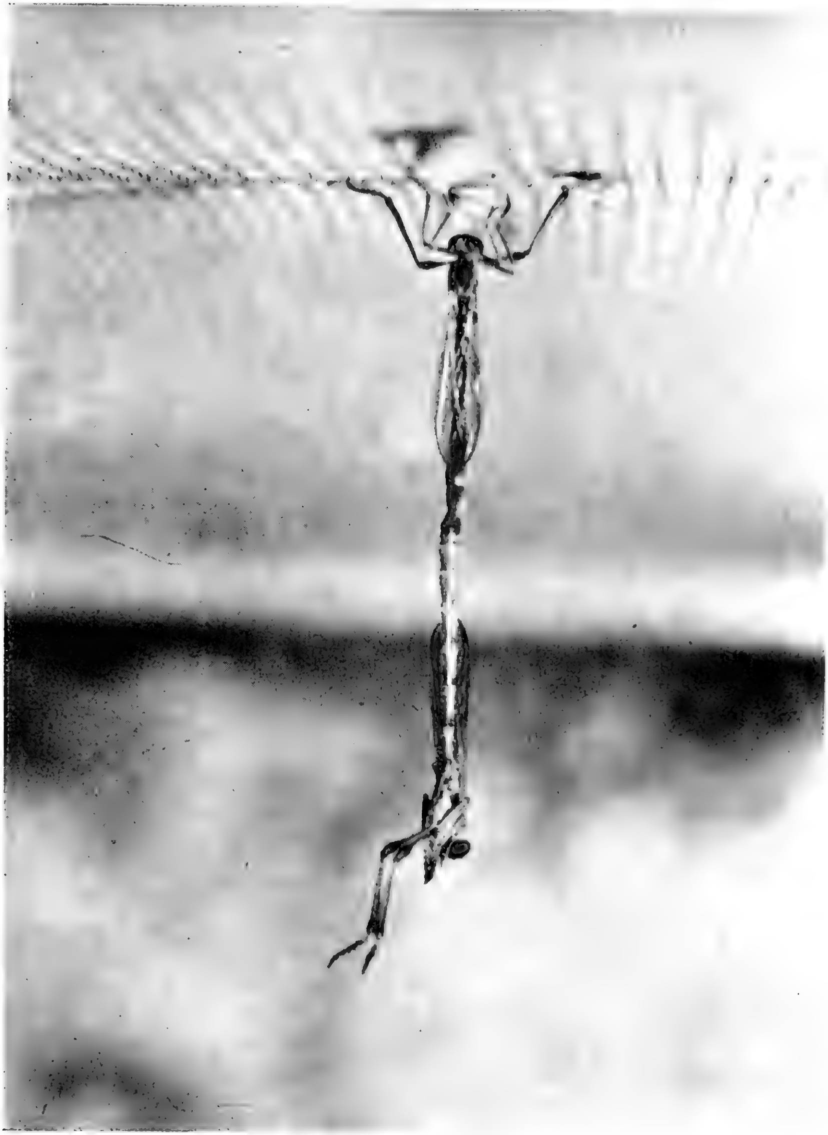

Fig. 1. Female and male *Leptogaster flavipes*, *in copula*.

1 egg at a time. Grooming of the abdomen usually follows oviposition. Females observed in the field flew away after depositing a single egg. In petri dishes, females behave similarily by crawling across the paper, pausing briefly to lay an egg and then crawling to a new location.

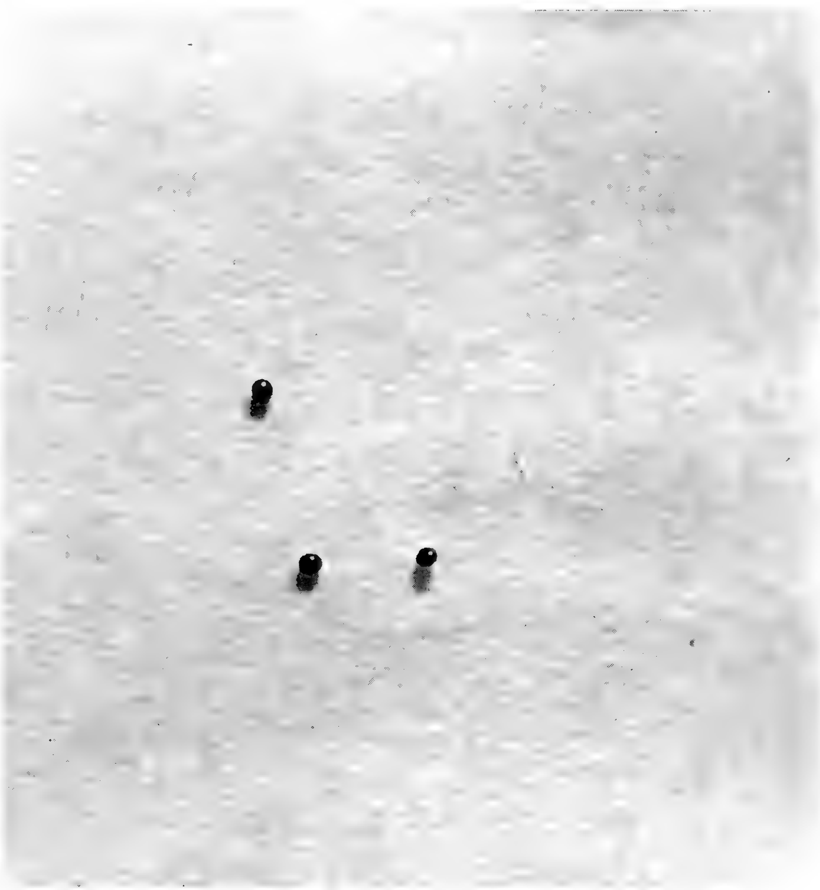

Fig. 2. Eggs of *Leptogaster flavipes.*

The wings are usually vibrating during the crawling phase, suggesting a flight phase between successive ovipositions. Perhaps this behavior aids in distributing the eggs over a wide area, increasing the chances for survival.

Egg production by 5 females mated in the laboratory is presented in Table 1. The eggs are smooth, amber colored, and slightly oval (fig. 2). No sculpturing of the egg chorion is detectable at 150× magnification. The sizes of the eggs are remarkably uniform, although slight variations do occur. The mean size of the eggs laid by female 3 was 0.34 mm in length and 0.27 mm in width. The mean sizes of the eggs laid by the remaining females are similar. The number of eggs laid by each female varied considerably, ranging from 25 to 72

Table 1.—Numbers and sizes of eggs laid by 5 females of *Leptogaster flavipes*.

Female	Number	Size (mm) Max. L × W	Min. L × W	Mean L × W
1	24	.357 × .294	.336 × .294	.344 × .279
2	56	.357 × .282	.315 × .249	.334 × .272
3	76	.348 × .282	.324 × .266	.335 × .273
4	54	.352 × .282	.330 × .250	.334 × .270
5	57	.354 × .290	.334 × .260	.335 × .274

in females 1 and 3, respectively. It seems doubtful, although not impossible, that such a wide range of egg production per individual fly would occur in nature. It seems more likely that female 1 may have been injured or was much older than female 3, and subsequently

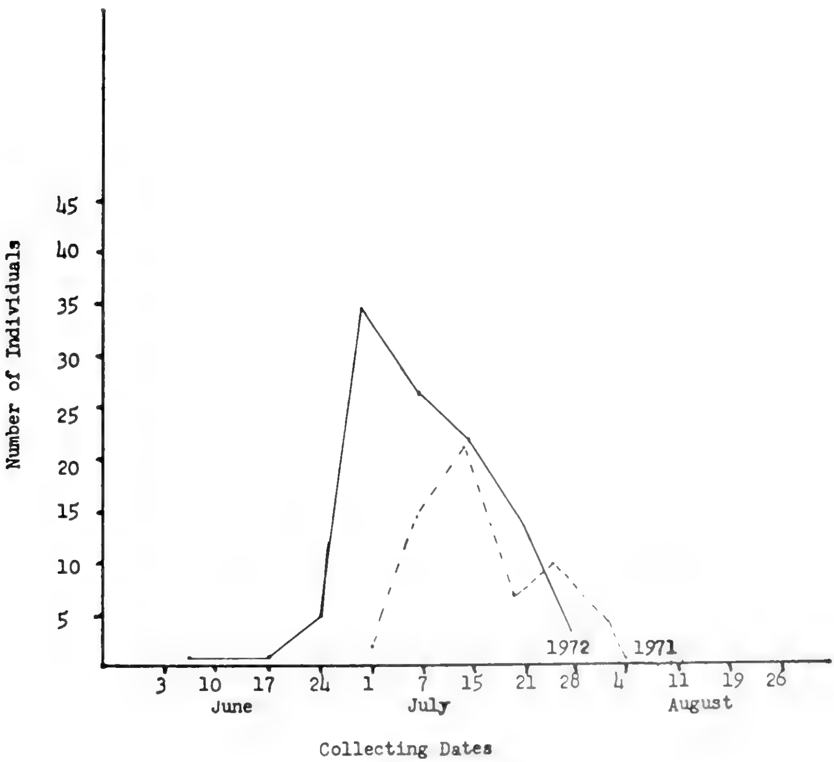

Fig. 3. Seasonal distribution and abundance of *Leptogaster flavipes* in the Sheppard Pratt Woods during the summers of 1971 and 1972.

had laid some eggs in the field before being captured. The eggs were deposited within 24 hours of mating and hatched in 10–14 days after oviposition.

Seasonal distribution and abundance. Figure 3 shows the seasonal distribution and abundance of *L. flavipes* in the Sheppard Pratt Woods during the 2 summer seasons of 1971 and 1972. The species was most abundant during July although it was present in small numbers during June (1972) and early August (1971). We have taken a few specimens in miscellaneous collections during late August of 1971 and 1972 in a wooded area of the Loch Raven Reservoir in Baltimore County, Maryland. It is also reported "fairly common" at Plummers Island, Maryland, from May 28 to September 1 (McAtee and Banks, 1920).

The distribution of this species during the summer is probably related to humidity. It is restricted to the more humid areas of the Sheppard Pratt Woods. These areas are covered by a thick undergrowth of small trees and herbaceous plant. The crests of the hills are without undergrowth, and are comparatively dry throughout the summer. *Leptogaster flavipes* is absent from these areas. In middle and late summer, the entire woods become noticeably dry. This period corresponds to the gradual decline in the fly population. In areas such as the Loch Raven Reservoir and Plummers Island which are moist for longer periods, the distribution of the fly made be lengthened.

Acknowledgments

We wish to express our appreciation to: Dr. R. L. Hilton, Department of Biology, Towson State College, for reading the manuscript and making suggestions for its improvement, Dr. D. R. Windler, Department of Biology, Towson State College, for assisting in the identification of plants, and Towson State College for the use of Sheppard Pratt Woods and facilities.

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PREVIOUSLY UNKNOWN NYMPHS OF WESTERN ODONATA (ZYGOPTERA: CALOPTERYGIDAE, COENAGRIONIDAE)[1]

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ABSTRACT—The previously unknown nymphal stages of the damselfly species *Hetaerina vulnerata* Hagen and *Argia nahauna* Calvert are described from southwestern Utah. A comparison with closely related species, on the basis of nymphal morphology, is given for each, and differentiating characterization is indicated. Notes on observed biology and habitat data are also included.

The nymphal taxonomy of North America damselfly species is for the most part well known today on the basis of stage correlations of reared materials. There have remained, however, certain species, particularly of the West, for which definitive descriptions and biological data concerning the nymphal stage have been lacking. *Hetaerina vulnerata* Hagen and *Argia nahuana* Calvert have been 2 such species.

During field investigations in the summer of 1971, as part of a systematic study of the Zygoptera of western North America, the authors were able to collect adults and associated nymphs of both the above named species from extreme southwestern Utah. Nymphal descriptions and illustrations of these 2 species are presented herewith along with notes on the taxonomy and observed biology of each.

Hetaerina vulnerata Hagen
fig. 2 and 3

Although the adults of *H. vulnerata* have been known since their original description by Hagen (in Selys-Longschamps, 1853) and from the Southwest since early in this century, the following represents the first description of the nymphal stage of this species. Distinct morphological differences are present between these nymphs and those of *H. americana* (Fabricius), the only other species of *Hetaerina* known from this region. The description is based on 5 specimens, 3 of which are last instar nymphs. The abundance of *H. vulnerata* adults and the absence of *H. americana* at the collecting site, along with obvious differences in these nymphs from known *Hetaerina* would assure application of the name.

Nymph: Head pentagonal in dorsal view, approximately $\frac{2}{3}$ as long as wide, frons prominent and slightly rounded anteriorly; labrum projecting slightly anterior of frons; antennae 7-segmented, first segment approximately 1.25 times length of

[1] Published with the approval of the Director of the Purdue University Agricultural Experiment Station as Journal Series No. 4945.

remainder combined, and subequal to midsagittal length of head, several long setae medially near base; labium extending posteriorly to mesosternum, proximal half of mentum (fig. 2) narrow with lateral margins subparallel, width approximately ¼ of length of mask, distal half of mentum with nearly straight lateral margins strongly divergent, length of cleft median lobe from base of bifurcations equal to width of proximal half of mentum, median cleft teardrop shaped, depth at level of articulations of lateral lobes, bifurcations narrower than greatest width of cleft, each bifurcation with single seta basally, lateral lobes terminating in 3 curved immovable hooks and longer movable hook, mesal hook shortest, 1 short seta near base of movable hook, and 5–7 short spines irregularly placed laterally.

Pronotum with anterior margin upturned and slightly concave, hind margin slightly rounded, pronotal shelf with 2 pairs of lateral projections slightly dorsad of each fore coxa, posterior projection most prominent; pterothorax stout, hind wing cases extending slightly distad of posterior margin of fourth abdominal tergum; legs long and thin, fore femora slightly shorter than width of head, fore tibiae nearly 1.5 times length of fore femora, tarsi 3-segmented, proximal segment half as long as distal segment, tarsal segments combined ⅓ as long as tibiae.

Abdomen with lateral carina poorly developed on segment 1, becoming more prominent posteriorly through segment 8, lateral carina of segments 9–10 smaller than on segment 8, heavily sclerotized and terminating in short spines, posteroventral margin of segment 10 (fig. 3) with 2 submedian spines equal in size to spines on lateral carina; middle caudal lamella slightly shorter than lateral lamellae, thin, flat, and rounded apically; lateral lamellae slightly longer than hind wing cases, dorsal margin curved, ventral margin straight almost to tip then curving upward ending in blunt point, spines on dorsal margin less distinct than those on ventral margin and lateral keel.

Color generally tan to reddish brown; cloudy brown markings on dorsum of head and pronotal shelf; lateral part of head posterior to eyes, lateral part of prothorax ventrad of shelf, and lateral pterothorax all marked with dark brown becoming darker and more extensive with age; legs light tan, femora with 4 brown stripes, tibiae with 3 brown stripes; abdominal terga with 4 dark spots on posterior margins and with tan mid-dorsal stripe, sterna darkened variously along posterior margins, sometimes appearing as lateral spots or transverse dashes and with fine dark midventral stripe; caudal lamellae with margins pale, dark brown granular pigmentation throughout median portion, with 2 or 3 dark bands extending to ventral margin.

Total length: 25.5–27 mm; lateral caudal lamellae: 6.5–7 mm; antennal segment 1: 2.7–3 mm.

Specimens examined: 4 nymphs—Utah: Washington Co., Santa Clara River, Veyo Warm Springs. June 14, 1971. A. V. Provonsha and W. P. McCafferty. Deposited in the Laboratory of Insect Diversity, Purdue University, West Lafayette, Indiana. 1 nymph—Utah: Washington Co., Weeping Rock, Zion Natl. Park. June, 1961. G. Musser. Deposited in the University of Utah collections, Salt Lake City, Utah.

Discussion: The nymphal stage of *H. vulnerata* resembles that of *H. americana* in general body form, but can be distinguished by the following diagnostic characteristics. The proximal half of the mentum is narrower in *H. vulnerata,* with the width being approximately ¼ of

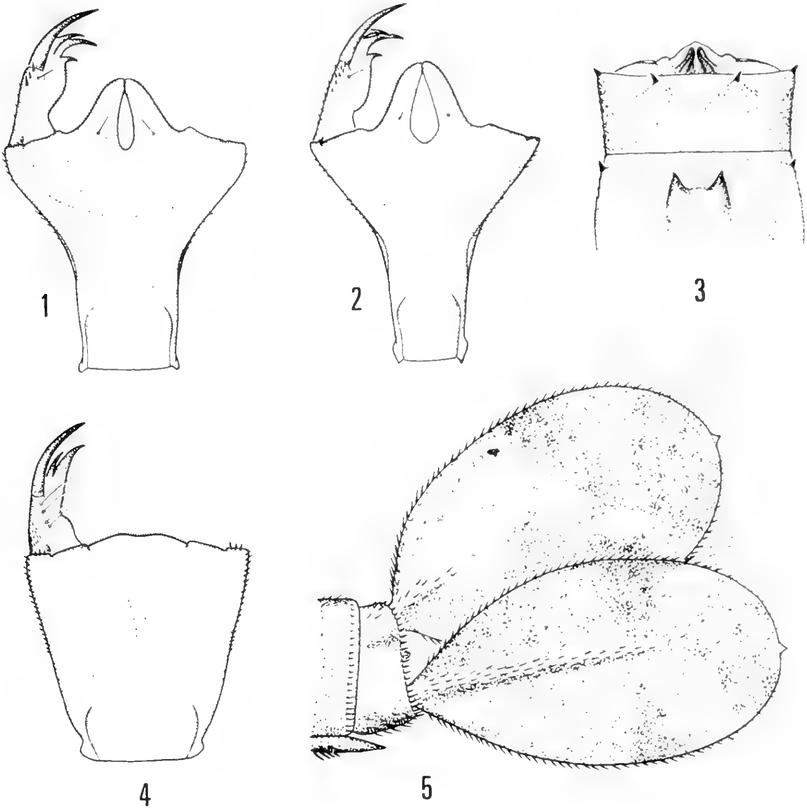

Fig. 1. *Hetaerina americana*, mentum, inner face. Fig. 2–3. *H. vulnerata*: 2, mentum, inner face; 3, abdominal sternites 9–10. Fig. 4–5. *Argia nahauna*: 4, mentum, inner face; 5, caudal lamellae, lateral view.

the total length of the labial mask (fig. 2); whereas, in *H. americana* the proximal half of the mentum is equal to $^1/_3$ of the length of the mask (fig. 1). The median cleft is more teardrop shaped in *H. vulnerata* with the bifurcations narrower basally than the greatest width of the cleft (fig. 2). In *H. americana*, however, the width of the bifurcations is greater than that of the cleft (fig. 1). The lateral lobes contain a cluster of 5–7 short spines irregularly placed basad of the movable hook in *H. vulnerata* (fig. 2); 3–4 spines only are found in *H. americana* (fig. 1). In addition to the above labial characters, the tenth abdominal sternum of *H. vulnerata* nymphs possesses a pair of submedian spines on the posterior margin (fig. 3) which are either totally absent or represented only by short, stiff, inconspicuous setae in *H. americana*.

The Santa Clara River, where most of the nymphal material was taken, drains part of the Pine Valley Mountains of southwestern Utah. Both runoff and natural springs contribute to the water flow which fluctuates somewhat throughout the year. The collecting site at Veyo is at an altitude of approximately 4,400 ft. in a rather deep and narrow canyon. The river substrate is composed mainly of red sand which is typical of the area, along with some large lava rubble. The river itself at this point ranges from 4–8 ft. in width and in most places is less than a foot in depth. Emergent vegetation is conspicuous along the shallower, slower moving sections. At the time the samples were taken the water temperature was recorded at 67 F.

Adults of *H. vulnerata* were abundant in the area and the majority sampled were teneral at the time. No oviposition or copulatory behavior was observed. Of the 4 nymphs taken, 3 were from root masses close to the bank and 1 from a stone near the middle of the river bed. Due to the large number of tenerals observed and the small number of nymphs taken, it appeared that emergence had been fairly recent and closely synchronized. Although *H. vulnerata* and *H. americana* are sympatric in parts of their range, the authors have not collected the 2 species from the same exact locality, a situation which perhaps suggests that the populations are isolated ecologically.

Argia nahauna Calvert
fig. 4 and 5

Seeman (1927) briefly described nymphs identified as *Argia agrioides* Calvert. However, examination of the accompanying figures of the mesostigmal laminae of an adult female reared from this population indicates that the species at hand was most likely *A. nahuana* rather than *A. agrioides*. It was pointed out by Gloyd (1958) that *A. nahauna* adults were structurally distinct from *A. agrioides* and warranted full specific recognition. Unfortunately, the description of the nymphs by Seeman was very incomplete and did not express needed differentiating characterization. This fact along with the high probability that Seeman's description has been improperly applied, has prompted the authors to present a detailed treatment of *A. nahuana* nymphs based on a recent positive association of nymphs and adults.

Nymph: Head more or less quadrangular in dorsal view, mid-sagittal length half of greatest width, anterior extension of frons from anterior margin of eyes equal to width of antennal socket, eyes protruding laterad of head approximately ¼ of total length of eye, median third of posterior margin of head emarginate, remainder of margin heavily spinose to eyes, posterolateral corners of head slightly rounded; labrum rounded and protruding anteriorly slightly beyond frons; antennae 7-segmented, total length equal to midsagittal length of head, third segment ¼ of total antennal length; labium extending posteriorly to middle of mesosternum, mentum (fig. 4) expanded distally, basal width slightly more than half of apical width, midsagittal length of mentum equal to apical width, margin of median lobe obtuse with very slight medial depression, ridged with numerous short apical spines, marginal setae 16–19, basal protuberances of mentum each with small cluster of spines, lateral lobes with 2 immovable apical hooks and longer movable hook, lateral immovable hook longer than median immovable hook, several erratically placed spines on dorsolateral surface of lobes, lateral setae 4.

Pronotum with anterior margin straight, lateral margins narrowly expanded posterolaterally, posterior margin angularly produced, approaching truncate; hind wing cases extending slightly distad of abdominal segment 3; fore femora ⅔ of length of tibiae and approximately half of length of hind femora, hind femora and hind tibiae approximately equal in length, tarsi 3-segmented, short basal segment half of length of second tarsal segment.

Lateral carina distinct on abdominal segment 1, becoming less distinct on posterior segments, becoming indistinct on segment 7, and absent on segments 8–10, lateral carina gently rounding on posterior margins of segments, spines absent on lateral carina of segments 1–2; middle caudal lamella (fig. 5) suboval, sometimes with minute apical point, few spines on median keel near base; lateral lamellae (fig. 5) narrowed at base, broadest slightly distad of midpoint, apices rounded, sometimes with a minute apical point, lateral keel heavily spinose, lamellae edged with spines mixed with long setae distally.

Color generally reddish brown, head with face tan, frons in dorsal view with pair of short submedian pale markings medially arched and originating from anterior margin of head, area surrounding ocelli dark reddish brown, area posterior to frontal suture paler with mottled markings; antennae and mouth parts pale. Pterothorax mostly dark reddish brown, legs pale, femora with 2 indistinct brown stripes. Abdominal terga with pale middorsal stripe widening on segments 9–10, stripe bordered by dark brown markings on all segments; lateral caudal lamellae with cloudy dark band just beyond middle and numerous spots of pigment throughout, apices pale.

Total length: 18–18.5 mm; lateral caudal lamellae: 4 mm; fore femora: 1.7 mm; hind femora: 3.5 mm; width of head: 3.5 mm.

Specimens examined: 7 nymphs, and 2 males and 1 female (reared)—Utah: Washington Co., Santa Clara River, Veyo Warm Springs. June 14, 1971. A. V. Provonsha and W. P. McCafferty. 3 nymphs—Utah: Washington Co., small stream 2½ mi. S. of Washington. June 12, 1971. A. V. Provonsha and W. P. McCafferty. All specimens deposited in the Laboratory of Insect Diversity, Purdue University, West Lafayette, Indiana.

Discussion: The nymphs of *A. nahuana* are similar to those of *A. sedula* (Hagen) and *A. fumipennis* (Burmeister) in general body form, shape of the labium, and form of the caudal lamellae. The caudal lamellae of all of the above species are broadened beyond the middle, narrowed toward the base, and margined with short spines intermixed with long setae near the tip. The caudal lamellae of *A. nahuana* most closely resemble those of *A. fumipennis* but tend to be broader and more oval in shape (fig. 5). Diagnostically the lateral lobes of the labium of *A. nahauna* bear 4 long setae (fig. 4) while those of *A. sedula* have 3 setae and those of *A. fumipennis* have only 2 setae.

The habitat description as discussed under *H. vulnerata* applies also to those specimens of *A. nahauna* taken at Veyo, Utah. Adults of *A. nahauna* were plentiful at this collecting sight and several were observed ovipositing. The nymphs were found on roots and detritus along the stream bank and on stones throughout the stream bed. Ten nymphs were taken; several were ready to emerge, while others were taken in pre-ultimate nymphal instars. Based on age distribution of nymphs and the maturity of some adults, emergence probably began around the last week in May and continued throughout the month of June.

The nymphs were placed in baby-food jars capped with screen cylinders similar to those rearing chambers described by Macklin (1960). During the 2 days following sampling, 2 males and 1 female emerged, providing a positive rearing correlation.

Acknowledgments

The authors wish to thank Mrs. Leonora K. Gloyd, Museum of Zoology, University of Michigan, for verification of identifications and advice given during this study.

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A EUROPEAN SPECIES OF MELANOTUS NOW ESTABLISHED AT BALTIMORE, MARYLAND (COLEOPTERA: ELATERIDAE)

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ABSTRACT—A European elaterid, *Melanotus dichrous* (Erichson), is reported from Baltimore, Maryland. It was collected during 1969, 1970, and 1973, indicating that it is established in the area. The species is redescribed and the male genitalia are illustrated. Modified couplets are given for the key in a recent revision of the nearctic species of *Melanotus* by Quate and Thompson (1967).

From mid June to mid August 1969, 1970, and 1973, Mr. E. J. Ford, U.S.D.A., Baltimore, Maryland, collected a total of 28 specimens of a species of *Melanotus* at Baltimore, Maryland. Mr. T. J. Spilman, U.S.D.A., Washington, D.C., requested my opinion concerning the identity of these specimens since he could not place them using Quate and Thompson's revision (1967). It was readily apparent after examining these specimens that they represented a species not included in Quate and Thompson's revision. Also the probability of a striking, undescribed species of *Melanotus* occurring in the northeastern United States was rather remote.

I tentatively identified the species as the European *M. dichrous* (Erichson). Miss Christine von Hayek, British Museum (Natural History), kindly confirmed my determination and remarked that the species was rather rare in Europe. Binaghi (1938), in his revision of the Italian species of *Melanotus*, illustrated the male genitalia and the female bursa copulatrix of *dichrous* and noted that the species occurred in southern Europe, particularly in Italy and Spain. According to Schenkling (1927), *dichrous* is known from southern Europe, Algeria, Morocco, and questionably from Turkey.

The description follows the format used by Quate and Thompson (1967). For a more complete bibliography and synonyms see Schenkling (1927). A scanning electron microscope was used to take the photographs.

Melanotus dichrous (Erichson)
fig. 1–3

Cratonychus dichrous Erichson, 1841, Zeitschr. Ent. 3: 93.
Melanotus dichrous: Candèze, 1860, Mon. Elat. III: 316.

Male.—Elytra dark brown to nearly black; head, pronotum, and undersides medium to dark reddish brown; antennae and legs light to medium reddish brown (specimens not obviously bicolored); covered with yellowish vestiture evenly distributed over body.

Head: Front usually with pair of very shallow, anterolateral, transverse depressions; margin extending slightly over clypeus, evenly rounded; parantennal fovea very shallow, indistinct. Mandible without pit; palpus yellowish brown. Antenna exceeds tip of hind angle of pronotum by 1 segment; average ratio of segments 2:3:4=4:5:12; fourth segment nearly twice as long as wide; erect male hairs moderately dense.

Pronotum (fig. 3) slightly wider than long; punctures at center dense, slightly umbilicate, separated by distance equal to about half own diameter; punctures larger, definitely umbilicate, and closer on sides; hind angles slightly divergent, each with only 1 carina.

Elytron with punctures of striae moderately deep, separated by distance equal to or more than own diameter, interstrial area at center of elytron about 4 times as wide as puncture diameter, interstrial punctures scattered. Punctures on venter of metathorax round and evenly distributed on disc, larger and closer together towards anterolateral areas. Punctures on venter of abdomen round and evenly distributed on disc, larger, closer, and slightly elongate on sides. Genitalia as figured (fig. 1, 2); paramere with apical blade almost as long as wide and with

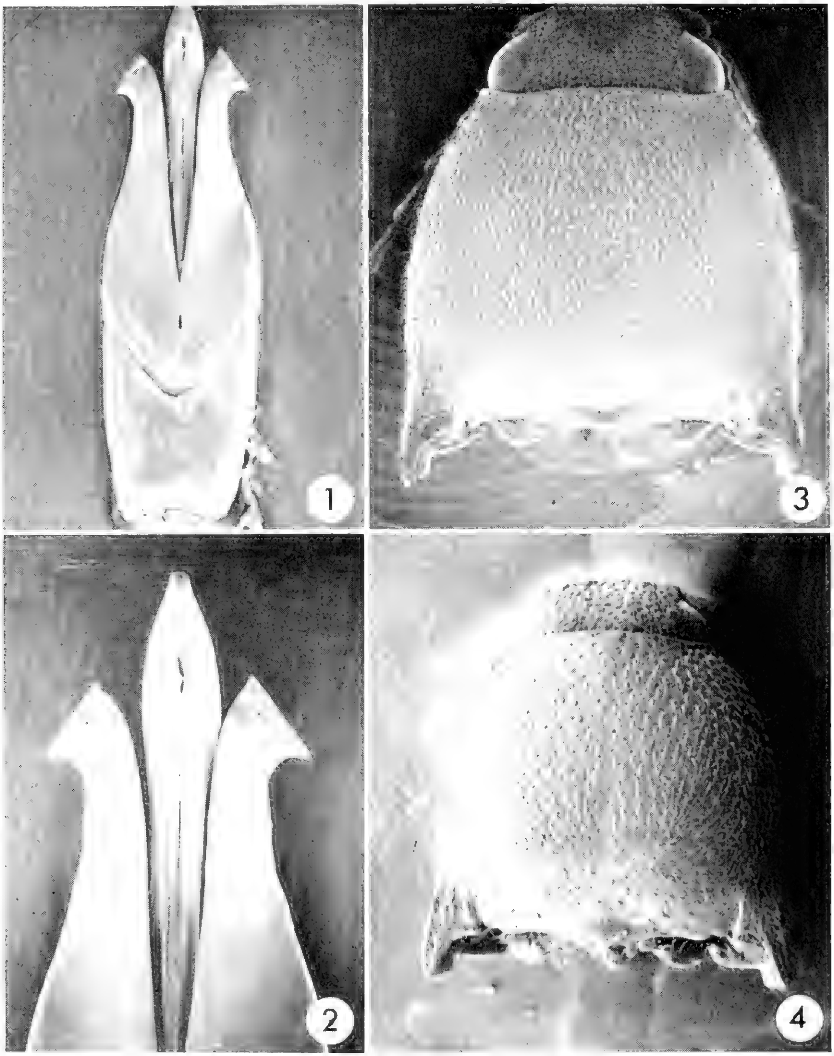

Fig. 1–3, *Melanotus dichrous*. 1, 2, male genitalia, ventral view; 3, pronotum. Fig. 4, *M. leonardi*, pronotum.

outer angle acute; aedeagus longer than usual compared with paramere, phallobase long compared with overall length of genitalia.

Elytron: 9.1–10.0 mm.

Female.—Similar to male except for sexual differences. Bursa nearly completely covered with numerous short spines except for area on each side near apex; acessory gland and spermathecal duct each arising near apex of bursa [similar to those Quate and Thompson (1967, fig. 12c) illustrated for *longulus longulus* (LeConte)].

Elytron: 9.4–9.6 mm.

Types.—Not examined.

Discussion. Specimens of *dichrous* might be confused with those of *leonardi* (LeConte), the only other nearctic species with a uniformly reddish pronotum and brownish elytra. However, the color contrast between the pronotum and elytra is much more distinct in specimens of *leonardi* than in those of *dichrous*. Also, *dichrous* adults are considerably larger with the elytron measuring 9.1–10.0 mm, whereas that of *leonardi* measures only 5.9–7.8 mm. Finally, the pronotum (fig. 3) of *dichrous* adults is more coarsely and closely punctured than in *leonardi* (fig. 4).

Quate and Thompson's key to the North American species of *Melanotus* should be modified as follows:

1a(1). Pronotal punctures (fig. 4) at center fine and sparse, separated by a distance equal to more than own diameter; small species, elytron length 5.9–7.8 mm; male genitalia slender, phallobase short compared with overall length 2

Pronotal punctures (fig. 3) at center moderately coarse and close, separated by a distance equal to less than half own diameter; larger species, elytron length 9.1–10.0 mm; male genitalia (fig. 1, 2) more robust, phallobase long compared with overall length; known only from near Baltimore, Md. .... *dichrous*

7a(7). Color uniformly reddish brown; pronotal punctures sparser and obviously umbilicate at center; interstrial punctures on elytra concentrated near strial punctures; paramere of male genitalia without apical blade, or if present, elongate and outer angle not acute 8

Color of elytra dark brown to black with pronotum and undersides medium to dark reddish brown; pronotal punctures closer and not umbilicate at center; interstrial punctures on elytra not concentrated near strial punctures; paramere of male genitalia with apical blade almost as wide as long and outer angle acute; known only from Baltimore, Md. .... *dichrous*

Distribution.—At present *dichrous* is known in North America only from Baltimore, Maryland. Mr. Ford collected most of the specimens from a light trap at Canton (an area in the southeastern portion of Baltimore). Two specimens were taken at a trap baited with a sugar, yeast, and vinegar mixture. He reported (pers. corr.) that the light trap was placed adjacent to a 15-acre open field with a variety of herbaceous weeds, grasses, bushes, and some small trees. Two sides of the area are adjacent to some old piers. Bulk ore of unknown origin has been piled in the open for many years. The specimens were taken on several occasions from mid June to mid August in 1969, 1970, and 1973. During 1971 and 1972 the light trap was operated on only a few nights and no additional specimens were found.

As Mr. Ford stated (pers. corr.), considering the location where much foreign cargo is imported and the fact that specimens were taken over a five-year period, there is strong evidence that *dichrous* is established in this area.

The larvae of several species of *Melanotus* are known pests of agricultural crops, but there seems to be no records of *dichrous* as a pest. I do not know of any references to the larva of *dichrous*.

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THREE NEW EPICAUTA FROM MEXICO (COLEOPTERA: MELOIDAE)[1]

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ABSTRACT—Three new species are described: *Epicauta* (*Epicauta*) **laevicornis** from the State of Jalisco, **hubbelli** from the State of Chiapas, and *Epicauta* (*Macrobasis*) **prosopidis** from the State of Durango. All have unusual modifications of the male antennae. The species groups of subgenus *Macrobasis* in which antennal segment 1 is at least slightly excavated externally at apex are realigned and keyed to include a Prosopidis-Group made up of *distorta* (Champ.), *disparilis* (Champ.), *torsa* (LeC.), *maculifera* (Mayd.), *purpurea* (Horn), and *prosopidis*. A key to males of this group is given.

The new species described here have such unusual modifications of the male antennae that I am describing them to call them to the attention of other workers. Two were taken in areas frequently sampled for Meloidae. I am much indebted to the collectors, who not only turned over the specimens for study but permitted me to deposit the holotypes in the Museum of Comparative Zoology at Harvard University.

Epicauta (*Epicauta*) *laevicornis* Werner, new species

Black except for a narrow rufescent spot on frons, subopaque, with short, fine inconspicuous black pubescence; moderately slender, 14–16 mm; antennae moder-

[1] Journal Paper No. 2018 of the Arizona Agricultural Experiment Station.

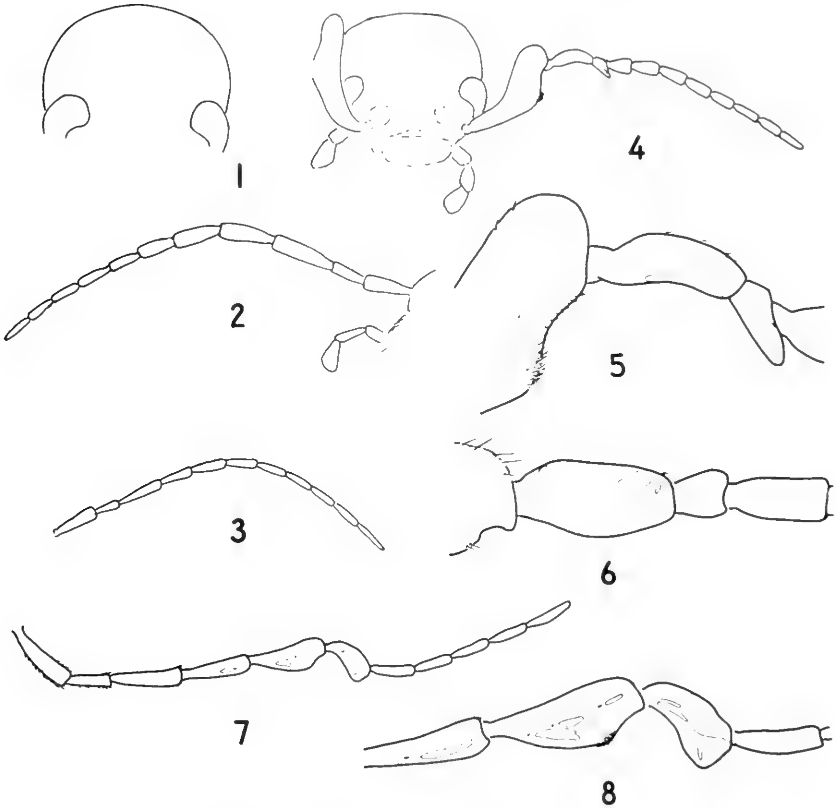

Fig. 1–3, *Epicauta laevicornis*: 1, head of holotype male; 2, right antenna and maxillary palpus of same; 3, left antenna of female. Fig. 4–6, *Epicauta prosopidis*, holotype male: 1, head; 2, details of antenna in front view; 3, same in ventral view. Fig. 7–8, *Epicauta hubbelli*, holotype male: 7, left antenna; 8, details of antenna in front view.

ately long, slender and tapering (fig. 2–3), with segments 3–5 slightly larger and slightly flattened in male (fig. 2), which has segments 1–5 shiny.

Holotype male: head narrowly rounded behind eyes (fig. 1), 5.2 mm long to clypeofrontal suture, 6.0 wide behind eyes; disc slightly flattened, median impressed line fine but distinct; surface evenly covered with shallow, flat-bottomed punctures, the narrow intervals microreticulate; punctures sparser on frons, absent on calluses next to antennae. Eyes 1.5×0.75 mm. Antennae ca. 9.5 mm; segment 1 without sign of apical emargination, its pubescence and sculpture nearly normal; 2 also nearly normal; 3–5 slightly flattened (3 about 0.04 mm wide, 0.28 thick), shiny and nearly glabrous, 5 with more normal punctures and pubescence near apex. Maxillary palpi (fig. 1) slightly enlarged; flattened and nearly glabrous below, their segments 0.90×0.32 mm, 0.70×0.35, and 0.95×0.40, base to apex. Pronotum 2.7 mm long, 2.4 wide, sides roughly parallel, gradually convergent from apical third; surface similar to head, intervals more deeply microreticulate. Elytra subopaque, densely punctured, 14 mm long, 4.6 wide, with distinct humeri and nearly parallel-sided, widest toward apex. Legs almost unmodified. Posterior tibial spurs moderately slender, center just perceptibly wider. Trochanters 2 and 3 somewhat flattened, with a feeble posterior fringe of black setae, the corresponding femora nearly glabrous behind and with a feeble dorsal black fringe. Metasternum with a well-defined broad, shallow excavation occupying most of space between middle and hind legs. Female with simple antennae, palpi, legs and metasternum.

Holotype: male, Mts. and cns. [mountains and canyons] N. Ajijic, Jalisco, Mexico, to 5400′; 11 Sept. 1964, W. L. Nutting and sons; scrub forest. Paratypes: 2 females, same date; 1 male 17 Sept.; 1 male 3 Oct. Holotype deposited in the M. C. Z.

The discovery of another black species of the genus in southwestern Mexico further complicates the identification of specimens from that region. Males of this species are unique in antennal characters. The female is very similar to *Epicauta* (*Macrobasis*) *melanochroa* (Wellman), which was collected in the same area. The antennae are slightly more slender, the punctures of the head slightly larger and more distinctly flat-bottomed, and the erect pubescence of the underside of the head sparse rather than moderately dense.

Part of the specimens have some purple material on them that would indicate that they had been feeding on blossoms of *Ipomoea*, one of the most reliable sources of Meloidae in the region.

Epicauta (*Epicauta*) *hubbelli* Werner, new species

18–19 mm, moderately slender, black except for a narrow rufescent frontal mark; pubescence moderately dense, black, with luteocinereous markings as follows: on head (small median mark at base, narrow in front); pronotum (0.5 mm wide midline, slightly wider at base; narrow fringe across base; lower portion of sides); scutellum (0.5 mm wide down middle); elytra (0.2 mm wide at suture of each, 0.3 mm at side margin, both narrowed and stopping before apex; margin of apex, to 0.5 mm; and a line 0.3 mm wide from very base to middle of apex); prosternum (mixed setae); mesosternum (posterolateral zone, mixed setae); mesopleura (solidly on sides, black ventrally); metasternum (sides except at base); metepisterna (small oblique zone at basal ⅖, parallel to anterior edge); coxae (on sides, conspicuous on hind coxae); and abdomen (apical ½ of sides of visible sterna 1–4, gradually smaller; and narrowly across apex of terga of visible sterna 4–5).

Holotype: male, 18 mm; head moderately narrow, 2.9 mm long to clypeofrontal suture, 3.2 wide just behind eyes, 3.3 wide across the not very prominent eyes, which are 1.7×0.75 mm. Temporal angles feebly indicated, the base almost a semicircle; surface subopaque, microreticulate, punctures moderately dense but shallow; frons slightly less densely punctured and shinier, with a narrow glabrous midline; calluses next to antennae with setae except on a small zone anterior to eyes. Antennae (fig. 7–8) 11.5 mm, slender; segments 1–6 moderately shiny, with pubescence about like body; 7–11 with dense, short pubescence and fine punctures. Segments 3–6 modified, 3–4 by flattening; 5 flat, expanded, 1.65 × 0.7 × 0.32 mm, with a subapical anterior excavation that grades onto the dorsal surface, largely glabrous but with a zone of short setae on edge at excavation; 6 forming an opposing structure, 1.15 × 0.55 × 0.27 mm, with some short setae on grasping edge and a zone of pubescence like segment 7 apically, both above and below. Maxillary and labial palpi flattened below, somewhat flattened. Measurements, base to apex: maxillary 1.2 × 0.4 (curved forward), 0.85 × 0.5, 1.15 × 0.4; labial 0.5 × 0.2, 0.65 × 0.4.

Pronotum nearly parallel-sided, 3.3 mm long, 2.9 wide, the anterior angles abrupt. Pubescence, including contrastingly pale midline, with an orientation to centers toward sides of dorsal portion and just behind middle, mostly directed posteriorly in front, anteriorly in back, and laterally across middle. Surface similar to head but punctures and pubescence denser, especially along middle. Elytra with finer and denser punctures. Metasternum with a shallow, broad concavity behind middle, not sharply delimited and not glabrous. Inner spur of anterior tibia slightly stouter than outer, strongly incurved. Hind trochanters, femora, and tibiae flattened on opposing surfaces but not fringed; middle legs similarly modified, but less strongly. Posterior tibial spurs moderately slender, the outer slightly wider.

Of the male secondary sexual characters, the only indication in the female is a slightly longer antennal segment 5 and shorter 6, with an indication of the offset of these segments; there is a gradual transition of pubescence, the dense starting on 5. Measurements of female antenna, base to apex: 1.4/0.35 mm, 0.75/0.3, 1.3/0.3, 1.1/0.3, 1.25/0.4, 0.85/0.4, 1.0/0.35, 0.95/0.35, 0.95/0.3, 0.85/0.27, 0.95/0.25. The unmodified maxillary palpi measure 1.0 × 0.3, 0.55 × 0.3, 0.9 × 0.37.

Holotype: male, Cumbre de Arriaga, Chiapas, Mexico, 18 June 1972, Peter Hubbell, deposited in the M. C. Z. Paratypes: 5 females, same data.

The only species with even similar antennal modification is *Epicauta curvicornis* (Haag), which does not have the flattening of segments and has segment 2 short. The color pattern is unique in the Mexican fauna.

Epicauta (*Macrobasis*) *prosopidis* Werner, new species

Black, tibiae, tarsi and a feeble spot on middle of frons rufescent; pubescence cinereous, appressed, absent from small spots around short, erect tactile setae, the resulting black spots especially noticeable on elytra. Male with antennal segment 1 long and excavated toward apex (fig. 4), 2 curved and flattened to oppose the excavation of 1, and 3 produced into an acute apical angle (fig. 5–6); segment 1 of anterior tarsi short, glabrous, contorted. Female unknown.

Holotype male, 8 mm: head subquadrate, slightly flattened on front, 1.32 mm long to clypeofrontal suture, 1.60 wide across eyes, slightly less behind. Surface strongly microreticulate, with moderately sparse, small but well-defined punctures; midline distinct, with a clear zone about 0.15 mm wide. Head and pronotum with a feeble indication of glabrous spots, but these small, and inconspicuous because the pubescence is moderately sparse. Calluses next to antennae glabrous, microreticulate. Eyes 0.84 × 0.40 mm. Antennal segments 1 and 2 with some cinereous setae dorsally, moderately sparsely punctured and pubescent; 3–11 densely and finely punctured and short-pubescent. Excavation of 1 glabrous, but angle before it with some longer setae; flattened surface of 2 with some short, decumbent setae, shallowly impressed from just beyond base in front to just before apex behind; 3–11 slightly flattened, process of 3 flattened and glabrous on surface next to 4. Maxillary palpi apparently unmodified.

Pronotum with surface similar to head, 1.3 mm long, 1.35 wide, nearly quadrate; midline impressed and narrowly glabrous, ending in a shallow excavation near base. Elytra 6.5 mm long, 2.2 wide, subparallel, with distinct humeri; surface more densely punctured and pubescent, with nearly uniform glabrous spots about 0.15 mm in diameter. Pubescence black in distinct humeral lines and adscutellar spots. Underside with pubescence similar to pronotum, slightly denser on sides of abdomen, sparse ventrally, with many ill-defined glabrous spots. Tibia 1 darker than rest. Posterior tibial spurs slender, outer slightly wider. Apical pecten of tibia 3 distinct, of 3 strong teeth. Tibia 1 apparently slightly thickened, with a single, nearly straight apical spur. Anterior tarsal 1 distinctly shorter than 2, lacking pad, glabrous behind, almost glabrous basally in front but with a pubescent knob toward apex. Trochanters 2 and 3 somewhat flattened and glabrous, femora 2 and 3 glabrous behind; these areas fringed with long, sparse, pale setae. Femur 1 glabrous on surface facing tibia except for normal sericeous patch, with area basad of patch slightly flattened. Last abdominal sternum with surface like rest, its apex not excavated.

Holotype: male, Mexico, Km. 739, Hwy. 45 [from Zacatecas] to Durango, 15-VII-69; Coll. Ward, Tenorio, and Bennett; Texas Tech. Mesquite Proj. Deposited in the M. C. Z., through the courtesy of Dr. Charles R. Ward, who informs me that the locality given is near Vicente Guerrero in the State of Durango, just inside the eastern border, at about 6400′, and that all specimens bearing Mesquite Proj. labels were taken on *Prosopis.*

Assignment of this species to group within the subgenus is difficult. By its characters, it would go to the Disparilis-Group (Werner 1954), but it seems more logically associated with *purpurea* and similar species. A modification of the groupings seems in order. The second half of the table of species-groups of *Macrobasis* (in the paper cited but under the name, *Gnathospasta*) can be changed to the following, on the basis of male character.

1. Antennal 1 at least slightly excavated externally at apex.
2. Tibia 1 with 2 spurs. Anterior tarsal 1 normal.
3. Large species; antennal 2 from longer than 3 to slightly shorter. (see Selander & Mathieu 1969). .... Albida-Group
3′ Small to medium species; antennal 2 distinctly shorter than 3. .... Uniforma-Group
2′ Tibia 1 with 1 spur.
4. Anterior tarsal 1 normal, not at all compressed or narrowed at base and with normal pad. Excavation of antennal 1 feeble. .... Funesta-Group
4′ Anterior tarsal 1 modified in varying degree, but at least compressed and narrowed at base.

5. Antennal 2 shorter than 3. Anterior tarsal 1 lacking pad.
6. Antennal 3 as long as and similar to 4. Anterior tarsal 1 with a knoblike protuberance on inside of apex. .... Ochrea-Group
6′ Antennal 3 shorter than 4, and more like 2 in form. Anterior tarsal 1 produced apically and overlapping 2 mesally, but not knobbed. .... Virgulata-Group
5′ Antennal 2 longer than 3, at least slightly curved to form a clasping structure when opposed to excavation of 1. .... Prosopidis-Group

The Prosopidis-Group, as here defined, would include the nominate species and all those formerly included in the Torsa-, Purpurea-, and Disparilis-Groups. Since the species-group category is an informal one, I prefer to abandon all of the previous names and substitute an entirely new one.

Key to Males of Prosopidis-Group

1. Antennal 2 narrower in plane perpendicular to surface facing excavation of 1.
2. Anterior tarsal 1 with reduced pad but very litle modified otherwise, its anterior face pubescent. Tan, elytra with a line of denser pale pubescence down middle. .... *distorta* (Champ.)
2′ Anterior tarsal 1 lacking pad, shiny in front, and with a pubescent knob near apex. Black, pubescence of upperside black, elytra narrowly margined with cinereous. .... *disparilis* (Champ)
1′ Antennal 2 at least slightly wider in plane perpendicular to surface facing excavation of 1.
3. Antennal 2 with surface facing excavation of 1 not flattened. Anterior tarsal 1 with reduced pad, but little modified. Black with sparse, inconspicuous tannish pubescence. .... *torsa* (LeC.)
3′ Antennal 2 with surface facing excavation of 1 flattened.
4. Anterior tarsal 1 with reduced pad. Tan, with moderately dense cinereous pubescence, absent in small spots around short tactile setae. .... *maculifera* (Maydell)
4′ Anterior tarsal 1 without pad.
5. Anterior tarsal 1 as long as 2, pubescent. Black, upperside with pubescence black except cinereous in markings that include a narrow midline and margins on elytra. .... *purpurea* (Horn)
5′ Anterior tarsal 1 short, mostly glabrous, but with a short-pubescent knob near apex of front surface. Antennal 3 unique, acutely angled apically. Black, with moderately dense cinereous pubescence, absent in small spots around short tactile setae. .... *prosopidis* Werner

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SYSTEMATIC AND DISTRIBUTIONAL NOTES ON MELANESIAN CERCERIS (HYMENOPTERA: SPHECIDAE)

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ABSTRACT—*Cerceris* **dogonensis**, n. sp., and the hitherto unrecognized male of *C. vechti* Krombein are described; distributional and descriptive notes are given for several other taxa.

Some additional specimens of Melanesian *Cerceris* have come to hand since publication of my revision (1969). The following notes are published to describe *C. dogonensis*, n. sp., and the previously unrecognized male of *C. vechti* Krombein, and to provide additional data on color variation, phenology and distribution. I am indebted to the following specialists for making the material available for study: I. H. H. Yarrow and C. R. Vardy, British Museum (Natural History) (BMNH); J. L. Gressitt, B. P. Bishop Museum (BPBM); and E. F. Riek, Commonwealth Scientific and Industrial Research Organization, Canberra (CSIRO).

Cerceris pictiventris immolator Smith

New Britain: 1♂, Mosa Palm Oil Plantation near Hoskins, January 1969, Mrs. J. E. Benson (BMNH).

Solomon Islands: 1♂, Konga Village (Buin), Bougainville, 6 February–21 March 1961, W. W. Brandt (CSIRO).

Cerceris dogonensis Krombein, new species
fig. 1

This species runs to couplet 9 (Krombein, 1969, p. 7) and may be separated from the other species keying there by having the clypeal process more erect and located basally rather than near the apex. Further, it is separated from *millironi* Krombein by having the front subcontiguously punctate and in lacking the small depression at the base of the second sternum. It is distinct from *reicula* Krombein, *minuscula* Turner, *vechti* Krombein and *venusta* Smith in that the inner eye margins converge slightly above.

Holotype: ♀, Dogon, Amazon Bay area, 2300 ft, Papua, 13 September–11 December 1962, W. W. Brandt (CSIRO).

Length 11 mm, forewing 9 mm. Black, the pale markings light to medium reddish yellow or red, appearing to be cyanided. The following light reddish yellow: basal ⅔ of mandible, clypeus except small median, basal blotch, face to top of interantennal lamella except for narrow stripes below and above antennal insertion, antenna beneath, narrow stripe along eye posteriorly, elongate lateral spot on pronotal dorsum, small lateral spot on scutellum, band on postscutellum,

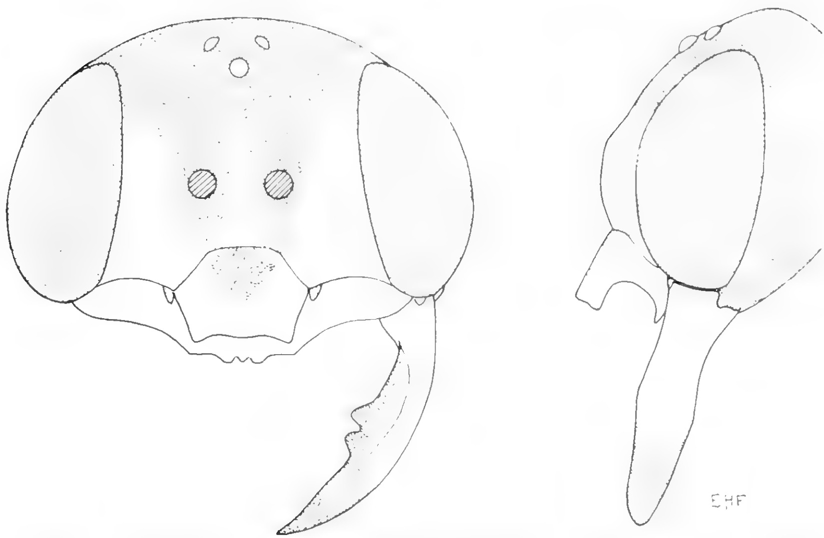

Fig. 1. Female head, *Cerceris dogonensis*, holotype; frontal view at left, profile at right.

small spot beneath tegula, rounded spot along juncture of lateral and posterior surfaces of propodeum, band on apex of first tergum narrowed anteriorly in middle, all of second tergum except rounded posterolateral spot, fore femur and tibia beneath, mid femur beneath, mid tibia on anterior surface, apical half of hind femur, and hind tibia beneath. The following medium red: tegula, fore tibia posteriorly, fore tarsus, mid basitarsus, narrow apical bands on third and fourth terga, apical half of fifth tergum, sixth tergum, lateral spot on second sternum, and posterolateral spots on third to fifth sterna. Wings clear except marginal cell and apex of forewing infumated, stigma and veins brown.

Head (fig. 1) transversely oval, the height (apex of clypeus to posterior ocelli) 0.68 times the width; inner eye margins converging above, the interocular distance across posterior ocelli 0.87 times that at intersection of epistomal suture and inner eye margin; inner margin of mandible with 2 blunt teeth at middle; apical margin of clypeus broadly rounded, with 3 small median teeth; clypeal process suberect, about twice as broad as high, apical margin rounded as viewed from above; front subcontiguously punctate, not rugose; first flagellar segment slightly longer than second.

Thorax coarsely and contiguously to subcontiguously punctate except metapleuron, propodeal enclosure and side of propodeum; anterior carina on lateral surface of pronotum not lamellate, extending a short distance onto dorsum; tegula not inflated; mesopleuron not dentate or tuberculate; metapleuron with close oblique rugulae; lateral surface of propodeum with more separated rugulae; propodeal enclosure with median, shallow crenulate groove, the sides more deeply crenulate, rest of surface densely micropunctate.

Fore basitarsal comb with 6 spines; keel of left hind tibia with 3 serrations, the right with 4.

First tergum subquadrate, sides rounded; first through fifth terga with relatively coarse, subcontiguous punctures; pygidium with sides rounded, length 1.63 times the width, most of surface with contiguous punctures bearing short, suberect setae, the sides narrowly and apical fourth with close wrinkles; first sternum with low rounded keel on basal half; second sternum flat at base; hypopygium with apical teeth separated by a narrow U-shaped emargination, lateral margin with a small tooth adjacent to apical tooth.

Male: Unknown.

Cerceris reicula Krombein

Territory of New Guinea: 1♀, Ulap, Morobe District, 800–1100 m, September 1968, N. L. H. Krauss (BPBM). 1♂, Mt. Missim, 1600 m, 7°15′S, 146°48′E, 6 February 1970, J. H. Sedlacek (BPBM). 1♂, Jimmi River, Western Highlands, 4700 ft, 21 September 1961, W. W. Brandt (CSIRO).

The female from Ulap is similar in color pattern to the holotype but has a small yellow spot on the left side of the pronotum, small paired spots anteriorly on the second tergum, and a small median spot posteriorly on the fifth tergum in addition to the posterolateral spots. The two males have the same color pattern as the allotype except that the specimen from Mt. Missim has only posterolateral spots on the fourth tergum instead of a band.

Cerceris minuscula sculleniana Krombein

New Britain: 2♂, Mosa Palm Oil Planatation near Hoskins, 29 January and 25 January-1 February 1969, Mrs. J. E. Benson (BMNH).

Territory of New Guinea: 1 ♂, Goroka Highlands, 6,000 ft, February 1969, Mrs. J. E. Benson (BMNH). 1♂, Kundiawa, Chimbu River, 26 March 1964, D. H. Colless (CSIRO).

Cerceris vechti Krombein

Territory of New Guinea: 1♀, Mt. Hagen, 5670 ft, 2 March 1969, Mrs. J. E. Benson (BMNH). 5♀, 1♂, Mt. Hagen, 19 April 1969, K. P. Dwyer (BMNH).

The females are more extensively maculated with yellow than the type series of three females from Karimui and Kiunga, Fly River. In addition to the yellow markings described for the holotype the Mt. Hagen females have the following yellow maculations: 1 or 2 pairs of spots on propodeum; first tergum with a broad apical band extending forward on sides; and second tergum with a complete or very narrowly interrupted band.

Male (hitherto unrecognized): Length 9 mm, forewing 7.5 mm. Black, the following yellow: clypeus except apical margin of median lobe, sides of front to a point opposite upper level of antennal insertions, interantennal keel, tiny spot behind eye, scape beneath, small lateral spot on pronotum, outer half of tegula, band on postscutellum, broad apical bands or smallish posterolateral spots on first and second terga, narrow apical bands on fourth, fifth and occasionally sixth terga, pair of small spots on first sternum, small spot beneath on fore femur, fore and mid tibiae except narrow black streak on outer surface, hind tibia beneath, fore tarsus and mid basitarsus.

Characters peculiar to the male are: head height 0.8 times the greatest width; eyes not convergent above or below, the interocular distance at posterior ocelli and intersection of epistomal suture and inner eye margin subequal; clypeus gently convex, the apical margin of median lobe feebly tridentate, the apical margin with a fimbria of curled, waxy-appearing hairs on lateral third; keel on lateral surface of pronotum produced into a lamella; sides of pygidium gently curved, the greatest width 2/3 the length, the surface coarsely punctate, fifth and sixth sterna without subbasal fimbriae; and hypopygium semicircularly emarginate at apex, the lateral teeth acute and slender.

The male most closely resembles *Cerceris venusta atrescens* Krombein and runs to that taxon in my key (1969, p. 11). It is distinguished by the yellow bands or spots on the first 2 terga, the presence of a yellow band on the sixth tergum, and the lamellate development of the lower part of the pronotal keel. The allotype of *v. atrescens* from Mt. Hagen and paratype from Wau are properly referable to *vechti*, leaving the paratype from Kumur as the only known male of *v. atrescens*.

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KROMBEIN, K. V. 1969. A revision of the Melanesian wasps of the genus *Cerceris* Latreille. Smithson. Contrib. Zool., No. 22, 36 pp., 23 figs.

THE SPECIES OF THE GENUS TACPARIA WALKER (LEPIDOPTERA, GEOMETRIDAE)

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ABSTRACT—The American genus *Tacparia* Walker, previously thought to consist of 2 species, is shown to include 3; namely, *zalissaria* Walker, *atropunctata* (Packard), and *detersata* (Guenée). The names *zalissaria* and *atropunctata*, which had been considered synonymous, actually refer to structurally distinct but superficially similar sibling species. Their distribution is limited mainly to the Atlantic coastal region, *atropunctata* being northern and *zalissaria* southern, with some overlap in the general vicinity of New York City.

Tacparia Walker

Tacparia Walker, 1860, p. 233. Type-species: *Tacparia zalissaria* Walker, 1860, by monotypy.

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Apaecasia Hulst, 1896, p. 340. Type-species: *Tephrina detersata* Guenée, 1857 = *Apaecasia detersata* (Guenée), designated by Hulst, 1896.

In his treatment of this genus, Rupert (1949) considered that there were only 2 species, *detersata* and *zalissaria.* Recent study of more material than was then available has revealed the existence of a third species, in appearance barely distinguishable from *zalissaria* but structurally well differentiated. The names *atropunctata* Packard and *fernaldi* Grote, relegated to the synonymy by Rupert upon his discovery of the older name, *zalissaria,* are available for this third species. *Tacparia zalissaria* and *atropunctata* are rare in collections and seem mainly restricted to the region of the Atlantic coastal plain and upper St. Lawrence Valley. Their distributions are mostly allopatric, *atropunctata* having a northern distribution from Nova Scotia and Ontario to New Jersey, and *zalissaria* occurring southward from Connecticut to Florida. Both are present in a narrow zone of overlap between southern Connecticut and southern New Jersey. *Tacparia detersata* (fig. 11, 12) occurs across southern Canada from Nova Scotia to Alberta and southward in the east to New Jersey and Pennsylvania, and is relatively well known. Its usual host plant is *Alnus rugosa* (DuRoi) Spreng. Rupert's diagnosis of *detersata* remains unchanged, the present discussion treating in detail only the two siblings that have been confused.

Tacparia zalissaria Walker
fig. 1, 2, 5–7, 13–15, 19

Tacparia zalissaria Walker, 1860, p. 234. Rupert, 1949, p. 150, in part. Kimball, 1965, p. 168.
Apicia ? deductaria Walker, 1860, p. 237.
Apaecasia deductaria, Dyar, 1902 [1903], p. 317, in part.
Apaecasia atropunctata form *darlingtoni* Lemmer, 1937, p. 23.
Apaecasia atropunctata, Barnes and McDunnough, 1917, p. 115, in part. McDunnough, 1938, p. 168, in part.
Lithina atropunctata, Forbes, 1948, p. 88, in part.

Diagnosis: Similar in size and basic pattern to *detersata* but differing slightly in wing shape, the apex of the forewing being more produced and pointed; general coloring much darker brown. Extremely similar to *atropunctata,* with which it has been confused, but slightly larger and dimorphic with light and dark forms. Female heavily dusted with blackish scales, unlike that of *atropunctata.* Genitalia distinctive in both sexes. Known mainly from the coastal plain from Connecticut to Florida.

Types: Before the publication of Rupert's paper (1949), the name *zalissaria* was overlooked in North America because the only localities mentioned by Walker were Australia and Sydney [Australia]. How-

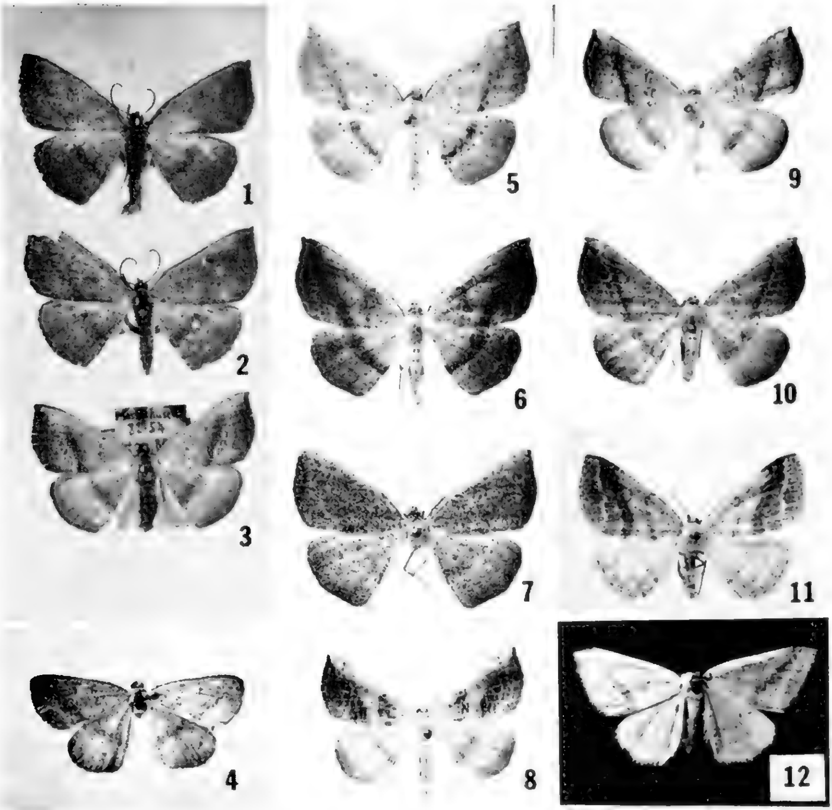

FIG. 1–12, *Taeparia* spp. 1, *zalissaria*, lectotype. 2, *zalissaria*, holotype of *Apicia* ? *deductaria*. 3, *atropunctata*, lectotype of *Drepanodes fernaldi*. 4, *atropunctata*, lectotype. 5, *zalissaria*, ♂, Arcadia Plantation, Georgetown, South Carolina, March 26, 1968, D. C. Ferguson. 6, *zalissaria*, ♂, University Conservation Reserve, Welaka, Putnam Co., Florida, March 11, 1962, D. C. Ferguson. 7, *zalissaria*, ♀, same locality and collector as for fig. 6, March 21, 1962. 8, *atropunctata*, ♂, Auburn, Kings Co., Nova Scotia, June 6, 1952, D. C. Ferguson. 9, *atropunctata*, ♂, Williams Lake, Purcell's Cove Road, Halifax Co., Nova Scotia, May 30, 1957, D. C. Ferguson. 10, *atropunctata*, ♀, Lake Kejimkujik, Queens Co., Nova Scotia, June 18, 1957, D. C. Ferguson. 11, *detersata*, ♀, Centreville, Kings Co., Nova Scotia, June 3, 1949, D. C. Ferguson. 12, *detersata*, holotype (in USNM).

ever, the type series of 4 specimens in the British Museum (Natural History) included 2 species, specimens a and b being said to equal the Australian *Idoides apicata* Guenée, and c and d, locality unknown, representing the American species now under discussion. One of the latter, the male specimen illustrated (fig. 1), was designated by Rupert as the lectotype of *zalissaria* on the basis of this same photograph, which he had received from the British Museum (Natural History). As he did not publish this figure or any other clear indication of which specimen was intended, there could arise a question as to whether his action constituted a valid lectotype designation. To overcome this problem, I now redesignate as lectotype the specimen herein represented by figure 1, and it is being so labeled. The type locality of *zalissaria* remains unknown but is probably Georgia or Florida, the sources of most material that Walker described from the southeastern United States.

The type of *deductaria* is a male (monotype) in the British Museum (Natural History) (fig. 2). The source of this specimen was unknown to Walker, but again it probably came from Georgia or Florida.

The name *darlingtoni* was based on 2 specimens from New Lisbon, Burlington Co., New Jersey, a holotype male taken June 1, 1935, and an allotype female taken May 5, 1930. Both specimens were in the collection of Dr. Emlen P. Darlington, and are now in the collection of the Academy of Natural Sciences, Philadelphia.

Synonymy: I am confident, on the bases of the photographs and probable places of origin of the type material, that *zalissaria* and *deductaria* represent the same species, the southern one. I have not seen the types of *darlingtoni*, but the original description would seem to leave little doubt as to their identity. Lemmer regarded this as a melanic form of *atropunctata*, and although both species are present in New Jersey, only *zalissaria* is known to occur in a dark form. Without evidence of such variation in *atropunctata*, it seems safe to conclude that *darlingtoni* is the dark form of *zalissaria*.

Further description: Male antennae subcylindrical basally, becoming slightly compressed distally, finely and densely setose; female antennae about half as thick as those of male, filiform, also finely setose, the setae similar to those of the male. Male palpi moderate, exceeding front by ¼ their length, coarsely scaled, third segment small, rounded, usually somewhat decumbent and mostly concealed by scales of second; female palpi similar, a little more slender. Front of both sexes with scales in lower half elevated and protruding as a tuft almost as far as palpi. Eyes of male very large, reducing the front to a width slightly less than its height; eyes of female smaller, front at least as wide as high. Tongue of both sexes well developed. Legs normal, but hind tibiae of both sexes stouter than those of *detersata*, subclindrical, not prismatic, hind tibiae of male more swollen than those of female. Wing shape as in *detersata* but with forewing more produced, resulting in slight concavity on outer margin between the pointed apex and vein M_3.

Scales of antennae, head and palpi light brown, with a variable mosaic mixture of dark scales; thorax and abdomen similar but slightly paler, with paired, blackish, dorsal spots on mesothorax and abdominal segments 1 to 3. Legs light brown, variably dusted with dark brown scales, those on hind tibia tending to be concentrated in a blackish lateral patch near basal end (a character not seen in *detersata* or *atropunctata*).

With respect to wing coloring, the species occurs as 2 different forms: the one light violaceous gray-brown, much like *atropunctata*; the other much browner, often rather dark, unlike *atropunctata.* These are described separately as follows:

Gray form (fig. 5). Both wings relatively uniform gray-brown with a violet tint, sparsely dusted with blackish brown; antemedial of forewing indicated by 3 dark dots, of hindwing, wanting; postmedial indicated on both wings by regular series of small, dark brown vein dots, some of these bearing miniature white rays outwardly. Postmedial on both wings usually preceded by a diffuse, dusky brown shade that disappears before reaching costa. Discal spots dark, minute. Costa bright yellowish brown, thinly margined with this shade but contrasting, especially toward base, followed by a subcostal shade somewhat paler than the rest of the wing. Fringes concolorous with wing, whitish tipped, otherwise unmarked. Underside grayish, more heavily dusted with dark scales, postmedial vein dots stronger than above but antemedial wanting; no dark shade associated with postmedial; several small, dark marginal dots, especially toward apex of forewing.

Brown form (fig. 6). Similar in pattern to the grayish form but with the ground color tawny brown, variably suffused with dark brown. Dark shade preceding postmedials more extensive and diffuse, sometimes continuing as dark shading to the outer margin, leaving the median, basal and costal areas paler. Dark specimens ("*darlingtoni*") appear commonest, but light brown specimens also occur. Underside as in gray form.

The only female of *zalissaria* available for examination, a specimen from Welaka, Florida (fig. 7), resembles the gray form described above except that it is uniformly and densely dusted with blackish scales, and the shade preceding the postmedial is weak, not contrasting, and reddish or tawny, not dusky brown.

Length of forewing: male, 15 to 17 mm; average male (of 16), 15.7 mm; female, 17 mm.

Male genitalia (fig. 13–15). Each valve with a long, slender, clavate, basal costal process, tipped with stout bristles, and with a second long, slender, curved process arising laterally near the sacculus and projecting through a median basal opening in the valve. Gnathos angulate, recurved. Transtilla large, bilobate. Juxta with 1 pair of stout processes, each terminating in a cluster of spines. Aedoeagus containing a long series of large cornuti, some of which may be lost in copulation as suggested by the specimens illustrated. *Zalissaria* differs greatly from *atropunctata* in all of the above features.

Female genitalia (fig. 19). Very peculiar and so extremely different from those of *atropunctata* that one would hardly suppose them to be closely related on this basis alone. Slender portion of bursa copulatrix, supposedly the ductus bursae, entirely sclerotized and rugose; corpus bursae similarly thickened and semirigid, and with its interior surface densely covered with bristlelike spicules, arranged in concentric circles about a large, heavily sclerotized, invaginated signum. *Atropunctata* has a more slender and membranous bursa copulatrix, with the spicules present as rudiments only on its finely scobinate interior surface.

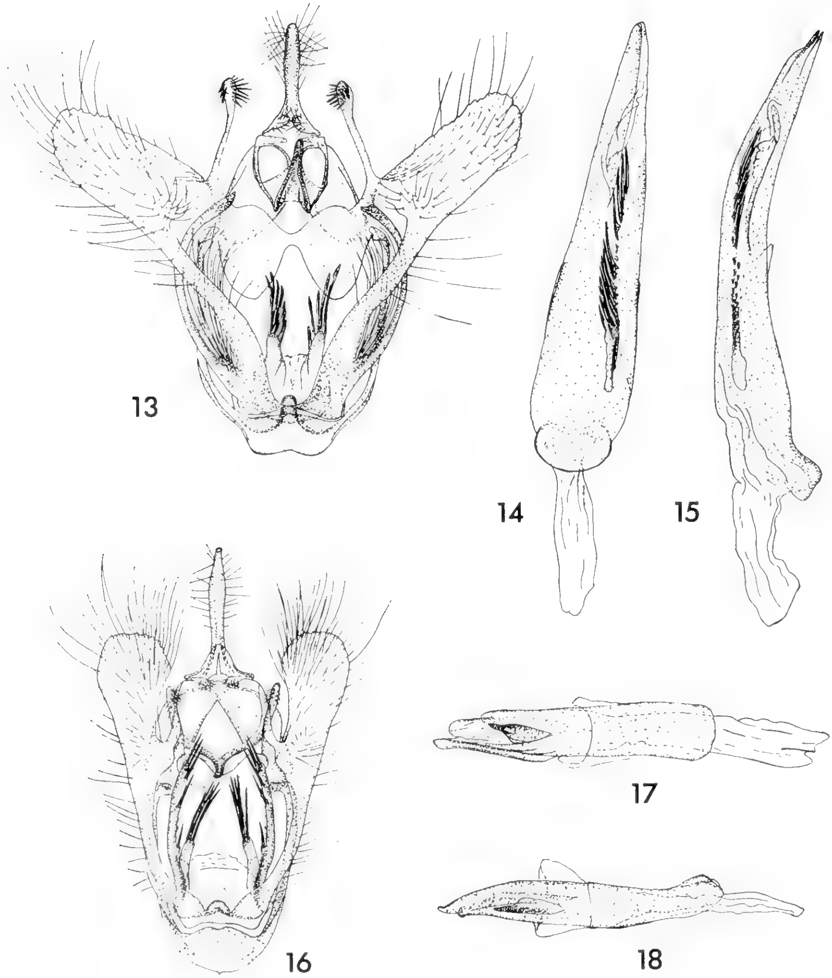

FIG. 13–18, *Tacparia* spp. 13, *zalissaria*, ♂ genitalia, Welaka, Putnam Co., Florida. 14, aedoeagus of same specimen, ventral view. 15, aedoeagus of another ♂ of *zalissaria*, also from Welaka, Florida, lateral view. Many of the deciduous cornuti have been lost in this example. 16, *atropunctata*, ♂ genitalia. Auburn, Kings Co., Nova Scotia. 17, aedoeagus of same specimen, ventral view. 18, aedoeagus of another ♂ of *atropunctata* from Mount Uniacke, Hants Co., Nova Scotia, lateral view.

The form of the signum, ostium, and sterigma also differs conspicuously in the 2 species.

Material examined: 28 males, 1 female; 3 male, 1 female genitalia slides.

Distribution: FLORIDA: Vero Beach [Indian River Co.]; Oneco, Manatee Co.; Archbold Biological Station, Lake Placid, Highlands Co.; University of Florida Conservation Reserve, Welaka, Putnam Co. Also reported by Kimball (1965, p. 186) from Escambia Co., Myrtle Grove, Quincy, and Siesta Key (not examined). SOUTH CAROLINA: Wedge Plantation, McClellanville, Charleston Co.; Arcadia Plantation, Georgetown, Georgetown Co. NEW JERSEY: Lakehurst, Ocean Co.; Freehold [Monmouth Co.]; New Lisbon, Burlington Co. (types of *darlingtoni*—not examined). NEW YORK: Yonkers, Westchester Co.; Valley Cottage, Rockland Co. CONNECTICUT: Bethany, New Haven Co.

Geographical variation: None apparent.

Flight period: In Florida, March 9 to April 4; in South Carolina, March 26 to May 8; New Jersey and New York, May 5 to June 3; the single Connecticut record taken May 19, 1968. Apparently 1 generation.

Early stages: Unknown. On the basis of what is known of *atropunctata*, bayberry and wax myrtle should be tried as host plants. Forbes (1948, p. 89, under *atropunctata*) states "Larva on birch (Lemmer)," but I have not found the source of this information.

Tacparia atropunctata (Packard)
fig. 3, 4, 8–10, 16–18, 20

Lozogramma atropunctata Packard, 1874, p. 50; 1876, p. 244, pl. 9, fig. 58.
Apaecasia deductaria, Dyar, 1902 [1903], p. 317, in part.
Apaecasia atropunctata, Barnes & McDunnough, 1917, p. 115, in part. McDunnough, 1938, p. 168, in part.
Lithina atropunctata, Forbes, 1948, p. 88, in part.
Tacparia zalissaria, Rupert, 1949, p. 150, in part. Ferguson, 1954, p. 319.
Drepanodes fernaldi Grote, 1878, p. 17.

Diagnosis: Extremely similar to *zalissaria* in appearance but with certain subtle differences in pattern and coloring pointed out in the description, and with very different genitalia in both sexes. Also, *atropunctata* has an exclusively northeastern distribution from Nova Scotia, southern Quebec and southern Ontario to New Jersey and Pennsylvania, only slightly overlapping that of *zalissaria*.

Types: *Tacparia atropunctata* was described from 1 male and 2 females from Boston, Beverly and Salem, Massachusetts. The only type that can now be found is a male, without abdomen, in the Museum of Comparative Zoology, Harvard University (fig. 4), and I hereby designate this example as the lectotype. It is labeled as follows: "Massachusetts, Packard Coll.", "A.S. Packard Type", "Type 14620", "Lozogramma atropunctata Pack. Type.", and "LECTOTYPE Lozogramma atropunctata Pack., By D. Ferguson, '73." The lectotype clearly rep-

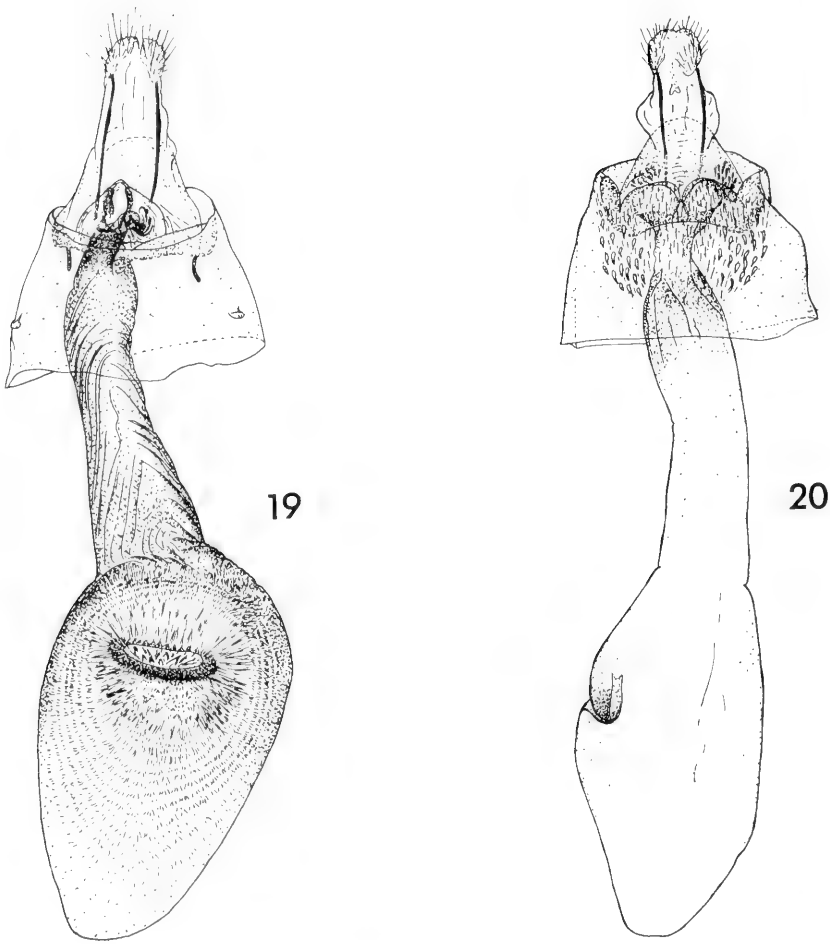

FIG. 19, 20, female genitalia. 19, *Tacparia zalissaria*, Welaka, Putnam Co., Florida. 20, *atropunctata*, Bog E of Big Indian Lake, Halifax Watershed Area, Halifax Co., Nova Scotia.

resents the northern species. *Drepanodes fernaldi* was described from 2 females collected at Newtonville, Massachusetts, on June 16, 1877 by Roland Thaxter. I hereby designate as the lectotype of *fernaldi* the specimen figured (fig. 3), which is in the British Museum (Natural History).

Synonymy: Identification of *fernaldi*, the only synonym of *atropunctata*, is based on a photograph (fig. 3) of 1 of the 2 original types, as well as knowledge of the type locality which I believe to be north of the range of *zalissaria.* This photograph shows the smaller size and relatively contrasting pattern characteristic of *atropunctata*, especially the dark submarginal shade on both wings in addition to the contrasting shade preceding the postmedial lines.

Further description: Antennae of both sexes as in *zalissaria* but slightly more slender. Structural detail of palpi, front, eyes, tongue, legs, and wing shape apparently the same as in *zalissaria* except that the female front looks narrower.

Coloring of front and palpi as in *zalissaria* but with few or no intermixed dark scales; legs and underside of body less heavily dusted with dark brown scales and lacking the concentrated blackish lateral patch near basal end of each hind tibia that is characteristic of *zalissaria.* Coloring of legs and body otherwise alike in the 2 species.

Although somewhat variable in the extent and intensity of the dark antemedial and postmedial bands, this species does not have the polymorphism of *zalissaria.* It occurs rather uniformly in a coloring only slightly browner than what I described as the gray form of *zalissaria.* Scales of body, wings and fringes, under magnification, appear more lustrous than those of *zalissaria.*

Upperside of both wings light brown, varying from reddish to grayish, commonly with a distinct violaceous tint, less obviously dusted with dark scales than *zalissaria*; costa not yellowish or but faintly so, never the contrasting yellow-brown shade of *zalissaria*; antemedial and postmedial lines of forewing sometimes apparent as blue-gray, weakly crenulate lines, incorporating the same though less obvious series of venular dots found in *zalissaria*; antemedial of hindwing wanting; postmedial of both wings preceded by a reddish-brown shade, forming an almost straight, oblique band from inner margin to costa on each wing; in most males, but not females, forewing with a diffuse, dark gray-brown shade preceding or suffusing the antemedial, and a corresponding shade bordering the postmedial outwardly, thus enclosing (and obscuring) the postmedial between inner reddish-brown and outer grayish to blackish-brown shades. Outer third of forewing often darker than median space, commonly pale inwardly, darkening toward outer margin; hindwing also slightly darker toward outer margin. Discal spot of forewing weak, blackish; of hindwing, usually wanting. Fringes concolorous with wings, whitish tipped, otherwise unmarked. Underside of wings dusted with reddish brown on a pale ground, often with a bluish tint, less coarsely speckled with dark scales than *zalissaria*, and with series of vein dots representing postmedial lines much less distinct. Discal spots beneath also less distinct than in *zalissaria*; marginal dots wanting.

Tacparia zalissaria differs in lacking the blackish scaling before the antemedial and after the postmedial commonly present in *atropunctata*, but the shade preceding the postmedial may be much darker and more diffuse in *zalissaria*, producing a somewhat similar effect with different components of the pattern.

Length of forewing: male, 13 to 14.5 mm; average male (of 24), 13.8 mm; female, 14.5 to 15.5 mm; average female (of 7), 15 mm.

Male genitalia: (fig. 16–18). Differing from those of *zalissaria* in several conspicuous features. Basal costal process of valve much shorter and arising nearer base of costa; valve differently shaped, with costa concave; long process arising from outer face of sacculus in *zalissaria* not present in the same position, but probably homologous to the larger of the 2 pairs of processes that appear to arise from the juxta; inner pair of juxtal processes somewhat similar to those of *zalissaria*; outer pair more than twice length of inner pair, bearing 5 or 6 long spines; transtilla smaller, differently shaped; gnathos a simple ring with a small tooth; aedoeagus with 1 large tooth on the vesica, not a long cluster of deciduous cornuti as in *zalissaria*.

Female genitalia: (fig. 20) Much less sclerotized than those of *zalissaria*. Bursa copulatrix almost entirely membranous and of a more slender shape; sclerotized structures of the integument associated with the ostium (the sterigma) very different in form, and surface of integument surrounding this area bearing scales strongly resistant to removal; a portion of interior surface of corpus bursae minutely scobinate but not heavily spiculate as in *zalissaria*; signum a simple, transverse, sclerotized, invaginated fold in wall of corpus bursae, on left side.

Material examined: 53 males, 18 females; 2 male, 2 female genitalia slides; 1 brood of larvae reared.

Distribution: NEW JERSEY: Lake Hopatcong; Lakehurst, Ocean Co. PENNSYLVANIA: Luzern Co. NEW YORK: Ithaca, Tompkins Co. MASSACHUSETTS: Boston, Beverly and Salem (types of *atropunctata*). CONNECTICUT: Beckley Bog, near Norfolk, Litchfield Co. MAINE: Biddeford. NOVA SCOTIA: Armdale, Halifax Co.; Williams Lake, Purcell's Cove Road, Halifax Co.; Bog E of Big Indian Lake, Halifax Watershed area, Halifax Co.; West Dover, Halifax Co.; Port Wallis, Halifax Co.; MacNab's Island, Halifax Co.; Mount Uniacke, Hants Co.; Coldbrook, Kings Co.; Aldershot, Kings Co.; Auburn, Kings Co.; Lake Kejimkujik, Queens Co.; Round Hill, Annapolis Co.; South Milford, Annapolis Co.; Annapolis Royal, Annapolis Co.; Digby, Digby Co.; Argyle, Yarmouth Co. NEW BRUNSWICK: Eel River. QUEBEC: Lac Mondor; Lac Connelly; Kazubazua. ONTARIO: Biscotasing; Marmora.

Geographical variation: None.

Flight period: Flies in late spring to early summer with only 1 generation—May 25 to July 9. Peak flight period in first half of June in most areas, showing little geographical variation in time of emergence; earliest and latest dates given are for Nova Scotia, the source of most material; June 11 and 15 in New Jersey; May 29 and 31 in New York; June 21 in Connecticut; May 26 to June 28 in Quebec and Ontario.

Early stages: Larvae that I reared on *Myrica Gale* L. at Armdale, Nova Scotia in 1948 were studied by Rupert (1949, p. 150, as *zalissaria*), who found them almost identical to those of *detersata* except that they were green instead of light brown. The pattern consisted of the same brown longitudinal lines. These larvae were offered alder and birch, which they refused, but fed readily on *Myrica Gale*. No other species of Myricaceae were tried, but the next year, on June 5, 1949, I flushed a number of fresh adults from a large patch of sweet fern (*Myrica asplenifolia* L.) at Coldbrook, Nova Scotia, under circumstances that led me to conclude that this plant also served as a host.

Summary

Checklist arrangement of the species of *Tacparia* would be as follows (synonyms in italics):

Tacparia Walker

1. zalissaria Walker
   deductaria (Walker)
   darlingtoni (Lemmer)

2. atropunctata (Packard)
   fernaldi (Grote)

3. detersata (Guenée)

Acknowledgments

The photographs of the types in the British Museum (Natural History), which I reproduced, were kindly sent to me by Mr. Laurence R. Rupert of Sardinia, N. Y., and this has made possible the correct association of the names *zalissaria*, *deductaria* and *fernaldi*. I am also indebted to Dr. Frederick H. Rindge of the American Museum of Natural History, Dr. John G. Franclemont of Cornell University, Dr. John Burns, Museum of Comparative Zoology, Harvard University and Dr. W. C. McGuffin of the Entomology Research Institute, Ottawa, Ontario, for the privilege of examining specimens. Also studied was the material in the U.S. National Museum, to which have now been added the specimens of *Tacparia* from my own collection.

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OVARIOLE NUMBER IN PASSALIDAE (COLEOPTERA)[1]

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ABSTRACT—Female Passalidae of 12 species, belonging to 8 genera, were found to have 2 ovarioles on each side.

In 1961, Robertson published a survey of ovariole numbers in Coleoptera. It included information on 329 species in 45 beetle families but only 1 species of Passalidae was mentioned. This species, listed as *Popilius disjunctus* (Ill.), was assigned to the genus *Odontotaenius* by Reyes-Castillo in 1970.

The writers recently dissected adults of 10 other passalid species from North America and 1 species from Australia, all of which were preserved in 70% ethanol or other fluids. We found the same 2–2 ovarian tubule number in the females as reported previously for *Odontotaenius disjunctus* (Table 1).

The Passalidae belong to the Scarabaeoidea, a superfamily which also includes the Lucanidae and Scarabaeidae. In contrast to the 2–2 ovariole condition in Passalidae, many Scarabaeidae have a 6–6 formula. In the Scarabaeinae, however, there is a reduction to 0–1 (Robertson, 1961) which is thought to be associated with nidification

[1] This investigation was supported in part by grant GS-31129 from the National Science Foundation. Oregon Agricultural Experiment Station, Technical Paper No. 3677.

Table 1.—Ovariole number in Passalidae

Group and Species	Ovarian Tubules
Subfamily Aulacocyclinae	
Aulacocyclus edentulus (MacLeay)	2–2
Subfamily Passalinae	
Tribe Proculini	
Vindex agnoscendus (Percheron)	2–2
Heliscus tropicus (Percheron)	2–2
Heliscus descipiens Kuwert	2–2
Odontotaenius disjunctus (Illiger)	2–2
Odontotaenius striatopunctatus (Percheron)	2–2
Verres hageni Kaup	2–2
Tribe Passalini	
Paxillus leachi MacLeay	2–2
Passalus (*Pertinax*) *punctatostriatus* (Percheron)	2–2
Passalus (*Pertinax*) *caelatus* Erichson	2–2
Passalus (*Passalus*) *punctiger* St. Far. and Serv.	2–2
Ptichopus angulatus (Percheron)	2–2

(Halffter and Matthews, 1966). Robertson lists 12–12 ovarian tubules for the lucanid *Dorcus* (*Lucanus*) *parallelipipedus* L.

In many beetle families, the number of ovarioles varies greatly and 2–2 is an uncommon number. Besides the Passalidae, only the Curculionidae and Scolytidae are consistent in having 2-2 ovarioles (Robertson, 1961).

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PLAGIOGNATHUS VITELLINUS (SCHOLTZ), A CONIFER-FEEDING MIRID NEW TO NORTH AMERICA (HEMIPTERA: MIRIDAE)

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ABSTRACT—The Palearctic mirid *Plagiognathus vitellinus* (Scholtz) is reported in North America from 17 counties in Pennsylvania during 1972-73. A diagnosis and figures of the adult, last instar nymph, and male genitalia are provided. *Plagiognathus vitellinus* was found to breed on Douglas fir, *Pseudotsuga menziesii* (Mich.) Franco; European larch, *Larix decidua* Mill.; Norway spruce, *Picea abies* (L.) Karst.; Colorado spruce, *P. pungens* Engelm.; and white spruce, *P. glauca* (Moench) Voss. Characters are given for separating late instar nymphs of *P. vitellinus* from those of other phyline mirids breeding on these hosts. *Plagiognathus vitellinus* is an early season, univoltine species. Overwintered eggs hatched in early May; adults first appeared in late May and were abundant only for a few weeks in June. *Plagiognathus vitellinus* appears to be an introduced species in North America. An introduction on nursery stock rather than on ship ballast is considered probable.

Plagiognathus vitellinus (Scholtz) represents the second Palearctic mirid discovered in North America during our survey of the Miridae associated with conifers in Pennsylvania. Recently, we reported *Camptozygum aequale* (Villers) from Pennsylvania and its association with Scotch pine, *Pinus sylvestris* L. (Wheeler and Henry, 1973). This paper summarizes our observations on *P. vitellinus* during 1972-73.

Plagiognathus vitellinus was described as *Capsus vitellinus* by Scholtz in 1846 and placed in the genus *Psallus* by Fieber (1861). Wagner (1952) described the subgenus *Parapsallus* in which he included *vitellinus* and *dilutus* Fieber. This arrangement was followed in Carvalho's (1958) "Catalog of the Miridae of the World" which covered all literature to the end of 1955. In that year, however, Wagner (1955) removed *vitellinus* from *Psallus* to *Plagiognathus* based on the type of pubescence, tarsi, vesica, and certain other characters. Later, Wagner (1961) placed *dilutus* as a variety of *vitellinus*. Woodroffe (1957) agreed that *vitellinus* did not belong in *Psallus s. str.*; Stichel (1958) and Southwood and Leston (1959) also followed Wagner (1955). Kerzhner (1964) elevated *Parapsallus* to generic rank with *vitellinus* as the only included species. Since he gave no basis for this decision, we are following Wagner (1955) by retaining *vitellinus* in *Plagiognathus*.

Plagiognathus vitellinus occurs throughout Europe and in Siberia and Algeria (Carvalho, 1958) and perhaps represents an introduced species in England (Butler, 1923). It is restricted to conifers, including

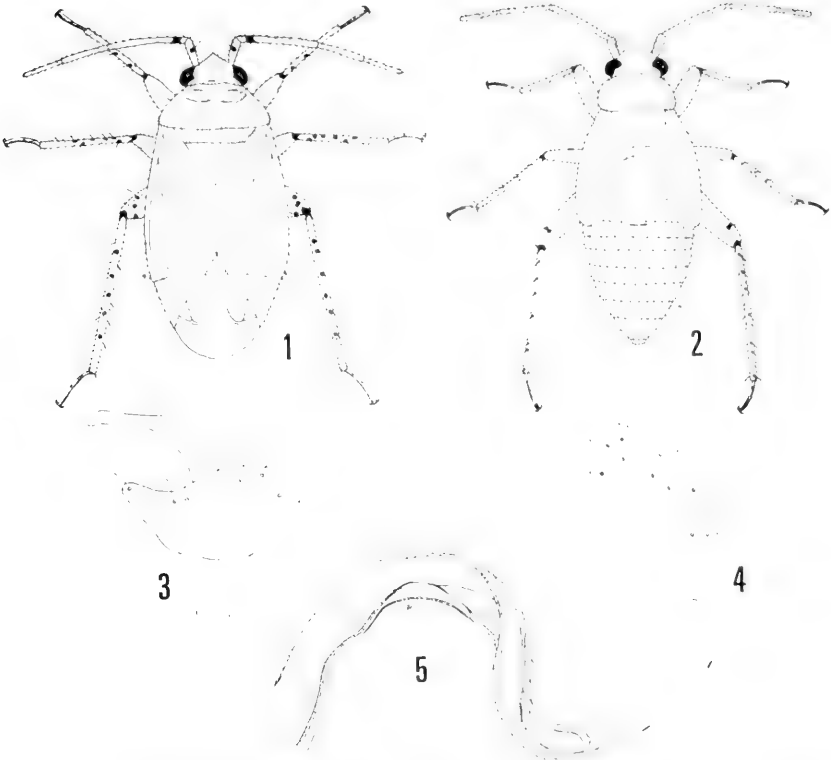

Fig. 1–5. *Plagiognathus vitellinus* (Scholtz): 1, adult; 2, fifth instar nymph; 3–5, ♂ genitalia: 3, left clasper; 4, right clasper; 5, vesica.

species of *Pinus, Picea,* and *Larix* (Reuter, 1908), and in England occurs mainly on spruces, less commonly on larch (Southwood and Leston, 1959). Kaltenbach (1874) listed it as a "Pflanzenfeind" on conifers, but gave no other information. Eggs are known to overwinter; adults appear in late June and persist until early August (Southwood and Leston, 1959).

In Pennsylvania 5 specimens were collected from spruces in 5 western counties during 7–14 July 1972. These specimens were keyed to *Plagiognathus* in Knight's (1941) key but did not fit descriptions of any of the phyline species included in his key. From a large series of specimens collected in 1973 this species was tentatively identified as the European *Plagiognathus vitellinus* (by TJH) using Southwood and Leston's (1959) key and by comparing our specimens with descriptions of *P. vitellinus* in Butler (1923), Wagner (1952), and Stichel (1958).

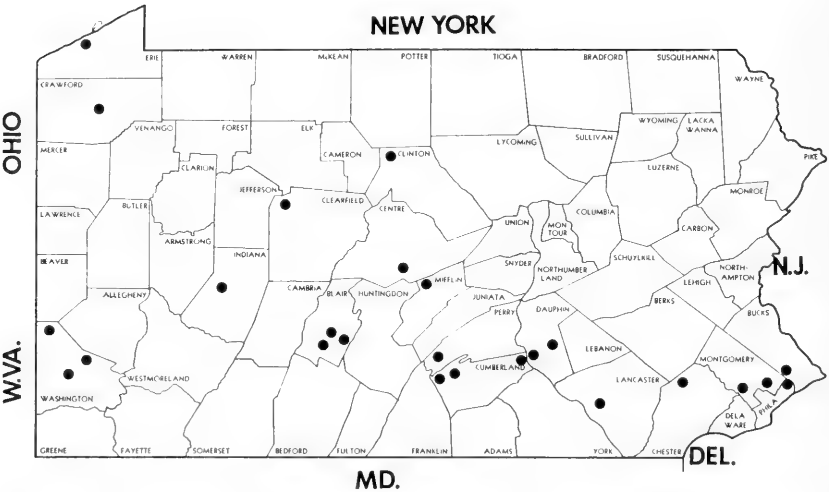

Fig. 6. Distribution of *Plagiognathus vitellinus* (Scholtz) in North America.

This identification was verified by comparison with specimens of *P. vitellinus* borrowed from the British Museum (Natural History).

This species may be distinguished from other species of *Plagiognathus* and phyline mirids in our area by the uniform flavotestaceous color, small size, pale yellow pubescence, first antennal segment with 1 or 2 black rings and sometimes the second with black at base, tibiae typically with black spots at base ("knees") and with black spines arising from large black spots, hind femora with black spots, last segment of hind tarsus almost as long as 1 and 2 together, and the structure of the male genitalia. Figures of the adult (fig. 1), last instar nymph (fig. 2), and male genitalia (fig. 3–5) are provided to facilitate identification.

Lengths of 10 ♂♂ and 20 ♀♀ are as follows: ♂ 3.00–3.32 mm ($\bar{X} = 3.18$ mm); ♀ 2.84–3.40 mm ($\bar{X} = 3.20$ mm). We have collected both the nominate form and variety *annulata* Stichel. The nominate form is characterized by having the first antennal segment black basally with a median black ring and the second segment black basally; the variety *annulata*, by the first segment black basally with 2 median brown spots and the second segment with a basal brown ring (Stichel, 1958). More detailed descriptions of the adult are given by Reuter (1878) and Hüeber (1911).

Biological Observations

During 1972–73, we collected *P. vitellinus* from 17 counties in Pennsylvania (fig. 6). This species can be characterized as an early season mirid that feeds at the base of needles on new growth of spruces, larch, and Douglas fir. The seasonal history of populations on Douglas fir, *Pseudotsuga menziesii* (Mich.) Franco, and European larch, *Larix decidua* Mill., was determined. We found no other phyline mirid to breed on Douglas fir, while on European larch only *Plagiognathus laricicola* Knight was collected with *vitellinus*. Fourth and fifth instar nymphs of *P. laricicola* can be distinguished by the fuscous head, pronotum, apical third of wing pads, and tarsi, by the 2 rows of uniformly small brown spots on hind femora, and the generally weaker spots at bases of tibial spines. Four species occur with *vitellinus* on spruces: *Atractotomus magnicornis* Fallén, another Palearctic species introduced into North America (Knight, 1923, 1924) and one known to occur with *vitellinus* on conifers in Europe (Hüeber, 1911); *Microphylellus tumidifrons* Knight; *Plagiognathus suffuscipennis* Knight; and *Psallus piceicola* Knight. Populations of *M. tumidifrons* and *A. magnicornis* develop at about the same time as those of *vitellinus*. Late instar nymphs of *M. tumidifrons* can be distinguished by the absence of dark spots at the bases of the tibial spines; those of *A. magnicornis*, by the thickened second antennal segment. Eggs of *Psallus piceicola* and *Plagiognathus suffuscipennis* hatch about a week later than those of *vitellinus*. Nymphs of *P. piceicola* are easily distinguished by their reddish color; nymphs of *P. suffuscipennis* could not be separated reliably from those of *vitellinus*.

Periodic collections were taken from populations of *P. vitellinus* on Douglas fir and European larch in southwestern, central, and southeastern Pennsylvania. In the latter two areas eggs hatched in early May; those in southwestern counties, about a week later. Populations consisted mainly of second instar nymphs by 10 May; by late May fourth and fifth instars predominated. The first adult was collected on 30 May. Adults were abundant only for a few weeks from about 5 June to 20 June. In many of our sampling sites adults had disappeared by the end of June. Our latest record was of a single female collected from Douglas fir on 17 July in Blair County.

The seasonal history on spruces is assumed to be similar. Large populations were found on Norway spruce, *Picea abies* (L.) Karst.; Colorado spruce, *P. pungens* Engelm.; and white spruce, *P. glauca* (Moench) Voss.

Discussion

Like *Camptozygum aequale*, *P. vitellinus* is known only from Pennsylvania (although it is probably more widely distributed) and may have been introduced into North America. This idea is supported by its collection from hosts that are not native to our area but have been introduced from western North America or from Europe. We did collect nymphs of what appeared to be *P. vitellinus* from American larch or tamarack, *Larix laricina* (Du Roi) K. Koch, growing in a bog in Clinton County. These could not be reared to maturity but were identical to late instar nymphs of *P. vitellinus* taken on European larch, Douglas fir, and spruces. Recently, Kelton (1966) suggested that from its collection from a wide area and from undisturbed habitats in North America, *Pithanus maerkeli* (Herrich-Schaeffer), previously thought to be a European introduction, might represent a true Holarctic species. However, until additional collections of *P. vitellinus* are made, the most reasonable assumption is that it represents an introduced species.

The observation that eggs of *C. aequale* were inserted into stems of seedling Scotch pine, *Pinus sylvestris* L., led us to speculate that this species could have been accidentally introduced with pine nursery stock (Wheeler and Henry, 1973). Even though *P. vitellinus* was not found associated with conifer seedlings, an introduction via nursery stock rather than on ship ballast seems more reasonable. Our area was never a major dumping grounds for European ballast, and most of the Heteroptera found associated with ballast sites have been species of ground-dwelling habits (Lindroth, 1957). Seed feeders such as rhyparochromine lygaeids or predators such as nabids may be able to survive for extended periods in ballast. The possibility of the more delicate Miridae surviving in ballast materials would seem to be less likely. Additional collections of this species may provide clues to its means and site of introduction into North America.

Acknowledgments

We are grateful to W. R. Dolling, Department of Entomology, British Museum (Natural History), for the loan of specimens. We thank Drs. C. O. Berg and L. L. Pechuman, Cornell University, for their suggestions on improving the manuscript, Dr. J. L. Herring, Systematic Entomology Laboratory, USDA, Washington, D.C., for his helpful advice, and Dr. J. A. Slater, University of Connecticut, for sharing with us his views on the possibility of the ballast introduction of mirids. Our regional Bureau of Plant Industry personnel made valuable collections of *P. vitellinus*, as did Dr. D. G. Trelka, Washington and Jefferson College, Washington, Pennsylvania, in Washington County.

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NOTES ON THE GENUS OPUNTIASPIS, WITH A KEY TO THE SPECIES (HOMOPTERA: DIASPIDIDAE)

In 1905, Green described *Opuntiaspis javanensis* (Entomol. Mon. Mag. 16:28) from material collected on *Agave mexicana* in Java. Ferris (1937, Atlas of the Scale Insects of North America, ser. 1:164) placed it as a junior synonym of *Opuntiaspis philococcus* (Cockerell) (1893, Bull. Soc. Zool. Fr. 18:252) on the basis of Green's description. Recently, I examined 7 specimens of *O. javanensis* from the British Museum (Natural History) that were mounted from the type material. The collection data for these specimens are as follows: Type material, Java, *Agave* sp., Coll. A. Zimmerman. I also examined a specimen of *O. philococcus* in the U.S. National Museum that was also mounted from the type material. The slide is labeled co-type #5860, on Cactus, Guanajuato, Mexico (Duges), T. D. A. Cockerell Coll. I found that *O. javanensis* and *O. philococcus* are different species. The U.S. National Museum has specimens of *O. javanensis* from Java and Mexico on *Agave decipiens*, *A. fourcroydes* (= *A. ixtli*), *A. sisalana*, *A. xylonacantha* (= *A. amurensis*), *Agave* sp., *Beaucarnea* sp., and *Bromelia* species. *Opuntiaspis javanensis* can be separated from the other 2 congeners by the following key.

1 Perivulvar pores present .... *O. carinata* (Cockerell) (new syn. *Mytilaspis nigra* Cockerell)
— Perivulvar pores absent 2
2 Dorsal macroducts distributed completely across the metathorax and abdominal segments 1–4; usually found on Cactaceae .... *O. philococcus* (Cockerell)
— Dorsal macroducts absent from the median areas of the metathorax and abdominal segments 1–4; usually found on *Agave* spp. .... *O. javanensis* Green

I thank Dr. D. J. Williams, British Museum (Natural History), for the loan of the type material of *O. javanensis*.

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BOOK REVIEWS

Butterflies of the Australian Region. Bernard D'Abrera. 1971. Landsdowne Press Pty. Ltd., Melbourne, Australia. [Distributed exclusively in North America by Entomological Reprint Specialists, P. O. Box 77071, Dockweiler Station, Los Angeles, California, 90007.] 415 pp. + loose errata page, 2 text figures, 3 maps, 2,362 color photographs. Size 10″x13½″. Price: $39.95.

Australian Butterflies. Charles McCubbin. 1971. Thomas Nelson Limited, Melbourne and Sydney, Australia. [Distributor as given above.] xxx + 206 pages, 335 species illustrated in color. Size: 9⅜″x13½″. Price: $30.00.

Butterflies of Australia. Ian F. B. Common and Douglas F. Waterhouse. 1972. Angus and Robertson Pty. Ltd., Sydney, London, Melbourne, Brisbane and Singapore. [Distributor as given above.] 498 pp., 41 plates (26 in color), 25 figures, 366 maps. Size: 9½"x7". Price: $39.95.

Three superb works on the butterflies of Australia and all almost at once! On first appearances this is two books too many.

A closer look however shows that D'Abrera's book is a treatment of the entire Australian region, including New Zealand north through the Fiji and Solomon Islands and west to Weber's line. In this large area occur over 900 species and numerous subspecies of the "true" butterflies (Papilionoidea). D'Abrera omits the skippers (Hesperoidea), but apparently intends to treat them in a later companion volume. His treatment, because of space limitations, is necessarily sketchy, but he does give the latin and common names, original references, distribution, brief description of imago and sometimes of early stages, as well as listing the food plants when known. The more than 2300 color photographs are mostly excellent. Certainly this is the book to buy if one is interested in the larger region covered and can only afford one of these rather expensive books.

To choose between the two books by McCubbin and by Common and Waterhouse is much more difficult. Both cover Australia (the continent) and Tasmania; both are well illustrated in color; both are well written and include a great amount of information.

The plates in McCubbin are based upon superb life-sized paintings done by the author and often include the foodplants on these same plates. The plates in Common and Waterhouse are often reduced in size but are quite good and many are the same as those used in an earlier work (*What Butterfly is That?*, by G. A. Waterhouse, 1932.) Two color plates, five black and white plates and 25 text figures are added to the present work.

Common and Waterhouse include 366 maps (not included in the earlier work) giving the distribution of all species and subspecies and this is a most excellent and useful feature. The bibliography offered by McCubbin seems to be complete and is much more extensive than the one offered by Common and Waterhouse. Both works give distribution under each species and subspecies treatment in the text. Both works offer a great amount of life-history information, the common names, characters for identification when needed to supplement the plates and other interesting facts.

I am sorry to report that neither of these two works nor the work by D'Abrera offers a checklist, that most helpful tool for the collector and scientist.

I do not see how the serious student of butterflies could choose between the two books covering the more restricted area of Australia. The one by Common and Waterhouse is smaller and could be more easily carried into the field although it is not intended to be, nor is it indeed a skimpy field guide. McCubbin's book one would want to leave at home so as not to soil or spoil the magnificent plates.

Jamaica and Its Butterflies. F. Martin Brown and Bernard Heineman. 1972. 478 pages, 11 color plates, 7 figures, 5 maps, end papers (=maps). E. W. Classey Limited, London. [Distributed exclusively in North America by Entomological Reprint Specialists, P.O. Box 77971, Dockweiler Station, Los Angeles, California, 90007.] Size: 8¾"x10¾". Price: $44.00.

This book under preparation for a number of years was certainly worth waiting for. I find the title somewhat pretentious. The publisher gives this title much emphasis in his advertizing brochure because he believes this book contains much more than one which might otherwise have been simply entitled "The Butterflies of Jamaica." The first chapter (six pages), "The Jamaican Scene" is apparently the basis for the publishers claim. Here there is a brief description of the island, a discussion of the climate, vegetation and animal life. As a matter of fact, today and for many years past we have come to expect any good faunal treatment to include general information of this sort.

There are interesting chapters upon early and present-day collecting, butterfly anatomy, biology, Jamaican butterfly habitats and zoogeography. The main body of this book (chapter 7) is an excellent treatment of the butterfly fauna. Here the taxonomy, habits, habitats and distribution for each species and subspecies are given in great detail. I believe the species headings would have benefited by the use of a bold-faced type such as was used for the genera and higher taxa. As it is, I find it a little difficult to separate and to locate individual treatments.

Jamaica, according to these authors, contains 133 known species and subspecies, 31 of which are endemic. One hundred and sixteen of these are very beautifully illustrated in color by Majorie Statham Favreau.

Four maps show dry and wet season rainfall, altitude and the chief vegetation of Jamaica. A fifth map shows prevailing wind direction and ocean currents of the Gulf of Mexico and the Caribbean Sea. The end papers are maps showing the counties, parishes and principal collecting localities of Jamaica. There is an excellent bibliography and a glossary.

A checklist is included and this may reflect the fact that the publisher is more knowledgeable than most publishers of the needs and wishes of both the amateur and professional worker. Too many publishers have insisted upon deleting this feature from similar works.

A few weaknesses and minor errors in this book have already been pointed out by Dr. Eugene Monroe (Jr. Lepid. Soc., 26(4):264–267, 1972) and I see no need to probe further.

The fact is that this work is probably the most complete treatment of butterflies for any similar sized island anywhere and it is certainly the best treatment ever to appear for any of the Antillean Islands.

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Scabies. Kenneth Mellanby. Published by E. W. Classey, Ltd. England. Distributed in North America by Entomological Reprint Specialists, P.O. Box 77971, Dockweiler Station, Los Angeles, California 90007. Paperback, 81 pp., illus. Price: $3.50.

This small, excellent book was originally published in 1944 during World War II when scabies was then a common complaint in the British Isles. I read it in 1944, and I was lucky enough to hear Dr. Mellanby lecture on the mite while in Washington. His film which accompanied the lecture was beautifully done. The book is exciting to read now—simply written and adequately illustrated. It includes all that is needed for the acarologist as well as the medical entomologist, and most of us will find it rewarding. Rather than discuss the book, I believe that a list of the chapters will suffice:

I. The anatomy and life history of the itch mite.
II. The parasitology of human scabies.
III. The development of symptoms.
IV. Secondary pathological conditions induced by scabies infection.
V. The transmission of scabies.
VI. The incidence of scabies.
VII. The prevention of scabies.
VIII. The treatment of scabies
  (A) The treatment of the parasitic infection.
  (B) The treatment of secondary infection.
IX. Conditions which may be confused with scabies.
X. Other mites of medical and veterinary importance.
Appendix. On how to make the materials mentioned in the text.

This book should be in all libraries, especially the medical entomology ones.

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BOOK NOTICES

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An Index to the Described Life Histories, Early Stages and Hosts of the Macrolepidoptera of the Continental United States and Canada. Harrison M. Tietz. 1973. Published by A. C. Allyn for the Allyn Museum of Entomology, Sarasota, Florida. 2 vols., 1041 pp. $25.00 per set. Sold exclusively by Entomological Reprint Specialists, P.O. Box 77224, Dockweiler Station, Los Angeles, California 90007.

Developmental Systema: Insects (2 Volumes). Edited by S. J. Counce and C. H. Waddington. 1972. (vol. 1), 1973 (vol. 2). Academic Press, London. 304 pp. (vol. 1), 615 pp. (vol. 2). 6.50 pounds sterling (vol. 1), 10.00 pounds sterling (vol. 2).

The Horseflies of Europe. M. Chvála, L. Lyneborg, and J. Moucha. 1972. Entomological Society of Copenhagen. 499 pp., 164 text figs., 8 plates (5 colored). $23.50. Sold exclusively by Entomological Reprint Specialists, P.O. Box 77224, Dockweiler Station, Los Angeles, California 90007.

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Revision of the Genus Pseudopanurgus of North America (Hymenoptera, Apoidea). P. H. Timberlake. 1973. University of California Publications in Entomology Volume 72. University of California Press, Berkeley, Los Angeles, London. 58 pp., 56 illus. $2.50.

OBITUARY

PHILIP LUGINBILL, JR.
1917–1973

The hearts of many entomologists and numerous friends were saddened by the sudden, tragic death of Philip Luginbill, Jr. in Tucson, Arizona on August 23rd. He was killed when a tire broke loose from a passing van and struck him as he was riding his bicycle home from work. Although he suffered severe head injuries he lived for nearly six hours after the accident.

Dr. Luginbill was born in Columbia, South Carolina on August 17, 1917. He was the son of Dr. Philip Luginbill, Sr., a well known entomologist and specialist on May beetles, and Alma Dean Luginbill. His early years were spent in Columbia, South Carolina and Monroe, Michigan. Phil received his B.S. in Agriculture from Purdue University in 1939, his M.S. in 1941 and his Ph.D. in entomology in 1949. During the summers of 1940, 1941 and 1949 he worked as a supervisor on grasshopper control in Montana and Wisconsin. In 1949 he was appointed as an entomologist with the Cereal and Forage Insects Section of the Bureau of Entomology and Plant Quarantine at Bozeman, Montana. He conducted research on wheat varieties resistant to the wheat stem sawfly that resulted in several wheats that are resistant to sawfly attack. In 1959 he was transferred to Beltsville, Maryland as Assistant Chief of the Field Crop Insects and Bee Culture Research Branch. When this Branch was reorganized in 1960 he became Assistant Chief of the Grain and Forage Insects Research Branch and served in this position until July of 1972 when he was transferred to Tucson, Arizona as Assistant Area Director of the Southern Arizona-New Mexico office of the Agricultural Research Service.

Dr. Luginbill worked in a defense plant before entering the Navy in World War II. He was discharged as Lieutenant Senior Grade in 1946. In addition to the Entomological Society of Washington, Phil was a member of the Entomological Society of America, The American Association for the Advancement of Science, and Sigma Xi. He was also active in church and civic affairs.

Phil was much in demand as a square-dance caller and devoted many hours to this, largely for charitable organizations. He was an excellent master of ceremonies at various meetings. His poems, programs and tape recordings were the highlights at many retirement parties. His other hobbies included bicycling, fishing and camping.

Dr. Luginbill was a very outgoing person and had a very wide circle of friends throughout the country. He was an optimist and often brightened the outlook of his friends and associates. It was a pleasure to work with him. We will all miss him but we are all better for having known him.

Phil is survived by his wife, Betty Noble Luginbill, 6756 Harran Drive, Tucson, Arizona, 85704; three sons, Michael D. and Stephen P. of Beltsville, Md. and James C. of Tucson; a daughter Pamela of Tucson; his mother Mrs. Elma Luginbill of Lafayette, Indiana; three brothers: Charles residing in Ohio, Dean in Illinois and Webster in Michigan; and a sister, Mrs. Phillip Holden in Michigan.

BERNARD A. APP, *3815 58th Ave., Hyattsville, Maryland 20784.*

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PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

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