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ENTOMOLOGICAL NEWS

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Eleven New Dolichopus from North America (Dolichopodidae: Diptera)

F. C. Harmston [1]

This report includes descriptions of eleven apparently undescribed species of the genus *Dolichopus* and notes on several described species.

Dolichopus nigropleurus n. sp.

Male. Length, 3.5 mm; of wing, 3.5 mm. Face silvery pollinose, its width slightly wider than the diameter of middle tibia. Front metallic, greenish-bronze. Antennae black; third segment as broad as long, round at tip. Arista dorsal. Palpi black. Postocular cilia wholly black.

Dorsum of thorax green, metallic, lightly dusted with brownish pollen which is most evident when viewed obliquely; pleurae green with bronze reflections, dusted with grayish pollen. Abdomen dark green, metallic, the incisures bronze; lower lateral surfaces of third to fifth segments silvery pollinose. Hypopygium black; lamellae large, including stem their length is equal to that of the hind basitarsus, whitish with wide black border, the apex broadly rounded with lower portion jagged with strong bristles, the upper edge fringed with black hairs; there is also a scattering of long delicate blackish hairs on the outer surface and along the lower edge.

[1] Biologist, Disease Ecology Section, Technology Branch, Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Greeley, Colorado 80632.

Coxae black, the anterior surface of the fore and middle pairs with black hairs and bristles. Femora black, the apices of fore and middle pairs yellow. Middle and hind femora each with a single preapical bristle; hind femora ciliated on lower inner edge with long black hairs which are nearly as long as the diameter of femora. Fore and middle tibiae yellow; hind tibiae black (one specimen has the hind tibia yellowish-brown on extreme basal portion), tapering toward the base, the apical portion distinctly thickened and appearing somewhat laterally compressed. Fore and middle tarsi black from the tip of first segment; middle basitarsus without a bristle on upper surface: hind tarsi black, first and second segments of equal length, the former conspicuously enlarged and much thicker than the following segments. Halteres and calypters yellow, the latter with black cilia.

Wings grayish hyaline; costa with an elongated enlargement at tip of first vein; anal angle not prominent, tapering rather gradually toward root of wing.

Described from 3 males collected by the author at Dillon, Colorado, August 13, 1958. Holotype male to be deposited in the U. S. National Museum; paratype male in the California Academy of Sciences, and in the collection of the author.

This species resembles *D. packardi* Van Duzee in general coloration but it differs in having the first two segments of hind tarsi of equal length, in the middle basitarsus lacking a prominent bristle on upper surface, and in having the hind femur densely ciliate along the lower edge. In *packardi*, the first segment of hind tarsi is not at all thickened and is nearly twice the length of second segment; the middle basitarsus bears one (occasionally two) prominent bristles on upper edge; and the posterior femora have only a few scattered long cilia along lower edge.

Dolichopus squamicilliatus n. sp.

Male. Length 3.5 mm; of wing, 3.3 mm. Face wide, lustrous silvery pollinose. Front metallic, greenish-bronze in the middle, the lateral portions bordering the eyes silvery pollinose. Palpi black, with grayish pollen when viewed obliquely. Antennae black; third segment slightly longer than wide, the tip bluntly pointed. Arista inserted just above the tip. Lower postocular cilia white, extremely long and flattened, especially those near the oral opening; about nine of the upper cilia black.

Dorsum of thorax metallic, dark green with bronze reflections; pleurae with grayish pollen. Abdomen with first two segments bright metallic green, the following three segments shining bronze, hairs and bristles on the dorsum black, the sides densely clothed with delicate pale cilia. Hypopygium black; lamellae large, about as long as the hind basitarsus; the apical portion equally wide, whitish with wide black margin which is evenly rounded with jagged edge and fringed with long black hairs.

Fore coxae black on basal half, the anterior surface densely silvery pollinose with delicate pale hairs and with black bristles at tip. Middle and hind coxae black. Femora yellow, the hind pair black at tip as far as the preapical bristle. Hind femora ciliated on lower inner edge with delicate white hairs that are longer than the diameter of femora and are slightly curled or crinkly at tip. Fore and middle tibiae yellow. Hind tibiae black on outer surface except upper edge which is yellow on basal three-fourths; flattened, gradually tapering and enlarged toward the tip, the inner surface more brownish and glabrous throughout. Halteres and calypters yellow, the latter with delicate pale cilia.

Wings grayish hyaline; costa with a knot-like enlargement at the tip of first vein; anal margin of wing not rounded or prominent, tapering rather gradually to root of wing.

Described from 1 male collected by the author at Red Feather Lake, COLORADO, June 19, 1964. Holotype to be deposited in the U. S. National Museum.

This species differs from all known members of the genus *Dolichopus* by possessing the following combination of characters: lower postocular cilia and bristles behind the oral opening extremely numerous, long, and flattened; cilia of squamae pale; outer surface of hind tibia wholly black. The only species which might be confused with *squamicilliatus* is *D. fucatus* Van Duzee, but it lacks cilia along the lower edge of hind femur and the lower post ocular cilia are yellowish and not at all flattened.

Dolichopus footei n. sp.

Male. Length, 4.2 mm; of wing, 4 mm. Face moderately wide, grayish-white pollinose. Front violet, metallic. Palpi concolorous with face. Antennae black; third segment triangular, about twice as long as wide, the tip pointed. Arista inserted just above the tip, appearing subapical. Postocular cilia wholly black.

Dorsum of thorax black; pleurae dark greenish, dusted with silvery pollen. Abdomen dark green, metallic, the portions bordering the incisures black, the sides with silvery pollinose areas. Hypopygium black, the apical portion narrowed, appearing less bulbous than usual with this genus; lamellae black, about one-half the length of hind basitarsus, rather round, with a large rounded notch in the lower apical margin, the remainder of margin jagged and fringed with black hairs and bristles.

Coxae, femora, tibiae, and tarsi black, of plain structure, their hairs and bristles black. Hind femora without long cilia on lower inner margin, but with a row of delicate hairs that are only about one-fourth as long as the diameter of the femur. Halteres and calypters yellow, the latter with black cilia.

Wings grayish, hyaline; costa with an elongated enlargement at the tip of first vein, the elongation as long as the cross-vein; tip of wing with a small, round, jet-black spot bisected by the tip of the fourth vein.

Female. Similar to the male in coloration of body and legs. Face about twice as wide as in male. Third segment of antennae triangular, as broad as long, the arista apical. Wing with the apical dark spot present, but smaller, slightly less prominent than in male.

Described from 3 male and 2 females collected by Dr. B. A. Foote, at Kalispell Bay, Priest Lake, IDAHO, July 7, 1959.

Holotype male and allotype female to be deposited in the U. S. National Museum; paratype male in the California Academy of Sciences; paratype male and paratype female in the collection of the author.

The wholly black coloration of body and legs together with the black hypopygial lamellae and small jet-black spot at apex of wing will readily distinguish this species from all of the known members of the genus *Dolichopus*.

Dolichopus shastaensis n. sp.

Male. Length, 5 mm. Face rather wide, long, reaching to near the lower corner of the eye, of rather uniform width, the portion immediately below antennae slightly wider than the middle portion, silvery pollinose, the upper portion showing a yellowish tinge when viewed obliquely. Front metallic, burnished bronze. Palpi silvery pollinose. Antennae black; first and second segments yellow on lower half, of about equal length, the former considerably expanded and with dense, stiff, black hairs, especially conspicuous on outer surface. Arista thick, densely pubescent, subapical. About the upper twelve postocular cilia black; six of the middle cilia white and slightly flattened; the lower cilia and the bristles behind oral opening black and slightly flattened.

Dorsum of thorax metallic green with bronze reflections; pleurae dull-greenish, densely whitish pollinose. Abdomen metallic green with bronze reflections, the lateral and lower portions silvery pollinose. Hypopygium black, silvery pollinose; outer lamellae slightly longer than wide, the apex rather evenly rounded, yellow with black margin fringed with stiff black bristles. Halteres and calypters yellow, the latter with dense tuft of white cilia.

Fore coxae yellow, the posterior surface concolorous with pleurae, the anterior surface clothed with black hairs except on upper outer portion where the surface is glabrous; middle and hind coxae black. Femora and tibiae yellow; middle femora with a single anterior preapical bristle; hind femora with a row of five or six bristles of increasing length ending in the preapical bristle, without cilia along lower inner edge. Hind tibiae thickened and noticeably compressed, with a long, flat, glabrous area on inner surface. All tarsi infuscated from near the tip of first segments.

Wings grayish hyaline; costa with an elongated enlargement at tip of first vein; hind margin of wing deeply indented at tip of fifth vein; anal margin rather evenly rounded and prominent.

Female. Face wider than in the male. Antennae smaller than in male. Costa not enlarged at tip of first vein. Hind tibiae normal. Coloration of body, legs, postocular cilia, and cilia of calypters as in the male.

Described from 5 males and 10 females collected by Mr. W. H. Lange, at Cassel, Shasta County, CALIFORNIA, July 15, 1955. Holotype male and allotype female to be deposited in the U. S. National Museum; paratypes in the California Academy of Sciences, the University of California at Davis, and collection of the author.

This species is related to *D. crenatus* Osten Sacken, but is readily distinguished by having the lower postocular cilia and the bristles behind oral opening wholly black and in having the anterior surface of fore coxae clothed with coarse black hairs. In *crenatus* the lower postocular cilia from about the middle of the eye are yellowish and the anterior surface of fore coxae is clothed with extremely delicate pale hairs.

Dolichopus abaftanus n. sp.

Male. Length, 5 mm. Face rather narrow, its width about equal to the diameter of hind tibiae, whitish pollinose, very slightly tinged with yellow in some lights. Front metallic green, with violet reflections. Antennae black; first segment expanded on inner portion, yellow on lower half; second segment narrowly yellow at base below; third segment about as long as wide, pointed, the arista rather thick on basal portion and inserted immediately above the tip of third segment. Postocular cilia yellow, about ten of the upper cilia black.

Thorax green with metallic bronze reflections and dense patches of yellowish-brown pollen on dorsum; pleurae dusted with silvery pollen. Abdomen green, usually with bronze reflections on the sides and with grayish pollen on lower portions (in some specimens the sides show a beautiful bluish-violet reflection). Hypopygium black, lightly grayish pollinose; lamellae slightly longer than wide, dusky yellow with dark brown apical margin, the apex rather evenly rounded and scarcely at all jagged; margins sparsely fringed with brownish hair-like bristles.

Fore coxae yellow with a broad green stripe on outer posterior surface; anterior surface with silvery pollen and minute white hairs except at extreme base on inner edge and on apical fourth where the hairs are larger and black. Middle and hind coxae black, narrowly yellowish at tip. Femora and tibiae yellow; hind tibiae blackish at tip, especially on inner side. Middle femora with a single large preapical bristle preceded by a row of several smaller hair-like bristles; hind femora with a row of about six bristles ending in the preapical bristle. Fore and middle tarsi black from the tip of first segment, the middle tarsi whitish on basal portion; hind tarsi black from about the basal third of first segment. Middle tarsi very slightly compressed from the tip of first segment, the comparative lengths of the segments as 10–6–5–4–4. Halteres and calypters yellow, the later with black cilia.

Wings grayish, hyaline; costa not thickened at tip of first vein; last portion of fourth vein bent near its middle; hind margin of wing broadly concave at tip of sixth vein, the anal lobe rounded, very prominent, and with anal margin at a right angle to the costa.

Female. Face wider than in male, yellowish-white. Fore coxae covered with black hairs on anterior surface. Middle tarsi not at all compressed. Hind margin of wings evenly rounded.

Described from 22 males and 8 females collected by Mr. L. S. Miller at Howard Prairie Lake Reservoir, 21 miles east of Ashland, OREGON, July 24, 1963. Holotype male and allotype female to be deposited in the U. S. National Museum; paratypes in the California Academy of Sciences, the Oregon State Board of Health, and the collection of the author.

Dolichopus abaftanus n. sp. closely resembles *Dolichopus aldrichii* (Wheeler): it differs from the latter species in the costa having no enlargement at tip of first vein; in lacking the conspicuously flattened middle tarsi; much shorter and less dense cilia of calypters; and broader anal lobe of wing.

Dolichopus sinualaris n. sp.

Male. Length, 4.8 mm; of wing, 4.3 mm. Face rather narrow, its width on lower portion equaling the diameter of fore tibiae, wider on upper portion; silvery pollinose when viewed from the front, but showing a yellowish tinge when viewed obliquely. Front metallic, blue-violet. Palpi yellow. Antennae black; first segment narrowly yellow at tip below; third segment slightly longer than wide, somewhat oval, bluntly pointed; arista inserted slightly beyond the middle of segment. Postocular cilia wholly black.

Dorsum of thorax dark green with bronze reflections, dusted with brownish pollen; pleurae dull green, densely silvery pollinose. Abdomen green, the incisures broadly darkened and with bronze reflections, the lower lateral portions densely silvery pollinose. Hypopygium black, dusted with silvery pollen; lamellae yellow, the margins narrowly blackened, about the length of second segment of middle tarsi, rounded on basal portion, flattened at apex which is deeply jagged and bristly, fringed above with bristle-like hairs.

Fore coxae yellow with large dark spot on outer side at base, the anterior surface clothed with black hairs; middle and hind coxae black. Femora yellow, the hind pair narrowly but sharply blackened at tip above. Middle and hind femora each with two preapical bristles placed one in front of the other. Hind femora with a row of delicate brownish (in some lights yellowish) cilia on lower inner edge which are longer and more numerous toward the tip where their length is about one-fourth the diameter of femur. Tibiae yellow, the hind pair black at tip for about one-sixth their length. Fore tarsi of plain structure, first four segments dark yellow, the fifth segment black. Middle tarsi blackened from the tip of first segment. Hind tarsi wholly black. Halteres and calypters yellow, the latter with black cilia.

Wings grayish, hyaline; costa with a small knot-like enlargement at tip of first vein; hind margin broadly concave between the tips of fifth and sixth veins, which makes the anal portion of wing lobe-like and very prominent.

Described from 1 male collected by the author at Bismarck, NORTH DAKOTA, August 25, 1961. Holotype male to be deposited in the U. S. National Museum.

The presence of two preapical bristles at the tip of middle and hind femora, together with the wholly black postocular cilia, and the broadly incised posterior margin of the wing with its large, broad anal lobe readily separate this species from other known *Dolichopus*.

Dolichopus zygomus n. sp.

Male. Length, 4.2 mm; of wing, 4 mm. Face rather wide, silvery white. Front metallic, green with bronze reflections. Antennae black; third segment slightly longer than wide, somewhat oval, bluntly rounded at tip. Lower postocular cilia white, upper cilia black.

Thorax green with slight bronze reflections; pleurae dusted with gray pollen. Abdomen green with coppery reflections, the incisures darkened, the sides with gray pollen. Hypopygium black, dusted with gray pollen; lamellae large, as long as the first segment of middle tarsi, the apex broadly rounded and nearly two-thrids as wide as the length of lamella, whitish-yellow with the apical and upper margins broadly blackened, jagged and bristly at apex and fringed with long black hairs that are continued along the upper margin to near the stem.

Fore coxae dark on about the basal half; anterior surface silvery pollinose and clothed with minute white hairs except narrowly on inner portion where the hairs are black. Middle and hind coxae black. Femora yellow, the hind pair blackened at tip, except below, as far as the preapical bristle; hind femora without black hairs on outer surface except narrowly along upper edge, which gives the outer surface a somewhat glabrous appearance, the lower inner edge with a row of delicate, evenly spaced, pale cilia the length of which is less than one-third the width of femur. Tibiae yellow; fore tibiae with a long bristle at tip on outer side that is about one-half the length of first segment of fore tarsi and with a similar, but more slender and slightly shorter, bristle on the inner side. Hind tibiae about as long as the hind femora, somewhat laterally compressed, particularly on basal half which is slightly wider than the apical half; black on about apical third and narrowly infuscated on outer side to about the middle, the posterior surface bright yellow in color except for the black tip. Fore and middle tarsi black from the tip of the first segment; hind tarsi wholly black. Halteres and calypters yellow, the latter with whitish cilia.

Wings gray; costa with a slightly elongated knot-like enlargement at the tip of first vein; hind margin of wing evenly rounded and somewhat narrowed toward the base, the anal angle not prominent.

Described from 1 male collected by Dr. C. P. Alexander along Taylor Highway, at Mile Post 49, West Fork Dennisan River, ALASKA, August 15, 1954. Holotype male to be deposited in the U. S. National Museum.

This species is related to *squamicilliatus* n. sp., from which it is readily distinguished by having the lateral portions of abdomen clothed with short, stiff, black hairs. In *squamicilliatus* the lateral portions of abdomen are clothed with long, delicate, pale cilia. *D. zygomus* n. sp. also differs in having the cilia along lower edge of hind femora only about one-third as long as the diameter of femora.

Dolichopus factivittatus n. sp.

Male. Length, 5.6 mm. Face wide, its width equaling the diameter of hind tibiae, silvery pollinose. Front metallic, blue-green, lightly dusted with gray pollen. Antennae yellow; third segment about as long as wide, obtusely pointed, brown on about the apical half. Postocular cilia white, about six of the upper cilia on each side black.

Thorax green with bronze reflections, dusted with gray pollen, the dorsum with a sharply defined, shining coppery, median stripe; pleurae dulled with silvery pollen. Abdomen green with bronze reflections, the sides dusted with silver pollen. Hypopygium black, dusted with gray pollen; lamellae equaling the length of second segment of middle tarsi, about one-half as broad as long and of nearly equal width throughout, the apex rather evenly rounded, narrowly blackened, jagged and bristly; the outer surface and lower edge clothed with delicate pale cilia, the upper edge with evenly-spaced, stiff, black hairs that are curved at their tips.

Fore coxae, femora, and tibiae yellow. Middle coxae brownish-black on outer surface. Fore coxae with delicate pale hairs on anterior surface and with a few small black hairs on inner edge. Middle and hind femora each with a single preapical bristle. Hind femora ciliated along entire lower inner edge with yellow hairs which are short and delicate on basal half; the hairs on apical half of about equal length and about one-third as long as the width of femora. Hind tibiae somewhat thickened and bowed inward at basal third, the inner surface glabrous except on apical third. Fore tarsi black from the middle of third segment; second segment slightly more than one-half the length of first segment and slightly less than twice the length of third segment; upper edge of third segment fringed with long black hairs on apical half; fourth segment fringed above with black hairs which are much shorter than those on third segment; fourth and fifth segments of equal length, each slightly less than one-half the length of third segment. Middle and hind tarsi black from the tip of first segment; middle basitarsi with a large bristle on upper edge at apical third. Calypters and halterese yellow, the former with black cilia.

Wings gray; costa with a prominent bulbous elongated enlargement at tip of first vein which is nearly as long as the third segment of middle tarsi; last section of fourth vein bent at right angles near its middle, the bend having a stump vein at its first angle; anal angle rounded, prominent.

Described from 4 males collected by the author at Terre Haute, INDIANA, July 4, 1944. Holotype male to be deposited in the U. S. National Museum; paratype males in the California Academy of Sciences and in the collection of the author.

This interesting species resembles *D. vittatus* Loew in possessing a bulbous elongated enlargement at the tip of first vein, in the form of the hypopygial lamellae, and in the comparative lengths of the segments of fore tarsi. It differs from *vittatus* by having a fringe of long hairs on the upper edge of the third and fourth segments of fore tarsi and in having the lower inner edge of hind femora ciliated with pale hairs which on the apical half of femora are nearly one-third as long as the diameter of the femora. The fringe on third and fourth segments of fore tarsi in *factivittatus* n. sp. is similar to that of *D. cuprinus, D. longipennis, D. sarotes,* and *D. absonus.*

Dolichopus smithae n. sp.

Male. Length, 6 mm. Face moderately wide, dark ochre yellow, more brownish when viewed obliquely. Front metallic, dark bronze, dusted with brownish pollen. Antennae black; first segment brownish-yellow on lower apical portion; third segment slightly longer than wide, pointed at tip; arista rather short, ending in a prominent fusiform lamella. Postocular cilia wholly black.

Thorax dark green, the dorsal surface with metallic bronze reflections when viewed obliquely; pleurae green, densely silvery pollinose. Abdomen green with bronze reflections, the incisures narrowly blackened, the sides grayish pollinose. Hypopygium black, grayish pollinose; lamellae about three times as long as wide, their length about equal to the length of first segment of fore tarsi, of rather uniform width, the basal three-fifths dusky yellow, the apical two-fifths black with the apex rounded, jagged, and bristly.

Fore coxae yellow, the basal half of the outer surface dull green and densely silvery pollinose, the anterior surface densely clothed with small black hairs. Middle and hind coxae black. Femora yellow, the middle and hind pairs each with one preapical bristle, the latter nearly bare below, showing only short, delicate, pale cilia at high magnification. Tibiae yellow, the hind pair narrowly black at tip on outer surface, the black color extending to apical third on inner surface. Fore tarsi with first three segments yellow, the tip of each very narrowly infuscated; fourth and fifth segments black; fourth segment conspicuously compressed, as wide at tip as it is long, the upper apical margin bearing several short, stiff, bristles; fifth segment much compressed, divided into two lobes, the upper of which is almost twice the length of lower lobe and only about one-half as wide. Middle tarsi black from the tip of first segment which has a large bristle above near apical third. Hind tarsi wholly black. Halteres and calypters yellow, the latter with black cilia.

Wings grayish; costa with an enlargement commencing before the tip of first vein and gradually tapering; wing of rather equal width, the anal angle only moderately prominent.

Female. Similar to the male in coloration of body and legs; face about twice as wide as that of the male, grayish pollinose, arista without fusiform enlargement at tip.

Described from 1 male and 3 females collected in ALASKA. Holotype male and allotype female taken at Mt. McKinley National Park, Mile Post 29, July 15, 1952, by Dr. Marion E. Smith; University of Massachusetts, in whose honor the species is named; one paratype female taken at Teklanika River, Mt. McKinley National Park, Mile Post 29, July 15, 1952, and one paratype female taken at Mile Post 1146, Alaska Highway, Yukon Territory, July 7, 1952, both collected by Dr. C. P. Alexander. Holotype male and allotype female to be deposited in the U. S. National Museum; paratype females in the collection of the author.

The structure of the fore tarsi in *D. smithae* n. sp. is very similar to that of *D. reichardti* Stackelberg, described from Pamir. The two species may be readily separated by the color of the postocular cilia which are wholly black in *D. smithae,* pale in *D. reichardti.*

Dolichopus fulgerus n. sp.

Male. Length, 5 mm. Face moderately wide, its width about equal to the distance between the tips of third and fourth veins, silvery pollinose when viewed from the front, grayish or brownish-gray when viewed obliquely. Front dark green, lightly dusted with brownish-gray pollen in the middle, the sides densely brownish pollinose. Antennae black; first segment yellow below on apical portion; third segment about one and one-third times as long as wide, bluntly pointed; arista long, noticeably widened on apical fourth. Postocular cilia white, about six or seven of the upper cilia on each side black.

Thorax metallic green with bronze reflections, the dorsum grayish pollinose; pleurae densely grayish pollinose. Abdomen green with bronze reflections, the sides densely grayish pollinose. Hypopygium black; lamellae about as long as the second segment of hind tarsi, the apex broadly rounded, scarcely jagged, fringed with black hairs, tapering rather gradually toward the base, of a sordid grayish color, the apical margin blackened.

Fore coxae black and densely grayish pollinose on basal half, the apical half yellowish; anterior surface with black hairs except the outer basal portion which is covered with minute white hairs. Middle and hind coxae black. Femora yellow; middle and hind femora each with one preapical bristle, the latter densely ciliated on lower edge of basal half and sparsely ciliated on apical half with delicate pale cilia that are about one-fourth as long as the diameter of femora. Tibiae yellow, the hind pair black on about apical fourth. Fore tarsi almost twice the length of their tibiae, the segments extremely slender, the second and third segments somewhat laterally compressed; first three segments yellow, the fourth and fifth black; fourth segment considerably compressed, elongate-triangular; fifth segment much compressed, triangular, about as wide at the tip as long, the apex somewhat concave. Middle tarsi about one and one-half times as long as their tibiae, black from the tip of first segment which has a long bristle on upper surface at apical third. Hind tarsi black, elongate, the first two segments equaling the length of their tibiae. Halteres and calypters yellow, the latter with black cilia.

Wings gray; costa with a prominent elongated enlargement at tip of first vein which tapers gradually toward tip of wing; hind margin of wing tapering toward base, the anal angle not prominent.

Female. Face wider than male. Arista plain, tapering evenly to the tip. Fore tarsi black from the tip of first segment; otherwise the coloration of the legs and the body as in the male.

Described from 2 males and 1 female collected by Dr. C. P. Alexander at Muncho Lake, Mile Post 455, Alaska Highway, British Columbia, June 28, 1952. Holotype male and allotype female to be deposited in the U. S. National Museum; paratype male in the collection of the author.

This very distinct species is readily recognized by the greatly elongated and peculiarly modified fore tarsi. No other known species of *Dolichopus* has the fore tarsi about twice the length of fore tibiae, second and third segments extremely slender and laterally compressed, the fourth and fifth segments black, laterally compressed and forming a broad concave-triangular tip.

Dolichopus kyphotus n. sp.

Male. Length, 4 mm. Face rather narrow, silvery pollinose. Front metallic green, lightly dusted with gray pollen. Palpi yellow. Antennae black; first segment brown on lower apical portions third segment as wide as long, the tip broadly rounded. Postocular cilia white, about six of the upper cilia black.

Thorax green, metallic, lightly grayish pollinose; pleurae densely grayish pollinose. Abdomen metallic, dark green with bronze reflections, the middle portion of the third segment shining blue when viewed from the side. Hypopygium black; lamellae about as long as the second segment of hind tarsi, somewhat oval, white with narrow black apical margin which is deeply jagged and bristly, the inner surface with numerous long, curled, pale cilia.

Fore coxae yellowish-brown, the inner portions of a lighter color, the outer and basal portions infuscated and dusted with gray pollen; anterior surface clothed with delicate pale hairs except on the inner basal portion where the hairs are larger and black. Middle and hind coxae black. Femora and tibiae yellow. Middle and hind femora each with one preapical bristle, the latter ciliated on about the apical third of the lower inner edge with delicate pale hairs the longest of which are about as long as the width of femur at point of attachment. Hind tibiae slightly thickened and blackened on apical fifth. Fore and middle tarsi infuscated from the tip of the first segment. First segment of fore tarsi about as long as the combined length of the second and third segments and with numerous short, stiff black bristles on its lower surface; first and second segments somewhat laterally compressed and appearing considerably broader than the following three segments. First segment of middle tarsi without a bristle on upper edge. Hind tarsi wholly black. Halteres and calypters yellow, the latter with delicate pale cilia.

Wings grayish; costa with a knot like enlargement at the juncture of first vein from which point the costa tapers gradually toward tip of wing; hind margin of wing evenly rounded, the anal angle only moderately prominent.

Described from 1 male collected by Mr. C. O. Berg, at Matanuska Valley, ALASKA, June 27, 1952. Holotype male to be deposited in the U. S. National Museum.

Dolichopus kyphotus n. sp. is much like *D. flavicilliatus* Van Duzee but differs in the structure of the antennae and the ciliation of hind femora. In *flavicilliatus* the third segment of antenna is about twice as long as broad; the cilia of hind femora are coarse, longer than the diameter of the femur, and are evenly spaced along the apical two-thirds of lower edge of femur. The first and second segments of the fore tarsi in *flavicilliatus* are slender, not conspicuously enlarged as in *kyphotus* n. sp.

Paratypes of *Dolichopus pingreensis* James in the Colorado State University collection have been compared with specimens of *D. flavicilliatus* Van Duzee from various areas in Canada, Minnesota, and Wyoming. They appear synonymous.

Dolichopus plumipes (Scopoli)

Musca plumipes Scopoli. Ent. Carn., p. 334, 1763.
Dolichopus nigroapicalis Van Duzee. Pan-Pac. Ent. 6: 125, 1930.

The coloration of the face and antennae together with the narrow black line on the dorsal surface of middle tibia identify *nigroapicalis* to be the same as *plumipes*. In the type male specimen of *nigroapicalis* from Colorado the middle tarsi and tips of middle tibiae were broken off which caused Van Duzee to misidentify his specimen.

Panoquina panoquinoides (Skinner) and Panoquina errans (Skinner) (Lepidoptera: Hesperiidae)

F. Martin Brown, Fountain Valley School, Colorado Springs, Colo. and Thomas W. Turner, Kingston, Jamaica, W. I.

This winter Mr. Turner sent to me the results of several years of work upon the life histories of Jamaican butterflies. These were for incorporation in a forthcoming book about the butterflies of Jamaica by Brown and Heineman. In reading Mr. Turner's notes about *panoquinoides* I was struck by the difference between his descriptions and those of Dr. John A. Comstock (1930) relative to *errans*. Dos Passos (1964) followed Evans (1955) in placing *errans* as a subspecies of *panoquinoides* thus differing from the treatment of *errans* by McDunnough (1938), who followed Lindsey, Bell and Williams (1931). Evans's placement was based upon the similarity of the male genitalia. These are similar, but by no means exactly alike. They are more alike than these structures are alike among the other species in the genus.

If *errans* is considered a subspecies of *panoquinoides*, then the species has a remarkably disjunct distribution. *Panoquinoides* is found from Florida to Texas in the Gulf States and in the Greater Antilles, *eugeon* Godman & Salvin in the Lesser Antilles, and *errans* in California and Lower California. Evans's subspecies *calna* from Callao, Peru, probably is another species. This bothered me when I reviewed the genus in preparation for writing the text of the book noted above. I believe it is much better to revert to the older treatment of these taxa and to consider *errans* a species that is related to *panoquinoides* and probably derived from it, but not a subspecies of it. Below is a comparison of the immature stages of the two that point up the significance of the slight but constant genitalic differences.

panoquinoides	errans
EGG: hemispherical, white	hemispherical, pale yellow
LARVA:	
1st Instar: vivid green, light brown head changing to blackish brown. Two fine dorsal cream colored lines.	white with black head
Mature: Green, four dorsal greenish-white stripes, a yellowish-white lateral stripe.	Reddish-brown with a dorsal dark line and a thin dark lateral line. Prothoracic shield white with a black transverse bar.
PUPA: Translucent green, larval stripes persist on dorsum of abdomen.	Whitish green head and wing-cases, a pair of brownish eye-spots; abdomen pale brownish yellow. Anterior portions hairy. Darkens materially just before imago emerges.
MALE VALVE: subquadrate, about 0.5 deep as long; caudad tooth coarsely spined; as long as aedoeagus.	subquadrate, about 0.4 deep as long; caudad tooth finely spined; a little shorter than aedoeagus.

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The Chinese Species Diplocheila minima Jedlička: A Redescription and Observations on its Relationships (Col.: Carabidae)

GEORGE E. BALL, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada

INTRODUCTION

This species was described in 1931, but in a revision of the genus *Diplocheila* (Ball, 1959: 47), the species was listed as *incertae sedis,* because I had not seen the type material, and could not decide on the basis of the original description if the insect was in fact a member of that genus.

While visiting the Deutsches Entomologisches Institut in 1961, I discovered the two cotypes of this species, and obtained the female on loan. Later, at the British Museum, I found a third specimen of the species, a male, which had not been mentioned in the original description, and which Jedlička evidently had not seen before he published the description. These specimens are described below, following which the classification of this species is discussed.

ACKNOWLEDGMENTS

I am grateful to Dr. J. W. Machatschke, Deutsches Entomologisches Institut, and to Mr. J. Balfour-Browne, British Museum (Natural History), for the loan of the material on which this study is based.

This work is a by-product of a study financed in part by Grant A-1399, National Research Council of Canada.

A preliminary draft of the manuscript was read and criticized by Brian Hocking, Donald R. Whitehead, and John R. Barron, Department of Entomology, University of Alberta, and the final draft was typed by Miss Joan Shore, Departmental secretary.

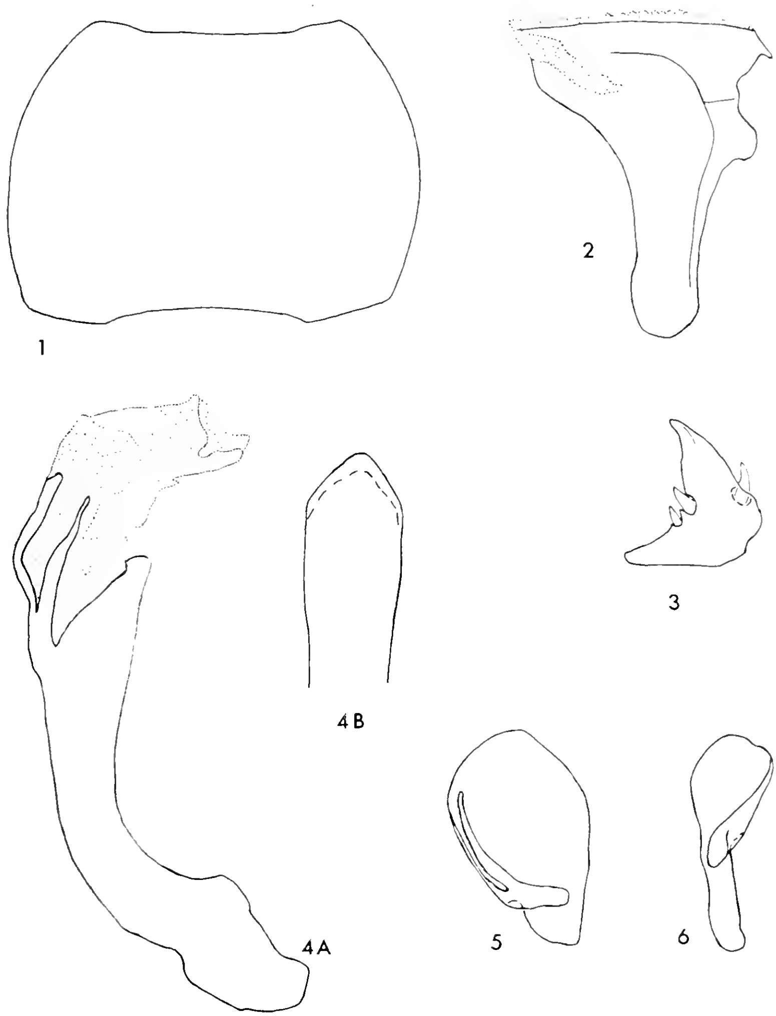
DESCRIPTION

Diplocheila minima Jedlička, 1931
Diplocheila minima Jedlička, 1931: 103. Ball, 1959: 47.

Female, labelled as follows: Nitou, Tatsieniu, Szechuan, China, Em. Reitter; COTYPUS [red paper]; *Diplocheila minima* Jedl [handwritten]; det. Ing. Jedlička; *Rembus minima* Jedl [handwritten]. Deutsch. Ent. Inst.

Total length 11.3 mm, width 4.8 mm. Color generally black, but tips of terminal articles of palpi piceous. Integument generally opaque, the following shining: head, median areas of thoracic sterna, and abdominal sterna. Microsculpture as described for the *striatopunctata* group (Ball, 1959: 58), except that meshes of propleura are about isodiametric, and lines on dorsal surface are coarser than in other species of the genus.

Head. Two supraorbital setigerous punctures over each eye; frontal impressions broad, shallow basins, posterior margins not extending to plane of anterior pair of supraorbital setigerous punctures. Clypeus as in subgenus *Isorembus* Jeannel; clypeus 0.24 times wider than long, 2.17 times wider than labrum, with a deep longitudinally directed groove on each side. Labrum 1.44 times wider than long; maximum length 1.76 times greater than minimum length, form typical of subgenus *Isorembus*.



Figs. 1–3. *Diplocheila minima*, ♀. Figs. 4–6. ♂ genitalia.

1. Outline of pronotum, dorsal aspect. Length, 2.50 mm.
2. Left half of sternum 8, dorsal aspect. Length, 1.70 mm.
3. Left stylus of ovipositor, ventral aspect. Length 0.40 mm.
4. Median lobe. Length, 2.44 mm. A. Left lateral aspect. B. Apical portion, ventral aspect.
5. Left paramere, dorsal aspect. Length, 1.14 mm.
6. Right paramere, dorsal aspect. Length, 1.12 mm.

Mandibles trigonal, asymmetrical, left one without teeth, terebral tooth of right one molariform, generally as described for *striatopunctata* group.

Thorax. Pronotum in outline as in Fig. 1; disc feebly convex, flattened posterior-laterally, posterior-lateral impressions very broad and shallow basins. Apex of prosternum between front coxae margined. Metepimeron with posterior margin broadly rounded, not sinuate.

Legs. Tarsus with articles 1–4 with a single row of setae on each ventro-lateral margin; article 5 without setae on ventro-lateral margins.

Elytra. Internal plica absent. Stria 1 joined to sutural stria, basal portion of stria 1 absent; striae impunctate, 7 as deep and distinct as 1–6, 2–7 obsolescent toward apex; stria 7 broken posteriorly, anterior portion separated from deepened apical portion; striae 8 and 9 close together. Intervals flat, interval 3 with a single setigerous puncture on disc.

Hind wings fully developed.

Abdomen. Sternum 6 with four setigerous punctures near apical margin; sternum 8 as in Fig. 2.

Ovipositor. Stylus as in Fig. 3, with spines.

Male. Labelled as follows: Tatsieniu, Prov. Setschuan China merid; verglichen mit der Type and mit ihr identisch [green paper; handwritten]; *Diplocheila minima* Jedlička [handwritten]; British Museum Natural History.

Total length 11.1 mm, width 4.8 mm. Except for inconsequential details, external characteristics as in female. Sternum 6 with two setae toward apex.

Male genitalia with median lobe and parameres as in Figs. 4, 5, and 6; internal sac without armature.

Classification and Zoogeography

This species is a member of the subgenus *Isorembus* Jeannel, as shown by the form of its mandibles, labrum, clypeus, the female eighth sternum, and stylus of the ovipositor. The species of the subgenus *Isorembus* are arrayed in three species groups. The diagnostic characteristics of these groups and the comparable characteristics of *minima* are presented in Table 1.

Note that *minima* differs from the *striatopunctata* group in only one characteristic: it has setose styli. *Minima* differs from the *aegyptiaca* group in three characters, and from the *zeelandica* group in four characteristics. On the basis of these considerations, I include *minima* in the *striatopunctata* group.

Now, *minima* is interesting for two reasons. First, its combination of morphological characteristics links more closely the

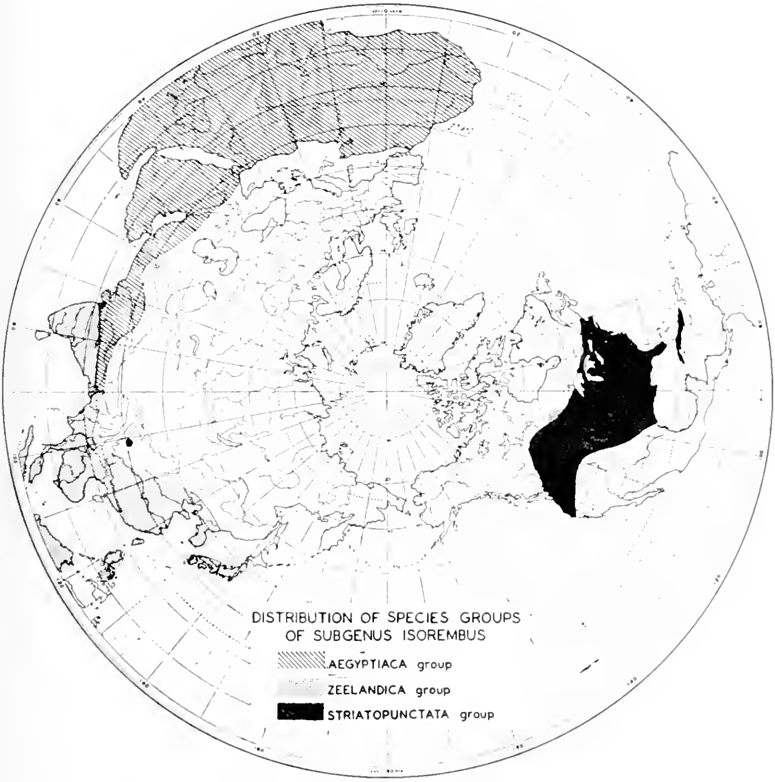


FIG. 7. Map showing the distribution pattern of the subgenus *Isorembus*. North Polar projection.

TABLE 1. *Distribution of Diagnostic Characteristics in the Subgenus Isorembus*

Groups	Characters							
	Left mand.	Head: setig. punct.	Pro-sternum	5th tarsal segment	Elytral punct.	Elytral base stria 1	Female stylus	Total
Zeelandica	inner edge not thickened	2	not margined	setose	absent	present	setose	
score	p[1]	p	p	p	p	p	p	7-p
Aegyptiaca	inner edge thickened	1	margined	setose	present	absent	setose	
score	d[2]	d	d	p	d	d	p	2-p
(*Minima*)	inner edge not thickened	2	margined	glabrous	present	absent	setose	
score	p	p	d	d	d	d	p	3-p
Striatopunctata	inner edge not thickened	2	margined	glabrous	present	absent	setae absent	
score	p	p	d	d	d	d	d	2-p

[1] p = primitive.
[2] d = derivative.

species of the *aegyptiaca* group with those of the North American species of the *striatopunctata* group. The species *minima,* while most like the North American members of the *striatopunctata* group (six characters in common), is also more like the members of the *aegyptiaca* group than are the North American species of the *striatopunctata* group (Table 1). Further, the *aegyptiaca* group and North American members of the *striatopunctata* group can be linked to the more primitive *zeelandica* group through *minima*. This is because *minima* has one more character judged to be primitive than have the other groups of species. (The basis for judging these characteristics is presented in Ball, 1959.)

The second point of interest concerns the possibility of verifying predictions made on the basis of taxonomic data. Before I saw *Diplocheila minima,* I stated that the *striatopunctata* group was probably of Old World ancestry (Ball, 1959: 96), based on the morphological and distributional characteristics of the species of the subgenus *Isorembus*. This hypothesis constituted a prediction in the sense that it could be tested by data discovered following proposal of the hypothesis. The presence of *minima* in the Old World, its relative primitiveness, and its clear affinities to the New World species of the subgenus lend support to the prediction, if they do not actually verify it. See Figure 7 for a map illustrating the distribution pattern of the subgenus *Isorembus*.

Summary

1. The species *Diplocheila minima* Jedlička, 1931 is redescribed.

2. On the basis of its morphological characteristics, *minima* is placed in the *striatopunctata* group of the subgenus *Isorembus*.

3. This species is important because first, its combination of characteristics links together more closely the known species groups of the subgenus *Isorembus*, and second, its presence in the Old World tends to confirm the previously made statement that the *striatopunctata* group is of Old World ancestry.

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Brachymeria intermedia (Nees) (Hymenoptera: Chalcididae) Established in North America

David E. Leonard, The Connecticut Agricultural Experiment Station, New Haven

Brachymeria intermedia (Nees) is a parasite of *Porthetria dispar* and other lepidopteran pupae in southern Europe and northern Africa. Burgess and Crossman (1929) describe the introduction of this parasite into this country as early as 1908, and Dowden (1935) discusses its biology.

Dowden (1935) noted that although 20,000 specimens of *B. intermedia* had been released in New England, none had been recovered, possibly because the climate of New England was colder than that in the Mediterranean area of Europe.

Burks (1960a) published the first record of recovery of this parasite. One adult was obtained from a pupa of *Cococcia* collected in Marion, Massachusetts, in 1942. Burks (1960b) considered this one record insufficient to demonstrate that this insect was established in North America.

During the summer of 1965, many *B. intermedia* [1] have been collected in Connecticut from gypsy moth pupae. The numbers of this parasite and its distribution indicate that it has become established in parts of this state. It is present in Oxford, Woodbury, Guilford, and Killingworth, where infestation of the gypsy moth has been high for several years, as well as in East Lyme, where a heavy infestation occurred for the first time in 1965.

Indications of the percentage of parasitism can be found in Table 1. Pupae were collected from three Connecticut towns.

TABLE 1. *The percentage of parasitism of Brachymeria intermedia (Nees) in field collections of gypsy moth pupae from three Connecticut towns*

Town	Date of Collection	Number of Pupae	Percentage Ichneumonid-Type Emergence Holes	Percentage *B. Intermedia* Recovered
East Lyme	July 19–20	1073	29.2	4.8
Guilford	July 20–21	435	4.4	0*
Woodbury	July 23	149	10.7	1.3

* One adult collected in the field.

On the trees selected, all pupal cases on the trunk from 0–6 feet from the ground were collected. The dates of collection were after adult emergence, and supposedly after parasites had emerged from the pupae. However, *B. intermedia* were found to be emerging from some, and emergence continued in the laboratory until the week of August 1. Undoubtedly, some of

[1] Identification confirmed by Dr. B. D. Burks, Entomology Research Divison A. R. S. U.S.D.A. Washington, D. C.

the *intermedia* had emerged in the field prior to the collection of pupae. The emergence holes of this parasite fit the ichneumonid emergence holes in the key of Campbell (1963). The percentage of parasitism cannot exceed the percentage of ichneumonid type emergence holes in the pupae.

Of considerable interest is the fact that this insect reached very high numbers in a short period of time. It does not appear likely that in the past this insect could have been at as high a population level as witnessed in 1965 and not have been noted. Moulton (pers. comm., 1965) reports that *Brachymeria* were rare in a collection of about 1,272,000 pupae from Connecticut in 1964. However, numbers of these parasites emerged from about 500,000 gypsy moth pupae in 1965.

In addition to the releases listed by Dowden (1963), the Plant Pest Control Division, U.S.D.A., released *B. intermedia* from Spain in Stratford and Redding, Connecticut, in 1963.

It would be difficult to explain the numbers and spread of *intermedia* as a direct result of these releases. It is more likely that *intermedia* had been maintaining itself at low population levels, as indicated by the four specimens collected in Oxford, Connecticut, in 1960 and the one reported by Burks from Massachusetts. *B. intermedia* appears now to be adapted to this environment.

This parasite has more than one generation per year. Although known primarily as a parasite of gypsy moth pupae, it also parasitizes other lepidopteran pupae (see Dowden 1935) and its high incidence may be correlated with an increase in numbers of other lepidopterans, perhaps of the leaf rollers that have recently been increasing in Connecticut.

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Number 19

BUTTERFLIES OF LIBERIA

By Richard M. Fox, Arthur W. Lindsey, Jr., Harry K. Clench and Lee D. Miller

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With 195 new records, this study increases the known butterfly fauna of Liberia from 280 to 475 species and another 254 species are noted as probably to be found. Two new tribes, 5 new genera, 13 new species and subspecies are described. Illustrations include photographs and, where pertinent, drawings of genitalia of all holotypes, along with photographs and drawings of closely related forms for comparison. The distribution of each species is given and those more difficult to identify or previously confused are treated at greater length. All known records from Liberia are noted. A 46 page introduction details climatic conditions and biotopes in Liberia and analyzes the zoogeographic and ecologic relationships of the butterflies of Liberia and of Occidental Africa.

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ENTOMOLOGICAL NEWS

Vol. LXXVII FEBRUARY, 1966 No. 2

Two New Species of Melanoplus from Alabama (Orthoptera: Acrididae)

Matt E. Dakin,[1] Department of Zoology-Entomology, Auburn University, Auburn, Alabama

During the course of a survey of the Orthoptera of Alabama in 1959 I encountered two new species of the genus *Melanoplus* but did not describe them because of insufficient material. Since that time I have collected both species in sufficient numbers to warrant publication.

Melanoplus cantralli new species

In 1916 Rehn and Hebard established the *decorus* group of the genus *Melanoplus*. In this group they placed five species—*decorus* Scudder (1897), *australis* Morse (1904), *attenuatus* Scudder (1897), *hebardi* (Rehn) (1906), and *nubilis* Rehn and Hebard (1916). Now, *Melanoplus cantralli* may be added to this assemblage.

Although in many respects the most distinctive member of the *decorus* group, *cantralli* is most closely related to *hebardi* (Rehn). It may be differentiated from that species, and all other members of the group, by its larger size, more robust form, and very distinctive male terminalia. The antennal crescent in both sexes of *cantralli* is nearly as wide as the basal segment of the antenna; this crescent in the other five forms of the *decorus* group is less than one-half the width of the basal segment.

[1] Present address: Box 1435, University of Southwestern Louisiana, Lafayette, Louisiana.

Females of *cantralli* can likewise be differentiated from their nearest relatives by their larger size, more robust form, and furthermore by the presence of a light, diagonal, irregular stripe lying obliquely across the black postocular band on the pronotum. Other differences in minor features of the female subgenital plates and cercus are evident.

Holotype—Male. General appearance and coloration very similar to *M. hebardi.* Antennal crescent broad and complete, at point of greatest width (0.41 mm) slightly less than width of first antennal segment (0.56 mm). Disk of pronotum with lateral carinae indistinct, outlined in color on prozona, subparallel, diverging slightly caudad; median carina well-developed throughout, cut only by principal sulcus; pencilled with black; caudal margin subtruncate; cephalic margin feebly rounded with slightest trace of median emargination; prozona (3.31 mm) less than twice as long as metazona (1.83 mm); lateral lobes distinctly longer than high; postocular black stripe terminating at cephalic margin of metazona, bearing two small yellowish-brown blotches separated by the coloration of the median sulcus. Tegmina dark yellow-brown, obovate (length 4.27 mm, width 2.50 mm), tips truncate, dorsal margins well separated. Cephalic and median femora yellow-brown. Caudal femora yellow-brown, knees blackened on outer and inner faces except for yellow-brown genicular lobes. Caudal tibiae pale glaucous, weakly infused with black dorso-distally. Spines of all tibiae black; calcars and spurs yellow-brown, tipped with black. Mesepimeron and metepimeron black; metepisternum peripherally black with disk yellow-brown. Abdomen yellow-brown; each tergite with a black suffusion laterally that becomes progressively smaller from the second to the ninth tergum. Cercus (Fig. a) tapering slightly from base to middle, then expanding to the rounded obovate apex, ventral margin broadly concave; entire cercus black except for a yellow-brown tinge on basal one-fourth and a light yellow-brown line around the dorsal and caudal rim of the apex. Furculae one-fourth length of supra-anal plate, strongly tapering in basal third, distal portions forming narrow, aciculate, parallel projections. Supra-anal plate triangularly shield-shaped, longer than broad; lateral margins briefly concave then convex to the broadly rounded right-angled apex, in basal one-half raised into a distinct ridge (not plicate at distal end as in other members of the *decorus* group); in basal third of plate, and between furculae, a narrow sulcus lying between well-defined ridges which fuse, obliterate the sulcus, and form a single broad longitudinal ridge lying in the center of the plate; distal one-third of plate feebly hollowed out, lateral to this area a swollen raised bump extending evenly on each side to the margins of the plate (not forming the short, blunt, evenly convergent ridges as found in other species of this group). Subgenital plate broad at base, strongly narrowing to a feebly tuberculate apex. Aedeagus (Figs. b & c) with apex of each dorsal valve expanded into a broadly rounded lamella which is bent caudally and caudo-ventrally until, from a lateral view, it appears as a broad "C"-shaped structure; ventral valves a pair of rectangular plates extending from the broad base, the meso-apical angle of each plate elongated into a rounded lamella situated at right angles to the apical margin of the valve. Length of body from vertex to tip of abdomen 24.52 mm, from vertex to tip of caudal femora 25.95 mm; length of pronotum 5.14 mm; length of caudal femora 13.08 mm; greatest width of caudal femora 3.28 mm.

Allotype—Female. Similar in build and coloration to holotype except cephalic margin of pronotum feebly rounded, caudal margin of pronotum rounded-truncate with broad emargination, dark post-ocular stripe strongly interrupted by a diagonal yellow-brown line beginning below the stripe at the cephalic margin of the pronotum and extending to the junction of the principal sulcus and the lateral margins of the pronotum, lateral margins more divergent; caudal tibiae deep glaucous. Antennal crescent complete; greatest width 0.46 mm. Width of first antennal segment 0.68 mm. Length of tegmina 5.30 mm, greatest width of tegmina 2.89 mm. Cercus triangular with margins very slightly but distinctly concave, 0.75 mm in length, one-third longer than wide. Ovipositor with valves only moderately curved; dorsal angle of upper valve 153 degrees; upper margin of dorsal valve with blunt irregular teeth. Lateral angle of eighth sternite 146 degrees. Notch of eighth sternite shallow. Length of body from vertex to tip of ovipositor valves 28.85 mm; from vertex to tip of caudal femora 29.16 mm; length of prozona 3.96 mm; length of metazona 2.09 mm; length of pronotum 6.05 mm; length of caudal femora 15.21 mm; greatest width of caudal femora 3.66 mm.

Variation: The most evident variation among the males is in the extent of the dark markings on the cercus. A few of the specimens show no black on the cercus; in most of the specimens, the extent of darkening is slightly less than that of the holotype. In the females, the extent of development of the light diagonal mark dividing the postocular dark stripe is the most evident variation. In most of the specimens the stripe is more distinct than in the allotype, but in one is only faintly indicated. The coloration of the caudal tibiae in both sexes also shows some variation. The tibiae range from a yellow-green darker than in the holotype to distinctly fuscous in the males, but in none are the tibiae deeply glaucous as in the allotype. The caudal tibiae are glaucous in most of the females, but in two specimens they are dark yellow-brown. The coloration in one female is very similar to that of the holotype. Males vary in body length from 21.2 to 26.5; females, from 22.5 to 28.3 mm.

Specimens examined: 27 males, 13 females, all collected by me.

Holotype: Escambia County, ALABAMA, 5 miles east of East Brewton on U. S. 29, August 25, 1962. Deposited in the Museum of Zoology, University of Michigan.

Allotype: Same data and depository as holotype.

Paratypes: 6 males, 2 females, same data as holotypes; 5 males, 1 female, same data as holotype except October 5, 1962; 1 male, Escambia County, 9.5 miles east of East Brewton, October 5, 1962; 3 males, 2 females, Escambia County, 8.4 miles southwest of Brewton, October 5, 1962; 8 males, 5 females, Escambia County, 1.2 miles north of Brewton, August 26, 1963; 2 males, 1 female, Baldwin County, 5 miles east of the Mobile Causeway, September 24, 1959; 1 male, Baldwin County, Gulf Coast Substation (near Fairhope), July 11, 1961. One pair of paratypes deposited at each of the following: University of Michigan, Academy of Natural Sciences of Philadelphia, U. S. National Museum, and my personal collection; all others in the Auburn University Insect Museum.

Ecology: All specimens were taken from the litter and short vegetation of pine woods. At the type locality they were collected from open areas in a slash pine woods. They appeared to occur in small local colonies of several individuals and were taken by carefully trampling the dry pine needle litter. The specimens taken in other locations were from similar habitats.

This species is named in honor of I. J. Cantrall, University of Michigan, Museum of Zoology, whose advice and encouragement aided me during my survey of Alabama Orthoptera.

Melanoplus primaestivus new species

This species is a member of the *tribulus* group of the genus *Melanoplus* as recognized by Hebard (1935). In the size and shape of the furculae and cerci, it is more closely related to *M. delaware* than to any of the other eight species presently assigned to the group. *Primaestivus* can be recognized readily by its distinctive aedeagus.

Holotype—Male. General coloration light yellow-brown: dorsal surface of head, pronotum, legs, and abdomen heavily sprinkled with numerous dark brown spots. Postocular stripe percurrent on the pronotum, terminating on the mesepimeron. Basal one-half of second abdominal segment suffused with black. Antennal crescent complete, about one-half (greatest width 0.22 mm) width of basal antennal segment (0.40 mm). Disk of pronotum with lateral margins moderately diverging posteriorly; median carina distinct throughout, slightly higher on metazona (1.39 mm); lateral carinae indistinct. Tegmina oval, tips rounded; dorsal margins not attingent. Caudal tibiae yellow-brown with a slight bluish tinge. Cercus (Fig. d) much broader at base than at apex; feebly narrowed at middle; tip subtruncate with lower angle moderately prolonged; entire cercus curving slightly mesad. Furculae as minute rounded lobes; well separated. Supra-anal plate trigonal, slightly longer than wide; basal one-fourth of lateral margin forming a blunt ridge feebly plicate at its caudal terminus; lateral margins weakly convex throughout, terminating in a sharply rounded right-angled apex. Aedeagus (Fig. e) with dorsal valves wrapped around ventral valves, the apical portion of the dorsal valves flaring strongly away from the ventral valves. Ventral valves like a pair of long, thin, attingent laminae, apices rounded and slightly divergent. Length of body: vertex to end of abdomen 18.42 mm; vertex to end of caudal femur 19.20 mm; length of pronotum 4.07 mm; length of caudal femur 9.88 mm; greatest width of caudal femur 2.62 mm; length of furcula 0.24 mm; length of supra-anal plate 1.67 mm; length of tegmen 3.59 mm; greatest width of tegmen 1.98 mm.

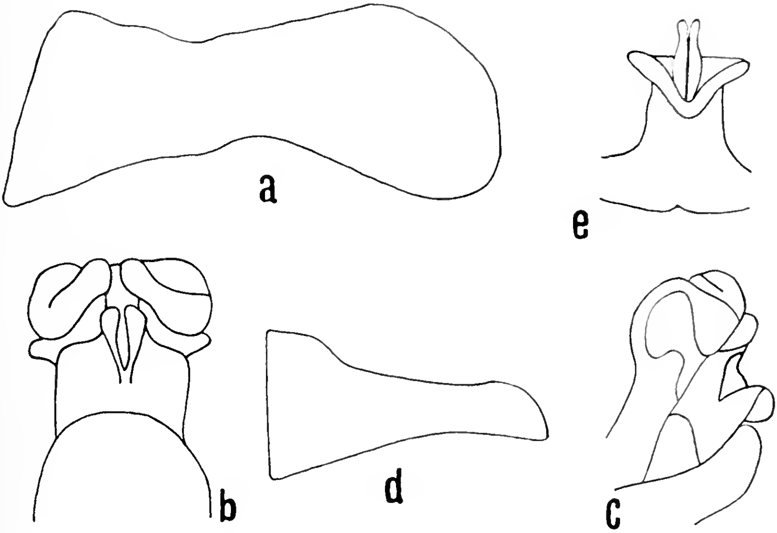
Allotype—Female. Coloration similar to that of holotype except for a slight reddish tinge throughout. Antennal crescent divided, much narrower (0.16 mm) than width of basal antennal segment (0.42 mm). Prozona (3.22 mm) slightly less than twice as long as metazona (1.90 mm). Cercus narrow, triangular, straight sided, tip acute, 0.77 mm in length. Upper valve of ovipositor with dorsal angle 136 degrees, armed with sharp evenly spaced teeth. Lateral angle of eighth sternite 150 degrees; eighth sternite without notching. Length of body from vertex to tip of ovipositor 24.25 mm; from vertex to end of caudal femur 21.94 mm; length of caudal femur 11.59 mm; greatest width of caudal femur 2.98 mm; length of pronotum 5.12 mm; greatest length of tegmen 4.44 mm; greatest width of tegmen 2.86 mm.

Variation: Very little variation occurs in the series except for the color of the caudal tibiae and the tips of the cerci of the males. Coloration of the caudal tibia varies from yellow-brown to glaucous in both sexes. The lower angle of the tip of the cercus in some specimens is not at all or only slightly prolonged, while in others it is more prolonged than in the holotype. Males in the series vary in body length from 16 to 19 mm; females range from 22 to 25 mm.

Specimens examined: 34 males, 22 females, all collected by me.

Holotype: Lawrence County, ALABAMA, 2 miles south of Wren, June 28, 1963. Deposited in the Museum of Zoology, University of Michigan.

Allotype: Same data and depository as holotype.



Melanoplus cantralli n. sp., holotype. a. Lateral view of left cercus. b. Caudal view of aedeagus. c. Lateral view of aedeagus.

Melanoplus primaestivus n. sp., holotype. d. Lateral view of left cercus. e. Caudal view of aedeagus.

Paratypes: 18 males, 14 females, same data as holotype; 1 male, 1 female, same as holotype except July 24, 1959; 2 males, Winston County, Alabama, Natural Bridge Recreation Area, Ala. 33, 1 mile north of U. S. 278, August 17, 1962; 12 males, 6 females, same as preceding except June 26–27, 1963. One pair of paratypes deposited at each of the following: University of Michigan, Academy of Natural Sciences of Philadelphia, U. S. National Museum, and my personal collection; all others in the Auburn University Insect Museum.

Ecology: All specimens were taken from leaf litter in oak-hickory woods. At the type locality the species was more abundant than at the Natural Bridge Recreation Area, where specimens of *Melanoplus tepidus* Morse and *M. similis* Morse were taken at the same time. *M. primaestivus* is an early maturing form, reaching its peak abundance in late June or early July. The name *primaestivus* is from Latin (*prima* and *aestivus*) meaning first of the summer, indicating that it is an early maturing form.

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New Stoneflies from Idaho (Plecoptera)[1]

Alan V. Nebeker and Arden R. Gaufin[2]

Several stoneflies new to Idaho are described and recorded here along with a list of stoneflies now known to occur in the state. Most of the data has been accumulated by the authors, but valuable material borrowed from Dr. W. F. Barr, Mr. S. D. (Skip) Smith, and Mr. Dick Logan, University of Idaho, Moscow, is gratefully acknowledged. Assistance from Mr. Stanley G. Jewett, Jr., is also gratefully acknowledged.

Capnia nedia new species

Male: Wings brachypterous, length of body 6 mm. First nine abdominal tergites without special modifications. No lobe on

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ninth sternite. Supra-anal process reflexed, extending forward to eighth tergite, narrow in dorsal view, somewhat triangular in side view (Figs. 1, 2, 3).

Holotype male: IDAHO, Boise Co., Boise, Sand Cr. IV-8-61, Max Ollieu.

Only a single male is known. It was dissected from a mature nymph which had just begun to exuviate. The male supra-anal process is distinct, showing no resemblance to other Idaho *Capnia*.

Capnia cygna Jewett

Two mature *Capnia nymphs* were dissected and identified as a male and female of *C. cygna* Jewett. The female is herein described. The males were described by Jewett (1954) from two males from Washington (probably Rock Cr.—no specific locality). This is the first record of this rare species from Idaho.

Female: Wings fully formed, eighth sternite unmodified except for a minute median notch on posterior edge. Two inconspicuous patches of hairs on eighth sternite (Fig. 8).

Figs. 6 and 7 show the male supra-anal process as it was when dissected from the nymphal skin. Fig. 5 illustrates the normal position (Jewett, 1954) in the naturally emerged adult. The process is directed back in the nymph with the nymphal cuticle forming a sheath around it (10th tergite). After exuviation the process is inverted and assumes the position in Fig. 5. This position is different from that in Plecoptera such as Alloperla in which the supra-anal process is preformed directed anteriorly. A very large tubercle is found on the hind margin of the 7th tergite of the specimens illustrated by Jewett. No such tubercle is found on the specimen illustrated here but a patch of spines is found in the same position. It may be assumed that after exuviation the tubercle is 'blown up' possibly as in wing expansion. A tubercle as large as that illustrated by Jewett would make exuviation rather difficult if it were preformed as such within the nymphal skin.

Capnia distincta Frison

This species is now known to occur in Idaho and is probably widespread in many parts of the state. Collections were made by the authors during the winter and spring of 1965.

It has been found at the following localities: Salmon R., Hwy. 93, 3 mi. W. of Clayton, Custer Co., III-7-65, A. V. Nebeker, 8 males, 5 females; Lake Fork Cr. Hwy. 15, 10 mi. So. of McCall, Valley Co., III-24-65, A. V. Nebeker, 1 female; Salmon R., South Challis, III-14-65, A. R. Gaufin, 1 female; N. Fk. Teton R., Hwy. 32, Fremont-Teton Co., III-6-65, A. V. Nebeker, 5 males, 3 females.

Capnia coloradensis Claassen

This common Rocky Mt. species is now reported from several localities in Idaho. Most specimens were collected during the intensive investigations in 1965.

It has been collected from the following localities: Salmon R., So. Challis, III-14-65, A. R. Gaufin, 1 female; Pine Cr., 6.5 mi. N. Priest River, Bonner Co., III-26-65, S. D. Smith, 4 females, 3 males; Kalispell Cr., 35 mi. N. Priest River, Bonner Co., III-20-65, S. D. Smith, 4 males, 8 females; Granite Cr. and Priest Lake, Bonner Co., III-12-65, S. D. Smith, W. F. Barr, L. Hawkins, 1 female, 1 male; Santa Cr., 3 mi. N. of Emida, Hwy. 95A, Benewah Co., III-25-65, A. V. Nebeker, 5 males, 7 females; Basin Cr., at jct. with Salmon R., 10 mi. W. of Stanley, Custer Co., III-7-65, A. V. Nebeker, 1 male; N. FK. of Teton R., Hwy. 32, Fremont-Teton Co., III-6-65, A. V. Nebeker, 4 males, 5 females; Salmon R., Hwy. 93, 3 mi. W. of Clayton, Custer Co., III-7-65, A. V. Nebeker, 2 males, 1 female.

Capnia trava Nebeker & Gaufin

Two additional species of *Capnia* belonging to the *Capnia columbiana* group have also been found in the state. One of those is *Capnia trava* which has been found only in the northern part of the state.

The following are collection records for this species: Granite Creek and Priest Lake, III-12-65, W. F. Barr, L. Hawkins, 11 males, 5 females; Pine Creek 6.5 miles N. Priest River, III-12-65, W. F. Barr, S. D. Smith, L. Hawkins, 21 males, 5 females; Deep Creek 7 miles north of Naples, Hwy. 95, Boundary Co., III-26-65, A. V. Nebeker, 1 male, 1 female; Moyie River 1 mile south of Canada, Hwy. 95, Boundary Co., III-26-65, A. V. Nebeker, 2 males, 4 females.

Capnia lemoniana Nebeker & Gaufin

This species belongs to the *Capnia columbiana* complex and is not common in Idaho, being primarily a more southerly form. It has been found at the following localities: Lenore, Nez Perce Co., 3-IV-55, W. F. Barr (UI), 2 males, one female; Worm creek, Franklin Co., 23-IV-55, Jewett, Gaufin, Wilson, 1 female.

Peltoperla brevis Banks

Nymphs of *Peltoperla* have been collected in most of the cold rapid streams throughout all of central and northern Idaho and have been identified as *P. brevis*. It has not been found in the Teton Drainage of S.E. Idaho but has been found commonly in N.W. Montana.

Nemoura haysi Ricker

This species is now reported in Idaho from the following locality: Cub River, Deer Cliff Inn, Franklin Co., A. R. Gaufin, IV-23-55, 5 females, 3 males.

Nemoura californica Claassen

This species is common and widespread throughout the Rocky Mt. states. Lack of records from Idaho surely indicates a lack of collecting rather than the scarcity of the insect within the state. It has now been found at the following localities: Reeder Cr., Priest Lake, Bonner Co., W. F. Barr, VII-23-62; Moon Cr., 3 mi. E. of Kellogg, Shoshone Co., S. D. Smith, IX-16-64; Garden Cr. 2 mi. W. of Challis, Custer Co., S. D. Smith, XI-11-65.

Arcynopteryx aurea Smith

One adult male was collected by Skip Smith from Laird Park, Latah Co., V-11-62. This is the only known collection from Idaho. This is a unique species known only from areas along the Pacific Coast (Fig. 9).

Isoperla fusca Needham and Claassen

One collection record for this species can be noted as follows: Lolo Pass Summit, S. D. Smith, VII-28-64.

Isoperla mormona Banks

This abundant species is probably in collections but is recorded here from the following locality: Little Cr. Rock Cr. Canyon, Twin Falls Co., T. R. Gittins, VII-16-60.

Isoperla pinta Frison

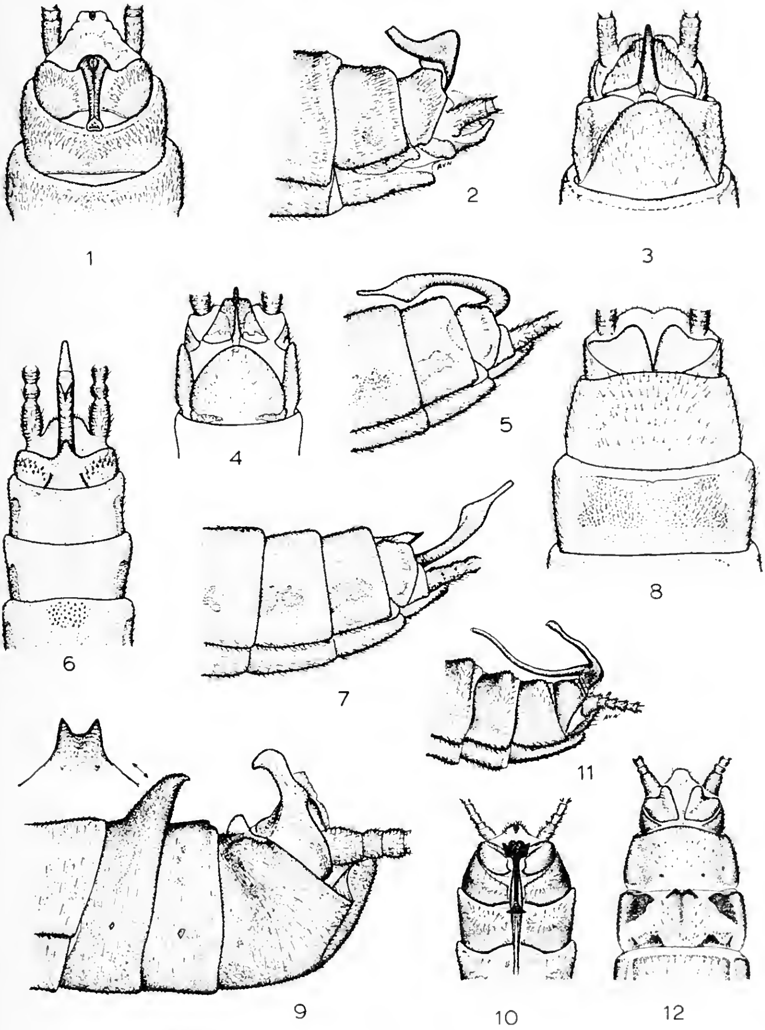
This species has recently been found to be locally common in the Rocky Mts. (Gaufin, 1964), and is here recorded for Idaho: Teton R., 4 mi. W. of Tetonia, Teton Co., W. F. Barr, VI-23-64.

Kathroperla perdita Banks

One collection record for this interesting species is as follows: S. Fk. of Coeur d'Alene R., 3 mi. E. of Mullen, Shoshone Co., A. V. Nebeker, W. C. Petty, 1 nymph. In conjunction with this, *Paraperla* cast skins have been found very commonly in many parts of the state and it appears to be one of the most common stoneflies.

Acroneuria californica Banks

This species has now been found abundantly inland from the Pacific coast as far as the continental divide and is taken rarely in the Green River drainage as far south as N. Utah.



FIGS. 1–3. Male terminalia of *Capnia nedia:* 1, dorsal view; 2, lateral view; 3, ventral view.

FIGS. 4–7. Male terminalia of *Capnia cygna:* 4, ventral view; 5, lateral view (inverted); 6, dorsal view (not inverted); 7, lateral view (not inverted).

FIG. 8. Ventral view of *Capnia cygna* female subgenital plate.

FIG. 9. Lateral view of male terminalia of *Arcynopteryx aurea.*

FIGS. 10–11. Male terminalia of *Capnia distincta:* 10, dorsal view; 11, lateral view.

FIG. 12. Ventral view of *Capnia distincta* female subgenital plate.

The following are the species known to occur in Idaho:

Peltoperla brevis Banks
Nemoura cataractae Neave
N. californica Claassen
N. flexura Claassen
N. tina Ricker
N. decepta Frison
N. delicatula Claassen
N. besametsa Ricker
N. haysi Ricker
N. cinctipes Banks
N. columbiana Claassen
N. frigida Claassen
N. oregonensis Claassen
Leutra augusta Banks
L. forcipata Frison
L. occidentalis Banks
L. sara Claassen
Megaleuctra kincaidi Frison
Capnia cygna Jewett
C. coloradensis Claassen
C. confusa Claassen
C. distincta Frison
C. gracilaria Claassen
C. lineata Hanson
C. venosa Banks
C. nedia Nebeker & Gaufin
C. zukeli Hanson
C. trava Nebeker & Gaufin
C. lemoniana Nebeker & Gaufin
Eucapnopsis brevicauda Claassen
Brachyptera occidentalis Banks
B. nigripennis Banks
B. pacifica Banks
Pteronarcella badia Hagen
Pteronarcys californica Newport
Arcynopteryx signata Hagen
A. subtruncata Hanson
A. aurea Smith
A. bradleyi Smith
A. curvata Hanson
A. parallela Frison
Isogenus tostonus Ricker
I. frontalis colubrinus Hagen
I. elongatus Hagen
I. modestus Banks
I. expansus Banks
Isoperla fulva Claassen
I. fusca Needham & Claassen
I. longiseta Banks
I. mormona Banks
I. patricia Frison
I. petersoni Needham & Christtenson
I. pinta Frison
Diura knowltoni Frison
Kathroperla perdita Banks
Paraperla frontalis Banks
Utaperla sopladora Ricker
Alloperla autumna Hoppe
A. medveda Ricker
A. serrata Needham & Claassen
A. severa Hagen
A. lineosa Banks
A. pallidula Banks
A. albertensis Needham & Claassen
A. borealis Banks
A. coloradensis Banks
A. fidelis Banks
A. fraterna Frison
A. lamba Needham & Claassen
A. diversa Frison
A. signata Banks
Acroneuria californica Banks
A. theodora Needham & Claassen
A. pacifica Banks
Claassenia sabulosa Banks

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The Status of Pezotettix bohemani Stål (Orthoptera: Acrididae), with Designation of a Lectotype and Restriction of the Type Locality

Gordon Alexander, Department of Biology, University of Colorado

In his paper on the Orthoptera of Colorado, Hebard (1929) suggested that a southern form of the *Melanoplus dodgei* complex be recognized as a distinct subspecies of *M. dodgei*. He used Stål's name *bohemani* (*Pezotettix bohemani*—though he erroneously referred to it as *P*[*odisma*] *bohemani*), stating that "Comparison of large series before us from the mountains of southern Colorado and northern New Mexico with the description of *bohemani* and paratypes of *altitudinum* convinces us that *bohemani* is a southern race of *dodgei*, with *altitudinum* a synonym. Scudder had placed *bohemani* as a synonym of *dodgei*." (The reference to altitudinum is to *Pezotettix altitudinum* Scudder (1879), which was described from northern New Mexico and southern Colorado.) Later, Hebard (1935) stated that he had decided, on the basis of examination of concealed genitalia, that *M. bohemani* was a species distinct from *M. dodgei*.

When I examined Stål's description (1878) I found nothing to indicate that his specimens came from southern Colorado, nor, in fact, that they corresponded with specimens of the *dodgei* group from southern Colorado. The complete description follows: "*P. Bohemani* Stål.—*P. frigido* simillimus et maxime affinis, differt autem magnitudine minore, genis minus tumescentibus, elytris alisque nonnihil brevioribus, cercis marium angustioribus, segmenti ventrali ultimo marium apice macula parva rotundata nigra notato. ♂♀ Long. 14–21 mill. Patria: Colorado. (Mus. Holm.)"

Specimens of *M. dodgei* do indeed have somewhat shorter tegmina and narrower cerci than does *Pezotettix frigido* Boheman, which is *Bohemanella frigida* as used by Harz (1957) or *Melanoplus frigidus* as used by Bei-Bienko and Mishchenko (1963 and earlier)—the only species of *Melanoplus* in the Old World as recognized by Bei-Bienko and Mishchenko. The black spot on the last ventral segment is an individual variation, and it is not "apical" in Stål's specimen referred to later in this paper. The only significant feature of Stål's description is in the measurements, these suggesting extremely small specimens. Specimens from the populations to which Hebard applied the name *bohemani,* even those from alpine areas, are typically larger.

My examination of Stål's description suggested to me that Scudder's synonymy was probably correct. Whereas Hebard had apparently not seen any of Stål's types, Scudder had. In his synonymy of *Podisma dodgei* (Thomas), Scudder wrote (1897): "By the kindness of Doctor Aurivillius, of Stockholm, I have received one of the type specimens of Stål's *Pezotettix bohemani,* and been able to compare it with the types of the other nominal species mentioned in the synonymy."

Hebard's comments (1935) about differences in the genitalia were not accompanied or followed by descriptions. In 1950, Fehlmann reported on a comparison of the internal genitalia of males from southern Colorado populations with those from the type locality of *Melanoplus dodgei* (Thomas), which is Pikes Peak, concluding that the variations within each population were as great as the differences between the Pikes Peak population and those from further south. Our assumption is that the differences Hebard found were individual variations.

With the use of the name *bohemani* in this apparent state of confusion, I asked Dr. Harold Grant if he would, on his recent trip to Stockholm, look for Stål's types of *Pezotettix bohemani*. They were in the Riksmuseum, in excellent condition. Through the courtesy of Dr. Erik Kjellander, three syntypes, one male and two females, were sent me for examination. An examination of them proved to be critical to a solution of the problem, for as soon as I saw them I realized that they were from an alpine area but were not typical of "southern" Colorado populations.

Each specimen bears, in addition to the Riksmuseum label and number, a locality label with the one word "Colorado," and a label stating that the specimen is a syntype of *Pezotettix behemani* Stål. The male, however, has an additional label below that of the locality, bearing the one word "Morrison." This almost certainly refers to Herbert Knowles Morrison, who collected insects in Colorado in the 1870's and sent specimens to specialists in Europe as well as America. We have no definite information on Morrison's itinerary, but I am indebted to Mr. F. Martin Brown (several letters, 1965) for information on the year the specimens were obtained and their possible source. He wrote that Morrison's only visit to Colorado for which he had concrete evidence was in 1877. On the basis of 140-odd species of butterflies collected by Morrison, Mr. Brown wrote, "it is possible to say that he collected west from Pueblo into the Wet Mountains around Rosita and probably south to Greenhorn Mt. There is no evidence that he visited Pikes Peak, although he may have. There is no evidence that he collected in alpine areas." These last comments were in response to my statement that the specimens appeared to have come from the alpine areas on Pikes Peak. Mr. Brown suggested, however, that the specimens may have been given Morrison by H. W. Nash, an entomological collector in Pueblo who wandered all over the mountains, had collected on Pikes Peak, and was quite generous in giving away his specimens.

The problem of restricting a type locality is easier in this group than with many insects. Members of the *dodgei* complex are brachypterous, and there is little gene flow between populations from different sections of the mountains. Populations from alpine areas that are isolated from each other by intervening lower elevations are phenotypically distinct. Thus, a comparison of Stål's syntypes with specimens from different populations in Colorado has given us a clue to the population represented by Stål's series.

Fortunately, through collections made in 1949 by Dr. H. A. Fehlmann, I have had available for comparison large series of specimens from the alpine areas where Morrison might have collected and where Hebard may have thought the type series was collected—Greenhorn Mountain and the Sangre de Cristo Range, west of the West Mountain Valley. The syntypes of *Pezotettix bohemani* differ from members of these populations in several respects. They are slightly smaller in overall size, the hind femora are definitely smaller in proportion to general body size, the tegmina are relatively shorter, and the hind femora in all populations from southern Colorado (south and southwest of Pikes Peak) are dark red in a broad ventral band while the syntypes are greenish yellow in the same region with only a trace of red along the ventral edge. The dark red in southern Colorado populations varies between Ridgway's (1912) coral red and jasper red; it may be as dark as pompean red in specimens from southwestern Colorado. Femur color is similar in the syntypes, the Pikes Peak population, and in populations from further north, but only the Pikes Peak population agrees in both size and color with Stål's syntypes. These data, for males, are summarized in Table 1. Though not here given in detail for females, these differences are as marked in females as in males. And in those respects in which comparison can be made, the male used by Stål closely resembles the type of *Caloptenus Dodgei* Thomas (1871), which is in the U. S. National

TABLE 1. Extremes of Measurements of Males from Various Colorado Populations of *Melanoplus dodgei* (Thomas) Compared with the Same Measurements from the Male Lectotype of *Pezotettix bohemani* Stål.

All measurements are in millimeters, made to the nearest 0.1 mm. under 8× magnification. (Each set of measurements from a population is based on five specimens *selected* from the series available, to include the two largest and two smallest as determined by visual inspection, hence no averages are used.) The alpine populations came from the highest elevations of *M. dodgei* populations in each area; the differences in altitude are not significant.

	Total Length	Pronotum		Hind Femur		Tegmen Length	Color Lower Part Hind Femur
		Length	Width	Length	Width		
Pezotettix bohemani Stål, lectotype	14.7	3.6	2.4	8.4	2.5	3.9	Greenish yellow
Pikes Peak, 12,500′–13,000′	13.5–16.0	3.5–4.0	2.4–2.8	8.3–9.0	2.4–2.7	2.8–4.4	Greenish yellow
Greenhorn Mtn., 12,300′	15.8–18.1	3.7–4.4	2.6–2.8	9.1–9.9	2.6–2.9	3.5–5.0	Deep red
Sangre de Cristo, Horseshoe Lake, 12,400′	15.6–17.9	3.9–4.6	2.6–2.7	9.0–10.2	2.6–3.1	3.5–4.9	Deep red
Sangre de Cristo, Trinchera Peak, 12,300′	16.1–17.8	4.0–4.5	2.6–2.8	9.3–10.6	2.8–2.9	4.0–5.5	Deep red
Front Range, Goliath Peak, 12,100′	15.2–17.9	3.8–4.1	2.5–2.7	8.9–9.8	2.6–2.8	4.3–4.8	Greenish yellow
Front Range Foothills, near Boulder, 6,700′	16.6–24.4	4.2–5.1	2.8–3.1	9.6–10.3	2.6–3.3	4.6–6.8	Buffy yellow

Museum, and which, through the courtesy of Dr. Ashley B. Gurney, I examined and made scale drawings of some time ago. Thomas's type is fragmentary and in a Riker mount, but the head and pronotum, part of the abdomen (including the terminal segments), and one hind leg have been preserved.

On the basis of comparison of three of Stål's syntypes with populations of the *Melanoplus dodgei* complex from different parts of Colorado, and from what we can surmise of the activity of the probable collector, I wish to restrict the type locality of *Pezotettix bohemani* Stål to the alpine area above 12,000 feet in altitude on Pikes Peak, Colorado. (On the basis of Thomas's description of *Caloptenus Dodgei* we might conclude that the type Thomas used came from approximately 10,000 feet, as this is the elevation he mentioned, but this elevation is below timber line and probably was an error.) *Pezotettix bohemani* Stål is a synonym of *Melanoplus dodgei* (Thomas), and the type specimens of both came from the same locality.

I wish to designate the male syntype that has been the principal basis of this comparison as the lectotype of *Pezotettix bohemani* Stål. This specimen, which is in the Riksmuseum, Stockholm, bore the following labels when I received it: Colorado/Morrison/168 [over] 65/Riksmuseum Stockholm/ Syn-

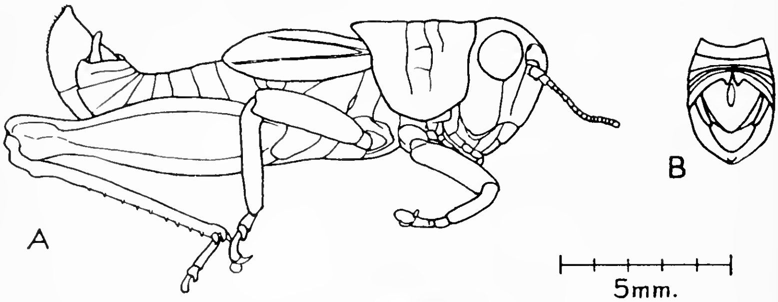

FIG. 1. Lectotype of *Pezotettix bohemani* Stål. A. Side view. (The terminal portion of the hind tarsus is missing.) B. Dorsal view of last abdominal segments.

type *Pezotettix bohemani* Stål. It now bears the additional label: lectotype *Pezotettix bohemani* Stål designated Alexander 1965. It is illustrated in Fig. 1. The female syntypes I examined bear the same sequence of labels, with the exception that neither bears the name "Morrison." Their numbers are 169 [over] 65 and 170 [over] 65. I am particularly grateful to Drs. Grant and Kjellander for their part in making possible my examination of these specimens.

Since *Pezotettix bohemani* Stål is based on a series of specimens from the type locality of *Melanoplus dodgei* (Thomas), a synonym, its name is not available for the northern form of *M. dodgei*. If this southern form merits recognition by name, such a name may be available in Scudder's *Pezotettix altitudinum* (1879). (Scudder's 1897 description emphasizes the deep red color of the lower portion of the hind femur, a feature I have commented upon.) Before a final decision is reached on the forms of *M. dodgei,* however, a thorough investigation of populations from New Mexico to Canada should be carried out in as much detail as the recent studies by Van Horn (1965) on populations of *M. dodgei* in the Front Range of the Colorado Rockies.

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Distribution of the Genus Sphecomyia Latreille (Diptera: Syrphidae)

KENNETH E. WEISMAN, Department of Biological Sciences, Western Illinois University, Macomb, Illinois

This paper, the third part in a revisionary study of the syrphid genus *Sphecomyia*, brings together available information and presents new data on the distribution of the genus.

I am indebted to the following institutions and individual for the generous loan of specimens used throughout this study. The abbreviations used in the "specimens examined" data are:

United States National Museum, USNM; Ohio State University, OSU; Oregon State University, OrSU; University of California at Berkeley, UCB; University of California at Davis, UCD; University of Kansas, UK; University of British Columbia, UBC; California Academy of Science, CAS; Canadian National Collection, CNC; University of Alberta, UA; Zoological Museum, Leningrad, ZML; and personal collection of Y. Sedman, YS.

The genus is limited to the Holarctic Region. *S. vittata, S. brevicornis, S. columbiana, S. pattonii, S. dyari, S. occidentalis, S. nasica,* and *S. fusca* are confined to the Nearctic Region while *S. vespiformis* is Palearctic.

Specimens have been recorded as collected on *Prunus gracillis, Heracleum maximum, Heracleum lanatum,* and *Vaccinium parviflorus* and at elevations between 4,000 and 6,000 feet. The records are from April through September.

Sphecomyia vittata (Wiedemann), 1830. Fig. 1.

TYPE LOCALITY: "Vaterland?" (Wiedemann, 1830), or "Georgien" (Roder, 1879). Type deposited, "Im Wiener Musseum" (Wiedemann, 1830).

RECORDS: Carolina (Latreille, 1825); Georgia (Wiedemann, 1830); Nebraska (Hunter, 1869); Colorado, New York, New Hampshire, Virginia (Osten-Sacken, 1877); Minnesota, Connecticut (Williston, 1886).

New Records: Canada; Alberta, British Columbia, Quebec. United States; Delaware. Indiana, Massachusetts, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas.

Specimens Examined: British Columbia: 1 ♀, Soda Creek, UBC. *Quebec:* 1 ♀, Montreal Is., USNM. *Alberta:* 1 ♀, Sundance, UA. *Virginia:* 2 ♂♂, 1 ♀, Falls Church; 1 ♂, Glencarlyn, USNM. *New York:* 2 ♂♂ 3 ♀♀, Paterson, OrSU; 1 ♀, Essex Co., USNM. *Michigan:* 1 ♂, 1 ♀, Midland Co., YS; 1 ♀, Newaygo Co., YS. *New Hampshire:* 1 ♂, 1 ♀, Jeffrey Co., UCD, USNM. *North Carolina:* 1 ♂, Highlands, USNM. *New Jersey:* 1 ♂, Malaga, USNM. *Oklahoma:* 1 ♂, 2 ♀♀, Dover, UK. *Wisconsin:* 1 ♂, Land O' Lakes, personal collection. *Indiana:* 1 ♀, Brown Co., USNM. *Pennsylvania:* 1 ♀, Collingdale, USNM; 1 ♀, Montag Co., UK. *Connecticut:* 1 ♀, Stamford, USNM. *Massachusetts:* 1 ♀, Forest Hills; 1 ♀, Petersham, USNM. *Texas:* 1 ♀, Necogd Co., UK. *Ohio:* 2 ♀♀, Hocking; 1 ♀, Ira, OSU.

Sphecomyia vespiformis (Gorski), 1852. Fig. 2.

Type Locality: "Lithuaniae . . ." (Gorski, 1852). Type deposited, "Musaeo berolinensi . . ." (Gorski, 1852).

Records: Lithuania (Gorski, 1852); Siberia, Norway (Schiner, 1857); Sweden (Osten-Sacken, 1876); Finland (Roder, 1879); Leningrad, Novgorod, Jaroslavl, Moscow, Kaluga, Mogilev Oblasts, Baltic Coastal Area, Middle belt of Western Europe (Stackelberg, 1958).

Roder (1879) incorrectly declared *S. vespiformis* synonymous with *S. vittata.* Therefore, the distributional records of *S. vittata* in the Palearctic Region are actually those of *S. vespiformis.* There is no doubt that the two species are very close phylogenetically in spite of their geographical separation.

Specimens Examined: *U.S.S.R.,* 1 ♂, 1 ♀, Leningrad, CNC. 1 ♂, 1 ♀, Berdestsino, ZML.

Sphecomyia brevicornis Osten-Sacken, 1877. Fig. 3.

Type Locality: Webber Lake, Sierra County, California. Type deposited, Museum of Comparative Zoology, Cambridge.

Records: California (Osten-Sacken, 1877); British Columbia (Osburn, 1908); Oregon (Shannon, 1925).

New Records: United States: Washington, Idaho.

Specimens Examined: *British Columbia:* 1 ♂, Robson, UBC; 2 ♂♂, Langley, UBC; 2 ♂♂, Saanich Dist., UBC. *Oregon:* 1 ♂, 1 ♀, Hood River, UBC. *Washington:* 1 ♂, Puyalup, OrSU; 1 ♀, Blue Mts., USNM. *California:* 1 ♂, Crystal Lake, UBC; 1 ♂, Stevens Creek, UCB; 1 ♂, Yuba Pass, UCB; 1 ♂, Walnut Creek, OrSU; 1 ♂, Camp Angelus, USNM; 1 ♂, Dutch Flat, UCD; 1 ♀, Mono Co., UCB; 1 ♀ Sentinel Dome, UCB. *Idaho:* 15 ♂♂, 2 ♀♀, Moscow Mt., USNM, UK, UCD.

Sphecomyia columbiana Vockeroth, 1965. Fig. 4.

Type Locality: Thirty-two miles S.W. of Terrace, British Columbia. Type deposited, Canadian National Collection. Ottawa.

Record: British Columbia (Vockeroth, 1965).

New Records: United States: Washington, Idaho.

Specimens Examined: *British Columbia:* Paratypes #8463, 2 ♂♂, 2 ♀♀, 32 miles S.W. of Terrace, CNC. *Washington:* 1 ♂, Walla Walla, USNM. *Idaho:* 1 ♀, Coolin, Priest Lake, CAS.

Sphecomyia pattonii Williston, 1882. Fig. 5.

Type Locality: Washington Territory. Type deposited, U. S. National Museum.

Records: Washington Territory (Williston, 1882); Oregon, Idaho (Shannon, 1925); Central British Columbia south to Idaho and California (Vockeroth, 1965).

New Record: United States: Montana.

Specimens Examined: *British Columbia:* 1 ♂, 1 ♀, Nanaimo, UK, USNM; 1 ♀, Cabriora, OSU. *Idaho:* 6 ♂♂, 3 ♀♀, Moscow Mt., USNM, UK, OrSU. *Washington:* 6 ♂♂, Mt. Rainier, USNM, OrSU; 1 ♂, Colokum Pass, UK; 2 ♂♂, North Puyallup, OrSU; 1 ♂, Blue Mt., USNM; 1 ♀, Signal Peak, OrSU. *Oregon:* 1 ♂, Linn Co.; 1 ♂, Three Sisters; 2 ♂♂, 1 ♀, Klamath Co.; 1 ♂, 1 ♀, Crater Lake; 1 ♂, Mt. Jefferson; 1 ♂, Duffy Prairie; 1 ♂, Mary's Peak; 1 ♂, 1 ♀, Crater Lake; 1 ♂, Parkdale; 1 ♀, Deschutes Co.; 1 ♀, Grant Co.; 1 ♀, Crescent Lake; all OrSU. *Montana:* 1 ♂, Missoula, UCD. *California:* 2 ♂♂, Sonoma Co., UCD; 1 ♂, Humboldt Co., OSU; 1 ♀, Eldorado Co., UK; 1 ♀, Walnut Creek, USNM; 1 ♀, Napa, UCD.

Sphecomyia dyari Shannon, 1925. Fig. 6.

Type Locality: Gold Lake Camp, Plumas County, California. Type deposited, U. S. National Museum.

Record: California (Shannon, 1925).

New Records: United States: Washington, Oregon, Nevada.

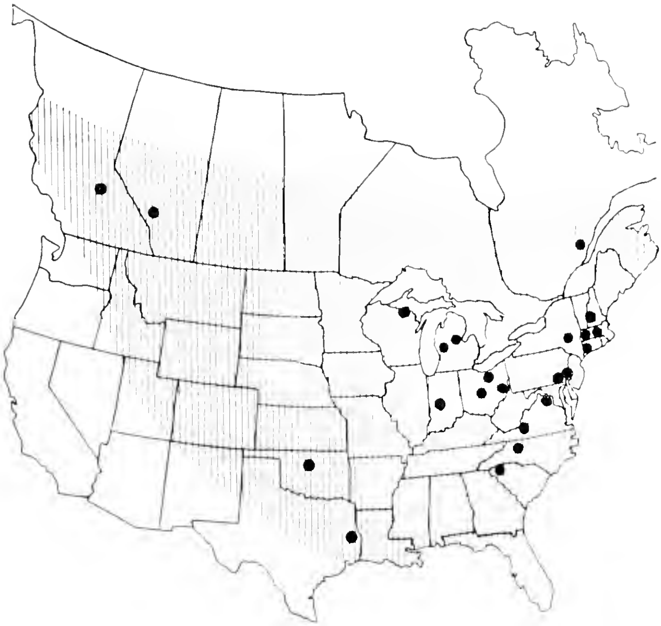
Specimens Examined: *Washington:* 1 ♀, Mt. Rainier, USNM; 1 ♀, Walla Walla, USNM. *Oregon:* 1 ♂, 1 ♀, Talent, OrSU; 1 ♂, 2 ♀♀, Crater Lake, OrSU; 1 ♀, Lake of the Woods, UCD. *California:* 2 ♂♂, 2 ♀♀, Camp Baldy, UCD, UCB; 8 ♂♂, 5 ♀♀, San Bernardino, UCD; 2 ♂, Chester, OSU; 1 ♂, Yosemite, UCB; 1 ♂, 2 ♀♀, Tahoe, UCB; 2 ♂♂, Woods Lake, UCD; 1 ♂, 1 ♀, Nevada Co., UCD; 1 ♀, Modoc Co., UCB; 1 ♀, Santa Cruz Mts., USNM; 1 ♀, Ventura, UK; 1 ♀, Crystal Lake, UCB; 1 ♀, Kern Co., UCB; 1 ♀, Lassen Co., UCD; 1 ♀, Lake Co., UCD; 1 ♀, Yolo Co., UCD; 1 ♀, Amardo Co., UCD; 1 ♀, Shasta Co., UCD.

Sphecomyia occidentalis Osburn, 1908. Fig. 1.

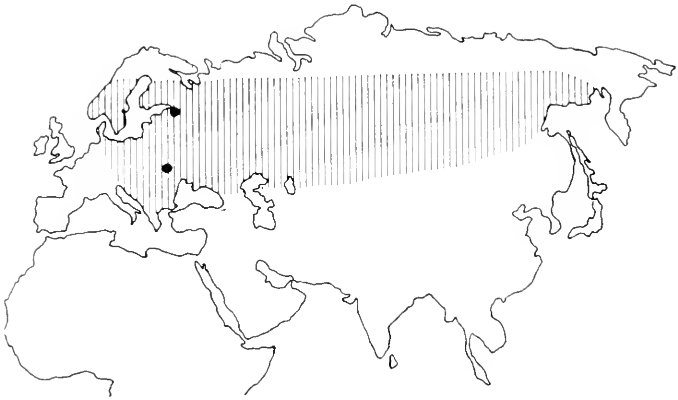
Type Locality: Vancouver, British Columbia. Type deposited, Department of Zoology and Entomology, Ohio State University.

Records: British Columbia (Osburn, 1904); Washington (Osburn, 1908); Idaho (Shannon, 1925).

Specimens Examined: *British Columbia:* Cotype, 1 ♂, Mission, USNM; 1 ♀, Bakerville, UBC. *Washington:* 3 ♂♂, Olympia, OrSU; 3 ♂♂, 3 ♀♀, Mt. Rainier, USNM, OSU, OrSU; 1 ♂, Mt. Steel, OSU; 1 ♂, Aberdeen, OrSU; 1 ♀, Baker Mt., UK. *Idaho:* 1 ♂, Moscow Mt., USNM.



1. S. vittata



2. S. vespiformis

Sphecomyia nasica Osburn, 1908. Fig. 8.

Type Locality: Hope Mts., British Columbia. Type deposited, Department of Zoology and Entomology, Ohio State University.

3. S. brevicornis 4. S. columbiana 5. S. pattonii 6. S. dyari

7. S. occidentalis 8. S. nasica 9. S. fusca

Figs. 1–9. Distribution of *Sphecomyia* spp.

Solid circles indicate localities represented by specimens examined during this study; hatching indicates previous distribution records and presumed range of the species.

Records: British Columbia (Osburn, 1908); Oregon, Washington (Shannon, 1925).

Specimens Examined: Washington: 4 ♂♂, 2 ♀♀, Mt. Rainier, UCD; 1 ♂, 1 ♀, Mt. Jefferson, UCD, OrSU; 1 ♀, American River. *Oregon:* 1 ♂, Mary's Peak, OrSU; 1 ♀, Mt. Hood, OrSU.

Sphecomyia fusca Weisman, 1964. Fig. 9.

Type Locality: Gold Lake, Sierra County, California. Type deposited, Department of Entomology, University of California at Davis.

Record: California (Weisman, 1964).

Specimens Examined: *California:* Holotype, Sierra Co., Gold Lake; Allotype, Nevada Co., near Hobart Mills; Paratypes, 4 ♂♂, 3 ♀♀, Nevada Co., all UCD.

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Vol. LXXVII MARCH, 1966 No. 3

A New Papilio from the Mojave Desert of California (Lepidoptera: Papilionidae)

John F. Emmel and Thomas C. Emmel, Department of Biological Sciences, Stanford University, Stanford, California 94305

In the vast arid reaches of the Mojave Desert of California, isolated mountain ranges support ecological islands of Upper Sonoran Zone plants and animals. Many of these organisms have been isolated for a sufficiently long time to have diverged from relatives in the main Sierra Nevada or Coast Ranges, some becoming endemic species. In the Providence Mountains of the eastern Mojave, a new *Papilio* butterfly was discovered several years ago and intensive field work in 1964 and 1965 has made possible the acquisition of a series of specimens, as well as a knowledge of the life history and foodplant.

The new *Papilio* seems referable to the *Papilio indra* Reakirt unit within the *Papilio machaon* complex, and is being named at this time as a subspecies of this species. It is evident from our studies, however, that evolutionary divergence has progressed to a remarkable degree within the group of "subspecies" ascribed to *Papilio indra,* and it may be necessary to change this assesment in the future.

Papilio indra martini new subspecies

Holotype, male. Expanse, 66 mm. Forewing length, 39 mm. Length of tail, 6 mm.

Primaries, superior surface: Dull black, with a complete submarginal series and a complete post-median series of cream-colored spots. All of these spots are less developed than in typical *indra,* and are clouded by black scaling. The post-median spots are arrow-shaped, with the apices made indistinct by dense black scaling; the band formed by these spots bends outward near the inner margin.

Secondaries, superior surface: Dull black, with a submarginal series of cream crescentic spots slightly less developed than in *indra.* The row of blue spots is more prominent than in typical

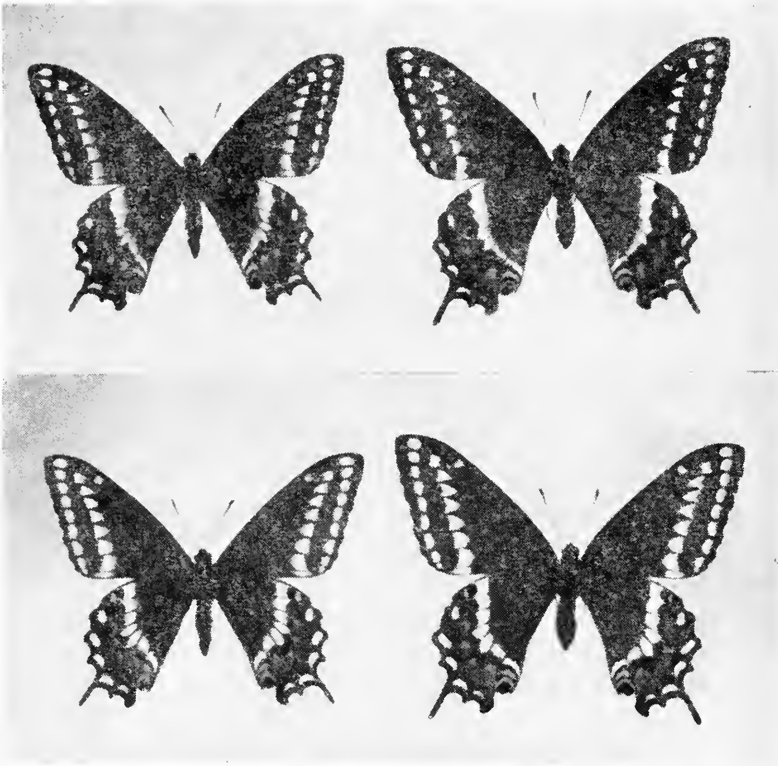

FIG. 1. *Papilio indra martini* Emmel and Emmel, new subspecies. Holotype (male) on left, and allotype (female) on right; upper surfaces above, lower surfaces below.

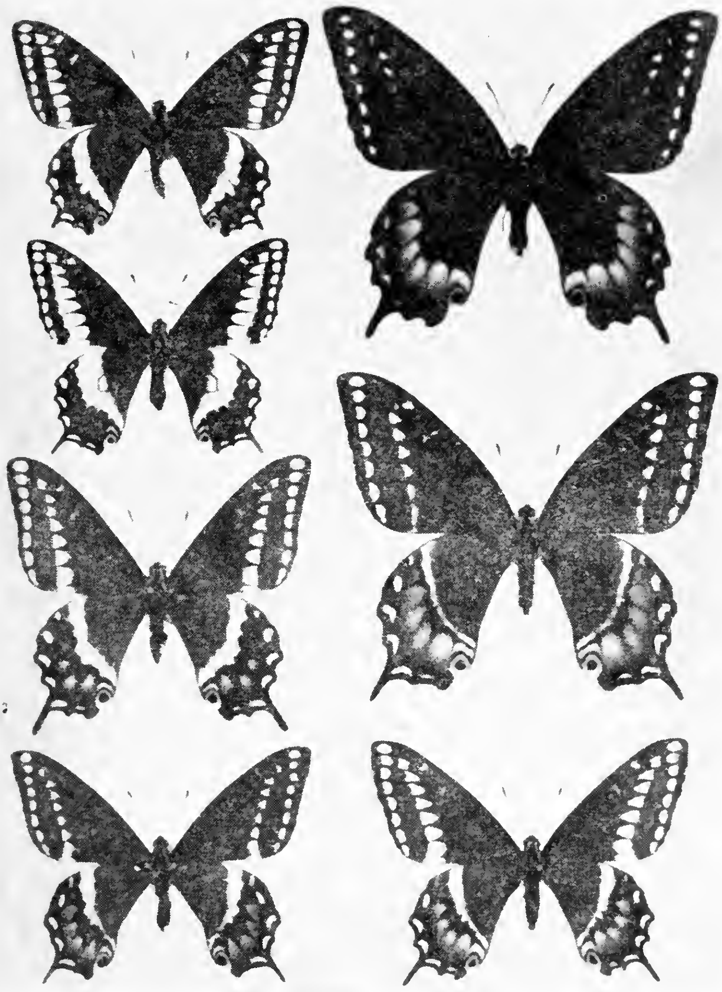

Fig. 2. The six subspecies in the *Papilio indra* group.

Left column: Top, *P. i. indra* male (Six Mile Canyon, Boulder Co., Colo., June 10, 1962). Second, *P. i. fordi* female (Calico Mts., San Bernardino Co., Calif., March 8, 1962). Third, *P. i. pergamus* male (Tecate Peak, San Diego Co., Calif., April 10, 1964). Fourth, *P. i. martini* female, Paratype No. 1.

Right column: Top, *P. i. kaibabensis* female (Roaring Springs, North Rim, Grand Canyon Nat. Park, Ariz., July 4, 1965, ex larva). Second, *P. i. minori* female (Black Ridge, Mesa Co., Colo., May 24, 1964, ex ovum). Third, *P. i. martini* female, Paratype No. 4.

The two paratypes of *P. i. martini* represent the extremes of forewing pattern variation within the type series.

indra, approximately intermediate between *indra* and *P. i. minori.* The orange-red anal spot is mostly filled by the central black spot; only the area lateral to and anterior to this black spot is orange-red; the area just posterior to it is cream. The post-median series of cream spots forms a band slightly less developed than in *indra.* Near the costal margin, the band is widest, narrowing posteriorly. Just posterior to the outer edge of the cell, the band bends inward, becoming an irregular line. Both the submarginal and post-median series of spots are slightly clouded by black scaling.

Primaries, inferior surface: Very similar to superior surface, except that the spots are slightly larger, and their color is lighter, being a cream-white.

Secondaries, inferior surface: Similar to superior surface, but with the submarginal spots and the posterior half of the post-median series slightly larger, and all spots lighter in color, being cream-white. The submarginal spot nearest the costal margin is largely light red-orange. The anal spot has a larger area of red-orange than it does on the superior surface.

Head and thorax as in typical *P. indra.* Abdomen, *entirely* black; in specimens of other subspecies of the *P. indra* group, there is nearly always a lateral yellow area of varying size just anterior to the claspers.

Allotype, female. Expanse, 72 mm. Forewing length, 43 mm. Length of tail, 7 mm.

Primaries, superior surface: Dull black, with same cream-colored markings as for male.

Secondaries, superior surface: Dull black, markings same as for male. The submarginal spot nearest the costal margin is obliterated by black scaling.

Primaries, inferior surface: Same as for male.

Secondaries, inferior surface: Same as for male, except that the second submarginal spot is tinged with orange, and the black central spot of the anal spot is larger than on the superior surface.

Head, thorax, and abdomen same as in male.

Holotype male: From an egg taken on *Lomatium parryi*

(Wats.) Macbr., on May 9, 1964, in Gilroy Canyon, elevation 5,600 feet, Providence Mountains, San Bernardino County, CALIFORNIA; reared on the same plant. Emerged July 8, 1964. Leg. John F. Emmel and Thomas C. Emmel. Gilroy Canyon is located approximately midway between Mitchell Caverns State Park and the Bonanza King Mine.

Allotype female: Same locality, date, and collectors as for holotype; emerged October 10, 1964.

Paratypes: 2 males and 7 females, Nos. 1–7 having been taken by the authors as ova on *Lomatium parryi* on May 9, 1964, at the type locality, and reared on the same plant.

Paratype No. 1: Emgd. Oct. 21, 1964. Deposited in Los Angeles Co. Museum. Paratype No. 2: Emgd. Oct. 21, 1964. Deposited in collection of John F. Emmel and Thomas C. Emmel. Paratype No. 3: Emgd. Jan. 17, 1965. Deposited in Los Angeles Co. Museum. Paratype No. 4: Emgd. Jan. 21, 1965. Deposited in collection of J. F. Emmel and T. C. Emmel. Paratype No. 5: Emgd. Mar. 17, 1965. Deposited in Los Angeles Co. Museum. Paratype No. 6: Emgd. Feb. 4, 1965. Deposited in Los Angeles Co. Museum. Paratype No. 7: Emgd. Oct. 6, 1964. Deposited in collection of J. F. Emmel and T. C. Emmel. Paratype No. 8: Coll. May 9, 1964, in canyon above Bonanza King Mine, elevation 5,650 fet, Providence Mts., Calif., leg. John F. Emmel. Deposited in collection of J. F. Emmel and T. C. Emmel. Paratype No. 9: Coll. April 5, 1934, Providence Mts., Calif., no collector. Deposited in Los Angeles Co. Museum.

The holotype and allotype will be deposited in the collection of the Los Angeles County Museum. A pair of topotypes will be deposited in the American Museum of Natural History at a later date.

We take great pleasure in naming this subspecies after our close friend Lloyd M. Martin, Associate Curator of Entomology at the Los Angeles County Museum, who has given unlimited aid and encouragement in our studies of the *Papilio machaon* complex and other Rhopalocera.

There are now six named subspecies of *Papilio indra,* including the typical form. The following summarizes their distinguishing characteristics.

In typical *indra* (Reakirt, 1866) the outstanding features are the small size, stubby wings, very short tails, and medium-width yellow limbal band. Range: Northern half of the states of California, Nevada, and Utah, and north-central Colorado, north to the Canadian border, in mountain areas.

P. i. pergamus (Edwards, 1874) is similar to *indra* in markings, but is larger, and has long tails and more angular wings. Range: Mountain ranges of southwestern California, from the Santa Barbara Mountains south to the mountains of northern Baja California.

P. i. minori (Cross, 1937) is generally larger than the previous two, and has a narrower limbal band, in some specimens obsolescent; there is greater development of the blue areas on the secondaries; tails are long. Range: Extreme western Colorado, southeastern Utah, northwestern New Mexico (J. F. Emmel, unpublished).

P. i. kaibabensis (Bauer, 1955) is similar to *minori,* but with the limbal band absent or reduced to a few spots; blue areas on secondaries are very prominent; tails are long. Range: Grand Canyon region of Arizona.

P. i. fordi (Comstock and Martin, 1955) has the greatest development of the light yellow markings, exhibiting a wide limbal band; smaller than typical *indra,* but with longer tails. Range: Mountain ranges of western Mojave Desert and northwestern Colorado Desert (J. F. Emmel, unpublished).

P. i. martini is slightly larger than typical *indra,* and has longer tails; the ground color is a duller black than in other subspecies; the limbal band is narrower than in *indra,* and on the secondaries it tapers posteriorly, and as it passes the outer edge of the cell, it bends inward, becoming a thin, irregular line—this pattern is unique to this subspecies, and may be used as an immediate distinguishing feature; the yellow markings are paler than in any other subspecies, and are often clouded by black scales; the abdomen is entirely black in nearly all specimens, the exceptions showing only a trace of yellow scales laterally—in all other subspecies yellow markings are present on the abdomen. Important character differences are also found in the early stages, which will be described in a separate paper. Range: Providence Mountains, eastern Mojave Desert.

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Byturidae and Biphyllidae (Coleoptera), Two Primitive Families of the Heteromera not the Clavicornia—A New Interpretation of some Old Observations [1]

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There is no doubt that the Byturidae (fruitworms) and the Biphyllidae (false skin-beetles) are families of the Cucujoidea. The superfamily includes a primitive section called Clavicornia from which seems to have evolved a derivative section called

[1] Senior author's paper number 47 on the Coleoptera.

[2] The research was supported by a Postdoctorate Fellowship awarded to the senior author by the National Research Council of Canada.

Heteromera. The only suggestion we know of regarding the origin of the Heteromera is Crowson's view that the Heteromera probably evolved from a fairly primitive clavicorn type near Byturidae and Biphyllidae (Crowson, 1955: 91, and *vide* Abdullah, 1964: 16). We have critically examined the observations of Crowson (1955, 1960, and 1964), Barber (1942), Böving and Craighead (1931), Emden (1942), Peterson (1951), and Roberts (1958) and come to the definite conclusion that the two families belong to the derivative cucujoid group called Heteromera and that they are primitive within the section. In other words, the Byturidae and Biphyllidae are primitive families of the Heteromera, not of the Clavicornia. However, we agree with Crowson (1955: 84) in dismissing the suggestion of some "older authors" of a direct connection between the Melyridae (Cleroidea) and the Biphyllidae-Byturidae.

With the understanding that the Heteromera is a derivative group of the Cucujoidea and keeping in mind the principles of phyletic weighting (*vide* Cain and Harrison, 1960; Simpson, 1961; and Crowson, 1965) we examined the characters defining the Clavicornia and Heteromera in both the adult and larvae. The following report on the primitive and derivative alternatives of a character in the Heteromera seems reasonable:

1. Antenna:
Primitive—clubbed as in the Biphyllidae, Byturidae, Hemipeplidae, Tetratomidae, etc. (and many Clavicornia).
Derivative—filiform as in the Anthicidae, Meloidae, etc.

2. Front coxa:
Primitive—transverse or oval (*i.e.*, non-projecting) as in the Biphyllidae, Byturidae, Hemipeplidae, Inopeplidae, etc. (and many Clavicornia).
Derivative—projecting as in the Anthicidae, Meloidae, etc.

3. Trochanter:
Primitive—non-heteromeroid as in the Hemipeplidae (and Clavicornia).
Derivative—heteromeroid as in the Biphyllidae, Byturidae, Anthicidae, etc.

4. Tarsal formula:
Primitive—5–5–5 as in the Biphyllidae, Byturidae (and Clavicornia).
Derivative—5–5–4 as in the Hemipeplidae, Inopeplidae, Tetratomidae, Anthicidae, etc.

5. Aedeagus:
Primitive—heteromeran type as in the Biphyllidae, Byturidae and other Heteromera (with the ventral part of the tegmen altogether absent). We do not know the condition in *Hemipeplus* and *Inopeplus* but if the aedeagus is heteromeran in these genera, then we are fairly confident of our conclusion.
Derivative—inverted heteromeran type as in the Cononotidae with the tegmen ventral and median lobe dorsal (however, quite variable in the Anthicidae).

6. Abdomen:
Primitive—all visible sternites free as in the Biphyllidae, Byturidae, etc. (and Clavicornia).
Derivative—first few visible sternites connate as in the Aderidae, Nilionidae, Lagriidae, Alleculidae, Tenebrionidae, etc.

7. Larval mandible:
Primitive—prostheca present as in the Biphyllidae (Roberts, 1958: 275, fig. 47) (and most Clavicornia, *e.g.*, the Endomychidae (Peterson, 1951: 91, fig. I).
Derivative—without a true prostheca as in the Tetratomidae (Crowson, 1963: 83 and fig. 3) and with a setiferous lobe below mola as in the Byturidae (Peterson, 1951: 91, fig. O) and some Anthicidae (Emden, 1942: 259, fig. 26).

8. Larval head: median epicranial suture:
Primitive—present as in the Byturidae, Tetratomidae (Crowson, 1964: fig. 1), etc.
Derivative—absent or reduced as in the Scraptiidae (Böving and Craighead, 1931: 175, fig. A).

9. Larval tenth abdominal segment:
Primitive—present, postero-ventral and pygopod-like as in the Byturidae (Peterson, 1951: 175, fig. Q) and typical Clavicornia (Crowson, 1960: 127).

Derivative—absent; if present not pygopod-like, position ventral, transverse and with sclerotized dorsal and ventral lips as in *Mecynotarsus*, Anthicidae (Böving and Craighead, 1931: 179, fig. W); Scraptiidae (*ibid.*, 1931: 175, fig. D) and other typical Heteromera (Crowson, 1960: 127).

We believe that the facts do not support Crowson's opinion that the "5–5–4 tarsi in the male sex might well be an ancestral feature in Cucujoidea" because in those families of the Heteromera where this tarsal formula exists either the aedeagus is of the heteromeran type or the trochanters are heteromeroid and the larval mandible lacks prostheca (Crowson, 1960: 128). The presence of these essentially correlated characters defines a natural group. The discovery of *Protomeloe* Abdullah has now fairly conclusively established that the Heteromera is a natural (monophyletic) group and that the old division (Tenebrionoidea, Meloidea, Cucujoidea) is artificial, for if the Meloidae evolved from the Anthicidae or the latter from the Pyrochroidae, these families could not be placed remote from each other in a phylogenetic classification (Abdullah, 1965).

There are two major possibilities with respect to the Biphyllidae-Byturidae: *either* we place them in the Clavicornia on the basis of primitive (negative) characters shared with other Clavicornia while attributing their similarities with the Heteromera to convergence *or* we place them in the Heteromera for having evolved a number of important Heteromeran characters in both the adult and larvae which could neither be attributed to convergence nor explained on the basis of adaptations to the same special mode of life while explaining their certain structural similarities with the Clavicornia as due to ancestry, an interpretation which is consistent with the view that the Heteromera have evolved from the Clavicornia.

Crowson (1955 and 1960) has made a number of suggestions, even seemingly contradictory at times, sometimes favoring the first view and sometimes the second view yet at no time taking a clear stand on the issue. For example, here are the suggestions that the byturids are primitive Clavicornia: . . . "by the totality of their structure they are most closely allied to the more decidedly 'Clavicorn' Biphyllidae" (Crowson, 1955: 106); "Byturids are the nearest 'Clavicorn' relatives of the Heteromera" (*op. cit.* :136); the Byturidae possibly have "direct affinity" with the Protocucujidae as suggested by "the structure of the front coxae, the pseudo-tetramerous tarsi, the relatively large bisetose empodium and the angular bend in the *r-m* cross-vein (suggesting an incipient spur)" (*op. cit.:* 106); the Byturidae may be related to the Endomychidae-Cerylonidae as suggested by the wing-venation (*op. cit.:* 106, 109). Further, "the families allied to Endomychidae" are the Cerylonidae, Corylophidae, Coccinellidae, Discolomidae, Merophysiidae and Lathridiidae (Crowson, 1960: 127).

On the other hand, it could be argued that Crowson had earlier suggested that the Biphyllidae-Byturidae are more "Heteromera-like" in the "wing-venation, aedeagus, trochanters and met-endosternite" than the Cucujidae (Crowson, 1955: 103), but it could be pointed out that he also used some of these characters to link them with the Endomychidae and certain other families of the Clavicornia and since the Cucujidae is not a family of the Heteromera, this does not prove anything. Perhaps, the best indication in his writings may be obtained in the following sentence "If the Clavicornia-Heteromera division is to be employed, I think the phylogenetically soundest procedure might be to base it essentially on the structure of the aedeagus and include Byturidae and Biphyllidae in Heteromera as well as Cisidae, Mycetophagidae, Colydiidae (excluding Cerylonidae), etc." (Crowson, 1960: 127). However, it should be pointed out that in the same paper, Crowson stated, . . . it is natural to suspect the group [Cucujoidea] of being worthy of subdivision into two or more superfamilies" and "5–5–4 tarsi in the male sex might well be an ancestral feature in Cucujoidea" (*op. cit.:* 127–128). We can not imagine anything sensible or necessary in a division involving more than two superfamilies (or even two) as the old division (Tenebrionoidea, Meloidea and Cucujoidea) is undoubtedly artificial. Also, if the 5–5–4 tarsal formula is a primitive feature then the Biphyllidae-Byturidae could be mistaken for derivative Heteromera, a view which is not supported by other features of their anatomy.

Compared with the Byturidae, Biphyllidae appears to be more primitive for the larval mandible has a prostheca but lacks the post-molar setose lobe found in the Byturidae. However, in other features it resembles the Byturidae closely: the heteromeroid trochanters, the first anal vein running into the subcubital fleck (Crowson, 1955: 92, fig. 113), the byturid type of the met-endosternite and the heteromeran aedeagus-characters which merit them to be called families of the Heteromera. The resemblances with the Endomychidae or the Cerylonidae in certain characters of the wing-venation are unimportant when the differences in the other above-mentioned characters are considered.

We, therefore, transfer the Biphyllidae and Byturidae to the Heteromera from the Clavicornia and at the same time reject any suggestion of direct affinities with any other group of the Coleoptera. The two families are primitive Heteromera, and not clavicorn ancestors of the Heteromera.

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New Exotic Crane-Flies (Tipulidae: Diptera). Part XII

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The preceding part under this general title was published in Entomological News, Vol. 76 (8): 213–222. I am continuing the consideration of Oriental crane-flies belonging to the tribe Hexatomini collected by Dr. Fernand Schmid in various parts of India and have included one further species from British North Borneo.

All species discussed at this time belong to the extensive genus *Epiphragma* Osten Sacken, abundantly represented in the Oriental and Neotropical Regions, with fewer species throughout the Holarctic. Attention is called to a neglected character to be found in the antennae where the proximal segments of the flagellum in many species are united to form a fusion-segment. The primitive number of antennal segments in the genus is 16 and the number involved in the fusion is readily determined by the number of free segments beyond. In the Indian species of

[1] Contribution from the Entomological Laboratory, University of Massachusetts.

Epiphragma the conditions obtaining are as follows. Antennae with 16 segments, with none fused: *Epiphragma* (*Epiphragma*) *dysaithria,* new species; *E.* (*E.*) *scoptes* Alexander. With 15 segments, there being two in the fusion: *E.* (*E.*) *commoptera,* new species; *E.* (*E.*) *dysommata* Alexander; *E.* (*E.*) *kempi* Brunetti; *E.* (*E.*) *vicina* Brunetti. With 14 segments, there being three in the fusion: *E.* (*E.*) *caligata* Alexander; *E.* (*E.*) *rhododendri,* new species. With 13 segments, there being four in the fusion: *E.* (*E.*) *perocellata,* new species. The condition of the antennae is unknown in *E.* (*E.*) *adoxa* Alexander and *E.* (*E.*) *ornatipennis* (Brunetti).

Epiphragma (Epiphragma) commoptera, new species

Mesonotal praescutum with a pattern of light and dark brown, yellow pollinose; antennae black, fusion-segment light yellow, of two articles; legs yellow, in male femora virtually unpatterned; wings whitened, with a dark pattern, the areas solidly dark brown; abdominal tergites dark brown, brownish black on sides, with a conspicuous silvery area on posterior half; male hypopygium with tergal lobes very low; dististyles slender.

♂. Length about 9.5 mm; wing 9.8 mm; antenna about 2.7 mm.

♀. Length about 10 mm; wing 10 mm.

Rostrum dark brown; palpi black. Antennae 15-segmented, the fusion-segment of two articles; black, the fusion-segment light yellow, vaguely darkened at apex; terminal segment about one-half the penultimate. Head above chiefly brownish black, narrowly cinnamon brown on orbits and sides of vertex.

Pronotum dark brown. Mesonotal praescutum with confluent stripes, the long intermediate pair light cinnamon brown in front, more yellowed behind, the posterior half with four paler brown areas before the suture to form a transverse band; lateral, humeral and cephalic parts of praescutum broadly dark brown; posterior sclerites of notum chiefly dark brown, scutal lobes and mediotergite slightly gray pruinose. Pleura dark brown, more pruinose behind, variegated by slightly more brownish black areas on propleura, dorsal anepisternum, and ventral sternopleurite and pteropleurite. Halteres dark brown, extreme base of stem and apex of knob vaguely brightened. Legs with fore coxae dark brown, yellowed apically; trochanters yellow; middle and hind coxae and trochanters chiefly dark brown; remainder of legs light yellow, the femora in male virtually unpatterned, in female with a narrow very pale brown subterminal ring that is subequal to the yellow apex. Wings whitened, with a conspicuous dark pattern, all areas being solidly dark brown, without differentiated margins; basal half of wing with three major ocelliform areas in cells *R* and *M*, all interconnected and broadly reaching the border in cell *C;* beyond the cord the ocelli are scarcely evident, the dark pattern being very irregular, leaving large marginal ground areas in all cells excepting R_5; cell *2nd A* with alternating brown and white areas; veins light brown, more yellowed in the costal ground areas. Venation: *m-cu* about its own length beyond the fork of *M*.

Abdominal tergites dark brown, the sides broadly brownish black, with a conspicuous silvery gray marginal area on posterior half; sternites and hypopygium dark brown. Male hypopygium with the tergite broadly transverse, posterior border sinuously truncate, the lobes very low, separated by a small V-shaped emargination. Interbase with outer arm slender. Both dististyles unusually narrow, the inner style at midlength slightly less than twice the diameter of the outer style.

HABITAT. INDIA (Sikkim, Kumaon). *Holotype:* ♂, Nanga, Sikkim, 5,000 feet, August 3, 1959 (Fernand Schmid). *Allotopotype:* ♀, Gery, Pauri Garhwal, Kumaon, 6,890 feet, August 16, 1958 (Fernand Schmid).

Epiphragma (Epiphragma) ornatipennis (Brunetti) has the wing pattern much as in the present fly except that the darkened areas are bordered conspicuously by darker brown, especially in the costal and outer cells.

Epiphragma (Epiphragma) dysaithria, new species

Size relatively large (wing of male 12.5 mm); all antennal segments unfused; femora uniformly brownish yellow, tibiae and tarsi clearer yellow; wings whitened, with a slightly ocelliform darkened pattern, the costal areas solidly darkened; abdomen uniformly brownish black, the hypopygium more brownish yellow, the tergal lobes rounded, pale yellow.

♂. Length about 15 mm; wing 12.5 mm; antenna about 2.6 mm.

Rostrum brownish black, margined above by gray; palpi black. Antennae black, the first flagellar segment small, yellow; all flagellar segments distinct and unfused, the first about one-half longer than the second, the remaining segments progressively lengthened; verticils of outer segments very long. Head dark brown, the anterior vertex adjoining the antennae yellowed.

Pronotal scutum brown, its posterior margin and the scutellum yellowed, sides broadly blackened. Mesonotal praescutum with anterior and lateral borders broadly dark brown, more intense at the margins, humeri paler; anterior half with two intermediate brown stripes divided by a capillary black central vitta; posterior half of praescutum variegated, median area yellow, the remainder gray with narrow brown lines, the intermediate pair shorter, not reaching the suture; posterior sclerites of notum dark brown, mediotergite and anterior half of scutum gray pruinose, posterior borders of scutellum and mediotergite indistinctly blackened; pleurotergite dark brown, the center gray pruinose. Pleura brownish black, variegated by silvery, especially on the mesepisternum; dorsopleural membrane dusky. Halteres dark brown, base of stem restrictedly paler, knob uniformly darkened. Legs with coxae yellowed, banded with brown, heavier on posterior pair; trochanters yellow, darkened beneath; femora brownish yellow, unpatterned, tibiae and tarsi clearer yellow. Wings with the ground whitened, subequal to or more extensive than the darkened pattern; costal cell chiefly whitened, the dark areas between *h* and the supernumerary crossvein barely reaching costa; the dark pattern includes weak ocelli, the most distinct in cells *R* and *M*, especially over origin of *Rs*, the other areas more uniformly darkened, not margined; darkened areas in outer radial field, including the basal fourth of cell R_4, more brownish yellow, the dark pattern in the costal and stigmal regions darker brown; cell *2nd A* with three dark areas, including the base and apex; veins brown, darker in the more heavily patterned parts, yellowed in the costal interspaces, including vein *C*. Venation: Cell *1st* M_2 slightly narrower at either end than at central part; *m-cu* about one-third its length beyond fork of *M*.

Abdomen brownish black, the posterior borders of tergites very narrowly and inconspicuously yellowed, hypopygium more brownish yellow. Male hypopygium with lobes of tergite rounded, pale yellow, with abundant delicate setulae. Interbase and the terminal spine of the outer dististyle long and slender.

HABITAT. INDIA (West Bengal). *Holotype:* ♂, Lingsoka, 4,270 feet, September 9, 1959 (Fernand Schmid).

Epiphragma (Epiphragma) dysaithria is readily told from other regional members of the genus by the unfused basal segments of the antennal flagellum, the uniformly colored legs and the wing pattern. The very different *E. (E.) scoptes* Alexander, of Nepal, similarly has 16 separate antennal segments, all being uniformly darkened.

Epiphragma (Epiphragma) perocellata, new species

Allied to *rhododendri;* antennae 13-segmented, the yellow fusion-segment being comprised of four articles; femora yellow, with a vague brown subterminal ring, the tips distinctly yellowed; wings with an abundant ocelliform brown pattern, the ocelli with darker borders, including the sections in the costal cell; central ocellus of cell *2nd A* short and arcuated.

♂. Length about 11 mm; wing 10.5 mm; antenna about 2.1 mm.

Rostrum light cinnamon brown, paler on margins; palpi dark brown. Antennae shorter than in *rhododendri,* scape brown, pedicel brownish black, fusion-segment yellow, remainder of flagellum brownish black; fusion-segment elongate, comprised of four articles, the former sutures indicated beneath; all outer segments with long verticils. Head above yellow pollinose, posterior vertex and occiput with a central brown line; bristles of head black, porrect.

Pronotal scutum yellow, infuscated above, scutellum yellow. Mesonotal praescutum with four yellow pollinose discal stripes, the anterior and lateral borders broadly cinnamon brown, the margin more blackened; mid-region of praescutum with a narrow cinnamon brown stripe that ends in an acute point some distance before suture, the stripe further divided by a capillary brownish black vitta; anterior half of scutum yellow pollinose, weakly darkened near suture, posterior half dark brown; scutellum gray pruinose, parascutellum darker, sunken; postnotum gray pruinose, mediotergite behind broadly brown, pleurotergite similarly darkened, the katapleurotergite variegated with gray. Pleura patterned with gray and brownish black, the latter appearing as an interrupted longitudinal stripe extending from cervical region to the pleurotergite, with less evident darkenings on the dorsal sternopleurite which is chestnut beneath; small black areas on meron and beneath wing root. Halteres with stem yellow, knob brown, tip slightly paler. Legs with coxae and trochanters yellowed; femora yellow with a vague brown subterminal ring that is more than twice the length of the yellow apex; tibiae and tarsi yellow. Wings with the ground whitened, with a very heavy ocelliform darker pattern, including large areas on disk at and before origin of *Rs*, over the cord, outer end of cell *1st* M_2 and at fork of M_{1+2}; further more or less complete marginal ocelli at ends of longitudinal veins, in cell *2nd A* the central area shorter and more arcuated than in *rhododendri;* darkened costal sections of ocelli with paler centers, not uniformly dark brown, as in *rhododendri;* veins brown, more yellowed in the costal interspaces. Venation: Cell M_1 relatively narrow; *m-cu* about its own length beyond fork of *M*.

Abdominal tergites variegated yellow and brown, the posterior lateral areas light gray; basal sternites brownish black, succeeding segments light yellow, dark brown laterally beneath the overlapping tergites; hypopygium brownish yellow. Male hypopygium with tergal lobes very low, obtuse, their contour about the same as that of the median emargination. Outer dististyle slender, narrowed gradually to the curved apical spine; inner style a little shorter and broader than in *rhododendri*.

HABITAT. INDIA (Sikkim). *Holotype:* ♂, Kechoiperi, 5,900 feet, April 9, 1959 (Fernand Schmid).

The nearest ally of the present fly is *Epiphragma (Epiphragma) rhododendri*, new species, which differs evidently in the pattern of the legs and wings and in antennal structure, such as the nature of the fusion-segment of the flagellum.

Epiphragma (Epiphragma) rhododendri, new species

Size large (wing of male over 11 mm); antennae with 14 segments, the fusion-segment comprised of three articles; mesonotum gray, the praescutum patterned with light brown, including a conspicuous blackened central vitta, pleura brown, variegated with darker brown; femora yellow, tips broadly dark brown, with vague indications of a dark suffusion beyond mid-length, the two enclosing a more yellowed ring; wings whitened, with a very extensive brown pattern that is unusually ocelliform, including a series of broken ocelli along the posterior border; cell *1st* M_2 longer than vein M_3 beyond it; male hypopygium with the outer dististyle relatively narrow, the interbase a long spine.

♂. Length about 9.5–11 mm; wing 10.5–13 mm; antenna about 3–3.1 mm.

♀. Length about 10 mm; wing 10 mm.

Rostrum silken yellow, tufted with long yellow setae; palpi black. Antennae with scape and pedicel dark brown, fusion-segment orange, remainder of flagellum black; antennae with 14 segments, the fusion-segment elongate, including three articles; outer flagellar segments elongate, subequal to their longest verticils. Front and anterior vertex silvery yellow; posterior vertex extensively dark cinnamon brown, the genae more grayish.

Pronotum obscure yellow with three coarse transverse corrugations, the posterior one including the scutellum. Mesonotum chiefly gray, praescutum with sides and anterior third patterned with light brown, the lateral margins narrowly darkened, a very conspicuous black central stripe that ends in a point just before the suture; posterior border of mediotergite darker. Pleura brown, sparsely pruinose, variegated with darker brown areas, chiefly including the propleura, anterior dorsopleural region, anepisternum, dorsal sternopleurite and pteropleurite. Halteres with stem light brown, its base, and apex of the knob yellowed. Legs with coxae and trochanters brownish yellow; femora yellow, tips broadly dark brown, with vague indications of a broad paler brown suffusion beyond midlength, the two enclosing a clearer yellow subterminal ring; tibiae obscure yellow, tips darkened; tarsi brown. Wings with the ground whitened, very extensively patterned with darker, the markings chiefly ocelliform, in cells *R, M,* and outer radial field paler and more fulvous than the areas behind; the ocelliform pattern includes partial or broken areas in all cells along posterior border, including cell *2nd A;* cell *C* with solidly darkened brown areas, including two before the supernumerary crossvein; most of the ocelli are narrowly and vaguely margined with slightly darker brown; darkened areas of disk tending to form crossbands, the one at origin of *Rs* separated from the band at cord by a whitened ground line that is connected behind with a comparable whitened band beyond cord, the latter extending from the outer radial field backward across cell *1st* M_2 at midlength; veins light brown, darker in the heavily patterned markings. Venation: *Rs* long, spurred at origin; R_{2+3+4} long, more than twice the arcuated R_{2+3}; cell *1st* M_2 elongate, exceeding vein M_4; *m-cu* less than its length beyond the fork of *M*.

Abdominal tergites yellowish gray, conspicuously variegated by dark brown, including lateral areas on the basal rings, the posterior lateral borders light gray, not silvery as in some species of the genus; basal sternites yellowed; hypopygium brownish black. Male hypopygium with posterior border of tergite virtually truncate, with two very low submedian lobes. Outer dististyle relatively narrow, its length more than five times the greatest breadth, the tip curved into a slender spine; inner style longer, the outer half a paddlelike blade. Apical spine of interbase subequal to or slightly longer than the enlarged base, narrowed very gradually to the acute tip.

HABITAT. INDIA (Sikkim). *Holotype:* ♂, Yedang, 10,600 feet, in *Rhododendron* association, June 9, 1959 (Fernand

Schmid). *Allotopotype:* ♀, May 25, 1959. *Paratopotype:* 1 ♂, pinned with type; *paratypes:* 1 ♂, Chachu, 9,950 feet, in *Rhododendron* association; 2 ♂♂, Chateng, 8,700 feet, May 22, 1959; 2 ♂♂, Zema, 9,100 feet, June 14, 1959 (Fernand Schmid).

Epiphragma (*Epiphragma*) *rhododendri* is told most readily from other Indian species by the structure of the fusion-segment of the antennae, the broad brown femoral tips, and the unusually heavy ocelliform pattern of the wings.

Epiphragma (Epiphragma) subvicina, new species

Epiphragma (*Epiphragma*) *vicina* Edwards; Jour. Federated Malay States Mus., 17: 283; 1933; nec *Epiphragma vicina* Brunetti; Rec. Indian Mus. 15: 331–332, pl. 8, fig. 15 (wing); 1918.

♂. Length about 10 mm; wing 10.5 mm; antenna about 2 mm.

Rostrum pale fulvous; palpi black. Antennae short, dark brown, the two-segmented fusion-segment light yellow; first free flagellar segment shorter than the second, the outer two segments subequal. Head light cinnamon brown, silvery behind the antennae, posterior vertex with a narrow darker brown central line that is expanded in front.

Pronotum and pretergites yellow, posterior section of scutum more infuscated. Mesonotal praescutum with stripes cinnamon brown, the intermediate pair dark brown on posterior fourth; lateral stripes yellowed, brown on posterior half, these darkened areas forming an interrupted transverse band before the suture; humeral and lateral parts more chestnut, restrictedly patterned with darker, more intensely so on lateral borders; scutum brown, yellow pollinose adjoining the suture; scutellum brown basally, the posterior border broadly yellow; mediotergite chiefly obscure yellow, behind broadly dark brown, pleurotergite extensively yellowed, dark brown anteriorly. Pleura yellowed ventrally, above patterned with dark brown, especially on the anepisternum and dorsal pteropleurite. Halteres yellowed, knob brown, tip paler. Legs with coxae yellowed, outer half patterned with pale brown; trochanters yellow; femora very pale brown, base and apex narrowly yellowed; tibiae and tarsi yellow. Wings with the ground pale yellow, with a pale brown pattern as in the genus, including three major ocelliform areas in cells *R* and *M*, the last at the cord, the parts in cell *C* solidly darkened; beyond the cord the darkened pattern very irregular, sending narrow branches to margin along veins R_3 and R_4; before the cord cell *1st A* extensively darkened, including a major cloud at and beyond midlength; veins yellow, clearer in the ground areas. Venation: Sc_2 long, terminating nearly opposite the fork of R_{2+3+4}; vein R_4 long and sinuous, cell R_3 at margin about one-half more extensive than cell R_2; cell *1st* M_2 long and narrow, nearly as long as *Rs*; *m-cu* more than its length beyond the fork of *M*; cell *2nd A* long.

Abdominal tergites chestnut brown, the posterior and lateral margins narrowly gray, bordered internally by darker; sternites more yellowed, the sides infuscated. Male hypopygium with the tergal lobes small, subtriangular, the tips obtuse with microscopically serrulated margins. Interbase with the free outer arm unusually short, subequal in length to the enlarged base. Both dististyles broader than in *vicina,* especially the inner style. Aedeagus much stouter, the apex fully three times the diameter of the interbasal arm; in *vicina* the apical third of aedeagus very slender, subequal to the diameter of the interbasal arm.

HABITAT. BRITISH NORTH BORNEO. *Holotype:* ♂, Mount Kinabalu, 5,500 feet, April 10, 1929 (H. M. Pendlebury).

The species is based on material received through an exchange with the late Dr. Fred W. Edwards who had identified it as being *Epiphragma* (*Epiphragma*) *vicina* Brunetti, of India (type, a female, from Sureil, Darjiling District, Eastern Himalayas, 5,000 feet, taken between October 11–31, 1917 by Annandale and Graveley). Besides the male in my possession it was indicated that further specimens were in the British Museum (Natural History), these including one male, two females from the type locality and two males from Kamborangah, 7,200 feet, taken in March–April 1929.

There is no question of the distinctness of the two species. The chief differences are in the wing pattern and venation and in the structure of the male hypopygium, particularly the interbase and aedeagus.

A Technique for Rearing the Immature Stages of Tabanidae (Diptera)[1]

R. H. Roberts, Entomology Research Division, Agr. Res. Serv., USDA, Stoneville, Mississippi

Most species of Tabanidae for which information about the larval stage is available have been found in semi-aquatic environments, and one of the principal problems in rearing the immature stages has been how to simulate such an environment.

Two rearing methods have been employed. Hine (1906) used jelly glasses that contained sand covered with algae or leaves of water plants, while others have modified this method by using material from larval habitats. Marchand (1917) reared larvae in 7-in. test tubes fitted with 6-in. rolls of filter paper kept moist by a small amount of water in the bottoms of the tubes. This method was better since it allowed the larvae to be observed. However, the tubes needed daily attention to prevent dessication. Attempts to reduce evaporation by corking the containers might have caused the larvae to be asphyxiated, especially in smaller vessels.

Roberts and Dicke (1964) described the use of plastic containers lined with filter paper. They noted a positive thigmotactic response of the larvae, i.e., larvae invariably were located between the container wall and the filter paper. In addition, they noted in large larvae, 10 to 15 mm or longer, a greater mortality because of incomplete ecdysis or a sealing of the anus by crusted fecal material. These difficulties indicated that, in nature, both ecdysis and evacuation of the gut are assisted by the mechanical resistance of the medium to the movement of the larvae.

Thus, a medium had to be developed in which (1) the larvae could easily be observed, (2) a wet environment could be maintained without constant attention, and (3) there was enough mechanical resistance to aid molting and evacuation of the gut.

[1] In cooperation with the Delta Branch of the Mississippi Agricultural Experiment Station.

Rearing Technique.—Two materials were used successfully in rearing various species of Tabanidae. The first consisted of glass beads 4, 5, or 6 mm in diameter barely covered with water. These were satisfactory for larvae 10 mm long or longer but not for early instars, since these smaller larvae and their exuviae were extremely difficult to locate in the beads.

The second material was agar. Nutrient bacterial agar, as a medium and food source, proved unsatisfactory because of the rapid growth of bacteria. However, agar, which by itself neither supports bacteria nor serves as a food source, was used successfully as a larval medium. The most suitable concentrations ranged from 0.8 to 1%. At less than 0.8% the medium was too soft to provide sufficient resistance, and above 1% it was too hard. Newly hatched and other small larvae had difficulty in penetrating the harder medium, whereas large larvae broke it apart, which seriously interfered with visual observation. In the 0.8–1% range, however, the small larvae were able to penetrate the medium and move easily about in it. With the larger larvae the medium closed around them and prevented visual distortion.

Even in plain agar waste materials and excess food supported bacterial growth, and in order to use the medium for longer periods, an antibiotic, Panalba®,[2] was added. This contains two parts tetracycline phosphate and one part novobiocin. The finished agar had 25 μg/ml of tetracycline phosphate and 12.5 μg/ml of novobiocin, and could be used 7–10 days, whereas untreated agar could be used only 3–5 days before contamination necessitated transferring the larvae to fresh medium. Recently, a second antibiotic, Pimafucin®,[2] used in conjunction with Panalba at a concentration of 30–40 μg/ml has extended the life of the medium to 2–3 weeks.

The present technique consists in rearing the larvae in the agar medium until they are 15–20 mm long. Then they are transferred to the glass bead substrate. The pupae are em-

[2] Mention of proprietary products does not necessarily imply their endorsement by the USDA.

bedded in an agar medium in an upright position, with the thoracic spiracles protruding above the surface, a position that appears to facilitate eclosion.

Fig. 1.

Rearing Containers.—Tabanid larvae are cannibalistic and must be reared in separate containers. Containers should be large enough to allow some freedom of movement. A rough rule of thumb used in the present studies was to select containers that gave a "crawl" distance equal to at least twice the length of the larva.

The circular containers used were made of crystal-clear rigid plastic, 2 in. in diameter and $1\frac{7}{8}$ in. deep, with close-fitting snap-on lids.[3] Since the larvae tended to remain near the outer circumference, a "crawl" distance of about 6 in. was available, which was more than adequate even for larvae that were 50–60 mm long. Although larger containers were also used, no outstanding advantage was noted (Fig. 1).

These containers were filled to one-third to two-thirds of their volume with either agar or glass beads, the amount depending on the size of the larvae. Several $\frac{1}{16}$-in. holes drilled in the lid allowed for interchange of air. Although not necessary for

[3] Manufactured by Tri-State Plastic Molding Co., Henderson, Ky.

small larvae, air exchange was needed for larvae 25 mm or longer, especially when the containers were opened and examined only at two- to three-day intervals. These lids were not used for larvae under 10 mm long because the larvae were able to escape.

This technique has been used successfully for nearly 2 years in rearing larvae of *Tabanus lineola* Fabricius, *T. schwardti schwardti* Philip, *T. abdominalis* Fabricius, *T. proximus* Walker, and *Chlorotabanus crepuscularis* (Bequaert).

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Marchand, W. 1917. An improved method of rearing tabanid larvae. J. Econ. Ent. 10: 469–72.

Roberts, R. H., and R. J. Dicke. 1964. The biology and taxonomy of some immature nearctic Tabanidae (Diptera). Ann. Ent. Soc. Amer. 57: 31–40.

Nomenclature Notice

Possible use of plenary powers by the Commission is announced for: In Araneae—(1625) Suppression of *Drassus atropos* Walck. 1830. In Siphonaptera—(1618) Neotype for *Ceratophyllus soricis* Dale 1878; (1709) Type species for *Monopsyllus* Kolenati 1875; Suppression of *Ceratophyllus sciuri* Kol. 1856, *Monopsyllus sciuri* Kol. 1857, and *Ceratopsyllus monoctenus* Kol. 1856. In Lepidoptera—(1708) Suppression of *Papilio lintingensis* Osbeck 1765. In Coleoptera—(1720) Suppression of *Xyleborus* Bowdich 1865. In Diptera—(1706) Type-species for *Phasia* Latr. 1804; (1716) Type-species for *Chamaemyia* Meigen 1803. In Hymenoptera—(1710) Type-species for *Stizus* Latr. 1802–1803; (1711) *Id.* for *Diodontus* Curtis 1834; (1712) *Id.* for *Trichosis* Foerster 1868; (1713) *Id.* for *Prospaltella* Ashmead 1904.

Send comments with case number (given above in parenthesis) to International Commission on Zoological Nomenclature, c/o British Museum (N. H.), Cromwell Road, London S.W.7, England. (See *Bull. zool. Nomencl.* 22, pt. 4.)

Review

Dobrotworsky, N. V. 1965. The Mosquitoes of Victoria. 237 pp. Melbourne University Press; New York: Cambridge University Press, $18.00.

This is a clearly printed and well illustrated (albeit expensive) volume covering the mosquito fauna of this interesting and ecologically varied corner of Australia. In all, 76 species, subspecies, and varieties are treated and both adult and larval characters (where known) are illustrated for each species. The descriptive material under each taxon includes characters of the adult male and female, fourth stage larva, biology and distribution. Keys are given to the adults and, where possible, to fourth stage larvae.

The introductory sections include brief but clear discussions of the structure and biology of the adult and immature stages, the distribution and composition of the mosquito fauna and their role as disease vectors in Victoria. The endpapers are illustrated with a map of Victoria, showing topography, average annual rainfall and tree cover.—Selwyn S. Roback

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Advances in Pest Control Research. Edited by **R. L. Metcalf.** Pp. vii + 289. Interscience Publishers, John Wiley & Sons, New York, London, Sydney, 1965. Price: $11.00.

Contents: P. C. Kearney *et al.* on chlorinated aliphatic acids in soils; P. de Pietri-Tonelli on rogor applied to plants; S. B. Soloway on biological activity and molecular structure of the cyclodienes; A. E. Dimond on natural models for plant chemotherapy; G. P. Georghiou on the genetics of insecticide resistance; and Izuru Yamamoto on nictinoids as insecticides. Indexes and cumulative index for Vols. I–VI.

Snodgrass, R. E. A Textbook of Arthropod Anatomy. 363 pp. (Comstock Publ. Co., Ithaca, 1952.) Facsimile reprint by Hafner Publ. Co., New York and London, 1965. $9.00.

Essig, E. O. A History of Entomology. 1029 pp. (The Macmillan Co., 1931.) Facsimile reprint by Hafner Publ. Co., New York and London, 1965. $16.50.

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ENTOMOLOGICAL NEWS

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Sarcophaga utilis Aldrich and Allies (Diptera, Sarcophagidae)

H. RODNEY DODGE, Department of Entomology, Washington State University, Pullman [1]

Previous identifications in this group have been liable to error, due to the presence of unrecognized new species and especially to the fact that Townsend himself sunk *arizonica* (Townsend) as a synonym of *bishoppi* Aldrich. *Arizonica* is a widespread western species which was unknown to Aldrich (1916).

I am grateful to the curators of many collections for making their material available for study. Types and other important material are to be found in the following collections: The U. S. National Museum (USNM); California Academy of Sciences (CAS); American Museum of Natural History (AMNH); Chicago Museum of Natural History (CMNH); University of Arizona (UAriz); University of California, Berkeley (UCalB); University of Kansas (KU); Washington State University (WSU). Various paratypes have been retained in the author's collection at the latter.

The species, which are merely a well marked group referrable to **Sarcophaga** (s.l.), have been referred to the following generic names:

[1] Scientific Paper No. 2700, College of Agriculture, Washington State University, Project No. 9043.

Wohlfahrtiopsis, Townsend, 1917, p. 45 (type *Sarcophaga johnsoni* Aldrich). Townsend, 1934 (key); 1937, p. 225 (description).

Sarcabaeophaga, Townsend, 1918, p. 160 (type *Sarcophaga utilis* Aldrich). Townsend, 1934 (key); 1938, p. 66.

Petrosarcophaga, Townsend, 1919, p. 543 (type *P. arizonica* Townsend). Townsend, 1934 (key); 1938, p. 53.

Wohlfahrtiopsis (Scarabaeophaga), Roback, 1954, p. 64.

Diagnosis: Large species with parafacials subequal to width of clypeus; cheeks broad, 0.30–0.30+ of head height; male front broad, with strong outer vertical present but no proclinate frontoorbitals; vibrissae somewhat above oral margin; prosternum bare; 4 posterior DC bristles, the discal thoracic bristles reduced; genital segments red and male hind tibia non-villous except in *johnsoni*. Male genitalia with forceps nearly straight, rather thick, contiguous most of length, often with dense preapical setules on outer margin, tip acute; accessory plate subtriangular, flat, with hooked, blade-shaped, nude and shining apical prolongation; claspers subequal in length, usually rather simple, the posterior without bristle and anterior often with an internal thorn; penis 2-segmented, the club large and very complicated, often enclosed in a mucilagenous mass. Female genitalia with tergum divided above, the ventral margins broadly separating to expose the genital sterna (ST 6–7); ST 6 with hind margin concave; spermatheca unusually elongate, with 7–8 very strong constrictions (Fig. 7).

Biology

Sarcophaga johnsoni is saprophagous; very little has been added to our knowledge of the biology of the other species since Aldrich (1916). They are evidently parasitic or perhaps scavengers in weakened adult scarabaeid beetles. *S. utilis* has been recorded from 3 genera of Scarabaeidae and from "pinned insects in a box"; *S. arizonica* has been reared from a dung beetle; *S. georgiana* from pitcher plants, *Sarracenia* species. It is possible that the latter species still attacks Scarabaeidae, because *Phyllophaga* species are commonly trapped by the larger *Sarracenia;* beetles thus trapped might be especially susceptible to larviposition by the fly.

Key to the Species

1. Genitalia black; male hind tibia villous (Coastal, Maine to Texas) .... **johnsoni** Aldrich
   Genitalia red; male hind tibia not villous 2
2. a External characters, male and female 3
   b Male genitalia (the male of *beeri* is unknown) 8
   c Male forceps 12
3. Palpi black; antennae black 4
   Palpi red, at least apically 5
4. Costal spine vestigial; parafrontofacials (PFF) gray; male front 0.28–0.32 of head width (Eastern North America) .... **utilis** Aldrich
   Costal spine subequal in length to anterior crossvein; PFF yellowish pollinose (Mexico) ..**beeri**, new species
5. Third antennal segment infuscated to nearly all black, 3x ANT 2; male front 0.26–0.275 of head width (Texas, Baja Calif. to central Washington) .... **arizonica** (Townsend)
   ANT 3 red or reddish, shorter; male front 0.30–0.36 of head width 6
6. Cheek white haired on posterior half; ANT 3 is 2–2.25× ANT 2; male front 0.30–0.32 of head width (Texas, Mexico) .... **bishoppi** Aldrich
   Cheek with few or no white hairs before metacephalon ... 7
7. Antenna 3 is 1.75× ANT 2; palpi thickened, especially in the female; male front wider than an eye, 0.36–0.37 of head width (Arizona, Texas, Mexico) .... **kesseli**, new species
   ANT 3 about 2.25× ANT 2 and infuscated; palpi moderately clubbed; male front 0.3–0.32 of head width (Georgia, Florida, Alabama) ...**georgiana,** new species
8. Posteroapical lobe of penis with strongly ribbed wings (Figs. 3, 5) 9
   Posteroapical lobe with simple, flattened wings (Figs. 1, 2, 4) 10
9. Posterior clasper with sides parallel on basal 0.75, then strongly excised to a sharp apex (Fig. 5) ....**arizonica**
   Posterior clasper uniformly tapered and curved to a sharp tip (Fig. 3) .... **utilis**

10. Claspers both with a strong tooth, that on the anterior clasper spur-like (Fig. 4) .... **bishoppi**
    Posterior clasper, at least, not thus toothed 11
11. Posterior clasper excised on apical third of length (Fig. 2) .... **kesseli**
    Posterior clasper evenly tapered to apex (Fig. 1) .... **georgiana**
12. Forceps with a strong subapical constriction 13
    Forceps not so, evenly tapered subapically 14
13. Constriction extends across the back, thus prominent in profile; tip of forceps slightly hooked (Fig. 1) . **georgiana**
    Constriction best seen in posterior view; tip of forceps straight (Fig. 4) .... **bishoppi**
14. Forceps nude subapically (Fig. 5) .... **arizonica**
    Forceps nearly uniformly haired to apex . . **utilis** and **kesseli**

Sarcophaga (Wohlfahrtiopsis) johnsoni Aldrich

Sarcophaga johnsoni, Aldrich, 1916, pp. 162–5, fig. 75; Hallock, 1942, p. 222, figs.
Wohlfahrtiopsis johnsoni, Townsend, 1917, p. 45; 1934 (key); 1937, p. 225. Roback, 1954, p. 64, figs. 82–84.

Easily recognized by its black genitalia, villous male hind tibia and restricted habitat. Ranges along the ocean beach from Maine to Texas; saprophagous in larval stages on dead animal matter.

Sarcophaga (Scarabaeophaga) utilis Aldrich. Fig. 3

Sarcophaga utilis, Aldrich, 1915, pp. 151–2, fig.; 1916, pp. 225–7, fig. 132. Davis, 1919, (host record); Hall, 1929, p. 89; Knowlton and Janes, 1931 (in error—see *arizonica*); Hallock, 1942, p. 228, figs.
Scarabaeophaga utilia, Townsend, 1918, p. 160; 1934 (key); 1938, p. 66.
Wohlfahrtiopsis utilis, Roback, 1954, p. 64, figs. 87–89.

Distinguished by its wholly black antennae and palpi and gray-pollinose face, this species ranges widely in the East—Atlanta, Ga., Baton Rouge, La. and Plano, Texas, to New York (Long Island, Ithaca, Cotturaugus and Chatauqua Co.), Michigan (Ag. College, Owosso, Black River), Galesburg, Ill., Iowa (Co. #52, Cl. Creek), Kansas (4 counties) and Atoka Co., Oklahoma.

Also recorded from Ontario (Pelee Point), Quebec and Utah. The latter record cannot be confirmed and doubtless refers to *arizonica,* which see.

S. utilis has been reared from *Allorhina nitida* and *Geotrupes splendens* (Aldrich, 1915, 1916), *Phyllophaga* spp. (Davis, 1919), and *P. futilis lanceolata* and *crassissima* (Hall, 1929). This species is not readily taken by fly trap; most specimens so taken are males.

Sarcophaga (Scarabaeophaga) beeri, new species

Length 10.5 mm. Very similar to *utilis* (antennae and palpi black) but front broader (0.37 *vs.* 0.33 of head width at vertex in female sex); face yellowish, palpi more strongly clubbed, costal spine stronger, vibrissae higher above oral margin and parafacial wider, nearly equal to the vibrissal span.

Female: Front at narrowest (vertex) 0.37 of head width and strongly widening to lunule; frontal vitta black, sides parallel, slightly narrowing below, width 0.5 of front at level of lower PFRO; frontal rows 8–10, diverging in last 2 pairs; PFRO 2; RFRO 1; ocellar present; outer vertical strong; PFF broad, yellowish gray, with scattered setules to below lunule, a row of stronger parafacial hairs; antennae black, vaguely reddish at base of ANT 3, which reaches 0.8 to vibrissa, is 2.5 ×1 and 2× ANT 2; arista long plumose 0.67 to tip, upper row single; arista whitish for 0.3 of length beyond the basal swelling; vibrissa above oral margin, span 1.1× width of parafrontal, index (height above oral margin/span) 0.4; oral margin slightly protuberant; cheek black haired, 0.33 of head height; metacephalon white haired; ANT axis 0.75, vibrissal axis 0.75 of head height; posterior orbits yellowish; occiput gray, with 3 rows black POC; palpi black, clavate, 1.2× antenna, apical 0.33 strongly swollen and nearly bare.

Thorax gray-pollinose, trivittate. Chaetotaxy: ACR 0:1; DC 4:4 (last 2 only strong); IA 1:2; SA 2:3; HUM 3; NPL 4; PAD setuled; SCUT 2 marginal, no apical, one discal; PPL and PST bare; MTST setuled; STPL 3, in line; beret setuled;

HYPL 7–8; INFSQ present. Wing subhyaline, veins brown, veins 1, 3 and 5 darker; vein 3 setuled 0.33 to crossvein; posterior crossvein oblique, sinuous; vein 4 right-angled; costal spine subequal to anterior crossvein; costal sections (from base) 20/36/22/43/18/4; basicosta white; epaulet black; squama white. Legs black; mid femur with 3 A, 3 strong AV, 5 PV and no comb or streak; hind femur with 7 AD, 5 A, 8 AV, 3 PV; mid tibia with 3 AD, 1 AV; hind coxa setuled posteriorly; tibial cicatrix small.

Abdomen black, with T 4 partly red above; a strong, tessellated, gray-pollinose pattern; MM on T 3; venter black haired; sterna 3–5 overlapped by terga and without marginal bristles; ST 2 with only bristly hairs. Genital segments red, ordinary, about as in Fig. 8.

Male: Unknown.

Holotype: MEXICO: Puebla 2 mi S. of Cholula, cornfield, 5 July, 1956, R. E. Beer and party (KU).

Sarcophaga (Scarabaeophaga) arizonica (Townsend). Figs. 5–7

Petrosarcophaga arizonica, Townsend, 1919, p. 543.
Petrosarcophaga bishoppi (=*arizonica*) in error, Townsend, 1938, p. 53.
Sarcophaga utilis, Knowlton and Janes, 1931, p. 148.

This species is distinct in both sexes by the elongate and infuscated to rarely wholly black third antennal segment, fully 3× ANT 2. From *utilis,* to which it is most closely allied through conformation of the penis, it differs by the red palpi. *S. georgiana* may resemble it by the infuscated antenna 3, but this segment is shorter in that species.

Distribution: Ranges widely in the West, from Texas to Baja Calif. and central Washington. It appears to be restricted to or is most commonly taken, in desert environments. In support of this statement, and because it has previously been confused with other species, I list all localities known to me: ARIZONA: Bumble Bee, Cameron, Canyon Lake, Chiricahua Mts., Globe, Kingsman, Oak Creek Canyon, Organ Pipe Cactus Natnl Monument, Prescott, Santa Catalina Mts., Tucson, White Sands, Yarnell Hill; CALIFORNIA (by Counties): Calaveras (San Andreas); Imperial (Coachella Valley); Inyo (Cedar Flat, Death Valley, Lone Pine, Panamint Mts., Shoshone, Surprise Canyon, Westgard Pass); Kern (Kernville, Onyx); Los Angeles (Desert Springs); Riverside (Anza, Box Canyon, Desert Hot Springs, Hopkins Well, Indio, Joshua Tree Natnl Monument, Idyllwild, Magnesia Canyon, Palm Springs, Pinon Flat, Riverside, San Jacinto Mts., Shaver's Well, Whitewater); San Bernardino (Chubbock, Goffs, Needles, Quail Springs); San Diego (Borego, Borego Springs, Boulevard, Campo, Dulzura, Jacumba, Julian, La Quinta, Mt. Springs, Yaqui Well); COLORADO: Macedonia; IDAHO: Owyhee Co. and Iron Springs; NEW MEXICO: Hidalgo Co.; NEVADA: Walker Lake, Pyramid Lake; TEXAS: El Paso, Alpine; UTAH: Bellevue (USNM), Grand Co., Logan, St. George, Zion Natnl Park; WASHINGTON: O'Sullivan Dam (Grant Co.), Columbia Basin Wildlife Reserve (Othello); MEXICO: (all Baja California): Islas Pardida & San Estaban (both in Gulf of California), San Felipe.

A Bellevue, Utah record of *utilis* by Knowlton and Janes (1931) is certainly in error and must apply to this species, with host "dung beetle." The specimen on which this record is based cannot be found at Utah State University and therefore must be the one in USNM labeled "Bellevue, Utah," without host data label. It is a male *arizonica*.

Sarcophaga (Scarabaeophaga) bishoppi Aldrich. Fig. 4

Sacophaga bishoppi, Aldrich, 1916, pp. 258–60, fig. 123.
Petrosarcophaga bishoppi, Townsend, 1934 (key); 1938, p. 53.
Wohlfahrtiopsis bihoppi, Roback, 1954, p. 64, figs. 85–86.

Distinguished by the short, red third antennal segment and cheeks partly white-haired, this species is not rare in Texas and ranges into adjacent Mexico. Aldrich's (1916) Florida record is in error (see *georgiana*); records and identifications from various Western states, like Townsend's treatment of *arizonica* as a synonym, are also in error.

The spur on the anterior clasper is not restricted to this species, but is particularly well developed. Fig. 4 shows the genitalia tilted, to show the spur on the far side.

The Melander paratype male which Aldrich referred to has the front at narrowest 0.32 and at vertex 0.333 of head width (not 0.353 at narrowest, as stated); antenna 3 is 2× ANT 2. The holotype has front 0.30 and thorn of anterior clasper slightly longer, but I believe these differences are intraspecific. A sketch of the process of the penis of the holotype is included in Fig. 4 because it varies from the specimen illustrated.

A female from Victoria, Texas (USNM) has palpi thicker than in the male sex; ANT 3 is 2.4× ANT 2; front 0.37 of head width at vertex.

Distribution: TEXAS: Crystal City (type), Austin, Brownsville, Castroville, Hidalgo Co., San Antonio, Sonora, Uvalde, Victoria; MEXICO: Ciudad Victoria and Santa Teresa, both Tamaulipas.

Sarcophaga (Scarabaeophaga) kesseli, *new species.* Fig. 2

Length 13–14 mm. A gray-pollinose species with antennae and palpi red, male front wider than an eye at vertex and strongly widening; parafacial wider than vibrissal span; palpi greatly swollen. Readily distinguished by the very broad male front and short ANT 3.

Male: Front at narrowest (vertex) 0.36–0.37 of head width, at lunule 0.50; frontal vitta velvety black, with sides parallel; frontal rows 8–9, strongly diverging in lower two pair; PFRO none (rarely one); RFRO 1; ocellar weak; outer vertical 0.8 of inner; PFF gray, with 3+ scattered rows of hairs, stronger below and towards the frontal row; antennae red, ANT 3 reaches 0.84 to vibrissa, 2.5:1 and is 1.7× ANT 2; arista long plumose 0.7 to tip, the upper rays in a single row; vibrissae above oral margin, index 0.45, span subequal to width of parafacial; epistoma slightly warped forward, not protuberant; cheek black-haired to metacephalon, 0.32 of head height; ANT axis 0.80, vibrissal axis 0.70 of height; occiput slightly convex, with 2 rows black POC; palpi red, clavate, nearly 2× vibrissal span and apically subequal to width of apex of antenna.

Thorax strongly gray-pollinose, trivittate. Chaetatoxy: ACR

0:1; DC 0:2; IA 1:2; SA 2:3; HUM 3; NPL 4; PAD setuled; SCUT 2 marginal, 1 apical, 1 discal; PPL 0; PST 0; STPL 3, in line; beret setuled; INFSQ present. Wing subhyaline, veins yellow brown, veins 1, 3 and 5 darker; vein 3 (only) setuled 0.6+ to crossvein; posterior crossvein straight, oblique; vein 4 acutely angled; costal spine minute; costal sections 20/33/20/46/15/4; basicosta white; epaulet black; squama white.

Legs black; mid femur with 5 A, 4–6 AV, 4 strong PV and no comb; hind femur with 7AD, 4 A, 7 AV, 5 PV; hind tibia not villous, hind coxa setuled posteriorly; tibial cicatrix small.

Abdomen black with T 4 mostly or part red, with tessellated, gray-pollinose pattern; MM on T 3; venter black-haired; sterna 1–4 uniformly haired, slightly narrowing, ST 5 broadly Y-cleft. Genital segments red, shining, without bristles; forceps red, finely haired, contiguous to apices; accessory plate red, triangular, with bare, curved apical blade; claspers subequal in length, the posterior without bristle, moderately excised apically on front margin; penis 2-segmented, the stalk ridged on the back, distal segment as figured, the posteroapical process not ribbed on the sides.

Female: Similar to male, with usual sexual differences; palpi unusually strongly thickened.

Holotype male, Bumble Bee, Yavapai Co., Arizona, Oct. 12, 1951, E. L. Kessel (CAS). *Allotype,* Brewster Co., Texas (Rio Grande), June 13–17, 1908, Mitchell & Cushman (USNM).

Various paratypes (some retained) as follows: 7 males, Menard, Tex., 1929 (Cushing) and 1 male, Uvalde, Texas, Bish. 6097 (genitalia lost) in USNM; 1 male, "Gr Can" (Grand Canyon, Ariz.), July 11, in my collection; 1 male, Marathon, Brewster Co., Texas (AMNH); 2 CAS males: Sheffield, Pecos Co., Texas, July 24, 1921, C. D. Duncan and Mexico: 27 mi SE of Chiuahuah (Arnaud et al.); from (KU) a male, Malaga, N. M. and 3 females from Starr Co., Texas, Sabino Canyon, Arizona and 15 mi SW of China, N.L., Mexico; from (AMNH) 2 males, Van Horn, Texas and Rodeo, New Mexico; 1 male, 8 mi S of Canutillo, Dgo., Mexico, Aug. 9, 1951, on flws. of *Guardiola tulocarpa,* P. D. Hurd (UCB); from (UAriz) 1 female, Standfield, Ariz., on cotton and 2 males, Tombstone, Ariz., July 27, 1955, on *Mortonia scaliella* and La Gloria, N.L., Mexico, May 24, 1948, Nutting Coll.

Sarcophaga (Scarabaeophaga) georgiana, new species. Figs. 1, 8

Sarcophaga utilis (*partim*), Aldrich, 1916, p. 277, last paragraph.

Sarcophaga bishoppi (*partim*), Aldrich, 1916, p. 260 (allotype and a Georgia male).

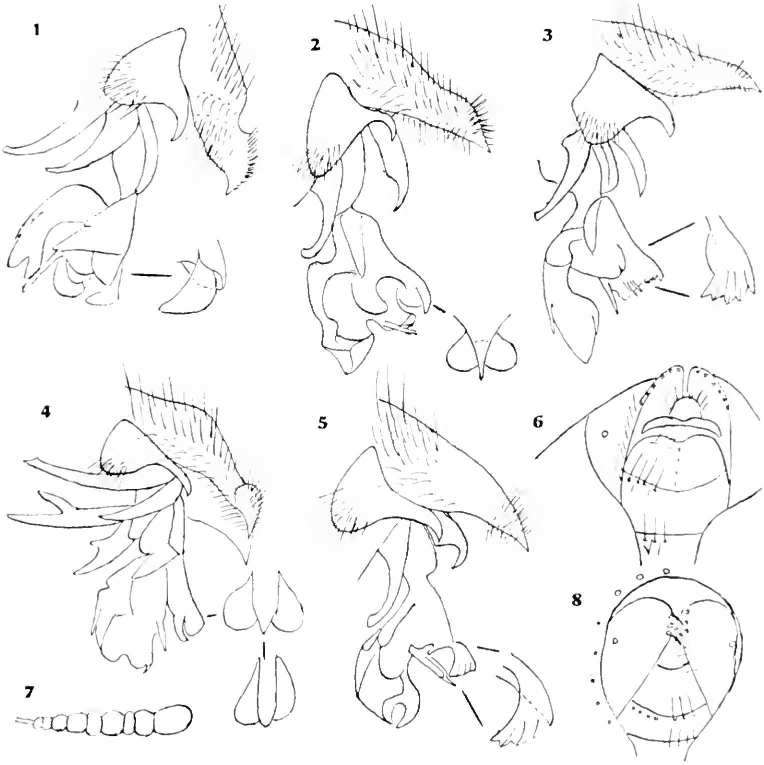
Aldrich recognized two males of this species from Theodore and Kushla, Alabama, as differing from *utilis* and perhaps worthy of a varietal name; his Georgia and Florida records of *bishoppi* also are *georgiana.* The male from Theodore, Alabama, reared from *Sarracenia* by Dr. F. M. Jones, remains the only rearing record, to my knowledge.

Length 9–14 mm. Differs from *utilis* by the antennae and palpi red, at least in part, the male forceps in profile with a subapical notch, the posteroapical process of penis with simple, unribbed wings. Differs from *kesseli* by ANT 3 longer and darker, male front narrower than an eye and posterior clasper not excised. The description of *kesseli* applies to this species, with the following exceptions:

Male: Front 0.30–0.32 (average 0.31 of five) of head width; frontal rows 11–12; ANT 3 reddish only at base, reaches 0.85 to vibrissae and is 2.25× ANT 2; parafacial 0.8 of vibrissal span; vibrissal index 0.33; cheek 0.3 of head height; palpi red apically or wholly; humerals 3–4; costal sections 20/30/18/33/14/4; hind femur with 8 AD, 4 A, 9–11 AV, 4 PV; T 4 usually narrowly red on hind margin; forceps with nude, diagonal, subapical groove, strongest on sides but visible in profile; posterior clasper evenly tapered; penis as figured.

Female: Similar to male, with the usual sexual differences; front 0.35 of head width; 2 PFRO; APS absent; mid femur with 4 A, 4 AV, 5 PV; hind femur with 7 AD, 5 A, 7 AV, 4 PV; femora without modified posterior streak; sternum 2 with marginal row of 4 bristles; genitalia as figured.

Holotype: Male, Stone Mountain, GEORGIA, May 17, 1952. Dodge & Seago, in author's collection. Allotype and 7 male, 4 female paratypes, Moultrie, Ga., Sept. 2 and 9, 1949, H. R. Dodge; 14 males, 11 females, Tifton, Ga., June and October,



FIGS. 1–5. Lateral view of male genitalia, with enlarged view of the posteroapical process of the penis (in Figs. 2 and 5 this process is shown in posterior view). 1, *Sarcophaga georgiana;* 2, *S. kesseli;* 3, *S. utilis;* 4, *S. bishoppi;* 5, *S. arizonica.*

FIGS. 6–8. Female genitalia. 6. *S. arizonica,* ventral view; 7, same, spermatheca; 8, *S. georgiana,* posterior view.

1896 (from Hough colln.; 5 at USNM, 6 at CMNH, others in various collections, including mine); 6 males, 2 females, Worth Co., Ga., May 16, 1951, O. K. Fletcher. Other paratypes, 4 Florida males at (KU): Fruitville, LaBelle, Likely, Lacoochee; in (USNM): 3 males, Leesburg, Fla., C. H. Curran; 1 female, Ormond, Fla. (allotype *bishoppi*); male and female *in copulo*, Miami, Fla., 7.XI and a female, 26.X, Townsend; 1 female, Orlando, Fla. and a male without genitalia from Lake Placid, Fla. also the two Alabama males referred to in the first paragraph.

This species may be expected to occur in the *Sarracenia* meadows from North Carolina to eastern Texas, but occurs far from *Sarracenia* at Miami and Stone Mountain, so is evidently not dependent upon that plant. The palpi may be red only at the tip or wholly red; the wings are quite strongly yellowed in some specimens.

Variations in Ventral Setules of Vein 3

This paper was completed and most of the specimens distributed or not before me when the following observations were made:

The presence of ventral setules on vein 3 beyond the basal node is exceptional and rarely mentioned in descriptions. In my quest for characters common to both sexes such setules, when they occur, have been assumed to be diagnostic. It is, therefore, disconcerting that one female of two mated pairs and one of 13 additional males of *utilis* (Fayetteville, Ark., May 15, 1965) have ventral setules half way to the anterior crossvein on both wings, whereas other specimens examined for this character have none beyond the node. Among 23 (UCalB) specimens of *arizonica*, only the basal node is setuled except for a single setule beyond the node on two (of 46) wings. The only *kesseli* examined, the (UCalB) male, has ventral setules on both wings half way to the crossvein.

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A Cavernicolous Pseudoscorpion of the Genus Microcreagris from Southern Tennessee

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The genus *Microcreagris* is widely represented in the epigeal fauna of the eastern United States. In addition, three troglobitic species have been described by Chamberlin (1962) from caves in Virginia and Alabama. Of these three the most highly modified is *M. valentinei* from Cudjo's Cave, in Lee County, Virginia [but erroneously located by Chamberlin (p. 350) at Cumberland Gap, Tennessee]. The present paper describes another highly modified form, from Nickajack Cave in Marion County, Tennessee.

Microcreagris nickajackensis, new species

Material: Holotype male (WM 754.01001) collected in Nickajack Cave, 0.6 mile south of Shellmound Station, Marion County, Tennessee on 1 August 1964 by R. Horton.

Description: Male: A highly modified troglobitic species of the genus—eyeless, pale in color and with greatly attenuated appendages. Carapace about one-third longer than wide, the greatest width being just behind the "ocular" region; epistome small and rounded; no eyes present; surface smooth dorsally and becoming finely reticulated on the sides. Carapacal setae 4-6-4-4-2-6=26.

Abdomen typical. Tergal chaetotaxy 6:6:6:7:8:7:8:7:8:6:6:mm. Genital area typical. Sternal chaetotaxy 7:[(6)(4)]:(3)$\frac{9}{10}$(3):(2)6(2):8:10:9:10:9:9:6:mm.

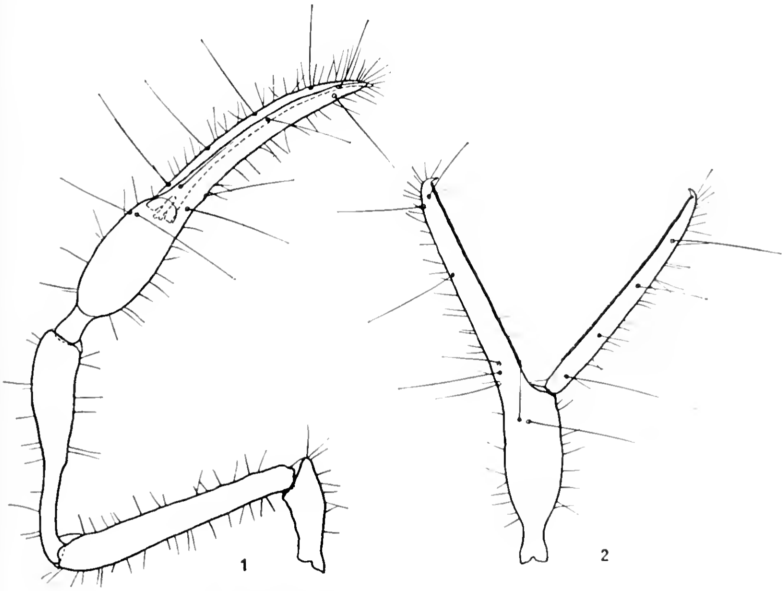
Chelicera less than two-thirds the length of the carapace; 2.21 times as long as broad. Right palm with six and left palm with seven setae; fixed finger with a row of 17–19 teeth, of medium size and pointed at the proximal end but becoming small and rounded distally; movable finger with 11–12 teeth, smallest at the proximal end and becoming larger distally; galea short, slender and unbranched; serrula exterior with about 35 blades; serrula interior with about 20 blades; flagellum of eight setae, of which all but the most proximal one or two are unilaterally pinnate.

Palps very long and slender; proportions of the podomeres as shown in Fig 1; placement of the tactile setae of chela as shown in Fig. 2. Fixed finger with 118 low, rounded, contiguous teeth; movable finger with 119 similar teeth. Trochanter 2.9, femur 7.2, tibia (including pedicel) 5.2, chela (without pedicel) 6.0, and hand (without pedicel) 2.2 times as long as broad; movable finger 1.95 times as long as hand.

Legs long and slender; leg I with basifemur 4.9, telofemur 4.0 and tibia 7.2 times as long as deep; leg IV with entire femur 6.0 and tibia 9.3 times as long as deep. Leg IV with a true tactile seta on telotarsus 0.47 the length of the segment from the proximal end. Subterminal tarsal setae unequally bifurcated at about the middle and each branch with several spinules.

Measurements (in mm): Body length 3.44. Carapace 1.02 long, greatest width 0.74. Chelicera 0.63 long by 0.29 broad; movable finger 0.43 long. Palpal trochanter 0.75 by 0.26; femur 1.69 by 0.24; tibia (with pedicel) 1.52 by 0.29; tibial pedicel 0.65 by 0.11; chela (without pedicel 2.37 by 0.40; chelal pedicel 0.25 by 0.19; hand 0.84 by 0.38; movable finger 1.63 by 0.14. Leg I: basifemur 0.79 by 0.16; telofemur 0.59 by 0.15; tibia 0.76 by 0.11; metatarsus 0.40 by 0.09; telotarsus 0.58 by 0.08. Leg IV: entire femur 1.37 long; basifemur 0.63 by 0.23; telofemur 0.74 by 0.22; tibia 1.27 by 0.14; metatarsus 0.50 by 0.11; telotarsus 0.76 by 0.09.

Remarks: This highly modified species most closely resembles *Microcreagris valentinei* Chamberlin among other American forms in the genus. It can, however, be distinguished easily from *M. valentinei* by the following combination of characters:



FIGS. 1–2. *Microcreagris nickajackensis*, n. sp., holotype male. 1. Dorsal view of left palp. 2. Lateral view of right chela.

1) 26 setae on the carapace,
2) only seven setae on anterior genital operculum of male,
3) six or seven setae on cheliceral palm,
4) less attenuated palpal podomeres,
5) base of chelal hand more clearly separated from pedicel.

Geographically, the nearest known cavernicolous species of the genus are *M. persephone* Chamberlin and *M. pluto* Chamberlin from caves in Marshall County, Alabama. *M. nickajackensis* has considerably more attenuated appendages than either of these species and also differs from them in details of the carapacal and tergal chaetotaxies. Since very little is known of the epigeal species of *Microcreagris* in Tennessee and Alabama, nothing can yet be determined about the relations of the carvernicolous forms to their epigeal ancestors.

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Ctenophthalmus cophurus schmiederi n. ssp. (Siphonaptera)

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Malaria Institute, Amani, Tanzania

High up in the Western Usambara Mountains of northeast Tanzania 16 miles northwest of Lushoto at the edge of the great Shume Forest Reserve there lies on the brink of an almost 4,000 ft escarpment a point known as "World View." Here one can meditate in jungle silence while looking out over the parched plains below through which the Mkomazi River flows to water the large masses of game in the Mkomazi Game Reserve that lies on the Umba Steppe. Close at hand is the ghost town of old German Shume, long since dead because, being a sawmill town, when the primeval forest was cut the town died and left behind as skeletons the abodes of workers, ranging from mud huts, and board and bat houses, to the big old German red brick home of the overseer which is now Shume Rest House. The elevation here is 6,000 feet, and the land is reforested with cypress which is not yet old enough to harvest. Here, if one sits on the veranda of the rest home, on a rock at "World View," or on a log at the forest edge, and waits quietly a moment or two, out will bob a medium sized "Chocolate Brown Mouse." Several of these mice, taken in live traps, were found to be carrying a new subspecies of *Ctenophthalmus cophurus* J. & R. 1913.

Ctenophthalmus cophurus schmiederi n. spp.

The new subspecies differs from both *C.c. cophurus* and *C.c. hemingwayi* Hubbard 1963 in the shape and the proportions of the finger F in the male and the angle of the slant and the proportion of the parts of the apical outline of the VII sternite of the female.

Type Data: The holotype male and the allotype female are mounted on slides bearing the writer's number T2450, dated May 23, 1965, host listed as *Lophuromys flavopunctatus margarettae* Heller, location as Shume, Loshoto District, TANZANIA, and deposited * in the Tring Branch of the British Museum. Bearing the same data are paratypes deposited in U. S. National Museum and the Academy of Natural Sciences of Philadelphia.

Description. Modified Segments. Male. Whereas the sides of the fingers of *cophurus* and *hemingwayi* may be close to parallel in *schmiederi* the apical portion is expanded until almost ham shaped (apically very much broader) and at the

* The types of the first 10 U. S. fleas described by the writer are in the Academy of Natural Sciences of Philadelphia with paratypes in U. S. National Museum and British Museum, the next 40 U. S. fleas described have their types in the U. S. National Museum with paratypes in the British Museum, and the types of some 25 fleas described from outside the U. S. are in the British Museum, with paratypes in the U. S. National Museum.

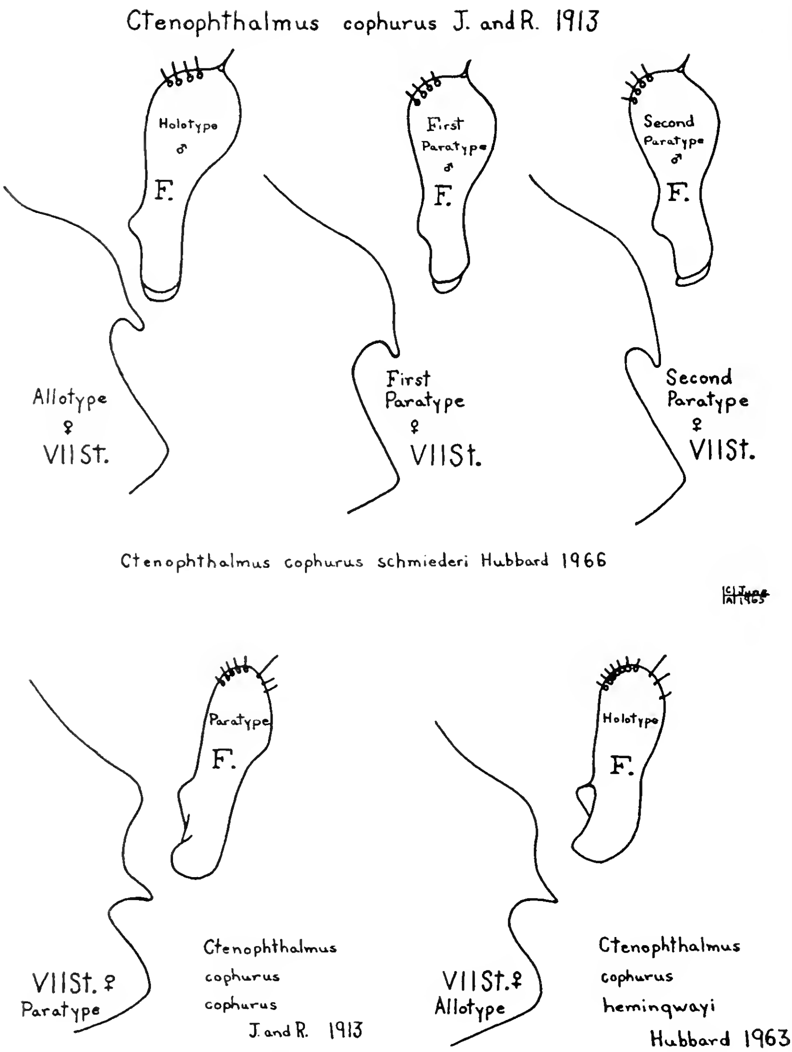

FIG. 1. *Ctenophthalmus cophurus schmiederi* Hubbard 1966, *Ct. c. cophurus* J. and R. 1913, *Ct. c. hemingwayi* 1963.

extreme apex where the anterior and posterior angle meet there is a small tip armed with a tiny bristle. Armature otherwise as in all *cophurus*.

Female: VII sternite with apical angle tipped anteriorly more, the upper hump less prominent, the hook more prominent, the bay shallower and higher on the margin, making the distance from the hook to the bottom of the outline greater than in other *cophurus*.

Length: A medium sized flea. Male 2.25 mm, female 3.00 mm.

Remarks: This flea is the representative of the *cophurus* group east of Mt. Kilimanjaro, where *hemingwayi* ranges west and *cophurus* is found in Kenya and Uganda.

This flear bears the name of Dr. Rudolf G. Schmieder, of the University of Pennsylvania, Editor of Entomological News, and friend of the writer for 20 years who, through these years, has published many papers for him on world fleas.

This is the fourteenth flea described by the writer as new from Tanzania under U. S. National Science Foundation grants G14023 and GB1954.

Copidosoma (Litomastix) naevia n. sp. A New Encyrtinae from Colorado (Chalcidoidea: Hymenoptera)

OLE A. SÆTHER, University of Oslo, Department of Limnology, Blindern, Norway

The Encyrtid flies help to control aphids, psyllids, coccids and many other insects injurious to plants. Members of the subgenus *Litomastix* Thomson are parasitic on hemipterous, lepidopterous, and dipterous larvae (Thompson 1875 p. 172, Mayr 1876 p. 682, Mercet 1921 p. 442, Nikol'skaya 1952 p. 432, Ferrière 1953 pp. 29–30, Peck 1963 pp. 360–369).

During a survey by Dr. Kåre Elgmork, Oslo, in upper parts of North Boulder Creek, Colorado, imagines of a new species, according to Nikol'skaya (1952), Ferrière (1953) and Erdös & Nowicky (1955) of the subgenus *Litomastix*, were occasionally found. Two female specimens were caught on July 9, 1960, at a height of about 3,500 m. Six females and one male were collected on July 13 on the slope of Navajo Peak in the uppermost part of the creek, between snowbanks, at a height of about 3,800 m (Elgmork & Sæther in preparation).

Copidosoma (Litomastix) naevia n. sp.

Female.—Head as wide as deep; frontovertex at the anterior ocellus as wide as one half the width of the head; ocelli in an obtuse-angled triangle, the posterior pair separated from the eye margins by their diameter, from occipital margin by about three quarters of their diameter; scrobes moderately deep; mandibles distinctly tridentate, the lower tooth larger (Fig. 1C). Antennae 0.80 mm in length; scape slender; pedicel 2.9 times as long as wide at apex; club solid, obliquely truncate, acuminate (Fig. 1B). Ratio of length of antennal joints to each other (radicula, scape, pedicel, 6 funicle segments, club) = 16 : 52 : 26 : 10 : 10.5 : 11 : 11 : 10 : 49. Ratio of greatest widths of antennal segments (same sequence) = 7 : 10 : 9 : 7.5 : 9 : 10.5 : 11 : 12 : 13 : 15.

Forewings 1.54 mm long by 0.65 mm wide and uniformly ciliated except the basal third; submarginal, marginal, stigmal and postmarginal veins approximately in the ratio of 133 : 9 : 18 : 11; submarginal vein with about 13 bristles; below the stigmal vein 4 spines of the same length as the usual bristles (Fig. 1F); stigmal vein cuneiform, with a cluster of 4 round white spots near apex; submarginal vein with a constriction at apex. Hind wings 1.14 mm long by 0.40 mm wide.

Middle tibia with 9 spines at the apex, and with several spines on the tarsal joints (Fig. 1A). Ratio of lengths of leg segments (coxa outwards)

front leg—43 : 18 : 81 : 76 : 16 : 11 : 9 : 9 : 16
middle leg—43 : 17 : 124 : 130 : 45 : 14 : 11 : 11 : 16
hind leg—42 : 20 : 110 : 130 : 35 : 18 : 15 : 14 : 19

Spur of middle tibia in same ratio : 37.

Head, axillae, and mesopleurae minutely reticulate (head more longitudinally reticulate anterior to eyes); coxae, trochanters, femora, tibiae except apical and basal, and scape longitudinally reticulate (coxae less longitudinally than the other); mesoscutum largely reticulate; scutellum coarsely reticulate longitudinally; tegulae minutely reticulate longitudinally.

Abdomen flattened and cordate.

Body black, in general, with a slight brownish tinge on abdomen. Head and prescutum with greenish and bluish reflections; mesoscutum and tip of scutellum with a greenish reflection; scutellum and mesopleurae with a coppery reflection; femora and tibiae with greenish and coppery reflections. Antennae brownish black. Forewings hyaline with a pale fuscous dot just below the marginal vein and surrounding the stigmal vein (Fig. 1F). The apex of fore and middle femora, base of all tibiae, basal two thirds of mesotibial spur and basal two thirds of first four tarsal joints whitish yellow; apical third of spur and first four tarsal joints subfuscous; fifth tarsal joints fuscous.

Length 1.4–1.8; length of holotype 1.8 mm; width of thorax of holotype 0.5 mm.

Male.—Head very little wider than deep; ratio of frontovertex at the anterior ocellus to width of head as 12.5 : 27; posterior pair of ocelli separated from the eye margins by their diameter and almost touching occipital margin; mandibles as in female, or perhaps a little more pointed. Antennae 0.85 mm in length; shape about as in female. Ratio of lengths of antennal joints to each other (radicula, scape, 6 funicle segments, club) = 16 : 62 : 26 : 12 : 13 : 14 : 14 : 14 : 12 : 34. Ratio of greatest width of antennal segments (same sequence) = 6 : 8.5 : 9 : 5.5 : 6.5 : 8 : 8.5 : 9.5 : 11. Bristles of male antennae very little longer than the female.

Forewings 1.39 mm by 0.57 mm wide; shape as in female; submarginal, marginal, stigmal, and postmarginal veins approximately in the ratio of 131 : 10 : 18 : 9; submarginal vein with about 11 bristles.

Middle tibia with 7 spines on the tip. Ratio of lengths of leg joints:

front leg—43 : 19 : 62 : 76 : 16 : 11 : 9 : 9 : 19
middle leg—40 : 23 : 100 : 116 : 32 : 16 : 13 : 12 : 19
hind leg—37 : 24 : 96 : 110 : 33 : 17 : 15 : 13 : 19

Spur of middle tibia in same ratio 29.

Reticulation as in the female. Coloration as in the female except that the abdomen is a little more brownish and apex of fore and middle femora, all tibiae, spurs, and tarsal joints more yellowish.

Coloration of wings as in the female.

Genitalia (Fig. 1D) rather stout.

Length of body 1.49 mm; width of thorax 0.43 mm.

Holotype, allotypes, and 4 paratypes at the Entomology Research Institute, Canada Department of Agriculture, Ottawa, Ontario; 3 paratypes in the author's collection.

This new species may be distinguished from all known European species by the fuscous dot on the forewings and by the male antenna of which the pedicel is larger than the first funicular segment. Its size is also greater than the most European species.

Of the 12 nearctic species presently placed in *Copidosoma* Ritz., sensu lato, (Peck 1963 pp. 360–369), 8 species seem to belong to the subgenus *Litomastix* Thomson. Only one of these species, *Copidosoma* (*Litomastix*) *truncatellum* Thomson, is circumpolar.

C. truncatellum s. str. (Dalm.) (Dalman 1820 pp. 168–169, Thomson 1875 p. 174, Mayr 1876 pp. 734, 739–740, Mercet 1921 pp. 456–457, Nikol'skaya 1963 p. 424) has no fuscous spot on the forewings, the male pedicel is shorter than the first funicular segment, the first funicular segment in the female is as long as wide, and the female measures only 0.9–1.2 mm in length. This species, however, is the nearest related of the European species.

C. truncatellum floridana Ashm. (Ashmead 1900 p. 365, Girault 1916 p. 49) does have the fuscous patch against stigmal

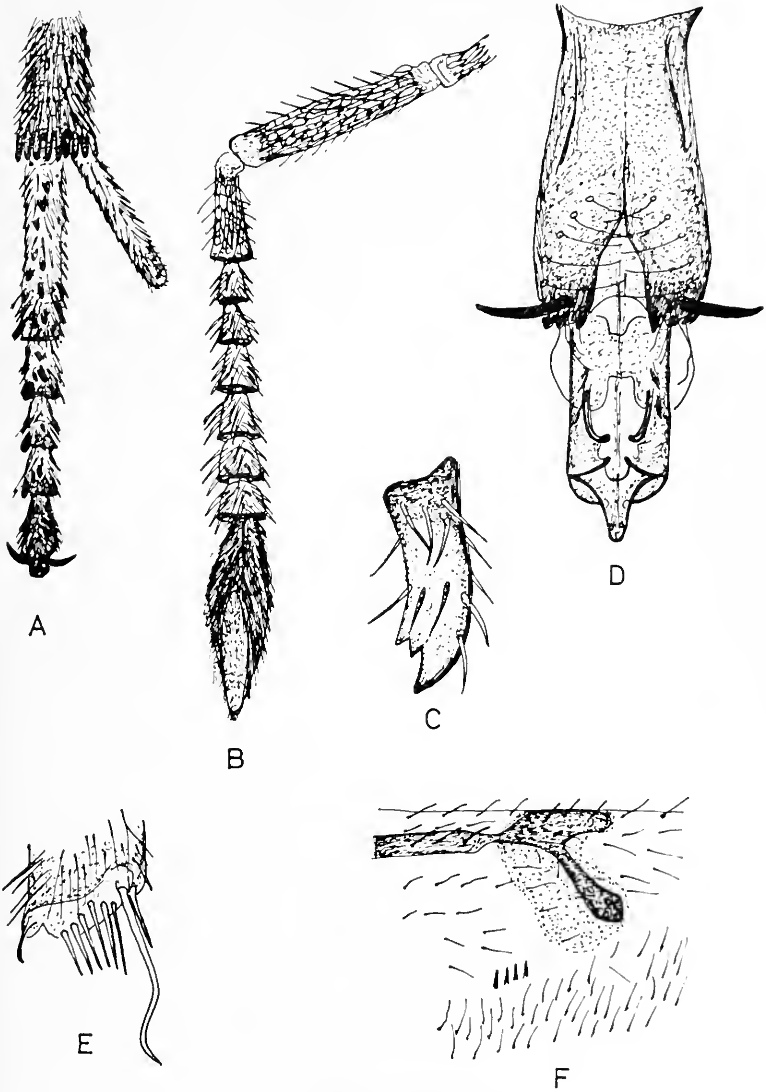

Fig. 1. *Litomastix naevia* n. sp.

A. Tarsal joints, apex of tibia and spur of middle leg of female. B. Antenna of female. C. Mandible of female. D. Genitalia of male. E. Apex of front tibia of female. F. Veins of forewing of female.

and marginal veins. But the mandibular teeth in the female are small and subequal, while *C. naevia* has a long first mandibular tooth. Its flagellum is not longer than the scape, whereas it is distinctly longer in *C. naevia.*

Of the 7 remaining nearctic species belonging to the subgenus *Litomastix,* namely *C. bakeri* (How.) (Howard 1898 pp. 237–238; Girault 1916 pp. 49–50; Snodgrass 1941 pp. 36–37, pl. 8, figs. F–H), *C. celaena* How. (Howard 1885 pp. 11–12), *C. gelechiae* How. (Howard 1885 pp. 10–11, 21), *C. intermedium* How. (Howard 1885 p. 12), *C. koehleri* Blanch. (Doutt 1948 pp. 145–148), *C. lymani* How. (Howard 1907 pp. 102–103), and *C. turni* (Pack.) (Howard 1889 pp. 1888–1889), only *C. bakeri* is mentioned as having a fuscous patch along the stigmal vein and the pedicel in male antenna shorter than first funicular segment (Girault *loc. cit.*).

C. bakeri and *C. naevia* n. sp. both have a long first mandicular tooth, about same ratio of lengths and widths of joints in female antennae to each other, and, in contrast to other nearctic species of *Copidosoma,* the male antennae are very similar to the female antennae, only with the funicle joints somewhat longer and the club shorter. *C. bakeri,* however, has a minute third mandibular tooth in the female and the second tooth over 4 times the size of the third tooth, while they are subequal in *C. naevia;* the forewings of *C. bakeri* are lightly infuscated from head of the submarginal vein distad to the apex, while hyaline in *C. naevia;* the abdomen is less pointed and less cordate in *C. bakeri;* there are shorter hairs on caulis, and the digiti volsellari are shorter and pointing backwards (Snodgrass 1941, pl. 8, figs. F–H). *C. bakeri* seems, however, to be the nearest related previously known nearctic species.

C. lymani may also be closely related as the description is inadequate and the male unknown. It measures only 0.92 mm in length, however.

The Japanese species *L. maculata* Ishii (Ishii 1928 p. 115) also has a fuscous dot on the forewings. The male is unknown, the size is only 0.87 mm in the female, and there are only 4 spines on the tip of the middle tibiae. However, this species also seems closely related with *C. naevia* n. sp.

Acknowledgments

I am much indebted to Dr. Oswald Peck, Entomology Research Institute, Canada Department of Agriculture, Ottawa, for his critical reading of the manuscript, and his helpful suggestions for improvement.

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Nomenclature Notice

Possible use of the plenary powers by the Commission is announced in connection with the following names, listed by case number: 1564, Neotype for **Acarus telarius** Linnaeus, 1758 (Acarina). 1722, Suppression of **Anopheles africanus** Theobald, 1901 (Diptera). 1725, Removal of homonymy of CHRYSOPINAE in Neuroptera and Diptera. 1613, Type-species for **Erbula** Stal, 1783 (Hemiptera).

Send comments with case number to International Commission on Zoological Nomenclature, c/o British Museum (N.H.), Cromwell Road, London S.W. 7, England. (See *Bull. zool. Nomencl.* 22, pt. 5/6.)

Obituary

In deep sorrow, we record the accidental death by drowning of Dr. **Harold J. Grant, Jr.**, in Trinidad, on February 27th. Dr. Grant was Curator and Head of the Department of Entomology of the Academy of Natural Sciences of Philadelphia, Editor of the Transactions of the American Entomological Society, and Associate Editor of Entomological News. A biographical memorial will appear in a later issue of this publication.

Review

A History of Genetics. **Alfred H. Sturtevant.** Harper and Row, N. Y., 1965, 165 pp. Price: $5.50.

This is a remarkable account of the significant events in the history of genetics by one of the great figures in genetics. Sturtevant's first-hand knowledge of the scientific relevance of each discovery, and in many cases of the individuals responsible as well, extends to the early part of this century, and it is evident that in many areas he has not lost touch with current developments. Where his personal acquaintance is lacking, for example in discussing Mendel's contributions and the intellectual environment in which they were made, the history is carefully researched. The writing is lucid and very concise without being disjointed. I found only one unclear passage in the book, the last sentence on p. 125 concerning temperate bacteriophages. The sense in which they form a transition to the "infective agents" responsible for transformation and transduction seems mysterious.

It must be borne in mind that the selection of material and especially of termination dates of his accounts of the various areas of genetics is arbitrary. The jacket claims that the history covers the period up to "about 1950"—in some cases it is well before this, and in others after. For instance no mention of the fundamental experiment of Luria and Delbrüch (1943) is made anywhere in the book, presumably because accounts are readily available elsewhere. On the other hand, there is reference to an article by Gibor and Granick in 1964, which is also accessible. I think this hazy termination of the accounts of work in various fields detracts from the book and could have been avoided easily.

Since the book is unique in being Sturtevant's own survey of genetics, and is authoritative because of his complete mastery of most of the field, these criticisms are not too serious.—N. R. Kallenbach

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Number 19

BUTTERFLIES OF LIBERIA

By Richard M. Fox, Arthur W. Lindsey, Jr., Harry K. Clench and Lee D. Miller

402 pages of text; colored frontispiece, 233 figures, 2 graphs, 2 tables, 3 maps, table of contents, full bibliography and a taxonomic index.

With 195 new records, this study increases the known butterfly fauna of Liberia from 280 to 475 species and another 254 species are noted as probably to be found. Two new tribes, 5 new genera, 13 new species and subspecies are described. Illustrations include photographs and, where pertinent, drawings of genitalia of all holotypes, along with photographs and drawings of closely related forms for comparison. The distribution of each species is given and those more difficult to identify or previously confused are treated at greater length. All known records from Liberia are noted. A 46 page introduction details climatic conditions and biotopes in Liberia and analyzes the zoogeographic and ecologic relationships of the butterflies of Liberia and of Occidental Africa.

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CONTENTS

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ENTOMOLOGICAL NEWS

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Notes on Tanypodinae Types in European Museums (Dipt.: Chironomidae)

SELWYN S. ROBACK, Curator, Department of Limnology, Academy of Natural Sciences of Philadelphia

As is the case in many groups of insects, many of the early descriptions of North American and Greenland species were by European workers and the types of these repose in the museums in Europe. Also, the names of many European species have been applied to North American specimens or used in the North American literature. In the course of a study of the North American Tanypodinae,* I found it desirable to go to Europe and study some of these types. In many cases, I found it necessary to label previously unrecognized or unlabeled holotypes or to designate lectotypes from syntypic series. Unfortunately, as is usually the case when old types are examined, some long used names proved to be synonyms. The synonymy and type designations are given under each species.

I am deeply indebted to the following individuals for making the collections at their institutions available to me and for the help and kindness shown me during my stay at their institutions.

Dr. Paul Freeman, British Museum (N.H.); Dr. M. Descamps and Dr. T. Tsacas, Paris Natural History Museum; Dr. S. L. Tuxen and Dr. L. Lyneborg, University Zoological Museum, Copenhagen; Dr. C. Lindroth, Entomological Institute, Lund University, Sweden. The ownership of a few specimens from American Institutions listed here is as follows: United

* The support of the National Science Foundation (Grant GB2719) is gratefully acknowledged.

States National Museum (USNM), Canadian National Collections (CNC), Illinois Natural History Survey (INHS). The figures are by Mr. Robert Moore, Jr.

In the following descriptions I have used the roman numerals I–III for the prothoracic—metathoracic legs, T_1–T_5 for the tarsal segments, LR for leg ratio, AR for antennal ratio. The thoracic chaetotaxy is as in Curran (1934).

Tanypus punctipennis Meigen

Tanypus punctipennis Meigen 1818:61, 62
Tanypus punctipennis (part) Malloch 1915:383
Tanypus punctipennis Edwards 1929:299
Tanypus punctipennis Sublette 1964:132

Sublette (1964) has noted that most of the New World specimens determined as *T. punctipennis* Meigen are not that species but rather *T. carinatus* or *T. neopunctipennis* Sublette. I have examined the Meigen specimen of *T. punctipennis* at Paris and it proved to be very close to, if not identical, with *T. carinatus* Sublette. Figs. 1–5 compare the genitalic dististyles of Edwards', two U. S., and the Meigen specimen with the holotype of *T. carinatus* and Table 1 compares some of their measure-

TABLE 1. *Comparison of ♂ T. punctipennis and T. carinatus specimens*

	punctipennis					*carinatus*	
	Meigen Type	Edwards speci-men	Lake City Mich.	Grand Junction Mich.	Sask.	Holo	Ontario
Dististyle length	.152	.158	.154	.160	.154	.104	.108
Basistyle length	.260	.270	.250	.290	.263	.196	.196
Carina present	+	small	small	+	+	+	+
Wing length	3.6	3.9	3.3		3.3	2.6	2.8
LRI	.76	.81	.79		.80	.81	.86
LRIII	.89	.90	.85		.91	.89	.90
Beard* I	8.0	7.0	7.0		8.0	2–5.0	5.0
Basistyle lobe	+	+	+		+	+	+

All measurements in mm.
* Beard ratio = length of longest hairs divided by tarsal diameter.

ments and ratios. There are too few specimens from too few localities to establish whether *T. carinatus* is a small form of *T. punctipennis*. For the present, I feel they should be retained as separate species. The Edwards specimens determined as *T. punctipennis* agree in general maculation and measurements but have a smaller carina on the dististyle, Fig. 4 (also see Fig. 7e, Sublette 1964). In the specimen I personally examined this difference may be an artifact of mounting. The orientation of the dististyle in the mount and the extent of clearing with KOH before mounting can affect the apparent size of the carina and the orientation of the hairs. Of the 3 North American males which I feel belong to *T. punctipennis,* one shows a dististyle similar to Edwards specimens, Fig. 3, while the other two are as in Meigen's specimen, Fig. 2. I have included these North American specimens in Table 1.

The detailed history of the Meigen material is not fully clear. Johannsen (1926) states that some of the Von Winthem material in Vienna was said to be determined by Meigen and in some cases were co-types. I cannot establish, to my satisfaction, whether the Paris specimen and those in Vienna are syntypic. In the interest of stability and in the absence of any evidence clearly establishing a single specimen as holotype, I feel it is reasonable to assume that they are syntypes and I have therefore designated the Paris specimens as lectotype of *T. punctipennis.*

Lectotype male.—Head brown, lighter around eyes; pronotum brown, lighter above; moderately produced above; vittae brown, highly pollinose; mesonotal tubercle low and dark; acrosticals not discernible; scutellum light brown; postnotum black-brown; femora with basal three-quarters and apex dark; base and apex of tibiae, apex T_1, apical half of T_2 and T_{3-5} dark; claws spatulate, toothed apically; 2 long and 2 short spines on base; empodium present about as long as claws; LRI, .76; spur tibia I, .068 mm with 2 lateral teeth; beard I about 8 times tarsal diameter; LRII, .74; spurs tibia II, .079, .049 mm with 3 lateral teeth each; LRIII, .89; spurs tibia III, .089, .064 mm with 2 lateral teeth each; comb tibia III with 11 bristles; wing, 3.6

mm; maculation similar to Fig. 7d, Sublette 1964; spots slightly darker; *m–cu*, .43 arculus to wing tip; Cu_2 about 4 times length of petiole of *Cu;* wing moderately haired; abdomen brown; ninth tergite with about 20 hairs on disc; genitalia brown, Fig. 7; basistyle .260 mm long with a group of larger spines mesoventrally, suggesting a lobe; dististyle, Fig. 1, .152 mm with a distinct internal carina.

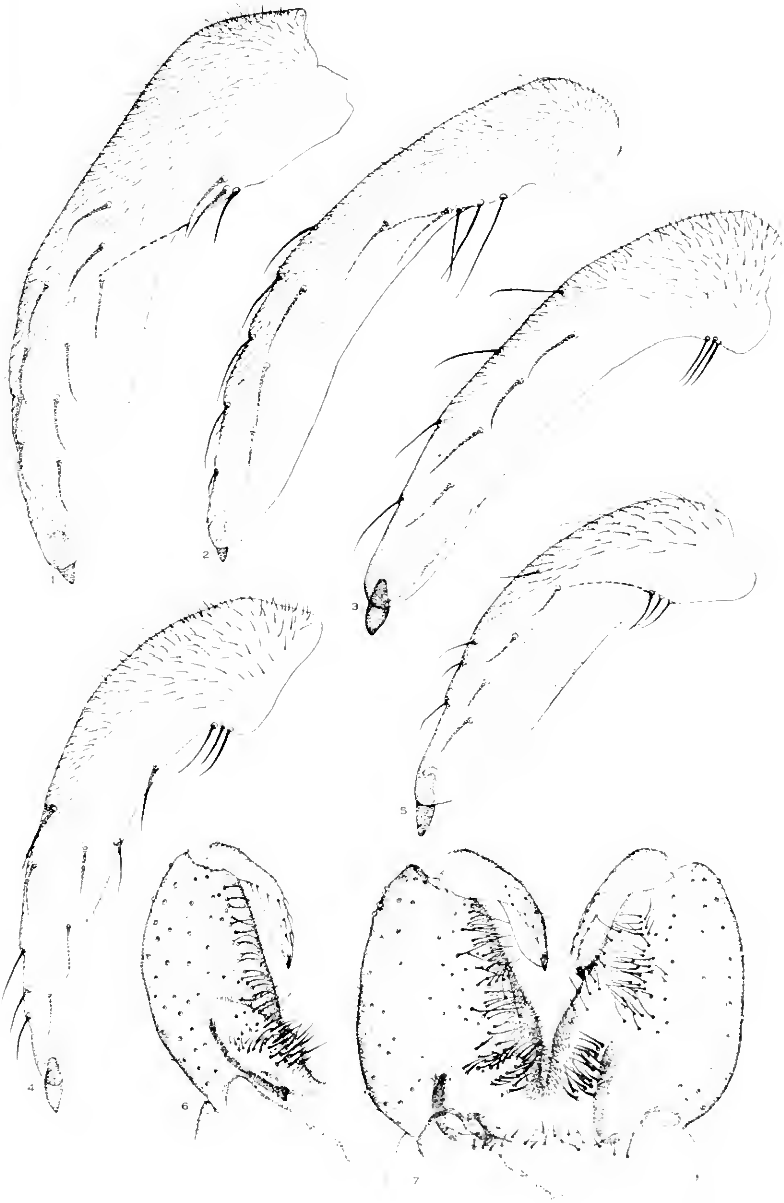
Specimens: ♂ Allemagne (Paris)
♂ Radwell Harts 15–VI–1917 (Edwards) (USNM)
♂ Lake City, Mich. 25 Aug. 1952 (USNM)
♂ Grand Junction, Mich. 15 July 1914 (INHS) 2477
♂ Indian Head, Sask, 9–VIII–45 (Sandercock) (CNC)
♂ Ottawa, Ontario 10–VI–56 (Vockeroth) (CNC)

Procladius crassinervis (Zetterstedt)

Tanypus crassinervis Zetterstedt 1838:817 (1) (Lyksele)
Tanypus crassinervis Staeger 1845:354 (11 ♂, 2 ♀♀)
Tanypus crassinervis Zetterstedt 1850:3599
Trichotanypus chorcus Andersen 1937:21, 22 (nec. *chorcus* Meigen)
Trichotanypus chorcus Henriksen 1939:68
Trichotanypus crassinervis Henriksen 1939:68
Procladius crassinervis Sublette and Sublette 1965:149

The type series at Lund consisted of 4 syntypes, one ♂ (slightly teneral), 2 ♀♀ and one poor specimen with no abdomen or wings. I have designated the male as lectotype and it is so labeled. The specimens determined as this species by Staeger consist of a ♂ and 2 ♀♀ at Copenhagen. Though a little larger and darker than the Zetterstedt type, they agree in all essentials, particularly the distinctive structure Fig. 12, of internal strut 2. The specimens determined as *T. chorcus* by

FIGS. 1–7. *Tanypus punctipennis* Meigen. 1. Dististyle, lectotype, Paris. 2. Dististyle, Grand Junction, Michigan. 3. Dististyle, Lake City, Michigan. 4. Dististyle, England, det. Edwards. 6. Genitalia, Grand Junction, Michigan. 7. Genitalia, lectotype, Paris.
FIG. 5. *Tanypus carinatus* Sublette, Dististyle, holotype.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Andersen (1937) are identical with the Staeger and Zetterstedt material. The shape of the heel of the dististyle Figs. 8–10, is subject to a great deal of variation. Though they superficially appear different, I have been able, by pressing down on the cover slip, to convert the shape of Fig. 10, into that of Fig. 8 (*T. crassinervis* Zett.).

Lectotype male.—Head brown; antennal ratio 2.1; pronotum brown; vittae black-brown; humeri and part of supra-alar area lighter; humerals 10 ±; prescutellars 6–7; scutellum and postnotum black brown; legs brown, base and apex of tibiae darker, apex of T_1 and all T_{2-5} dark; LRI, .73; tibial spur, .054 mm; LRII, .64; LRIII, .74; preapical spurs on T_{1-2} of leg III; comb leg III with 9 filaments; tibial spurs, .068, .039 mm with 5 and 4 lateral teeth, respectively; claws toothed apically; 4 fine spines at base of each; empodium as long as claws; wing, 2.9 mm; *r–m,* lightly infuscated; Cu_2, 1.36 as long as petiole of *Cu;* abdomen dark; ninth tergite simple with scattered hair; genitalia dark, Fig. 11; basistyle, .280; dististyle, .118 mm; Fig. 8, heel of dististyle, .049 mm; ratio, dististyle length to heel length 2.4; strut 2 as in Fig. 12; strut, 3 ovoid.

Variation (Greenland specimens—2 ♂♂ Andersen, 1 ♂ Staeger).

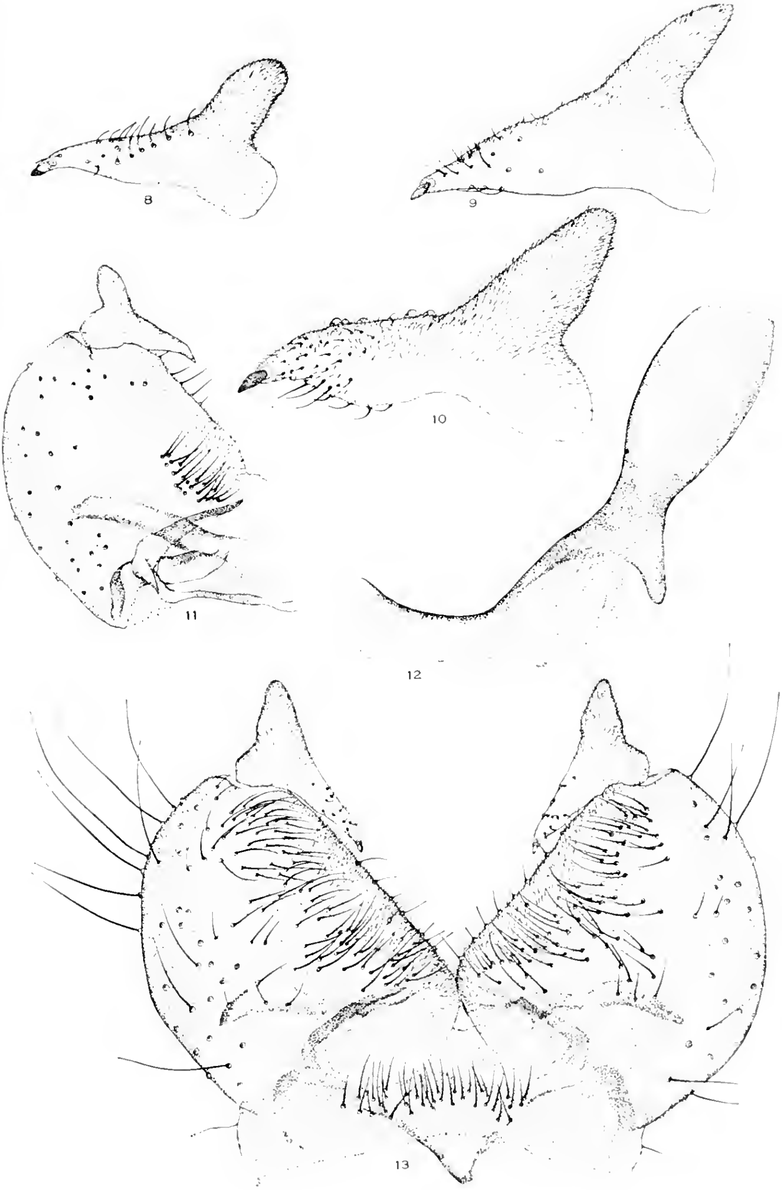
Antennal ratio, 2.5–2.9; LRI, .68–.74; LR II, .62; LR III, .62–.68; all legs with preapical spurs on T_{1-2}; pronotals, 15; supra-alars, 32 ±; humerals, 13; prescutellars, 6–7; mesopleurals, 5; mesosternals, 0; basistyle, Fig. 13, .295–.320 mm; dististyle, .133–.152 mm; heel, .054–.064 mm; ratio dististyle length to heel length, 2.2–2.5, Figs. 9 and 10.

Macropelopia decedens (Walker)

Tanypus decedens Walker 1848:22 (St. Martins Falls, Albany River, Hudson Bay)

Tanypus hirtipennis Loew 1865: 5, nec. *Tanypus hirtipennis* Malloch 1915:367 (New Synonym)

FIGS. 8–13. *Procladius crassinervis* (Zetterstedt). 8. Dististyle, lectotype, Lund. 9. Dististyle, det. Staeger, Greenland. 10. Dististyle, det. *chorcus* Andersen, Greenland. 11. Genitalia, lectotype. 12. Detail strut 2, Andersen specimen. 13. Genitalia, det. *chorcus*, Andersen.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Anatopynia brunnea Roback 1958:2 (New Synonym)
? *Macropelopia decedens* Fittkau 1962:114
Anatopynia (*Macropelopia*) *decedens* Sublette and Sublette 1965:145
Anatopynia (*Psectotanypus*) *dena* Sublette and Sublette 1965:145

The description of this species indicates that it came from the above locality and was presented by G. Barnston, Esq. On the pin with the specimen is a label stating that it was in the collection under *decedens* from Barnston but actually came from Children's collection. The British Museum accession records state that it entered the collection in 1840, labeled *T. nebulosus* and was bought at Mr. Children's sale. Walker in his description states that the species is like *T. nebulosus* and gives the body length as 2 lines and the wing length as 5 lines. This is an unusual ratio for a tanypodine male where the body is usually as long, if not longer, than the wings. The single male in the British Museum collection lacks the greater part of the abdomen and the ratio of the residual body to the wings is as in Walker's description. Inasmuch as Walker was often careless in his observations and in view of the facts that the specimen was in the British Museum collections at the time Walker was working, and was labeled *T. nebulosus* it seems reasonable to assume that, in spite of the source discrepancy, this was the specimen Walker described and therefore the holotype. The assignment of the donation to Barnston was probably an error on Walker's part.

In spite of the lack of genitalia, the type of *T. decedens* is clearly conspecific with *T. hirtipennis* Loew and *A. dena* Roback which are here placed into synonymy. The males assigned by Malloch (1915) to *T. hirtipennis* belong in *Natarsia* Fittkau.

Holotype male.—Body length (abd. 3–8 missing), 2.0 mm; head brown; postoculars multiseriate; pronotum brown; thorax light brown; vittae slightly darker; mesonotal spur not visible (specimen is pinned through thorax); scutellum light brown; postnotum dark brown with dorsal hairs; LR I, .75; LR II, .60; spur of tibia I, .122 mm long with about 20 lateral teeth; apex of tibia I with comb of 12–13 light bristles, .033 mm long;

spurs II, .108 and .087 mm with 20 and 19 lateral teeth respectively; wing, 4.8 mm; moderately haired; *r–m*, lightly infuscated; *m–cu*, .52 arculus to wing tip; abdomen brown (tergites 1 and 2).

Type in British Museum (N.H.).

Psectrotanypus pictipennis (Zetterstedt) n. comb.

Tanypus pictipennis Zetterstedt 1838:818 (5) (Lapponia? Groenlandia)
Tanypus pictipennis Staeger 1845:354
Tanypus pictipennis Zetterstedt 1850:3611
Tanypus pictipennis Henriksen 1939:69
Macropelopia pictipennis Fittkau 1962:114
Anatopynia (*Macropelopia*) *pictipennis* Sublette & Sublette 1965:145

In Zetterstedt's original description after the initial diagnosis there is the ♀ sign. The description below, however, is of a Mas. (male). In 1850 he refers to his 1838 specimen as a ♂ and also mentions Staeger's 1845 ♀. The Zetterstedt collection at Lund possesses a single male which bears the label "*T. pictipennis* ♂ gronland." This male is slightly teneral but agrees with Zetterstedt's original description. Based on this evidence I feel that this male is the holotype of *T. pictipennis* and have so labeled it. The ♀ sign in the original description was undoubtedly a manuscript or printer's error.

The female in the Staeger collection at Copenhagen is in good condition. It agrees in all respects with the Zetterstedt male. The distinctive wing pattern, only faintly indicated in the male, is clearly seen in the female, Fig. 24.

Holotype male.—Head brown; antennal ratio about 3.0; pronotum brown with 16 pronotal hairs; vittae brown—slightly reddish; mesonotum pale brown, lightly pollinose; dorsocentrals multiseriate; humerals, 18; supra-alars 30+; postalars, 7–8; pteropleurals, 1–3; sternopleurals, 12; postnotum dark brown, dorsally haired; legs pale brown; Leg I incomplete; LRII, .51; tibial spurs, .122, .084 mm with 16 and 15 lateral teeth, respectively; LRIII, .61; tibial spurs, .140, .092 mm with 13 and

12 lateral teeth, respectively; tibia III with comb of 8 bristles; claws sharp; pulvilli well developed, wing slightly curled, about 4.0 mm long; pattern faintly indicated; *m–cu*, .47 arculus to wing tip; halteres light; abdomen brown; ninth tergite bare; basistyle, .39 mm; dististyle, .26 mm, Fig. 25; ratio, 1.5.

Female.—Head brown; antennal flagellum 14-segmented; last 5 segments in ratio 12-12-13-14-31; postoculars multiseriate pronotum brown with 7–9 hairs dorsally and 11–13 latero-ventrally; vittae dark red brown; pollinose; mesonotal ground color orange-brown; humerals numerous; postalars 6; mesopleurals 4; mesosternals 7; scutellum, postnotum dark orange-brown; postnotum haired dorsally; legs brown; LRI, .48; spur tibia I, .074 mm with 15 lateral teeth; comb III with 7–8 bristles; claws and pulvilli as male; wing, 3.8 mm; wing mostly brown infuscated with light spots, Fig. 24; halteres shaft brown; globe light; abdomen dark orange-brown.

Holotype male—Ent. Institutionen, Zool. Inst. Lund.

Female—Universitetets Zoology Museum. Copenhagen.

Apsectrotanypus trifascipennis (Zetterstedt)

Tanypus trifascipennis Zetterstedt 1838:819 (11)
Tanypus trifascipennis Zetterstedt 1850:3618 (26)
Apsectrotanypus trifascipennis Fittkau 1962:143–149

The series of specimens labeled *T. trifascipennis* Zett. at Lund consisted of 1 ♂ and 5 ♀♀. The male bore a black label indicating that it was collected in 1832 and its data label bore the legend—*T. trifascipennis* Zett. ♂ Tresunda, Lapp. The original description lists a male from Tresunda (Lapponica). In 1850, Zetterstedt refers to this single male, giving full collection data which is in agreement with the aforementioned label and also mentions 10 ♀♀ collected in 1840. The 5 ♀♀ in the Lund Entomological Collection bear green labels indicating that they were collected in 1840. From this data it would appear that the male at Lund was the only specimen before Zetterstedt when he wrote the original description and is therefore the holotype. I have so labeled it. Fittkau (1962) has given a complete description and figures of this species. The data he presents are in agreement with the characters of the Holotype.

Natarsia baltimoreus (Macquart) n. comb.

Tanypus baltimoreus Macquart 1855:15 (Baltimore)
Ablabesmyia fastuosa Johannsen 1905:153 (New Synonym)
Tanypus hirtipennis Malloch 1915:367, nec. *hirtipennis* Loew 1861 (New Synonym)

Most of the specimens I have seen in North American collections identified as this species were *Procladius* species. The type in the Bigot Collection at the British Museum (N.H.) proved to be a *Natarsia*. *A. fastuosa* Joh. and *T. hirtipennis* Mall. (nec. Loew) are identical and must fall as synonyms.

Holotype female.—3.6 mm; head brown; postoculars uniserial; pronotum brown; vittae brown on lighter brown mesonotum; mesonotum highly pollinose; vittae not too distinct; pleurae and sternum brown; 5 hairs on pteropleuron, about 12 laterally on sternum; supra-alars about 50; legs light brown; knees darkened; tarsi I, III absent; LR II, .53; spurs of tibia narrow; apex about one-half spur length; wing, 3.8 mm; *r–m*, darkened; costa past R_{4+5}; apex of M below and before wing tip; *m–cu*, .56 arculus to wing tip; wing densely haired; abdomen brown; apical half of tergites highly pollinose.

Thienemannimyia carnea (Fabricius)

Chironomus carneus Fabricius 1805:16
Tanypus carneus Meigen 1818:67
Thienemannimyia carnea Fittkau 1962:187, 188

The type of this species still exists in the Fabrician collection at Copenhagen. It is, however, incomplete with only the thorax (pronotum missing), right wing, right legs II, III left leg III (femur, tibia) remaining. The following notes were made from this holotype.

Vittae red-brown, not too distinct; scutellum red-brown, postnotum dark red-brown; legs pale; LRII, .59; LR III, .65; no brush on T_3 II; wing, 2.9 mm; wing densely haired; maculation as in Fittkau (1962) pp. 165, Fig. 97; *m–cu*, .41 arculus to wing apex.

The specimen of *T. carneus* in the Meigen material at the Paris Natural History Museum agrees with the type remnant and with the description of *T. carnea* in Fittkau (1962). The aedeagus is as Fig. 108, pp. 171 in Fittkau. This name has been applied to North American specimens by Johannsen and others. Fittkau notes that Johannsen's specimens of *T. carnea* belong to *Zavrelimyia* and has renamed them *Z. carneosa*. To date I have not seen any adult specimens from North American which could be properly assigned to *T. carnea*.

Thienemannimyia or Rheopelopia unicolor (Walker)

Chironomus unicolor Walker 1848:19 (Nova Scotia)
Chironomus unicolor Johannsen 1926:274 (as synonym of *T. melanops*)
Pentaneura unicolor Sublette & Sublette 1965:147 (*P. melanops* as synonym)

The type of this species is, unfortunately, a female and it cannot, at present, be placed any closer than genus. It is impossible to assign it to a known North American species. From its distribution it is possibly the female of *T. prudens* (Walley).

Female.—Length 3.0 mm; head, thorax, abdomen pale orange-brown; vittae indistinct, legs pale; fore and hind tarsi missing; LRII, .56; spurs of leg III, .100 and .067 mm with 9 and 7 lateral teeth, respectively, Fig. 14; comb of tibia III with 8 spurs; wing, 3.9 mm, unmarked; apex of R_{4+5} above apex of M.

Type in British Museum (N.H.). Label on specimen indicates it was identified as type by E. A. Waterhouse.

Conchapelopia melanops (Wiedemann)

Tanypus melanops Wiedemann in Meigen 1818:65
Tanypus melanops Staeger 1840:588 (14)
Tanypus melanops Zetterstedt 1850:3621 (29)
Conchapelopia melanops Fittkau 1862:242–245

This species name like *T. carnea* has been applied to North American specimens. To date, however, I have seen no New

World material which is conspecific with the European specimens. As Fittkau (1962) notes, Johannsen's (1946) figure is from an English specimen determined by Edwards. Fittkau (1962) has offered an excellent description and figures of *C. melanops* (p. 230, Figs. 166, 167). I have examined the genitalia of the specimens determined as *T. melanops* in the Staeger collection at Copenhagen and the Zetterstedt collection at Lund and they agree with Fittkau's concept.

The specimens labeled *T. melanops* in the Meigen Collection at Paris are a male and three females. The label with the specimens also bears the notation, = *binotata* (Wied). Examination of the male proved that it is indeed *Krenopelopia binotata* (Wied) rather than *C. melanops* (Wied).

Krenopelopia nigropunctata (Staeger)

Tanypus nigropunctatus Staeger 1840:589
Krenopelopia nigropunctata Fittkau 1962:271–273
nec. *Tanypus nigropunctatus* Authors (North America)

Fittkau (1962) expressed some doubt as to whether this species belonged in *Krenopelopia,* where he placed it, or in *Zavrelimyia.* An examination of the type series at Copenhagen shows that Fittkau's placement was correct. The extension of C past R_{4+5}; the form of the claw, Fig. 20; the tibial spur I, Fig. 21; and the ratio of T_{4+5} of leg II all agree with the generic concept of *Krenopelopia.*

All the specimens I have seen in North American collections determined as *T. nigropunctatus* proved to belong to *Zavrelimyia* or *Thienemannimyia.*

The type series at Copenhagen, consisted of 2 ♂♂ and 1 ♀. One of the males bearing the label "♂ St." has been designated as lectotype and is so marked.

Lectotype male.—3.2 mm; head orange-brown; antennal ratio 1.68; pronotum pale; vittae orange-brown; not too distinct; scutellum pale orange-brown; postnotum brown; legs pale; LR I, .76; spur tibia I, .049 mm with 3 lateral teeth, Fig. 21; LR II, .64; spurs II, .049, .030 mm with 3 lateral teeth each; T_{4+5} II with ratio 26–20; LR III, .68 +; spurs tibia III, .064; .025 mm with 3 and 2 lateral teeth respectively; comb tibia III with 5 bristles; claw as in Fig. 20; pulvilli reduced; empodium present; wing, 2.35 mm; haired and unmarked; C exceeds R_{4+5} by two-thirds length of *m–cu; m–cu*, .46 arculus to wing apex; R_{4+5} ends just behind apex of M; halteres light; abdomen as in Fig. 23; ninth tergite narrow with 3 apical hairs; basistyle, .195 mm; dististyle, .148 mm; both light, Fig. 22.

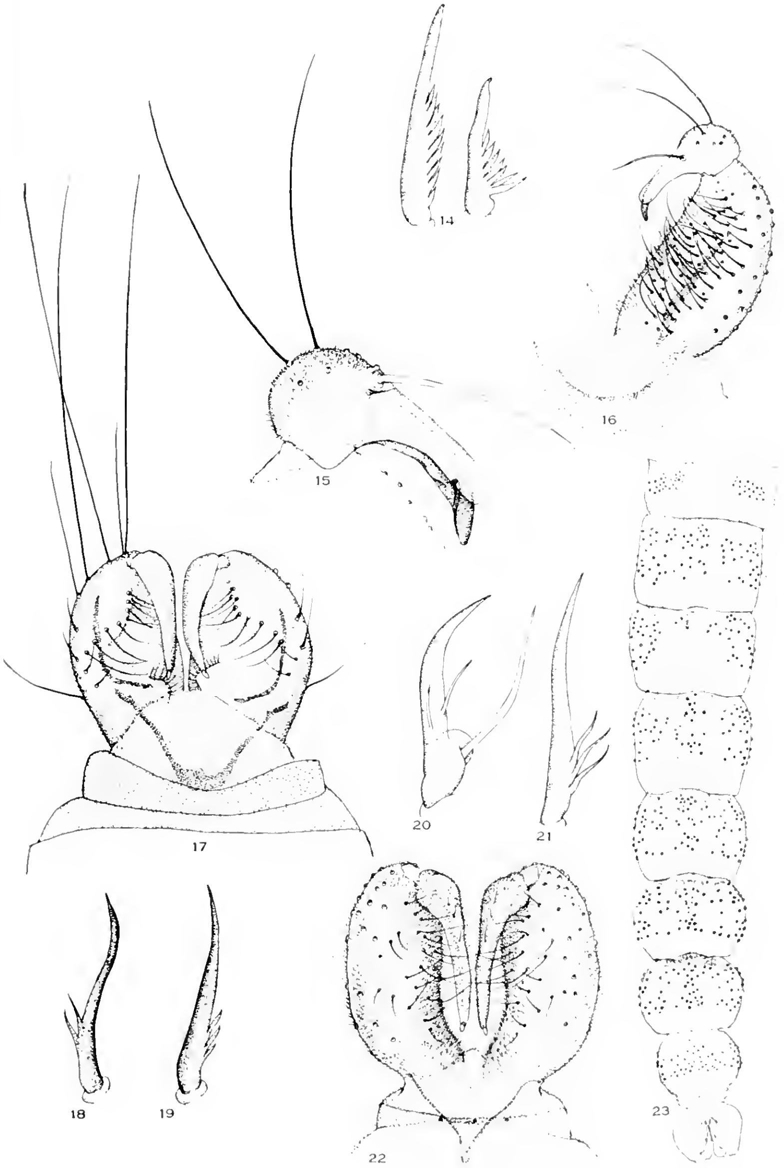
Nilotanypus fimbriatus (Walker) n. comb.

Chironomus fimbriatus Walker 1828: 20 (St. Martins Falls. Albany River, Hudson Bay)
Pentaneura dubia Johannsen 1946: 286 (nec. *dubia* Meigen)
? *Nilotanypus* spec. America Fittkau 1962: 415 (pupal exuviae)
Pentaneura fimbriata Sublette and Sublette 1965: 147

This very small species falls in *Nilotanypus* Kieffer. It differs from *N. dubia* (Meigen) in a lower LRII and in possessing a distinct lobe on the inner mesal corner of the basistyle, Fig. 17.

Male.—1.4 mm; head brown, postoculars uniserial; pronotum and thorax dark brown; vittae indistinct; LRI, .80; spur tibia I, .032 mm, Fig. 18 with apparently 2 fine lateral teeth; tarsal segments 1 and 2 each with 2 preapical spurs; LRII, 1.22; spur, .038 mm with 3 fine lateral teeth Fig. 19; tarsal segment 1 and leg II with 2 preapical spurs; wing, 1.2 mm long; R_{2+3} absent; R_{4+5} ends half way between the apices of Cu, Cu_2; costa not past R_{4+5}; M-Cu, .26 arculus to wing apex; wing densely haired; abdomen wholly brown; basistyle, Fig. 17, .080 mm; dististyle, .060 mm.

FIG. 14. *Rheopelopia* or *Thienemannimyia unicolor* (Walker), Spurs tibia III, holotype.
FIGS. 15–16. *Podonomus kiefferi* Garrett. 15. Detail dististyle, lectotype. 16. Genitalia, lectotype.
FIGS. 17–19. *Nilotanypus fimbriatus* (Walker). 17. Genitalia, holotype. 18. Spur tibia I, holotype. 19. Spur tibia II, holotype.
FIGS. 20–23. *Krenopelopia nigropunctata* (Staeger). 20. Claw, lectotype. 21. Spur tibia I, lectotype. 22. Genitalia, lectotype. 23. Abdomen, lectotype.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Type in collection of British Museum (N.H.). Label on specimen indicates it was identified as type by Crosskey.

Ablabesymia pulchripennis (Lundbeck)

Tanypus pulchripennis Lundbeck 1898: 293 (Egedesminde)
Tanypus pulchripennis Henriksen 1939: 69
Ablabesmyia pulchripennis Sublette & Sublette 1965: 148

The type series in Copenhagen consists of 2 ♂♂, 7 ♀♀ Syntypes. I have selected one of the males as Lectotype and it bears my label so indicating.

Lectotype male.—Head black; postoculars multiseriate, long dense and dark; antennal ratio 3.6; pronotum black; mesonotum dark; vittae not distinct; dorsocentrals biserial; humerals 15+; supra-alars 31+; postalars 1; scutellum black, postnotum black, no dorsal hairs; femora completely dark brown; tibiae with 3 brown rings, Fig. 28; area between rings infuscated; rings not as contrasting to ground color as in other *Ablabesmyia;* tarsi 1 and 2 as in Fig. 28; T_{3-5} dark; claws sharp with 2 short and 2 long basal spines; pulvilli reduced; empodium half claw length; LRI, .66; tibial spur, .092 mm; T_{1-3} with preapical spur pairs; beard of leg I about 4.5 times tarsal diameter; LRII, .65; T_{1-3} with preapical spurs; tibial spurs, .070, .064 mm with 8 and 7 lateral teeth, respectively; LRIII, .73; preapical spurs on T_{1-3}; tibial spurs, .092, .064 mm; larger with 8 lateral teeth; tibial comb not distinguishable; wing, 3.9 mm, with typical maculation; *m-cu,* .43 from arculus to wing apex; halteres dark, abdomen black; dorsal hairs dense and dark; genitalia dark; basistyle, .330 mm long; dististyle .245 mm; spur of dististyle sharp, Fig. 26, .044 mm long; aedeagus, Fig. 27; blade, .092 mm; dorsal lobe, .023 mm; lateral filaments, .053 mm; ninth tergite with 2 hairs, one on each side of midline.

FIGS. 24–25. *Psectrotanypus pictipennis* (Zetterstedt). 24. Wing, Staeger ♀. 25. Genitalia, holotype.
FIGS. 26–28. *Ablabesmyia pulchripennis* (Lundbeck). 26. Detail, apex of dististyle, lectotype. 27. Genitalia, lectotype. 28. Legs I–III, lectotype.

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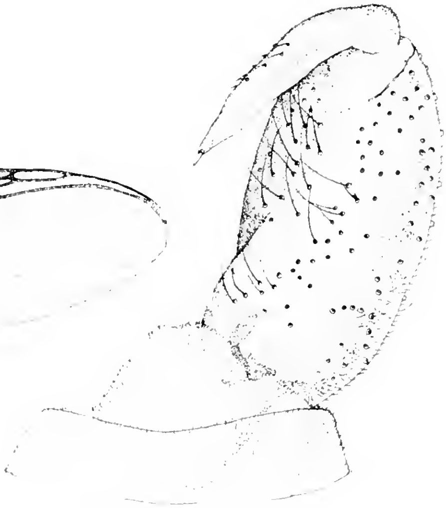

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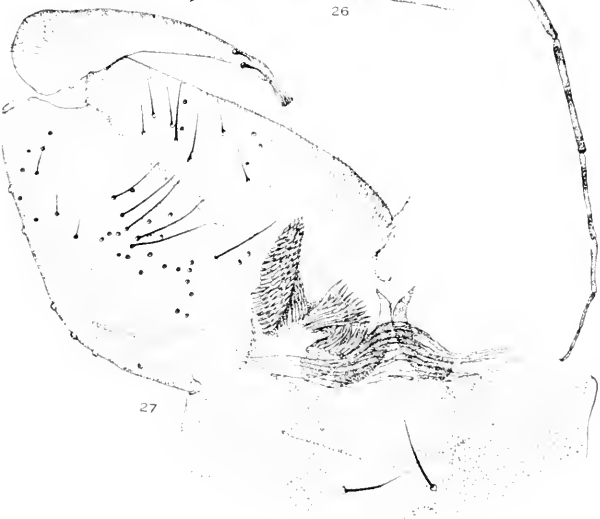

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Podonomus kiefferi Garrett

Tanypus tibialis Staeger 1845 : 354 (Preoccupied by *T. tibialis* Say 1823 : 151)
Tanypus tibialis Lundbeck 1898 : 294
Tanypus tibialis Henriksen and Lundbeck 1918 : 593
Paratanypus kiefferi Garrett 1925 : 8, 9 (New Synonym)
Podonomus peregrinus Edwards 1929 : 296
Podonomus (*Paratanypus*) *kiefferi* Edwards 1937 : 101
Tanypus tibialis Henriksen 1939 : 69

Staeger's original description recorded 6 males. The Staeger collection at Copenhagen contains two males with Staeger type labels from "gronland." One of these males lacks the abdomen. The more nearly perfect specimen, from which a slide mount was made, has been selected as lectotype and is so marked. In addition to the Staeger specimens there are 2 ♂♂ and 1 ♀ collected in 1889. These are the specimens mentioned by Lundbeck (1898) and Henriksen and Lundbeck (1918). As can be seen above the type proved to be a Podonominae, genus *Podonomus*. From the published figures and descriptions I cannot separate *P. kiefferi* Garrett and *P. peregrinus* Edwards from *P. staegeri*.

Lectotype male.—Head brown; antennal flagellum 14-segmented; last six segments in ratio 10-10-10-10-42-27; pronotum brown, reduced; thorax and abdomen subshining dark brown, lightly pollinose; acrosticals present; dorsocentrals uniserial; humerals, 5–7, supra-alars 10; legs brown; LR I, .45; LRII, .40; LR III, .47; tibia III with two spurs .064, .044 mm; spurs with fine spines along length, preapical comb with 9 filaments; claws spatulate apically with 2 basal filaments; pulvilli reduced; empodium almost to apex of claws; wing, 2.9 mm, haired; no markings; halteres dark; genitalia, Fig. 16; basistyle, .190 mm; dististyle, .122 mm, Fig. 15.

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Aspisoma yechae sp. nov. (Coleoptera: Lampyridae)

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The largest described species of the Lampyridae are in the genera *Cratomorphus* Motschulsky, *Lamprocera* Laporte, and *Aspisoma* Laporte. Lengths up to 30 mm have been given for species of *Cratomorphus,* and a female of *C. splendidus* Drury measured by the writer was 35 mm long. *Lamprocera latreillei* Kirby ♀ is reported as 13 lines long, about 27.5 mm. Several species in both of these genera attain 20 to 25 mm. Gorham (1881, p. 53) said that *Aspisoma* does not attain the size of the Cratomorphi, but several species have been described as being 20 to 23 mm long. Larviform females in other genera, e.g., *Lamprigera,* may greatly exceed the lengths for males given above.

There is at present no comprehensive key to the species of *Aspisoma.* The largest species so far described is *A. grossum* Erichson (1847) from Peru, 21–23 mm long, and *A. luridum* E. Oliv. (1907) from Brazil, 21 mm long. I have not seen valid specimens of either of these species but the descriptions and reported sizes do not agree with the specimens described below.

A collection of twelve Ecuadoran *Aspisoma,* one a female, has recently been presented to me by Miss Anne Marie Yech. The specimens are from 30 to 35 mm long. It appears to be a previously unrecorded species, which is rather surprising in view of its conspicuous size, and is described below.

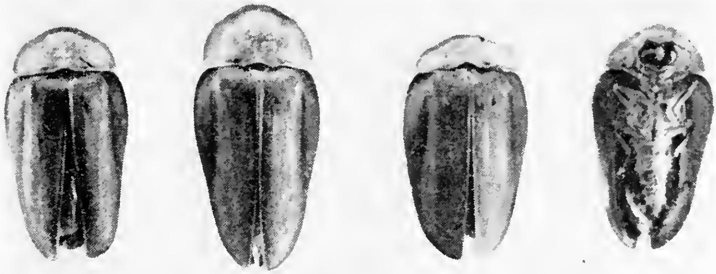
Aspisoma yechae sp. nov.

Holotype Male:

Type locality, Santo Domingo de los Colorados, Ecuador. Specimens collected in July to November, 1965. Altitude 200–300 meters.

Body outline typical for *Aspisoma;* elytra broad at base, widened in lateral margins in basal fourth, and then narrowing to apices.

Dimensions. 31.85 mm long (pronotum plus elytra), 14.5 mm broad at elytral half-length.



FIGS. 1–4. *Apisoma yechae* sp. nov. 1. Holotype, dorsal view; 2, 3. Dorsal views of paratype ♂♂; 4. Ventral view of allotype ♀. All approximately actual size.

Pronotum 8.4 long, 12.4 mm broad at base. Angles much rounded. Outline semicircular, with slight emarginations on each side of apical edge. Base slightly sinuate. All margins reflexed, the base only shallowly. Dorsal surface except disk densely punctate. Disk convex with a subrectangular darker spot *ca.* 5.6 × 3.6 mm median in basal half; this spot is irregularly granulate at the angles and finely strigillose in the median half. Sides dull brownish yellow or light tan color; no vitreous spots in anterior portion but with slightly translucent areas forward of eyes. Villosity short and pale over darker spot, much less dense on the sides.

Scutellum mainly black, apex paler, hairy; mesonotal plates dull light brown, hairy.

Elytra 23.45 mm long, each 7.25 mm wide at basal fourth, narrowing in the wide margins to about 4.3 mm near apex where rounding to suture begins. Densely rugose, with two or three indistinct costae on each. Ground color a uniform very dark brown, nearly black, with a slight purplish tinge. Suture slightly paler than disk, lateral margins not pale. Villosity short and scant except on sutural bead.

Head: Frons flat, dark yellow; 8.4 mm across eyes, 1.0 mm between them above antennal sockets. Eyes very large but not contiguous; interocular margins slightly divergent. Mandibles modified as described by Green (1959). Terminal article of maxillary palpi black, very large, *ca.* 1.4 mm long; the first three articles together *ca.* 1.0 mm long. Labial palpi securiform, black. Labrum long, incised medially at edge, not connate with frons. Mouth parts project forward as a short beak.

Antennae of eleven articles, slightly compressed, 7.6 mm long, tapering, barely serrate owing to apices of articles being slightly wider than the bases of the succeeding articles; villosity very fine, appressed.

Pro- and mesosterna mainly pink or pinkish; metasternum basally pinkish, remainder black, hairy.

Ventral abdominal segment 2 short, pinkish tan color; 3, 4, and 5 progressively somewhat darker; 3 the longest and 10.7 mm broad; 6 and 7 practically black, with small, median, semicircular luminous organs; 8 narrowed at half length, the apex incised; residual larval luminous organs in basal half. Abdominal spiracles ventral, in the antero-lateral corners of the segments.

Pygidium basally nearly as broad as the 7th ventral segment, semicircular and like pronotum emarginate on each side near apex.

Fore and intermediate coxae pale, the posterior pair brown; femora pale at base, darkening to nearly black distally; tibiae and tarsi black. Claws relatively short, broad, apically acute.

Allotype Female:

Length, 30.1 mm; generally similar to male but with only one definite luminous organ, on the 6th ventral segment. Antennae somewhat shorter, 6.9 mm long; eyes smaller, 5.1 mm across, and closer together, 0.5 mm between them above antennal sockets. 8th ventral segment short, sinuate, with projecting lateral lobes and a bilobed median genital projection. Frons dark brown, vertex slightly concave.

Variations:

The elytra of eleven of the specimens were very dark brown to nearly black with a slightly purplish tinge; one was distinctly paler, the elytra being of nearly the same tan color as the pronotum. The degree of infuscation of the pronotal spot varies; in one specimen this spot was dark yellow. The pink color on the ventral thoracic segments is sometimes absent, and the general color of the venter varies from dark to light tan. The vertex may be black, this sometimes extending to the antennal sockets. Occasional specimens are 2 or 3 mm broader across the base of the pronotum, and noticeably paler sutural and lateral elytral margins may be present. The antennae vary from about 6.0 to more than 8.0 mm long. The total length of the 12 specimens varies from 30.1 to 35.3 mm. The translucent areas in the forward border of the pronotum may be more marked than in the holotype. No data on the pattern of the light emission are available.

The male holotype and female allotype have been deposited in the U. S. National Museum, with two male paratypes. Eight paratypes are in my collection, and others are in Miss Yech's collection.

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Two New North American Species of Smodicum Lacordaire (Coleoptera: Cerambycidae)

JOSEF N. KNULL, Department of Zoology and Entomology, The Ohio State University, Columbus 43210

The two following species of *Smodicum* were attracted to blacklight.

Smodicum arizonarium n. sp.

Female.—Elongate, shining light brown throughout.

Head convex, glabrous, with exception of scattered punctures which are denser back of eyes, long hairs around eyes, eyes separated by more than combined lengths of antennal segments two and three; antennae extending to middle of elytra, tapering toward apex, scape stout, rest of segments thinner, clothed with scattered short pubescence and longer hairs near apex of each segment.

Pronotum wider than long, widest back of middle, wider at apex than at base; anterior margin broadly emarginate; basal margin truncate; sides rounded in front, sinuate on apical half, then broadly rounded and converging to base; surface flat in middle, irregularly punctured, punctures more numerous at sides, a few long hairs on sides. Scutellum rounded in rear, glabrous.

Elytra at base wider than pronotum, dehiscent at apices; sides subparallel, expanded in apical third, apices broadly rounded; surface densely, irregularly punctured, punctures larger and deeper toward base, a few scattered hairs at apices.

Prosternum smooth in middle, densely punctured on sides; prosternal process about twice as wide between coxae as length of second segment of antenna, apex truncate.

Abdomen extending beyond apices of elytra, last sternite as long as fourth, truncate at apex; surface smooth with a few scattered minute punctures, a long hair arising from each puncture. Femora clavate.

Length 9 mm; width 2.4 mm.

Male.—With abdomen not extending beyond apices of elytra, last sternite shorter than fourth; antennae slightly thicker; femora more strongly clavate; prosternum with a small coarsely punctate depressed area on each side of middle.

Type female collected in the Chiricahua Mountains 1 mile south of Portal, Cochise Co., ARIZONA, July 2, 1965 and one paratype from same area July 5, 1965 by D. J. and J. N. Knull. Allotype and paratypes collected in same locality June 24, 29, July 2, 3, 4, all 1965, by J. H. and J. M. Davidson and M. A. Cazier.

Holotype and paratypes in collection of the author, allotype and paratypes in collection of Arizona State University.

Smodicum texanum n. sp.

Female.—Elongate, shining light brown throughout.

Head glabrous with irregularly placed coarse punctures, an obtuse tubercle on front at inside of insertion of antenna, scattered long hairs sparce; eyes separated by combined lengths of antennal segments two and three; antennae extending to slightly beyond middle of elytra, tapering toward apex, scape stout, rest of segments thinner, clothed with scattered short pubescence and longer hairs near apices of each segment.

Pronotum wider than long, widest back of middle, wider at apex than at base; anterior margin broadly emarginate; basal margin truncate; sides divergent from apex to back of middle, then broadly rounded and converging to base; surface glabrous, with coarse, irregular punctures, which are more numerous at sides, a long hair arising from each puncture. Scutellum rounded in rear, glabrous.

Elytra at base wider than pronotum, dehiscent at apices; sides subparallel, expanded in apical third, apices broadly rounded; surface densely irregularly punctured, punctures more numerous and deeper toward base, with scattered long hairs at sides and at apices.

Prosternum smooth in middle, coarsely punctured on sides;

prosternal process as wide between coxae as length of second antennal segment, apex truncate.

Abdomen extending beyond apices of elytra, last sternite as long as fourth, truncate at apex; surface smooth with scattered minute punctures, each puncture bearing a long hair. Femora clavate.

Length 9.3 mm; width 2.3 mm.

Male.—With abdomen not extending beyond apices of elytra, last sternite shorter than fourth, broadly emarginate; antennae slightly longer and thicker; femora more stoutly clavate; prosternum with a punctate depressed area on each side of middle.

Type female and allotype collected in Bentsen Rio Grande Valley State Park, Hidalgo Co., TEXAS, March 29, 1964. Paratypes from the same locality and date, also March 24, 1950; April 4, 11, 1963; April 11, 1964; April 10, 1965. All specimens collected by D. J. and J. N. Knull.

Holotype, allotype and paratypes in collection of the author, paratypes in Ohio State University Collection.

Both of the above species can be separated from *S. parandroides* Bates (1884) which has a trapezoid shaped pronotum wider in front. *S. pacificum* Linsley (1934) has the prosternal process emarginate at apex.

The three species known from north of Mexico can be separated as follows:

1. An obtuse tubercle on front on inside of base of antenna....2
   No tubercle present on front on inside of base of antenna, Arizona........................*arizonarium* n. sp.
2. Width of prosternal process between coxae less than length of second antennal segment; prosternum of male with large coarsely punctured area on each side, surrounded by smooth surface....*cucujiforme* (Say)
   Width of prosternal process between coxae slightly less than twice the length of second antennal segment; prosternum of male with small finely punctured area, surface surrounding it punctured, southern Texas...... ....*texanum* n. sp.

I am indebted to John A. Chemsak for examination of Arizona material and also Mont A. Cazier for loan of specimens.

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Leaf Mining Weevil Damage on the Tulip Tree in West Virginia [1]

W. W. NEEL [2] and W. H. GILLESPIE [3]

A leaf mining weevil, *Odontopus* (*Prionomerus*) *calceatus* (Say) was noted to cause extensive leaf injury and defoliation of the tulip tree, also known as the yellow poplar (*Liriodendron tulipifera*) in West Virginia during June and early July, 1965. This insect previously considered to be of minor importance suddenly appeared in extremely large numbers in most counties bordering the Ohio River and in southwestern counties. The symptoms varied from complete defoliation of trees to defoliation of a few top branches. Some trees presented a complete "leaf-burn" appearance, whereas others had only a few leaves showing this injury.

This insect, according C. J. Hay, (1965) has caused damage in eastern Kentucky as early as 1960. Since then it has increased alarmingly in many parts of Tennessee, Ohio and West Virginia. Miller has reported that a 1962 outbreak in Kentucky caused extensive damage to *Magnolia grandiflora* as well as *Liriodendron*, and Bray (1956) noted damage on *Sassafras albidum* in the Marblehead, Massachusetts area, while Whitten (1965) reported heavy infestations on both tulip and

[1] Published with the approval of the Director of the West Virginia University Agricultural Experiment Station as Scientific Paper No. 869.

[2] Assistant Professor, West Virginia University, Morgantown.

[3] Forest Biologist, West Virginia Department of Agriculture, Charleston.

sassafras trees in the counties of Scioto, Lawrence, and Adams, Ohio.

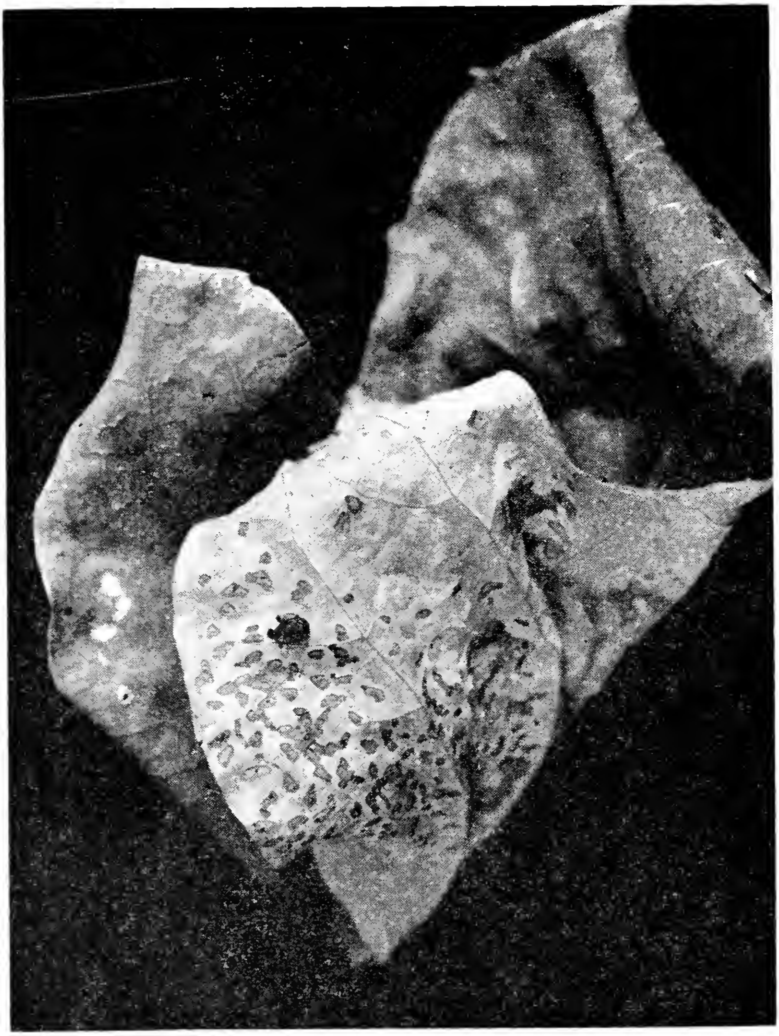

FIG. 1. Leaf of *Liriodendron tulipifera* affected by feeding of adult *Odontopus (Prinomerus) calceatus* (Say).

In another area, Smith and Weber (1951) reported from Louisiana that this insect had increased its severity of attack on both *M. grandiflora* and *M. virginiana*.

A plantation of *Liriodendron*, 10–15 feet in height, near Ravenswood, West Virginia, was heavily infested in June, 1965, with four to five adults per branch. Sassafras in the vicinity was also heavily infested.

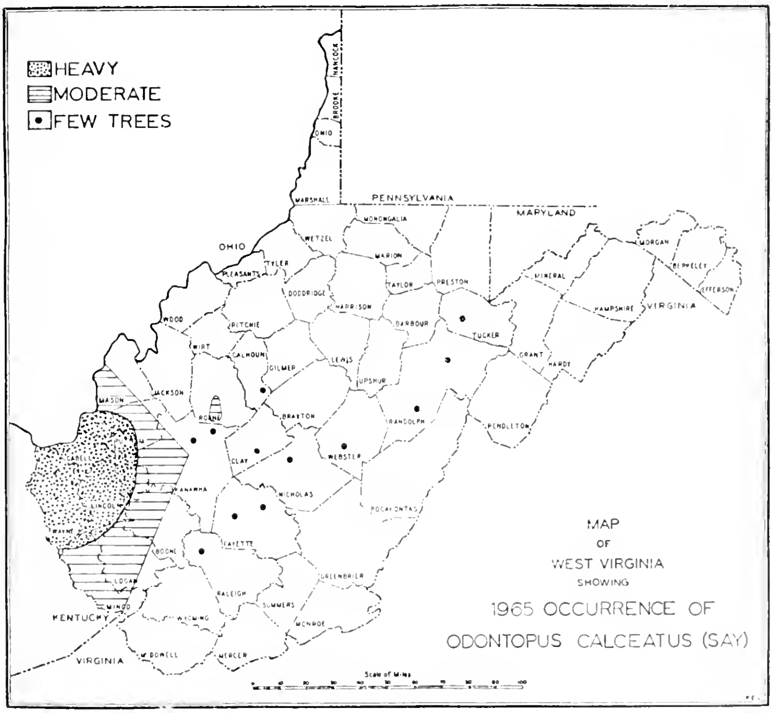

FIG. 2. Occurrence of *Odontopus* in West Virginia, 1965.

During June and July personnel of the West Virginia oak wilt aerial detection survey team reported seeing thousands of affected trees, with yellow or brown leaves, in the southwestern part of the state (Fig. 1). Trees showing typical symptoms were seen in the vicinity of Charleston in Kanawha County, west along the Kanawha River to the Ohio River, and south on a line through Logan to the Kentucky and Virginia border. Trees most severely affected were in Wayne and Lincoln Counties. Only scattered trees were noticed in the eastern part of the general area as contrasted with entire coves or hillsides showing evidence of this damage in the western part of this area near the Ohio River.

Small isolated areas, of from one to several infested trees, were noted to the north and east of the general area in Raleigh, Fayette, Nicholas, Clay, Calhoun, Webster, Randolph and Tucker counties, and another infestation occurred along Route 119 between Clendenin, in Kanawha County, and Spencer, in Roane County, especially around Walton and Gandeeville.

Adult weevils hibernate during the winter and begin appearing early in May. The females start inserting their eggs in the midrib of leaves of the host tree about the middle of May. The larvae mine the leaves in groups of 6 to 12 but the damage that they cause is not very noticeable. Pupation takes place in the midrib also, and the adults appear the latter part of May and are present in large numbers during most of June. They feed for about a week or more on young foliage before aestivating, and it is their extensive mining and feeding that provides the chief evidence of tree injury (Fig. 2). (Although the leaf mining damage appeared conspicuous and serious during the first part of the season it was hardly discernible by the end of the growing season). No leaf injury occurs later in the season because this insect has only one generation per year.

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The taxonomic position of the Australian Anaplopus tuberculatus, with a proposed new subfamily (Anaplopinae) of the Tenebrionidae, and including remarks on the family status of the Merycidae (Coleoptera) [1, 2]

MOHAMMAD ABDULLAH,[3] Department of Entomology, Macdonald College of McGill University, P. Q.

Dr. G. F. Gross of the South Australian Museum has kindly sent me a very interesting beetle with the following data on the label: "Richmond R., N.S.W., Lea." The specimen turned out to be a female of *Anaplopus tuberculatus* Blackburn, 1890. The genus with its only included species has so far been placed in the Pedilidae of older authors. The family association did not seem right to me and consequently the problem was investigated in detail.

The heteromeroid trochanters coupled with 5-5-4 tarsi in the beetle establish its affinities in the Heteromera. *Anaplopus* could not be placed in the Anthicidae *sensu mihi* for a number of reasons such as the penultimate tarsal segments which are not lobed below and the shape of the pronotum which is not like any Anthicid known to me (Fig. 1). After critically examining the distinguishing features of the families of the Heteromera it appears to me that *Anaplopus* should be placed in the Tenebrionidae and this action will necessitate modification in the definition of the family which, however, seems justified under the circumstances. Like most Tenebrionidae (and unlike *Hydromedion* and *Parahelops*) the front coxal cavities are visibly closed behind. As compared with the Lagriidae, the front coxae are not projecting and the prosternal intercoxal process is relatively wide. Unlike the Alleculidae, the tarsal claws are

[1] Paper number 48 on the Coleoptera.

[2] Research assisted by my wife, Mrs. Abida Abdullah, M.Sc.

[3] Postdoctorate Fellow of the National Research Council of Canada.

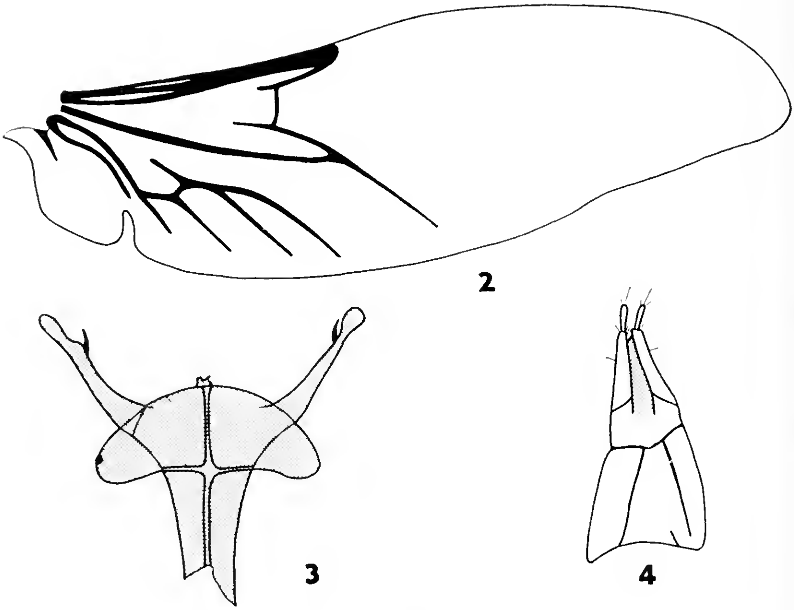
simple. Perhaps the most anomalous character for a Tenebrionid is the lack of connation of the first three visible abdominal sternites even though the suture between the first and second visible sternites is less prominent than elsewhere but is nevertheless distinct. I think that Crowson (1955: 125) is right in making the following statement concerning the Tenebrionidae: "This is by far the largest Cucujoid family, and its members tend to be relatively large insects; on both accounts and from their generally advanced drought-resistant physiology the Tenebrionids are entitled to be regarded as the most highly evolved family of Cucujoidea." It seems to me that the Tenebrionidae should have evolved from a primitive heteromeran type where all the visible abdominal sternites were freely articulated and that the character is preserved in *Anaplopus* and lost in most other Tenebrionids. When the definition of the family is modified to include forms like *Anaplopus* which lack the connation of the first three visible abdominal sternites then we have no difficulty in placing in this family the New Zealand genera *Chalcodrya, Philpottia* and *Onysius* hitherto wrongly attributed to the Melandryidae (*vide* Crowson, 1955: 133).

The met-endosternite (Fig. 3) of *Anaplopus* is very interesting indeed. Outside the Cucujoidea one could compare the structure with the Melyrid *Danacaea pallipes* (Cleroidea) but it is highly improbable that this similarity alone could suggest affinities between the two groups. It should be noted that as in *Tribolium* the stalk is rather short and the anterior tendons arise on the lateral arms—characters which seem to be primitive for the Tenebrionidae. The met-endosternite of the Australian *Meryx* is rather similar to *Anaplopus* and I doubt if Crowson (1955: 121) was right in placing the former in a distinct family Merycidae. The 4-4-4 tarsal formula of *Meryx* could be derived from the 5-5-4 formula of most Tenebrionidae. The sub-Cubital fleck in its wings is not necessarily a Colydiid-Mycetophagid character as I recall noticing the structure in *Cryphaeus* when working on the immature stages of a South Indian species (Abdullah, 1964). I have examined a larva of *Meryx* at Glasgow University and can add that the mandible of the larva

FIG. 1. *Anaplopus tuberculatus* Blackburn, female. One division on the scale = 1 mm. (University of Reading photograph.)

is unlike the Colydiidae-Mycetophagidae. The family Merycidae of Crowson does not seem justified to me.

In the hind wing (FIG. 2) the absence of a radial or anal cell need not be a primitive feature of the Tenebrionidae and may be a reflection of the comparatively small size (about 6 mm) of the beetle. However, the possibility could not be ruled out that in this feature *Anaplopus* is specialized. Similarly the presence of tubercles on the elytra and pronotum is undoubtedly a derivative feature.



FIGS. 2–4. *Anaplopus tuberculatus* Blackburn, female: 2, hind wing; 3, met-endosternite; 4, ovipositor.

The ovipositor (Fig. 4) is essentially long and tubular but comparatively shorter than in other Tenebrionidae. The coxites are two-segmented as in some other Tenebrionids but most of them have a non-segmented coxite. In the Anthicidae, it could be said with confidence that the presence of two-segmented coxites is a primitive feature which could be traced back to some primitive Pyrochroidae as well. This may very well be the case here in the Tenebrionidae but I am not sure.

The antennae are essentially filiform even though the apical three segments are slightly thickened (Fig. 1). The eyes are convex, lateral and entire, and the width of the head across them is slightly more than that of pronotum at its widest part. The pronotum is not bordered. In these characters also *Anaplopus* is rather different from most other Tenebrionidae.

It is certain that *Anaplopus* should be transferred from the Anthicidae to the Tenebrionidae where it could not be placed in any of the existing subfamilies. A new subfamily ANAPLOPINAE is proposed to receive *Anaplopus* Blackburn, 1890 and its type-species *A. tuberculatus* Blackburn, 1890. The distinguishing feature of the Anaplopinae is the absence of connation in the first three visible abdominal sternites. It may be possible to divide this subfamily into two or more tribes if some of the New Zealand genera mentioned earlier are found to be quite distinct from *Anaplopus* in the met-endosternite, wing-venation, ovipositor, etc. The larva of *Anaplopus* should also be very useful in understanding the relationships of the Tenebrionidae.

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The Laboratory Branch of the Communicable Disease Center, U. S. Public Health Service, Atlanta, Georgia 30333, has announced a series of courses in special subdivisions of microbiology for the period Aug. 1, 1966–June 30, 1967. There are 28 courses, each of from one to four weeks duration. Further information and application forms may be obtained by writing to the Training Office of the Laboratory Branch.

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CONTENTS

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Photomicrographs of gynandromorph of *Melanoplus differentialis.*

FIG. 1. Left (male) side of gynandromorph. Note well-developed cercus at posterior end. × 1.8.

FIG. 2. Dorsal view of posterior end of abdomen. Note boot-shaped male cercus at left (arrow) and small female cercus barely visible at right; suranal plate shows both median (male) and transverse (female) furrows. Left basal quadrant of plate is darker and more heavily sclerotized than rest. Compare male pigment pattern on left side of tergum VIII with female pattern on right. × 4.4.

FIG. 3. Ventral view of posterior end of abdomen. Sternum VIII normal for male on left (right side of figure) and for female on right

ENTOMOLOGICAL NEWS

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A Gynandromorph Grasshopper that Laid Eggs (Orthoptera, Acrididae)[1]

Eleanor H. Slifer,[2] Department of Entomology, Academy of Natural Sciences of Philadelphia, Pennsylvania

There are at least 15 reports in the literature of acridid gynandromorphs (Baccetti, 1954, *Podisma pedestris;* Carothers, 1939, F_1 from *Trimerotropis citrina* ♂ × *T. maritima* ♀; Dirsh, 1957, *Schistocerca gregaria, Sphingonotus caerulans;* Friauf, 1947, *Pardalophora phoenicoptera, Camnula pellucida;* Hebard, 1919, *Oedaleonotus phryneicus;* Hubbell, 1932, *Melanoplus adelogyrus;* Joly, 1960, *Locusta migratoria;* Kimura, 1951, *Oxya velox;* Morales Agacino, 1959, *Schistocerca paranensis;* Natori, 1931, *Podisma sapporoense;* Paul, 1941, *Camnula pellucida;* Pener, 1964, *Schistocerca gregaria;* Potter, 1940, *Anacridium moestum;* Severin, 1943, 1955, two individuals of *Melanoplus mexicanus mexicanus*). Of the eighteen individuals

[1] This work was begun at the Department of Zoology, State University of Iowa, Iowa City, Iowa and completed at the Academy of Natural Sciences in Philadelphia. It was supported in part by a grant from the National Science Foundation GB-4553.

[2] Mail address: 308 Lismore Avenue, Glenside, Penna. 19038.

(left side of figure). Female side (= subgenital plate) with lower egg guide. Male subgenital plate (sternum IX) with basal portions reduced but posterior end normal. Note dorsal and ventral ovipositor valves of female. × 4.4.

Fig. 4. Left lateral view of posterior end of abdomen. All parts normal for male except basal part of subgenital plate which is defective. Ventral ovipositor valve on opposite side visible at lower right. × 4.4.

Fig. 5. Right lateral view of posterior end of abdomen. All parts normal for female. Arrow points to base of cercus. Distal part of male subgenital plate on opposite side visible between the open ovipositor valves. × 4.4.

studied 12 are described as having the external features of a normal male with some female or female-like structures at the posterior end and, in a few cases, elsewhere as well; two are listed as entirely male externally; one was a normal female except for the mesosternum and terminal abdominal segments; two were bilateral gynandromorphs and one was an intersex showing sexual bilaterality and mosaicism. Most of the individuals had been dried but seven had been fixed and the internal organs examined. Carothers (1939) found a normal ovary with fully-developed eggs and an oviduct on the right side of her gynandromorph but no trace of a gonad or other reproductive organs on the left. Dirsh (1957) reported a small deformed ovary on the left with male accessory glands and a seminal vesicle on the right but no testis. Joly (1960) described an ovary with young oocytes and a poorly-developed oviduct on the left side of his specimen, together with a normal testis and duct on the right. Kimura (1951) reports the presence of four young oocytes in a testis smear. Natori (1931) described an ovo-testis with follicles showing all stages of spermatogenesis along with ovarioles containing oocytes up to 250 μ in length. Both gynandromorphs examined by Pener (1964) had ovaries but no testes. Potter's (1940) gynandromorph had a normal testis and accessory glands together with a normal vas deferens on the left and an incomplete one on the right. There was no outlet for the sperm. The only internal female organ was the spermatheca.

The gynandromorph to be discussed here was found in a colony of *Melanoplus differentialis* (Thomas) kept at the State University of Iowa while the author, together with Dr. Robert L. King, was studying the inheritance of diapause in the eggs of this species. This individual was first seen as a young adult and was transferred immediately to a separate cage. Several weeks later a small egg pod was found in the bottom of the cage. This was removed to an incubator. The grasshopper, although still alive, seemed very weak and was killed by injection of Bouin's solution into the abdomen. The later history of the eggs will be given below.

External Anatomy

The specimen is a bilateral gynandromorph with the left side showing normal male structures, except for a few areas, and the right side those of a normal female (Fig. 1). The division down the mid-line is clear cut and there is relatively little distortion where the two halves meet. The abdomen is curved to the right since the female half is longer than the male half (Fig. 2). The more extensible intersegmental and pleural membranes of the female were stretched by the mass of eggs.

Both antennae have 24 subsegments but the left antenna is slightly longer than the right. The left gena is shorter than that on the opposite side and the left lateral ocellus is closer to the antennal base than is the right. These features indicate that the left side of the head is male and the right female.

Evidence for sexual bilaterality of the thorax is provided by the femora, arolia and claws of the prothoracic and meso-thoracic legs. Those on the left side are distinctly larger and sturdier than are those on the right. Normal males and females show such a difference.

The pigmentation pattern of the abdomen is normally very different in the two sexes and that on the left side of the speci-men is typically male and that on the right female. The special-ized "heat-sensitive" spots or fenestrae differ markedly in the two sexes and provide a valuable means of distinguishing male and female parts of the abdominal terga (Slifer 1953a, 1953b). None are present on the first abdominal segment. However, they are present on terga II to VIII on the left side and terga II to VII on the right. Except for the lack of fenestrae on tergum I this is the distribution found earlier for the two sexes of this species. On segments II, III and IV the spots are of nearly the same size on the two sides but on terga V, VI and VII those on the left side are large, as are those of a normal male, while those on the right are small and typically female (Fig. 6). The fenestra on the left side of tergum VIII is two thirds the length of that on VII.

The anterior tergal ridges of the abdomen are well-developed on each segment from III to VIII on the left or male side but stop abruptly in the dorsal mid-line and are absent posterior to segment V on the right or female side. The ridges are sexually dimorphic in this species. The outline of the suranal plate or epiproct is typically male on the left side and female on the right. However, the median furrow, a male character, is present and the transverse furrow, a female character, extends across the entire plate from left to right (Fig. 2). The basal quarter of the plate on the left is more heavily sclerotized than it is elsewhere. Thus, the suranal plate combines features from both sexes but is not intermediate. The left cercus is boot-shaped and completely normal for a male while the right is short, conical and typically female (Figs. 1, 2, 4, 5). On the left side the male subgenital plate (sternum IX) is about one third of its usual length and the basal part is missing (Figs. 3, 4). The pallium is well-developed and extends somewhat to the right of the mid-line. No trace of an aedeagus could be found. The right or female side of the terminal abdominal segments is entirely normal in appearance (Fig. 5). Both dorsal and ventral ovipositor valves are present. The female subgenital plate (sternum VIII) extends slightly beyond the mid-line and the lower egg guide is present at its apex (Fig. 3).

Internal Anatomy

Removal of the dorsal abdominal wall revealed a large right ovary and oviduct both normal in appearance. The ovary contained eggs in all stages of development including some with a chorion and nearly ready to be laid. The right oviduct opened into the median oviduct and this into the floor of the genital chamber in the usual manner. A glandular pouch was attached to the anterior end of the genital chamber on its right side. The left third of the genital chamber was missing. The right ovipositor apodeme was large and covered with muscles but there was none on the left. A normal spermatheca lay above the genital chamber and its duct opened into the roof of the chamber. This was sectioned and stained. As was to be expected, it contained no sperm but was otherwise normal. The genital chamber opened to the exterior at its posterior end.

None of the structures just described was present on the left side. There was no trace of a testis, vas deferens, accessory glands, seminal vesicle, endophallus or aedeagus. An apodeme was present on the left side of the eighth sternum but there was none on the right. This is a usual sex difference. After treatment with a solution of potassium hydroxide two small sclerotized bars were found in the membrane extending inwards from the pallium. These may represent rudiments of an epiphallus. The anterior intervalvula between the dorsal and ventral ovipositor valves was normal. The right intervalvular plates were present but those on the left were rudimentary.

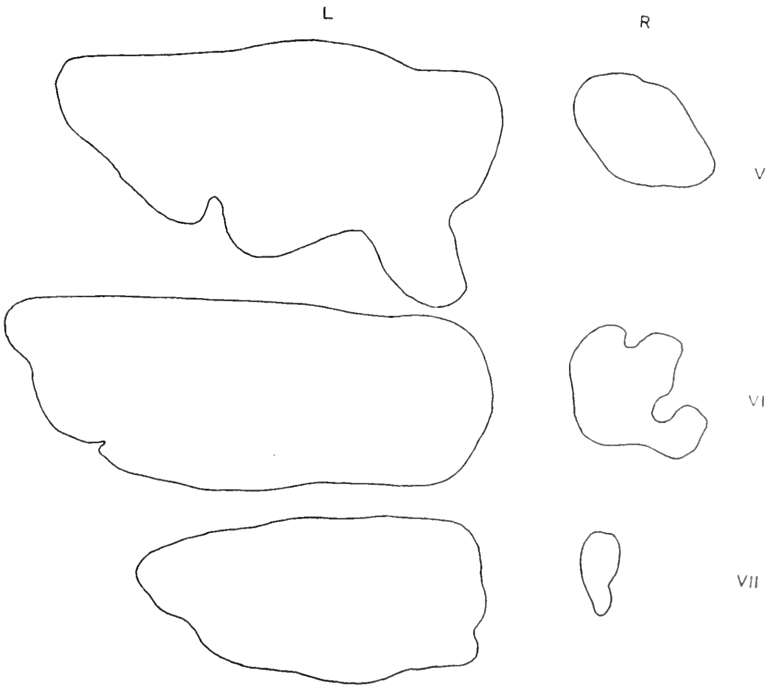

Fig. 6. Outline drawings of "heat-sensitive areas" or fenestrae on abdominal terga V, VI and VII as seen in dorsal view. Those on the left are typically male in size and shape and those on the right typically female.

Eggs Laid by the Gynandromorph

So far as we know, this is the first report of egg-laying by a gynandromorph grasshopper. Since the event was unexpected the individual was isolated shortly after becoming adult and so there was no chance for the eggs to be fertilized. Unfertilized eggs of this species often start to develop but embryonic abnormalities are common and only a few of the eggs reach the hatching stage (King and Slifer, 1934). The 52 eggs in the pod, which was laid April 17th, were kept in an incubator at 25° C for several weeks and then placed in a refrigerator until September. They were then returned to 25° C and on September 23rd one of the eggs hatched. Unfortunately this individual tore a hole in its side while hatching and had to be preserved. Since none of the remaining eggs appeared to contain embryos all were fixed. Later these were stained with borax carmine and examined with the following results. Two had a well-developed chitinous cuticle indicating that development had continued for at least a week. In one of these there was a serosa with large, normal nuclei in its cells. In the other no cells remained although a serosa must have been present earlier to secrete the cuticle. Presumably, the cells had disintegrated. The remaining eggs showed no signs of development.

Possible Origin of the Gynandromorph

When all of the evidence is considered the simplest explanation would be that this individual started development as a female and during a very early mitotic division an X chromosome was lost from a cell from which the greater part of the left side developed. This would not account for the absence of the male internal reproductive organs. Natori (1931) reported an ovotestis with normal eggs and sperm existing side by side in a *Podisma* nymph so we may assume that the female organs present in our specimen did not suppress the male organs. Thus it would be necessary to postulate a second error at a later stage of development which resulted in the elimination of the cells from which the testis and associated organs would have developed. This is not as improbable as it may appear for the writer has frequently found embryos and nymphs of this species in which whole areas, external, internal or both, were missing. The absence of male gonadal tissue does not affect the viability of the individual or the development of male external sexual structures.

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Gynandromorphism in Rocky Mountain Stoneflies (Plecoptera: Nemouridae) [1]

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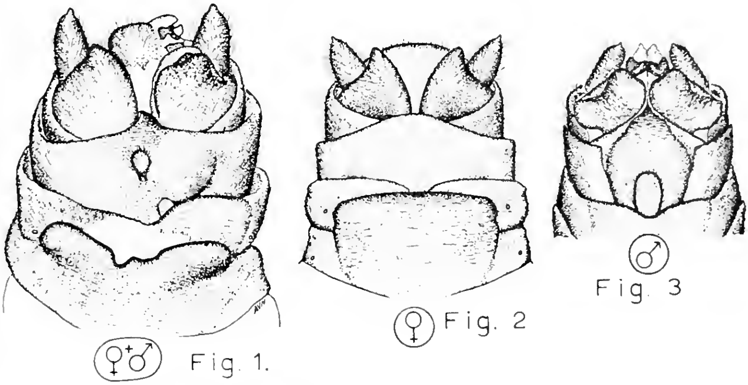
The occurrence of gynandromorphism (individuals exhibiting a spatial mosaic of male and female characteristics) is rare in the order Plecoptera. The specimens here described are the first such forms found during stonefly research at the University of Utah.

Five specimens exhibiting gynandromorphism were found in two different species: two *Nemoura cinctipes* and three *Nemoura besametsa*. The genus *Nemoura* is one of the most common and widespread genera in the Rocky Mountain area. This gives us some indication as to the slight probability of encountering such forms in the much less common groups of stoneflies.

[1] This study was aided by a grant from the National Science Foundation, G-20703; and a training grant from The Division of Water Supply and Pollution Control, WP-54.

A total of 7400 specimens was examined from six genera of winter emerging stoneflies. Fifteen hundred *Nemoura besametsa* yielded three gynandromorphs, giving a ratio of one per five hundred normal specimens. In 1,000 specimens of *Nemoura cinctipes* two gynandromorphs were found giving again the ratio of one per five hundred.

The terminalia of *N. cinctipes*, shown in Figs. 1–3, illustrate the typical form of alteration consistent for the five specimens found. Fig. 1 is the gynandromorph; Fig. 2 shows the normal female; and Fig. 3 the normal male, all in ventral view. All appear to be basically female with rudiments of the male



Figs. 1–3. *Nemoura cinctipes*, gynandromorph and normal ♀ and ♂.

secondary sexual characteristics distorting the fundamental female symmetry. In the drawing of the *N. cinctipes* gynandromorph (Fig. 1), the left half is primarily female; the right half showing nearly all of the male influence. The normally large lobe of the male ninth sternite (Fig. 3) appears as a small appendage in the center of the ninth sternite of Fig. 1. A partial suture is formed on the right side of the ninth sternite of Fig. 1. As can be seen in Fig. 3, these sutures delineate the male subgenital plate which terminates posteriorly in a sperm conveying duct. As seen in Fig. 2, the subanal lobes (paraprocts) are normally triangular in the females and rectangular in the males (Fig. 3). In Fig. 1 the left subanal lobe is triangular and the right lobe is rectangular. A beginning of the male supra-anal process (epiproct, 11th segment) can be seen on the right side. The left side is comparatively unmodified. The female genital area (8th sternite) is distorted, with the right side having the more sclerotized form of the male and the left side retaining the more membranous female structure. The 7th sternite of the normal female (Fig. 2) is greatly enlarged forming a conspicuous subgenital covering. In Fig. 1 this is distorted and partially broken down, being proportionately smaller. The larger size of Fig. 1 is of little significance as there is normally wide fluctuation in body size within this species.

The specimen was dissected to determine the primary sexual characteristics. The male genital opening at the tip of the subgenital plate (9th sternite) is rudimentary and non-functional, as are the necessary supra-anal accessory structures. A fully developed female reproductive system consisting of a normal genital opening, genital cavity with associated seminal receptacles, oviduct, and ovarioles with normally developing eggs was found. No internal male sexual apparatus was discernible, indicating that the sexual characteristics of the male are of a superficial nature and have not influenced the basic female reproductive structure to any great extent.

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This bibliography is a continuation from the earlier volume (IAEA, No. 9) for 1950–60. It was compiled by Mrs. M. Binggeli of the Agency's Division of Scientific and Technical

(*Continued on p. 175*)

A New Species of Montezumina with the Description of the Male of M. bradleyi Heb. (Orthoptera: Tettigoniidae; Phaneropterinae)

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The genus *Montezumina* was erected by Hebard who included in it *Symmetropleura modesta* * Brunner, 1878, *Turpilia oblongoculata* Brunner, 1878, *T. oridiops* Saussure and Pictet, 1897, and *T. ocularis* Saussure and Pictet, 1897. Hebard also described the species *M. sinaloae,* 1925, and *M. bradleyi,* 1927, and the subspecies *M. oblongoculata mesembrina,* 1927. *M. bradleyi* was described on the basis of two females.

While looking over specimens of the genus *Montezumina* at the Academy of Natural Sciences of Philadelphia, I discovered a distinct species represented by a series of fifteen males and eight females, all in good condition and all but four on loan from the Los Angeles County Museum. Moreover, I found a series of six *Montezumina bradleyi* males, also in good condition.

This paper presents descriptions of the male of *Montezumina bradleyi* and the new species, which I have named *granti.* I have placed *granti* in the genus *Montezumina* because the eyes are elongate, oval; the cephalic and median tibiae are subsulcate dorsad; the dorsum of the head behind the eyes is high, and the vertex tapers sharply down to the fastigium to meet but not extend beyond the frons; and the subgenital plate of the male lacks styles. A brief comparative study is included in the description.

Montezumina bradleyi Hebard 1927

MALE. As a complement to Hebard's description of the female of *Montezumina bradleyi,* the following description presents additional characters unique to the species. It is

* Hebard placed this species in *Montezumina* in 1934 (p. 205, See Literature Cited).

presented in a manner to allow a more meaningful comparison with *M. granti.*

Diagnosis.—This species differs from others in that its tenth tergite is truncate, slightly produced, and medially depressed. Also, the lateral lobe of the pronotum is deeper than long. The eyes are large for the genus. It is the most colorfully marked member of the genus, with characteristic E-shaped markings on the inner lateral surfaces of the cephalic femora.

Description.—*Head.* Eyes large for genus, ovoid elliptical. Dorsum of head high, vertex tapering down sharply to fastigium which approximates tip of frons, but does not touch it, as in other species.

Pronotum. Median length/width of pronotal disc 1.45 (mean of males). Surface of disc and cephalic half of lateral lobes smooth, caudal half of lobes weakly punctate. Lateral lobes deeper than long (Fig. 1).

Wings. Anterior wing about 5.13 times longer than wide (mean of males). Surface marked with scattered brown dots; apical half of anal margin of both pairs of wings in folded position edged with a jagged brown line.

Legs. Variable number of spines on all femora. Posterior femora about 7.04 times longer than wide (mean of males).

External genitalia. Male. Tenth abdominal tergite produced slightly with deep median depression; as seen from above, edge of tergite forming a very wide V. Supra-anal plate ovoid, reflexed inward, produced from inner surface of tenth tergite. Cerci simple, cylindrical, the proximal half curved gradually upward, then downward to apical end, where it recurves sharply upward; apical end laterally slightly flattened, ending in a conspicuous tooth. Subgenital plate as long as cerci, broad at base and tapering slightly distally; a medial ridge running the length of the plate; tip of plate wide, bearing two conspicuous pseudostyles (Figs. 4, 6).

Concealed genitalia. Not observed.

Coloration. Eyes dark brown, uniform to mottled. General body color a pastel yellow-green. Pronotal disc with reddish to brown spots at each corner. Abdomen yellow with little evidence of green pigmentation. Each cephalic femur bearing a distinctive brown E-shaped marking on inner lateral surface and a simple horizontal brown bar on outer surface. Apices of other femora tipped with brown; distal tips of tibiae similarly highlighted with brown as are the bases of many of the tibial and femoral spines. Dorsal surface of cerci of male medium to dark brown.

Variation. Very little variation. One specimen lacks the conspicuous pseudostyles on the subgenital plate.

Discussion.—This species agrees with other *Montezumina* species in head and eye shape, but differs in that the tenth tergite is not elongate as in the type species *oblongoculata.* The cerci and subgenital plate most closely resemble those of *oblongoculata mesembrina.*

Specimens examined.—6♂. Pozo Azul de Perris, Costa Rica, Taken at night in house, VIII–20–1927 (Lankester & Rehn) 2♂ [Academy of Natural Sciences of Philadelphia]; Trinidad Rio, Panama, III–19–20–1912 (A. Busck) 3♂ [United States National Museum]; Barro Colorado Island, Canal Zone, Panama, VI–27–1930 (J. Zetek) 1♂ [Academy of Natural Sciences of Philadelphia].

Measurements. Values listed are means of ♂ (mm). Total length 30.5; length pronotal disc 3.6; width pronotal disc 2.5; length posterior femur 16.9; width posterior femur 2.4; length anterior wing 22.2; width anterior wing 4.3.

Montezumina granti, n. sp.

Diagnosis.—MALE. The tenth abdominal tergite is truncate and medially slightly concave. This species differs from all other *Montezumina* species in the shape of the subgenital plate, which is elongate, upcurved, with a deep apical emargination.

FEMALE.—The subgenital plate is thick, bilobed. The basal lobe of the ovipositor lacks a ventro-posteriorly directed process.

Types.—*Holotype* ♂, nr. Rincón, Osa Peninsula, Puntarenas Prov., COSTA RICA, II–23–1966 (H. R. Roberts) [Academy of Natural Sciences of Philadelphia]. *Allotype* ♀, same data as type [Academy of Natural Sciences of Philadelphia].

Description.—*Pronotum.* Median length/width of disc ratio 1.64 (mean, both sexes). Outline of lateral lobe as in Fig. 2. General surface smooth, with posterior portion of disc around curvature weakly punctate. Lateral lobes as wide as deep; posterior border well rounded.

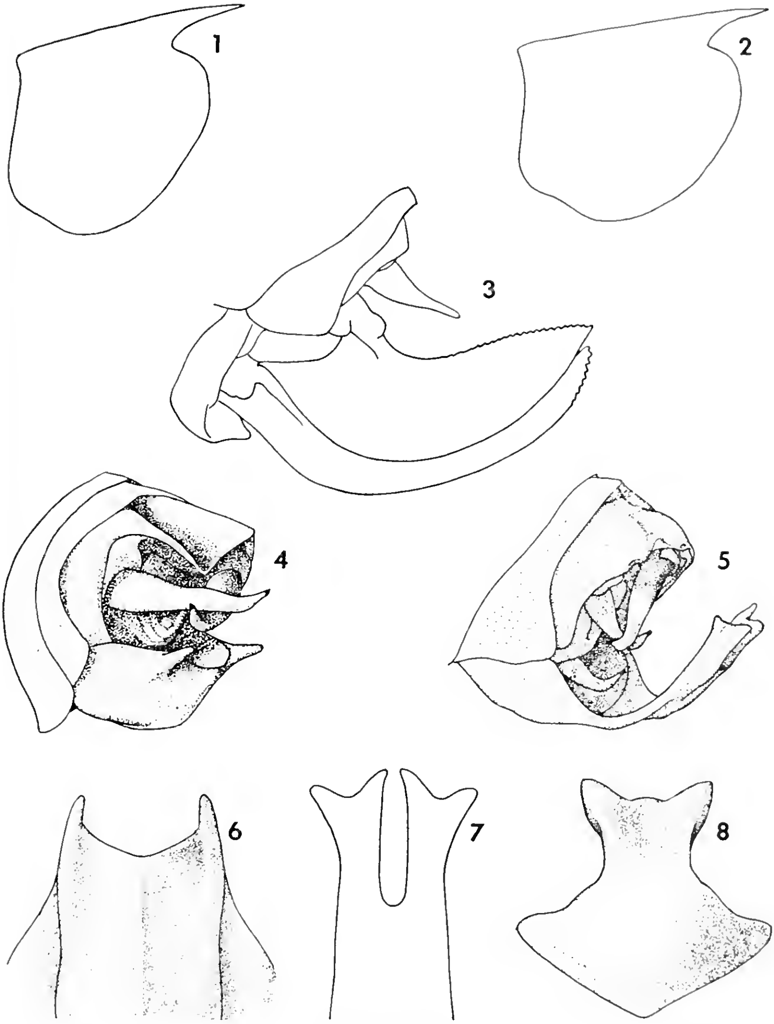
Wings. Anterior wing unmarked, about 4.98 times longer than wide (mean, both sexes).

Legs. Variable number of spines on all femora. Anterior femora with 1–4 spines along inner ventral border and none along outer ventral border, median femora with none along inner and 1–4 along outer, and posterior femora with 0–6 along inner border and 4–8 along outer. Posterior femora about 7.23 times longer than wide (mean, both sexes). Cephalic and median tibiae subsulcate as typical of genus.

External genitalia. MALE. Tenth abdominal tergite truncate, medially slightly concave. Supra-anal plate ovoid, directed slightly inward, produced from inner wall of the terminal tergite. Subgenital plate elongate, upcurved with a deep apical emargination, producing two bilobed processes (Fig. 7); lateral margins thickened, apex in section forming a right angle, the origin lying on the midline and the arms flaring out at 45° from the horizontal. Cerci simple, cylindrical, tapering and distally sharply curved mesad, apically bearing a single tooth (Fig. 5).

FEMALE.—Ovipositor short, approximating median length of pronotal disc; curved sharply upward as in *oblongoculata;* surface of valves punctate; apical half of dorsal valve finely toothed, ventral valve toothed at apex only; apex of dorsal valve produced beyond apex of ventral valve (Fig. 3). Basal lobe of ovipositor simple, oval in shape, lacking ventral posteriorly-directed lobate process found in other *Montezumina* species (achieving its greatest development in *sinaloae*). Subgenital plate thick with median depression at apex, giving impression of a thick bilobed structure; proximal portion rounded, convex (Fig. 8).

Concealed genitalia. Not observed.



Morphological aspects of *Montezumina* species. FIGS. 1–2. Male pronotum, left lateral aspect, outline; 1, *M. bradleyi;* 2, *M. granti.* FIG. 3. Female abdomen, left lateral aspect, *M. granti.* FIGS. 4–5. Male abdomen, dorso-posterior aspect; 4, *M. bradleyi;* 5, *M. granti.* FIGS. 6–7. Male subgenital plate, ventral aspect; 6, *M. bradleyi;* 7, *M. granti.* FIG. 8. Female subgenital plate, ventral aspect, *M. granti.*

Locality of specimens: FIGS. 1 and 6, Trinidad Rio, Panama; FIGS. 2, 3, 5, 7 and 8, Golfito, Costa Rica; FIG. 4, Barro Colorado Island, Canal Zone, Panama.

Color. General body color katydid green. Abdomen yellow with little green pigment (although this may represent discoloration due to death or to preservation methods, since some specimens exhibit light green abdomens). Vertex in many specimens colored pink to red. Eyes with two reddish-brown stripes originating on the dorsum of the eye and flaring ventrally, the anterior (and shorter) stripe running along midline of eye, and the posterior stripe running along the posterior to the ventral border of eye.

Paratypes.—14♂, 7♀. Golfito,Costa Rica, VII–10, 23, 27–1957, VIII–12, 21–1957 (Truxal & Menke; Arnold Menke) 14♂, 4♀ [Los Angeles County Museum]; nr. Villa Neily, Punt. Prov. (S.), Costa Rica, VIII-5-11-1963 (C. L. Hogue) 1♀ [Los Angeles County Museum]; nr. Rincón, Osa Peninsula, Puntarenas Prov., Costa Rica, II–23, 25–1966 (H. R. Roberts) 2♀ [Academy of Natural Sciences of Philadelphia].

Variation. The depth of the apical emargination on the subgenital plate varies, as does the length of the subgenital plate, many being higher than the dorsum of the tenth abdominal tergite. Color variation is minor. Variation between sexes is mainly one of size, the female being larger and more robust. The posterior femora of the female are 7.06 times longer than wide, whereas the posterior femora of the male are 7.41 times longer than wide. Similarly, the length/width index of the anterior wing of the female is 4.80, whereas in the male it is 5.15.

Discussion.—In general appearance, this species superficially resembles *Anaulacomera* more than *Montezumina.* The body is smaller and more narrow and delicate than other *Montezumina* species, and the wings are translucid as in *Anaulacomera.* However, its ovoid, elliptical eyes, the high occiput, the more sharply rounded posterior border of the lateral lobe of the pronotum, the dorsally subsulcate cephalic and median tibiae armed with only a single disto-caudal spine, and the short, toothed ovipositor of the female clearly distinguish it from species of *Anaulacomera.* The subgenital plate of the male is atypical of the genus, bearing a closer resemblance in length, curvature, and apical emargination to species of *Ceraia.* The species is distinct from the other *Montezumina* species on the basis of the external genitalic complex. The tenth tergite is truncate, whereas in other species it is elongate, with the median portion sharply declivent between the cerci, and the supra-anal plate forming the distal triangle of the tergite. The subgenital plate is elongate, upcurved, quite unlike other species, in which the subgenital plate is small, as in *Anaulacomera* species.

Montezumina granti has no close relatives, but on the basis of the tenth tergite and shape of the cerci it most closely resembles the species *bradleyi*, which is also from Costa Rica and Panama.

The species is named in the fond memory of Dr. Harold J. Grant, Jr., in recognition of his outstanding work on the subfamily Phaneropterinae and whose assistance and kind advice have been an inspiration I will not forget.

Distribution.—This species is known only from Costa Rica.

Measurements. Values listed are means (mm). Total length ♂ 27.8, ♀ 30.1; length pronotal disc ♂ 3.8, ♀ 4.0; width pronotal disc ♂ 2.3, ♀ 2.4; length posterior femur ♂ 15.6, ♀ 17.4; width posterior femur ♂ 2.1, ♀ 2.5; length anterior wing ♂ 20.9, ♀ 22.8; width anterior wing ♂ 4.1, ♀ 4.7; length ovipositor ♀ 4.3.

Acknowledgments.—I wish to thank Dr. H. Radclyffe Roberts, who advised me on the format of this paper, and Mrs. Mary Fuges for her excellent illustrations. Also, I wish to acknowledge the help of Dr. Lloyd M. Martin, who loaned most of the material upon which this paper is based.

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The Subgenus Cyphomannia Weber 1938 of Cyphomyrmex Mayr 1862, Reinstated, and Systematic Notes (Hymenoptera: Formicidae)

Neal A. Weber, Swarthmore College, Swarthmore, Pennsylvania 19081

The subgenus *Cyphomannia* was created for Bolivian ants of the *Cyphomyrmex* complex (Weber 1938). In the description and figures of the type species *laevigatus* I showed them to differ markedly from known species, particularly in thoracic and petiolar characters. Unfortunately types or identified material were not seen by Kempf (1962) when he synonymyzed *Cyphomannia* or when he prepared his revision of the *strigatus* group (1964). His conclusion that *Cyphomannia laevigatus* was part of the *rimosus* complex was based on the assumption that it was a smooth *rimosus*. Differences of subgeneric rank are the complete lack of thoracic tubercles, the mesonotal area flat dorsally and with angular margins, the smoothly declivous epinotum without angles or tubercles, and both the petiole and postpetiole being flat dorsally and without tubercles. The femora and tibiae are rectangular in section and there is an exserted sting, the latter being a character of general biological rather than systematic interest.

In the group of *rimosus* Dr. Kempf includes a heterogeneous list of species based on head characters and on the possession of two or no median pronotal tubercles. A species like *longiscapus*, however, can hardly fit here better than in the alternative group of *strigatus*. The outstanding character of *rimosus* is biological rather than morphological—it cultures a yeast rather than a mycelium.

Specimens, including types, were taken to Europe under a National Science Foundation grant in 1957 and compared with Emery, Forel, and Santschi type material. The following notes may assist in future revisionary work of this genus of variable characters.

Nothing in the Emery, Forel, or Santschi collections was seen that I considered to be in the same subgenus with *laevigatus* although *lectus* Forel was noted to be somewhat transitional. The side view of the thorax of *lectus* is shown by Dr. Kempf (1964) to be transitional in its smothness.

CYPHOMYRMEX (CYPHOMYRMEX) Mayr 1862

C. bicornis Forel. The Bolivian *vorticis* Weber is close but specifically distinct.

C. bigibbosus Emery. The Emery collection had one pin marked Typus, Pará 166, not seen by Dr. Kempf. The worker thorax, excluding neck was 0.835 mm or with neck 0.89 mm. The postpetiolar node is 0.285 mm long × 0.248 mm wide. A cotype of the subspecies **tumulus** Weber had a thorax excluding neck of 0.99 mm and, when directly compared, appeared to be subspecifically distinct. A cotype of **petiolatus** Weber differed from the Emery type in having much longer occipital angles and less crenulate frontal lobes. A topotype of **faunulus** Wheeler had the same kind of postpetiolar node as the Emery species but the occipital angles were much more acute and the median pronotal tubercle less marked. It is entirely possible that the species shows considerable variability but at present the taxonomy appears to be:

C. bigibbosus Emery
C. bigibbosus Emery subspecies **tumulus** Weber, reinstated
C. bigibbosus Emery subspecies **petiolatus** Weber, reinstated
C. faunulus Wheeler (Kempf emend.)

C. colombianus Weber. Near **strigatus** Mayr but specifically distinct. As originally noted, this is close to *costatus*, and Dr. Kempf believes it to be the same.

C. daguerrei Santschi. Santschi types seen. The ants are close to **rimosus** but specifically distinct. The thorax is much as in **rimosus** but there are no occipital tubercles.

C. flavidus Pergande. Mexican material in the Emery collection shows this to be a species related to **rimosus**. The thorax bears a flat oval area instead of tubercles.

C. foxi E. André. Jamaica material in the Emery collection shows this species to be highly distinctive.

C. morschi Emery. Types seen. A very smooth species with low thoracic tubercles, the occipital corners evenly rounded; an unusual character is the humeral angles directed forward as sharp, flat right-angles. It resembles none of my forms. Dr. Kempf has synonymized **personatus** Santschi with **morschi**, a useful step. This latter type also was seen.

C. olitor Forel. Types seen. A good species related to **rimosus.**

C. lectus Forel. Type seen. Quite different from the **rimosus** group.

C. rimosus subsp. **pencosensis** Forel. Type seen. A good subspecies marked by epinotal tubercles, a pair of anterior median pronotal tubercles, and low, median tubercles. The thorax is 0.934 mm long and the postpetiole 0.211 mm long by 0.422 mm wide.

C. strigatus Mayr. Material in the Santschi collection placed here was labelled "Types" and was of all castes. While probably not type material, it did come from Santa Catarina, Brasil (Moeller) and may well be **strigatus.** The Colombian **colombianus** Weber is related to this and **costatus** Mann is quite different.

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The Immature Stages of Stictochironomus annulicrus (Townes) (Diptera, Tendipedidae)

Selwyn S. Roback, Curator, Department of Limnology, Academy of Natural Sciences of Philadelphia

The immature stages of *S. annulicrus* were sent to the author by Mr. J. L. Willhm, Radiation Ecology Section, Oak Ridge National Laboratory, Tennessee. The larvae were collected July 7, 1965, the pupae and adults September 13, 1965.

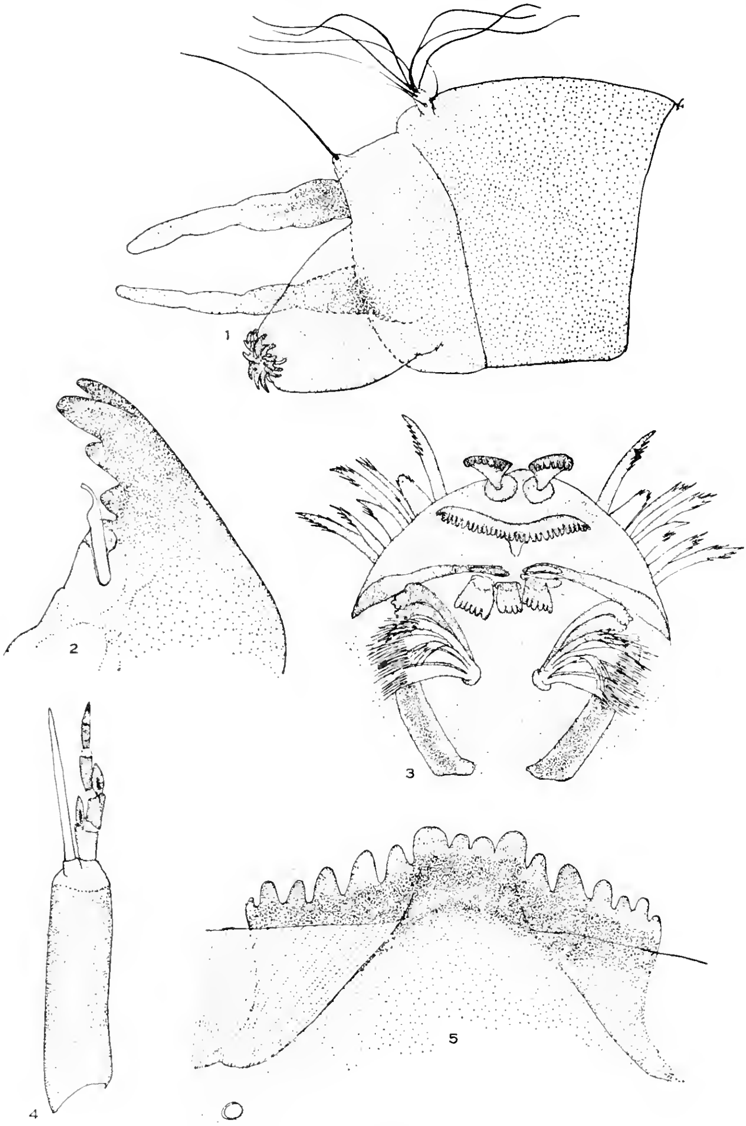
The species in the *varius-annulicrus* group of *Stictochironomus* are poorly defined and little material is available to delimit the color and structural variation in the species described by Townes (1945). Whether an increased knowledge of the immatures will aid in resolving these species or indicate that some are merely variations of a single species, remains to be seen. The larva which I described as *T.* (*Stictochironomus*) sp. 1 in 1957 differs from that of *S. annulicrus* only in that the blade of the antenna is slightly longer than the flagellar segments. This may be local variation. The larva and pupa which Johannsen (1937) described under the name *flavicingula* (Walk.) do not appear to differ from *S. annulicrus*, but without seeing the specimens I hesitate to list the species in synonymy.

Stictochironomus annulicrus (Townes)

Tanytarsus (*Stictochironomus*) *annulicrus* Townes 1945: 83.
Tanytarsus (*Stictochironomus*) sp. 1? Roback 1957: 122.

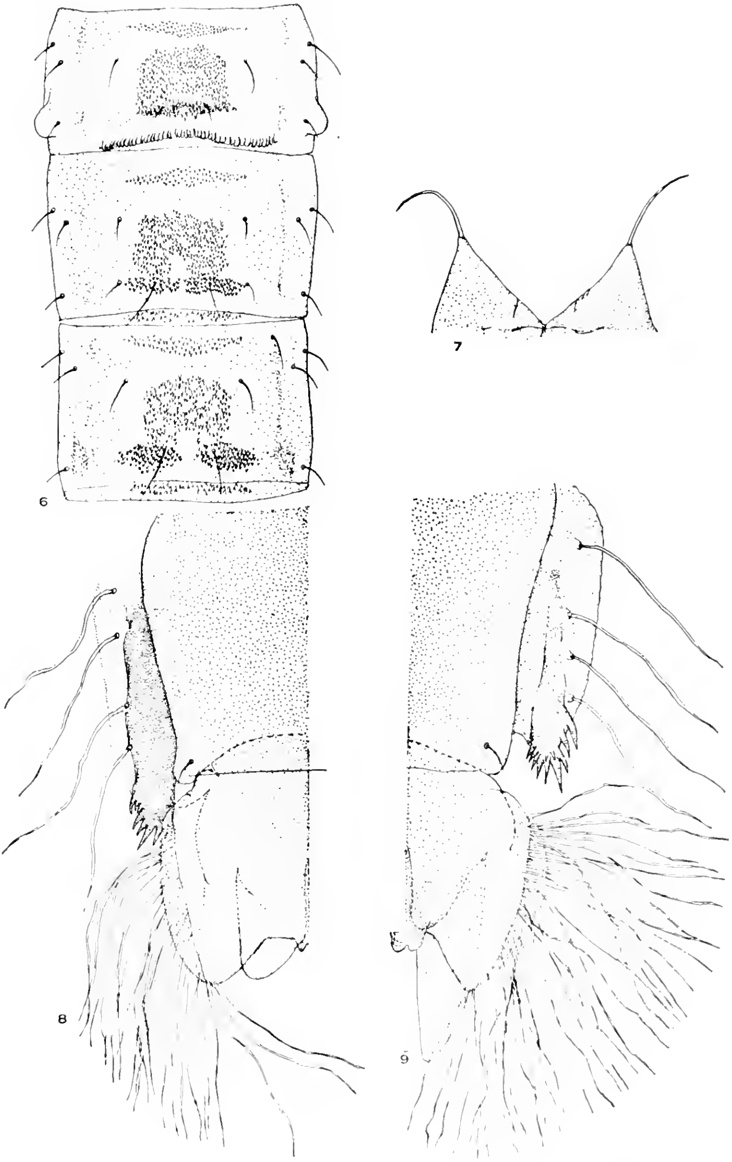
Ecological data:

Pool—15 meters long by 1.29 to 9.14 meters wide.
Depth—0.45 meter.
Bottom where specimens were collected—*Spirogyra* covered.
Spring discharge—0.0028 m^3/sec.
Current—0.15 cm/sec.
Water temperature—16.1° C, relatively constant annually.
D. O.—8.48 ppm.
Alkalinity—110 ppm.



Figs. 1–5. Larva of *Stictochironomus annulicrus* Townes

1. Apex abdomen. 2. Apex of mandible. 3. Epipharyngeal area. 4. Antenna. 5. Labial plate.



Figs. 6–9. Pupa of *Stictochironomus annulicrus* Townes

6. Abdominal tergites 2–4. 7. Cephalic tubercles. 8. Apex female abdomen (half). 9. Apex male abdomen (half).

Location: Tennessee, 80° 19′ West, 35° 54′ North.

LARVA: Length 10.8–13.8 mm; head, brown, 0.55 mm long by 0.49 mm wide; darker caudo-ventrally; eye spots vertically arranged, contiguous; epipharyngeal area and apex of labrum, Fig. 3; pair of palmate bristles on labrum; premandibles bifid; antennal ratio 36–6–6–5–4–2 to 40–7–5–5–4–2, Fig. 4; sense pit one-third from base of first segment; blade 0.065 mm long, does not extend to apex of flagellar segments; lauterborn organs 0.014 mm; mandible, Fig. 2, 0.180 mm long; with well developed comb and plumose brush; labial plate as in Fig. 5; salivary glands in thoracic segments 2 and 3; lumen 1.65 mm long with furcate side branches; anal papillae 0.059 mm long by 0.034 mm wide; with 8 apical bristles and 2 fine lateral hairs; tenth tergite with a pair of apical hairs, Fig. 1; anal gills, Fig. 1, 0.61 mm long.

PUPA: Length ♂ 7.8–8.4 mm; ♀ 9.0–10.6 mm; head with conical tubercles, Fig. 7, 0.17 mm long by 0.17 mm wide at base; thorax with a pair of bristles at Mth 1 and Mth 3 (see Fittkau 1962, Fig. 150); respiratory organs plumose, over 200 filaments; abdominal tergites 2–4 as in Fig. 6; segment 2 always with caudo-lateral projections; in the caudal spine bands the spines are closer together than in the mesal fenestrated area but the two are not distinctly separated; spinose areas of tergite 5 like 4; tergite 6 with the anterior spine band forming a caudally directed triangle, and the reduced caudal band mesally divided; tergite 7 with only some fine spines antero-laterally; tergite 8 bare; dorsal hairs of tergites 2–7 as in Fig. 6; laterally 2–4 with 3 fine hairs, Fig. 6; 5 to 7 with 3 long filaments, two anterior to middle and one caudo-lateral; segment 8 with 4 lateral hairs, Figs. 8 and 9; segments 4–7 with oval patches of spines caudo-ventrally, largest on segment 4, Fig. 6, and smaller on succeeding segments; intersegmentalia 3–4 and 4–5 with bands of anteriorly directed spines; caudo-lateral combs of segment 8, Figs. 8 and 9, with a large apical spine and 6–9 smaller spines; anal fins about 0.50 mm long with 70 ± lateral filaments; apices of male and female abdomen, Figs. 8 and 9.

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Photuris lloydi sp. nov. (Coleoptera: Lampyridae)

FRANK A. McDERMOTT, Wilmington, Delaware

Photuris lloydi sp. nov.

Type locality, Highlands County, Florida. Twelve specimens, all males, were collected in this county by Dr. James E. Lloyd; one of these, his No. 6524, was selected as the type specimen. Five other specimens were collected by Dr. Lloyd in Alachua and Levy Counties, approximately 300 km north of Highlands Co.

Dimensions, 9.6 mm long (elytra plus pronotum) by 3.4 mm wide at elytral half-length.

Outline subparallel, slightly widest at elytral half-length.

Pronotum 1.9 mm long by 2.1 mm broad just forward of angles. Angles 90°, rounded. Base of the form frequent in *Photuris,* with a median small indentation from each side of which a slightly arcuate edge leads to a rather marked crease at the interior side of the angle. Disk slightly convex with a longitudinal black vitta similar to that of *P. versicolor,* on each side of which is a subelliptic orange spot. Margins transparent, with some opaque white mottling. Orange spots and black vitta coarsely punctate. Villosity pale, sparse, and short, but long hairs on edge of base.

Scutellum white, apex acute. Mesonotal plates dull yellowish.

Elytra, each 7.65 mm long and 1.71 mm wide at midlength; 1.32 mm wide at humerus. Coarsely granulate. Villosity pale, fairly long and dense. Ground color black; margins and suture white, continuous around apices; a narrow but pronounced sharply defined white vitta to about two-third elytral length. No evident costae. Wings black.

Head: Frons yellow, slightly concave, with short pale hairs; vertex brown. Interocular margins divergent; 0.4 mm between eyes over antennal sockets and 0.75 mm. across vertex. 2.0 mm across eyes in front, eye length 1.2 mm; eyes proportionately large and appear globular in side view. Clypeus dark brown, tridentate. Mandibles rather small, 0.5 mm across in closed position. Maxillary palpi black; labial palpi mitten-shaped, black.

Antennae black, hairy; articles narrowly white at bases; articles 2 and 3 subequal. Total length *ca.* 4.85 mm, 0.5 of body length.

Prosternum white; meso- and metasterna very dark brown.

Ventral segments 2 to 5 black; 6 and 7 luminous and about two times as long as 5; 8 rather long, pale yellowish, medially short-mucronate; 9 long-ogival.

Coxae pale, almost white. Posterior femora white except at distal ends; tibiae largely black; tarsi black, bases of articles pale. Posterior legs 8.4 mm long, 0.87 of body length; tibiae alone 2.3 mm long.

Aedeagus as in *P. versicolor*, 1.8 mm long.

Typical male flash pattern consists of single coruscations *ca.* 0.2 second long, at 4 to 5 second intervals at 75° F, and up to 0.75 sec. long at 58° F. Shorter intervals and longer flashes, sometimes flickering, were also seen. Female response at 0.2–0.5 sec. after male flash.

Type and fifteen paratypes returned to Dr. Lloyd; two paratypes, Lloyd's Nos. 6521 and g12, retained in my collection. The type has been placed in the collection of Cornell University.

There was very little variation among the specimens. Those from Highlands County were from 9.15 to 11.45 mm long,

FIG. 1. *Photuris lloydi* sp. nov.

averaging 10.42 mm; those from Alachua and Levy Counties were slightly larger. Several very similar specimens, including a female, collected at Bradenton, Florida, on the Gulf Coast, were submitted by Miss Anne M. Yech; these appear to be the same species as Dr. Lloyd's specimens but flash records were not available. Confusion with *P. hebes* is avoided by the larger size of the latter and its longer antennae; *hebes* is also usually lighter colored and the pronotal vitta narrower.

(*Continued from p. 158*)

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Number 19

BUTTERFLIES OF LIBERIA

By Richard M. Fox, Arthur W. Lindsey, Jr., Harry K. Clench and Lee D. Miller

402 pages of text; colored frontispiece, 233 figures, 2 graphs, 2 tables, 3 maps, table of contents, full bibliography and a taxonomic index.

With 195 new records, this study increases the known butterfly fauna of Liberia from 280 to 475 species and another 254 species are noted as probably to be found. Two new tribes, 5 new genera, 13 new species and subspecies are described. Illustrations include photographs and, where pertinent, drawings of genitalia of all holotypes, along with photographs and drawings of closely related forms for comparison. The distribution of each species is given and those more difficult to identify or previously confused are treated at greater length. All known records from Liberia are noted. A 46 page introduction details climatic conditions and biotopes in Liberia and analyzes the zoogeographic and ecologic relationships of the butterflies of Liberia and of Occidental Africa.

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ENTOMOLOGICAL NEWS

Vol. LXXVII JULY, 1966 No. 7

A New Procladius Species with Description of the Immature Stages (Dipt.: Chironomidae)*

Selwyn S. Roback, Curator, Department of Limnology, Academy of Natural Sciences of Philadelphia

The species here described was originally found in a collection of *Stictochironomus annulicrus* Townes, sent to the author for determination by Dr. J. Wilhm, of the Oak Ridge National Laboratory, Tennessee. Dr. Wilhm was kind enough to go back to the spring where the adults were collected and send the author a lot of live *Procladius* larvae from the spring. Some of these (♂, 2 ♀♀) were reared to the adult stage in the laboratory and confirmed the immature-adult association. A great many of the larvae pupated but there was a high mortality in this stage and only a few adults emerged. It gives me great pleasure to name this species after Dr. Wilhm. I should like to thank Dr. Eleanor Slifer for advice on the sensory hairs. The figures were done by Mr. Robert P. Moore, Jr.

Procladius wilhmi n. sp.

On the basis of the denticulate extension of the median internal strut (Fig. 6) this species is related to *P. denticulatus* Sublette. It differs in the greater extent of the denticles and the shorter heel of the dististyle. The dististyle (Fig. 7) is more like that of *P. freemani* Sublette which lacks the denticulate median strut.

Male.—Head brown, postoculars (Fig. 4) uniserial mesad of

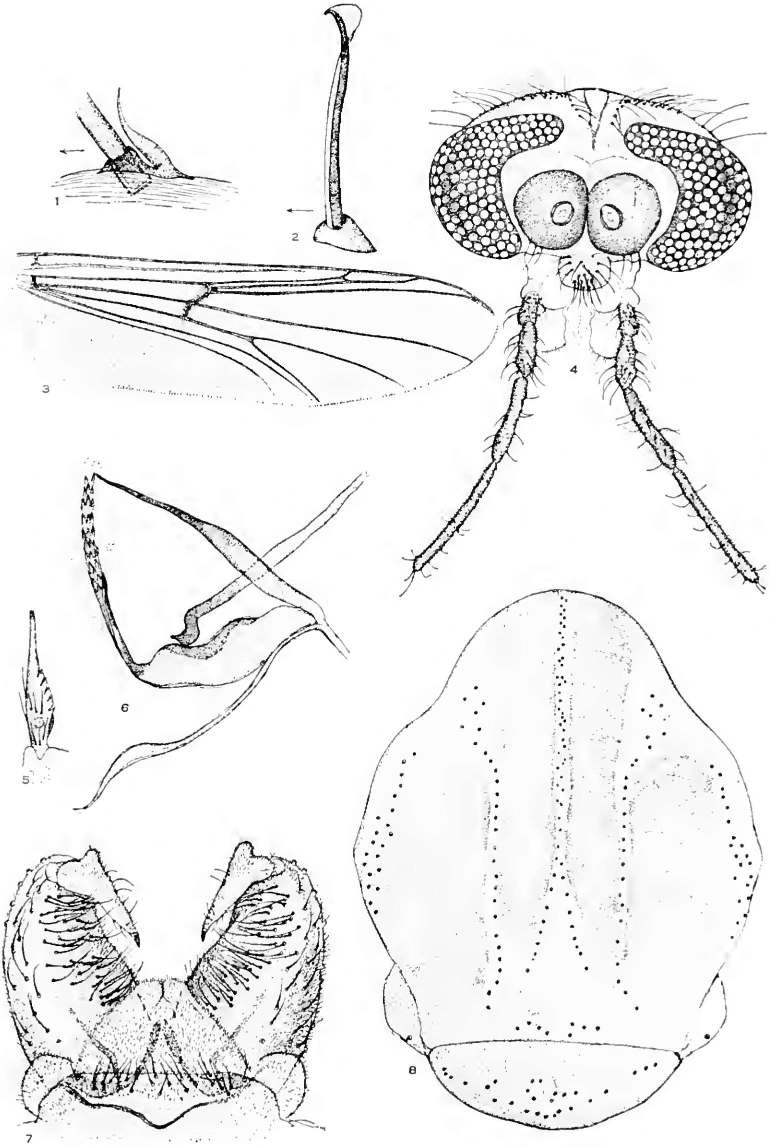
* The support of the National Science Foundation (Grant GB2719) is gratefully acknowledged.

dorsal eye extensions, multiserial behind eyes; ratio of dorsal eye extension to interocular space 1; antennal pedicel dark brown with 3 latero-ventral hairs; antennal ratio 1.97–2.01; ratio of palpal segments 15–24–36–60; pronotum brown with latero-ventral patch of hairs; mesonotum (Fig. 8) lightly pollinose, brown; vittae brown, moderately distinct; humeri and supraalar areas lighter; humeral bristles 7–9; supraalars 22–25; postalars 1; prescutellars 7–9; dorsocentrals uniserial; legs brown; LRI .85–.87; LRII .70–.75; LRIII .73; tibial spur leg I (Fig. 5) 67 μ with 5 lateral teeth; spurs of tibia, leg II 58, 46 μ with 5 lateral teeth each; spurs of tibia, leg III 74, 48μ with 6 lateral teeth each; comb of tibia III with 13 spines; preapical spurs present on T_1 of legs I, II, III and on T_2 of legs II, III; pulvilli absent; empodium well developed; claws spatulate apically; enlarged base of claw with one large and 3 small teeth; no beard on leg I; wing (Fig. 3) 2.6 mm; strongly infuscated, with brownish cast; *r-m* slightly darkened; ratio Cu_2-petiole *Cu* 1.25; *m-cu* one-third arculus to wing tip; halteres light; abdomen black-brown; densely haired; ninth tergite with 21 ± hairs; genitalia (Fig. 7) dark; basistyle 250 μ long; dististyle 118 μ; heel of dististyle 22.5 μ–24.5 μ; ratio of dististyle length to heel length 4.9–5.1; struts of genitalia as in Fig. 6; mesal strut antero-mesally extended; joins elongate row of spurs along a diagonal curving suture; spines embedded in membrane but join strut along this suture.

Female.—Head brown; postoculars completely multiserial; antennal flagellum 12-segmented; rato of apical 5 segments 7–8–10–10–35; last 3 segments (Fig. 9); ratio interocular space to dorsal eye extension 2.6; palpal segments in ratio 15–25–40–72; thorax as in male; LRI .69; LRII .63; LRIII .64; claws apically sharp; wing 2.7 mm; abdomen brown; spermathecae (3) 88 × 102 μ; eighth sternite with mesal light area.

Holotype ♂ emerged March 20, 1966. Allotype ♀ emerged March 17, 1966. Paratypes, 2 ♂♂ September 13, 1965 (Coll.

FIGS. 1–8. *Procladius willhmi* n. sp. ADULT. 1. Socket of tactile hair, mesal edge, first tarsal segment. 2. Chemosensory (?) hair, base of mesal edge, first tarsal segment. 3. Wing. 4. Male head. 5. Spur, tibia I. 6. Detail struts. 7. Male genitalia. 8. Thorax, dorsal.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Wilhm). Paratype ♀ emerged March 17, 1966. Type locality TENNESSEE 80° 19′W, 35° 54′N. All specimens in collection of Academy of Natural Sciences of Philadelphia.

Larva.—Length, 7.2 mm; head (Fig. 13) 650–700 μ long, greatest width 600–650 μ, 480 μ high; ratio length to width 1.04–1.13; labrum and sensory projections as in Fig. 10; antenna 168 μ long, slightly longer than mandible; ratio 63–10–1.5–1.0 to 63–8–1.5–1.5; basal segment (Fig. 18) 4.3–5.0 as long as apical segments; sense pit .70 from base of basal segment; detail of apical segments, Fig. 17; mandible (Fig. 12) 148 μ long; maxillary palpus 48 μ long by 15 μ wide; sense pit .6 from base; labial plate as in Fig. 14; paralabials generally with 7 teeth; hypopharynx as in Figs. 15, 16; glossa 5-toothed; paraglossae (Fig. 11) 49 μ long with 1–2 inner teeth and 4–5 outer teeth; suspensorium of hypopharynx with 10–12 teeth on each side; body pale orange-brown with scattered opaque white flecks; prothoracic segments bare; mesothorax with some hairs anterolaterally and 2 hairs behind these; metathorax with a lateral hair row in anterior half of segment; abdominal segments 1–6 with lateral hair row; anal papillae 175 μ long by 64 μ wide; 15 apical filaments and one lateral hair; tenth tergite with a pair of long hairs; anal gills (4) conical, uppers 324 μ, lowers 178 μ; claws of prolegs all pale brown, 5 shorter, hook-shaped, and 10 longer, more linear; each anal leg with an elongate simple hair.

Pupa.—♂ 5.4 mm, ♀ 5.6 mm; respiratory organ (Figs. 21, 22) 420–480 μ long by 150–200 μ wide; depth about 120 μ; Mth_1 narrow, pointed, about 12 μ long; Mth_3 elongate, flattened, about 116 μ; Mth_2 not discernible; Oth_1 and Oth_2 elongate, flattened, about 84μ; scar of tergite 1 (Fig. 25) 220 μ long; abdominal integument covered with scale-like spines (Fig. 23); hairs of abdominal segments 5 as in Fig. 24; L_1 and L_2 about 48 μ; D_1 30 μ; D_2 101 μ; D_3 and D_5 about 120 μ; D_4 about 60 μ; V_1 84 μ; V_2 42 μ; abdominal segments 2–7 similar to

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FIGS. 9–18. *Procladius wilhmi* n. sp. FIG. 9. Apex adult female antenna. FIGS. 10–18. LARVA. 10. Labrum. 11. Paraglossae. 12. Mandible. 13. Head, dorsal. 14. Labium and paralabials. 15. Hypopharynx, lateral. 16. Hypopharynx, dorsal. 17. Detail of antennal apex. 18. Antenna.

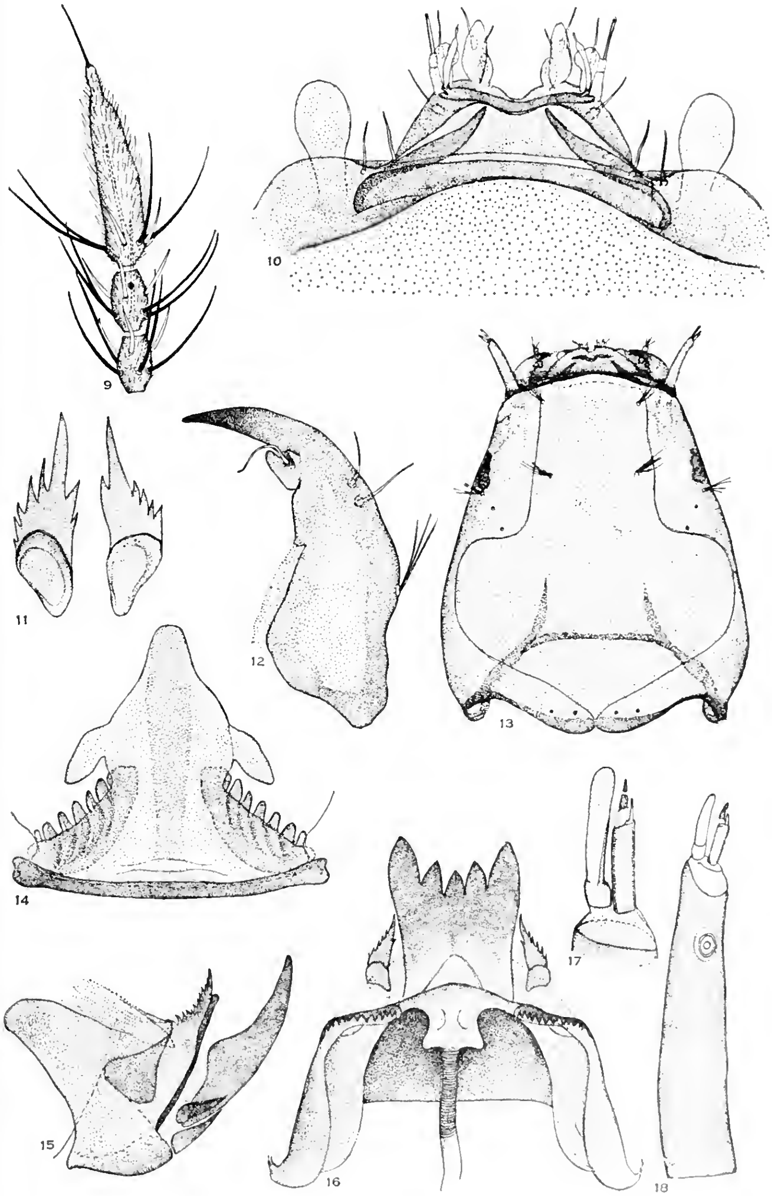
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Fig. 24; mesal. two-thirds of abdominal segments brown; segment 7 with 4 long lateral filaments (480 μ) in apical half; segment 8 as in Figs. 19, 20; filaments about 520 μ; integument spinose above lateral filaments on segment 8 and anal fins; male anal fins 580 μ long (Fig. 20); female 650 μ (Fig. 19); about 42 spines on caudo-lateral margin of anal fins, longest at bend and apex.

(*Ecological Data.*—Pool 15 meters long, 1.29–9.14 meters wide, .45 meters deep; bottom *Spirogyra* covered; discharge 0.0028 m^3/sec; current 0.15 cm/sec; temperature 16.1° C (relatively constant); D.O. 8.48 ppm; alkalinity 110 ppm.

Tarsal Sensory Hairs.—Fittkau (1962) illustrates an unusual sensory hair on the mesal side of the first tarsal segment of the female leg II of *A. plumipes*. On the females of *P. wilhmi* I found similar hairs (Fig. 2) near the base of the first tarsal segment on legs II, III of the female. There were none on leg I. Unlike *Anatopynia plumipes* where they are in an irregular group, on *P. wilhmi* they are in a straight row of 5–7 hairs. On the males there were none on legs I or III but the first tarsal segment of leg II bore a single such hair. The structure of the hair with its apparent double lumen is very similar to the chemosensory hairs of the blowfly, figured by Dethier (1955, Figs. 1, 2). The possible function of a chemosensory hair at the mesal base of the first tarsal segment is not at all clear nor why its presence is apparently associated with the female sex.

Another interesting structure which may be sensory is shown in Fig. 1. It appears to be a basal tapering sinuate extension of the socket of the tactile hairs of the first tarsal segment of both sexes. It is found only associated with those tactile hairs along the entire length of the mesal side of the first tarsal segment. They are found on all legs of both sexes. On the male, they appear to be present on the second tarsal segment, though in more rudimentary form. Whether this extension serves as

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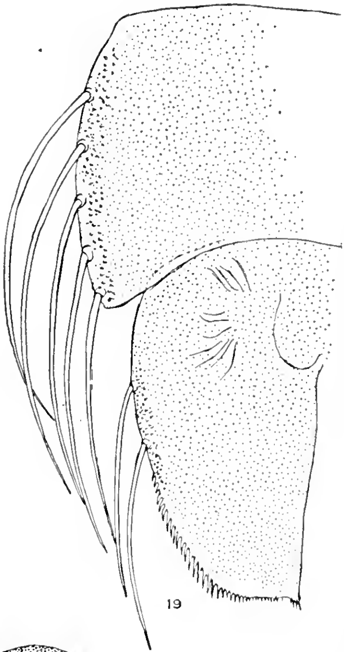
FIGS. 19–25. *Procladius wilhmi* n. sp. PUPA. 19. Apex abdomen, female. 20. Apex abdomen, male. 21. Respiratory organ. 22. Detail of apex of respiratory organ, lateral. 23. Spines of abdominal tergites, detail. 24. Diagrammatic chaetotaxy of fifth abdominal segment; D, dorsal; V, ventral. 25. Scar of first abdominal tergite.



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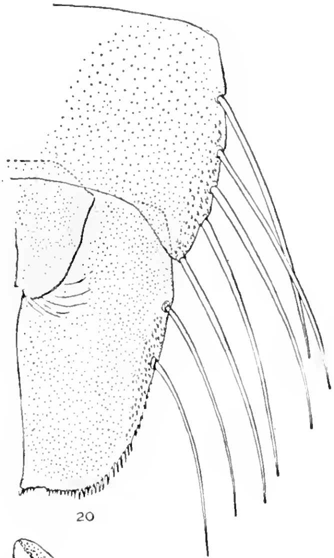

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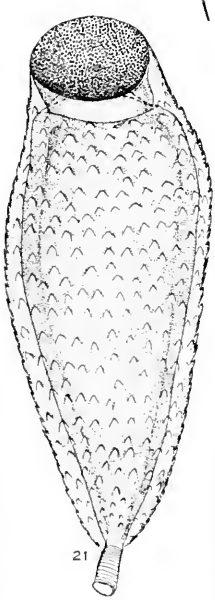

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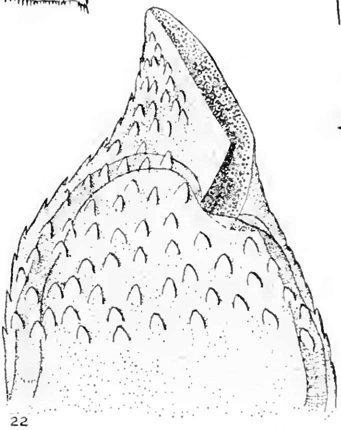

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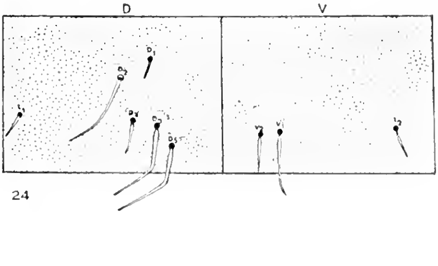

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merely a physical backstop for the tactile hair or has a sensory function cannot be determined without histological study.

In addition to the above, the tarsi bear, scattered over the surface, elongate tactile hairs; recurved, blunt tipped chemosensory hairs, and microtrichiae. The lengths of all these hairs or structures are as follows: tactile (average), 58 μ; recurved chemosensory, 38 μ; hooked chemosensory (Fig. 2), 22 μ; sinuate socket extensions (Fig. 1), 14 μ; microtrichiae, 4.8 μ.

Systematic Position of Procladius.—Fittkau (1962) places *Procladius* in his tribe Macropelopiini primarily on the evidence of the immature stages. While the immatures do show a close relationship to *Apsectrotanypus, Macropelopia,* etc., a comparison of the figures here with those given by Fittkau (1962) for *A. plumipes* will show that the immature stages of *Procladius* are as close or closer to *A. plumipes* than they are to the other Macropelopiini. The shape of the anal fins (Figs. 19, 20) the scalelike spines of the abdomen (Fig. 23), the structure of the labrum (Fig. 10), antenna (Figs. 17, 18), and the labial plate and mandible (Figs. 12, 14) show a very close correspondence with the same structures in *A. plumipes*—more so than to those structures in the Macropelopiini.

The adult, on the other hand, is quite specialized and has diverged more from the anatopyniine stem in the wing venation, genitalic structure and chaetotaxy than the macropelopiine adults. While both *Procladius* and the other macropelopiine genera are closely derived from the anatopyniine stem, the other macropelopiine genera appear to be more closely related to each other, as a group, than they are to *Procladius*. This suggests that if *Procladius* is to be retained in the Macropelopiini it should be given equal subtribal rank with the other genera as a group.

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A New Hydroptilidae (Trichoptera)[1]

R. L. Blickle, Durham, New Hampshire

The species of *Oxyethira* described below is closely related to *O. abacatica* Denning and *O. aeola* Ross under which names it was erroneously listed as occurring in New Hampshire (Morse and Blickle 1957). This species was included in a list of Hydroptilidae of Maine as *Oxyethira* sp. (Blickle 1964). A study of material from Florida, the type locality of *O. abacatica,* and Maine has led to the conclusion that the northeastern material constitutes a new species.

The following species is similar to *O. abacatica* and *O. aeola* in the shape of the claspers, the two rod-like extensions of the 9th segment, and in the shape of the subgenital plate.

The holotype and paratypes will be deposited in the Illinois Natural History Survey Museum. Other paratypes will be placed in the National Museum, Washington, D. C., and in the University of New Hampshire Entomological collection.

Oxyethira anabola, n. sp.

Male: Length from front of head to tip of wings 3.0 mm. The seventh sternite has a short, pointed apico-mesal process. Genitalia as in Fig. 1. The subgenital plate in lateral view, Fig. 1A, is arcuate; in dorsal view, Fig. 1B, the plate appears more or less circular, with the anterior portion indented. The claspers are short, heavily pigmented and the tip of the claspers in lateral aspect appears notched. Attached near to the base of the clasper is a finger like process, bearing a stout spine on its tip. Two long rod like extensions of the 9th segment extend dorsally and posteriorly to the subgenital plate; these rods curve ventrally at their apex and end just beyond the subgenital plate. The aedeagus is 0.6 mm long; Fig. 1C shows the apical two-thirds of the aedeagus with the apex unexpanded. The tip of the aedeagus is composed of four lobes; Fig. 1D, shows the

[1] Published with the approval of the Director of the New Hampshire Agricultural Experiment Station as Scientific Contribution No. 383.

lobes expanded. A sclerotized rod extends along the ventral side of the aedeagus and curves dorsally at the apex.

Holotype Male: Durham, New Hampshire, 5 October 1951.

Paratype Males: Bow, New Hampshire, 25 June 1951, 2 specimens; Allagash, Maine, 30 July 1959, 1 specimen; Jim

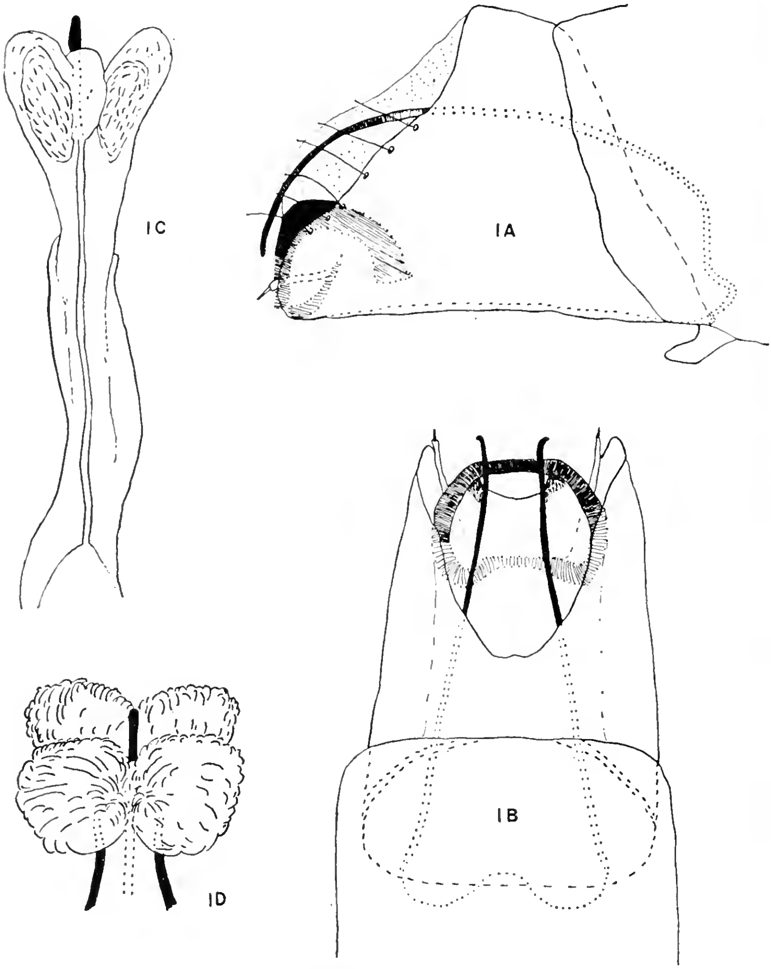

Fig. 1A–D. *Oxyethira anabola,* n. sp., Genitalia. 1A, lateral; 1B, dorsal; 1C, aedeagus; 1D, expanded lobes of aedeagus.

Pond, Maine, 11 July 1959, 19 specimens; Oquossoc, Maine, 25 July 1959, 1 specimen; Oxbox, Maine, 20 July 1959, 102 specimens.

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New Records for Anax longipes Hagen (Odonata)

MARY DAVIS RIES, Normal, Illinois, and ROBERT WILLIAM CRUDEN, Department of Botany, University of California, Berkeley

Since its original description from Georgia (Hagen 1861), *Anax longipes* has been reported from almost every state south of the Great Lakes and east of the Mississippi River. To the list of 13 states summarized by Needham and Westfall (1955) have been added Louisiana (sight record, Bick 1957), Oklahoma (sight record, Bick and Bick 1957), West Virginia (Cruden 1962), and Tennessee (Trogdon 1962). In the case of the last-named state additional unpublished data (Trogdon 1961) indicate the occurrence of *Anax longipes* in three counties: Blount, Cocke, and Knox., Two earlier published reports have been generally overlooked: Alabama (Smith and Hodges 1937) and Pelee Island, Ontario, Canada (sight record, Montgomery 1937). The first collections from Virginia and Oklahoma are reported below.

VIRGINIA: Charles City County, 9½ miles west of Barrett's Ferry crossing of the Chickahominy River. Two specimens collected by M. D. Ries on 23 May 1938 (♂) and 18 June 1938 (♀) are deposited in the collection of the Illinois Natural History Survey, Urbana.

These adults were taken at a small, shallow pond on the south side of Route #5 near the entrances to historic estates known as "Lion's Den" and "Sherwood Forest." The pond occupied a small, somewhat shaded opening in the scrubby woods. It was sparsely filled with emergent reeds and grasses. It seems likely the pond lay in an old marl pit, an older and smaller version of the modern "borrow pit."

OKLAHOMA: Comanche County, 24 July 1961. A single male was captured by the junior author and is in his collection. The site was a narrow, shallow stream in a large, marshy field at the base of Mt. Scott dotted with large shrubs and small trees. Four other individuals were observed.

In addition, four individuals were observed at a pond near Enos, Marshall County, on 24 and 25 June 1961. The insects flew well away from shore. The water was muddy and the shore line thoroughly trampled by cattle. Clusters of sedges and a few willows were scattered around the edge of the pond.

We wish to thank Mrs. Leonora K. Gloyd for helpful suggestions in connection with this manuscript and Dr. B. E. Montgomery for supplying information from the Williamson-Montgomery bibliography and index.

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Sphecomyia (Diptera: Syrphidae) a Taxonomic and Descriptive Analysis *

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This final part in a revision of *Sphecomyia*, presents synoptic descriptions of the genus and species, and their taxonomic history. I wish to thank the numerous individuals who have given their generous assistance during this study.

Figures, unless otherwise indicated, were drawn free-hand and to scale; ratios of antennal segments, measured from outside dorsal surfaces, begin with basal segment. Citation of the page number in the synonomy refers to that page in which the species is first mentioned within the article.

Genus SPHECOMYIA Latreille

Sphecomye Latreille, 1825, Fam. Natur. du regne Animal 1: 495.
Sphecomyia Latreille, 1829, Dict. Class. d'Hist. Nat. 15: 545.
Tyzenhauzia Gorski, 1852, Analec. ad. Ent. prov. occid. imperii Rossici 1: 172.

GENOTYPE: *Chrysotoxum vittatum* Wiedemann (1830), by action of Coquillett (1910, U. S. Natl. Mus. Proc. 37: 607).

GENERIC DIAGNOSIS: Head slightly longer than wide with bare dichoptic eyes, more widely separated in females; antennal process and oral margin prominent; ocellar triangle black pilose; 1st and 2nd antennal segments with sparse pile, ventro-lateral surface of 1st segment bare, 3rd segment bare; postocular area pollinose and pilose; face pollinose, some species and sexes with medial black stripe, cheeks bare; below antennal process face is concave, medially convex to moderately tuberculate, then produced downward to oral margin; oblique band of pile extends

* This revisionary series, an abridgment of a thesis submitted to the Faculty of the Graduate School of Western Illinois University in partial fulfillment of the requirements for the Degree of Master of Science, was partially supported by the Research Council of Western Illinois University.

from near lateral apices of antennal process to mid-anterior margin of eyes, continuous with margin to ventral apex. Thorax black, scutum pilose, humeri and usually area internal to humeri pollinose; posterior $\frac{1}{2}$ of mesopleuron and posterior dorsal area of sternopleuron pollinose, pilose; scutellum black, pilose, some species with yellow pollinose area, border of undersurface with short sparse pile; legs yellow to black, pilose, outer surface of hind coxae pollinose; wings hyaline to brownish, more pronounced around veins, 3rd longitudinal vein sinuate, r-m vein oblique, internal area of anal cell next to 1st anal vein without microtrichia. Abdomen black, convex, pilose, about twice length of thorax; 2nd tergite with at least 1 pollinose fascia. Length 9.0–15.0 mm (excluding antennae).

The morphology of the male genitalia has previously been described in detail (Weisman, 1965).

Discussion: Latreille (1825) in establishing the genus, from specimens collected in Carolina by D. Bosc, did not include a description nor assign the specimens a specific epithet; four years later Latreille (1829) described the genus. Coquillett (1910) designated the Type-species. Gorski (1852) proposed the generic name *Tyzenhauzia* for a Palearctic species.

Key to species of Sphecomyia

1. Scutellum yellow pollinose, at least in part (Species of **S. vittata** Group) 2
   Scutellum black, nonpollinose (Species of **S. occidentalis** Group) 7
2. First tergite with single pollinose fascia 3
   First tergite without pollinose fascia (Fig. 15) . . . . **columbiana** Vockeroth
3. Thoracic scutum with pollinose vittae, interrupted medially forming four areas (Figs. 10, 11, 12) 4
   Thoracic scutum without vittae (Figs. 13, 14) 6
4. First two antennal segments elongate (Figs. 1, 2, 10, 11) . . . 5
   First two antennal segments short, not as above; third and fourth tergites with black diamond-shaped area medially (Figs. 9, 12) . . . . **brevicornis** Osten-Sacken
5. Pteropleuron yellow pollinose; pollinose areas of thoracic scutum wide (Fig. 10) . . . . **vittata** (Wiedemann)

Pteropleuron nonpollinose; pollinose areas of thoracic scutum narrow; Palearctic (Fig. 11) .... **vespiformis** (Gorski)

6. Pteropleuron yellow pollinose; scutellum yellow pilose (Fig. 14) .... **dyari** Shannon

Pteropleuron nonpollinose; scutellum black pilose (Fig. 13) .... **pattonii** Williston

7. Thoracic scutum with pollinose fascia along posterior border; third antennal segment longer than first two segments combined (Figs. 8, 16) .... **occidentalis** Osburn

Thoracic scutum and antennae not as above (Figs. 17, 18) 8

8. All tergites with single pollinose fascia (Fig. 17) .... **nasica** Osburn

Third and fourth tergites without pollinose fasciae (Fig. 18) .... **fusca** Weisman

Species Diagnosis

Sphecomyia vittata (Wiedemann), 1830. Figs. 1, 10.

Chrysotoxum vittatum Wiedemann, 1830, Auss. zwei. Ins. 2:87.
Psarus ornatus Wiedemann, 1830, Auss. zwei. Ins. 2: 91. —Macquart, 1834, Hist. nat. dipt. 1: 491.
Sphecomyia vittata, Macquart, 1842, Dipt. Exot. 2: 18. —Gorski, 1852, Annal. ad Ent. prov. Rossici. 1: 170. —Zetterstedt, 1855, Dipt. Scand. 12: 4646. —Hunter, 1869, Canad. Ent. 28: 101. —Osten-Sacken, 1876, Buffalo Soc. Nat. Sci. Bul. 3: 62; 1877, U. S. Geol. and Geog. Survey of Ter. 3: 342. —Roder, 1879, Entomol. Nachricht. 7: 96. —Williston, 1886, U. S. Natl. Mus. Bul. 31: 257. —Portschinsky, 1887, Russ. Ent. Obshch. Trudy. 21: 8. —Chagnon, 1901, Nat. Canad. 28: 71. —Aldrich, 1905, Smithsn. Misc. Collect. 46: 405. —Jones, 1907, N. Y. Ent. Soc. Jour. 15: 99. —Osburn, 1908, Canad. Ent. 40: 14. —Kertesz, 1910, Cat. dipt. hucu. descr. 7: 349. —Metcalf, 1913, Ohio Biol. Survey, Bul. 1: 98. —Shannon, 1925, Pan-Pacific Ent. 2: 43. —Curran, 1932, Amer. Mus. Novitates 519: 8. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 613. —Weisman, 1965, Ent. News 76: 268.

Distinguished from others of genus by elongate 1st and 2nd antennal segments and pollinose area on pteropleuron.

Male: Pollinose areas yellow; face with medial black stripe; antennae black, segments $1:1:\frac{1}{3}$, 3rd segment subtriangular, arista $\frac{3}{4}$ length of 1st segment; thoracic scutum with 2 pollinose vittae broadly interrupted medially forming 4 areas, none confluent with thoracic margins, anterior pair "tear-drop" shaped; anterior-dorsal area of pteropleuron and scutellum pollinose; 1st abdominal tergite with 1 pollinose fascia, tergites 2–4 with 2 fasciae, anterior fascia interrupted, posterior fascia entire; epandrium with apices of claspers rounded and directed caudoventrally, ventral surface with basal lobe; penis sheath with dehiscent system; axial system with sustentacular apodeme unkeeled, ejaculatory hood rounded apically.

FEMALE: Similar to male except facial stripe is wider.

DISCUSSION: *Chrysotoxum vittatum* and *Psarus ornatus* were both declared synonymous with Latreille's specimens by Macquart (1842) who also emended *vittatum* to *vittata*.

Sphecomyia vespiformis (Gorski), 1852. Figs. 2, 11.

Tyzenhauzia vespiformis Gorski, 1852, Annal. ad Ent. prov. Rossici. 1: 170.

Sphecomyia vespiformis, Wahlberg, 1854, Ofvers. Kongl. Vet. Akad. Forhandl. 11: 155. —Zetterstedt, 1855, Dipt. Scand. 12:4646; 1859, Dipt. Scand. 13: 5075. —Schiner, 1857, Zool.-Bot. Ver. Wien, Verhandl. 7: 445; 1862, Fauna Austr. 1: 367; 1864, Cat. system. dipt. europ. 112. —Bonsdorff, 1861, Finlands tvaving. Ins. 6: 213. —Curran, 1932, Amer. Mus. Novitates 519: 8. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 612. —Weisman, 1965, Ent. News 76: 268.

Sphecomyia vittata, Roder, 1879, Entomol. Nachricht. 7: 96. —Portschinsky, 1887, Russ. Ent. Obshch. Trudy. 21: 8. —Aldrich, 1905, Smithsn. Misc. Collect. 46: 405. —Kertesz, 1910, Cat. dipt. hucu. descr. 7: 349. —Stackelberg, 1958, Akad. Nauk S.S.S.R., Zool. Inst., Trudy. 24: 244. —Seguy, 1961, Dipt. Syrph. Europe Occedent. Serie A(23): 156.

This species, likely to be confused only with *S. vittata,* has a Palearctic distribution. The preceding description will apply here, except as follows:

MALE: 1st antennal segment shorter, segments $1:1\frac{1}{4}:\frac{1}{3}$; pteropleuron nonpollinose; pollinose areas of thoracic scutum narrow, posterior pair divergent posteriorly; basal $\frac{1}{2}$ of scutellum pollinose; epandrium with claspers appearing more robust, invagination preceeding ventral lobe not as deep; ejaculatory hood with ridge on caudal face.

FEMALE: Pollinose area of scutellum wider, facial stripe wider.

DISCUSSION: Loew (1851, Stettin Ent. Ztg. 11: 307) initially mentioned this species but failed to name or describe it. Gorski (1852) assigned it the generic name *Tyzenhauzia* and stated that evidently his specimens and Latreille's were very similar in appearance but an opportunity for inspecting them (*S. vittata*) had escaped him. Apparently Gorski's main reason for creation of *Tyzenhauzia* was due to Latreille's description of *Sphecomyia* being erroneous concerning the arista being inserted in the second antennal segment.

Sphecomyia brevicornis Osten-Sacken, 1877. Figs. 9, 12.

Sphecomyia brevicornis Osten-Sacken, 1877, U. S. Geol. and Geog. Survey of Ter. 3: 341. —Roder, 1879, Entomol. Nachricht. 7: 97. —Williston, 1882 Amer. Phil. Soc. Proc. 20: 328; 1886, U. S. Natl. Mus. Bul. 31: 258. —Aldrich, 1905, Smithsn. Misc. Collect. 46: 404. —Osburn, 1908, Canad. Ent. 40: 11. —Kertesz, 1910, Cat. dipt. hucu. descr. 7: 348. —Shannon, 1925, Pan-Pacific Ent. 2: 43. —Hull, 1949, Zool. Soc. London, Trans. 26: 264. —Stone (*et al.*), 1965, U .S. Dept. Agr., Agr. Handb. 276: 612. —Weisman, 1965, Ent. News 75: 266.

Sphecomyia vespiformis, Curran, 1932, Amer. Mus. Novitates, 519: 8.

This species, although somewhat similar to both previously described species due to pollinose pattern of thoracic scutum, may be distinguished by the black diamond-shaped area medially on 3rd and 4th tergites and shorter antennae.

MALE: Front with medial longitudinal groove; antennal segments 1 : 1 : $\frac{3}{4}$, 3rd segment suborbicular, arista yellow, apical $\frac{1}{3}$ black; thoracic scutum with anterior pollinose areas confluent with anterior thoracic margin, twice length of posterior pair; pteropleuron nonpollinose; 1st abdominal tergite with 1 pollinose fascia, tergites 2–4 with 2 fasciae, 3rd and 4th tergites with black diamond-shaped area; epandrum with apices of claspers acute, ventral surface without deep invagination; horn of chitinous box subtruncate at apex.

FEMALE: Front with sparse black pile and lacks groove.

Sphecomyia columbiana Vockeroth, 1965. Figs. 7, 15.

Sphecomyia columbiana Vockeroth, 1965, Canad. Ent. 97: 86. —Weisman, 1965, Ent. News 76: 268.

The absence of a pollinose fascia on 1st tergite distinguishes this species. I shall only complement Vockeroth's description as follows: penis sheath with dehiscent system, ventral surface with minute pile medially; axial system with sustentacular apodeme unkeeled, horn of chitinous box produced acutely on apical cephalad angle, produced and rounded on apical caudal angle.

Sphecomyia pattonii Williston, 1882. Figs. 6, 13.

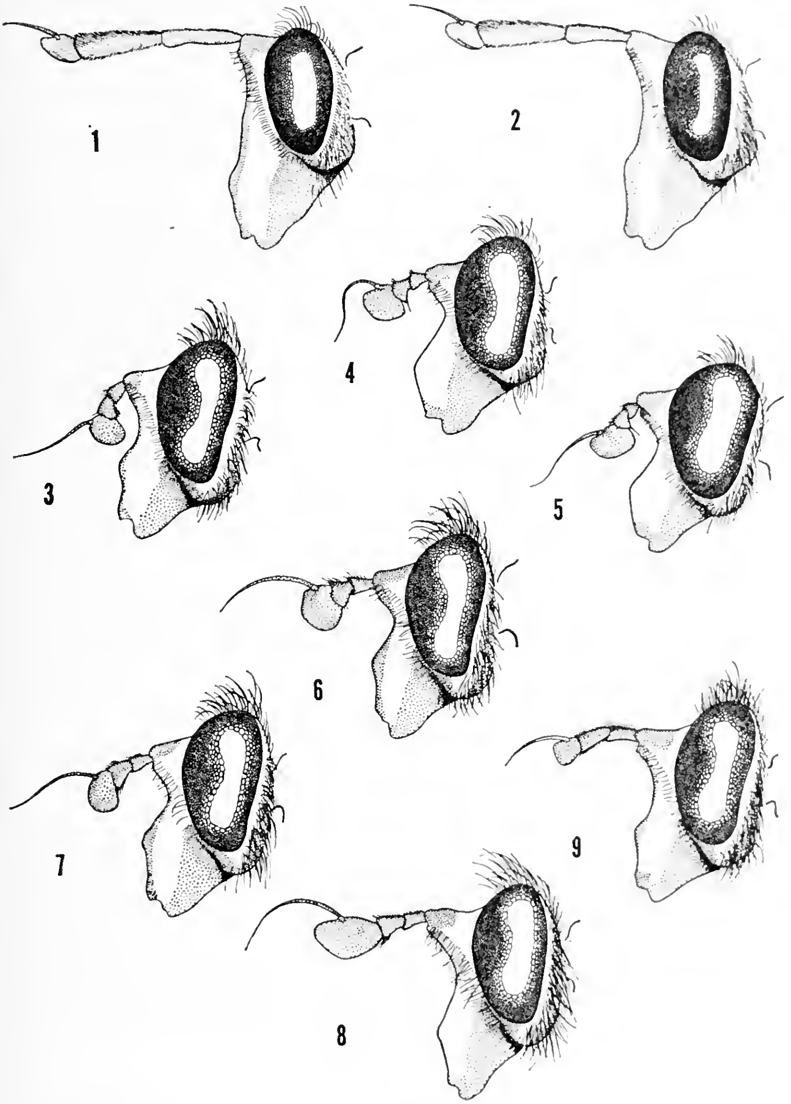
Sphecomyia pattonii Williston, 1882, Amer. Phil. Soc. Proc. 20: 328. —Kertesz, 1910, Cat. dipt. hucu. descr. 7: 349. —Vockeroth, 1965, Canad. Ent. 97: 86. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 613. —Weisman, 1965, Ent. News 76: 268.

Calliprobola calorhina Bigot, 1883, Soc. Ent. de France, Ann. 32: 353.

Sphecomyia pattoni, Williston, 1886, U. S. Natl. Mus. Bul. 31: 258, 299. —Aldrich, 1905, Smithsn. Misc. Collect. 46: 404. —Osburn, 1908, Canad. Ent. 40: 14. —Shannon, 1925, Pan-Pacific Ent. 2: 43. —Curran, 1932, Amer. Mus. Novitates 519: 8.

Differs most sharply from *S. dyari,* which it closely resembles, by absence of definite pollinose area on pteropleuron, black pile of scutellum, and shape of male's claspers.

MALE: Pollinose areas yellow; face with medial black stripe; antennal segments 1 : 1 : 2, 3rd segment suborbicular, arista $\frac{1}{2}$ longer than combined segments; scutellum black pilose, some specimens with short yellow pile underlying black pile, basal



FIGS. 1–9. Heads of male *Sphecomyia:* 1, *S. vittata;* 2, *S. vespiformis;* 3, *S. dyari;* 4, *S. nasica;* 5, *S. fusca;* 6, *S. pattonii;* 7, *S. columbiana;* 8, *S. occidentalis;* 9, *S. brevicornis.*

border pollinose; 1st tergite with 1 pollinose fascia, tergites 2–4 with 2 fasciae, anterior fascia interrupted, posterior fascia entire; epandrium with apices of claspers rounded, ventral surface with basal lobe; penis sheath with dehiscent system; axial system with sustentacular apodeme unkeeled, horn of chitinous box flanged on apical $\frac{1}{2}$.

FEMALE: Facial stripe wider, front with sparse black pile and groove.

Sphecomyia dyari Shannon, 1925. Figs. 3, 14.

Sphecomyia dyari Shannon, 1925, Pan-Pacific Ent. 2: 43. —Vockeroth, 1965, Canad. Ent. 97: 86. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 612. —Weisman, 1965, Ent. News, 76: 266.

This species, very similar to *S. pattonii,* may be differentiated as follows: arista generally shorter; pollinose area on pteropleuron; scutellum yellow pilose; epandrium with claspers elongate and directed upward at apical $\frac{1}{6}$, ventral surface without basal lobe; penis sheath with open system; horn of chitinous box flanged on cephalad surface only.

Sphecomyia occidentalis Osburn, 1908. Figs. 8, 16.

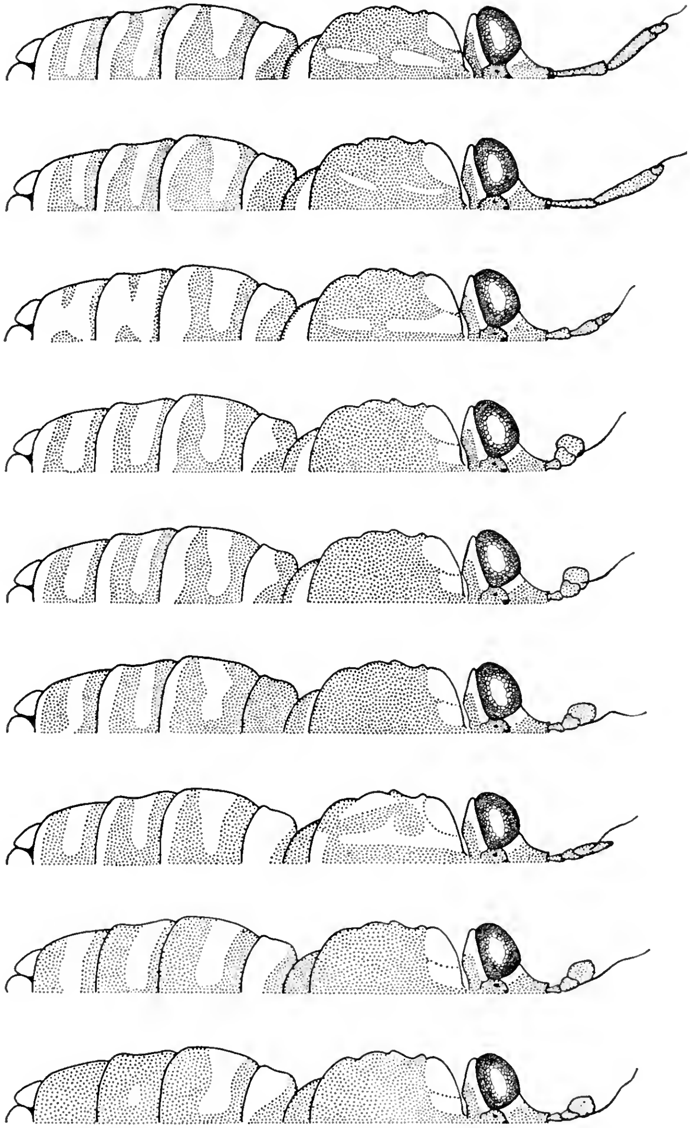
Sphecomyia occidentalis Osburn, 1908, Canad. Ent. 40: 12. —Shannon, 1925, Pan-Pacific Ent. 2: 43. —Curran, 1932, Amer. Mus. Novitates 519: 8. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 612. —Weisman, 1965, Ent. News 76: 265.

Sphecomyia pattoni, Osburn, 1904, Canad. Ent. 36: 262.

Sphecomyia pattonii, Kertesz, 1910, Cat. dipt. hucu. descr. 7: 349.

Separated from others of genus by pollinose pattern of thoracic scutum and elongate 3rd antennal segment.

MALE: Pollinose areas yellow; face lacks black stripe; antennal segments 1 : 1 : 2$\frac{1}{2}$, arista about equal to combined antennal segments; thoracic scutum with pollinose patterns as in Fig. 16, pollinose area on pteropleuron; 1st abdominal tergite with 1 pollinose fascia, tergites 2–4 with 2 fasciae, anterior fascia



Figs. 10–18. Semidiagramatic representation of dorsal surfaces of male *Sphecomyia*: 10, *S. vittata*; 11, *S. vespiformis*; 12, *S. brevicornis*; 13, *S. pattonii*; 14, *S. dyari*; 15, *S. columbiana*; 16, *S. occidentalis*; 17, *S. nasica*; 18, *S. fusca*.

interrupted, posterior fascia entire; posterior margin of 4th sternite undulated, 7th segment with ventrally projected tubercle; epandrium with apices of claspers acute, basal ventral lobe produced into hook-like process; penis sheath with open system; axial system with sustentacular apodeme keeled, apex of ejaculatory hood rounded and directed ventrally, horn appears attached to chitinous box.

FEMALE: Face with medial stripe, front black pilose, 4th sternite and ventral surface of 7th segment unmodified.

Sphecomyia nasica Osburn, 1908. Figs. 4, 17.

Sphecomyia nasica Osburn, 1908, Canad. Ent. 40: 13. —Shannon, 1925, Pan-Pacific Ent. 2: 43. —Curran, 1932, Amer. Mus. Novitates 519: 8. —Weisman, 1964, Ent. News 75: 266; 1965, 76: 268. —Stone (*et al.*), 1965, U. S. Dept. Agr., Agr. Handb. 276: 612.

Readily distinguished from others of genus by 1 pollinose fascia on tergites 1–4.

MALE: Pollinose areas yellow; face lacks black stripe; front with longitudinal groove; antennal segments 1 : 1 : 2, 3rd segment suborbicular, arista about $\frac{1}{2}$ longer than combined segments; scutellum yellow pilose; abdominal tergites 1–4 with 1 pollinose fascia and with dense appressed yellow pile along posterior border; epandrium with apices of claspers rounded and directed caudally, base with lateral evagination; penis sheath with open system; axial system with sustentacular apodeme keeled, chitinous box without horn, apex of ejaculatory hood rounded.

FEMALE: Face with medial black stripe, front black pilose.

Sphecomyia fusca Weisman, 1964. Figs. 5, 18.

Sphecomyia fusca Weisman, 1964, Ent. News 75: 266; Ent. News, 1965, 76: 268.

Distinguished from others of genus by absence of pollinose fasciae on 3rd and 4th tergites. It is similar and appears closely related to *S. nasica.* The preceeding description will apply here, except as follows:

MALE: Pollinose areas grayish; 3rd and 4th abdominal tergites lack fasciae, 3rd tergite of some specimens exhibit faint pair of pollinose spots; chitinous box with apex of dorso-caudal tubercle truncate, apex of ejaculatory hood horn acute, directed cephalad.

FEMALE: Face with medial black stripe, front black pilose.

In listing the types of *S. fusca* an error was made, the correction is as follows: Holotype; Sierra Co., Gold Lake, July 8, 1954 (Blaylock). Allotype; Nevada Co., near Hobart Mills, June 23, 1962 (Parker). Paratypes; 5 ♂♂, Sierra Co., Gold Lake, July 8, 1954 (Bohart); 2 ♀♀, Nevada Co., Sagehen Creek near Hobart Mills, June 18, 1962 (Irwin)—1 ♀, Sierra Co., Yuba Pass, July 6, 1962 (Irwin). All types are from California.

The Immature Stages of Axima zabriskiei Howard (Hymenoptera, Eurytomidae)

B. D. BURKS, Entomology Research Divison, Agric. Res. Serv., U. S. Department of Agriculture, Washington, D. C.

In 1890, Howard published a brief description of the larva and pupa of *Axima zabriskiei:* "Larva of *Axima* has six or more strong dorsal tubercles and head of pupa is strongly tuberculate." Nothing further was published on the distinctive immature stages of this eurytomid until Krombein (1960) reared it from *Ceratina calcarata* Robertson and mentioned that the pupa of *zabriskiei* has "a flange on each side of the abdomen with a narrow curved expansion . . . presumably to assist in holding the pupa in position." In the present paper I present illustrations and descriptions of the mature larva and the pupa of *zabriskiei,* drawn from Krombein's material.

The mature larvae of most Eurytomidae have long been known to have small dorsal protuberances on the abdominal segments, as illustrated by Parker (1924). These protuberances are situated at the segmental boundaries, and an intersegmental suture can be seen to pass through the center of each. They are not, however, restricted to the eurytomid larvae, but occur also, although poorly developed, in many torymid and some pteromalid larvae. Consequently, only a chalcidoid larva having such protuberances strongly developed may be placed with confidence as an eurytomid. However, not all mature eurytomid larvae have these dorsal protuberances; phytophagous larvae, such as *Harmolita* and *Bephrata,* or plant-feeding species of *Eurytoma,* such as *E. amygdali* Enderlein, have them only slightly developed or wanting entirely.

Among eurytomid larvae *Axima zabriskici* has the largest intersegmental protuberances. In the mature larva, Fig. 1, there is a low mid-dorsal projection at the suture separating the metathorax and the first abdominal segment. There are 5 much larger, pointed projections at the sutures separating abdominal segments 1 to 6, and a low, rounded one midway between the anterior and posterior margins of abdominal segment 8. Segment 9 bears a more broadly rounded dorsal projection.

The larva of *zabriskici* is sparsely setose, unlike many eurytomid larvae. There are 3 pairs of setae on the head, Fig. 4, a single pair of subdorsal ones on each thoracic segment, 2 pairs on the first abdominal segment, and one pair on each of the following abdominal segments. These setae are unique in being capitate, Fig. 2; such setae are not known elsewhere in the Eurytomidae.

The distribution of spiracles (Fig. 1) in the mature larva of *zabriskici,* 2 thoracic pairs and 7 abdominal pairs, is the same as in other known eurytomid larvae. *See* Parker (1924) and Silvestri (1920) for illustrations of several eurytomid larvae.

The head, shown in anterior aspect in Fig. 4, bears a pair of minute, peglike antennae. The pleurostoma bears 2 pairs of mid-dorsal sensoria, but the labrum apparently none. The mandibles each have a single apical tooth, unlike the mandibles in some eurytomid larvae, such as *E. amygdali,* that have 2 teeth. The maxillary-labial lobe is a simple, rounded structure, without palpi and without visible openings for the salivary ducts.

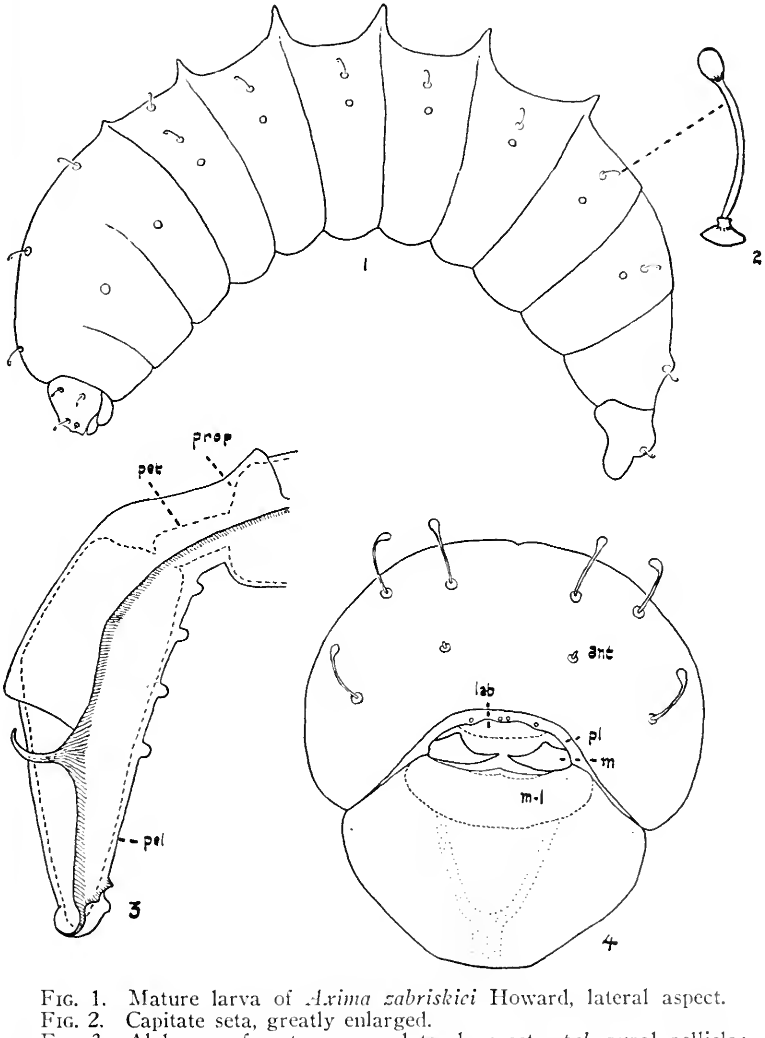


FIG. 1. Mature larva of *Axima zabriskici* Howard, lateral aspect.
FIG. 2. Capitate seta, greatly enlarged.
FIG. 3. Abdomen of mature pupa, lateral aspect. *pel,* pupal pellicle; *pet,* petiole of adult; *prop,* propodeum of adult.
FIG. 4. Head of mature larva, anterior aspect. *ant,* antenna; *lab,* labrum; *m,* mandible; *m-l,* maxillary-labial lobe; *pl,* pleurostoma.

The abdomen of the mature pupa of *zabriskici* is shown in lateral aspect in Fig. 3. The pupal sheath, a tenuous pellicle, through which the propodeum, petiole, and gaster of the adult can be seen, bears 4 midventral protuberances and a narrow, longitudinal flange along the midlateral line. This flange is produced near the apex of the abdomen as a pair of narrow, curved and hooklike, lateral expansions which are joined at the apex of the abdomen by a narrow ventral flange. The head of the pupa bears a pair of prominent, rounded projections on the vertex. Within these may be seen the pair of sharp spines borne in this position by the adult.

I have not seen the egg of *zabriskici,* but it very likely bears an elongate pedicel at its proximal end, as is illustrated for several eurytomid eggs by Parker (1924).

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Books

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There are papers by J. E. Treherne on active transport in insects; by Th. Bücher on formation of the specific structural and enzymic pattern of insect fight muscle; by Wintringham on metabolism; by Kilby on intermediary metabolism in the fat body; by Brunet on aromatic compounds; by Wigglesworth on hormones; and by Rudall on skeletal structures in insects. There are twenty electronmicrographs and x-ray diffraction photographs.

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OCTOBER 1966

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ENTOMOLOGICAL NEWS

Vol. LXXVII OCTOBER, 1966 No. 8

The Genus Epomidiopteron Romand (Hymenoptera: Tiphiidae)

Harry W. Allen [1, 2]

EPOMIDIOPTERON Romand

Epomidiopteron Romand, 1836, Ann. Soc. Ent. France 4: 653. Type, *Epomidiopteron julii* Romand. Monobasic.—Sichel, in Saussure and Sichel, 1864, Cat. Espèces Scolia, etc. p. 264.—Saussure, in Grandidier, 1892, Hist. Madagascar 20: 236.—Ashmead, 1903, Can. Ent. 35: 39.—Bridwell (*Epimodiopteron!*) 1919, Proc. Hawaii Ent. Soc. 4: 119.—Pate, 1949, Jour. New York Ent. Soc. 55: 129.

Scoliphia Banks, 1912, Can. Ent. 44, 201. Type, *Scoliphia spilota* Banks. Monobasic and by original designation.—Bridwell, Hawaii Ent. Soc. 4: 119.

This genus can be immediately separated from other American genera of the subfamily Tiphiinae by its large size, black wings, and maculated thorax and abdomen. The characters in which it differs from one or more of the other genera are given below.

Vestiture of head, thorax and abdomen is short, sparse, and relatively inconspicuous. Clypeus white in the male, smoothly arched with a convex margin. Mandible cusped in both sexes. Mouth opening elongate; polished, submandibular triangle lacking; palpi much reduced in size. Scutum lacks an anteromedian

[1] Research Fellow in Entomology, Academy of Natural Sciences of Philadelphia and Collaborator, U. S. Department of Agriculture.

[2] This is the sixth paper in a study by the author of the Tiphiinae of the New World supported by Grant GB-1240 of the National Science Foundation.

groove, but has in middle area, anterior to punctures, four obscure grooves. Mesopleuron in both sexes lacks prepectal carina. Tegula nearly twice as long as wide. Forewing densely and entirely blackish with bluish reflections; radial cell of female open; first transverse cubitus an elongate spur of uniform thickness nearly separating first and second cubital cells; stigma small, indistinct. Sensorium on inner surface of tibia absent. Hind basitarsus of female without a longitudinal groove.

Dorsum of propodeum without areola in female; with only one transverse carina. Side of propodeum only obscurely rugulose. Tergum 1 with an obscure transverse carina in both sexes, without sunken setigerous sensorium on sides. Sternum without escutcheon or ventrally directed spine. Abdominal terga and sterna broad, with ribbon-like apical impunctate bands. Pygidium of female finely punctate basally, finely shagreened at apex, with tufts of fine erect bristles between the two areas. Sixth sternum not conspicuously sculptured in either sex.

The genotype, a female from Cayenne, French Guiana, described with remarkable clarity by Romand over 130 years ago, has not been seen by the author. Dr. Karl Krombein of the Smithsonian Institute who recently studied Hymenoptera types in Paris and Munich, states (in litt.) "I think that the probable type of *Epomidiopteron julii* Romand is in Munich. It is a female bearing four labels as follows: "Cayenne/coll. Guerin"; "Cay."; "coll. Guerin"; and "Epomidiopteron/julii/Rom./Cayenne." There is no specimen in the Paris Museum labeled as Romand's type."

This wasp despite its rarity has been collected over a much wider range of environments than any other species of the subfamily. Small variations have been observed, but until larger series are available it seems advisable to consider all as belonging to one species.

Epomidiopteron julii Romand

Epomidiopteron julii Romand, 1836, Ann. Soc. Ent. France 4: 653.—Romand, 1938, Trans. Ent. Soc. London ser. 2, 2: 149.—Sichel in Saussure and Sichel, 1864, Cat. Spec. Scolia

p. 265.—Saussure in Grandidier, 1892, Hist. Madagascar 20: 236.—Holmberg, 1903, Ann. Mus. Buenos Aires ser. 3, 2: 504.—Allen, 1962, Trans. Amer. Ent. Soc. 88: 72.

Paratyphia 12-maculata Cameron, 1904, Trans. Amer. Ent. Soc. 30: 94.

Scoliphia spilota Banks, 1912, Can. Ent. 44, 201.

Epomidiopteron duodecemmaculata Cameron, Allen, 1962, Trans. Amer. Ent. Soc. 88: 61. New Synonym.

Female.—Front with an impunctate ridge bordering inner eye orbit; least distance between eyes is at level of lowest ocellus where it is 0.88 times as great as at level of lower margin of antennal sockets. Clypeus with small white spot near base of mandible; margin moderately sinuous and in front view not receding near base of mandible. Antennal flagellum with first joint longer than wide, the next three wider than long.

Dorsal pronotum with a white spot at humeral angle; impunctate apex more clearly defined than in male, about half the median length. Lateral pronotum without anterior process, or median groove. Mesopleuron with broad white spot near tegula; without prepectal ridge or suture; its large round shallow punctures largely grouped in middle area, with numerous secondary punctures. Scutellum and metathorax each with a small white spot. Legs black to dark reddish brown. Middle and hind tibia on outside with numerous stout spines, subobsolete except for dorsal rows; hairs fine, short and sparse; faintly carinate toward base. Tegula 1.5 times as long as wide with parallel sides, completely fine shagreened. Wings violaceous black; spur from radial vein nearly bisects second cubital cell as in *Paratiphia*; radial cell open and much elongated.

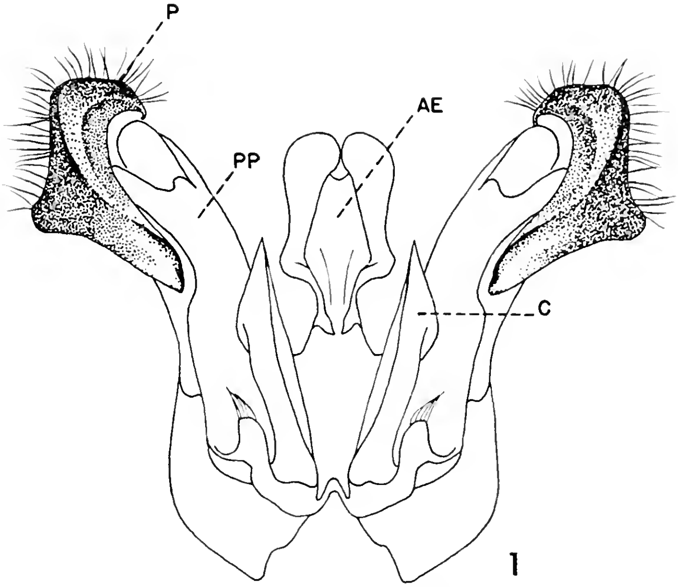
Dorsal propodeum strongly arched, with coarse, round, contiguous punctures medially; transverse apical carina sinuous and prominently elevated on either side of median line. Areola nearly obsolete and consists of an elongate depressed impunctate area tapered at both ends and about three times as long as wide. Tergum 1 with a white spot laterally and with a prominent transverse carina; punctures coarse and largely in small plaques or short rows; almost devoid of vestiture except for short inconspicuous hairs at sides. Sternum 1 without escutcheon or well-defined sculpturing. Intermediate terga with a lateral white spot on 2 and 3, almost devoid of vestiture; punctures increasing in size posteriorly in each segment to a terminal row of very coarse ones in middle of each tergum, with broad, ribbon-like impunctate apices. Sternum 2 with a broad, median tubercle. Sterna with apical bands as on terga. Pygidium with white spot at base, with fine, regular punctures on basal two-fifths, punctate part bordered apically by a row of clustered black bristles; apical part smooth except for shagreening in which the elements increase greatly in size from base to tip. Sixth sternum uniformly fine punctate except for polished crescent-shaped apex which is separated from punctate part by a dense row of bristly hairs.

Length, 16 to 18 mm.

Male.—Like the female except as noted below. Head length 1.1 times head width. Least distance between eyes is at level of lower edge of antennal fossae. Clypeus white with black apical fringe, and with smaller white spots on cheek; margin smoothly arcuate and in front view visible to base of mandible.

Dorsum of pronotum coarsely first-degree punctate anteriorly, punctures more scattered posteriorly without a well-defined impunctate apex; completely fine shagreened. Forewing with radial cell closed, much elongated but not equal to second cubital cell in apical extension.

Dorsal propodeum with an obscure apical transverse carina; an inconspicuous areola broadest at apex, depressed; area beside areola with coarse, round punctures and numerous micropunctures. Pygidium with its apical margin obtusely V-shaped. Sixth sternum smoothly convex with an impunctate apex terminating in a margin that is slightly emarginate on sides. Uncus usually concealed. Genitalia (Figs. 1 and 2) with paramere modified into a conspicuous laterally oriented, heavily sclerotized plate enclosing rear of sixth tergum and arranged like a hood over much thinner convolute lobes of parameral plate. Cuspis much smaller than paramere with its apex acuminate. Another small structure situated posteroventrad to cuspis possesses upright terminal hairs. Aedeagus short, stout and broadest at the lobate apex.



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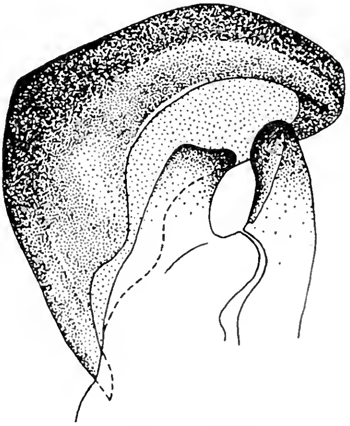

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FIG. 1. Genitalia of male from "Palmerlee" Arizona, paratype of *Spilota* Banks. AE, aedeagus; C, cupis; P, paramere; PP, parameral plate.

FIG. 2. Same as Fig. 1 showing bilobate tip of parameral plate under the hooded paramere.

A. C. Williams, del.

Length, 13 to 15 mm.

Only 7 males and 6 females of this rare and showy wasp have been seen by the author in the many thousands of North and South American Tiphiinae examined. These have been taken over a very wide range of environment, from Arizona to Argentina.

The type, a female from Cayenne, French Guiana, and presumably the specimen in the Zoologische Commlung des Bayerischen Staates at Munich has not been seen by the author. Holmberg (number and sex not listed) states that the species occurs at Formosa, Argentina and "Pard," Brazil. These also not seen by the author. The Brazilian locality might be any of several places in southeastern Brazil. Sichel mentions specimens from Brazil that I have not seen. Others examined by me are as follows:

1 ♂, Santarem (presumably Brazil) at Cornell University, Ithaca, N. Y. Genitalia and other characters appear identical with Arizona specimens, except for small variations in the yellow spots. 1 ♂ labelled "probably from Colonia Hansa, Brazil," Baker Collection, Cornell University differs slightly from the Arizona specimens in having a thin, complete median carina on posterior aspect of propodeum; transverse propodeal carina obsolete at sides and there is no row of punctures in that area. 1 ♂ labelled "Ichilo, Buena Vista, Martinez, Bolivia" at the U. S. National Museum appears identical in all respects including the genitalia with the Arizona specimens. 1 ♀ at the American Museum of Natural History, New York, N. Y., from Tingo Maria, Huan., Peru has yellow spots on side of five abdominal segments; posterior aspect of propodeum has a high, complete, transverse carina bordered by a regular row of round punctures, and there is no medium carina. 1 ♀ at the American Museum of Natural History from Palmar, Manabi, Equador, collected 10-V-41, has a broad white band on the clypeus; transverse carina of propodeum obsolete medially with no row of punctures in that area; no thin medium carina on posterior aspect of propodeum. 1 ♂ from Panama at Natural History Museum, London (type of 12-*maculata*) appears identical with

Arizona specimens. 1 ♀ labelled "Garcia" Arizona, type of *spilota* Banks, at Museum of Comparative Zoology, Cambridge, Mass., collected in August by Biederman. There are spots on the sides of three abdominal segments in this specimen; transverse propodeal carina is complete but there is no bordering row of punctures, 3 ♂♂, "Palmerlee" Ariz. and paratypes of *spilota* have body characters and genitalia that are apparently the same as specimens from Brazil and Peru. 2 ♀♀, Ramsey Canyon, Huachuca Mts., Ariz. collected by Wm. Mann. 1 ♂, Ramsey Canyon, Huachuca Mts. Ariz. collected by Werner and Butler, 5-IX-51 on *Melilotus alba*.

A New Cryptic Species of Cymbiodyta from the Midwestern U. S. (Coleoptera: Hydrophilidae)

Paul J. Spangler [1]

This new species from Kansas, Missouri, and Nebraska belongs to the *Cymbiodyta* species group which has only the sutural striae. It is very similar to *Cymbiodyta fimbriata* (Melsheimer) but it is somewhat larger and more robust. In Winter's (1927) key this new species runs to couplet 10 but may be distinguished readily by its distinctive male genitalia from the other species, *C. fimbriata* (Melsheimer), *C. vindicata* Fall, and the recently described *C. hatchi* Miller (1964) that also run to that couplet.

Cymbiodyta toddi, sp. nov. (Figs. 1–7)

Length of holotype male 5.2 mm, greatest width 3.0 mm. Color of head piceous except indistinct margins before eyes and anterior edge of labrum reddish brown; pronotum piceous except narrow anterior and broader lateral margins reddish brown; elytra piceous except moderately broad reddish brown lateral

[1] Department of Entomology, United States National Museum, Smithsonian Institution, Washington, D. C.

margins. Venter piceous except reddish brown epipleura of pronotum and elytra; maxillary and labial palpi testaceous; antenna with basal segments testaceous and club dark reddish brown. Legs dark reddish brown except slightly lighter colored knees.

Head densely, moderately coarsely punctate; punctures separated by distance equal to half their width; punctures more dense around eyes. Labrum feebly emarginate medially; moderately densely punctate, punctures finer apically.

Pronotum twice as wide as long, sides arcuate, finely margined anteriorly and laterally, antero- and posterolateral angles obtuse.

Elytra with punctures similar to those of pronotum, no striae present except sutural stria on apical half, three rows of coarser serial punctures on discal area and one row of coarser punctures laterally on each elytron, apical angles obtuse. Scutellum punctate similarly to elytra.

Venter with short, fine, dense pubescence. Prosternum not carinate. Mesosternum with short transverse ridge; ridge almost straight and not angularly elevated or dentiform at middle. Last abdominal segment entire at apex.

Legs with femora pubescent in basal three-fourths. Protarsus with five segments, first four segments subequal; fifth segment about three-fourths as long as first four segments combined; protarsal claws about one-third as long as last tarsal segment and not dentate.

Aedeagus (Figs. 2, 3) with parameres strongly sinuate laterally and tapering to slender apices, apices almost straight; inner edges of parameres feebly sinuate; median lobe broad at base, bluntly pointed apically and concave medially. In ventral view, gonopore near apex of median lobe.

Female: Similar to male.

Variations: Specimens of both sexes in the type series vary considerably in color from ochraceous to piceous. However, the lighter colored specimens appear to be teneral individuals and the mature forms are piceous. The specimens vary in length from 5.0 mm to 5.5 mm.

Holotype: Male, KANSAS, Douglas Co., Lone Star Lake, VI–10–1952, P. J. Spangler. Type No. 68919, deposited in the U. S. National Museum.

Allotype: Same data as holotype.

Cymbiodyta toddi n. sp., holotype. FIG. 1. Habitus view.

Paratypes: 18 ♂♂, 21 ♀♀, same data as holotype. 3 ♂♂, same locality as holotype, IV–27–1953, P. J. Spangler. KANSAS: 3 ♂♂, Douglas Co., Grant Twp., "Scorpion Hill," IV–19–1952, P. J. Spangler; 1 ♂, same locality, IV–25–1952, P. J. Spangler. 9 ♂♂, Douglas Co., XII–2–1951, P. J. Spangler. 1 ♂, Johnson Co., ½ mile E. Sunflower, IX–12–1952, Spangler and Bell; 1 ♂, Johnson Co., 2 mi. W. Sunflower, IV–4–1953, P. J. Spangler. NEBRASKA: 1 ♂, no other data, C. V. Riley. MISSOURI: 3 ♂♂, 10 miles E. Anderson, VII–12–1960, E. Todd. 1 ♂, 5 miles W. Linn, Big Maries River, II–25–1956, P. J. Spangler. 1 ♂, Cassville, IX–9–1953, P. J. Spangler. 1 ♂, Kingdom City, VI–25–1954, P. J. Spangler. 1 ♂, Columbia, MM Pond, V–1–

1960, D. Kuester (U. Mo.). 1 ♂, Columbia, Gans Creek, V–7–1962, L. J. B. (U. Mo.).

Because of the difficulty of identifying females, I have designated the allotype and female paratypes only from the type collection made on VI–10–1952, when all males in the large series collected were the new species.

All of the types listed above are the property of the U. S. National Museum except two followed by the abbreviation (U. Mo.) which were kindly lent to me by Dr. Wilbur R. Enns, Director of the Entomology Museum, University of Missouri.

It gives me great pleasure to dedicate this new species to my friend and colleague, Dr. Edward L. Todd who collected some of the paratypes of this new species.

Habitat: Specimens were collected at Lone Star Lake from the overflow area below the breast of the dam, along the lake shore, and from a drainage ditch alongside the lake. The specimens from "Scorpion Hill" were collected along the shore of a stock pond. In most cases, specimens were collected among dead leaves and other decaying vegetation.

Discussion: The use of color is unsatisfactory for separating some of the species of *Cymbiodyta* belonging to the group of species that run to couplet 10 in Winter's (1927) key. Unfortunately, other characters such as the presence or absence of an emarginate margin of the last sternum, present on some specimens, also seem to vary. Apparently the only reliable character for separating the species of this group is the male genitalia.

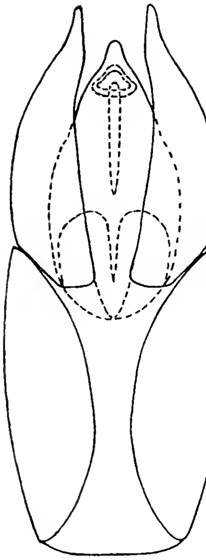
The following key will separate the males of the four species that run to couplet 10 in Winter's key.

1. Median lobe of male genitalia angulate at apex (Figs. 2, 3, 6, 7) 2

Cymbiodyta toddi n. sp., holotype. Fig. 2. Male genitalia, dorsal view. Fig. 3. Male genitalia, ventral view.

Cymbiodyta vindicata Fall. Fig. 4. Male genitalia, dorsal view. Fig. 5. Male genitalia, ventral view.

Cymbiodyta fimbriata (Melsheimer). Fig. 6. Male genitalia, dorsal view. Fig. 7. Male genitalia, ventral view.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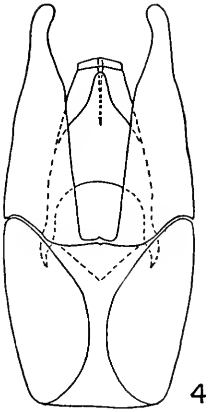
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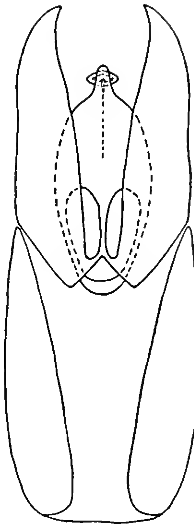
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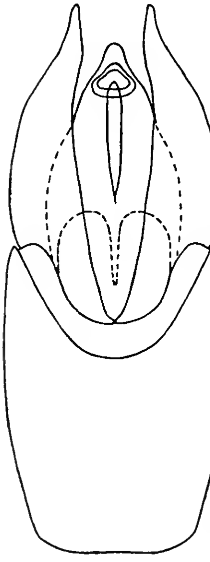
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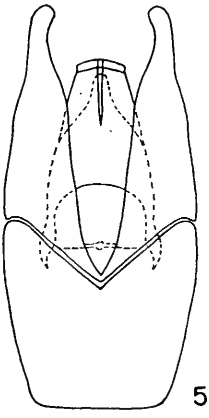
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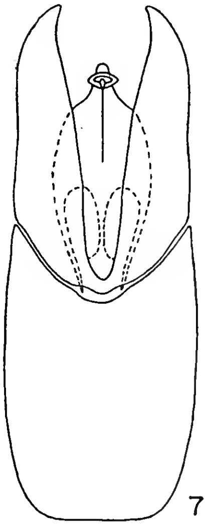
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Median lobe of male genitalia truncate at apex (Fig. 4, 5) 3

2. Apices of parameres slender, sinuate and slightly curved outward (Figs. 2, 3); midwestern United States.. **toddi** sp. nov.

Apices of parameres broad and curved inward (Figs. 6, 7); eastern and midwestern United States.. **fimbriata** Melsh.

3. Apices of parameres curved inward (Figs. 4, 5); Northern United States........................ **vindicata** Fall

Apices of parameres straight; northwestern United States.. **hatchi** Mil.

References

Miller, D. C. 1964. Notes on *Enochrus* and *Cymbiodyta* from the Pacific Northwest. (Coleoptera: Hydrophilidae). Coleop. Bul. 18 (3): 69–78.

Winters, F. C. 1927. Key to the subtribe Helocharae Orchym. (Coleoptera-Hydrophilidae) of Boreal America. Pan-Pacific Ent. 4 (1): 19–29.

A Correction

In the description of **Aspisoma yechae** n. sp., Entomological News, 1966, Vol. 77, pp. 132–135, the abdominal spiracles are noted on p. 134 as ventral. This is a mistake, as these spiracles are definitely on the dorsum. I wish I could explain how the mistake occurred and why I did not catch it in reading the proof.

Frank A. McDermott.

New Exotic Crane-Flies (Tipulidae: Diptera). Part XIII

CHARLES P. ALEXANDER, Amherst, Massachusetts [1]

The preceding part under this title was published in ENTOMOLOGICAL NEWS, Vol. 77 (3): 69–78. At this time I am discussing further crane-flies from India belonging to the tribe Hexatomini, all collected by Dr. Fernand Schmid.

Limnophila (Dicranophragma) analosuffusa, new species

General coloration of thorax brown, the praescutum with three more yellowish brown stripes; legs yellow, the femora with a narrow pale brown subterminal ring; wings whitened, with a very heavy dark brown pattern that includes markings in base of cell *2nd A*.

♀. Length about 6 mm; wing 6–6.2 mm.

Rostrum and palpi brownish black. Antennae with scape dark brown, pedicel paler brown; first flagellar segment clear light yellow, the remainder dark brown. Head brown, faintly dusted with yellow pollen.

Pronotum brown. Mesonotal praescutum with the restricted ground dark brown, with three more yellowish brown stripes, pseudosutural foveae darkened; scutal lobes darkened, patterned with brown; posterior sclerites of notum darker brown, sparsely pruinose. Pleura brown, restrictedly patterned with darker spots. Halteres light brown, base of stem narrowly yellowed. Legs with coxae dark brown; trochanters obscure yellow, lower surface with a blackened apical spot; femora yellow with a narrow pale brown subterminal ring, the yellow apex slightly narrower; remainder of legs yellow. Wings with the restricted ground whitened, prearcular and costal fields more yellowed; a very heavy and conspicuous dark brown pattern, paler in cells *M, Cu* and the Anals, the darkened pattern exceeding the

[1] Contribution from the Entomological Laboratory, University of Massachusetts.

whitened ground except in cells *C* and *Sc;* compared with *venustipennis,* with a darkened spot at tip of Sc_1 and a larger mark at near midlength of *Rs* in cells *R* and R_1; cell *1st A* suffused, cell *2nd A* with three more or less confluent brown spots at base and near midlength, without a subterminal darkening as in *venustipennis.* Venation: No spur near outer end of vein *2nd A* as in *venustipennis.*

Abdomen brownish black.

Habitat. INDIA (Assam). *Holotype:* ♀, Sirhoi Kashong, Manipur, 6,000 feet, June 8, 1960 (Fernand Schmid). *Paratopotype:* ♀, pinned with type.

Limnophila (*Dicranophragma*) *analosuffusa* is quite distinct from other known species, especially in the wing pattern. The closest relative appears to be *L.* (*D.*) *venustipennis* Alexander (*pulchripennis* Brunetti, 1912, preoccupied) which differs in the characters outlined above.

Limnophila (Dicranophragma) karma, new species

Generally similar to *venustipennis;* wings of male broadest opposite termination of vein *2nd A*, of female opposite vein *1st A;* no spur near tip of vein *2nd A* nor a darkened cloud before outer end of this cell.

♂. Length about 5–5.5 mm; wing 5.5–6 mm; antenna about 1 mm.

♀. Length about 6.8–7 mm; wing 6.2–6.5 mm.

Rostrum black, pruinose, mouthparts and palpi black. Antennae relatively short, the basal four segments yellow, outer ones brown; in male the proximal and intermediate flagellar segments with long verticils, the longest exceeding three times the segment. Head light gray in front, darker gray behind.

Pronotum with scutum brown, the scutellum much paler. Mesonotal praescutum with three pale brownish gray stripes, the intervening interspaces reduced to narrow brown lines, with further linear or triangular sublateral brown darkenings; pseudosutural foveae black, conspicuous, tuberculate pits paler, contiguous; scutal lobes brown, posterior sclerites brown, more or less pruinose. Pleura brown, with a dark brown longitudinal stripe over the dorsal sclerites from the cervical region to the postnotum. Halteres with stem yellow, knob pale brown. Legs with coxae and trochanters brownish yellow; femora yellow, tips narrowly whitened, preceded by a subequal pale brown ring; remainder of legs yellow, outer tarsal segments darker. Wings of male broadest opposite termination of vein *2nd A*, in female much narrower, broadest opposite vein *1st A;* general coloration pale yellow, prearcular and costal fields clearer yellow; a conspicuous brown pattern that includes five costal areas, behind attaining vein *M* or beyond, the third at Sc_2, the fourth at stigma, converging behind over the anterior cord; a more or less complete brown subterminal band from outer end of cell R_2, crossing the supernumerary crossvein and outer fork of *M* to the margin at vein M_3; all longitudinal veins excepting R_5 with an oval brown marginal spot, on *2nd A* in cases more submarginal in position; no preapical darkening in cell *2nd A*, as in *venustipennis;* cord and outer end of cell *1st* M_2 seamed with brown; microscopic darkenings at *h* and across the veins that comprise the arculus; a paler brown wash occupying much of cell *M* and basal half of cell *Cu;* veins light yellow, light brown in the patterened areas, still darker in the heavier markings. Venation: Supernumerary crossevin in cell R_3 about equal to or longer than vein R_3 beyond it; no spur on vein *2nd A* as in *venustipennis.*

Abdomen dark brown, hypopygium with proximal ends of basistyles obscure yellow.

Habitat. INDIA (Kumaon). *Holotype:* ♂, Tarak Tal, Pauri Garhwal, 7,540 feet, August 14, 1958 (Fernand Schmid). *Allotopotype:* ♀. *Paratopotypes:* 6 ♂ ♀; *paratype:* 1 ♀, Dhar, Pauri Garhwal, 7,220 feet, August 17, 1958.

Limnophila (Dicranophragma) karma agrees with *L. (D.) venustipennis* Alexander in the faintly indicated dark ring on the femur and in the general distribution of the dark pattern of the wings. In the present fly vein *2nd A* is unbranched in both sexes and the subterminal darkened band in cell *2nd A* is lacking.

Limnophila (Dicranophragma) kashongensis, new species

General coloration of mesonotum brownish black, the praescutum with three light brown discal stripes; pleura obscure brownish yellow with a conspicuous dark brown dorsolongitudinal stripe; legs pale brown; wings light brown with a diffuse darker brown pattern that includes six larger costal areas.

♂. Length about 5–6 mm; wing 5.5–7 mm; antenna about 0.8–0.9 mm.

♀. Length about 7–7.5 mm; wing 6.5–7 mm.

Rostrum brown, palpi black. Antennae with proximal segments obscure yellow, the outer ones brown, the segments with long verticils. Head brown, the anterior orbits paler.

Pronotal scutum brown, scutellum and pretergites yellowed. Mesonotal praescutum with the ground brownish black, the disk with three light brown stripes, the central one more yellow pollinose, pseudosutural foveae black; posterior sclerits of notum dark brown. Pleura obscure brownish yellow, with a conspicuous dark brown dorsolongitudinal stripe extending from cervical region, across the propleura and dorsal mesopleura to beneath the wing root on the pteropleurite; ventral sternopleurite and meron paler brown. Halteres with stem obscure yellow, clearer at base, knob pale brown. Legs with all coxae and trochanters obscure yellow; remainder of legs yellowish brown to very pale brown, the femoral bases vaguely clearer yellow. Wings with the ground light brown with about six larger and darker diffuse costal areas that are subequal in extent to the light yellow interspaces, the areas placed at *h*, above the arculus, origin of *Rs*, near end of *Sc*, stigma and the tip of R_3; vague paler brown areas cover the cord, outer end of cell *1st* M_2 and the prearcular field; vague transverse ground bands immediately before wing tip, at near midlength of cells beyond cord and more broadly at near midlength of wing before the cord; veins light brown, slightly darker in the patterned areas, light yellow in the costal interspaces. Venation: Sc_1 ending shortly beyond fork of *Rs*, Sc_2 slightly removed, Sc_1 alone nearly equal to R_{2+3+4}; supernumerary crossvein in cell

R_3 lying far distad; petiole of cell M_1 subequal to or slightly longer than the cell; *m-cu* at or before midlength of M_{3+4}.

Abdomen dark brown, the lateral borders and outer segments more brownish black. Male hypopygium with the outer dististyle very slender, the tip bifid; inner style very broad at base. Phallosome large, darkened; interbasal blades large.

Habitat. INDIA (Assam). *Holotype:* ♂, Sirhoi Kashong, Manipur, 7,500 feet, July 13, 1960 (Fernand Schmid). *Allotopotype:* ♀, pinned with type. *Paratopotypes:* numerous ♂♀, July 11–13, 1960.

Limnophila (Dicranophragma) kashongensis is quite distinct from all other Oriental members of the subgenus in the wing pattern. No other species has the darkened ground with diffuse darkened clouds as described above.

Limnophila (Eloeophila) perdilata, new species

Size large (wing of male 9 mm); femora light yellow with a medium brown subterminal ring; wings of male dilated opposite the termination of vein *2nd A,* conspicuously spotted and dotted with brown, all such areas restricted to the vicinity of the veins; male hypopygium with the outer dististyle expanded outwardly, terminating in a slender curved spine, the lateral flange conspicuous, yellow, the apex subtruncate.

♂. Length about 8.5 mm; wing 9 mm.

Rostrum dark brown; palpi black. Antennae with scape and pedicel brownish black, proximal five or six flagellar segments light yellow, the succeeding ones darker; proximal segments more enlarged and without setae on lower surface. Head yellowish gray, center of vertex brown.

Thorax yellowish gray, the praescutum restrictedly patterned with dark brown streaks and spots, representing the remains of darkened stripes; scutal lobes vaguely patterned; posterior third of mediotergite slightly more darkened. Pleura gray, patterned with dark brown. Halteres with stem yellow, knob dark brown. Legs with coxae brownish gray; trochanters light brown; femora light yellow with a medium brown subterminal ring, the tip brownish yellow; tibiae and tarsi yellow, the outer segments slightly darker. Wings whitened, with a heavy brown spotted and dotted pattern, including a nearly complete crossband at the level of origin of *Rs* and a broader area over the region of the stigma and anterior cord; a further extensive darkening at wing tip, including much of cells R_5 and M_1; a series of about eight additional transverse lines in cells *C* and *Sc;* remaining darkened pattern extensive, consisting of transverse areas and circular dots in all cells, least so in *R* and R_1 and beyond the stigma, all such markings being restricted to the vicinity of the veins and commonly occurring on both sides; veins brown, clear light yellow in the ground areas, most evidently so in the prearcular field and in outer radial field. Wings conspicuously dilated opposite termination of vein *2nd A*. Venation: Supernumerary crossvein in cell *M* oblique.

Abdomen brown, the hypopygium more brownish yellow. Male hypopygium with the outer dististyle narrowed at base, dilated outwardly, terminating in a long curved spine, the lateral flange conspicuous, light yellow, surface longitudinally striate, tip subtruncate.

Habitat. INDIA (Sikkim). *Holotype:* ♂, Lachen, 8,900 feet, June 13, 1959 (Fernand Schmid).

In its major size the present fly suggests *Limnophila* (*Eloeophila*) *ornata* (Brunetti) being readily separated by the very different wing pattern.

Limnophila (Eloeophila) pluriguttula, new species

Size medium (wing under 7 mm); mesonotum gray, the praescutum patterned with medium and dark brown; pleura brownish black, variegated by yellowish gray areas; femora yellow, tips extensively brown; wings with the ground pale yellow, very heavily patterned with brown spots and dots, the dark color exceeding the ground in area; dots in all cells confluent to form an irregular pattern.

Sex? Length about 6.5 mm; wing 6.8 mm; antenna about 1.3 mm.

Rostrum and palpi brownish black. Antennae with the more proximal flagellar segments weakly bicolored, the bases of the segments brown, their apices paler, obscure yellow, outer segments uniformly infuscated. Head brown.

Pronotum brownish gray. Mesonotal praescutum with the ground gray, with a pair of brown intermediate stripes and brownish black sublateral areas, the posterior ends of the interspaces similarly brownish black, the lateral borders brown; scutum yellowish gray, the lobes extensively dark brown; scutellum and postnotum brownish black. Pleura brownish black, variegated by yellowish gray areas. Halteres with stem obscure yellow, knob brownish black. Legs with coxae blackened; trochanters obscure yellow, the lower face blackened; femora yellow, tips extensively brown; tibiae and tarsi yellow, the last segment darker. Wings with the restricted ground pale yellow, very heavily patterned with brown spots and dots, the darkened areas exceeding the pale ground in amount; prearcular field light yellow; major brown spots over the stigma and cord and as a broken band at origin of *Rs* and the supernumerary crossvein; other cells with abundant smaller spots and confluent brown dots, with virtually none of the marks disconnected into separate units, as in *bicolorata;* veins brown, yellow in the costal interspaces.

Abdomen partly destroyed by fungi; basal segments obscure yellow, their lateral and posterior borders brownish black.

Habitat. India (Sikkim). *Holotype:* Sex? Yagtang, 11,650 feet, in *Rhododendron* association, June 17, 1959 (Fernand Schmid).

The most similar regional species is *Limnophila* (*Elocophila*) *bicolorata* Alexander, from lower altitudes in Nepal. The present fly is most readily told by the nature of the darkened wing pattern, including very abundant almost uniformly confluent brown dots which in *bicolorata* are chiefly isolated in the ground.

Limnophila (Eloeophila) fumigata, new species

Size medium (wing of male to 7 mm); antennae brownish black; thorax chiefly dark brown, the praescutum and pleura patterned; legs yellow, the femora with a broad black terminal ring; wings yellow, very heavily patterned with brown, including diffuse spots in the cells; male hypopygium with very long setae on mesal face of basistyle; phallosome with gonapophyses narrow, tips pointed.

♂. Length about 6.5–6.7 mm; wing 6.5–7 mm; antenna about 1.8–1.9 mm.

Rostrum black, gray pruinose, with long black setae; palpi black. Antennae of holotype brownish black with extreme tips of the proximal flagellar segments vaguely yellowed; terminal segment slightly more than one-half the penultimate. Head yellowish gray, the center of vertex, posterior orbits and genae slightly patterned with brown.

Pronotum light gray, restrictedly patterned with brown, more extensive laterally. Mesonotal praescutum yellowish gray with a conspicuous dark brown pattern that includes a pair of long intermediate stripes, shorter sublateral areas, broader lateral borders, a median spot at cephalic margin and further darkenings near the suture; posterior sclerites of notum dark brown, sparsely yellow pollinose. Pleura dark brown, with two narrowly interrupted longitudinal gray stripes, the narrower lower line crossing the dorsal sternopleurite and meron. Halteres with stem dusky, narrowly yellowed at base, knob dark brown. Legs with coxae dark brown, sparsely yellow pollinose; trochanters brownish yellow; femora yellow with a broad black terminal ring that is vaguely paler at outer end; remainder of legs yellow, the outer tarsal segments slightly infuscated. Wings with the restricted ground yellow, heavily patterned with brown, the amount of dark color more than twice the yellow areas, prearcular field chiefly darkened; broad dark bands at origin of *Rs* and the cord, with narrower areas more basally in the costal field; beyond the cord the cells extensively darkened, including all of M_1; the interpolated yellow ground areas further interrupted by very extensive smaller marks that tend to be confluent, their borders ill-defined; veins yellow in the ground, brown in the patterned areas. Venation: *m-cu* before one-third the length of M_{3+4}.

Abdomen dark brown to brownish black, the hypopygium slightly paler. Male hypopygium with outer half of mesal face of basistyle with several very long delicate setae. Outer dististyle expanded outwardly, the outer apical angle a slender curved hook; lateral flange narrow, applied to margin of style, the outer end free; border beyond the flange microscopically serrulate; inner style outwardly narrowed to an obtuse point. Phallosome with aedeagus small, slender; apophyses somewhat shorter, appearing as narrow pale blades, their tips acute.

Habitat. INDIA (Assam). *Holotype:* ♂, Sirhoi Kashong, Manipur, 7,500 feet, July 11, 1960 (Fernand Schmid). *Paratopotype:* 1 ♂, with the type.

Limnophila (*Elocophila*) *fumigata* is generally similar to *L.* (*E.*) *bicolorata* Alexander, *L.* (*E.*) *fascipennis* (Brunetti), and *L.* (*E.*) *pluriguttula*, new species, differing from all in the unusually heavy wing pattern and in the antennal coloration. Of the above the male sex is known only in *fascipennis* where it is quite different from the present fly.

Notes on the Genus Neodiplocampta Curran and Certain Other Bombyliidae. Part I

F. M. HULL, University of Mississippi

So far as I am aware only two species have been placed in the genus *Neodiplocampta*, Curran. These are the generotype species *roederi* Curran from Porto Rico, the wing figured by Curran (1934), and the species *paradoxa* Jaennicke. As I have before me six species none of which can be those named above I include notes and descriptions on some of these as a preliminary to the preparation of an illustrated key to species.

Neodiplocampta (Agitonia) sepia n. sp.

A large species with large, quite broad wings which are almost wholly sepia save for faint hyaline areas in the marginal and posterior cells.

Head: Brownish black, the pile of front, face and antennae black with appressed, scattered, brownish yellow scales intermixed on face and front. First two antennal segments brownish yellow, third blackish, its base short conical, the style long and slender. Occipital pile appressed, scanty, scale-like yellowish. Face conical, with a bare, yellow brown strip from each antenna down the sides; proboscis extends barely beyond apex of face. Thorax black, feebly shining, the pleuron more brownish. Pile scanty, yellowish appressed with additional scattered fine, erect black hairs; anterior collar of pile, long, dense, brownish yellow. Notopleuron with black, and upper mesopleuron with longer, bristly, yellow pile; metapleural pile black. Legs dark brown, the bristles black, the femora with some fine, appressed black pile. Wings exceptionally broad, almost wholly dark sepia, the middles of discal, posterior and more particularly the submarginal cells faintly subhyaline; second vein and anterior branch of third more strongly contorted than in generotype; alula reduced. Abdomen nearly twice as long as generotype species, black with pile like mesonotum.

Type: a male, and one paratype female. Nova Teutonia, BRAZIL, Dec.–Feb. 1964–1965. (Fritz Plaumann). In collection of author. Because of its aberrant and atypical form it may be assigned to a new subgenus: *Agitonia*, under *Neodiplocampta*.

Eclimus (Arthroneura) tridentatus n. sp.

Head black, grayish pollinose, pile of front and face, long, fine, loose, and black; pile of occiput and gena abundant, long, fine, gray-white. Antennal pile black, third segment as long as first segment, tapered sharply on dorsal aspect near the apex. Sides of oral cup shining black. Palpus quite large, especially the leaf-shaped apical segment. Proboscis long and slender. Thorax dull black; mesonotum with fine, crinkled, curled, pale, appressed pile and scattered, very fine, erect, black hairs. Pleural pile pale except for some black hairs on upper mesopleuron; knob of halteres blackish. Legs black, with matted appressed gray white pile of perhaps slightly flattened hairs, some erect white pile and with black bristles. Anterior tibia with well developed black spicules. Wings hyaline, the anterior border narrowly black to apex of first submarginal cell. There are three conspicuous, sharply delimited, blackish spots extending down or backward from fore border, one of these extends to end of second basal cell and borders the cells beyond, another extends over and just below the anterior cross vein and widely on each side of it, the third extends over and just below the base of the submarginal cells. There is an additional small black spot at base of second and third posterior cells. There are three distinct submarginal cells in each wing of material on hand. Moreover there is a rectangular bend in the lower vein of discal cell with strong, backward spur in both wings. These characters together with the large leaf like ovate palpus is made the basis of a special subgenus, of the genus *Eclimus*.

Type: a female 10 mi. East of Auburn, Cal., Placer Co. 1958. In coll. of California at Berkeley. Paratype female, Black Mts, 6 mi. N.E. of Pose, Calif. May 1st 1962. In collection of author. I wish to thank Frank Cole for the opportunity of studying this interesting fly.

I propose the name *Bryodema,* new genus, for the giant, thick-bodied, very robust bee flies hitherto going under the name *Ogcodocera valida* Wied.; from *Ogcodocera* sensu stricto, of which I have 3 species before me, it differs besides the very thick body and giant size, in the closed and stalked, or narrowly open first posterior cell, the position of the anterior cross vein, very strongly oblique and placed at the outer sixth of the discal cell. All of the 3 species of true *Ogcodocera* before me, including the generotype, and which range into southern Brazil, are of very nearly uniform size, flattened body, basally swollen third antennal segment, and the first posterior cell is open maximally. The anterior cross vein lies very near the middle of the discal cell and is almost rectangular. All three species are very small indeed compared to *valida* Wiedemann.

A Resin Bee Using Trap-Nests in Wisconsin, and a Note on Other Resin Bees. (Hymenoptera: Megachilidae)

J. T. MEDLER [1]

Megachile (*Chelostomoides*) *campanulae* Robertson utilizes resin as a building material for nest construction. Six nests of this species were found while conducting trap-nest research in Wisconsin. The traps consisted of eight-inch lengths of sumac stem with a hole 6.4 mm in diameter and 150 mm long drilled in the center pith to provide a nesting niche. Each nest was characterized by partitions and plugs made of a dark brown resin having a "piny" smell. Occasionally, the cells also were partly lined with resin. A reddish rather sticky pollen that was very susceptible to spoilage was used to provision cells.

Nest 1 was collected in Fond du Lac County, 18 August, 1956. At the bottom of the 150 mm hole there were two cells 14 and 16 mm in length which contained 8 and 4 mm white larvae, respectively. The remainder of the hole was empty, but three additional partitions and an orifice plug had been constructed in it.

When reared at 22° C, the small larva developed into a medium sized larva in seven days, whereas the medium sized larva matured and spun a very thin, transparent cocoon in seven days. Therefore, at least two weeks would be normally required for larval development.

Nest 2 was an overwintering nest collected in Iowa County, 21 October, 1959. Two cells in the bottom of the hole were 11 and 13 mm long. The remainder of the hole was empty, but had 5 partitions at intervals of 4, 14, 38, 8, and 52 mm.

Nests 3–6 were all overwintering nests collected in September, 1962. Each had an orifice plug of resin 2–5 mm thick and one

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intercalary partition in a long empty vestibule. Nest 3 from Jefferson County contained three cells, 40, 22, and 42 mm in length.

Nests 4–6 were collected in Grant County. Nest 4 had three cells, 24, 17, and 12 mm long. Nest 5 had two cells, 18 and 30 mm long, and nest 6 had two cells 12 and 24 mm long.

A "typical" nest of this species, therefore, consisted of 2 or 3 cells in the bottom of the hole, a long vestibule with one or several partitions, and an orifice plug. The species apparently is univoltine, overwintering as a prepupa in a cocoon.

Three female bees were reared from the 14 available cells. The provisions were spoiled in five cells and rearing mortality accounted for the other six cells. The reared bees had head width measurements of 2.5, 2.8, and 3.1 mm.

It is well known that species in the *Megachilidae* utilize a great diversity of nesting niches in nature, and manipulate a wide variety of building materials with their mandibles to construct cells in which to rear progeny. Burrows in wood, and materials such as clay, pieces of leaf, plant fibers and masticated vegetable matter are used most commonly. Michener (1962, *Jour. New York Ent. Soc.* 70: 17–29) discussed morphological differences between those species which make nests with pieces of leaves or petals and those that use resin, mud, or other such material. One difference is that in the mandibles of female leafcutters there is a sharp cutting edge in the interspaces between the teeth.

This appears to be the first record of *M. campanulae* using resin. However, several other species of resin bees in the *Megachilidae* are well documented, especially in Europe, where they are known as Harzbienen or resiniers. For example, several species of *Anthidiini* using resin were studied by Fabre (Bramble-bees and Others, Transl. by A. T. de Mattos, 1915).

Incidentally, both honey bees (Apini) and stingless bees (Meliponini) among the social bees utilize vegetable resins (e.g., propolis) in nest construction and repair. Man-made products are used also. I personally observed *Trigona* bees in northern Queensland collecting balls of fresh house paint on their hind legs in a manner similar to the pollen loads of honey bees. I was informed that these bees become an economic problem in some areas because they strip the paint as fast as it is applied. The species probably responsible for this activity is *Trigona hockingsi* Cockerell, according to Michener (1961, *Amer. Mus. Novit.* 2026, 46 pp.).

It is hypothesized that the resin bees have a glandular secretion with anti-sticking properties. This secretion provides a protective coating on the mandibles and hairs, thus allowing utilization of resinous material without damage to the insect.

Reviews

Rolston, L. H. and **C. E. McCoy.** INTRODUCTION TO APPLIED ENTOMOLOGY. Pp. v + 208. The Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price: $5.00.

The first 90 pages are chiefly on insect ecology and ecological principles. Perception, mobility, reproduction, and adaptation are discussed as well as climate, moisture, food, parasites, populations, seasonal and geographic distribution. Included here is also a chapter of 26 pages on the orders of insects, devoted again primarily to their ways of living and ecological relationships rather than classification or form. The remainder of the book is concerned with organizing and analyzing our relevant knowledge and developing concepts and general principles. The chapter "Environmental Management" is a kind of applied ecology, and here, as in the chapters on chemical control, the approach is from the broadest point of view. The intent is to provide the basic understanding needed for planning successful control. Although the preface suggests that applied entomology "is a science," on p. 162 we learn that "The practice of applied entomology is an art, and herein lies room for mistakes in judgement and execution." The book stresses the possible complexities and ramifications when a control program must fit into the existing economic, legal, sociological, and physical environment as well as adapted to a biological environment that may include several species of pests together with their parasites.—R.G.S.

Klots, Elsie B. The new field book of FRESHWATER LIFE. Pp. 1–398. Over 700 illustrations, drawings by SuZan Noguchi Swain. G. P. Putnam's Sons, 200 Madison Ave., New York 10016. Price: $4.95.

In that it covers the freshwater plants and invertebrates this little book may be thought of as an abridged Ward and Whipple. However, it goes farther and includes the vertebrates as well, thus covering the entire range of aquatic life from algae to alligators. Actually, it takes one mostly to the family or some ecological group, while Mrs. Swain's excellent illustrations will often name a common genus or even species. In place of dichotomous keys a system of paragraphing is used that works well and that is not only practical but also instructive. Throughout, the emphasis is on adaptations, habits, habitats, and other ecological matters so that one comes to know and to understand the forms as living things in their natural surroundings. Chapters 11 and 12 (100 pages and over 170 illustrations) deal with arachnids and insects, and like the rest of the book show very careful planning and selection of material, and concise but clear presentation. The page size is $4\frac{1}{2} \times 7\frac{1}{4}$ and its slips easily into a coat pocket.

Knudsen, Jens W. BIOLOGICAL TECHNIQUES. Collecting, Preserving, and Illustrating Plants and Animals. Pp. xi + 525. Harper and Row, 49 East 33rd St., New York 10016. Price: $12.00.

An excellent book that includes algae, bacteria, and everything up to the birds and mammals. Chapter 13 (62 pages) is on insects and is amazingly comprehensive, with clear instructions on collecting, killing, preserving, dissecting, mounting, and housing of insects for study, illustrated by clean line drawings. Older methods as well as the newer (e.g., freeze drying) are included. There is also a chapter on Crustacea, and one on the remaining arthropods.

Extremely useful to students as well as to their professors will be Chap. 24 (43 pages) on Scientific Illustration which describes and illustrates various techniques using pencil, ink, stippling, Ross board, scratch board, Ben Day, air-brush, and photography, especially as applicable to the preparation of theses and dissertations. Finally there is a short chapter on slide making with formulae for solutions and reagents.—R.G.S.

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CONTENTS

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Harold J. Grant, Jr., 1921–1966.

ENTOMOLOGICAL NEWS

Vol. LXXVII NOVEMBER, 1966 No. 9

Harold Johnson Grant, Jr., 1921–1966

The death of Harold J. Grant on February 27, 1966, came as a particularly sudden and severe shock to his family and his many friends and associates at the Academy of Natural Sciences of Philadelphia. It resulted from an unhappy accident when he was caught by the undertow while swimming on the coast of Trinidad. Dr. Grant was born in the Bronx, New York, on November 4th, 1921. He attended grade school on Staten Island, New York, where his family lived, and was graduated from Port Richmond High School with honors. Inducted into the army in November of 1942, he served as a non-commissioned officer in the Malarial Control Unit of the Sanitary Corps in the Philippines and New Guinea through the remainder of World War II. Following this he was sent to Japan, being attached to the commission which studied the biological effects of the Hiroshima nuclear bomb explosion.

After his release from the army in January, 1946, he attended Champlain College at Plattsburg, New York, for a period but in 1948 transferred to the University of Colorado where he received his B.A. degree in 1950. His interest in entomology was evident while he was still an undergraduate and he continued with his advanced work in that field under Dr. Robert E. Gregg, a hymenopterist. As a result of this association his Master's thesis was titled: "The larval morphology of *Myrmica brevinodis sulcinodoides* Emery (Hymenoptera, Formicidae)."

After receiving his Master's degree in 1952, his graduate study was continued for another year, and he then accepted a position at the Academy of Natural Sciences of Philadelphia. Here he worked as an assistant to Mr. James A. G. Rehn, helping in the preparation of the first volume of *A Monograph of the Orthoptera of North America (North of Mexico)*. Quite apparently he found the study of Orthoptera much to his liking for from that time this group seemed to become his first love, scientifically.

Returning to the University of Colorado in 1960 to complete his graduate study, he there received his Ph.D. in June of 1962. During this period of two years he also carried a part-time teaching assignment. An associate there, Dr. Gordon Alexander, says he was an excellent teacher, enjoyed the work and "toyed with the idea of looking for a teaching appointment." He decided, however, to return to the Academy in Philadelphia. This he did and received an appointment as Junior Investigator with Mr. Rehn under the National Science Foundation grant for the Orthoptera monograph. Before the end of 1962 he was appointed Associate Curator at the Academy and made chairman of the Department of Entomology. Upon the death of Mr. Rehn he was made Principal Investigator on the monograph project. He was also Principal Investigator on *A Monographic Revision of the Subfamily Phaneropterinae (Orthoptera; Tettigoniidae) of the New World*, under another grant from the National Science Foundation.

He was a member of a number of scientific societies including the American Association for the Advancement of Science, the American Entomological Society, the Society of Systematic Zoologists, American Society of Zoologists and a Fellow of the Royal Entomological Society of London.

Harold Grant possessed enormous enthusiasm and drive in his work as well as having unusual talents as an administrator. He had the happy gift of getting along with people and was exceedingly well liked by his associates. Such a person almost inevitably finds that he has wished upon him many extra jobs. Dr. Grant was no exception. He served on numerous committees in the Academy and in the American Entomological Society. Of the latter he also served as president and, for a time, was editor of its *Transactions*. Both his many services and his cheerful personality will be much missed in these institutions.

It seems appropriate to append here a bibliography of the more than thirty scientific papers published by Dr. Grant. Their number and quality lend conviction to the belief that a fine future as a scientist was interrupted by his death.

MAURICE E. PHILLIPS

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Description of Male Agrilus bentseni Knull and One New Species (Coleoptera: Buprestidae)

Josef N. Knull, Department of Zoology and Entomology, The Ohio State University, Columbus, Ohio 43210

Since *Agrilus bentseni* Knull (1954) was described, more material has been collected. The male is slightly smaller than the female. Front of head greenish becoming cupreous on vertex. Antennae serrate from the fourth segment. First two ventral abdominal segments not modified. Anterior and middle tibiae armed on inside at apex with a small tooth.

The species should be placed next to *A. lautuellus* Fisher (1928). On *A. bentseni* the elytral apical patch of white pubescense is elongate and parallel to suture; whereas on *A. lautuellus* the entire apical third is pubescent, with anterior margin of pubescent area extending obliquely backward from the suture to the lateral margin. In addition the male genitalia of the two species differ as shown by Figs. 1 and 2 and also by Fisher (1928), figure 48 a and b.

A. bentseni occurs on the foliage of myrtle croton (*Bernardia myricaefolia* (Scheele) S. Wats.) in Hidalgo and Starr Counties, Texas, in March and April. *A. lauticellus* is on the foliage of capote (*Diospyros texana* Scheele).

Agrilus hazardi n. sp. Figs. 3 and 4

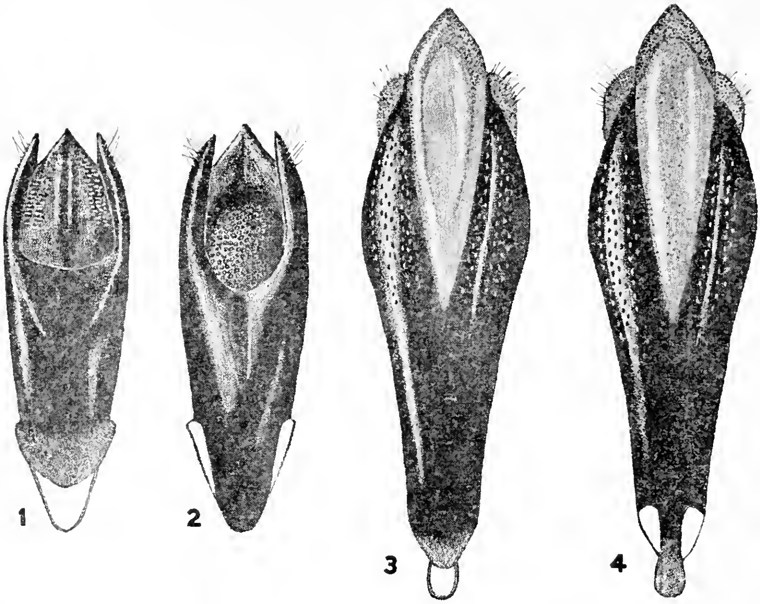
Male.—Form of *A. otiosus* Say, shining; head and antenna greenish blue; pronotum cupreous becoming bluish green toward sides; elytra black; pro-, meso-, and metasternum and legs greenish blue; abdomen cupreous.

Head granulose, sparsely lightly punctate, punctures more evident toward apex, lower part of front densely pubescent; antennae extending to past middle of pronotum when laid along side, serrate from the fourth segment.

Pronotum wider than long, widest about middle; sides subparallel from apical angles to about middle, then broadly rounded to basal angles; when viewed from the side, marginal and submarginal carinae separated in the front, joined near base; anterior margin strongly sinuate, median lobe broadly rounded; basal margin strongly sinuate; disk convex with two shallow median depressions, an oblique deep depression and a feeble prehumeral carina each side; surface granulose, with feeble transverse rugae, shallow punctures between rugae. Scutellum transversely carinate.

Elytra wider than pronotum; sides subparallel behind base, constricted in front of middle, expanded behind middle, then obliquely narrowed to rounded serrulate apieces; disk flattened, a basal depression each side; surface imbricate, recumbent pubescence short.

Abdomen beneath finely punctate, first and second segments slightly concave at middle, sparsely clothed with short recumbent pubescence. Prosternal lobe broadly emarginate. Tibiae armed with a distinct tooth on inner margin at apex. Tarsal claws similar on all feet, cleft near middle, outer tooth acute at apex, inner tooth shorter, broader and turned inward, the points touching.



Figs. 1 and 2. *Agrilus bentseni* Knull, ♂ genitalia; 3 and 4. *Agrilus hazardi* n. sp., ♂ genitalia.

Length 4.4 mm; width 1.1 mm.

Described from one male specimen collected in Gilmer Co., Ga., May 25, 1961, by E. I. Hazard, to whom I am indebted for the specimen. Type in collection of author.

This species comes near *A. atricornis* Fisher (1928) and *A. osburni* Knull (1937). The male genitalia as shown in Figs. 3 and 4 and as illustrated by Fisher, and Knull (1944) will separate them. The fifth antennal segments of *A. osburni* and *A. atricornis* are about as long as wide, whereas in *A. hazardi* the fifth segment is nearly twice as long as wide.

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Development of Pigmentation in the Pupa and Callow of Trachymyrmex septentrionalis (Hymenoptera: Formicidae)

NEAL A. WEBER, Swarthmore College, Swarthmore, Pennsylvania

The color of fungus-growing ants (Attini) is notoriously variable, as is often the case among ants in general. Various forms have been described, using color as one of the characters. The most northerly of all fungus-growers, *Trachymyrmex septentrionalis* McCook, is an example.

Wheeler (1907) created *obscurior* var. nov. as "necessary to distinguish the darker southern form" of *septentrionalis*. Later (1911) he created *vertebrata* on the basis of color and used color in large part in naming *seminole*. Creighton (1950) retained *obscurior* and *seminole* as geographical races but synonymized *vertebrata* with the typical form.

It is the purpose of this article to demonstrate the development of pigmentation in several of the stages of this species in its three castes, as a contribution both to embryology and to systematics. During the development of pigmentation, intermediate stages may also be useful in indicating relationships between species. In any case a particular color form that is known only from original or a few collections should always be suspect.

New Jersey colonies of *Trachymyrmex septentrionalis* have been kept in my laboratory for years and results of some observations and experiments published (Weber 1956). During the summer of 1963 fresh colonies from the same site, the intersection of U. S. Highway 322 with the boundaries of Atlantic and Gloucester Counties, were used for the following studies. One colony (No. 4263) taken 4 June 1963 was the source for the specimens drawn.* It was normal in all respects and had two chambers at depths of 8 cm and 20 cm in sand; temperatures were 24.5 and 19.9° C., respectively. The fungus garden was formed on typical vegetal substrate. Eggs were recognized 6 June. By 20 June in the laboratory there was a brood of large larvae, some 4 mm long. Temperatures were variable, 24–30° C., until on 15 July the colony was placed in a room of 23.4–24.0° C. Pupae appeared on 27 June and the first callows of all castes on 5 July. The callow stage may be defined as the stage following the pupa when the ant has been removed from the exuvia and can stand but lacks full pigmentation. At first it stands unsteadily on its legs, then it starts to walk about and feed on the fungus by itself.

The descriptions and figures below were made from living specimens (except Figs. 9–10) since the color changes after death.

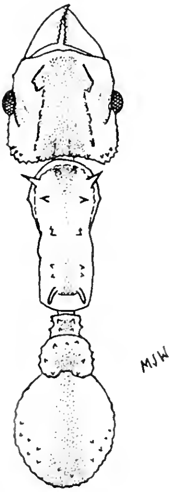
Pigmentation in the Pupa

The compound eyes become pigmented before other parts of the body in all castes. Ocelli of the males and females become pigmented before the body. In all castes the masticatory border of the mandibles next darkens slightly, followed by a brownish outline of some of the thoracic sutures (male and female). By this time the pupa has become a grayish white. As the mandibular margins darken, the frontal ridges of the head and

* By Marilyn Warkentin under the National Science Foundation Undergraduate Research Participation Program.

Figs. 1–7. *Trachymyrmex septentrionalis* callows drawn from life (appendages omitted).

1. Worker, 1st week. 2. Worker, 2nd week. 3. Worker, nearly adult pigmentation. 4. Female, 1st week. 5. Female, 2nd week. 6. Female, nearly adult pigmentation. 7. Male, 1st week.



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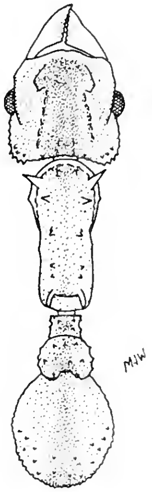

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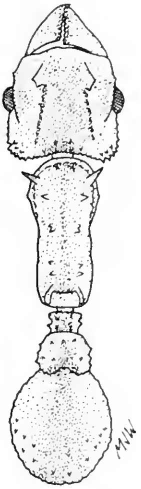

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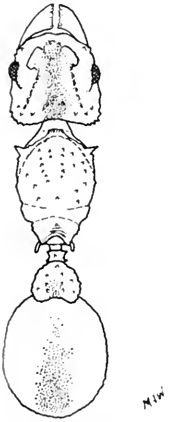

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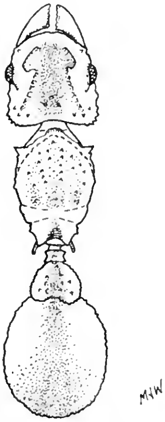

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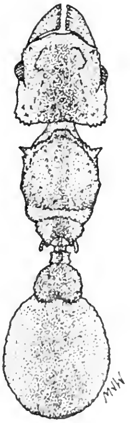

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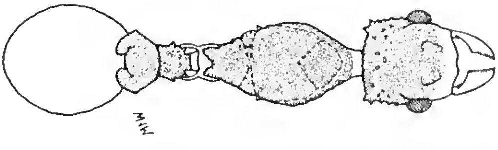

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tubercles of the body become faintly indicated. The wing pads of the sexes darken distally before proximally. The entire integument becomes a pale brown as the pupa reaches maturity, the male gaster remaining paler than the rest of the body (Fig. 8).

Pigmentation in the Callow

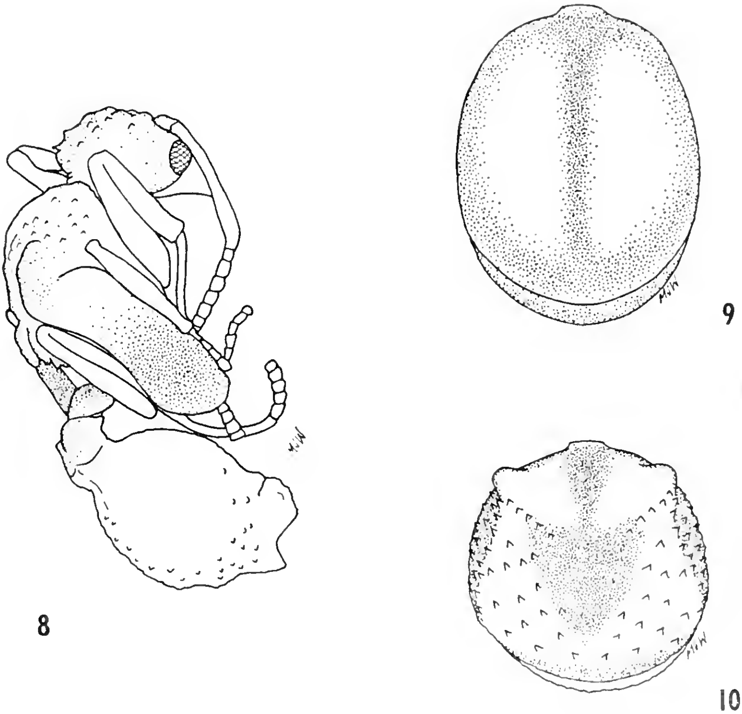
The callow is unable to emerge from the pupal skin without the aid of the worker although it can start the process. The exuvia is removed by the intensive licking of it by one or more workers. During this period the general pale brown darkens slightly.

When the callow has become freed of the exuvia pigmentation proceeds as shown in the figures (Figs. 1–7). The worker develops a faint mid-dorsal streak from the clypeus to the posterior of the first gastric segment. This is widest anteriorly and posteriorly. Lateral areas then darken and render the dorsal streak less conspicuous but it is generally retained throughout life to a variable extent. The female pattern is similar except that a dark area marks the ocellar region and there are three dark streaks on the thorax. The male differs markedly from the female and worker in having a uniformly pale brown gaster.

Pigmentation in the Adult

Older ants in this species tend to be darker than younger ones during the summer in nature. By the fall of the year all are mostly dark ferruginous with faint indications of the callow pattern. Worker callows that emerge in the laboratory tend to be pale ferruginous and remain this color for a much longer time than in nature.

Ants of the genus *Acromyrmex*, closely related and perhaps derived from *Trachymyrmex*, are also a ferruginous color of variable intensity. The female of *Acromyrmex* (*Moellerius*) *versicolor* Pergande has a characteristic gastric pattern (Fig. 9). The gaster of the female of *Acromyrmex* (*A*) *coronatus globoculis* Forel has a bold hastate pattern (Fig. 10).



FIGS. 8-10. Pattern of pigmentation.

8. Male pupa of *Trachymyrmex septentrionalis* showing early pigmentation. 9. Adult female gaster of *Acromyrmex* (*Moellerius*) *versicolor* Pergande, Imperial County, California. 10. Adult gynetype female gaster of *Acromyrmex coronatus globoculis* Forel of British Guiana. The dark brown spear-shaped area is on a yellowish brown background.

DEVELOPMENT OF ISOLATED BROOD

Brood was isolated from adult ants on 1 August 1963 in a container of sterile quartz sand kept moistened with distilled water. Each specimen was isolated in a shallow depression, in a numbered series, and its progress noted. All had a coating of the fungus garden mycelium as is normal in most Attini. The temperature was maintained at 23.4° C. ± 0.5°.

The history of nine males is given in Table 1.

Table 1

No.	1 August	4 August	6 August	9 August
1	white pupa, nearly black eyes	brown, dark wing pads		moves
2	white pupa, gray eyes	dark eyes		brown
3	white pupa, dark gray eyes	dark wing pads		moves
4	pale yellow pupa, dark gray eyes	brown, dark wing pads	moving legs	nearly black
5	pale brown pupa, appendages yellow	dark brown	moves	dark
6	white pupa, gray eyes	dark eyes		dark
7	white pupa, unpigmented eyes	gray eyes		pale brown
8	white pupa, pale gray eyes	shrivelling		pale brown
9	semi-pupa	became pupa	gray eyes	pale gray

In addition, No. 3 moved his mouthparts on the 7th and No. 1 moved more generally on this day.

An isolated white worker pupa with unpigmented eyes on 1 August had gray eyes on 4 August and dark gray eyes on 8 August and 10 August. The integument became gray on 9 August.

Of three workers in the semi-pupa stage on 5 August, one became a pupa on 7 August and the other two on 9 August, indicating a duration of this stage of 2–3 days at 24° C.

Of a cluster of some 12–15 new eggs on 5 August the first larva developed on 16 August in the same container that held the above males and workers.

All of the above specimens were later preserved when it became clear that development could not proceed further in the absence of the social environment. In the ant colony they would have been licked repeatedly by the workers and moved from place to place. These fragmentary data, however, afford specific developmental times that may be extrapolated to the normal colony.

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Weber, N. A. 1956. Fungus-growing ants and their fungi: *Trachymyrmex septentrionalis* McCook. Ecology 37: 150–161; (subsp. *seminole*) 197–199.

Wheeler, W. M. 1907. The fungus-growing ants of North America. Bull. Amer. Mus. Nat. Hist. 23: 669–807.

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Three New Species of Mimesa from the Western United States (Hymenoptera: Sphecidae)[1]

ARTHUR R. GITTINS, University of Idaho, Moscow, Idaho

These three new species of psenine wasps are described at the present time in order to make the names available for a subsequent series of papers on the psenine wasps of North America.

Mimesa sabina new species

Female. Length, 8 mm. Black; tegulae, undersides of antennal flagella, much of fore tarsi, inner portion of fore tibiae, apex of first abdominal sternite, all of second, third and fourth abdominal sternites, and first, second and third abdominal tergites, red. Wings hyaline, stigma and veins dark brown. Pubescence silvery, dense on frons and clypeus.

Head. Nearly quadrate, slightly wider (including compound eyes) than long; clypeus shiny, moderately punctate, with a prominent subapical tubercle, apex strongly emarginate medially with emargination flanked by a well-developed tooth, lateral of which there is a second less well-developed tooth; lower frons moderately shiny, finely but densely punctate, appearing granulate under low magnification, with a well-developed tubercle between the lower margins of antennal insertions; upper frons closely but finely punctate medially, with a fine, incomplete, longitudinal facial carina below median ocellus; vertex moderately punctate, shagreened, never striate, without a postocellar tumidity or furrow; gena reflexed near lower eye, upper gena moderately punctate, lower gena densely shagreened; occipital carina terminating shortly before juncture with hypostomal carina; antenna with first flagellar segment approximately one and one-third times as long as second flagellar segment, width of last flagellar segment at base equal to width of scape.

[1] Submitted with the approval of the Director, Idaho Agricultural Experiment Station as Research Paper No. 683.

Thorax. Pronotum normal but with dorsolateral angles slightly extended; mesoscutum shiny, lightly and very sparsely punctate, shagreened at least anteriorly; notaulices distinct anteriorly; parapsidal lines distinct; mesoscutellum bright and shiny, nearly impunctate; postscutellum normal; mesoepisternum with anepisternal area noticeably striate, katepisternal area densely shagreened, finely punctate particularly along posterior margin; propodeum with lateral spheres elevated from dorsal area, separated by an irregular carina, dorsal area with longitudinal carinae laterally, becoming almost reticulate medially, lateral spheres mostly rugose-reticulate, nearly smooth near enclosure, striate laterally and smooth and shiny along extreme lateral margins; enclosure deep and narrow; hind coxa approximately twice as long as hind trochanter and bearing only a fine incomplete longitudinal ventral carina.

Abdomen. Ratio of length of petiole to first abdominal tergite to hind femur—7:6:8. Petiole distinctly convex above, somewhat flattened apically, dorsal surface shiny, dorsolateral carinae distinct. First abdominal tergite moderately elevated above petiole; pygidium broad, delimited by a well-developed carina and with deep, closely set, elongated punctations, less pronounced along anterolateral margins, becoming more densely piliferous apically and with some indication of integumental reddening apically.

Male. Length, 7 mm. Characters similar to female generally but differing in following respects: black, but with greater degree of red on legs, particularly on fore tibiae; silvery pubescence generally heavier on clypeus and lower frons; apex of clypeus notched medially; antenna with indistinct linear tyloides present on flagellar segments two through five; propodeum more rugose on lateral spheres, extending medially to enclosure; no delimited pygidial area.

Types. *Holotype:* ♀, Davis, California, Oct. 8, 1959 (L. A. Stange) (University of California, Davis, California); *allotype:* ♂, Davis, California, Oct. 8, 1959 (F. D. Parker) (University of California, Davis, California). *Paratypes:* 2 ♀♀, 3 ♂♂, Sept. 27, 1959, 34 ♀♀, 1 ♂, Oct. 8, 1959, 9 ♀♀, Oct. 17, 1959 (F. D. Parker), 2 ♀♀, 1 ♂, Oct. 8, 1959, (L. A. Stange), 1 ♀, Oct. 19, 1957 (R. E. Rice), 1 ♂, May 28, 1950 (R. C. Bechtel), and 1 ♂, Sept. 27, 1952 (J. C. Hall), all from Davis, California; 1 ♂, Antioch, Contra Costa Co., California, Sept. 25, 1958. Paratypes are deposited in collections at University of California, Davis; University of Idaho; California Academy of Science; U. S. National Museum.

Distribution. Apparently restricted to the central portion of California.

Diagnosis. Both sexes can be readily recognized by the entirely red first abdominal tergite, the noticeable convexity of the dorsal surface of the petiole, the impunctate condition of the mesokatepisternum, and the smooth, shiny condition of the lateral margins of the propodeum.

Discussion. This species appears to have a fairly restricted distribution. It is most closely related to *M. basirufa* because of a strong similarity in the ornamentation on the clypeus and the general color and form of the petiole. It is possible that *sabina* is a displacement of *basirufa* in central California. Additionally, there is a similarity in form and structure of the clypeus between the females of *sabina* and those of *coquilletti*. I believe that these three species have probably evolved from a common stock within the genus Mimesa.

Biology. Unknown.

Mimesa barri new species

Female. Length, 8 mm. Black; much of antennae, tarsi, fore tibiae, tegulae, posterior portion of first abdominal tergite, second tergite, portion of third tergite, second and third abdominal sternites, yellowish-red. Wings hyaline, stigma dark, veins mostly brown, becoming fuscous proximally. Pubescence silvery.

Head. Quadrate, slightly wider (including compound eyes) than long; clypeus shiny, granulate, with a faint, elongate, transverse subapical tumid area, apex nearly truncate with slight medial indentation; lower frons with only moderately developed tubercle between the bases of the antennal insertions; upper frons finely but closely punctate; vertex shiny, moderately but finely punctate, except striate laterally, without a postocellar tumidity or furrow; gena shiny, reflexed near lower eye margin, upper gena distinctly striate, lower gena mostly punctate; occipital carina distinct except for a very narrow distance immediately before juncture with hypostomal carina; antenna with first flagellar segment only slightly longer than second flagellar segment, width of last flagellar segment at base at least equal to width of scape.

Thorax. Pronotum normal; mesoscutum moderately shiny, moderately punctate; notaulices indistinct; parapsidal lines distinct; mesoscutellum more shiny than mesoscutum, sparingly punctate; postscutellum moderately shiny, granulate, with moderate numbers of long silvery hairs; mesoepisternum entirely shagreened, finely striate on anepisternal and katepisternal areas; propodeum with lateral spheres elevated and separated from dorsal area by carinae; dorsal area irregularly striate, lateral spheres shagreened, striate anteriorly, rugose-reticulate centrally, mostly shagreened on extreme lateral areas; enclosure narrow and deep; hind coxa about twice as long as hind trochanter, and with a nearly complete, longitudinal, ventral carina.

Abdomen. Ratio of length of petiole to first abdominal tergite to hind femur—2:4:4. Petiole short and broad, flattened above, particularly posteriorly, dorsolateral and ventrolateral carinae distinct, dorsal surface irregularly shagreened to finely granulate; first abdominal tergite well-elevated above petiole; pygidium very narrow, about one-third as wide as sixth tergite at pygidial base, delimited by a well-developed carina, mostly covered with dense, fuscous, bristle-like pile, otherwise dull and finely granulate, without orange markings.

Male. Length, 6.5 mm. Characters similar to female but differing in the following respects: legs with tarsi yellowish-red, fore and mid tibiae yellowish-red laterally, darker on outer and inner faces, hind tibia yellowish-red at basal and apical ends, otherwise darker, remainder of legs black; abdomen with reddish markings frequently confined to posterior margin of first tergite and all of second abdominal segment; antenna lacking distinct tyloides.

Types. *Holotype:* ♀, Squaw Creek, 4 mi. east Emmett, Gem Co., Idaho, July 7, 1952 (on *Grindelia* sp.) (W. F. Barr) (University of Idaho); *allotype:* ♂, (same data as holotype) (University of Idaho). Deposited at California Academy of Sciences on indefinite loan from University of Idaho. *Paratypes:* 4 ♀♀, (same data as holotype); 1 ♀, 3 mi. SW Sweet, Gem Co., Idaho, July 3, 1956 (on *Grindelia* sp.) (W. F. Barr); 1 ♀, 2 ♂♂, 12 mi. NW Regina, Ada Co., Idaho, July 11, 1952 (on *Helianthus* sp.) (W. F. Barr); 1 ♀, 7 mi. N Bliss, Gooding Co., Idaho, June 10, 1956 (R. C. Newton); 1 ♀, Corvallis, Ore., Aug. 7, 1941 (on wild carrot) (R. E. Rider); 1 ♀, 1 ♂, Rumsey, Yolo Co., Calif., May 17, 1958 (A. E. Menke); 1 ♀, Pt. Reyes St., Marin Co., Calif., July 11, 1958 (S. M. Fidel); 1 ♀, Berkeley, Alameda Co., Calif., July 27, 1910 (J. C. Bridwell); 1 ♂, Vacaville, Calif., Sept. 27, 1930. Paratypes are deposited in collections at University of California, Davis and Berkeley; University of Idaho; California Academy of Sciences; U. S. Natural Museum.

Diagnosis. The females of this species are immediately distinguished by the very narrow pygidium, extremely short petiole and the uniformly striate condition of the mesoepisternum. The males are distinguished by the extremely short, broad petiole and the uniformly striate condition of the mesoepisternum.

Discussion. I take deep pleasure in naming this species after my colleague, Dr. Wm. F. Barr. This species bears some similarity to *M. gregaria.* Members of this previously undescribed species vie with those of *cressoni* and *dawsoni* in their divergence anatomically from the basic North American stock of *Mimesa. M. barri* bears closest resemblance to *agalena* and it is probably a northerly displacement of the latter. Unlike so many other western North American forms of *Mimesa,* this species is quite distinctive.

Biology. Unknown except the females are known to visit the flowers of *Grindelia* sp., *Helianthus* sp. and *Daucus* sp.

Mimesa agalena new species

Female. Length, 7 mm. Black; undersides of antennae, tegulae, tarsi, femorotibial joints, posterior margin of first abdominal tergite, all of second tergite and sternite, variable portions of third sternite and tergite, and medial portion of pygidium, yellowish-red. Wings hyaline, stigma and veins dark brown. Pubescence silvery.

Head. Nearly quadrate, slightly wider (including compound eyes) than long; clypeus finely punctate, apex truncate, slightly protuberant, with an elongated subapical transverse depression; lower frons with a slight tubercle, much less pronounced than in other species of the genus, between the lower margins of the antennal insertions, upper frons punctate to slightly striatopunctate mesally above antennal insertions; vertex shiny, tending toward striatopunctate, particularly laterally, without a postocellar tumidity or furrow; gena shiny, reflexed near lower eye margin, upper gena generally striate, lower gena commonly sparsely punctate and lightly shagreened; occipital carina evanescent immediately before its juncture with the hypostomal carina; antenna with first flagellar segment little if any longer than second flagellar segment, width of last flagellar segment greater at base than width of scape.

Thorax. Pronotum normal; mesoscutum moderately to densely punctate, moderately shiny; notaulices indistinct; parapsidal lines not prominent; mesoscutellum shiny, more sparsely punctate than mesoscutum, postscutellum appearing nearly granular at least mesally; mesoepisternum finely striate throughout; propodeum with lateral spheres slightly elevated from dorsal area, sometimes separated from dorsal area by carinae, dorsal area traversed by distinct striations, frequently with striations continuing onto lateral spheres, lateral spheres finely rugose-reticulate or striate throughout, enclosure narrow, deep anteriorly, not flanked by carinae, extreme lateral areas striate, strongly shagreened; hind coxa about twice as long as hind trochanter, with an indistinct, incomplete, longitudinal ventral carina.

Abdomen. Ratio of length of petiole to first abdominal tergite to hind femur—1.5:4.5:4. Petiole slightly convex above, square in outline, with dorsolateral carinae, dorsal surface irregular; pygidium extremely narrow, width about one-third width of sixth tergite at pygidial base, delimited by a well-developed carina, covered at least mesally with a dense orange-colored pile, basal portion coarsely granulate.

Male. Length, 5 mm. Characters similar to female but differing in following respects: coloration generally much darker, considerably less integumental red or yellow, particularly on abdomen; clypeus with apex broadly truncate, generally lacking a transverse subapical depression; antenna darker with large, well-developed, rounded tyloides present on flagellar segments two to six; mesopleuron more coarsely striate; propodeum more coarsely striate on dorsal area, more granulate on lateral spheres.

Types. *Holotype:* ♀, Jamestown, Tuolumne Co., California, April 26, 1951 (P. D. Hurd) (University of California, Davis, California); *allotype:* ♂, Davis, California, June 5, 1949, E. I. Schlinger) (University of Calif., Davis, California). *Paratypes:* All from California: 3 ♀♀, 8 ♂♂, April 17, May 20, June 5 and Aug. 3, 1949, and 1 ♂, April 30, 1948 (E. I. Schlinger) all from Davis; 1 ♀, Arroyo Seco Camp, Monterey Co., May 1, 1960 (R. D. Parker); 1 ♀, Tesla, Alameda Co., March 22, 1953 (J. G. Rozen); 1 ♀, Arroyo del Valle, Alameda Co., April 30, 1958 (R. M. Bohart); 1 ♀, 4 mi. E Sonora, Tuolumne Co., May 22, 1953 (J. G. Rozen); 1 ♂, Riverside Co., April 19, 1960 (J. C. Hall); 1 ♂, Saugus, April 13, 1939 (on *Cryptantha*) (R. M. Bohart); 1 ♀, May 30, 1953, 1 ♀ and 1 ♂, May 12–13, 1955, 1 ♂, May 22, 1956 (E. I. Schlinger) 1 ♀, May 16, 1957 (R. C. Bechtel), 2 ♀♀, May 22, 1956 (J. C. Hall and E. I. Schlinger), 1 ♂, May 16, 1917 (R. C. Bechtel), 3 ♂♂, May 9, 1955, and 1 ♂, May 13, 1956 (R. M. Bohart) all from Samuel Springs, Napa Co. Paratypes are deposited in collections at University of California, Davis and Berkeley; University of Idaho; California Academy of Sciences; U. S. National Museum.

Distribution. California.

Diagnosis. This species is immediately distinguished from all others of the genus, except *barri*, by the extreme, short, squared petiole. It differs from *barri* in smaller size, and more finely ornamented mesopleuron and propodeum. Males additionally differ from those of *barri* with the general presence of tyloides on flagellar segments two to six.

Discussion. This species bears a closer relationship to *barri* than to any other taxon within the genus, and is possibly, in part, a southern displacement of the more northern *barri*.

Biology. Nothing is known on the habits of members of this species other than a floral visitation record from *Cryptantha* sp.

A New Record of Symbiocladius equitans (Claassen) (Diptera, Tendipedidae, Orthocladiinae)

Selwyn S. Roback, Curator, Department of Limnology, Academy of Natural Sciences of Philadelphia

Symbiocladius equitans (Claassen) has been recorded from California, Utah, Colorado, and Vermont (Roback 1953). Recently Mr. Ralph Sinclair of the Division of Stream Pollution Control, Tennessee Department of Public Health, sent me some nymphs of *Epeorus* (*Iron*) sp. collected in the Great Smoky Mountains in North Carolina. These nymphs had mature or nearly mature larvae of *S. equitans* under their wing pads. The exact collection data are as follows: Big Creek, one-quarter mile above mouth at Walters powerhouse, Haywood County, North Carolina, 6–15–66 (Coll. Sinclair). This is a considerable southward extension of the range of this species in the east.

References

Claassen, P. W. 1922. The larva of a chironomid (*Trissocladius equitans* n. sp.) which is parasitic upon a may-fly nymph (*Rithrogena* sp.). Kansas University, Sci. Bull. 14, No. 16: 395–405.

Roback, S. S. 1953. New records of *Symbiocladius equitans* (Claassen) with some notes on the genus. Not. Nat. Acad. Nat. Sci. Phila. 251: 2 pp.

New Paraleuctra from the Rocky Mountains (Plecoptera: Leuctridae)[1]

ALAN V. NEBEKER and ARDEN R. GAUFIN, University of Utah, Salt Lake City, Utah

Two new species of *Paraleuctra* were discovered during the course of intensive investigations of Rocky Mountain stoneflies. Extensive collecting in all of the Rocky Mountain states has been carried out as a part of an overall program to obtain information concerning the taxonomy and ecology of the Rocky Mountain stonefly fauna. The new species herein described are found in Montana, Idaho, and Utah. They are closely related to *Paraleuctra occidentalis,* which is found uncommonly in all of the Rocky Mountain states and all along the Pacific area from California to Alaska. All three species have been found in the same streams and no intermediate forms have been encountered. Ecological separation of the 3 species has been noted in Big Cottonwood Canyon, Salt Lake Co., Utah. *P. occidentalis* occurred throughout the length of Big Cottonwood Creek while *P. jewetti* was restricted to smaller tributary streams fed predominantly by springs. *P. rickeri* was found almost exclusively in small seeps and springs.

The three species are similar in general morphological features. The females are almost indistinguishable and cannot be separated with confidence at the present time. All of the females of *Paraleuctra* except *P. purcellana* are difficult to separate. The specific diagnostic characters are found in the male genitalia and associated structures (Fig. 4).

Paraleuctra jewetti new species (Fig. 2)

Male: length of titillator 0.9 mm; apex of titillator distinctly lobed and folded (Figs. 2A, 2B, 2D); upper lobe of apex of

[1] This study supported by a grant from the National Science Foundation, G-20703; and a training grant from the Division of Water Supply and Pollution Control, W-54.

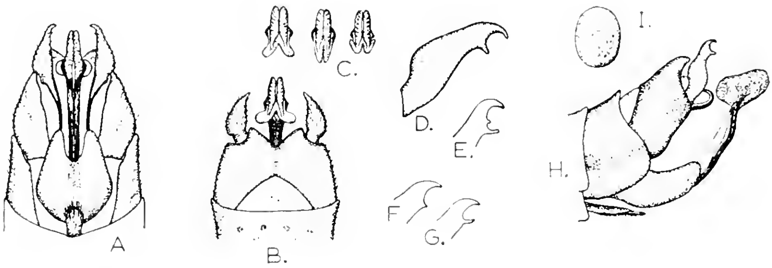

Fig. 1. Paraleuctra occidentalis

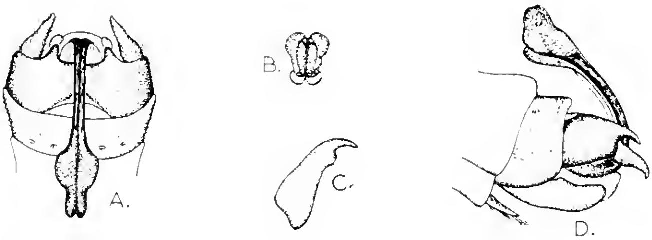

Fig. 2. Paraleuctra jewetti

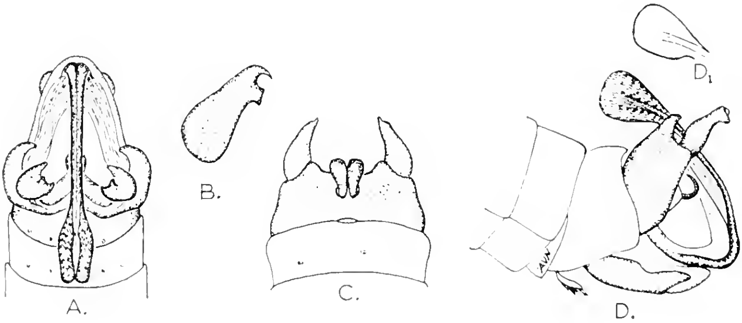

Fig. 3. Paraleuctra rickeri

FIGS. 1–3. New species of *Paraleuctra.*

titillator much larger than lower lobe (Fig. 2D); posterior margin of ninth tergite with two posteriorly projecting lobes (Fig. 2A), each one-sixth the width of the tergite at base. Stem of titillator (Fig. 4) heavy and massive, not undulated but

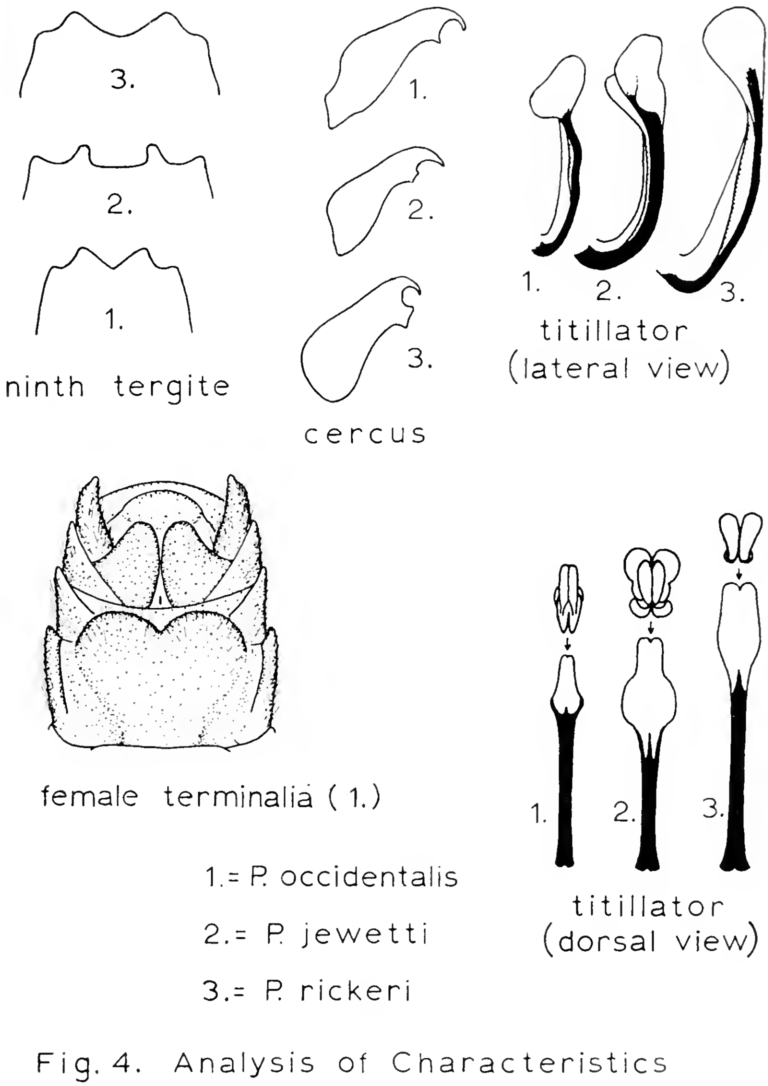
3.
2.
1.
ninth tergite
1.
2.
3.
cercus
1.
2.
3.
titillator
(lateral view)
female terminalia (1.)
1.
2.
3.
titillator
(dorsal view)
1.= P. occidentalis
2.= P. jewetti
3.= P. rickeri
Fig. 4. Analysis of Characteristics

Fig. 4.

smoothly arched. Cercus fairly consistent in having a terminal hook and a small blunt projection subterminal in position (Fig. 2C).

Type.—Holotype male, UTAH, Salt Lake Co., Big Cottonwood Creek ½ mile below jct. Mineral Fork, A. V. Nebeker, June 9, 1965. Additional paratypes as follows: Big Cottonwood Creek: at Power plant, May 26, 1 male; at Mineral Fork, June 4, 1 male; May 26, 3 males, 4 females; at Water Treatment Plant, May 28, 1 male, 1 female; Montana, Glacier Nat'l. Park, Swift Current Creek at Swift Current Campground, July 10, 1964, A. V. Nebeker, 1 male.

This form is readily separated from *P. occidentalis* by the massive titillator with the folded and lobed apex. The small projections of the ninth tergite also separate the two forms. The two species are about the same size overall. The cercus rarely has the sharply pointed second subapical projection.

Paraleuctra rickeri new species (Fig. 3)

Male: length of titillator 1.2 mm; apex of titillator smoothly rounded, not infolded or lobed (Figs. 3A, 3D); upper and lower lobes of apex of titillator of nearly equal size. Posterior margin of ninth tergite with two posteriorly projecting lobes (Fig. 3C) each ½ to ⅓ width of tergite at base, triangular in shape. Stem of titillator long, slender and smoothly arched but bent slightly medially. Cercus fairly consistent with a heavy blunt subterminal projection, angular in side view.

Type.—Holotype male, Utah, Salt Lake Co., Big Cottonwood Cr. at The Spruces, A. R. Gaufin, June 18, 1954. Additional paratypes as follows: Montana, Lake Co., Yellow Bay Cr., at Yellow Bay, Hwy. 35, March 28, 1965, A. V. Nebeker, 1 male; Utah, Salt Lake Co., Cig Cottonwood Cr. at The Spruces, A. R. Gaufin, June 18, 1954, 2 males, 3 females; Idaho, Latah Co., 5 mi. N. E. Laird Park, April 19, 1963, W. E. Barr, 1 male; Montana, Missoula Co., Rattlesnake Cr., 12 mi. N. E. Missoula, April 25, 1965, D. M. Lehmkuhl, 1 male; Montana, Glacier Nat'l. Park, seep 1 mile below Iceberg Lake, July 27, 1965, A. V. Nebeker and A. R. Gaufin, 1 male; Montana, Gallatin Co., Hell Roaring Cr., May 20, 1951, W. Alvord, 1 male, 1 female; Montana, Gallatin Co., Hyalite Cr., May 4, 1951, R. Hays, 1 male.

This species is about one-fourth larger than *P. occidentalis* with a much longer titillator. The cercus is different with the massive square-looking lower process.

Forty-five collections of *P. occidentalis* from Utah, Idaho, Colorado, Montana, Oregon, Washington, and California were carefully compared with the new species. No variations of *P. occidentalis* except the cerci were observed. The cercal variations are illustrated in Figs. 1D–1G. Fig. 1D is from Montana; 1E is from Oregon and Washington; 1F is from Washington; and 1G is also from Washington. California and some Oregon specimens show a distinction in that they have a third prong on the cercus but this is of little value. The egg is illustrated in Fig. 1I. The female is illustrated in Fig. 4.

Nomenclature Notice

Notice is given of the possible use of plenary powers by the Intern. Comm. Zool. Nomencl. in connection with the following, listed by case number (see *Bull. zool. Nomencl.* 23, pt. 2/3).

1642. Suppression of **Bryaxis schneideri** Kugelann, 1794: Type-species for *Bryaxis* Kugelann, 1794 (Coleoptera).

1732. Neotypes for **Anthocoris nigrellus** Zetterstedt, 1838; **Anthocoris nigriconrnis** Zetterstedt, 1838; **Lygaeus pygmaeus** Fallen, 1807 (Hemiptera).

1741. Type-species for **Phlaeothrips** Haliday, 1836 (Thysanoptera).

Send comments, with case number, to the Secretary, Intern. Comm. Zool. Nomencl, c/o British Museum (N.H.), Cromwell Road, London, S.W. 7, England.

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ENTOMOLOGICAL NEWS

Vol. LXXVII DECEMBER, 1966 No. 10

A New Staphylus from Costa Rica (Lepid.: Hesperiidae)[1]

Lee D. Miller, Department of Biology, The Catholic University of America, Washington, D. C. 20017

While attending the Seminar in Tropical Biology at the Universidád de Costa Rica during July and August, 1963, I had the opportunity to collect in various parts of the country. One of the most interesting areas visited was a patch of relatively undisturbed tropical wet forest located about ten miles west of Guapiles in the province of Limón. Many insects were taken there, but there were relatively few hesperiids, and most of these were common, widespread species. One specimen, however, represented an undescribed species and is very interesting from a distributional standpoint.

Staphylus esmeraldus, new species. Figs. 1, 2 (♂), 3 (♂ genitalia)

Male: Head and most of the distal two segments of the palpus brilliant iridescent green above; frons, upper surface of the proximal segment of the palpus and the tip of the third segment black. Cheek and palpus below dark gray. Antenna dark brown above, below with shaft ringed with brown and yellow and yellow alone inside flexion of club; nudum dull brown. Thorax and abdomen above thickly covered with blackish-brown hairs intermingled with a few golden ones; below, thorax and abdomen brown; legs brown.

[1] This research was supported in part by National Science Foundation Grant No. G-21977.

Upper surface of forewing dark brown sparsely overlaid with golden scales, shaded darker basad and with prominent black spot at the end of the cell. Two transverse dark bands are present, one lying just outside the cell and the other along the margin. The costal fold is well developed. Hindwing above also dark brown thinly overscaled with gold, darker basad, with a thin, dark extradiscal line and poorly defined dark submarginal spots. Under surface of forewing unmarked, rich dark brown, and that of the hindwing dark brown with basal gold overscaling and a few scales of the same color forming an ill-defined mesial spot-band. The fringes of both wings above and below dark brown. Length of forewing of holotype, 13 mm.

FIG. 1. *Staphylus esmeraldus,* new species. Holotype ♂, upper side.
FIG. 2. Same, under side.

The male genitalia are characteristic of the green-headed *Staphylus* with a massive, straight tegumen; a small, curved uncus; no scaphium and ornamented valvae. The well-developed dorsal median spine on the valva serves to separate the male genitalia of *esmeraldus* from those of *S. chlorocephala* (Latreille).

The *female* is unknown.

Described from a single specimen. *Holotype* ♂: Costa Rica: 10 mi. W. of Guapiles, Prov. Limón, 520 m.; 10.viii.1963; perched on foliage with wings outstretched along forest trail, tropical wet forest (Lee D. Miller); ♂ genitalia slide no. M-1457 (Lee D. Miller).

The Holotype is deposited in the collection of Carnegie Museum (C. M. Ent. Type No. 512).

This species can be keyed only with difficulty to *chlorocephala* in Evans' (1953: 84) key to *Staphylus* since he mentions a tornal white area on the under surface of the hindwing which is totally absent in *esmeraldus*. The only other green-headed *Staphylus, chlora* Evans, is totally different, as may be seen in the diagnosis of the *chlorocephala* group which follows:

Fig. 3. *Staphylus esmeraldus*, new species. ♂ genitalia of holotype.

1. *chlorocephala*—Contrasting dark and pale bands above; no hyaline forewing spots; forewing costal fold well developed; under surface of hindwing with a tornal white shade; southern Brazil.

2. *esmeraldus*—Dark bands above less prominent; no hyaline forewing spots; forewing costal fold well developed; under surface of hindwing dark tornally with a few golden scales; Costa Rica.

3. *chlora*—Dark bands above less prominent; forewing with prominent hyaline apical and discal spots; no costal fold on

forewing; under surface of hindwing dark tornally; Bolivia and Brazil (Rio Tapajos, Para).

The holotype of *esmeraldus* is the first record for its group in Central America; in fact, this group has previously been recorded from no closer than central Brazil. This apparent gap in the distribution of the *chlorocephala* group may be real or not since these insects are rare wherever they are found, closely resemble some of the commoner *Staphylus* in flight and may have been overlooked by many collectors who were chiefly concerned with the gaudier, more conspicuous butterflies. In any event, members of this group of *Staphylus* should be sought wherever there are suitable tropical wet or rain forests throughout South America and at least southern Central America.

Reference

Evans, W. H. 1953. A catalogue of the American Hesperiidae . . . in the British Museum (Natural History). Part III (Groups E, F, G) Pyrginae. Sect. 2. London, Trustees British Museum: v + 246 pp.; pls. 26–53.

Nomenclature Notice

Possible use of plenary powers by the Commission is announced in connection with the following names, listed by case number: 1742: Type species for **Cosmopteryx** Hübner, 1825 (Dipt.). 1745: Suppression of **Macrochoeta** Macquart, 1851 (Dipt.). 1748: Suppression of **Scoptes** Hübner, 1819 (Lep.). 1747: Emendation of Stenopodinae Stal, 1859, to Stenopodainae (Hemip.). 1758: Type species for **Neolycaena** de Nicéville, 1890 (Lep.). 1760: Suppression of **Cellia errabunda** Swellengrebel, 1925 (Dipt.). 1762: Type species for **Enithares** Spinola, 1837 (Hemip.).

Send comments with case number to International Commission on Zoological Nomenclature, c/o British Museum (N.H.), Cromwell Road, London, S.W. 7, England. (See Bull. zool. Nomencl. 23, pt. 4.)

Two New Sister Species of the Winter Stonefly Genus Allocapnia (Plecoptera, Capniidae)[1]

Herbert H. Ross and Toshio Yamamoto, Illinois Natural History Survey, Urbana

Examination of winter stoneflies belonging to the genus *Allocapnia* has disclosed two new sister species belonging to the *granulata* group. One of these is abundant in the Cumberland Plateau area of eastern Tennessee, the other one is known only from a single specimen collected in the Ozark region of northwestern Arkansas. The two new species must therefore have originated from a common ancestor that at one time dispersed between these areas and later broke up into an eastern and a western population that have since evolved into distinctive species. This distribution pattern is another example from the aquatic insects that the fauna of the Missouri, Arkansas, and Oklahoma mountains is more extensive than formerly believed and is intertwined historically with the fauna of the area east of the Mississippi embayment region.

We take great pleasure in naming these species in honor of L. O. Warren and J. D. Unzicker who have contributed much to the study of the winter stoneflies.

Descriptions of New Species

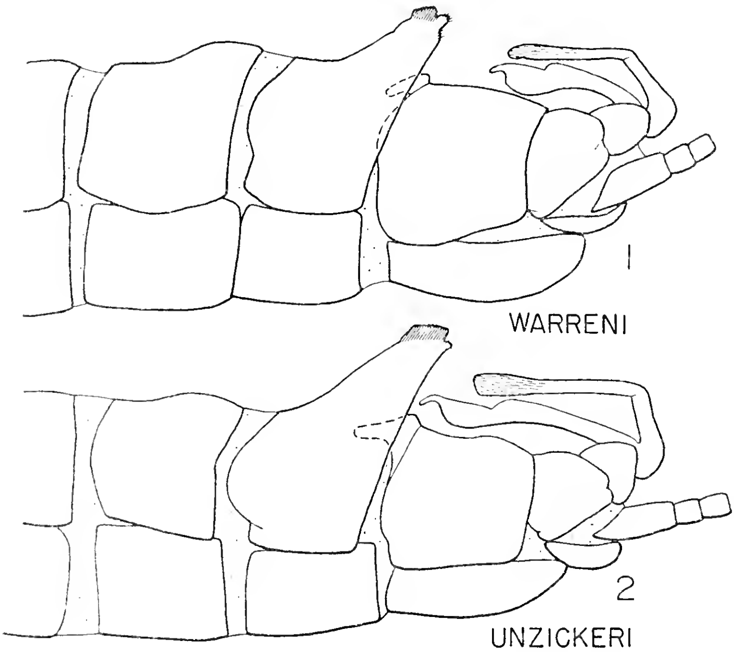
The two species described herein are typical of the genus *Allocapnia* in size, color, and general structure. They belong to the *granulata* group, which is characterized by a large, somewhat V-shaped, rugose dorsal process on the eighth segment and, in most species, by a pair of small, haired projections below the large dorsal rugose process.

Allocapnia warreni new species

Male.—Wings reaching fifth abdominal segment. Seventh tergite with no dorsal process. Process of eighth tergite with

[1] This project has been supported by a research grant from the National Science Foundation.

rugose area markedly raised and sharply set off from contour of anterior part of segment; the pair of small haired projections below the rugose area appear slightly detached from it in dorsal view. Upper supra-anal process moderately narrow, the apical segment slightly longer than the basal segment.



Figs. 1, 2. Male genitalia of *Allocapnia*, lateral aspect.

Holotype male.—Clear Creek, Washington Co., Arkansas; January 29, 1962; L. O. Warren.

This species is most closely related to *granulata* (Claassen), differing in the unusually prominent differentiation of the rugose lobes of the eighth tergite, and in the longer, uniformly narrow apical segment of the upper supra-anal process.

Allocapnia unzickeri new species

Male.—Wings reaching the sixth tergite. Seventh tergite with no dorsal process. Process of eighth tergite high and prominent, the large rugose lobes somewhat V-shaped from dorsal view; the pair of haired projections just below them small but prominent. Upper supra-anal process narrow, the apical segment about $1\frac{1}{2}$ times the length of the basal segment.

Female.—Many female specimens collected on the same bridges as the male described above would appear to be the same species. They are exactly like those of *granulata.*

Holotype male and *Allotype* female.—3 miles North of Dunlap, TENNESSEE; March 12, 1964; H. B. Cunningham. *Paratypes.*—Many ♂, ♀ from the type locality and the following localities in Tennessee: Annadel, twenty-four miles south of Hillsboro, and Whitwell.

This species possesses a mesal hump on the eighth tergite which is markedly higher than that of either *warreni* or *granulata,* and has the apical part of the upper supra-anal process much longer than in either of these two species. From *warreni*, to which it is most closely related, it differs also in having larger rugose lobes which are confluent with the profile of the eighth tergite.

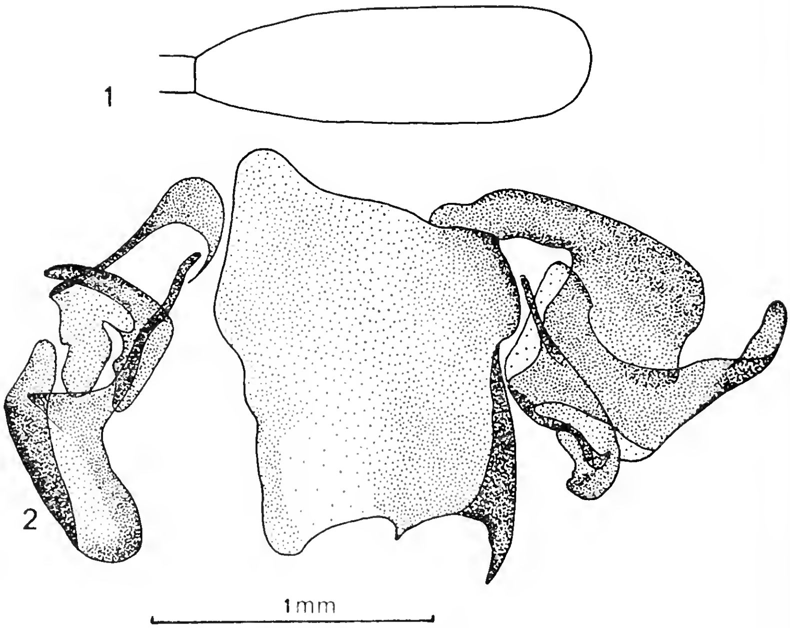
A New Species of Amorphoscelis from Iraq (Mantodea: Amorphoscelidae)

R. ROY, Institut Fondamental d'Afrique Noire,
Université de Dakar, Sénégal

Among specimens of *Amorphoscelis* from the U. S. National Museum, which kindly have been made available for study by Dr. A. B. Gurney, I have been surprised to find a specimen native to Iraq, that is, in the southern part of the Palearctic region, when up to now the genus is known only from the Ethiopian (Africa south of the Sahara) and Oriental (from

India to New Guinea) regions. After detailed examination, this specimen is seen to belong to a new species, described as follows:

1



2

Figs. 1, 2. *Amorphoscelis pantherina*, n. sp. Holotype ♂.
1. Last article of cercus. 2. Genitalia.

Amorphoscelis pantherina n. sp.

Male: General color grayish-beige, with numerous dark spots; length of body 18 mm, elytra a little surpassing the apex of abdomen.

Head strongly spotted with brownish-black, with the frontal shield almost entirely of this color; juxta-ocular tubercles scarcely distinct, the posterior ones the best defined; lateral prolongations of vertex rather large and rounded. Antennae annulated in the usual way.

Pronotum spotted with dark equally strongly and the surface weakly uneven: the anterior tubercles are not distinct and the posterior tubercles form only low bosses; the very distinct carinae are weakly elevated; the lateral margins are straight.

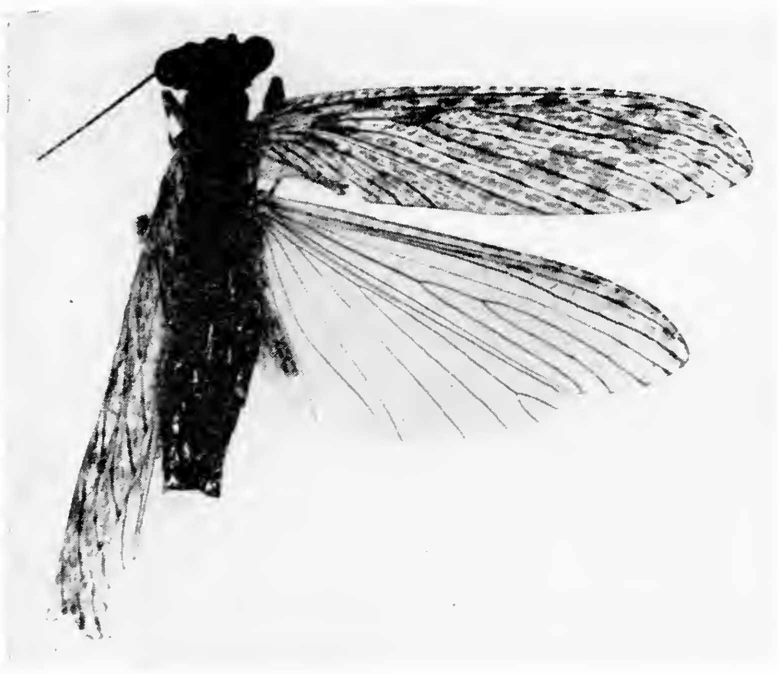


FIG. 3. *Amorphoscelis pantherina*, n. sp. Holotype ♂.

Anterior coxae with inner surface pale, with some dark spots; trochanters also with some small dark spots, and a larger subapical spot; femora considerably spotted with dark on inner surface, with the region of the brush in particular completely darkened; tibiae with 3 large dark transverse bands, subbasal, median, and apical; the first article of the tarsi dark-banded at each end and in the middle, the following ones at the ends only.

Middle and hind legs with tibiae and tarsi regularly dark-banded, the annulations less regularly on the femora.

Elytra 16.5 mm long, pale, with very numerous dark spots. Wings hyaline, with some dark spots only in the apical half of the costal field and at the apex of the discoidal field.

Abdomen dark brown upon the two surfaces; subgenital plate trapezoidal, with margins nearly straight and very convergent; styles lacking on the sole specimen seen; cerci wholly pale, their last article very elongate and with almost parallel margins (Fig. 1).

Genitalia rather strongly pigmented; hypophallus with the lobe well developed and with two rather separated pointed prolongations, a long one at the left and a shorter one in the middle; apophysis of the right epiphallus with a lateral boss; titillator with simple rounded apex; pseudophallus with denticulate apex (Fig. 2).

Holotype male: Iraq, Arbil Liwa, Aug. 1962; this specimen, preserved in the U. S. National Museum, Washington, is the only one known to me.

Affinities: This new species is closely related to no other Asiatic species, but seems especially related to *A. tigrina* Giglio-Tos, 1913, known only from the Sudanian regions of West Africa, from Senegal to Cameroun; it has the same type of coloration, and these two species are the only ones to have similarly two rather separated points on the hypophallus, and the apex of the titillator simple and rounded. One may note further that both of them inhabit relatively dry regions, in contrast to the great majority of the other species of the same genus.

Similarities stop there, and the two species both are distinguished by various characters, among others, details of coloration of legs and elytra, form of pronotal tubercles, form and coloration of the cerci, relative importance of the two prolongations of the hypophallus.

Observations on Ropalidia variegata (Smith) (Hymenoptera: Vespidae)

T. A. DAVIS, Indian Statistical Institute, Calcutta, India

Sixteen colonies of *Ropalidia variegata* (Smith) were closely watched from November 1963 to July 1965 on the premises of the Indian Statistical Institute, Calcutta. This wasp is active throughout the year and colonizes both on a dicot plant (*Diospyros discolor*) and on a monocot, the banana (*Musa sapientum*), although Yoshikawa (1964) observed two nests on electric wires and one on a *Bauhinia* branch, and van der Vecht (1962) on a shoot of a shrub and on a completely exposed iron wire. Recently I observed an abandoned nest on a woody shoot of *Jasminum* sp. FIG. 1 shows portions of three nests on a banana leaf.

The present observations on 100 nests revealed some very interesting behaviour patterns. Cannibalism or brood eating, recorded in other wasps, is also common in *Ropalidia variegata*. Some founding females as well as workers were periodically seen devouring eggs, sucking larvae, and even munching pupae after cutting open the cocoons. This brood eating is more prevalent where many adults have already emerged, and may suggest that the wasp has a tendency to check the population growth. Most larvae, and consequently the adults, which are seen towards the end of the activities of a colony are usually smaller in size. Cannibalism may possibly function to prevent the multiplication of these smaller, and presumably weaker adults. Scarcity of food, regarded as an important factor, does not seem to apply in the present case. Of the two or even three colonies found developing simultaneously on the same tree, severe cannibalism was noticed in the oldest colony but not in the younger ones. As the foraging territory could reasonably be the same, scarcity of food need not affect one colony more acutely than the others. The most obvious factor that induces cannibalism seems to be the withering of the leaves on which the colonies are founded. When the foundation leaf sheds, the letfover eggs, larvae, and pupae are usually consumed by other predatory animals. Cannibalism may enable workers and females to utilize the rich food available in the body of those members unable to reach maturity. At other times it may serve to maintain the stability of nests partially damaged by wind.

Unlike most *Polistes* wasps in which the founding mother is helped in nursing the larvae as well as in nest-building solely by her progeny, in the present case, foreign workers from other nests of the same or different colonies help in these activities, and also in cleaning the cells, sometimes reducing the length of cells after their occupants emerge, and occasionally helping an emerging wasp by widening the mouth on the lid. Until about the hatching of the first few eggs, only the founding female is invariably seen on the nest, but when the number of larvae increases, the mother usually continues her cell-building and oviposition, and so she has hardly enough time for the feeding and nursing of the larvae which require frequent attention. At this stage foreign workers arrive and share her burden. Even before the emergence of the first adult from a nest, as many as 5 to 9 workers were seen arriving one by one from outside. As the number of adults increases with the eclosion of domestic pupae, some of the workers fly to other younger nests as maids-in-waiting of the founding mothers. Some females may start their own nests (or colonies).

The wasps at Calcutta were nesting on the lower surface of the leaves in the cases of both *Diospyros* and banana. The lower surface of the leaves of the former tree is very rough and hairy and affords greater stability for the nest. Out of the 53 nests of 5 colonies on the dicot leaves, only 2 nests were built on the upper glossy surface and they were blown off prematurely. However, when stronger bases in the form of paper clips were provided on the smooth side, some wasps readily accepted this scaffolding for building nests. Evidently the paper clips stimulated the same reactions as the mid-rib of a leaf in other cases. On the banana leaf, invariably the lower midrib is selected as it is the strongest and most secure portion of the lamina. Even when both halves of the lamina bend backwards, the nests could

FIG. 1. *Ropalidia variegata* (Smith). Portions of three nests on a banana leaf.

still be quite safe, and also protected from wind, rain and direct sunlight, as well as hidden from predators. It may, however, be mentioned that in *Diospyros* only a smaller number of nests was attached to the mid-ribs.

Each nest has only a single stalk (pedicel), invariably behind the topmost cell, and balancing of the nests results from the subsequent cells, which are formed downwards, being so arranged as to avoid unnecessary strain on the pedicel. Accordingly, the shape and size of the nests vary widely. A count of the vertical rows of cells per nest in the 100 nests revealed that the structure of the nests on the banana differs significantly from that on the dicotyledonous plant. This is due mostly to the wide dissimilarity in the morphology of the two types of leaves (Davis, 1966). In 59.57% of the nests in the 11 colonies on the banana plants there were only two rows of cells each, and this figure differs significantly from the corresponding one for the nests on *Diospyros,* the χ^2 value with one degree of freedom being 7.01 ($P = 0.0085$) which implies that the animal is capable of changing even the structure of the nest to suit different sites. The smaller *Diospyros* leaf, its weaker petiole and the flexibility of the shoots on which the leaves are borne tend to produce frequent changes in the position of the lamina. When the position of a leaf is slightly altered, the stability of the tilted nests is restored by adding new cells or rows of cells along the side nearer to the line of gravity. With time, the leaf may be subjected to further deflections in different directions. Thus, the number of cell-rows may increase and the nests show great variations. Since the banana leaf is adapted to vertical movements, the nests on it do not differ greatly from the usual two-row pattern.

Ropalidia variegata demonstrated other instances of adaptive behavior. It chooses the leaf of the right stage of maturity. A young leaf permits the colony to survive for a longer period, but a very young leaf is unsuitable. Some superficial injury on the surface of the leaf is necessary to fix the foot of the pedicel firmly, and on a very young leaf the pedicel will be loosened when rapid expansion of the lamina takes place. On the other hand, a leaf that is too old will wither away before the wasp can complete its life cycle.

In a nest partially damaged by wind, three pupae on one half were consumed by adults, thus relieving the weight of that side and averting a threatened snapping of the nest. When the weight was thus reduced, the nest was restored to the original position and then workers reinforced the pedicel.

The wasp, before laying an egg, examines the empty cell a few times by inserting her head into it, her mouth almost reaching the base of the cell. This behavior seems very striking if the cell happens to be a used one which is generally long. A female in this posture was disturbed 17 times but she repeated the inspection of the cell each time before she attempted to oviposit.

TABLE 1. *Ropalidia variegata*: *Duration of pupal life.*

Week	Commencing from	No. of Pupae	Pupal Life (days)	Mean Temp. °C
1	19.11.63	16	*	25.1
2	26.11.63	17	*	24.1
3	3.12.63	8	*	22.4
4	10.12.63	15	20.85	22.4
5	17.12.63	6	21.75	20.2
6	24.12.63	11	25.38	19.6
7	31.12.63	19	28.10	21.3
8	7. 1.64	18	28.00	23.1
9	14. 1.64	9	28.00	19.9
10	21. 1.64	6	25.00	22.9
11	28. 1.64	4	25.00	18.3
12	4. 2.64	2	27.00	22.2
13	11. 2.64	2	25.00	23.5
14	18. 2.64	1	18.00	28.2
15	25. 2.64	11	14.50	27.1
16	3. 3.64	22	13.77	28.0
17	10. 3.64	26	13.16	29.1
18	17. 3.64	27	12.70	29.3
19	24. 3.64	30	12.04	30.9
20	31. 3.64	47	11.22	32.3
21	7. 4.64	74	10.78	31.7
22	13. 4.64	41	11.00	30.8
23	21. 4.64	24	11.71	28.2
24	28. 4.64	12	12.08	30.6

* Dates of eclosion only are known.

N.B. The 448 pupae are from 3 colonies (112, 285 and 51). Of these, 24 met with premature destruction.

The time of development varies with atmospheric changes. A shift of about 17° C (between the daily mean temperatures during summer and winter of Calcutta) brings about a considerable difference in the egg-to-adult cycle. In summer, an egg develops into an adult in about a month, but in winter, in about 3 months. The pupal period varies from 29 to 9 days between winter and summer, thus accounting for about a 300 per cent acceleration in the biological activity. Table 1 gives data on the duration of pupal life and weekly mean temperatures (recorded from within 100 meters from the nests) from 19.11. 1963 to 28.4.1964 relating to the first three colonies observed on *Diospyros*.

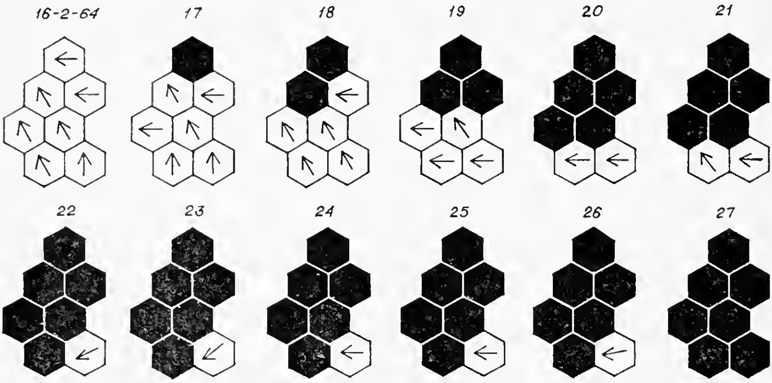


FIG. 2. Portion of Nest 8/II. Arrows inside cells represent the positions of larvae at about 9 AM for a 12-day period. Dark cells contain pupae.

The position of an egg in a cell appears to have some significance as regards the position of the subsequent larva. As the pedicel of a nest is almost horizontal, the first cell at its tip is also built horizontally, and the subsequent cells attached on to the first one downwards assume the same orientation. While laying an egg, the wasp usually faces downwards and inserts her abdomen into the cell, stretching out the rest of her body in the air. Thus, the egg which is oblong, is placed vertically at a lower part of the horizontal tube, and attains the best possible stability. In over 80% of the cases, the eggs are placed on the lowest part of the cells, some on the sides, and only very few are fixed at the top hanging downwards, positions that will apply as well for the larva that hatches. The young larvae are virtually immovable, and the older ones seldom change their positions. In FIG. 2 is shown a portion of nest 8 of colony II with the positions of the mature larvae indicated by arrows. The darkened cells have pupae. These are daily records taken at about 9 hrs. between 16.2.1964 and 26.2.1964. Observations made at 3-hour intervals during a day likewise did not indicate frequent changes in position. Most of the larvae lie on their backs projecting their mouths upwards, a position more convenient for receiving food from the adults. However, at the time of spinning its cocoon, the larva rotates freely to enable its mouth to reach the entire rim of the cell.

I thank Prof. G. Grümmer of Greifswald for taking the photograph and Mr. S. K. De of the above Institute for the inked drawing.

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Number 19

BUTTERFLIES OF LIBERIA

By Richard M. Fox, Arthur W. Lindsey, Jr., Harry K. Clench and Lee D. Miller

402 pages of text; colored frontispiece, 233 figures, 2 graphs, 2 tables, 3 maps, table of contents, full bibliography and a taxonomic index.

With 195 new records, this study increases the known butterfly fauna of Liberia from 280 to 475 species and another 254 species are noted as probably to be found. Two new tribes, 5 new genera, 13 new species and subspecies are described. Illustrations include photographs and, where pertinent, drawings of genitalia of all holotypes, along with photographs and drawings of closely related forms for comparison. The distribution of each species is given and those more difficult to identify or previously confused are treated at greater length. All known records from Liberia are noted. A 46 page introduction details climatic conditions and biotopes in Liberia and analyzes the zoogeographic and ecologic relationships of the butterflies of Liberia and of Occidental Africa.

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