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Volume 57

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THREE NEW SPECIES OF NEW GUINEA CULEX, SUBGENUS LOPHOCERAOMYIA, WITH NOTES ON OTHER SPECIES

(DIPTERA, CULICIDAE)

By WILLARD V. KING[1] and HARRY HOOGSTRAAL[2]

The material herein described was collected by the writers and other members of the 19th Medical General Laboratory, U. S. Army, while stationed at Hollandia on the northern coast of Netherlands New Guinea during 1945. The collections contained a number of other undescribed species but, unfortunately, part of the material was spoiled by mold or lost in transit and naming of the species from the remaining specimens does not appear desirable. All of the material is deposited in the U. S. National Museum.

Culex (Lophoceraomyia) kuhnsi, new species

Male.—Head with a median triangular area of narrow-curved scales intermixed with upright forked scales, a patch of broad appressed scales on each side and extending as a line along eye margins. Proboscis dark, 1.2 times the length of fore femur. Palp just equal the length of the proboscis, without forked process at base; apical segment with only three bristles near tip; long segment with a row of short bristles below. Antenna (fig. 1a) with minutely pilose projection or prominence on inner surface of torus; segment 6 with six or seven slender bristles or bristle-like scales; segment 7 with a tuft of about 12 flattened scales; segment 8 with a group of about 8 short crumpled scales and 3 longer broader ones; segment 9 with about 10 bristles and a group of minute spines at base; segments 10 and 11 apparently without modified hairs. Scutum and scutellum with fine bronzy scales; pleura without scales; one lower mesepimeral bristle present. Wings with lateral scales of veins 2-4 long and narrow; forks of vein 2 almost 1.5 times as long as its petiole. Legs and abdominal tergites entirely dark scaled. Genitalia: Basistyle (fig. 1b) with an inner row of four bristles. Subapical lobe with a broad leaflet, a long stout bristle, several shorter setae, and

[1]Ft. Lauderdale, Fla.
[2]U. S. Naval Medical Research Unit No. 3, Cairo, Egypt.

a proximal group of three rods, two of which have hooked tips. Disti-style slightly curved, evenly tapered to tip; appendage attached sub-apically, long, angled at tip. Proctiger (fig. 1c) with a compact group of small bristles apically. Lateral plate of mesosome (fig. 1d) with a serrated margin, a spinose apical knob and a stout basal arm curved and tapered to a blunt point.

Female.—Palpi and antennae normal; scaling similar to male.

Larva (Fig. 1e).—Antenna straight, long with needle-like spicules on basal half of shaft; hair tuft arising three-fourths of distance from base, with about 20 branches. Preclypeal spines usually with one or two lateral spinules. Upper and lower head hairs (C and B) usually 3-branched, sometimes double, plumose. Thorax and abdomen densely pilose. Lateral comb of segment VIII consisting of a patch of from 35 to 45 elongate, fringed scales. Siphon slightly tapering from base and often very slightly curved just beyond middle, about 8 times as long as width at base; pecten of 14 to 19 teeth, the apical tooth or two somewhat removed from the others, each tooth with 3 or 4 large lateral denticles; three or four pairs of posterior hairs, 2- to 4-branched, each pair from 1 to 2 times as long as width of siphon at point of attachment. Anal segment completely ringed by a pilose plate, posterior margin with dense row of long thin spines; dorsal subcaudal hair with 3 or 4 unequal branches, ventral hair single; anal gills equal, slender, tapered to a point, about twice as long as saddle.

Types.—Holotype: ♂ (Lot 766C), reared from larvae from shaded tree hole in open coastal hillside woods, Doromena, Hollandia area, Netherlands New Guinea, February 28, 1945 (H. Hoogstraal and W. B. Christ, collectors). Paratypes: 9 ♂, 5 ♀, and 19 larvae, or exuviae, as follows: 2 ♂, 1 ♀ (428), reared from larvae from tree hole, rain forest, 250 feet elevation, Hollandia, December 15, 1944 (W. T. Nailon); 1 ♂ and associated larval skin (695-6), from shaded tree hole, sparse coastal forest just east of Nakasawa village, Hollandia area, February 12, 1945 (H. Hoogstraal); 1 larva (745) from tree hole at Doromena, February 25, 1945 (D. Johnson); 1 ♂ (763F) from larva from hole in coconut tree, Sapari (coastal) village, Hollandia area, February 26, 1945 (W. B. Christ); 2 ♂, 1 ♀, 5 larval exuviae (764) from larvae from hillside tree hole, Doromena village, February 27, 1945 (W. B. Christ); 1 ♂, 3 ♀, 5 larval exuviae (766C), same data as holotype; 2 ♂ and 2 larval exuviae (773), from larvae from large tree hole, Cyclops Mountains above Doromena village, elevation about 2,500 feet, March 1, 1945 (W. R. Fullem and H. Cook); 5 larvae (887), from fallen palm bracts, rain forest, elevation 250 feet, Hollandia, March 19, 1945 (H. Hoogstraal).

One ♂ and 1 ♀ (lot 346), from log hole, Hollandia, November 11, 1944, also identified as this species.

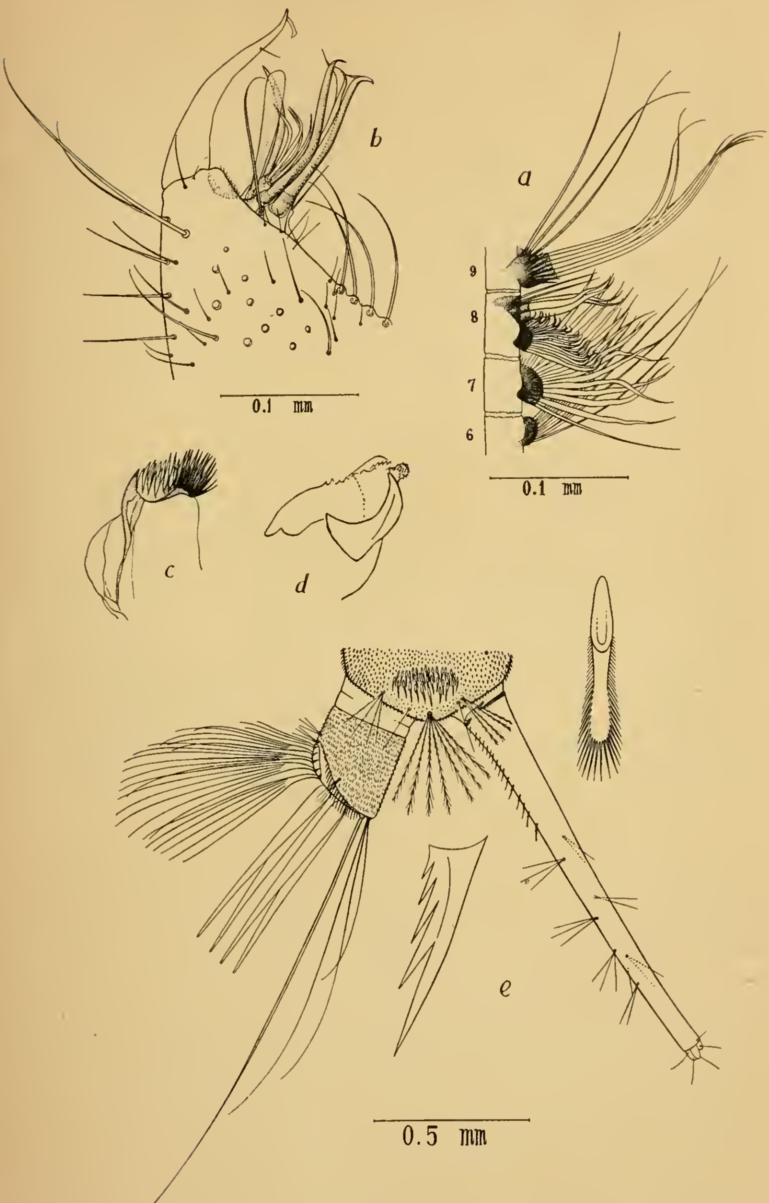


Fig. 1, *C. kuhnsi*, n. sp. :*a*, male antenna, segments 6-9; *b*, apical portion of basistyle; *c*, proctiger; *d*, lateral plate of mesosome; *e*, posterior segments of larva.

Almost all of the specimens came from tree holes in the light coastal woods near villages in the Hollandia area, though one collection was from 2,500 feet elevation. A single collection of five larvae was made from a palm bract in the rain forest at 250 feet elevation at Hollandia, and another from a tree hole in the same place. Breeding in association with this species were larvae of *Aedes* (*Stegomyia*) *albolineatus* (Theob.), *A.* (*Finlaya*) *notoscriptus* (Skuse), *A.* (*F.*) *hollandius* King and Hoogstraal, *Culex* (*Neoculex*) *brevipalpis* (Giles), *Tripteroides bimaculipes* (Theob.), and *Megarhinus splendens* (Wied.)

The species is named in honor of Dwight M. Kuhns, Colonel, Medical Corps, U. S. Army, Commanding Officer, 19th Medical General Laboratory.

This species belongs to the *mammilifer* group (group C) of Edwards because of inner projection on torus. It is closely related to *C. uniformis* Theob. of India because of the densely pilose larva, but differs in reduction of male antennal processes, much shorter male palpus, differences in number of sub-basal appendages of coxite as well as differences in shape of style, apical appendage of style, leaflet of subapical lobe, and the mesosome. It is closely related to *mindanaoensis* Baisas of the Philippines, with the types of which it was compared by the junior author. The lateral arm of mesosome (median process of Baisas), however, is quite different, being a smooth curved arm in *kuhnsi* but club-shaped and with serrated or toothed border in the Philippine species. The male palpus of *mindanaoensis* is slightly longer and segment 10 of the antenna has a few modified hairs.

Culex leei, new species

Male.—Head with broad appressed grayish scales, a median triangular patch of narrow curved scales not reaching eyes at vertex; palp slightly longer than proboscis, with forked process at base, the two apical segments with only a few bristles. Antenna (fig. 2a) without prominence on torus; segment 6 with a group of about 12 scales, the first 4 or 5 flattened but sharp-pointed and the rest somewhat longer, hair-like; segments 7 and 8 with the usual crumpled scales; segment 9 with about 7 flattened bristles; segment 10 with 2 flattened blade-like bristles terminating in a long slender tip; segment 11 with a group of 5 or 6 hair-like bristles. Scutum and scutellum with fine brownish scales; sternopleuron without scales; lower mesepimeral bristle present. Abdominal tergites uniformly dark scaled. Genitalia (fig. 2b): Basistyle with a row of 4 bristles on inner side; subapical lobe with 2 small leaflets, several short bristles and a proximal group of three stout rods, one unusually broad apically, the tips of all three somewhat hooked. Lateral plate of mesosome with a prominent slender arm, slightly curved, and a small tooth on the plate near base of the arm; proctiger slender, straight, with several minute bristles subapically. Ninth tergite lobed, each with 7 or 8 bristles.

Female.—Similar in coloration to male; palpi and antennae normal.

Larva.—Very similar to other larvae in this group except for longer anal gills. Lower head hair 2-branched, upper hair 2- or 3-branched; lateral hairs of abdominal segments 3-5, mostly 4-branched; comb a patch of slender scales, evenly fringed around tip. Air tube about 8 x 1 with about 12 pecten teeth, fringed on one side to tip; four pairs of small hair tufts, usually 3-branched. Anal segment longer than wide, completely ringed; lateral hair small, 2-branched; dorsal sub-caudal hair with 1 long and 1 short branch, the lower hair long and single. Anal gills long, slender, about twice the length of the segment.

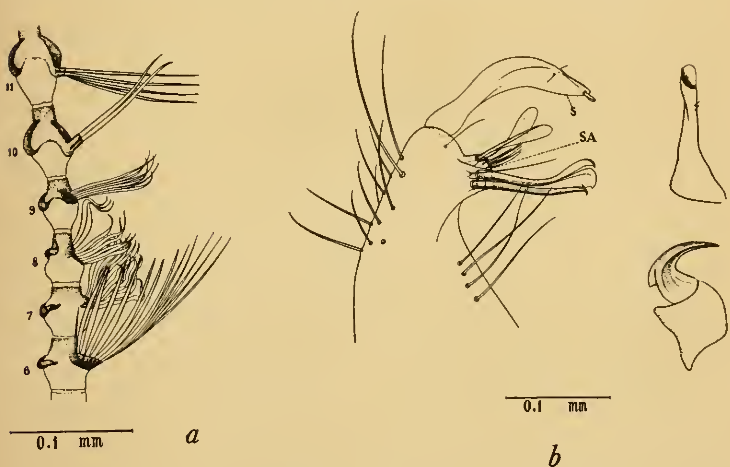


Fig. 2, *C. leei*, n. sp. :*a*, male antenna, segments 6-11; *b*, basistyle, proctiger, and lateral plate of mesosome.

Types.—Holotype: ♂ (1063-3), with slide mounts of genitalia, both antennae and larval and pupal skins; reared from larva collected from "Roseboom pond" near Pollimac road, Hollandia, Netherlands New Guinea, May 5, 1945 (H. Cook, collector). Paratypes: Two ♀, lot 1063-1 and -2, with associated slide mounts of larval skins, and one larval skin of 1063-5, same data as holotype; one ♂ lot 666 (now badly molded) with slide mount of whole head, and slide mount of genitalia and antenna of another male from same lot (rest of specimens lost), reared from larvae collected in a large log hole near Army hospital area, Hollandia, February 5, 1945 (G. L. Love).

This species belongs to the *fraudatrix* group but differs from other Oriental and Australasian species known to the writers by the combination of the characters of the male antennae and genitalia. *C. fraudatrix* differs in having the scales of the 6th segment much broader and bluntly rounded at tip, the lateral plate of the mesosome has a large second arm distally, somewhat knobbed at tip, and the proctiger has a smooth thumb-like tip beyond the row of bristles. *C. hilli* Edw. differs in having only 4 or 5 rather short scales, all except one of which are almost hair-like; the pleurae were said to have small patches of pale scales and the abdominal segments small basal lateral spots. *C. hilli buxtoni* Edw. was described as having 12 very narrow but blunt-ended scales on segment VI and 3 or 4 hair-like scales on segment X (versus sharp-pointed scales on VI and 2 blade-like scales on X).

The species is named in honor of Mr. T. G. Lee who has contributed much to the knowledge of Australasian Culicidae.

Culex (Lophoceraomyia) marksae, new species

Male.—Head with broad appressed scales separated by a median triangular patch of narrow-curved scales extending nearly to eyes at vertex; palp with forked process at base; longer than proboscis by slightly more than the length of the apical segment; last two segments with numerous long bristles; long segment with a row of short bristles below. Torus without a prominence; segment 6 with a fan of about 15 long scales, an upper and lower group of broad, very dark, bluntly tipped scales separated by 3 to 5 narrower pale scales; segments 7 and 8 with the usual crumpled scales and segment 9 with a group of longer, curved scales; segment 10 with 3 stout bristles and 3 or 4 blade-shaped scales ending in a long slender tip; segment 11 with 2 long bristles. Scutum and scutellum with fine brownish scales; pleura unscaled; one lower mesepimeral bristle present. Abdominal tergites entirely dark scaled. Genitalia: Inner margin of basistyle (fig. 3a) with a row of 3 or 4 bristles; subapical lobe with 2 fairly broad leaflets, 2 small setae and a proximal group of 3 rods, 2 with hooked tips and the other very broad apically; lateral plate of mesosome (fig. 3b) with the usual large hooked arm; proctiger (fig. 3c) with a subapical row of small bristles or spines and extended distally into a stout, curved, bluntly pointed tip; lobes of 9th tergite (fig. 3d) each with 8 to 10 bristles.

Female and larva unknown.

Type.—Holotype: ♂, taken in light trap at edge of rain forest, elevation 250 feet, Hollandia, Netherlands New Guinea, April 23, 1945, King and Hoogstraal, collectors.

This species belongs to the *fraudatrix* group but differs from the other known members by the bicolorous fan on the 6th antennal segment, by the presence of two kinds of modified bristles on segment 10, and by the shape of the tip of the proctiger which is more pointed and curved than in *fraudatrix.* From the latter it differs also in the absence of pale spots on the abdomen.

The species is named in honor of Dr. Elizabeth N. Marks who has added a great deal to the knowledge of Australasian Culicidae.

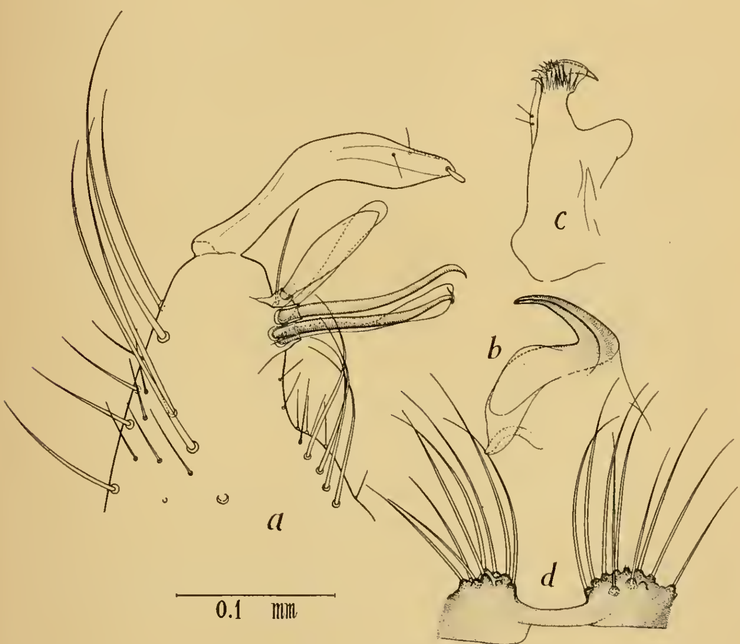


Fig. 3, *C. marksae,* n. sp. :*a,* basistyle; *b,* lateral plate of mesosome; *c,* proctiger; *d,* 9th tergite.

Culex (Lophoceraomyia) ornatus (Theobald)[1]

Melanoconion ornatus Theobald, 1905, Ann. Mus. Nat. Hung., 3:100. Type female, Friedrich-Wilhelmshafen, New Guinea.

This species apparently has not been recognized since it was first described under the genus *Melanoconion.* Edwards (1924) stated, "The figure of the wing suggests a species of

[1]Dr. Alan Stone has called our attention to the fact that this name is not a primary homonym of *Culex ornatus* Meigen 1818 since it was originally described in another genus and Meigen's species has been placed as a synonym of *Aedes geniculatus.* Under the rules adopted at Paris and Copenhagen no change in name is necessary.

the subgenus *Lophoceratomyia*." A fairly common species of this subgenus taken by us in the Hollandia area was identified as *ornatus* since the female characters agreed with Theodbald's description. An excerpt is given below of Theobald's description of the female, followed by a description from our series of the male and larvae, which were previously unknown.

Female.—Head with small dusky curved scales, some dull yellowish ones in the middle, dusky gray flat ones at the sides, a few dusky and dull ochreous upright forked ones. Palpi and probocis black. Thorax deep chestnut-brown with very small narrow-curved scales, two pale-scaled lines on the posterior half running down to the scutellum, golden scales at the sides in front of the wings and extending to the head and some golden scales in front. Scutellum brown with pale creamy narrow-curved scales. Pleura brown with yellowish tinge. Abdomen with basal creamy lateral spots which on some segments nearly meet to form indistinct basal bands. Legs deep brown, ungues small, equal and simple. Wings with brown scales, fork-cells short, the first submarginal with dense thick scales, also the first longitudinal and to same extent the third long vein. Described from a single female.

Unmentioned in the original description is the presence of a lower mesepimeral bristle and a row of pale scales along the upper and posterior margins of the sternopleuron. In our series the pale-scaled lines on the posterior half of the scutum are usually not very definite.

Male.—Similar to female except as follows: palp longer than probosis by length of apical segment; last two segments turned sharply upwards, with a dense row on each side of long, dark bristles; a hairy, forked process at base of palp. Antenna (fig. 4a) strongly plumose, without a prominence on torus; segment 6 with a large fan consisting of 18 or more long scales, the upper two thirds of which are dark, broad, and broadly rounded apically, the remaining scales being narrow, more pointed, and paler in color, especially basally; segment 7 with a short wavy tuft and 3 longer pointed scales, segment 8 with a short matted tuft and with 3 or 4 longer scales which are bowed at right angles distally, segment 9 with a tuft of 5 long, subapically curved hairs; segment 10 with 5 long, thickened hairs and 6 blade-like scales with narrow apical prolongations along one side; segment 11 with about 6 long, dark, slightly curved thickened hairs. Genitalia: Ninth tergite with shoulders bearing a few weak setae. Proctiger (fig. 4c) with a rounded, smooth tip and a single row of small graduated spines subapically; mesosome (fig. 4d) consisting of a pair of curved, flattened plates tapered to a narrowly rounded tip, a narrow sharp retrorse projection on the distal border, a row of small spines near base on outer border. Basistyle (fig. 4b) about twice as long as mid width, outer surfaces clothed with fine spicules and short and medium long setae; inner margin with a row of five strong setae. Subapical lobe prominent, with 11 appendages which fall into three groups, the proximal group consisting of 3 heavy, curved rods with enlarged hooked tips and a single stout seta, the second group with a large leaf-like spine, 2 smaller, flattened spines, and 2 setae, the third group a single large leaflet and a single seta. Dististyle three-fourths as long as coxite, curved nearly at right angles, broadest at apical third and tapered to a narrowly rounded tip, a pair of short hairs at apical fourth and a row of very short hairs between this pair and apex on outer surface; claw attached slightly before tip, short, rounded.

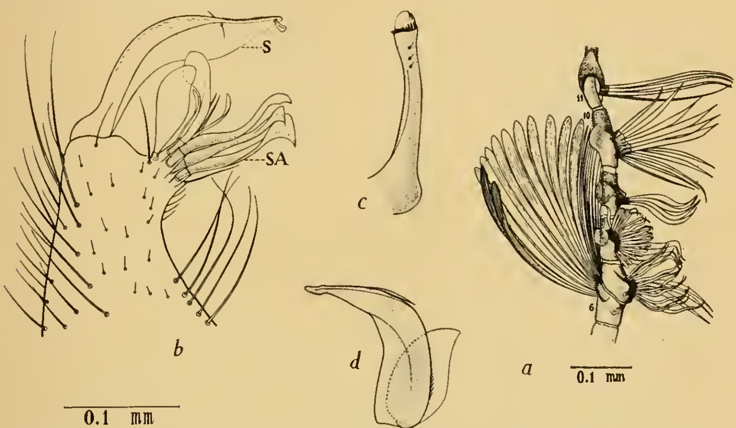


Fig. 4, *C. ornatus* (Theob.) :*a*, male, antenna, segments 6-11; *b*, basistyle; *c*, proctiger; *d*, lateral plate of mesosome.

Larva.—Antenna about as long as head, straight, narrow, with numerous spicules between base and hair tuft; hair tuft arising almost three-fourths distance from base, multibranched. Preclypeal spines about one-fifth as long as antennae, moderately thickened. Upper and lower head hairs usually 2-branched, the upper sometimes 3-branched on one side. Thorax covered with fine spicules, upper meso- and metathoracic pleural hair tufts long, with 5 to 8 plumose branches. Upper lateral hairs of abdominal segments I to IV with 2 or 3 branches, segment V with 3 or 4 branches. Segment VIII with lateral comb of from 34 to 46 narrow, elongate, fringed scales. Siphon long and narrow, widening slightly at tip; ratio 6 or 7 x 1; prominent acus present; from 9 to 14 pecten teeth on basal third, each with a fringe of denticles along the entire length of one side; four or five pairs of single to 3-branched ventro-lateral hair tufts on apical three fourths, not longer than width of siphon. Anal segment elongate, cylindrical, completely encircled by saddle; saddle with minute spicules posteriorly; lateral hair 3-branched; dorsal sub-caudal hair with 3 branches, ventral one single; anal gills equal, about as long as saddle, strongly tapered to a narrow, rounded point apically.

The rich, dark bronzy brown scales on the scutum, especially dense over the fossae and lateral surfaces, are distinctive among the New Guinea *Culex.* The pale scales along upper and posterior borders of sternopleuron and the large lateral abdominal spots extending at least a short distance onto dorsum and usually forming nearly a complete band are also distinctive. The large fan of scales on the sixth antennal segment is similar to that of *C. fraudatrix.*

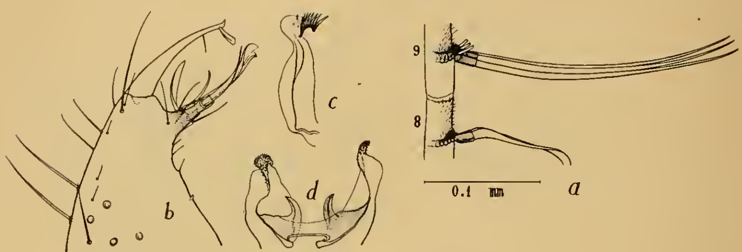


Fig. 5, *C. digoelensis* Brug: *a,* male antenna, segments 8 and 9; *b,* basistyle; *c,* proctiger; *d,* mesosome.

The larva is similar to that of *C. fraudatrix* from which it can be separated by the spiculated thorax. Living specimens of *ornatus* larvae could be distinguished from those of *fraudatrix* by the larger size, uniformly darker color (one abdominal segment not pale as often noted in *fraudatrix*), and by the absence of the dark siphonal band usual in *fraudatrix.*

Adults of this species were frequently encountered in the Hollandia area but larvae were seldom taken. Twenty-two larvae, from which 10 males and 8 females were reared, were taken from a deep hole, completely shaded by grass, in the laboratory clearing in March 1945 along with larvae of *Aedes* (*Aedimorphus*) *alboscutellatus* (Theobald), *Culex* (*Culiciomyia*) *pullus* (Theob.), *C.* (*Lutzia*) *halifaxi* (Theob.) and *Uranotaenia* sp. The previous day two larvae were taken from a partly sunlit, muddy, leaf-filled seepage pool at the edge of a sago swamp, along with *Culex pullus* and *Uranotaenia* sp. In February several larvae were taken in the hoof print of a boar in a dark sago swamp. On several occasions between December 1944 and February 1945 males and females were taken by various members of the laboratory resting among the buttresses of large trees deep in the rain forest. Two females were taken "while attempting to bite," one in the afternoon in the rain forest and one in a tent early in the evening. A light trap operated for 115 nights between January and June 1945 at the edge of the rain forest yielded 85

♂ and 138 ♀, while another operated for 76 nights during the same period in the large laboratory clearing yielded 19 ♂ and 52 ♀ specimens.

Culex (Lophoceraomyia) digoelensis Brug

Culex (*Lophoceraomyia*) *digoelensis* Brug, 1932, Bull. Ent. Res. 23: 81-82. Female and male described from Upper Digoel River, South New Guinea.

This species was described as having the pleurae all black, abdomen and legs with dark brown scales only, male palpi about one-third longer than the length of the proboscis, and the antennal ornamentation as in *C.* (*L.*) *infantulus* Edwards, 1921. The description of the genitalia was as follows: "Hypopygium differing from that of *C.* (*L.*) *infantulus* as described by Edwards (Ind. Jl. Med. Res., X, 1921, p. 287) by having tubercular, not spinose, lobes on the mesosome, with rounded tips; moreover the 10th sternite has no membranous projection, but one stout spine, three smaller but well developed spines and three minor spines; the bases of the lobes of the mesosome with a medially directed hook." In the original brief description of *infantulus,* however, Edwards stated that the mesosome had a tubercular surface so it appears that Brug must have intended to say that *digoelensis* had spinose, not tubercular, lobes. A specimen collected by us in a light trap at Hollandia on January 19, 1945, has a rounded spinose apex on the lateral plate of the mesosome and in view of the above supposition was identified as *digoelensis* since the other characters agree with Brug's brief description. Segment 8 of the antenna has two short bristles, and segment 9 three long bristles closely appressed, which agree with Edward's description of *infantulus.* Drawings of the antennal and genitalic characters of our specimens are shown in fig. 5, since illustrations of the species have not previously been published.

ADDITIONAL DATA ON SABETHINI
(Diptera, Culicidae)

By J. Lane[1] and O. R. Causey[2]

When we had the opportunity of studying a collection of Sabethini made in Passos, State of Minas Gerais, Brazil, during the years 1946 to 1949, hitherto undescribed males, pupae, and larvae of five known species were encountered. These are described in the present paper. The material on

[1] From Departamento de Parasitologia, Faculdade de Higiene Saúde Pública da Universidade de São Paulo, Brazil.
[2] Division of Medicine and Public Health, Rockefeller Foundation, Rio de Janeiro, Brazil.

which these descriptions are based was collected in the course of epidemiological field studies on sylvan yellow fever in Ilhéus, Bahia, and Passos, Minas Gerais. These studies were made under the auspices of the International Health Division of the Rockefeller Foundation and the Ministry of Education and Health of Brazil.

Wyeomyia (Davismyia) petrocchiae (Shannon & Del Ponte, 1927)

Figs. 1, 2, 3

The material studied comprises ten males, three pupal exuviae and two larval skins.

The larva of this species is, due to the hypertrophied maxilla, in a group with *W. confusa* (Lutz). In the key given by Lane (1953) it should be placed in a separate dichotomy together with *W. confusa.*

Male.—Similar to the female except for the following characters: Proboscis ventrally white on basal two-thirds, more so in the middle; palpus slender; antenna with slightly denser plumosity than in female. Mesonotum with reddish-green, metallic sheen; legs dark, femora yellow on whole length ventrally; tarsi dark, scales lighter coppery ventrally on fore and mid pairs; tarsi IV and V of mid pair thickened and differentiated; claw simple.

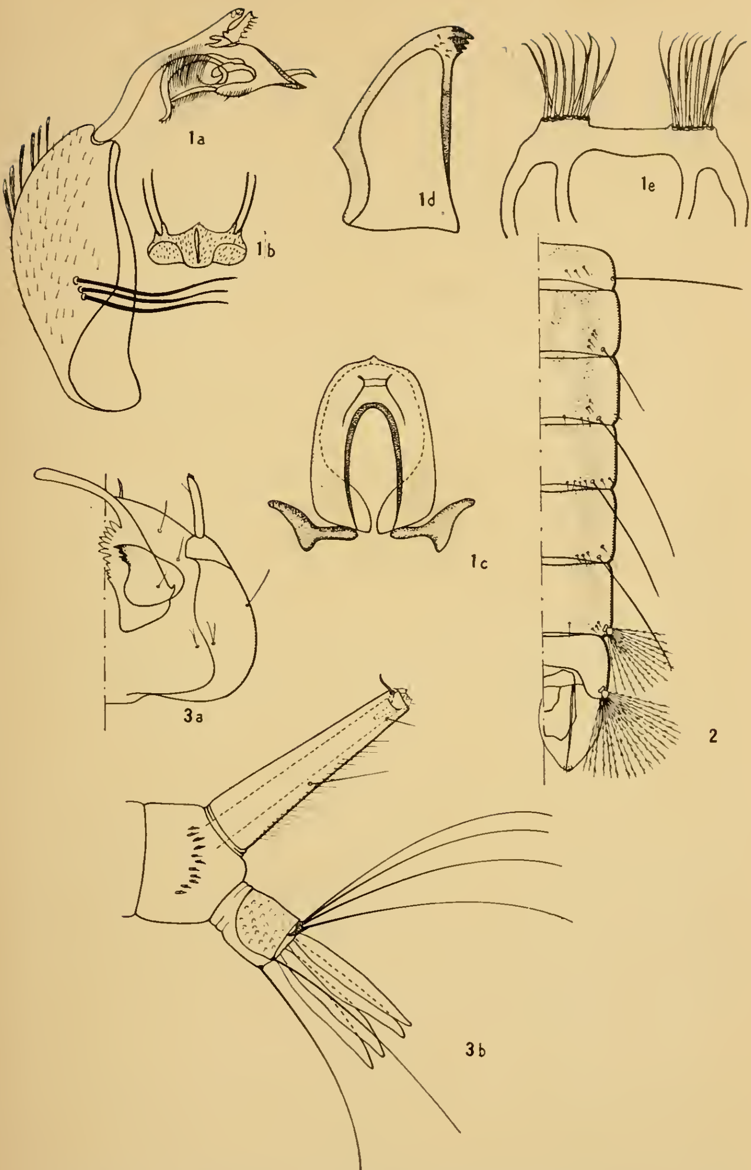
Genitalia, fig. 1: Basistyle twice as long as broad, attenuated apically, with three long setae placed close together in the middle and diagonally; middle plate spiculose, with two lateral setae inserted on mamillate protuberances; dististyle with slender, curved stem and complex lobes at apex, as shown in the figure. Tenth sternite with three larger and two smaller apical teeth and a few spicules. Mesosome ovate, the anterior opening large. Ninth tergites with the interlobar space broad, plane, each lobe with a double row of nine or ten setae which are curved outwards.

Pupa.—Tube short, slightly expanded at base. Cephalothoracic hairs with an evarage triple seta and a long double one, the others short.

Abdomen, fig. 2: Darker in the middle. Hairs A of segment II and B of segments IV to VI nearly twice as long as respective segments. Hair B of III shorter or longer than the length of segment. Tuft A of VII definitely smaller than that of VIII, both black. Paddle one and a half times the length of segment VIII, rounded and coarsely spiculose at apex.

Larva.—Fig. 3. Head broader than long, hairs short, simple except occipitals which are double. Antenna short, with a small single hair at the distal third. Maxilla hyperthrophied, as long as head, with a slender long apical horn which is thickened at apex; internally with rows of teeth, as in fig. 3.

Body nude, hairs long. Prothoracic formula m.m.l.m. (all small), m.l.m. (all stout and long. Pecten of segment VIII with an irregular row of about sixteen to twenty pointed scales. Siphon less than four times its basal width, nearly uniform; false pecten from near base to



Wyeomyia (*Davismyia*) *petrocchiae* (Shannon & Del Ponte, 1928). Fig. 1, male genitalia: a, basistyle and dististyle; b, median plate; c, tenth sternite; d, mesosome; e, ninth tergite; fig. 2, pupa, abdominal segments II to apex, dorsal; fig. 3, larva; a, head and b, terminal abdominal segments.

apex; a single moderate ventral hair. Anal segment with the plate saddle shaped and uniformly spiculose; dorsal setae (3+1); lateral and ventral setae single, all setae long. Gills four, long and pointed.

Type.—A male specimen with corresponding larval and pupal exuviae has been selected as the allotype of this species. It is registered in the collections of the Departamento de Parisitologia da Faculdade de Higiene e Saúde Pública, under number 9.378.

Wyeomyia (Dendromyia) knabi Lane & Cerqueira, 1942

Figs. 4, 5

We have two slides from Bahia, Ilhéus, Pirataquissè. The material was determined by G. V. Santos in 1944; the adults were not examined by us. As the pupa and larva of this species have not been described we give their descriptions below.

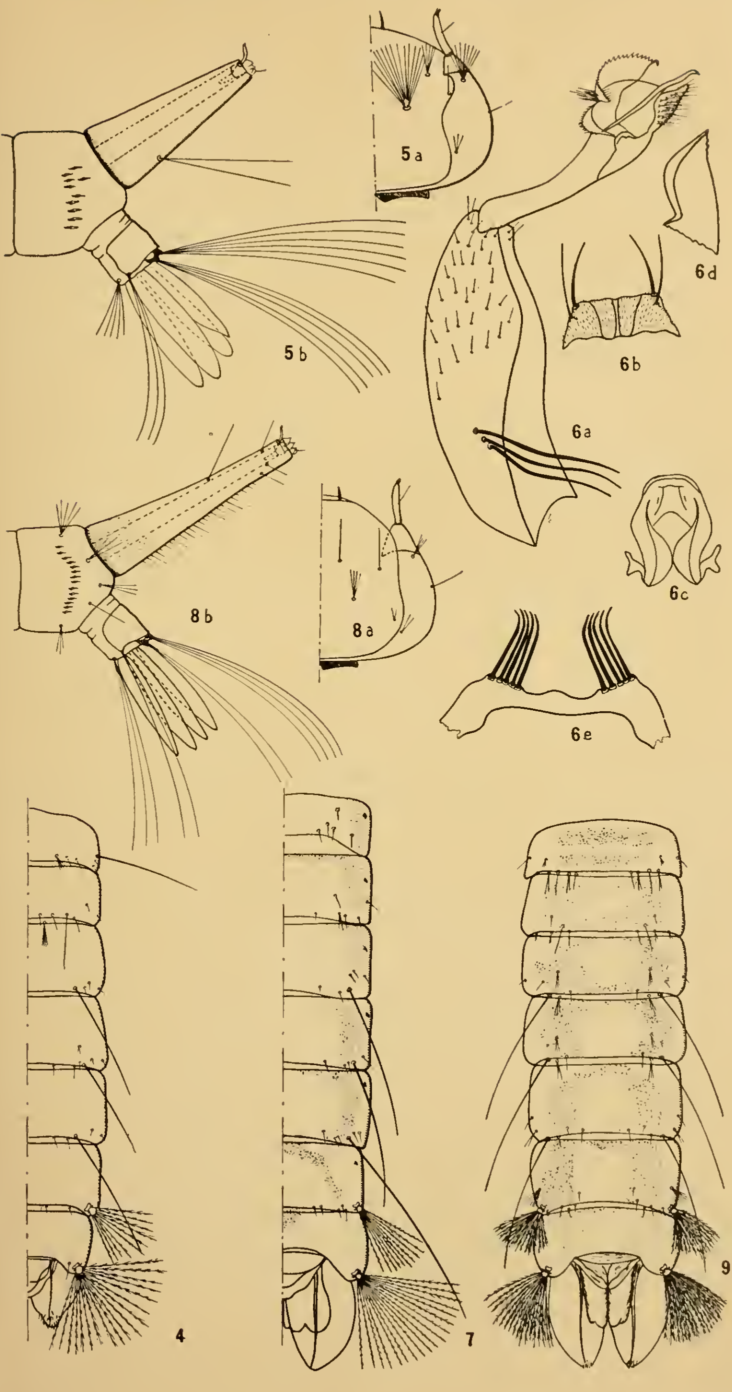
Pupa.—Tube slender, thickened in the middle and expanded at apex. Cephalothoracic hairs a long double or triple and a long five or six branched tuft, the other hairs small.

Abdomen, fig. 4, narrowly darkened at base of segments III to VII. Hair A of II and B of VI about twice as long as respective segments. B of III two-thirds the length of segment. C of II and III in tufts one-third the length of segment. Tuft A of segment VII less than half the size of that of VIII. Paddle the size of segment VIII, subtriangular, spiculose at apex.

Larva.—Fig. 5. Head rounded; antenna very small, a single mesial hair; head hairs multiple or single, as in figure.

Body nude. Prothoracic hair formula m.l.m. (small, slender), m.l.m.m. (large and long). Comb of segment VIII of about 10 free scales in an irregular row. Siphon slightly more than twice its basal width, attenuated apically, with a long double ventral hair on basal third. Anal segment with the plate saddle shaped, smooth; dorsal hairs (6, 5); lateral hair three or four branched, both long; ventral tuft of five small hairs in a tuft. Gills about three times the length of anal segment, broad and rounded at apex.

Wyeomyia (*Dendromyia*) *knabi* Lane & Cerqueira, 1942. Fig. 4, pupa, abdominal segments II to apex, dorsal; fig. 5, larva; a, head and b, terminal abdominal segments. *Sabethes* (*Sabethes*) *belisarioi* Neiva, 1908. Fig. 6, male genitalia: a, basistyle and dististyle; b, median plate; c, tenth sternite; d, mesosome, e, ninth tergite. *Sabethes* (*Sabethoides*) *glaucodaemon* Dyar & Shannon, 1925. Fig. 7, pupa, abdominal segment II to apex, dorsal; fig. 8, larva; a, head and b, terminal abdominal segments. *Sabethes* (*Sabethoides*) *chloropterus* (Humboldt, 1820). Fig. 9, pupa, abdominal segments II to apex, dorsal.


5a
5b
6a
6b
6c
6d
6e
8a
8b
4
7
9

Sabethes (Sabethes) belisarioi Neiva, 1908

Fig. 6

We have a single male, from Minas Gerais, Passos.

Male.—Similar to female even as to length of palpus and plumosity of antenna, although these may be slightly denser.

Genitalia, fig. 6: Basistyle nearly three times as long as wide, nearly uniform, three setae below middle; median plate spiculose, quadrate with two lateral setae, one over the other. Dististyle shorter than basistyle, a smooth basal arm of average size, apical structures forming a moderate knob, as in the figure. Tenth sternite with two or three very inconspicuous teeth. Mesosome as in the figure, small. Ninth tergite with broad, interlobar space which is protuberant in the middle, each lobe with five setae which are thick and turned outwards.

Type.—The single specimen has been selected as the allotype of this species and is registered in the collection of the Departamento de Parasitologia e Higiene Rural da Faculdade de Higiene under number 9.367.

Note.—This species would be placed in dichotomy 15 of the key by Lane (1953), but can be differentiated by the much smaller knob on dististyle, without the long lateral lobe, the setae of basistyle (which are close together), and the absence of teeth on the tenth sternite.

Sabethes (Sabethoides) glaucodaemon Dyar & Shannon, 1925

Figs. 7, 8

Our description is based on three larval and pupal exuviae. All come from the State of Minas Gerais, Passos, March and August 1946.

Pupa.—Fig. 7. Tube darkened, uniform, a little broadened at base and apex. Cephalothoracic hairs double, in two pairs, long. Other setae small.

Abdomen slightly darkened as in the figure. Segments IV to VI with hair B longer than segment. Tuft A of segment VII smaller than of VIII. Paddle nearly twice the length of segment VIII, nude.

Larva.—Fig. 8. Head with hairs small, as in figure. Antenna very short with a hair in the middle. Maxilla long and with a black pointed apical tooth.

Body nude. P.h.f. 2.1.2. (very small) m.m.m.? (large). Lateral comb of segment VIII of a single free row of approximately thirteen scales. Tube about four times as long as wide; false pecten over most of the length of tube; two dorsal and two ventral setae. Anal segment not ringed by the plate, dorsal hairs (4+2); lateral hair double; ventral tuft triple. All these hairs long. Gills two and a half times as long as anal segment, broad and blunt at apex.

Sabethes (Sabethoides) chloropterus (Humboldt, 1820)

Fig. 9

We have a male which is, in the adult, slightly different from the one which we described (Lane, 1953). The proboscis is dark underneath and the palpus has white scales dorsally and is very short. As only the pupa has not been described we append below a description.

Pupa.—Tube nearly uniform, average, slighty expanded at base and apex. Cephalothoracic hairs double, long and in two pairs, the rest small.

Abdomen, fig. 9, slightly marked on segments, as in the figure. Segments IV to VI with hairs B longer than segment. Tuft A of segment VII quite smaller than that of VIII. Other hairs small. Paddle twice as long as segment VIII, spiculose at apex.

This pupa is described from a slide which has a pupal and larval exuviae. The material was determined by G. V. Santos and comes from the State of Bahia, Ilhéus, Pirataquissè, 29.IX.1949.

The larva has a tube about five times as long as basal width so that this character is not useful for the separation of this species from *S. purpureus* Peryassu and *cyaneus* (Fab.).

Reference

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CULEX (CULICIOMYIA) TERMI, AN UNUSUAL NEW MOSQUITO FROM THAILAND

(Diptera, Culicidae)

By †Deed C. Thurman, Jr.[1, 2]

In the course of mosquito collecting in Ngao District, Lampang Province, Northern Thailand, during July, 1952, the author was much surprised to collect larval specimens of a *Culex* that were most unusual in that the siphon of each

[1]Sanitarian, Division of International Health, United States Public Health Service, assigned as Regional Malaria Control Adviser for Northern Thailand with the U.S.A. Operations Mission to Thailand of the Foreign Operations Administration. Due to the sudden death of the author on April 18, 1953, from illness contracted while on duty in Northern Thailand, the responsibility of completing this paper and others was undertaken by Mrs. Ernestine B. Thurman, Senior Assistant Sanitarian (R), Division of International Health, USPHS, assigned as Malaria Control Training Adviser, USOM to Thailand, FOA.

[2]I wish to thank Dr. Alan Stone, U. S. National Museum, and Dr. Melvin E. Griffith, USOM to Thailand, FOA, for making it possible for me to complete this study and for reviewing the manuscript.—Ernestine B. Thurman.

fourth instar larva was more than twice the length of its body. On return to the laboratory it was found that the siphons measured between 11 and 12 mm. Later studies have revealed that the length of the siphon of almost all fourth stage specimens is 39 to 40 times its width at the base and more than 78 times its width at the most apical pecten tooth which is located at a basal point 1/13 of the total length. Due to the efforts of Dr. Term Vejarasthira and his assistant, Mr. Chalao Dangswasti, who reared males and females from larvae collected later at the same location, it is possible to present a complete description of this species.

The species exhibits morphological characters of the subgenus *Culiciomyia*: the palpus of the male is much longer than the proboscis; the penultimate segment is noticeably shorter than the terminal segment; there is a peculiar row of translucent, elongated, diamond-shaped scales projecting downward from the long segment of the palpus; there is one lower mesepimeral bristle present.

Culex (Culiciomyia) termi, new species

Adult small, fragile, pale yellowish-tan, sometimes with a pale greenish tinge.

Male.—Head: Dorsal surface with numerous narrow, pale, curved setae and upright narrow pale forked scales on vertex and nape; a patch of pale, flat scales around a central patch of darker scales on either side, the light scales continue dorsally around the eyes in a narrow border but seem not to meet centrally. Torus light yellowish-tan without a prominence on inner side. Antenna with complete whorls of long yellow hairs on each segment. Palpus about 1 1/5 length of proboscis; pale scales on long segment except at apex; antepenultimate segment dark scaled at apex and on dorsal surface; penultimate segment light scaled at basal 1/3 and on ventral surface; terminal segment pale scaled. Proboscis pale scaled with few dark scales at base and apex; a tuft of long pale hairs placed medio-ventrally. Clypeus with some pale scales. Thorax: Mesonotum light yellowish-tan; integument yellowish-tan with a thin vestiture of narrow, pale curved scales; a few whitish scales at anterior edge; weak bristles placed anteriorly. Prescutellar and scutellar bristles long with slight copperish tint. Scutellum with few narrow pale scales on lobes. Anterior pronotal lobes with dark integument and many dark bristles. Posterior pronotal lobes with dark integument and 3 copperish colored bristles. Two upper and one lower sternopleural bristles, five upper and one lower mesepimeral bristles present (two lower mesepimeral bristles were seen on one side of a paratype). Pleural integument light yellow with a narrow integumental stripe beginning anteriorly at the posterior pronotal setae and continuing to upper mesepimeron setae. No scales on pleura. Wing: Veins and scales uniformly pale yellowish, basal 1/3 of costa, subcosta, and radius with denser, whitish scales; all wing scales relatively long and narrow. Anterior fork cell longer than stem. Vein 6 almost bare, ending well beyond fork of vein 5. Legs: Dark scaled dorsally and pale beneath, continuing from femur and tibia onto tarsus of fore-and mid-legs. Femur of hind leg pale scaled ventrally. Hind tarsus dark. Abdomen: Dorsum covered with flat yellowish-brown scales, somewhat paler on apical 1/2 or 2/3 of each segment giving the appearance of broad apical bands; sides and venter pale scaled; eighth segment all pale scaled.

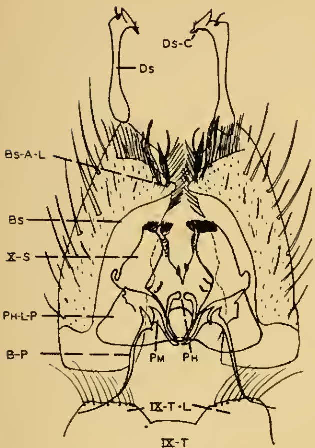
Terminalia.—Basistyle about 3 times as long as wide, covered with minute setae and few stout ones, without scales; subapical lobe pointed, crowned with a leaf-like, medially swollen seta, tapering to point at apex; a leaf-like seta curved at the tip placed just dorsal to a spine-like seta and followed by a double row of 10-12 setae. Ventro-subapical lobe bears a single, sharp-pointed seta and along the ventral edge a row of long, fine setae directed posteriorly. Dististyle half the length of the basistyle, rounded and slightly bulging basally, narrowed medially, and expanded subapically; terminating in a reflexed, hood-like process pointed anteriorly, a small claw posteriorly, two minute subapical setae on crest of hood; crest not spiny; one seta located dorsally between subapical angle and apical hood. Tenth sternite crowned with short, heavy spines, lateral ones blunt or rounded; lateral membrane with two minute setae. Phallosome dorso-laterally expanded with two fingerlike folds; tapering apically to sharp, curved points reaching to or slightly beyond comb of tenth sternite; inner surface with row of 6-7 fine spicules, a short, heavy spine on each side; wide elephant-ear-like ventro-lateral processes. Paramere triangular, rounded basally, pointed apically, with lateral, pointed expansion beyond middle. Basal plate small, apex slightly rounded, from lateral points tapers into extremely long and narrow basal points.

Female.—Size and coloration similar to male. Head: Antennal integument and hairs dark; flagellar segments dark with three long, black hairs dorsally and shorter hairs ventrally on each segment. Torus with light brown pubescence; proboscis straight with yellowish-brown scales; a narrow ventral longitudinal stripe of yellowish-white scales, darker at base and tip; without medio-ventral tuft of male. Palpus dark, ⅛ the length of proboscis. Thorax: Mesonotum, pleura, wings, halteres, and legs similar to male. Abdomen: Segment I with patch of pale copperish scales in center at apex. Segment II almost entirely pale copperish scaled, darker scales at base. Segments III-VII with apical 2/3 pale scaled; medio-basal V-shaped spot of darker copperish scales. Segment VIII pale scaled. All segments pale tan or drab-white scaled laterally and ventrally.

Larva (fourth stage).—Head: Antenna (0.65 mm) about 3/5 the length of the head (1.0 mm in length and 1.35 mm in width); antennal shaft with fine spicules to the tuft; fan-shaped tuft of 15-17 branches placed 2/3 from base; shaft at base about 1/10 as wide as long; a long pair of preapical spines; one short apical spine; one, three times the length of the short one. Pre-clypeal spine curved, very slender, pale, and long. Frontal hairs: 7 with 6-8 branches; 6 and 5 with 3-4 branches, feathered; 5 placed medially to 6 almost in a straight line, hairs equal length; 4 single, minute; 8 usually single, long; 9 usually double, long; hair 10 single, slender, long. Mentum variable, about as wide as long with 3-4 large basal denticles on either side and 10 short apical teeth on either side of a large, central one. Thorax: Wider than long, densely spiculated. Prothoracic hairs: 1 and 2 long, single, reaching beyond front of head; 3 long, double, shorter, branched from base; hairs 1, 2, and 3 arise from a common chitinized plate; 4 fan shaped, 8-branched, ¼ length of 1; 5 and 6 long, single, longer than 1; 7 with 5-6 branches, ½ length of 1; 8 with 3 branches, ½ length of 1. Pro-, meso- and metathorax with 1 pair of delicate stellate hairs. Abdomen: One pair of delicate, dorsal stellate hairs on segments I-VII. Segment VIII with 50 fringed comb teeth on each side in an irregular patch. Lateral hairs on segment VIII: 1 fine, with 3 (2-6) branches; 2 single; 3 feathered, with 7 (5-8) branches; 4 long, single; 5 with 5 (2-7) branches. Siphon: 11.8 mm (11-12 mm) in length; 0.3 mm in width at base or about 39-40:1; dorsally projecting up over body, with small square acus anchored ventro-laterally. Pecten usually of 11 (9-17) teeth, apical teeth more widely spaced; pecten tooth small, fringed with denticles from base to tip, about 0.01 mm. in length. Integument of siphon with many tiny spines in closely set rows from base to tip, those at base heavier. Six pairs of minute, single hairs widely spaced along siphon. Anal segment: About as wide as long, not quite twice as wide as siphon at base; saddle covered with fine spicules, completely encircling the anal segment. Lateral hair single, longer than anal segment. Upper and lower caudal hairs long and single; ventral fan of 8 hairs each with 2 or 4 smooth branches. The siphon of a first stage larva is 1¼ times its body length; of a second stage, 1½ times; and of a third stage, 2 times.

Pupa.—Trumpets long, slender, longer than abdominal segments I and II combined. Hairs on cephalothorax usually double, delicate and inconspicuous; hairs on abdomen inconspicuous, fine; each segment with one pair of apical stellate hairs. Hair 7 on Segment VIII 5 branched; on Segment VII 3 branched.

Culex (Culiciomyia) termi, new species. Fig. 1, structures of male terminalia; fig. 2, apical lobe of basistyle (enlarged); fig. 3, terminal structures of fourth stage larva (eighth abdominal segment, anal segment with gills, siphon). *Abbreviations*: *B-P*—basal plate, *Bs*—basistyle, *Bs-A-L*—apical lobe of basistyle, *Ds*—dististyle, *Ds-C*—dististyle claw, *IX-T*—ninth tergite, *IX-T-L*—lobe of ninth tergite, *Ph*—phallosome, *Ph-L-P*—lateral plate of phallosome, *Pm*—paramere, *X-S*—tenth sternite.


Ds-C
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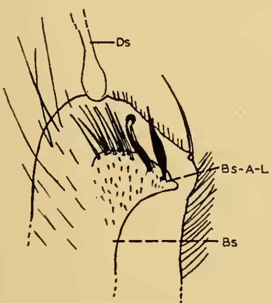
1.


Ds
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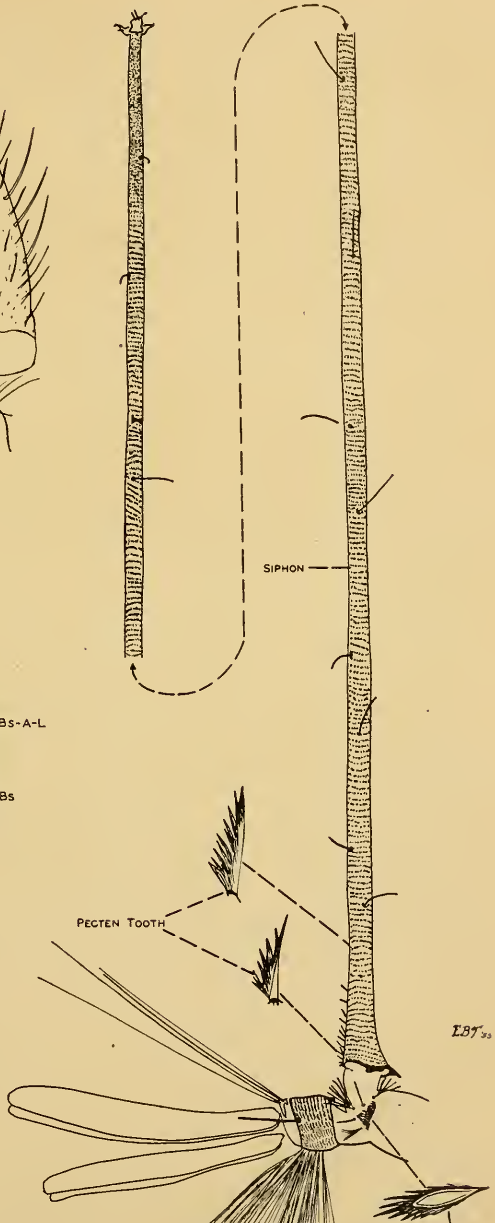
Siphon
Pecten Tooth
Comb Scale

3.

The system of nomenclature employed for the chaetotaxy of the immature stages follows that of Belkin (1950, 1952, 1953).

Holotype male, allotype, and paratypes (1 female and 6 males), larvae and pupae in alcohol, and four stages of larvae, pupal skins, and male terminalia mounted. USNM Cat. No. 62023.

Type locality: Kew Kong Lom, Kilometer 114 on the road between Lampang and Payao, Ngao District, Lampang Province, Thailand, ex.—elephant tracks. July 3, 1952, 62 larvae (all stages), adults reared (D. C. Thurman, Jr.); July 10, 1952, larvae, mass reared (Term Vejarasthira); July 25, 1952, 1 ♂ reared (D. C. Thurman, Jr.); August 18, 1952, larvae, mass reared (Term Vejarasthira); October 1, 1952, larvae (2 mounted) (D. C. Thurman, Jr. and Melvin E. Griffith); September 18, 1952, larvae, mass reared (2 mounted) (Chalao Dangswasti); November, 1952, larvae, 2 ♂ and 1 ♀ reared (Chalao Dangswasti); December 14, 1952, 2 larvae (D. C. Thurman, Jr.); March 21, 1953, 6 larvae and 3 pupae mounted, 3 ♂ and 1 ♀ reared (D. C. Thurman, Jr. and Manop Rattanopradith); March 21, 1953, 3 larvae (D. C. Thurman, Jr.); March 23, 1953, 14 larvae, 1 ♂ reared (D. C. Thurman, Jr.).

This species was first collected July 3, 1952 from a high jungle area in the mountainous region of Northern Thailand. The larvae were collected from elephant-track depressions in a marsh overgrown with luxuriant vegetation where the water was highly polluted with elephant dung and filled with brown algae, and from similar tracks in the edge of the adjacent flowing stream. Movements of the larvae were slow and clumsy. *C. termi* was collected with other culicine larvae, including *Hodgesia malayi*, some species of *Culex* (*Lutzia*), and other undescribed *Culex*. *C. termi* could be readily separated in the field from the others by the length of the siphon. Though *C. termi* seems to fit more closely with the *fragilis* group (Oriental group) rather than the *nebulosus* group (African group) as set up by Edwards (1932), the species is markedly different in all stages from the other species currently recognized in the sub-genus *Culiciomyia*. The unusual length of the siphon, bands on the abdominal segments and the light coloration of the adults, and the structures of the male terminalia are distinguishing features.

It is a pleasure to name this mosquito for Dr. Term Vejarasthira, Malaria Control Officer, Payao, Chiengrai Province, Thailand.

The author is indebted to Mr. Chalao Dangswasti and Mr. Manop Rattanapradith for field and laboratory assistance.

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NOTES ON AMERICAN MOSQUITO PUPAE, I. DESCRIPTION OF AEDES RIPARIUS AND AEDES PIONIPS (DIPTERA, CULICIDAE)[1]

BY RICHARD F. DARSIE, JR.,[2] *University of Delaware, Newark*

Although a sizable key to American culicine mosquito pupae appeared in Mitchell's "Mosquito Life" (1907, p. 251-258), the first extensive specific descriptions of this stage were published by Darsie (1951). To continue that work, two previously unknown pupae are here described, and their position in the *Aedes* key is shown. The nomenclature of pupal chaetotaxy used here is the same as was used in the 1951 paper. Limits of variation and the modes of setal branching are given in the table at the end of this paper.

Aedes (Ochlerotatus) riparius Dyar and Knab

Cephalothorax.—Setae **1**, **2** and **3** of the ocular sclerite long, usually 2-branched; prothoracic seta **6** short, others long, **4** and **7** generally trifid; **5** with 2 or 3 branches, **6** double to 7-branched; mesothoracic setae long, **8** commonly with 6 slender branches, **9** pedunculate, bifurcate; metathorax, fig. 1, faintly binotate, setae long, slightly plumose, **10** usually 5-branched, **11** and **12** generally double. *Respiratory trumpet*, fig. 3, constricted at base, notched slightly at apex, surface reticulate, except for small tracheoid semicircle at base; averaging 3.59 times as long as the greatest diameter and 6.8 times as long as the pinna.

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[2]The author is indebted to Dr. J. G. Rempel, Department of Biology, University of Saskatchewan for the gift of material from Saskatchewan, and to Dr. Alan Stone, Section of Insect Identification, Entomology Research Branch, Washington, D. C., and Mr. G. E. Shewell, Systematic Entomology, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada, for the loan of specimens.

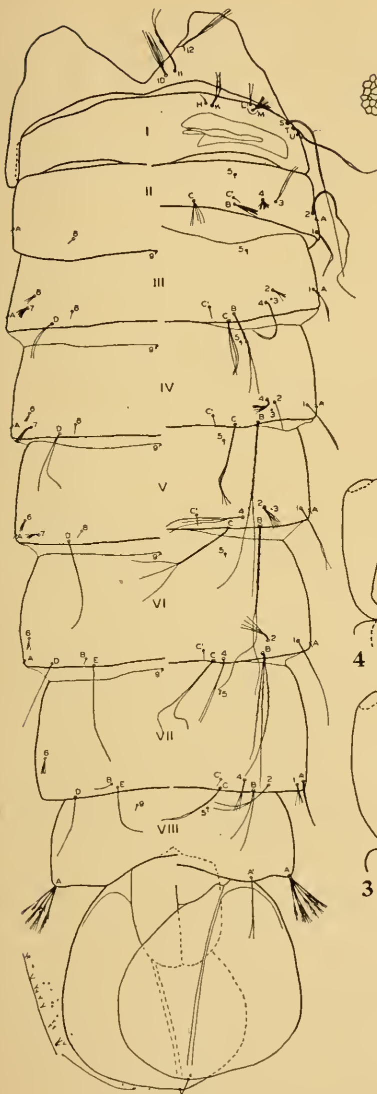
Abdomen, fig. 1.—Reticulation between float hairs on tergum 1 well developed, lines medium to heavy. On I, **H** and **K** generally double, H short, K long; **L** and **M** medium, L with 4 to 7 branches in the outer half, M 6- to 11-branched. **S** extremely long, mostly single; **T** long, bifid or trifid; **U** short, ordinarily simple. **A** minute, simple, lateral on II-VI; rather stout, long, usually double (1-2) on VII; stout, with 4 to 8 primary branches, often bifurcate in outer one-fourth to one-half on VIII. **A′** long, single on VIII. **B** medium on II-III, long on VII, very long, stout, slightly plumose on IV-VI; generally double (1-3) on II-VII. **C** medium on II-III, long on IV-VII; mostly 6-branched on II and III, triple or quadruple on IV and VI, bifid on V, and simple on VII. **D** medium on III-IV, long on V-VII; usually double on III-IV, single V-VII. **E** long, single on VI-VII. **1** long on II-VI, short on VII; ordinarily double on II and V-VI, triple on III-IV, 6- to 8-branched on VII. **2** extremely long on II, short to medium on III-VI, long on VII; generally simple or bifid on II and VII, with 6 to 8 branches on III and V, 2- to 4-branched on IV, trifid or quadrifid on VI. **3** long, 4- to 8-branched on II. **4** short on II, long on III-VII; mostly 6- to 8-branched on II, 4- to 7-branched on III-IV, double on V-VI, triple on VII. **6** short on III-VII; usually with 4 or 5 branches on III, bifid or trifid on IV-VII. **7** short to medium on III-V; commonly 6- to 9-branched on III, double to 5-branched on IV, 5- to 6-branched on V. **8** very short, medio-posterior, simple on III-VII. **9** minute, medio-anterior, simple on III-VIII. *Paddle* oval, with very small marginal and submarginal denticles on the apical fourth, surfaces sparsely clothed with minute denticles; seta **x** long, simple; index 1.40 to 1.83, average 1.60.

The description is based on 3 males from Winnipeg, Manitoba, Canada (H. G. Dyar) and 3 males and 2 females from Waskesiu, Saskatchewan, Canada (J. G. Rempel).

According to the author's key to *Aedes* pupae, this species belongs with that group having abdominal setae C-IV, C-V, and I-IV not less than triple, I-VI generally double, and 3-II 4- or 5-branched (couplet 8). It will key to *excrucians* Walker (couplet 11) from which it may be separated as follows:

11. MT-11 single, rarely double; L-1 generally double (1-4); 1-II usually triple .... *fitchii* F. & Y.
    MT-11 double, rarely single; L-1 with 3 or more branches (3-8); 1-II usually double 11A

11A. C-VII seldom with less than 2 branches; 4-VII usually double; B-II generally triple .... *excrucians* (Walk.)
    C-VII single, seldom double; 4-VII usually triple; B-II generally double .... *riparius* D. & K.



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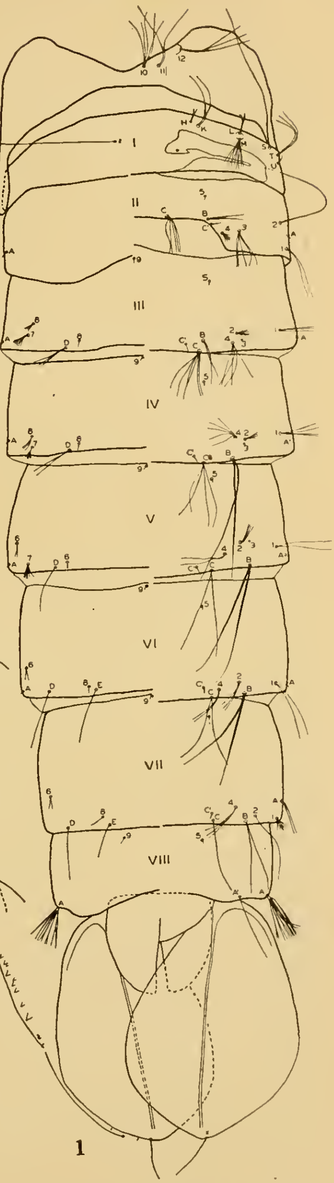

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Fig. 1, metanotum and abdomen, pupa of *Aedes riparius* (dorsal, right; ventral, left); fig. 2, metanotum and abdomen, pupa of *Aedes pionips* (dorsal, right; ventral, left); fig. 3, respiratory trumpet of *Aedes riparius;* fig. 4, respiratory trumpet of *Aedes pionips.*

Aedes (Ochlerotatus) pionips Dyar

Cephalothorax.—Ocular setae 1, 2, and 3 long, usually double; prothoracic seta 6 short, others long, 7 rather stout, 4 and 6 mostly triple, 5 and 7 quadruple; mesothoracic setae long, 8 generally 4- to 6-branched, 9 with 1 to 4 branches in the outer half; metathoracic setae, fig. 2, long, **11** plumose, **10** and **12** commonly quadrifid, 11 bifid. *Respiratory trumpet,* fig. 4, dark, surface reticulate, small tracheoid patch at base, averaging 3.69 times as long as its greatest diameter and 8 times as long as its pinna.

Abdomen, fig. 2.—Reticulation on tergum I between float hairs variable, usually evident but poorly developed. On I, **H** short, single, rarely double to quadruple; **K** long, sometimes plumose, generally with 2 or 3 branches; **L** and **M** medium, L mostly trifid to 5-branched in the outer half, M 5- to 13-branched; **S** extremely long, single (1-3); **T** long, usually double; **U** small, simple. **A** minute, lateral, single on II-VI; stout, long, slighty plumose, commonly double (1-3) on VII; stout, long, plumose in the outer half, with 2 to 15 branches on VIII. **A'** long, single or double on VIII. **B** medium on II, long on III, VI, and VII, extremely long on IV and V, plumose on III-VI; generally 3- to 5-branched on II, double on III-VI, and simple or bifid on VII. **C** medium on II, long on III-VII; mostly 6-branched or more on II, quadrifid on III, 3- or 4-branched on IV and VI, double on V, single or double on VII. **D** present on II in only 12 per cent of the specimens examined and just the trichopore in an equal proportion, 2- to 4-branched; long on III-VII, usually double on III-IV, single on V-VII. **E** on VI-VII long, simple. **1** long on II-VI, medium on VII; commonly with 2 or 3 branches on II, triple on III, double on IV, single or bifid on V, simple on VI, and 6-branched or more on VII. **2** extremely long on II, short to medium on III-VI, long on VII; generally single on II, 4- to 7-branched on III, double on IV, with 6 or more branches on V, quadrifid on VI, bifurcate on VII. **3** on II long, usually triple. **4** short on II and IV, long on III and V-VII; mostly 6- to 9-branched on II and IV, with 2 to 6 branches on III, triple on V and VII, double on VI. **6** short to medium on III-VII; generally 4- to 6-branched on III, with 3 to 5 branches on IV-VII. **7** medium on III-V; commonly 6- to 9-branched on III and V, double to quadruple on IV. **8** present on II in 61 per cent of the specimens examined, short, simple on II-VII. **9** minute, simple, occasionally double, medio-anterior on III-VIII. *Paddle* ovate, with marginal and submarginal denticles on apical one-third, surfaces sparsely clothed with minute denticles; seta **x** medium, rather stout, usually single; index 1.11 to 1.64, average 1.34.

The description is based on 10 males from Lac La Ronge, Saskatchewan, Canada (J. G. Rempel); 3 males and 3 females from Otter Lake Marsh, Anchorage, Alaska (Alaska Insect Project, U. S. Department of Agriculture); 6 males and 1 female from Anchorage, Alaska (Gjullin, Jenkins, and Stone); 1 female from McKinley, Alaska (A. Stone); 2 females from Lower Post, British Columbia, Canada; 2 females from Whitehorse, Yukon Territory, Canada; 1 male from Reindeer Depot, Mackenzie Delta, Northwest Territories, Canada; and 1 female from Fort Chimo, Quebec, Canada (Collection of Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada).

Matheson (1944, p. 177) states that *A. pionips* is probably only a variety of *A. communis* (DeGeer), but Vockeroth (1952) has shown that there are good characters for separating the adults, male genitalia, and larvae. Curtis (1953, p. 358) also presents biological evidence of their distinctness. As a result of this study, pupal morphology may likewise be used. The two species may be distinguished on the basis of the branching of abdominal setae S-1 and 2-II. In *pionips* they are both single; whereas, in *communis* they have two or more branches.

In the author's key to *Aedes* pupae, *pionips* would be included in the group characterized by having abdominal setae C-IV and C-V usually double, 1-VI single, 1-IV usually single or double, and 3-II generally double or triple. (In couplet 8, it is necessary to consider all the characters and select that couplet half in which a majority applies; for instance, in *pionips* C-IV and 3-II more often have three or more branches, so reliance must be placed on the branching of the other three setae.) *A. pionips* will key to couplet 16, which, with couplet 17, involves the species *canadensis* (Theo.), *stimulans* (Walk.), and *sticticus* (Meig.). This section of the key has been reconstructed to include *pionips*. The following alteration of the key is proposed:

16. Reticulation on abdominal tergite I well developed, lines distinct; MT-12 usually double; 1-V generally single 16A
    Reticulation on abdominal tergite I poorly developed or absent; MT-12 usually with 3 or more branches; 1-V generally double 17

16A. A-VIII usually with 6 or more branches (5-10); 2-IV generally triple to 5-branched; 1-VII mostly with 5 or more branches .... *stimulans* (Walk.)
    A-VIII usually with fewer than 6 branches (2-7); 2-IV generally single or double; 1-VII mostly double to quadruple .... *canadensis* (Theo.)

17. A-VII and 2-IV with 3 or more branches; 1-III generally single or double; U-1 often double or triple .... *sticticus* (Meig.)
    A-VII and 2-IV usually single or double; 1-III generally triple; U-1 simple .... *pionips* Dyar

Seta	*riparius*	*pionips*
	Cephalothorax	
1	2 (2)	2-4 (2)
2	2-3 (2)	1-5 (2)
3	1-2 (2)	1-4 (2)
4	2-4 (3)	2-7 (3)
5	2-3 (2)	1-6 (4)
6	2-7 (?)	1-9 (3)
7	3-4 (3)	2-6 (4)
8	4-8 (6)	1-9 (5)
9	2 (2)	1-4 (2)
	Metathorax	
10	3-8 (5)	3-9 (4)
11	1-2 (2)	1-5 (2)
12	2-4 (2)	1-7 (4)
	Abdomen I	
H	1-3 (2)	1-4 (1)
K	2-3 (2)	2-4 (3)
L	4-7 (5)	2-7 (3)
M	6-11 (?)	5-13 (7)
S	1-2 (1)	1-3 (1)
T	2-3 (2)	1-3 (2)
U	1-2 (1)	1 (1)
	II	
B	1-3 (2)	1-6 (4)
C	5-20 (6)	2-11 (6)
C′	1-2 (1)	1 (1)
D	------------	2-4 (?)
1	2-4 (2)	1-6 (2)
2	1-3 (1)	1-3 (1)
3	4-8 (4)	2-5 (3)
4	6-10 (6)	5-14 (8)
8	------------	1 (1)
	III	
B	1-3 (2)	1-3 (2)
C	3-7 (6)	3-9 (4)
D	2-4 (2)	1-5 (2)
1	2-5 (3)	1-5 (3)
2	4-9 (?)	2-8 (5,6)
4	3-10 (4)	2-9 (3,4)
6	4-6 (4)	3-8 (5)
7	5-11 (7)	3-12 (7)
9	1 (1)	1-2 (1)

Seta	*riparius*	*pionips*
	IV	
B	2 (2)	1-3 (2)
C	2-5 (3,4)	1-6 (3)
D	1-3 (2)	1-3 (2)
1	2-4 (3)	1-4 (2)
2	2-5 (2)	1-4 (2)
4	4-7 (5)	2-14 (7)
6	2-4 (3)	2-6 (3)
7	2-5 (3)	1-6 (3)
9	1 (1)	1-2 (1)
	V	
B	2 (2)	1-3 (2)
C	2-4 (2)	1-4 (2)
D	1 (1)	1-2 (1)
1	2-3 (2)	1-3 (1)
2	4-8 (6)	3-13 (6)
4	1-3 (2)	1-5 (3)
6	2-4 (2)	2-6 (4)
7	4-8 (6)	4-12 (6)
9	1 (1)	1-2 (1)
	VI	
B	2 (2)	1-4 (2)
C	2-5 (3)	1-5 (2)
E	1-2 (1)	1 (1)
1	1-4 (2)	1-3 (1)
2	2-5 (4)	2-6 (4)
4	1-3 (2)	1-3 (2)
6	2-5 (2)	1-8 (4)
8	1 (1)	1-2 (1)
9	1 (1)	1-2 (1)
	VII	
A	1-2 (2)	1-3 (2)
B	1-2 (2)	1-4 (2)
C	1-2 (1)	1-3 (2)
1	4-9 (7)	3-9 (7)
2	1-2 (1)	1-3 (2)
4	2-4 (3)	1-5 (3)
6	2-4 (3)	2-7 (4)
9	1 (1)	1-2 (1)
	VIII	
A	4-8 (?)	2-15 (6)
A′	1-2 (1)	1-2 (2)
	Paddle	
x	1 (1)	1-3 (1)

TABLE—COMPARISON OF SETAL BRANCHING
(Limits of variation are followed in parentheses by the modes)

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NOTES ON HAEMAGOGUS IRIDICOLOR DYAR

(Diptera, Culicidae)

By William H. W. Komp, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

Haemagogus iridicolor Dyar was described from males and females from Higuito, San Mateo, Costa Rica, collected by Pablo Schild, and from adults reared from larvae in bamboo-joints, collected in Alajuela and Maravilla, Costa Rica, by Anastasio Alfaro. Dyar (1921) states that the types are "two males," the "paratypes, 8 males and 7 females, No. 24,332, U. S. Nat. Mus." There is no date of collection on the labels on the type males or paratype males and females from Higuito. One of the two type males designated by Dyar has the terminalia mounted on a slide numbered 1468, and this specimen is hereby designated as the lectotype. Another male from Higuito, collected by Schild, has the terminalia on a slide numbered 1467, but the label does not state that it is one of the two males selected as types by Dyar. Additional material was collected in Alajuela and Maravilla, Costa Rica, by Alfaro in 1921. Males and females were reared from larvae, but the skins were not preserved. Dyar (1921) states: "The larva figured in the monograph as '*Stegoconops lucifer*' (vol. ii, pl. 77, 1912) and described as '*Haemagogus splendens*' (vol. iv, 866, 1917) probably belongs here [as *iridicolor*]. Mr. Knab brought living specimens from Costa Rica, from which he made his drawing. These came from Port Limon, but the adults are unfortunately all females." No larval material collected by Knab in Port Limon can be found in the U. S. N. M. collection.

Dyar (1928) described a larva as *iridicolor*, but states: "This larva from Port Limon, Costa Rica, from coconut-husks may not be correctly referred." Probably the larva described is one collected by Knab, which is referred to above. Two females in the U. S. N. M. from Port Limon are labeled, "See F. Knab's Entom. Notes. No. 352 f, and 353 d," but corresponding larval skins cannot be found.

The writer found larvae in the water in bamboo stubs at Almirante, Bocas Province, Panama, in 1928 and 1931, from which males were reared. The larval skins have been lost, but two male terminalia preserved show that the species is *iridicolor*. In 1947, Dr. Pedro Galindo kindly sent the writer a series of authentic larval skins from Bocas del Toro, Bocas Province, Panama, most of which are in good condition. The following description of the larva is drawn up from these specimens.

The Larva of Haemagogus iridicolor

Head rounded, somewhat wider than long. Antennae moderate, smooth, scarcely tapering; antennal hair single, inserted slightly beyond middle, extending to apex. Ante-antennal hair variable, usually a tuft of 3 elements. Dorsal anterior head-hairs double. Intermediate tufts long, multiple, about 12 hairs in each, their insertions set in a line anterior to and closer to the median line than the anterior hairs. Posterior head-hairs single, longer and more slender than the anterior hairs. Sutural hairs fine, single. Transsutural hairs fine, double.

Integument of thorax and abdomen glabrous. Stellate hairs of thorax multiple, short, of about five elements. Lateral abdominal hairs double on segments 2 to 6, single on segment 7. Intermediate abdominal hairs short, fine, stellate, with 5 to 6 elements in each. Comb of eighth segment of 20 to 25 scales in a patch several rows deep; the larger scales about five times as long as wide, the apex blunt, widened and rounded, with long spinules on apex and well up the sides, the base slightly less than half the length of the scale. Siphon about twice as long as wide, slightly tapering. Pecten of 10 to 12 teeth, not quite reaching the middle of siphon, not closely followed by a tuft of 3 to 4 hairs. Pecten teeth gradually increasing in size from base of siphon towards tuft, the more distal teeth unusually long and sharp-pointed, with a large basal tooth; the more proximal teeth often rudimentary. Anal segment slightly longer than wide, the saddle extending well down the sides, and covered with irregular rows of very fine spinules from curved bases. Postero-lateral border of saddle with fine spinules, some with a short median tooth, none large. Lateral saddle-hair usually with two or three elements. Caudal hairs a long single outer hair, and an inner hair of about six elements, half the length of the single hair, on each side. Ventral brush of about nine tufts, sometimes one or two preceding the barred area; a triangular chitinized area is on each side of the barred area. Anal gills short, rounded, the ventral pair shorter than the dorsal pair.

One larva had the antennal hair double on each side, and another had one of the dorsal anterior head-hairs, which are normally double, fused at the base distally to half its length.

Notes on the Species

In October 1951 the writer collected larvae and pupae from a hole in a tree stump about five feet from the ground, in a clearing at the edge of a forest near Arenal, San Carlos Province, Costa Rica. The adults reared from the larvae and pupae were *H. iridicolor.* Yellow fever had caused deaths in the vicinity of this collecting site in the immediate past. Because of its distribution in northwestern Panama and in Costa Rica, in areas where jungle yellow fever had occurred during the past few years, *H. iridicolor* may be a vector of this disease.

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A REDEFINITION OF THE GENUS ZATROPIS, WITH DESCRIPTIONS OF THREE NEW SPECIES

(Hymenoptera, Pteromalidae)

By B. D. Burks, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

Dr. W. V. Balduf of the University of Illinois has for several years been rearing the insects associated with the hips of wild roses. In this work he has secured many specimens of an undescribed species of the genus *Zatropis.* He has requested that this species be described so that its name will be available for use in his publications on the biologies of rose-hip insects. Accordingly, it is herewith described, along with two other species that have remained unnamed for several years in the U. S. National Museum collection. A redefinition of the genus *Zatropis* itself and the transfer of one species from another genus to *Zatropis* are also included in this paper.

Genus **Zatropis** Crawford

Zatropis Crawford, 1908, Proc. Ent. Soc. Wash. 9: 159. Kurdjumov, 1913, Rev. Russe d'Ent. (Ent. Obozr.) 13:6. Girault, 1916, Ent. News 27:403. Crawford, 1921, Proc. Ent. Soc. Wash. 23:171. Gahan and Fagan, 1923, U. S. Natl. Mus. Bul. 124, p. 155. Peck *in* Muesebeck and others, 1951, U. S. Dept. Agr. Monog. 2, p. 558.

Type: *Zatropis catalpae* Crawford; monobasic.

Generic description.—Each mandible with 4 teeth, ventral tooth long, slender, and acute at tip, 2 intermediate teeth shorter and rather blunt at apices, dorsal tooth truncate, broad, and slightly shorter than intermediate teeth; genae at bases of mandibles slightly flattened, but not excavated; antenna with 3 ring segments and 5 funicle segments, club not pointed at apex; fore wing with marginal vein relatively slender, an asetose area behind marginal vein on dorsal side, and, on ventral side of wing, 1 or 2 rows of bristles parallel with marginal vein; parapsidal grooves of praescutum incomplete; hind tibia with one apical spur; propodeum with median carina, lateral folds, and without neck or with an obscure one; gaster sessile, narrower than thorax, and longer than head and thorax combined.

This genus, like the others in the tribe Pteromalini, is characterized from the females only.

Girault (1916) was of the opinion that *Zatropis* was a synonym of the genus *Neocatolaccus* Ashmead. That clearly is not true, as the two have been correctly referred to different tribes of the Pteromalinae (see Peck, 1951). *Zatropis,* having 1 apical spur on each hind tibia, is placed in the Pteromalini, while *Neocatolaccus,* having 2 apical spurs on each hind tibia, is referred to the Metastenini.

The species of *Zatropis* are all, so far as is known, primary parasites. They attack the larvae of weevils, bruchids, or gall-making cecidomyiids, except for *tortricidis* Crawford, which parasitizes Microlepidoptera belonging to several families.

Zatropis rosaecolis, new species

Female.—Length 2.0-4.0 mm. Head and body black with faint blue-green or blue metallic coloration visible from oblique angles; antennal scape yellow or tan, shading to dark brown at apex, flagellum very dark brown or black; tegulae and wing veins light brown; coxae black, femora very dark brown with apices yellow, each tibia yellow at base and apex, shaded with brown in the middle.

Face clothed with numerous short hairs; mesal side of apical half of each antennal scape clothed with numerous short, silvery hairs, antennae inserted slightly below center of face; relative lengths of parts of antenna: scape 48, pedicel 15, ring segments 2, 3, 4, funicle segments 14, 12, 12, 10, 10, club 26; height of compound eye twice as great as width of malar space; median length of head from dorsal aspect one-third as great as maximum width of head; postocellar line one and one-fourth times as long as ocellocular.

Thoracic dorsum with a few scattered, golden-yellow hairs; mesepimeral ridge with a single row of short hair; each hind coxa bearing 6 to 8 long setae on the dorso-mesal margin; pronotum the same length at dorsal meson as at dorso-lateral margins; mesoscutum twice as wide as long, and equal in length to mesoscutellum; 2 slightly irregular rows of bristles on ventral side of fore wing behind marginal vein, submarginal vein twice as long as marginal, stigmal one-half as long as marginal; postmarginal slightly shorter than marginal.

Propodeum with continuous lateral folds, area between folds strongly shagreened, small neck present at apex of propodeum, median carina slightly irregular, a pair of oblique carinae extending from middle of median carina to mid point of either lateral fold; a deep pit situated at anterior end of each lateral fold and another just posterior to point where oblique carina intersects lateral fold; spiracle elongate-oval, separated from anterior propodeal margin by a space one-half as great as length of spiracle itself; 8 to 10 long hairs present at either lateral margin of propodeum; gaster with first 3 segments emarginate at meson of posterior margin, apical 4 segments bearing short setae dorsally, all gastral segments bearing dorsolateral patches of setae; gaster one and one-quarter times as long as head and thorax combined.

Male.—Length 1.5-2.0 mm. Color of head and thorax black without metallic sheen, gaster dark brown, basal segment with faint blue or blue-green metallic luster; antenna entirely black or very dark brown, only 2 ring segments present; relative proportions of parts of antenna: scape 30, pedicel 10, ring segments 1, 1, funicle segments 7, 8, 8, 8, 8, 8, club 22; apical six segments of gaster setose, gaster slightly shorter than head and thorax combined.

Type locality.—Urbana, Ill.

Types.—U. S. N. M. No. 61977.

Described from 33 ♀ and 3 ♂ specimens, all reared by Dr. W. V. Balduf from wild rose hips: holotype ♀, allotype ♂, and 5 ♀ and 1 ♂ paratypes, Urbana, Illinois, Aug. 18, 1947-July 27, 1948, from *Rosa carolina;* 1 ♀ paratype, Urbana, Ill., May 28, 1943, from *Rosa rugosa;* 1 ♀ paratype, Velma, Illinois, June 29, 1948, from *Rosa carolina villosa;* 1 ♀ paratype, Taylorville, Ill., June 24, 1946, from *Rosa rugosa;* 1 ♀ paratype, Onarga, Ill., June 26, 1945, from *Rosa rugosa;* 1 ♂ and 1 ♀ paratypes, Mayview, Ill., June 27, 1949, from *Rosa carolina;* 10 ♀ and 1 ♂ paratypes, San Jose, Ill., Aug. 1-Sept. 11, 1951, from *Rosa carolina;* 1 ♀ paratype, Philo, Ill., Sept. 9, 1948, from *Rosa carolina;* 1 ♀ paratype, Madison, Wisc., July 2, 1947, from *Rosa arkansana;* 9 ♀ paratypes, Chetek, Wisc., Sept. 19, 1948-Sept. 20, 1951, from

Rosa blanda or *carolina;* 1 ♀ paratype, Solon Springs, Wisc., June 13, 1947, from *Rosa* sp.; 4 ♂ paratypes, U. S. Rt. 61 at Pike Lake Rd., Minn., Aug. 27, 1947, from *Rosa acicularis bourgeauiana.*

Host.—This species is a primary external parasite of the larva of the rose curculio, *Rhynchites bicolor* (Fab.), which develops in rose hips. This information was furnished in correspondence by Dr. Balduf.

This species differs from all other North American species of *Zatropis* in having the face clothed with simple hair, rather than flattened hair as in *bruchivorus* (Ashmead), or spatulate-acuminate scales as in *nigroaeneus* (Ashmead). *Z rosae* is also the only North American species of the genus which has 2 rows of bristles behind the marginal vein on the underside of the forewing.

Zatropis chalcis, new species

Female.—Length, 1.5-2.2 mm. Head coppery-red or bronze colored, shading to metallic green on the vertex and eye margins; antennal scape and pedicel yellow, flagellum tan; thorax coppery-red dorsally with a suggestion of metallic green along sutures; wing veins yellow; all coxae brown with faint metallic green iridescence, legs otherwise yellow; propodeum dark bronze-brown; gaster brown with faint bronzy iridescence; silvery hairs and scales clothing head, body and legs.

Head clothed with spatulate-acuminate scales; antennae inserted in center of face; relative lengths of parts of antenna: scape 44, pedicel 14, ring segments 2, 2, 3, funicle segments 10, 10, 10, 9, 9, club 24; height of compound eye slightly more than twice as great as width of malar space; occiput excavated and relatively narrow, lateral ocelli almost touching occipital margin and median length of head only one-fourth as great as width of head; postocellar line two and three-fourths times as long as ocellocular.

Thoracic dorsum clothed with spatulate-acuminate scales, and a closely set row of these scales borne on mesepimeral ridge, with a tuft of these scales just ventral to tegula; coxae with sparse, long hair; pronotum at meson one-eighth as long as mesoscutum, the latter one and one-fifth times as long as mesoscutellum, mesoscutum one and three-fourth times as wide as long; marginal vein of fore wing twice as long as post-marginal, two and one-half times as long as stigmal, and three-fourths as long as submarginal; a single row of four to six bristles on ventral side of fore wing behind marginal vein.

Surface of propodeum between lateral folds shagreened, median length of propodeum one-third as great as length of mesoscutellum, median propodeal carina strong, lateral folds complete and arcuate, six to eight scale-like hairs at either posterolateral angle of propodeum; propodeum entirely without neck; gaster clothed laterally with slightly flattened hairs and as long as head and thorax combined.

Male.—Length, 1.2-1.8 mm. Thoracic dorsum almost black, coppery-red color very faint, gaster with a vague yellow spot near base, color otherwise as in female; gaster two-thirds as long as head and thorax combined.

Type locality.—Miami, Florida.

Types.—U. S. N. M. No. 62304.

Described from 32 ♀ and 14 ♂ specimens as follows: holotype ♀, allotype ♂, and 11 ♀ and 4 ♂ paratypes, reared from cotton bolls, Dec. 5, 1932, C. F. Rainwater; 1 ♀ paratype, Flagler Co., Fla., Dec. 28, 1929, taken in Florida Fruit Fly Survey, D. B. Webb; 13 ♀ and 6 ♂ paratypes, Long Key, Fla., reared from cotton blossoms, Oct. 1, 1932, C. F. Rainwater; 1 ♀ paratype, Key Largo, Fla., reared from wild cotton boll, May 8, 1933, C. F. Rainwater; 1 ♀ paratype, Grassy Key, Fla., Dec. 30, 1932, reared from wild cotton boll, C. F. Rainwater, 2 ♂ paratypes, Miami, Fla., Dec. 12, 1932, reared from cotton bolls, C. F. Rainwater; 1 ♀ paratype, Key West, Fla., Dec. 29, 1952, H. V. Weems; 1 ♀ paratype, Summerville, S. Car., July 1921, ex *Anthonomus grandis*, C. B. Nickels; 1 ♀ paratype, Dunedin, Fla., Apr. 18, 1930, L. J. Bottimer.

Hosts.—This species is said to be a parasite of the cotton boll weevil, *Anthonomus grandis* Boh., and it might also parasitize the wild cotton boll weevil, *A. thurberiae* Pierce. Mr. Rainwater, however, was of the opinion that it was parasitic on the cotton flower bud maggot, *Contarinia gossypii* Felt, when he reared the specimens which are listed above from Miami, Florida, and the Florida Keys.

This species closely resembles *nigroaeneus* (Ashmead) in having the head and thoracic notum clothed with spatulate-acuminate scales and the first funicle segment as long as wide; the thoracic notum of *chalcis*, however, is coppery-red in color, rather than black as in *nigroaeneus*, and the propodeum of *chalcis* entirely lacks an apical neck, while *nigroaeneus* has a small one.

Zatropis capitis, new species

Female.—Length 1.2-2.0 mm. Head dark metallic green, antennae light brown, scapes yellow at bases; thorax black with faint iridescent green luster, legs mostly red-brown, light tan at apices of femora, bases and apices of tibiae, and on basal four segments of each tarsus, tegulae and wing veins yellow-brown; propodeum dark metallic green, gaster red-brown with faint metallic green or blue sheen.

Face clothed with short, very inconspicuous, silvery hair; antennae inserted slightly below center of face, relative lengths of parts of antenna: scape 40, pedicel 14, ring segments 1.5, 1.5. 2, funicle segments

6, 8, 8, 8, 8, club 24; width of malar space one-half as great as height of compound eye; occiput only slightly excavated—median length of head one-third as great as its width, lateral ocellus located more than its diameter forward of occipital margin; postocellar line two and one-half times as long as ocellocular.

Thoracic dorsum with a few, scattered, golden-yellow hairs, mesepimeral ridge bearing 3 or 4 hairs, hind coxa bearing 5 to 7 long hairs on its inner dorsal angle and having one row of shorter hairs along outer dorsal margin; pronotum two-thirds as long on meson as at lateral margins; scutum almost twice as long, scutellum as long as scutum; marginal vein of fore wing three-fifths as long as submarginal, stigmal vein slightly more than one-half as long as marginal; postmarginal vein five-sixths as long as marginal; a single, slightly irregular row of bristles on ventral side of wing behind marginal vein, this row composed of 10-12 bristles.

Surface of propodeum between lateral folds faintly sculptured, almost smooth, median length of propodeum two-fifths as great as length of scutellum, median carina strong, lateral folds complete, arcuate, a deep pit at posterior end of each, and a depression at anterior end of each fold; spiracle almost touching anterior margin of propodeum, a tuft of long hair at each lateral margin of propodeum; gaster clothed laterally with short, inconspicuous hair, gaster one and one-third times as long as head and thorax combined.

Male.—Length 1.2-1.8 mm. Head and thorax bright, metallic green, antennae tan with base of scape and apex of pedicel yellow; row of bristles on ventral side of wing behind marginal vein composed of 6 to 8 bristles; gaster slightly shorter than head and thorax combined.

Variation.—The smallest specimens of this species have the first funicle segment of the antenna proportionately shorter than it is in the largest specimens.

Type locality.—Reno, Nevada.

Types.—U. S. N. M. No. 62305.

Described from 17 ♀ and 12 ♂ specimens as follows: Holotype ♀, allotype ♂, and 8 ♀ and 11 ♂ paratypes reared from undetermined galls on *Chrysothamnus,* 1936-1937, Ira La Rivers; 2 ♀ paratypes, Ft. Duchesne, Utah, May 6, 1933, collected on *Chrysothamnus,* G. F. Knowlton; 3 ♀ paratypes, Tamalpias, Calif., Dec. 1927, from cecidomyiid gall on *Baccharis pilularis;* 3 ♀ paratypes, Crater Lake National Park, Oreg., Aug. 4-Sept. 1, 1930, H. A. Scullen.

Hosts.—This species may be parasitic on species of *Rhopalomyia,* cecidomyiid gall makers on *Chrysothamnus* and *Baccharis.*

Z. capitis agrees with *Z. incertus* (Ashmead) and *bruchivorus* in having the head and thoracic notum clothed with flattened hair, rather than simple hair or scales; *capitis,* however, has the lateral propodeal folds complete, rather than being interrupted in the middle as in *incertus* and *bruchivorus*.

Zatropis albiclavus (Girault), new combination

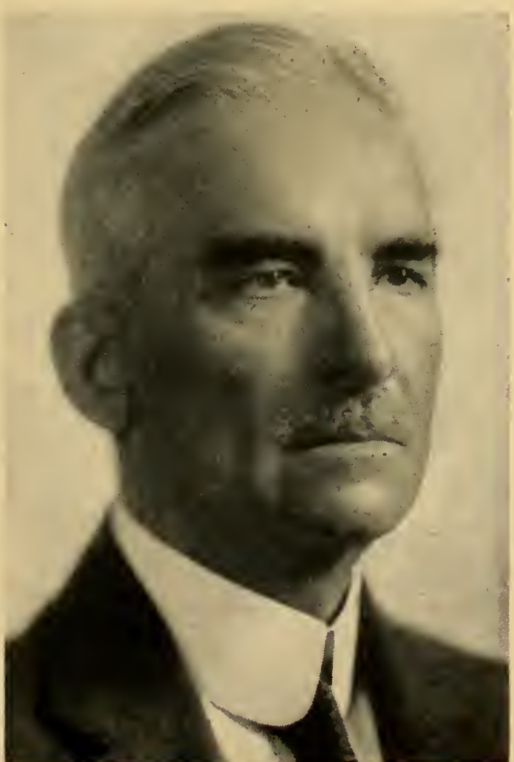
Eurydinoteloides albiclavus Girault, 1917, Chalc. Nov. Mariland., pt. 3, p. 5. Peck *in* Muesebeck and others, 1951, U. S. Dept. Agr. Monog. 2, p. 566 (*albiclava*).

Type.—U. S. N. M. No. 21465.

This species is known from New York, Maryland, and Ohio; it has been reared from the gall of an undetermined midge.

CHARLES LESTER MARLATT

1863-1954



On the morning of March 3, 1954, Dr. Marlatt, the last of the Society's "Old Guard," passed on after a long, useful and adventurous career. The part that he played in the development of economic entomology and plant quarantine in this country will remain as a lasting monument to his forceful character.

C. L. Marlatt was born in Atchison, Kansas on September 26, 1863. He graduated from Kansas State College, Manhattan, Kansas (originally chartered as Bluemont College in 1858 by a group of pioneers of whom his father was one) with the degree of B.S. in 1884. Two years later he received his M.S. from the same institution where it was his good fortune to come under the tutelage of Prof. E. A. Popenoe. Kansas State College granted him the Sc.D. degree in 1922. In 1887 he was made Associate Entomologist of Kansas State College and it was while he was serving in this capacity, under Professor Popenoe, that Dr. C. V. Riley, Chief of the Division of Entomology, U. S. Department of Agriculture, learned of his skill as an insect delineator. So impressed was Dr. Riley by Dr. Marlatt's work that he brought him to Washington in January 1889 to serve as Assistant Entomologist and artist. Fortunately for entomology, at about the same time Miss Lily Sullivan, another outstanding entomological artist, was employed. She made many of the excellent illustrations which appeared in the early bulletins of the Division. Her employment made it possible for this versatile young man to concentrate on insecticides and equipment for their application, rather than devoting his time to drawing insects.

Rarely in the early days of professional entomology in this country did workers confine their interests to a single group or family of insects; Dr. Marlatt was no exception. Thus we find that during the first fifteen years of his official life he published papers on insect oviposition, morphology, life history, hibernation and control, and descriptions of a number of new species of sawflies. In the meantime (1894) he was made First Assistant Entomologist and Assistant Chief of the Division (the Division was made a Bureau in 1904). He held this position until 1925 when he was promoted to Associate Chief. When Dr. Howard retired in 1927 Dr. Marlatt became Chief of the Bureau, adding this responsibility to his already heavy load as Chief of the Plant Quarantine and Control Administration. After serving approximately two years in this dual capacity, at his request he was relieved of the responsibility of the management of plant quarantine enforcement in order that he might devote full time to the administration of the Bureau of Entomology. He retired in 1933.

Along with these numerous jobs he found a little time to delve into the taxonomic aspects of the Nematinae and the Coccidae. He laid the groundwork for the classification of the former, and in a paper published in 1892 he described some ninety odd new species of sawflies which attack food plants over a wide range. The advent of the San Jose scale into the

East in the nineties greatly stimulated an interest in the Coccids of the United States and resulted in the accumulation of an outstanding collection of this family in the Bureau. Following a trip to southern California which revived his interest in scale insects in 1900 he assumed general charge of the National Collection of Coccidae. His methods of organizing the great mass of coccid material which had been accumulated over a period of some twenty years brought order out of chaos. He devised a system of storing coccids on their hosts in pasteboard boxes of uniform depths and heights and a new system of housing slide material in manila jackets. Both boxes and jackets, after labeling, were filed in the manner of a card catalogue. These greatly increased the usefulness and safety of the collection and resulted in a reduction of the time required in consulting material for comparative or identification purposes by approximately two-thirds. Furthermore, when it was learned of the care which surrounded the safeguarding of the National Collection, many of the coccid workers of the several states turned over to the Bureau for safekeeping their type or cotype material. Likewise, some foreign types were made available for study and considerable foreign material was donated to the Collection. His ideas regarding coccid classification and the papers which he published in this field were definite advances, both in knowledge and in working standards in the group.

The literature of economic entomology is replete with papers by Dr. Marlatt on insecticides and their method of application. He also published on insects affecting the household (including the woodwork of buildings), cattle, wheat, and shade, forest and subtropical trees. The periodical cicada received considerable attention from him, and he devised a new nomenclature for the broods of this insect. The San Jose scale, because of its destructive nature and wide distribution in this country after its introduction in the early 70's, was the subject of a number of papers which he published from time to time. Largely at his own expense he made a trip to Japan and China in 1901-1902 in search of the native home of this insect pest which more than any other aroused the interest of fruit growers as to the need for adequate plant quarantine protection, both State and Federal. Information obtained on this trip established the fact that China was the native home of this scale insect and he suggested that it should be known as the Chinese scale. This common name, however, was not accepted since it had gone under the pseudonym of San Jose scale for too many years and was too well known by the layman under that name. He also discovered that the Asiatic ladybird beetle was holding this pest in check in

Japan and China. Taking into account the success which was experienced by introducing the Australian ladybird beetle into California to control the cottony-cushion scale, he forwarded several shipments of the Asiatic ladybird beetle to Washington. Unfortunately, most of the specimens succumbed en route, or during their first winter in this country. Two individuals survived the first summer and the progeny from these beetles exceeded 5,000 in a relatively short time. The story of the incidents associated with this trip is entertainingly told in his book *An Entomologist's Quest,* privately published in 1953.

An event of great importance to the welfare and future of entomological work in the U. S. Department of Agriculture took place in 1902. In the absence of the Chief of the Division the preparation and submission of the Annual Report fell upon Dr. Marlatt, and in that report he submitted a plan of reorganization of the work on the basis of field crop investigations. This was accepted by the Secretary and the Appropriation Committee of the Congress in the appropriation bill for 1904, which likewise approved the elevation of the Division to Bureau status. This in turn resulted in the establishment in the new Bureau of divisions and sections, an efficient and orderly organization of the work. This continued without interruption for fifty years.

Beginning in 1897 several attempts were made to secure a Federal law to curb the flow of insects and plant diseases into the United States, but after a number of failures the idea became moribund. Fortunately for the country Dr. Marlatt with his characteristic courage would not accept defeat. When told that the bill was not accepted by Congress he replied, "A new bill will be introduced tomorrow." The battle was on in earnest and numerous hearings were held by the Legislative Committee. On one occasion the Chairman of that Committee commented that he did not fear the bill so much as he did the possibility that it might be administered by its proponent, and mentioned Dr. Marlatt by name. Dr. Marlatt replied that he would not be disposed to accept ". . . such a thankless and difficult position." When the Plant Quarantine Act of August 20, 1912 was finally passed he received a wire while en route on the *S. S. Lurline* from Honolulu to San Francisco from Secretary James Wilson asking him to accept the Chairmanship of the Federal Horticultural Board. This was a fitting recognition of victory after his years of persistent effort to provide the country with a law which would make it possible to prohibit or regulate the entry of plants and plant products (as well as their interstate movement) when the occasion required. Fortunately for the country, Dr. Marlatt reconsidered the statement he previously made before the Legislative Committee and accepted this onerous task. This was an entirely new undertaking without previous experience from which to draw. However, his soundness of judgment and honesty of purpose resulted, with the help of the other members of the Board, in the establishment of a quarantine service second to none. This, of course, was not accomplished without some opposition, particularly by many nurserymen who were accustomed to receiving foreign nursery stock without any restriction as to permit, inspection, certification or treatment. The situation at times became quite tense and the purposes of the Act might well have been defeated had its enforcement been placed in the hands of one with less stamina or one without the courage of his convictions. Name calling and misrepresentation in the early twenties regarding these matters were not infrequent, but this did not deter or intimidate him.

Some years after retirement he was hailed on the streets of Nassau by a prominent American importer who had bitterly fought Nursery Stock, Plant, and Seed Quarantine No. 37. "Hi!" he called, and coming up to shake his hand, remarked, "When last we met you were Mussolini and I was Haille Selassie!"

Noting the tact and judgment displayed by Dr. Marlatt in the administration of the plant quarantines under the provisions of the Plant Quarantine Act of 1912, the Secretary of Agriculture asked him to take on an additional assignment. Difficulty was being experienced in the drafting and administration of regulations governing the shooting of game under the migratory law of the Tracy Act. The controversy between the rabid Audubon enthusiasts, who objected to the shooting of all birds, and the hunters, who wanted to shoot certain birds, had waxed hot. Dr. Marlatt in his honest way advised the Secretary that he was not an ornithologist — that he ". . . didn't know a reed bird from a snipe." Even so, the Secretary's desire prevailed with the understanding that the assignment would be a temporary one. After some months had elapsed Dr. Marlatt was called by the Head of the Audubon Society who told him, "For some time now, I have been watching your work and have concluded at least you mean to be honest!", emphasizing his words by pounding on the desk. Dr. Marlatt chuckled when he told his wife that after many years in Government service he was glad that at least honesty had been conceded him.

Two eradication programs were successfully completed under his leadership, the Mediterranean fruit fly in Florida and the date scale in California. The eradication of the former species, which first appeared in Florida in 1929, was almost at the "sunset" of his exciting and useful career. He accepted this challenge, determined that nothing short of eradication should be the goal. Displaying his usual ability to select the right man to do the job in the field, he appointed Dr. Wilmon Newell, Plant Commissioner of the State Plant Board of Florida, who was in complete accord with the eradication idea. These two made an unconquerable team and within 18 months from the date of its discovery the much feared pest was indeed eradicated from 1,022 properties in Florida, at a cost of seven and one-half million dollars. Had this program been led by men with less foresight and determination than was shown by Drs. Marlatt and Newell, this pest might have remained with us as a permanent unwelcome guest. It is men of this caliber that make us proud of our profession.

Dr. Marlatt was the author of more than one hundred publications on entomological and plant quarantine subjects. To this number should be added one Annual Report of the Bureau of Entomology as Acting Chief and six as Chief. While connected with plant quarantine work he published seventeen Annual Reports as Chairman of the Federal Horticultural Board and as Chief of the Plant Quarantine and Control Administration.

Dr. Marlatt was a fellow of the American Association for the Advancement of Science, and a member of the Entomological Society of Washington, Kansas Academy of Science, American Association of Economic Entomologists, Cosmos Club, Chevy Chase and Burning Tree Golf Clubs, Gamma Sigma Delta, and Phi Kappa Phi.

Dr. Marlatt took an active interest in the affairs of the Entomological Society of Washington and served in the various offices of the Society, being President in 1896 and 1897. In 1951 he was made Honorary President. As retiring President he presented two noteworthy addresses, "A Brief Historical Survey of the Science of Entomology with an Estimate of What Has Been and What Remains to be Accomplished"[1] and "An Investigation of Applied Entomology in the Old World."[2] The soundness of his conclusions fifty-eight and fifty-nine years ago are indicative of his breadth of vision.

In 1899 he served as President of the American Association of Economic En[illegible]logists.

As an admi[illegible]or and organizer he had no superior in the fields of [illegible]ogy and plant quarantine. He was a

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[1]Proc. Ent. Soc[illegible]ash., IV (2):83-120 (1897)
[2]Proc. Ent. So[illegible]ash., IV (3):265-291 (1899)

firm believer in the choosing of personnel with care, but after discussing the work to be performed in a general way with the appointee, he then gave the worker wide latitude in the exercise of judgment. This promoted loyalty and intense interest in the work. Further, he had the ability and personality to bring the needs of entomological and plant quarantine work to his superiors and members of Congress.

As a host he had few equals, whether on the golf course, at his clubs mentioned, on the train, at scientific meetings, or in his home. He had the faculty of making one comfortable when it was one's good fortune to be with him and to hear his many interesting and amusing comments. The meetings of the Entomological Society of Washington in the early days of the Society at his home on Massachusetts Avenue, N. W. and later on 16th Street were delightful and stimulating events long to be remembered.

His was an adventurous spirit. The following paragraph taken from a courageous letter received from Mrs. Marlatt shortly after his leaving describes our friend perfectly:

"He told one of our daughters a short time ago that when he was free he was going to fly around the world and then maybe up to the moon. I am sure that somewhere he is off adventuring."

ERNEST N. CORY
W. DOYLE REED
E. RALPH SASSCER, *Chairman*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
638TH REGULAR MEETING, OCTOBER 7, 1954

The 638th regular meeting of the Society was called to order at 8:00 P.M., Thursday, October 7, 1954, in room 43 of the U. S. National Museum by President A. B. Gurney. Sixty members and 31 visitors were present. The minutes of the previous meeting were read and approved.

The following new members were elected:

Dr. G. Kruseman, Zoölogisch Museum, Afd. Entomologie, Zeeburgerdijk 21, Amsterdam (0), The Netherlands

Robert E. Hamman, Shell Chemical Corporation, 1120 Shoreham Bldg., Washington 5, D. C.

Dr. Flora E. Gorirossi, c/o Dr. Clyde Smith, Box 5215, State College Sta., Raleigh, N. C.

Dr. Clarence G. Thompson, Entomology Research Branch, Agriculture Research Center, Beltsville, Md.

E. A. Taylor, Entomology Research Branch, [illegible]ulture Research Center, Beltsville, Md.

Arthur Lindquist, Entomology Research B[illegible]lant Industry Station, Beltsville, Md.

Jean E. Mabry, 320th Preventive Medici[illegible]ch. (Control), Fort George G. Meade, Md.

George B. Craig, Jr., Medical Laboratories, Army Chemical Center, Edgewood, Md.

Wm. Richard Ballinger, Orkin Exterminating Co., Inc., 5804 Georgia Ave., N. W., Washington, D. C.

President Gurney reported that he had named a committee to study the finances of the Society, consisting of Alan Stone, chairman, H. J. Conkle, P. X. Peltier, and F. W. Poos. A committee to study improvement of the *Proceedings* consists of R. H. Foote, chairman, P. X. Peltier, and F. W. Poos.

A committee to prepare an obituary for Miss Colcord was named; it consisted of Miss Hawes, chairman, Doris H. Blake, and J. L. Wade. J. I. Hambleton spoke briefly about Professor Herbert Osborn, whose death in September deprived the Society of its oldest Honorary Member. The committee to prepare Professor Osborn's obituary is Mr. Hambleton, chairman, D. M. DeLong, G. S. Langford, F. W. Poos, and R. I. Sailer.

C. W. Sabrosky reviewed ''Composition of Scientific Words,'' by R. W. Brown, citing this reference work as a useful addition to the entomologist's library.

Price G. Piquett showed motion pictures of cockroaches of eleven species, including the giant drummer, *Blaberus giganteus* (L.), which are being reared for experimental purposes in the Pesticides Chemicals Research Section.

Two members of the Entomology Research Branch spoke on the use of microorganisms in the control of insect pests. The first speaker was Dr. C. G. Thompson, who told of the use of entomogenous protozoa and viruses in control of insect pests. The few field tests performed with artificial dissemination of Protozoa to control insect pests have given rather disappointing results. Protozoa, particularly the Microsporidia, cause considerable insect mortality in nature, but the method of infection and dissemination is not thoroughly understood. Many show high infectivity in laboratory tests and are often major problems in insectaries. The best known protozoan diseases of insects are the Nosema diseases of the silkworm and honey bee. Of the four types of viruses infecting insects, those characterized by the presence of polyhedral inclusions and those granular ''capsule'' inclusions appear to be the most important in the biological control of insects. These viruses are long-lived, resistant to desiccation, tolerant to almost any condition tolerated by the insect host, and, as a rule, are highly destructive to their hosts. As yet, they cannot be produced on any medium other than in living host tissues. A number of successful attempts to control important insect pests by the artificial dissemination of polyhedrosis viruses have been performed. (Speaker's abstract.)

Dr. S. R. Dutky continued on the use of entomogenous bacteria, fungi, and nematodes. Milky disease has been a successful control for the Japanese beetle. T use of spore formers and viruses for the control of other insects f roduced a new interest and hope in the general application of this method. The entomogenous bacteria, fungi, and nematodes provide a multiplicity of forms from which to choose pathogens well adapted to a given insect and its peculiar ecology. In contrast to the viruses, these microorganisms are usually less host specific and will attack a number of different insects; a pathogen isolated from one species may be effective against other quite unrelated insects. The choice of a particular pathogen for use against a specific insect includes in addition to its virulence toward the insect a consideration of how its requirements for infection and development fit the ecology of the insect. Other factors to be considered in the choice are its ease of propagation, resistance to unfavorable conditions, longevity in storage, and rapidity of kill. No single factor can be the basis of choice. (Speaker's abstract.)

In addition to F. P. Keen of the California Forest and Range Experiment Station at Berkeley, visitors included a large number of students of the University of Maryland. Wm. Ballinger, new member, was also introduced.

The meeting adjourned at 10:10 P.M.—KELLIE O'NEILL, *Recording Secretary.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
639TH REGULAR MEETING, NOVEMBER 4, 1954

The 639th regular meeting of the Society was called to order at 8:00 P.M., Thursday, November 4, 1954, in Room 43 of the U. S. National Museum by President A. B. Gurney. Forty-eight members and 30 visitors were present. The minutes of the previous meeting were read and approved.

The following new members were elected:

Dr. R. G. Dahms, Cereal and Forage Insects Section, Entomology Research Branch, Plant Industry Station, Beltsville, Md.

Albert S. Michael, Section of Beekeeping and Insect Pathology, Entomology Research Branch, Agricultural Research Center, Beltsville, Md.

Henry Gray, 916 Shoreham Bldg., 15th and H St., NW, Washington 5, D. C.

Roger O. Drummond, Robert A. McIntyre, Jr., Gordon M. Clark, Ivan Huber and Hansell F. Cross, all of the Department of Zoology, University of Maryland, College Park, Maryland.

T. E. Snyder for the Nominating Committee presented a slate of nominations for offices to be filled at the Annual Meeting. (Note: Officers for the year 1955 are presented on the inside front cover: Ed.)

R. W. Sherman reported on the sale of tickets for the banquet celebrating 100 years of professional entomology, announcing that the toastmaster was to be Dr. William Mann.

President Gurney spoke of the death of Mr. Austin H. Clark, whose obituary will be prepared by a committee consisting of T. E. Snyder, Chairman, H. H. Shepard and J. F. G. Clarke.

Notes and exhibitions of specimens were presented by several members. E. N. Cory exhibited underwear presented to him by Roy Campbell; on one article more than 100 specimens of ants were pictured, and on the other, H. L. Dozier had identified over 100 species of insects from their illustrations. Demonstrating the depth of Japanese interest in insects, L. W. Teller, recently a visitor to Japan, showed diverse objects including a child's insect cage, a metal container for paper triangles, a Japanese-style pinning block, and a manual of insects of unexcelled color lithography. Different aerotropic reactions of the stink bug, *Euschistus ictericus* (L.), were demonstrated by R. I. Sailer. When Dr. Sailer fanned the bugs with ordinary paper they clung to their string bean host; when he breathed on them they quickly dropped from it. He suggested that bugs failing to drop promptly when breathed upon by a grazing animal might be eaten by it.

Dr. Dietrich Bodenstein, insect physiologist at the Army Chemical Center, spoke on "Endocrine Mechanisms in Insect Morphogenesis." Transplantation or extirpation of appropriate endocrine organs can cause premature or delayed metamorphosis. Intermediate creatures (partially adult individuals) can be produced by experimentally altering the normal humoral balance of the hormones responsible for larval or adult characteristics. Even adult insects can be made to molt again if they are supplied with molting hormone, and these retain their imaginal characteristics. A balanced hormone system and the constant interaction of the endocrine glands with each other are very important physiological requirements for a normal animal. A specifically balanced humoral system and the ability of the target material to respond to this system together determine the characteristic developmental response. (Speaker's abstract.)

Introductions included L. D. Newson, head of the Entomology Department, Louisiana Agricultural Experiment Station, Baton Rouge; Dr. P. N. Chatterjee, Indian Forest Research Institute, Dehra Dun, U.P., India; and Dr. José C. M. Carvalho, Museo Nacional, Quinta da Boã Vista, Rio de Janeiro, Brazil. Maryland and George Washington Universities were each represented by a number of visiting graduate students.

The meeting adjourned at 9:45 P.M.—KELLIE O'NEILL, *Recording Secretary.*

BOOK NOTICE

A MANUAL OF THE DRAGONFLIES OF NORTH AMERICA

By JAMES G. NEEDHAM and MINTON J. WESTFALL, JR. xii + 615 pp., 341 text illustrations, 1 plate, index. University of California Press, Berkeley, 1954. $12.50.

The information on the inside of the jacket best explains the purpose and scope of this new book:

"This is an authoritative introduction to dragonflies.

"The first part of the book deals with dragonfly adults and nymphs in general. The species are introduced and their life histories, body structures, haunts, breeding habits, and other characteristics described. Under the subheading 'Field Studies,' many practical tips about methods and implements for collecting, preserving and studying dragonflies are offered.

"The second part consists of a systematic classification of species. In the preparation of keys and tables much time and thought were given to the convenience of the user and the limitations of the beginner.

"The study of dragonfly nymphs has been greatly neglected in the past. In this book, characters by which nymphs may be recognized are stated in separate keys and tables. An illustration is placed near the key to nymphs in each genus.

"The language used is as simple as is consistent with clearness, and the necessary technical words are elucidated by the use of diagrams and abundant photographic illustrations. A glossary at the end offers an additional help to beginners.

"The range of species is given in terms of states, which the user can readily find on his map, rather than in terms of life zones or provinces of climatology and zoogeography.

"This will be an indispensable manual for the entomologist, expert and beginner alike."

RIL 1955 VOL. 57, NO. 2

PROCEEDINGS

of the

NTOMOLOGICAL SOCIETY

of **WASHINGTON**

U. S. NATIONAL MUSEUM
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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
1884

CONTENTS

THE
ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884

The regular meetings of the Society are held in the U. S. National Museum on the first Thursday of each month, from October to June, inclusive, at 8 P.M.

Annual dues for members are $4.00, initiation fee $1.00 (U. S. currency). Members are entitled to the Proceedings, and manuscripts submitted by them are given precedence over any submitted by non-members.

PROCEEDINGS

Published bimonthly beginning with February by the Society at Washington, D. C. Terms of Subscription: $4.50 per annum, both domestic and foreign, payable in advance (U. S. currency). Remittances should be made payable to the Entomological Society of Washington. The Society does not exchange its publications for those of other societies.

Authors will be furnished copies of the number in which their articles appear at cost to the Society, or reprints of such articles, at the following rates, plus postage and insurance, provided a statement of the number desired accompanies the returned proofs.

	2 pp.	4 pp.	8 pp.	12 pp.	16 pp.	Covers
50 copies	2.00	3.00	5.00	5.60	6.25	4.00
100 copies	2.50	3.80	6.00	7.20	8.25	4.75
Additional copies per 100	1.00	1.15	2.00	2.60	3.15	1.50

These charges are for reprints with side stapling; saddle stapled reprints (which will open flat) may be had at prices approximately 70% greater.

Illustrations in excess of one full page line cut are to be paid for by the author. Immediate publication may be obtained at author's expense. All manuscripts should be sent to the Editor, U. S. National Museum, Washington 25, D. C.

SPECIAL NOTICE

The Committee on Memoirs of the Entomological Society of Washington announces that it will consider manuscripts for possible publication in the Memoir series. Members who have papers comparable in length and scope to previously published memoirs are invited to correspond with the Editor. It is hoped that Memoir No. 5 may be published in 1955.

Entered as second-class matter at the Post Office at Washington, D. C.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 57 APRIL 1955 NO. 2

A REVISION OF THE GENUS DENDROCORIS AND ITS GENERIC RELATIONSHIPS

(HEMIPTERA, PENTATOMIDAE)[1,2]

By GAYLE H. NELSON, *College of Medical Evangelists, Loma Linda, Calif.*

The generic name *Dendrocoris* was proposed by Bergroth in 1891 for *Liotropis* Uhler, 1877, which was found to be preoccupied by *Liotropis* Fitzinger, 1843, in the Reptilia. The type of the genus *Dendrocoris* is *humeralis* (Uhler), 1877, the only originally included species in the genus *Liotropis.* The latest work on the genus is the key to the species by Torre-Bueno (1939).

The position of *Dendrocoris* within the family Pentatomidae has been a matter of dispute. It was first regarded by Uhler (1886) as belonging to subfamily Asopinae. It was later placed in the subfamily Pentatominae near the Brazilian genus *Lopadusa* Stål by Bergroth (1891). Montandon (1893) concurred with this placement and Kirkaldy (1909), in his systematic arrangement, placed *Dendrocoris* between *Lopadusa* Stål and *Bothrocoris* Mayr. A critical study of *Dendrocoris* and closely related genera has indicated that this systematic arrangement should be modified. *Lopadusa* differs from *Dendrocoris* in its extremely small and proportionately shorter head, much elevated bucculae which are shorter than the first rostral segment, as well as the form of the mesosternum which has a pronounced median keel and metasternum which is broadly elevated. In *Dendrocoris* the head is slightly broader than long, but not to the extent found in *Lopadusa*, and the first rostral segment is shorter than the bucculae. The mesosternum and metasternum, instead of being keeled or elevated, are depressed to the extent of having a shallow median groove. The genus *Bothrocoris* also has the raised meso- and metasternum and is closely allied with *Lopadusa.* These two genera apparently belong to a group within the tribe Pentatomini quite apart from that to which *Dendrocoris* belongs.

The group to which *Dendrocoris* belongs appears to include the genera *Odmalea* Bergroth and *Brepholoxa* Van Duzee.

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[1] Part of a thesis submitted to the Faculty of the Graduate School of the University of Maryland in partial fulfillment of the requirements for the degree of Master of Science.

[2] Scientific Article No. A493. Contribution No. 2599 of the University of Maryland Agricultural Experiment Station (Department of Entomology).

Bergroth (1914) established the genus *Odmalea* for two species, *quadripunctula*, which he designated as the type of the genus, and *schaefferi* Barber, transferred from *Dendrocoris*. Kirkaldy (1909) placed the genus *Brepholoxa* near *Arvelius* Spinola to which it bears but a superficial resemblance. The following characteristics clearly ally *Brepholoxa* to *Dendrocoris* and *Odmalea:* (1) depressed midventral line of meso- and metasternum (2) bucculae longer than the first rostral segment and (3) the projection anteriorly of the second ventral abdominal segment into a rather prominent blunt spine. The three genera may be separated by the following key:

1. Second segment of antennae always longer than the third, fourth, or fifth segments; ostiolar canal reduced to a short raised and blunt projection, never reaching the lateral ⅓ of evaporative area .... *Brepholoxa* Van Duzee
   Second segment of antennae always shoretr than the third, fourth or fifth joints; ostiolar canal long and tapering, attaining the lateral ⅓ of evaporative area 2
2. Femora with the apex above produced into a short spine or angle; humerus of pronotum produced into an acute triangular process .... *Odmalea* Bergroth
   Femora unarmed apically; humerus of pronotum, if produced, an obtusely rounded process .... *Dendrocoris* Bergroth

The genus *Atizies* described by Distant (1893) is a synonym of *Dendrocoris*. Distant's description and figure of *Atizies suffultus* seem to differ from *Dendrocoris* only by his statement that the tibiae are sulcate. Actually the sulcation is obscure on the anterior and middle tibia and distinct only on the posterior tibia. Dr. W. E. China has examined the type of *suffultus* and confirmed its identity as a true *Dendrocoris*.

The genus *Dendrocoris* and the two closely related genera mentioned above are confined to the Western Hemisphere. *Brepholoxa* is known from Florida, and *Odmalea* from Texas, Panama, Bolivia, Brazil and Uruguay. *Dendrocoris* is known from northern United States, from the East to the West Coast, south to Southern Mexico, with the center of distribution apparently in the Lower Sonoran Life Zone of the Southwestern U. S. and Mexico.

The biology of *Dendrocoris* is poorly known. From available information it is found on various trees and shrubs, except two Mexican species which came from orchids. More specific information, when known, is given in the discussion of each species.

The technique used to study the internal male genitalia of *Dendrocoris* is as outlined by Sailer (1952), with the exception of the method of relaxing the specimens. Instead of using the 95% alcohol, etc., solution, the specimens were relaxed by immersing them for 30 seconds in boiling water.

The terminology of the parts of the internal male genitalia used in this paper is based on that proposed by Baker (1931). All descriptions are with penis lobes of aedeagi distended; length measurements are made from the tip of the head to the apex of the membrane and widths are measured across the body at the base of the hemelytra.

Acknowledgments.—The writer wishes to express his sincere appreciation to Dr. R. I. Sailer of the U. S. National Museum, at whose suggestion and under whose direction this study was undertaken, for the benefit of his experience in taxonomy and his knowledge of the literature. Thanks are also due to Dr. William E. Bickley of the University of Maryland for his encouragement and suggestions; to Dr. W. E. China of the British Museum for comparing specimens with the type of *Atizies suffultus* Distant; and to the following institutions and individuals for the loan of material in their collections: United States National Museum (through R. I. Sailer); University of Kansas Snow Entomological Museum (through R. H. Beamer); University of California (through John D. Lattin); Chicago Natural History Museum (through R. L. Wenzel); Museum of Comparative Zoology (through P. J. Darlington); The American Museum of Natural History (through Herbert Ruckes); California Academy of Sciences (through E. S. Ross); Ohio State University (through J. N. Knull); University of Michigan (through T. H. Hubbell).

Dendrocoris Bergroth

Liothropis Uhler, 1877, Bul. U. S. Geol. Survey, 3:399; 1886, Checkl. Hem.-Het. N.A.; 5; Lethierry and Severin, 1893, Cat. General Hemip., Tome I: 186; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Dendrocoris Bergroth, 1891, Revue d'Ent. 10:228; 1908, Mem. Soc. Ent. Belgique 15:177; 1914, Ann. Soc. Ent. Fr. 83:438,439; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:262; 1911, Ent. News 22:268; Kirkaldy, 1909, Cat. Hemip. 1:151; 1912, Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het. p. 84; Van Duzee, 1917, Cat. Hemip. N. Amer.:64; Stoner, 1920, Iowa Univ. Studies in Nat. Hist. 8:112, 113; Parshley, 1923, Hemip. Conn. 769; Blatchley, 1926, Heterop. East. N. Amer.: 173; Torre-Bueno, 1939, Ent. Americana 19:208, 240; Froeschner, 1941, Amer. Midland Nat. 26:128.

Atizies Distant, 1893, Biol. Cent. Amer., Heterop., I:456. (New synonomy.)

Generic Description

Color.—The general coloration is variable. Dorsum punctured fairly uniformly with concolorous punctures or in part or wholly fuscous to black. Punctures of venter pale concolorous. Pronotal cicatrices with a transversely elongate ring of punctures. Legs and antennae pale testaceous sometimes tinged with or completely rufous. Rostrum straw color to rufous with a median line and distal portion of terminal segment black.

Structure.—Oval to broad oval, sides subparallel, tapering rather sharply anteriorly, more gradually posteriorly. Moderately convex dorsally and strongly so ventrally. Anterior half of pronotum and head slightly to rather strongly declivous. Head broader across eyes than long, juga contiguous before tylus. Tubercle of antennifer in part or almost wholly distinct from above. First segment of antennae short and stout, second to fifth slender with second equal to or greater in length than first and third, fourth and fifth longer than either joints 1 or 2. Second joint of antennae longer in female than in males (except *reticulatus,* in which they are subequal). Third joint longer in males than in females in all cases. Rostrum slender and extending to but not beyond posterior coxae. First and fourth rostral segments short, subequal in length, the second being the longest segment and third somewhat shorter but longer than segments one or four. Pronotum usually obtusely prominent, with a small tooth at anterior lateral angles. Ostiolar canal extending antero-lateraly to outer third of episternum, evaporative area well defined. Thoracic sterna depressed as a shallow groove. Tibiae sulcate, except in *variegatus,* the males of which have sulcate anterior and middle tibiae but terete posterior tibiae, while the females have sulcate posterior tibiae, flattened middle tibiae and terete anterior tibiae. Scutellum as broad at base as long, apex rounded. Outer angles of corium bluntly acute. Connexivum exposed. Second ventral abdominal segment produced anteriorly at middle as a blunt spine, except in males of *humeralis* and *variegatus* which have but a median convexity.

Male genitalia.—Genital segment (ninth abdominal) a deep cup opening dorso-posteriorly. Anterior margin rounded downward; posterior margin of lip on either side of median notch, variously produced as a plate-like process. The inner margins of the processes carinate, the carinae extending downward on ventral surface of hypopygium approximately one fourth to one third the total exposed length. Hypopygium, from a ventral view, strongly convex at base and concave postero-laterally on either side of mesal carinae. Clasper with ental arm elongate and narrowly rounded; ectal arm variously produced or not at all, never equaling the ental arm.

Aedeagus with lateral penis lobes well developed, projecting laterally with distal portion variously turned; median penis lobe distinct but not as prominent as lateral lobes; penisfilum curving upward, apex pointed dorsally or postero-dorsally.

Female external genitalia.—Genital plates varying in size and placement. Subgenital plates bluntly acuminate at tip, not reaching posterior margin of middorsal plate. Lateral plates with apices not extending beyond posterior margin. Middorsal plate contiguous with lateral plates, their margins together evenly rounded in outline or slightly sinuate. Female internal genitalia not examined.

KEY TO THE SPECIES OF DENDROCORIS

1. Vertex of head and base of tylus distinctly convex 2
   Vertex of head and base of tylus in part flat 4
2. Antero-lateral margins of pronotum straight or somewhat convexly arcuated (W. and S.W. United States) .... *pini* Montandon
   Antero-lateral margins of pronotum concavely arcuated 3
3. General body color rufous, or if clay yellow, connexivum with black band at base and apex of each segment. (New Mexico) .... *neomexicanus,* new species (p. 64)
   General body color flavotestaceous; connexivum without a black band at base and apex of each segment (S. W. United States) .... *contaminatus* Uhler
4. Antero-lateral margins of pronotum straight or substraight 5
   Antero-lateral margins of pronotum concavely arcuated 7
5. Veins of membrane reticulated; form broad oval (Arizona) ....

reticulatus Barber

Veins of membrane not reticulated; form more narrow, suboval 6

6. Connexivum with a distinct black spot at incisures which is separated from lateral margin; spiracles raised, black (S. E. United States) *fruticicola* Bergroth

Connexivum with a fuscous or black band on either side of incisures, if black always extending to lateral margins; spiracles generally pale concolorous (S. W. United States) *arizonensis* Barber

7. Spiracles black; second ventral abdominal segment produced anteriorly at middle as a short blunt spine in both sexes (Mexico) *suffultus* (Distant)

Spiracles pale; second ventral abdominal segment produced anteriorly at middle in female only 8

8. Head distinctly wider than long, a ratio of 1.36 to 1; male hypopygium with a distinct tooth at antero-ventral apex of each median carina; anterior margin of male head with widely spaced denticles (Mexico) *variegatus*, new species (p. 60)

Head appears to be as long as wide, actually width to length a ratio of 1.26 to 1; male hypopygium without a tooth at antero-ventral apex of each median carina; head of male smoothly rounded in front (United States) *humeralis* (Uhler)

Dendrocoris humeralis (Uhler)

Liotropis humeralis Uhler, 1877, Bul. U. S. Geol. Survey 3:400; 1886, Checkl. Hem.-Het. N.A.: 5; Lethierry and Severin, 1893, Cat. Gen. Hemip., Tome I.: 186; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Dendrocoris humeralis (Uhler): Bergroth, 1891, Revue d'Ent. 10:228, 229; 1914, Ann. Soc. Ent. Fr. 83:438, 439; Uhler, 1904, Proc. U. S. Natl. Mus. 27:351: Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:262; 1911, Ent. News 22:269; Kirkaldy, 1909, Cat. Hemip. 1:151; 1912, Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1917, Cat. Hemip. N. Amer.: 64; Stoner, 1920, Iowa Univ. Studies in Nat. Hist. 8:113; Parshley, 1923, Hemip. Conn.: 769; Blatchley, 1926, Heterop. East. N. Amer.: 173; Torre-Bueno, 1939, Ent. Americana 19:241; Froeschner, 1941, Amer. Midland Nat. 26:131.

Color.—Pale testaceous or clay yellow above and below frequently tinged with orange or rufous. Dorsal punctures variable. Head clay yellow narrowly margined with black and coarsely and thickly punctured with black or brown, except for impunctate anterior and antero-lateral jugal margins, and two impunctate spots located on either side anterior to the ocelli and mesal to compound eyes, lateral spot oval and well defined, median spot elongate and less well defined. Eyes red to dark brown, ocelli red. Head beneath coarsely and thickly punctured with concolorous or pale ochraceous punctures, more numerous between bucculae and eyes. Dark line running from eye over base of tubercle of antennifer anteriorly. Antennae rufous, basal joint paler. Rostrum pale yellow or tinged with rufous, with a median line and distal half of terminal segment piceous or black. Pronotum pale testaceous or clay yellow sometimes with orange or rufous lateral margins. Punctures of pronotum concentrated at margins and frequently producing dark areas anteriorly and four spots (not always evident) across the disk, two near midline and two near lateral margins. Propleura thickly punctured with concolorous or pale ochraceous coarse punctures as on head, becoming coarser and darker (sometimes black) laterally, less numerous on mesopleura and much smaller and less numerous on the metapleura. Scutellum testaceous or clay yellow, thickly punctured rufous to black with concentrations at base forming irregular spots. Punctures less concentrated on disk, a black spot on either side at distal extent of frenum. Hemelytra testaceous or clay yellow with rose tints often coloring base or disk, punctures frequent but irregular, leaving a few bald spots on disk and costal margins. Membrane pale ochraceous, connexivum testaceous with orange tint, posterior lateral angles of segments black, sometimes anterior and posterior margins also. Abdominal venter testaceous or pale yellow with flecks of rufous, punctures concolorous or ochraceous to black laterally, fine and sparse on disk becoming coarse and concentrated laterally. Black spot evident at posterior lateral angles of segments. Spiracles concolorous with venter. Posterior edge of female anal segment black on each side.

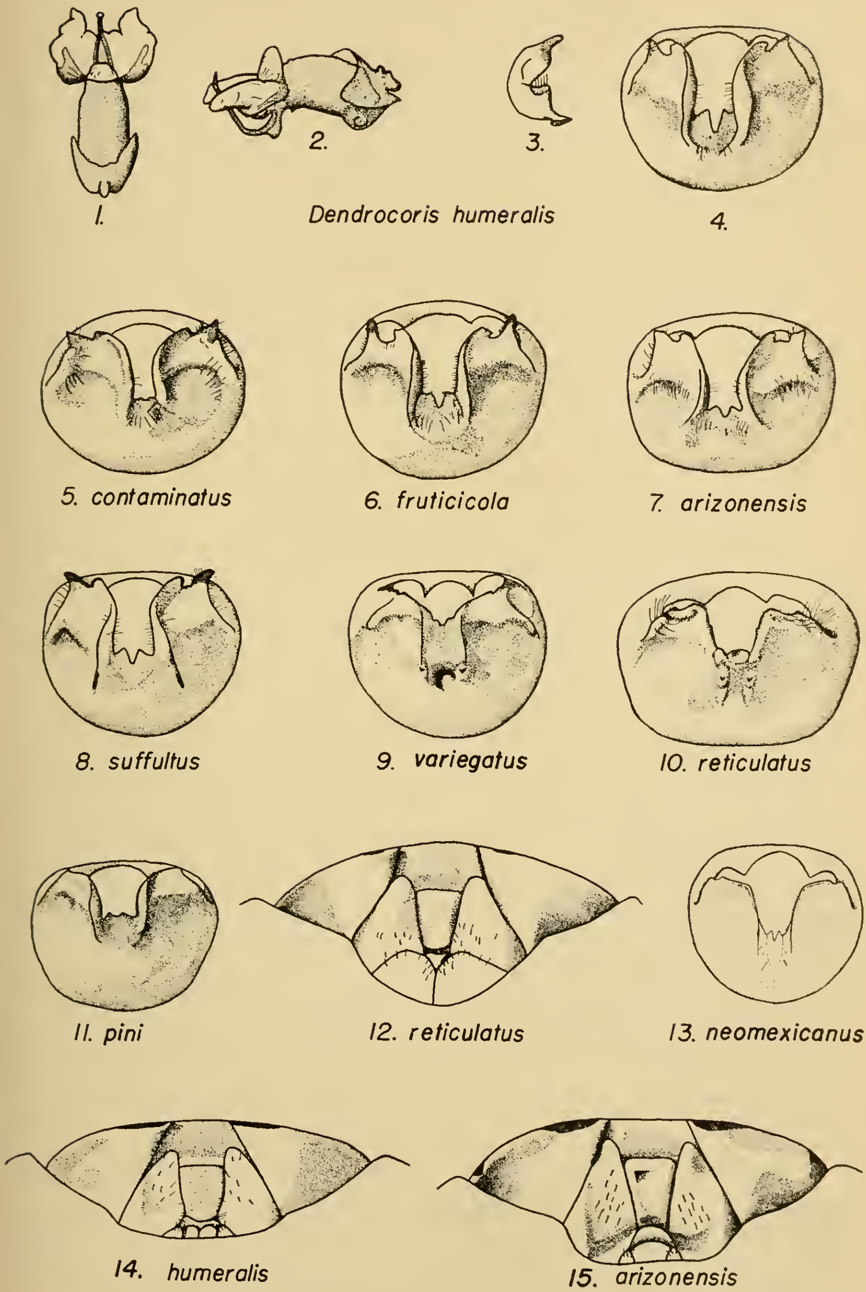
Structure.—Form broad-oval, with prominent humeri. Head width to length a ratio of 1.26 to 1, broadly rounded in front; sides subparallel; vertex flat. Tylus much shorter than juga. Almost all of tubercle of antennifer visible from above. Lateral margins of pronotum before humeri concave. Length: ♂, 6.3-7.3 mm; ♀, 7.0-8.5 mm. Width: ♂, 3.7-4.45 mm.; ♀, 4.2-4.9 mm.

Male genitalia.—As in figures 1-4. Hypopygium as viewed from beneath concave posteriorly on either side of middle, with a well defined notch in median posterior margin. Hypopygium on either side of median notch produced posteriorly as a plate and reflexed upward and forward with a slight torsion toward the outside; mesal and lateral angles of plate acutely produced. Clasper rounded medially, concave laterally, with ental arm elongate and narrowly rounded at apex, ectal arm reduced to a rounded lobe. Proctiger slightly concave ventrally and convex dorsally, posterior ventral margin truncate.

Female genitalia.—As shown in figure 14, strongly pitted with large punctures. Genital plates small and separated by twice their width at base. Subgenital plates bluntly acuminate at tip. Lateral plates contiguous with middorsal plate, their margins together rounded posteriorly.

Variation.—Color varies considerably as mentioned above, a few specimens with punctures uniformly light colored, others with punctures almost wholly black.

Male hypopygia are shown from a ventral caudal view; female genitalia from a ventral view. Punctation not indicated. *Dendrocoris humeralis* (Uhler): fig. 1, aedeagus, dorsal view; fig. 2, same, dextral view; fig. 3, clasper, postero-ventral view; fig. 4, male genital segment, showing ventral median notch posteriorly on hypopygium, hypopygial plates and mesal carinae; fig. 14, female genital segment, ventral view; fig. 5, *D. contaminatus* Uhler, male genital segment; fig. 6, *D. fruticicola* Bergroth, male genital segment; fig. 7, *D. arizonensis Barber,* male genital segment; fig. 15, female genital segment; fig. 8, *D. suffultus* (Distant), male genital segment; fig. 9, *D. variegatus,* new species, male genital segment; fig. 10, *D. reticulatus* Barber, male genital segment; fig. 12, female genital segment; fig. 11, *D. pini* Montandon, male genital segment; fig. 13, *D. neomexicanus,* male genital segment.


1.
2.
3.
4.
Dendrocoris humeralis
5. contaminatus
6. fruticicola
7. arizonensis
8. suffultus
9. variegatus
10. reticulatus
11. pini
12. reticulatus
13. neomexicanus
14. humeralis
15. arizonensis

Spiracles in a few specimens darkened to brown or black. Rather uniform in structure except humeri which vary from broadly rounded obtuse to narrowly rounded acute.

Type material.—Uhler described this species from a cotype series. One female has been selected as lectotype, labeled in Uhler's longhand with the following data: line 1, *humeralis;* line 2, June 28 Uhler; line 3, Sept. 30 on *Carya;* line 4, Md. Lectotype in U. S. National Museum.

Distribution.—This species is widely distributed in the United States, being found throughout the East and South north to Massachusetts, New Hampshire, Michigan, and Iowa, and westward through Kansas, Colorado to California.

Biology.—Taken in New Jersey from small oaks in August and September, in New York and New Jersey from pine and in Colorado from small bushes. The author took it in Michigan in copula from black oak in July. Torre-Bueno (1939) records it from hickory and hazel also. Recorded as being predaceous.

Dendrocoris contaminatus Uhler

Dendrocoris contaminatus Uhler, 1897, Trans. Md. Acad. Sci. 1:390; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Bergroth, 1908, Mem. Soc. Ent. Belgique 15:177; 1914, Ann. Soc. Ent. Fr. 83:440; Kirkaldy, 1909, Cat. Hemip. 1:151; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Ruckes, 1938, Bul. Brookl. Ent. Soc. 33:13; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis contaminatus: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62; Osborn, 1909, Ent. News 20:177.

Easily distinguished by its general coloration, and differs from *humeralis* in its more square male genital segment and short, obliquely narrowing head.

Color.—Flavotestaceous or tinted with ochraceous or rufous with cicatrices of pronotum dark ochraceous or piceous, color extending toward humeral angles and in contrast to general body color. Punctured rather uniformly with concolorous punctures for most part, but black on anterior part of pronotum, black interrupted at middle and irregular on head. Antennae flavotestaceous to pale rufous, rostrum the same with typical dark markings. Under-surface flavotestaceous usually paler than dorsum, with rose spots on venter of abdomen laterally, not always present; punctures colored as venter. Spiracles pale or fuscous to black.

Structure.—Form broad-oval, with moderately prominent humeri. Head width to length a ratio of 1.18 to 1; sides converging obliquely to rounded tip; vertex and base of tylus convex. Juga longer than tylus and either contiguous in front or not. Almost all of tubercle of antennifer visible from above. Lateral margins of pronotum before humeri slightly concave. Length: ♂, 6.0-6.8 mm.; ♀, 6.5-7.7 mm. Width: ♂, 3.8-4.55 mm.; ♀, 3.8-4.55 mm.

Male genitalia.—Hypopygium as in figure 5, broader and more square apically, than *humeralis,* mesal angle of hypopygial plate less prominent, with a blunt lobe on lateral margin of plate near apex; ental arm of clasper prominent, more bluntly rounded than in *humeralis,* ectal arm as in *humeralis* but less rounded; proctiger and aedeagus as in *humeralis.*

Female genitalia.—As in *humeralis*, except that genital plates are hidden by sixth ventral abdominal segment, and subgenital plates are more acute at apex.

Variation.—Color varies as mentioned above, the darkened area on anterior part of pronotum varying considerably in its extent. Occasionally the spiracles are black. General form constant, lateral margins of pronotum sometimes almost straight. In many specimens the juga are non-contiguous before the tylus.

Type material.—Uhler described the species from a cotype series. One female specimen has been selected as lectotype, labeled in Uhler's longhand with the following data: *D. contaminatus* on the first line and Ariz. in the lower left hand corner. Lectotype in U. S. National Museum.

Distribution.—Found in Southwestern United States from Texas, New Mexico, Arizona, California and Utah.

Biology.—Osborn (1909) records this species as feeding on *Opuntia*, and Hubbard collected it from *Opuntia fulgens* and from *Cereus*. E. W. Davis collected it in September from *Covillea tridentata*, R. S. Beal from *Larrea* by beating in July and J. H. Russell from *Larrea* in April. Ruckes (1938) took it frequently while beating *Quercus gambeli* near Santa Fe, New Mexico.

Dendrocoris fruticicola Bergroth

Dendrocoris fruticicola Bergroth, 1891, Revue d'Ent. 10:228; 1914, Ann. Soc. Ent. Fr. 83:440; Lethierry and Severin, 1893, Cat. Gen. Hemip., Tome I: 186; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Kirkaldy, 1909, Cat. Hemip. 1:151; Van Duzee, 1909, Buf. Soc. Nat. Sci. Bul. 9:157; 1912, Proc. Ent. Soc. Hawaii 2:126 (*fruticicola* cited in error); 1917, Cat. Hemip. N. Amer.: 64; Torre-Bueno and Engelhardt, 1910, Can. Ent. 42:148; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Blatchley, 1926, Heterop. East. N. Amer.: 174; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis fruticicola: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Differs from *humeralis* and *arizonensis* in black color of spiracles and in its lack of markings on connexivum.

Color.—Pale ochraceous above and below, usually with an orange or ferruginous tinge above becoming rufous on corium. Punctures of dorsum variable, rufous to castaneous and black. Head punctured with castaneous or black except for an impunctate oval area mesal to each eye and impunctate margins on juga. Antennae rufous, paler basally. Lateral margins of pronotum darker than disk with punctures of pronotum extremely variable in color, median impunctate line sometimes obliterated, punctures concentrated toward margins and forming four dark spots across middle of disk, lateral two sometimes faint or absent. Punctures of thoracic pleura concolorous or pale castaneous laterally, coarse on propleura, less coarse and less numerous on meso- and metapleura. Legs pale ochraceous basally, becoming rufous distally. Scutellar punctures variable in color, coarse and numerous at base, progressively finer toward apex, a dark spot at antero-lateral angles and one on each side at apex of frenum. Hemelytra pale ochraceous or rufous, at least rufous on disk or with rufous punctures, with impunctate areas on disk. Membrane pale ochraceous, transparent. Connexivum pale yellow tinted with orange, with extreme apical angle of abdominal segments dorsally and ventrally, posterior edge of female genital segment on either side and a large spot at each incisure of connexivum next to costal margin, black. Venter of abdomen pale ochraceous, smooth with fine punctures laterally. Spiracles black and elevated.

Structure.—General form as in *arizonensis* but more convex dorsally. Head width to length a ratio of 1.29 to 1. Humeral angles of pronotum generally less rounded than in *arizonensis*. Length: ♂, 7.0-7.9 mm.; ♀, 7.1-8.8 mm. Width: ♂, 4.5-4.9 mm.; ♀, 4.4-5.4 mm.

Male genitalia.—Hypopygium as in figure 6, lateral angles of hypopygial plate blunt and more prominent than in *humeralis;* clasper like *humeralis* but with ectal lobe acute; proctiger and aedeagus like *humeralis*.

Female genitalia.—As in *humeralis*.

Variation.—Color varies as mentioned above, occasionally without orange or ferruginous tints in general coloration. Spot on connexivum at each incisure is distinct but sometimes quite small. General form rather uniform with an occasional specimen having lateral margins of pronotum before humeri slightly concave.

Type material.—Bergroth described the species from a cotype series. One male has been selected as lectotype, with the printed label bearing the following data: Duval Co., Fla. Lectotype in U. S. National Museum.

Distribution.—Restricted to southeastern United States, recorded from Florida, North Carolina, Georgia and Alabama.

Biology.—Torre-Bueno (1939) records it from scrub oak and H .G. Barber collected it at Wilmington, North Carolina in April on oak. The author collected one specimen while beating long-leaf pine at Southern Pines, North Carolina in June.

Dendrocoris arizonensis Barber

Dendrocoris arizonensis Barber, 1911, Ent. News 22:270; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Torre-Bueno, 1939, Ent. Americana 19:241.

Closely related to *humeralis* from which it can be distinguished by its straight antero-lateral margins of pronotum and divergent mesal carinae on hypopygium; from *fruticicola* it differs as mentioned in the key to species.

Color.—Pale stramineous to pale testaceous above and below with rosy tints frequently showing on corium. Dorsum punctured with castaneous, with black punctures frequently occurring on head, anterior and lateral parts of pronotum and on lateral parts of corium. A small block spot marks base of tubercle of antennifer before eye. Antennae and legs colored as venter or rufous, sometimes ferruginous. Connexivum as dorsum or tinted rufous, closely and concolorously punctate except at base and apex of each segment where surface is smudged with fuscous encircling smooth pale calloused edges of incisures; lateral margin of connexivum either side of incisures, black. Lateral edges of abdomen either side of incisures of segments 2-5, tip of 6th and edges of female genital segment, black. Spiracles usually pale, occasionally black.

Structure.—Form broad-oval with humeral angles moderately prominent and rounded. Head width to length a ratio of 1.25 to 1, sides slightly converging anteriorly to broadly rounded front; vertex slightly raised; juga contiguous, sometimes overlapping before tylus. Lateral margins of pronotum before humeri straight. Length: ♂, 6.6-7.3 mm.; ♀, 7.4-9.25 mm. Width: ♂, 3.9-4.5 mm.; ♀, 4.3-5.5 mm.

Male genitalia.—Hypopygium as in figure 7, similar to *humeralis* but with the antero-ventral apex of mesal carinae divergent instead of convergent; ental arm of clasper less prominent than in *humeralis* and ectal lobe angular; proctiger with concave surface extending dorsally farther than in *humeralis*; aedeagus as in *humeralis.*

Female genitalia.—As in figure 15, not as coarsely punctured as in *humeralis*, subgenital plates more acuminate and more in line with body axis than in *humeralis.*

Variation.—Color varies considerably as mentioned above, some specimens being almost wholly ferruginous or rufous. General form rather constant with some variation in the pronotal humeri, occasionally barely projecting beyond side margins of body.

Type material.—Holotype and paratypes in the U. S. National Museum (the author used the term cotype for paratype; description made from two females and one male).

Type locality.—Huachuca Mts., Ariz.

Distribution.—In Southwestern United States from California, Arizona, Texas and Colorado.

Biology.—One female was collected at the base of the Pinal Mts., Ariz. in September from oak by D. K. Duncan and two males were collected at Palo Alto, California in May from oak. The author took one at Prescott, Arizona in August while beating oak. This is the only information available as to the biology of this species.

Dendrocoris suffultus (Distant), new combination

Atizies suffultus Distant, 1893, Biol. Cent. Amer., Heterop., 1:456, pl. 39, fig. 20.

A large Mexican species that resembles *arizonensis* but can be distinguished by concave antero-lateral margins of pronotum and black spiracles.

Color.—Pale ochraceous and stramineous above, pale stramineous below, above punctured with dark brown and black punctures, ventral punctures concolorous or pale ochraceous. Head stramineous, ochraceous basally, margined with black; punctures above, black, coarse and partially confluent, outlining a smooth oval area mesal to each eye. Head beneath impunctate anteriorly on juga, punctures coarse posteriorly and tinged with pale rufous. A black spot before eye extends onto base of tubercle of antennifer. Antennae moderately ferruginous, basal joint paler. Rostrum stramineous, terminal segment ochraceous with typical black markings. Pronotum stramineous, cicatrices ochraceous; punctures black and concentrated laterally and anteriorly, brown and less concentrated on disk leaving a faint median impunctate line that extends to both anterior and posterior margins. Scutellum colored as pronotum with disk punctured dark brown, punctures darker and concentrated as spots, one on either side where frenum ends and one near the apex; black punctures arranged along basal margin and forming indistinct spots at lateral basal angles. Hemelytra stramineous, faintly tinted with pale rufous on disk, deep rufous on ventral surface of corium; punctures dark brown and fairly sparse on disk leaving irregular smooth areas, but black and more concentrated basally and laterally. Membrane transparent, smoky. Connexivum pale stramineous with suffuse pale rufous markings, a broad band at base and apex of each segment surrounding smooth pale edges of incisures, black, extending to lateral margins. Dorsal disk of abdomen black. Ventral surface of thorax and abdomen spotted with pale rufous. Propleural punctures coarse and numerous medially becoming less coarse laterally; mesopleural punctures moderately coarse but sparse; those of metapleura fine, a little heavier lateral to evaporative area. Legs stramineous at base tinged with rufous toward apex of femora and on ochraceous tibiae, tarsi moderately ferruginous. Venter of abdomen colored as mentioned above, with apical and basal angles of segments and spiracles, black.

Structure.—Form broad-oval, broadest across humeral angles. Head width to length a ratio of 1.30 to 1, sides narrowing anteriorly to broadly rounded front; vertex slightly raised; tylus enclosed at tip by juga. Tubercles of antennifer clearly visible from above. Lateral margins of pronotum slightly concave before prominent rounded humeri. Length: ♂, 7.5-8.4 mm; ♀, 7.8-9.0 mm. Width: ♂, 4.70-5.15 mm; ♀, 4.75-5.25 mm.

Male genitalia.—Hypopygium as in figure 8, similar to *arizonensis* but with more prominent mesal and lateral angles on hypopygial plates; ental arm of clasper prominent, ectal arm slightly shorter and more blunt, clasper with a lobe at base of ectal arm laterally; proctiger as in *arizonensis*, aedeagus similar to *humeralis* but more rounded with apex of lateral penis lobes turning dorsally and not as prominent, median penis lobe more slender.

Female genitalia.—Similar to *humeralis*, but genital plates are hidden by sixth abdominal segment.

Variation.—Fairly uniform in color and structure. Connexivum paler and humeral angles of pronotum acute in one pair from Cuernavaca, Morelos, Mexico, in the California Academy of Sciences collection; median impunctate line on pronotum sometimes obliterated.

Type.—Described from a single male specimen; Chilpancingo, Guerrero, Mexico, H. H. Smith. British Museum. Dr. W. E. China compared specimens from Cuernavaca, Mexico with the type. The characteristic outline of the male genital segment of *Dendrocoris* as seen from above is clearly visible in Distant's figure.

Distribution.—Collected in Mexico from Cuernavaca, Morelos; and intercepted in the United States on orchids from the following localities: Tuxtla, Chiapas; and Tepechitlan, Zacateca.

Biology.—One recorded from *Epidendrum* sp. and ten recorded from "orchid plants."

Dendrocoris variegatus, new species

The contrasting colors make this one of the most colorful species of the genus. Distinctive features: Male with denticulate head and hypopygial plates fused with sides of hypopygium. Like *suffultus* it is taken from orchids.

Color.—Above ochraceous with brown markings, below head and thorax stramineous, abdomen pale ochraceous with rufous markings. Punctures below concolorous with body color, coarse on head and pleura, fine and sparse on abdominal venter; above variable. Head punctures coarse, numerous, concolorous with a few light brown punctures on lateral margins of juga. Antennae light ferruginous; rostrum stramineous at base and light ferruginous distally with typical dark markings. Pronotum with brown on humeri; punctures concolorous on anterior two thirds, black on anterior lateral margins, brown on posterior third and forming an indistinct spot on either side on middle of disk. Punctures sparse toward middle of disk leaving an impunctate median line on anterior half and a raised smooth anterior margin. Punctures of scutellum ochraceous, fine and sparse on disk, becoming coarser and dark brown toward base and lateral margins, a broad band of brown punctures marking lateral and distal margins of posterior half, concentrated near apex of frenum. Hemelytra ochraceous becoming brown on disk and pink laterally at base; punctures brown except laterally at base where they are concolorous with hemelytra. Punctures coarse at base becoming finer on lateral margins and toward apex, an irregular impunctate area occurring on corium two thirds of way from base on lateral margin and smaller impunctate areas on disk. Membrane transparent, faintly smokey; connexivum pink, posterior lateral angles of segments above and below, black.

Structure.—General form like *humeralis* with abdomen more narrow. Head short and broad with width to length a ratio of 1.36 to 1, sides parallel; rounded apex of juga with widely spaced denticles in male, smooth in female; vertex flatly raised. Tubercle of antennifer entirely visible from above. Lateral margins of pronotum before humeri concave, tooth at anterior lateral angle moderately prominent. Length: ♂, 6.75-7.3 mm; ♀, 7.1-8.5 mm. Width: ♂, 4.3-4.5 mm; ♀, 4.3-5.3 mm.

Male genitalia.—Hypopygium as in figure 9, anterior margin of hypopygial plate obliquely produced to antero-lateral margin of cup; a tooth is located at antero-ventral apex of each mesal carina; ental arm of clasper prominent, ectal arm produced but not as prominent; proctiger slightly convex ventrally, with a concavity dorsally; lateral penis lobes not as prominent as in *humeralis*, distally curving ventro-mesally, median penis lobe more slender.

Female genitalia.—Differs from *humeralis* in the larger broadly rounded genital plates which are narrowly separated and in the subgenital plates which are broader in comparison to length than in *humeralis*.

Variation.—Some specimens have the dark punctures extending over whole surface of pronotum and head. Three specimens show pale rufous markings on scutellum and some lack the pink markings laterally at base of hemelytra and on connexivum. In form the species is rather constant with slight variation in humeral angles. One female from Tejupilco, Mexico, Mexico, in the University of California collection has the anterior margin of juga uneven.

Type material.—Holotype: Male; Oaxaca, Oaxaca, Mexico, intercepted at Laredo, Tex. on orchids, December 20, 1949. U. S. National Museum. 4 ♂ and 11 ♀ paratypes—distributed in MEXICO—1, Chilpancingo, Guerrero, intercepted at Laredo, Texas, February 4, 1947; 1, Chilpancingo, Guerrero, intercepted at Laredo, Texas, March 27, 1946; 3, Mexico, intercepted at San Francisco, Calif., June 13, 1938; 1, Chiapas, intercepted at Laredo, Texas, April 1, 1952; 1, Sinaloa, intercepted at Nogales, Arizona, November 20, 1948; 1, Sinaloa, intercepted at Nogales, Arizona, June 9, 1938; 1, Mexico, intercepted at Laredo, Texas, February 17, 1947; 4, Michoacan, June 14, 1938; 1, San Luis Potosi, intercepted at Laredo, Texas, December

4, 1951; 1, Tejupilco, Mexico, June 26, 1933, H. E. Hinton and R. L. Usinger.

These paratypes are distributed in the following collections: 10, U.S. National Museum; 4, California Academy of Sciences; 1, University of California.

Distribution.—In Mexico as mentioned above.

Biology.—Eleven specimens were intercepted on orchids so this species is evidently similar to *suffultus* in its habits.

Dendrocoris reticulatus Barber

Dendrocoris reticulatus Barber, 1911, Ent. News 22:270; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Torre-Bueno, 1939, Ent. Americana 19:241.

This species differs from others in the genus by its broad oval body form, and ornately developed penis lobes in the male aedeagus.

Color.—Uniform pale ochraceous, sometimes colored with rufous. Upper surface coarsely and uniformly punctured with pale to fairly dark castaneous except on corium where irregular smooth areas exist on disk between exterior vein and clavus; punctures sometimes becoming black toward margins of head, less frequently so on lateral margins of pronotum, corium and connexivum. Juga with a dark brown or black line marking the lateral margin. Antennae pale rufous usually with basal segment pale yellow. Rostrum straw colored with typical markings. Entire under surface pale ochraceous but usually paler than dorsum and with punctures concolorous or pale castaneous on pleural regions, side margins of abdomen, and lateral impressed lobes of male genital segment. Legs of same color as venter, usually shaded with rufous, especially on tarsi. Disk of abdominal venter sparsely punctate and sometimes with flecks of red which are more numerous toward lateral margins. Rim of spiracles and apical angle of each abdominal segment, black.

Structure.—Form short and broad, with moderately prominent humeral angles. Head with width to length a ratio of 1.37 to 1, sides converging to rounded tip; vertex flat; tylus noticeably shorter than juga, the latter contiguous in front. Only distal part of tubercle of antennifer visible from above. Second joint of antennae in male subequal or longer than in female. Lateral margins of pronotum before humeri straight. Length: ♂, 5.7-8.0 mm; ♀, 6.3-8.2 mm. Width: ♂, 3.75-5.2 mm; ♀, 4.0-5.4 mm.

Male genitalia.—Hypopygium as in figure 10, hypopygial plate barely produced at mesal and lateral angles, thickened at mesal angle and with a setae-bearing lobe at lateral margin turning postero-ventrally; each mesal carina with a tooth just before the antero-ventral apex; ental arm of clasper short and rounded, ectal lobe acutely rounded; proctiger concave with convex margins. Aedeagus with simple median penis lobe, but with greatly produced lateral penis lobes, extending laterally and turning posteriorly as in *humeralis* but with two smaller lobes extending from curve, one anteriorly and one ventro-mesally, and two extending mesally from lobe distal to curve, one half way from curve to apex and one at apex.

Female genitalia.—As in figure 12. Genital plates (larger than any others of this genus) contiguous mesally. Subgenital plates broader than in *humeralis.*

Variation.—General coloration remarkably stable, varying slightly as mentioned above. Punctures more variable, an occasional specimen with black punctures along lateral margins of body and on head and some with bright orange punctures. Form rather constant with a slight variation in humeral angles, some are broadly rounded while others are narrowly rounded. Extremely variable in size, the smaller specimens were set aside as a possible new species in some collections.

Type material.—Holotype and paratypes in the U.S. National Museum (the terms type and cotype were used by the author).

Type locality.—Huachuca Mts., Ariz.

Distribution.—Limited to Arizona.

Biology.—Two females were collected in July at Oracle, Ariz. from white oak by E. P. Van Duzee. Nothing else is known of the biology of this species.

Dendrocoris pini Montandon

Dendrocoris pini Montandon, 1893, Proc. U. S. Nat. Mus. 16:51; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Bergroth, 1908, Mem. Soc. Ent. Belgique 15:178; Kirkaldy, 1909, Cat. Hemip. 1:151; Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1914, Trans. San Diego Soc. Nat. Hist. 2:5; 1917, Cat. Hemip. N. Amer.: 65; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis pini: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Its small size and oval body form are enough to separate this species from others in the genus.

Color.—Pale yellow ochraceous or ferruginous above and beneath. Punctures same color as body, or slightly dark in color, beneath pale concolorous. Head fully or partly margined with piceous or black. Antennae ferruginous usually paler toward the base. Rostrum concolorous as body with red tint and typical dark markings. Legs concolorous as body, in many cases ferruginous distally. Dark anterior and posterior lateral angles of abdominal segments visible from a side view. Spiracles concolorous with body.

Structure.—General form oval. Head width to length a ratio of 1.13 to 1, obliquely narrowing to rounded front; vertex and base of tylus moderately convex; juga contiguous in front. Disk of pronotum with irregular raised smooth areas, humeri not prominent, lateral margins before humeri straight or slightly convex. Scutellum with irregular raised impunctate areas on its lateral and apical margins. Hemelytra with a pale impunctate area in middle of disk and smaller irregular ones on lateral margins. Length: ♂,[3] 5.4-6.7 mm; ♀, 5.4-7.3 mm. Width: ♂, 3.3-4.0 mm; ♀, 3.3-4.2 mm.

Male genitalia.—Hypopygium as in figure 11, with mesal angle of hypopygial plate not produced and lateral angle barely produced; clasper similar to that of *humeralis* with ectal lobe more prominent; proctiger less concave ventrally than in *humeralis;* aedeagus with lateral penis lobes more prominent laterally and median penis lobe more acutely produced than in *humeralis.*

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[3]Montandon, 1893 records a minimum of 5 mm., smaller than any specimens at the writer's disposal.

Female genitalia.—Similar to but differs from *reticulatus* in the less prominent genital plates which are separated at the base by one half their width and in the less prominent middorsal plate.

Variation.—General coloration may be wholly rufous or almost so. Structurally quite constant, the humeri vary in prominence from distinctly broader than body to the same width.

Type material.—Montandon described the species from a cotype series. One male has been selected as lectotype, with a printed label containing the following data: line 1, Argus Mts.; line 2, May 91 K. Lectotype in the U.S. National Museum.

Distribution.—Found in western and southwestern United States from the following states: Oregon, Utah, California, Arizona, New Mexico and Colorado.

Biology.—Cotype series collected from *Pinus monophylla* in May; recorded also from pine from other localities.

Dendrocoris neomexicanus, new species

Female similar to *pini*, but the concave antero-lateral margins of pronotum quickly separate it from that species; male similar to *contaminatus*, but smaller and differs in color as noted in key.

Color.—Ground color ochraceous above and below, above heavily colored with rufous, with a waxy appearance; below with rufous tints on head and pleura. Head above mainly rufous, ochraceous showing at anterior end, on margins of juga, on base of tylus and on vertex mesal to each ocellus, black marking base of head behind each ocellus and extending to eye. Punctures coarse, concolorous with body color, more sparse at lateral margins of juga, at base of tylus and on lateral parts of vertex. Head beneath pale ochraceous, with pale rufous marking undersurface of juga, with black behind each eye and a small spot of black from before each eye to base of tubercle of antennifer; punctures concolorous as general color. Antennae dark ochraceous, basal joint pale. Rostrum ochraceous with typical markings. Pronotum profusely colored with rufous, ochraceous showing on median anterior and posterior margins and irregularly on disk; punctures ochraceous or rufous except on cicatrices and a few before and behind inner margin of cicatrices, which are black; punctures sparse on disk showing irregular smooth areas, becoming more numerous at margins. Pleural regions pale ochraceous with a small dark brown spot just before anterior median angle of evaporative area and a black line marking posterior margin of evaporative area. Pleural punctures coarse, concolorous ochraceous, except for a few dark brown punctures at anterior and posterior margins of propleura. Legs ochraceous with tarsi a little darker and distal portion of femora with definite rufous markings. Scutellum rufous with ochraceous showing on middle lateral margins and on apex, with dark spots, one on either side where frenum ends, one at each basal lateral angle and one on each side of basal margin midway between the lateral margin and median line; punctures colored same as scutellum, fairly coarse, finer apically, sparse on raised portion of disk, an impunctate and raised area occurring within lateral basal angles. Hemelytra ochraceous along median margin, gradually becoming rufous toward lateral margins; punctures moderately coarse and numerous on lateral and mesal margins, disk showing a large impunctate area, punctures concolorous laterally and on some parts of disk, but dark brown or black along mesal margin, dark punctures forming a faint spot midway along the lateral margin of the corium and another more definite spot toward the apex of the corium laterally. Membrane transparent, colorless. Connexivum ochraceous with dark brown apical angles laterally and an incomplete dark brown band at base and apex of each segment, band at base distinct but apical band becomes indistinct on posterior four segments. Abdominal venter ochraceous with a dark spot at lateral apical angles of segments; punctures concolorous ochraceous, extremely fine, with the disk almost impunctate.

Structure.—General form broad-oval. Head width to length a ratio of 1.20 to 1, feebly narrowing to rounded front; vertex and base of tylus distinctly convex, tylus depressed anteriorly; juga contiguous in front and broadly rounded on the margins. All of tubercle of antennifer seen from above. Pronotum short and broad, humeri not prominent, lateral margins distinctly concave before the humeri with the antero-lateral tooth small and indistinct. Length: ♂, 5.8 mm; ♀ 6.25-6.6 mm. Width: ♂, 3.3 mm; ♀, 3.7-3.85 mm.

Male genitalia.—Hypopygium as in figure 13, with mesal angle of hypopygial plate not produced, and a small blunt notch in posterior margin near lateral angle; internal genitalia not examined in the one specimen available.

Female genitalia.—Similar to *pini* but differs in position of genital plates which are hidden by sixth abdominal segment in this species.

Variation.—Male differs from female as follows: clay yellow above and below, ochraceous on head above and scutellum, rufous limited to punctures of abdominal venter. Dark markings more definite with the following additions: Punctures of pronotum toward center of anterior margin, behind cicatrices and across basal third, black; cicatrices black. Pleural regions with black punctures more numerous on propleura and near evaporative area. Tarsi darker. Punctures of scutellum pale brown to black. Punctures of hemelytra black except at base of lateral margin where they are ochraceous. Connexivum with black band at base and apex of each segment. Structurally like female. Dark markings more distinct on one female and vary to indistinct or absent on the others. Slight rugae may appear near base of scutellum on either side.

Type material.—Holotype: ♀; Mountain Park, New Mexico, June 27, 1940, R. H. Beamer. Snow Collection, University of Kansas. Five paratypes—2 as above; 1, Fort Wingate, New Mexico, June 8, 1935, E. C. Van Dyke; 2 (one of which is the only male specimen), Gallup, New Mexico, August 18, 1954.

These paratypes are distributed in the following collections: 2 (the male and one female), U.S. National Museum; 1, Snow Collection, University of Kansas; 1, California Academy of Science; 1, University of Michigan.

Distribution.—As mentioned above, New Mexico.

Biology.—The pair, collected by the author at Gallup, New Mexico, were taken while beating *Juniperus* sp.

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BOOK REVIEW

THE WORLD OF THE HONEYBEE, by Colin G. Butler. Cloth, xiv + 226 pp., 2 colored and 40 black and white plates, 1954. A volume in ''The New Naturalist'' series, MacMillan, $4.50.

This book by the head of the Bee Department at the Rothamsted Experimental Station in England is an engaging and authoritative presentation of honeybee behavior and the organization of its social life. It is not a manual of beekeeping! As is usual with volumes in ''The New Naturalist'' series, this one is written in a very readable style which will appeal to the layman. Still, it is sufficiently technical so that the general entomologist and animal behaviorist can obtain a wealth of information from it. The photographs by the author are superb and have been well chosen to illustrate many phases of behavior. There are extended discussions of the latest published researches on bee behavior such as the monumental studies by von Frisch on honeybee language and senses, and those of Lindauer on the division of labor in the colony. The author also discusses his theory of ''queen substance,'' a product which the worker bees probably obtain by licking any part of the queen's body surface. This substance is passed from one household bee to another during the movement and feeding that is continually going on among bees engaged in duties within the hive. Butler suggests that this ''queen substance'' enables the bees in a colony to determine the loss or physical weakening of the queen even though only a small number have been in actual contact with her. So long as the queen is in good health and produces enough of this material, the ''queen substance'' is thought to inhibit the construction of all kinds of queen cells and the production of laying workers, and to promote colony cohesiveness.—KARL V. KROMBEIN, *Agricultural Research Service, Washington, D. C.*

BOOK NOTICE

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AN ANNOTATED LIST OF THE CULEX OF PANAMA
(DIPTERA, CULICIDAE)

By Pedro Galindo[1] and Franklin S. Blanton[2]

The last comprehensive list of the *Culex* of Panama was published by Dyar in 1925. Since that date many new species have been described from this country and Rozeboom and Komp (1950) added several new records of species belonging to the subgenus *Melanoconion.*

During a light trap survey conducted in the years 1951, 1952 and 1953 (Blanton, Galindo and Peyton, in press) we personally examined a total of 22,878 terminalia of *Culex* males. This survey resulted in the discovery of a number of new species already described by the authors (Galindo and Blanton, 1954) and of several interesting new records for the country. The collections of the senior author in the last ten years which have covered every district in the Republic, as well as the intensive work on forest mosquitoes carried on by Dr. Harold Trapido and the senior author, have also yielded new records of *Culex* and interesting biological data on many of the species.

With this information at hand we have considered it advisable at this time to publish a list of the species of *Culex* known to occur in Panama, giving taxonomic, biological and distributional notes in cases of special interest. In this list we include 88 species distributed in 8 subgenera as follows: *Culex,* 15; *Neoculex,* 1; *Lutzia,* 1; *Aedinus,* 2; *Tinolestes,* 4; *Melanoconion,* 54; *Microculex,* 7; *Carrollia,* 4. With few exceptions we have followed the classification proposed by Lane (1953).

Subgenus **Culex** Linnaeus

1. *beauperthuyi* Antunes. Venezuela, Brazil and Panama.
   First record for the country. A single male was picked up during the light-trap survey in a trap set within an extensive fresh water swamp near the town of Aguadulce, province of Coclé.
2. *bonneae* Dyar and Knab. Surinam, Brazil and Panama.
   This relatively rare species was first recorded from Panama by Dunn (1934). Larvae are usually found in this country in fallen logs and at the base of buttressed roots. Males have been captured in light traps set 70 feet above the ground in the canopy of the forest.
3. *chidesteri* Dyar. Mexico to Brazil.
   Common in the lowlands of both coasts. Larvae may be found in large numbers throughout the year breeding in open fresh water swamps, particularly in the presence of the large sedge *Fuirena umbellata* Rottb.
4. *corniger* Theobald. Mexico to Uruguay.
5. *coronator* Dyar and Knab. Southern U. S. A. to Argentina.
6. *delys* Howard, Dyar and Knab. Panama.

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This species, which was considered a synonym of *mollis* D. & K. by Dyar (1928), was revived by Lane (1953) because of the peculiar line of white scales at the base of the first vein. We have seen no material of it and the only specimen known to us is the type.

7. *inflictus* Theobald. Mexico to Venezuela.
Trapido and Galindo (manuscript in preparation) found females of this species attacking man on the ground and in the upper canopy of the forest after dusk.

8. *interrogator* Dyar and Knab. U. S. A., Mexico and Panama.

9. *laticlasper* Galindo and Blanton. Panama.
Found only in the highlands of Chiriquí above 6,000 feet, where it breeds in very large numbers in the water held by fallen palm spathes in the forest.

10. *mollis* Dyar and Knab. Mexico to Brazil.

11. *nigripalpus* Theobald. Mexico to Brazil.

12. *pinarocampa* Dyar and Knab. Mexico and Panama.
According to Martínez Palacios (personal communication) *pinarocampa* occurs in Mexico from sea level to over 7,000 feet, breeding commonly in water held by the grooved leaves of *Agave*. In Panama it is found only in the Chiriquí Volcano region at elevations between 4,000 and 6,000 feet, breeding normally in water held by the basal leaves of *Furcraea* sp. and occasionally in tree-holes. Galindo, Carpenter and Trapido (in manuscript) report a single larva from a bamboo internode set out as a larval "trap."

13. *pipiens quinquefasciatus* Say. Tropics and subtropics.

14. *thriambus* Dyar. Western U. S. A., Mexico and Panama.
This species was described from Texas and in 1928 Dyar placed it in the synonymy of *stigmatosoma* Dyar. Galindo and Kelley (1943) revived the name, pointing out specific differences between the two forms. Martínez Palacios (1952 *a*) reported *thriambus* from Mexico and noted additional differences in the terminalia to separate it from *stigmatosoma*. In Panama the species is found in the highlands and it is possible that the records from Central America and Venezuela given by Dyar (loc. cit.) really refer to *thriambus* rather than to *stigmatosoma*.

15. *virgultus* Theobald. Mexico to Uruguay.
Lane (1953) considers *declarator* D. & K. a synonym of this species.

Subgenus **Neoculex** Dyar

16. *derivator* Dyar and Knab. Mexico to Panama.
First reported from Panama by Bohart (1948) from material sent to him by the senior author. Females have been observed feeding on lizards of the genus *Sceloporus* in the Chiriquí Volcano region. It is interesting to note that Galindo and Trapido (unpublished report) found these lizards commonly infected with a species of *Plasmodium* which has been isolated and is being studied by Dr. Clay Huff.

Subgenus **Lutzia** Theobald

17. *allostigma* Howard, Dyar and Knab. Central America to Brazil.

Subgenus **Aedinus** Lutz

18. *accelerans* Root. Brazil and Panama.

This species was previously known only from the type locality in Brazil. The authors have several males taken in a light trap at Garachiné, Darién Province and one specimen from the Tocumen swamps near Panama City, both localities on the Pacific side of the Isthmus.

19. *amazonensis* Lutz. Panama to Brazil.
One of the commonest *Culex* of the Pacific coastal swamps of Panama. Males show a very strong positive phototropism and are picked up in large numbers in light traps set near their breeding place.

Subgenus **Tinolestes** Coquillett

20. *browni* Komp. Panama.
In the last few years we have reared abundant material of this species from tree-holes in deep forest. It is particularly common in the area known as La Victoria or Cerro Azul, just east of Panama City. Females are not known to bite man. Males are only occasionally found in light trap collections.
21. *conservator* Dyar and Knab. Panama to Brazil.
22. *corrigani* Dyar and Knab. Panama.
23. *latisquama* Coquillett. Costa Rica and Panama.

Subgenus **Melanoconion** Theobald

24. *aikenii* Aiken. Mexico to Brazil.
25. *albinensis* Bonne-Wepster and Bonne. Surinam, Brazil and Panama.
We have taken this species only in the vicinity of the extensive Tocumen swamps near Panama City where it appears to be fairly common.
26. *alogistus* Dyar. Surinam, Brazil, Panama and Costa Rica.
From the highlands of Chiriquí we have what appears to be a new species which differs from *alogistus* in larval characters (having the comb-scales in a patch as in *vexillifer*) and in details of the male terminalia.
27. *atratus* Theobald. U. S. A., Antilles, Panama, Trinidad and Guianas.
28. *bastagarius* Dyar and Knab. Mexico to Brazil.
29. *caribeanus* Galindo and Blanton. Panama.
30. *caudelli* Dyar and Knab. Surinam, Brazil, Trinidad and Panama.
31. *changuinolae* Galindo and Blanton. Panama.
32. *commevynensis* Bonne-Wepster and Bonne. Surinam, Colombia and Panama.
33. *comminutor* Dyar (= *distinguendus* Dyar). Surinam, French Guiana and Panama.
34. *conspirator* Dyar and Knab. Mexico to Venezuela.
35. *crybda* Dyar. Central America to Brazil.
36. *dunni* Dyar. Mexico to Brazil.
Trapido and Galindo (manuscript in preparation) have found females of this species attacking man both on the forest floor and in the upper canopy after dusk.
37. *eastor* Dyar. Panama to Brazil.
38. *educator* Dyar and Knab. Mexico to Brazil.
39. *egcymon* Dyar. Panama.
Very common in the lowlands along both coasts of Panama, but found nowhere else.

40. *elephas* Komp. Panama.
Closely related to *egcymon* but much rarer than the latter species.
41. *elevator* Dyar and Knab. Mexico to Brazil.
42. *erraticus* Dyar and Knab. U. S. A. to Brazil.
43. *evansae* Root. Brazil and Panama.
44. *fairchildi* Galindo and Blanton. Panama.
45. *flabellifer* Komp. Mexico, Honduras and Panama.
46. *foliafer* Komp and Rozeboom. Surinam and Panama.
We have a single slide in perfect condition of this distinct species originally described from Surinam. Our male was captured in a light trap set at Patiño Point in the Province of Darien.
47. *fur* Dyar and Knab. Panama, Surinam, Belice and Mexico.
This species was described from Panama in 1907 and wrongly synonymized under *spissipes* Theob. by Bonne-Wepster and Bonne (1921). Lane (1953) revived the name after examining the type of *spissipes* in the British Museum. The only specimen from Panama known to the authors is the type.
48. *galindoi* Komp and Rozeboom. Panama.
49. *iolambdis* Dyar. Mexico to Colombia.
50. *jubifer* Komp and Brown. Panama.
Previously known from a single specimen. The senior author has reared abundant material of this species from larvae collected in forested marshy springs some 15 miles east of Panama City.
51. *kummi* Komp and Rozeboom. Panama.
Locally common in the mountains to the northwest of Almirante, Bocas del Toro, in deep tropical rain forest.
52. *lacertosus* Komp and Rozeboom. Panama.
This species was described from two males captured by Komp in Almirante. No specimens have been taken since.
53. *limacifer* Komp. Costa Rica and Panama.
Commonly found breeding in shaded pot-holes along streams in the semi-arid region between Chame and Rio Hato on the Pacific side of Panama.
54. *menytes* Dyar. Honduras to Brazil.
We have found this species breeding in large, shallow, fresh water swamps covered with sedges. Trapido and Galindo (manuscripts in preparation), working in Panama and Honduras, have found females attacking man in the upper canopy of the forest, both during the day and at night, being particularly common during hours 1800 to 2000.
55. *mistura* Komp and Rozeboom. Panama to Brazil.
This species was recently described from Colombia and additional specimens were reported from Venezuela and Brazil in the same publication. The authors have two males captured in a light trap set near Aguadulce, Coclé Province and one male from the Tocumen swamps near Panama City.
56. *mutator* Dyar and Knab. Mexico to Panama.
This represents the first time that true *mutator* is reported from Panama. We have taken larvae several times from pot-holes along rocky mountain streams, as well as males in light traps.
57. *oedipus* Root. Brazil to Panama.
58. *opisthopus* Komp. U. S. A., Puerto Rico, Mexico, Honduras and Panama.

59. *paracrybda* Komp. Panama.
Described from a single male. We have additional light trap material from the Upper Chagres River, from the Madinga River in the Canal Zone, and from the Tocumen swamps.
60. *phlogistus* Dyar. Panama to Brazil.
61. *pilosus* Dyar and Knab (= *hesitator* D. & K.). U. S. A. to Brazil.
62. *plectoporpe* Root. Brazil, French Guiana and Panama
63. *psatharus* Dyar. Panama.
Previously known from the Atlantic side of Panama only. We recently took two males in a light trap set by a mangrove swamp near Garachiné, Darién Province, on the Pacific side of the isthmus.
64. *pseudotaeniopus* Galindo and Blanton. Panama.
65. *quadrifoliatus* Komp. Panama.
66. *quasihibridus* Galindo and Blanton. Panama.
67. *rooti* Rozeboom. Panama and Mexico.
68. *sardinerae* Fox (= *bilobatus* Galindo and Blanton). Puerto Rico and Panama.
When the manuscript in which we described *bilobatus* Galindo and Blanton, 1954, was already in press, we noted the description of *sardinerae* Fox, 1953. The excellent drawings and the description of this species leaves no doubt as to the conspecificity with *bilobatus*, thus making the latter a synonym.
69. *serratimarge* Root. Panama to Brazil.
70. *spissipes* Theobald (= *chrysonotum* Dyar and Knab). Mexico to Brazil.
Lane (1953) has included *chrysonotum* D. & K. and *theobaldi* Lutz in the synonymy of *spissipes* Theob.
71. *sursumptor* Dyar. Colombia and Panama.
72. *taeniopus* Dyar and Knab. Honduras south to Bolivia and Brasil.
We have abundant material of this species from the north coast of Honduras where it is far more abundant than its close relative *opisthopus* Komp as judged by densities in light trap collections. Trapido and Galindo (manuscript in preparation) record *taeniopus* females attacking man in upper canopy of the forest after dark.
73. *tecmarsis* Dyar. Panama and Venezuela.
74. *trifidus* Dyar. Mexico to Panama.
Found in Panama along precipitous mountain streams breeding in shaded rock-holes. The lobes of the ninth tergite in specimens from Panama consistently show three to five hairs instead of the single one typical of northern material, which may possibly indicate a subspecific difference.
75. *vexillifer* Komp. Panama.
The species referred to as *vexillifer* by Galindo, Carpenter and Trapido (1951) and found commonly breeding in tree-holes in La Victoria (Cerro Azul) near Panama City probably represents a distinct and undescribed species, as it obviously differs in several important details of the male terminalia from typical *vexillifer* collected by us in the Mojinga swamp and in Gatún Lake.
76. *vomerifer* Komp. Panama and French Guiana.
77. *zeteki* Dyar. Panama, Venezuela and French Guiana.

Subgenus **Microculex** Theobald

78. *chryselatus* Dyar and Knab. Panama to Brazil.
79. *daumastocampa* Dyar and Knab. Panama.
80. *erethyzonfer* Galindo and Blanton. Panama.
81. *gaudeator* Dyar and Knab.
    Lane (1953) recognizes this species as valid despite the fact that Howard, Dyar and Knab (1915) and Dyar (1928) had considered it a synonym of *jenningsi* D. & K. It differs from the latter in the ornamented mesonotum, as in *imitator* Theobald. We have no specimens in our collection.
82. *imitator imitator Theobald.* Panama to Argentina.
83. *jenningsi* Dyar and Knab. Panama.
84. *restrictor* Dyar and Knab. Mexico, Honduras, Costa Rica and Panama.
    Larvae of this species are encountered rather frequently in tree-holes in the highlands of Chiriquí above 3,000 feet. It is here reported from Panama for the first time.

Subgenus **Carrollia** Lutz

85. *bihaicolus* Dyar and Nuñez Tovar. Mexico to Brazil.
    This widely distributed species was first recorded from Panama by Galindo, Carpenter and Trapido (1951) and later Martínez Palacios reported it from Mexico (1952 *b*). It is very common in tropical rain forests as judged by larval collections, but does not appear to attack man and is seldom taken in light traps.
86. *metempsytus* Dyar. Costa Rica, Panama and Colombia.
87. *secundus* Bonne-Wepster and Bonne. Panama, Colombia and Brazil.
88. *urichii* Coquillett. Panama to Brazil and Peru.

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LIPEURUS DOVEI McGREGOR, A SYNONYM OF LIPEURUS CAPONIS (LINNAEUS)

(MALLOPHAGA, PHILOPTERIDAE)

Lipeurus lineatus McGregor, 1917 was described from a male supposedly collected from a quail at Hamburg, Mississippi. Later McGregor proposed *Lipeurus dovei* as a *nomen novum* for *Lipeurus lineatus* McGregor, 1917 (*nec* Giebel, 1874).

Through the courtesy of Mr. C. F. W. Muesebeck, the author was recently permitted to examine the Mallophaga collection of the U. S. National Museum. In that collection are two slides bearing the same collection data and Bishop number; one has been labeled ''type'' and the other has a penciled notation ''type material.'' The writer has examined both slides and has found that these specimens agree in all details with *Lipeurus caponis* (Linnaeus), a common parasite on the domestic chicken.

Undoubtedly the poor drawings and absence of illustrations of the male genitalia in the original description have been the principal reasons why the true identity of this form has not been previously established.

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K. C. EMERSON, *Ft. Leavenworth, Kansas*

NOTICE

Short scientific articles, not illustrated, two double-spaced typewritten pages or less in length, are welcome and will usually receive prompt publication. References to literature should be included in the text.

A NEW CHRYSOBOTHRIS FROM EASTERN RED CEDAR, JUNIPERUS VIRGINIANA

(Coleoptera, Buprestidae)

By B. K. Dozier, *Tennessee Agricultural Experiment Station, Knoxville, Tenn.*

The *Chrysobothris* described below is of interest because it illustrates a typical and yet puzzling example of two very closely related species occurring on a mutually common host (*Juniperus virginiana* L.) in two widely separated areas. This brings up the question of whether the eastern form is merely an isolated or intergrading variation of a widely ranging species. More intensive collecting throughout the Gulf Coast states would help clarify this problem.

Juniperus virginiana L. ranges from Maine to North Dakota, south through the central and eastern states to central Georgia, and across the northern sections of the Gulf Coast to central Texas. Along the Gulf Coast, across north Florida, and in the coastal areas of Georgia and South Carolina it is replaced by Southern Red Cedar (*J. siliciola* Small). In the southwest it is replaced by several species of junipers including Rocky Mountain Red Cedar (*J. scopulorum* Sarg.), which ranges from Washington south to central Arizona and New Mexico, Alligator Juniper (*J. deppeana* Steud.), which occurs from central Arizona to western Texas, and Utah Juniper (*J. osteosperma* Torr.), which occurs mainly in Utah, Nevada, and northern Arizona.

The species of *Chrysobothris* described here is known only from the type locality in North Carolina, from *J. virginiana;* its nearest relative, *C. texana* Le Conte, has not been recorded east of Texas and Nebraska and is evidently confined to the more arid area west of the Mississippi River. *C. texana* has been recorded from Eastern Red Cedar, Utah Juniper, Rocky Mountain Red Cedar, and Arizona Cypress (*Cupressus arizonica* Greene).

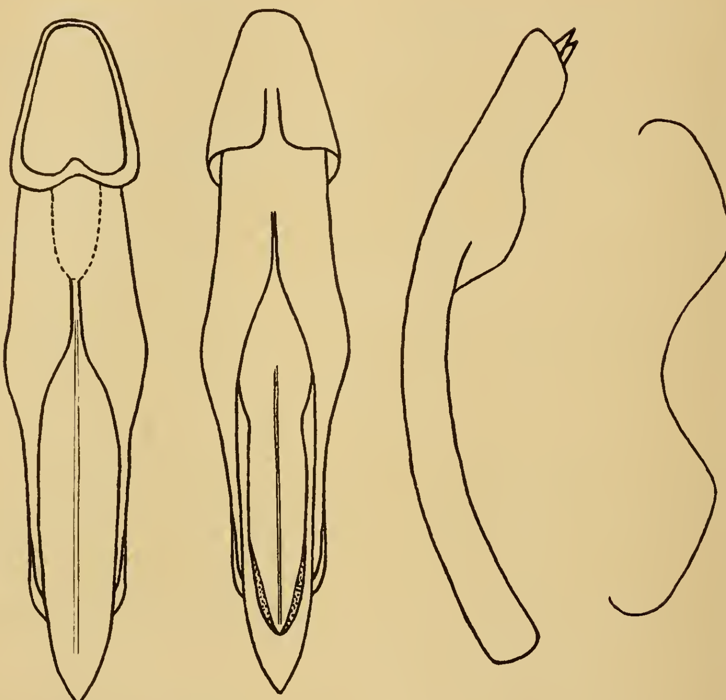
Due to the structural differences noted in the description, and the apparent isolated distributions, the author believes that two very close yet distinct species are represented. The eastern species is described below.

Chrysobothris neotexana, new species

Holotype Male.—Form small, moderately elongate, shining; antennae black; head and pronotum black with cupreous reflections, more pronounced on head; elytra black with greenish reflections in certain light; ventral surface black.

Head black with strong reddish cupreous reflections; front converging dorsally, twice as wide at base of eye as at occiput, slightly convex, slightly depressed above clypeus, two small callosities in middle, surface heavily punctate, punctations broad and shallow, densely clothed with long hairs, a smooth longitudinal carina on occiput bearing a prominent longitudinal groove; clypeus shallowly, broadly emarginate; antenna with first segment as long as following two united, segments subtruncate beginning with the fourth.

Pronotum black with faint reddish cupreous reflections, 1.6 times wider than long, slightly wider anteriorly; base arcuately emarginate with a well produced median lobe; lobe broadly rounded at apex; anterior margin nearly straight; anterior median lobe faintly indicated; disk moderately convex, a vague depression on either side near lateral margins, moderately punctate in center becoming confluently punctate near lateral margins, punctations broad and shallow, particularly near lateral margins.



Chrysobothris neotexana, new species. Male genitalia, dorsal and ventral views; fore tibia and clypeus. Drawings from holotype.

Elytra moderately elongate, 1.8 times longer than wide, 1.3 times wider than pronotum, sides nearly parallel, posterior third arcuately converging to broadly rounded apex; lateral margins serrate; basal depression broad and deep; humeral depression broad and shallower than basal; heavily punctate between costae; four longitudinal costae on each elytron, the first extending from the base to apex; strongly elevated in posterior half; second costa extending from between basal and humeral depressions, joining fourth costa near apex, strongly interrupted at points one and two-thirds of its length; third costa extending from humerus, converging to meet second costa, interrupted near the middle; fourth costa extending from humerus to apex paralleling lateral margin of elytron.

Ventral aspect: Prosternum densely punctate, fairly smooth at center, moderately clothed with long hairs; anterior femur with a single large obtuse tooth, heavily dentate on outer margin; anterior tibia moderately arcuate with a dilation near apex; middle and hind tibiae simple; abdomen moderately punctate, clothed with short white hairs; poorly developed lateral callosities present; last visible sternite broadly and shallowly emarginate with a serrate submarginal ridge.

Allotype Female.—Differs from male in having less arcuate fore tibia, which lacks an apical expansion, by having prosternum and frons less hairy, and by having last visible abdominal sternite more narrowly notched.

Variations.—One paratype male lacks the expansion on the fore tibia, otherwise no noteworthy variations can be seen in the type series. The length varies from 7.4 mm to 9.1 mm.

Described from 27 males (one type) and 6 females collected by the author at Charlotte, North Carolina. Holotype, allotype and 28 paratypes collected on May 31, 1953; 2 paratypes on June 14, 1953; and 1 paratype on July 5, 1953. Holotype deposited in the U. S. National Museum (No. 62301), paratypes in the collection of H. F. Howden, N. C. State College; the allotype and the remaining paratypes are retained in the writer's collection.

Host.—The type series was taken in a cut over second growth pine woods on recently cut logs of Eastern Red Cedar approximately four to eight inches in diameter. All specimens were taken on logs and none were observed or collected on the smaller branches in nearby brush piles. Apparently this species breeds in the main trunk of the tree and not the branches.

The writer did not observe oviposition on cedar but he assumes that this is the host as no specimens were observed on any other species of tree in the immediate area.

Comparison.—*Chrysobothris neotexana* will key to *C. texana* Le Conte in Fisher's key (1942) and appears to be very closely related to that species. It can be separated from *C. texana* by its uniformly smaller size, more acuminate genitalia, and by the lack of a strong constriction behind the dilation on the fore tibia of the male.

Reference

Fisher, W. S., 1942. A revision of the North American species of buprestid beetles belonging to the tribe Chrysobothrini. U.S.D.A. Misc. Publ. No. 470, 274 pp.

BOOK NOTICE

THE BLACK FLIES (DIPTERA, SIMULIIDAE) OF GUATEMALA AND THEIR ROLE AS VECTORS OF ONCHOCERCIASIS, by Herbert T. Dalmat, Laboratory of Tropical Diseases, National Institutes of Health. vi + 425 pp., 44 plates, bibliography, index. Smithsonian Misc. Coll., Vol. 125, no. 1 (Publication 4173), Smithsonian Institution, Washington 25, D. C. 1955.

A comprehensive review of studies occomplished by the author who worked in an endemic zone of onchocerciasis in Guatemala from 1947 to 1953.—Ed.

NOTES ON THE GENUS EUSCELIDIUS RIBAUT IN THE UNITED STATES

(Homoptera, Cicadellidae)

The genus *Euscelidius* Ribaut contains two Old World species. One of these, *E. schenkii* (Kirschbaum), has been recorded from North America for some years, the earliest record being its redescription as *Euscelis maculipenis* by DeLong and Davidson (1934: 221), from Moscow, Idaho. Oman (1947: 63) synonymized the DeLong and Davidson name under the Kirschbaum species mentioned above and stated that the earliest collection record for North America was 1927.

One species of *Euscelidius* is received fairly often for identification by the Insect Identification and Parasite Introduction Section. It has been referred to *E. schenkii* (Kbm.) in earlier determinations, but more critical study indicates that two species have been confused, that both *E. schenkii* (Kbm.) and *E. variegatus* (Kbm.) occur in the U. S., and that the latter appears to be more common and widespread.

The male genitalia of the two species have been adequately illustrated by Ribaut (1952: 99). Externally the species are separable by the markings of the upper portion of the face, the dark clypeal arcs fusing and forming a pair of conspicuous black spots in *variegatus* but retaining their separate identity in *schenkii*.

Specimens of *schenkii* are at hand only from Idaho; of *variegatus* from Washington, Oregon, California, and Utah. The species used in virus transmission experiments in California, identified as *Euscelis maculipenis* by DeLong and Severin (1947: 532), is probably *variegatus*, although the genitalia illustrations undoubtedly apply to *schenkii*. Possibly the illustrations were made from Idaho specimens from Dr. DeLong's collection. Specimens collected in 1953 from Sonoma County, California, the same general region as the California records reported by DeLong and Severin (*loc. cit.*) are *variegatus*.

Probably both species of *Euscelidius* have been introduced from the Old World.

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—David A. Young, Jr., *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

ATTENTION!

See special notice on inside front cover of this issue.

A NEW FOSSIL TERMITE, PARASTYLOTERMES FRAZIERI, FROM CALIFORNIA

(ISOPTERA, RHINOTERMITIDAE)

By THOMAS E. SNYDER, *Washington, D. C.*

Except for fossilized pellets of excreta of *Kalotermes* and *Zootermopsis* in southern California and of *Kalotermes* in southern Florida from Quaternary (Pleistocene) formations, all evidences of fossil termites in the United States have been discovered in Tertiary rock. Included are termite borings recently found in petrified coniferous wood from Miocene formations of Idaho, Oregon and Washington.

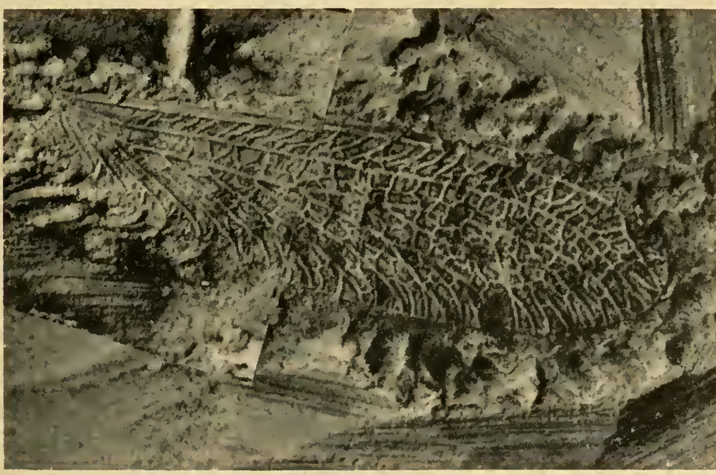

Fig. 1. Forewing of *Parastylotermes frasieri* new species in limestone concretion. Enlarged 6 times.

To date, 9 species in 4 families and 7 genera have been described from Eocene or Miocene strata in Tennessee, Colorado and Washington. No species of the highly specialized family Termitidae so far have been represented as fossils in the United States.

The portion of the termite wing which is described in this paper was found in a gray nodule of calcium carbonate (approx. 80 mm. by 70 mm.) in Miocene or older calcareous shale strata, immediately below the principal colemanite horizon, age at least 25 million years. Chironomid flies and thrips were other fossil insects found in this deposit, where disarticulated fish and coprolites indicate a more or less permanent prehistoric lake.

I am indebted to Dr. Allison R. Palmer of the U. S. Geological Survey for the opportunity to examine this fossil wing.

Parastylotermes frazieri, new species

Wing. Forewing? (fig. 1). Subcostal vein joined to the costal margin by numerous vertical short veinlets. Wing membrane strongly reticulated with accessory veinlets arising vertically from main nervures. Median vein free from stump, single, but slightly closer to cubitus than to subcosta, with numerous vertical, relatively short veinlets. Cubitus with many closely placed, branching branchlets to posterior margin of the wing. All veins are prominent and thickened. Wing scale absent.

Length of wing approximately 10.00 mm., broken, the pieces separated.

Width of wing at widest portion 3.00 mm.

Type locality: Old Frazier Borax Mine northwest of Frazier Mountain, west of Lebec in Mt. Pinos quadrangle, Ventura Co., Cal.

Holotype: Forewing?—Cat. No. 62383, U. S. National Museum. Collected by T. H. McCulloh, U. S. Geological Survey, in March 1954.

Two other species of the fossil genus *Parastylotermes* Snyder and Emerson have been found: *washingtonensis* (Snyder) from the Upper Miocene Latah shale of the state of Washington and *robustus* (von Rosen) in Lower Oligocene or Upper Eocene Baltic amber. *P. washingtonensis* has the median vein closer to the cubitus than in *frazieri.*

The closely related living genus, *Stylotermes* Holmgren, contains only one species, *fletcheri* Holmgren, which occurs in south India.

BOOK REVIEW

MATURE LARVAE OF THE BEETLE FAMILY ANOBIIDAE, by Adam G. Böving. Biologiske Meddelelser, vol. 22, no. 2, Copenhagen, Denmark, 1954. 298 pp., 50 plates. May be purchased from Ejnai Munksgaard, Nörregade 6, Copenhagen K, Denmark. Price: 35 kroner.

In this work on anobiid larvae Dr. Böving has enhanced his already well-founded reputation as an authority of immature stages of the Coleoptera. Seldom has there been a more critical or exhaustive study made of a group of insects. The published result can not fail to help give studies of immature insects the important role in insect taxonomy that they deserve.

The book is divided into two main sections or chapters. The first of these contains a detailed description of the internal as well as the external anatomy, with careful attention given to the musculature. The second chapter treats the taxonomy of the available larvae of the family. The key to the species is preceded by a family characterization, and an important consideration of the natural groups based on larval characters. Following the key, the species are taken up in order with complete descriptions and references to figures. There are 50 plates containing 572 figures, each prepared carefully and accurately. A very complete index is supplied.

Dr. Böving and the Royal Danish Academy of Sciences and Letters are to be congratulated on the fine appearance of the work. The arrangement of the text by the editor and the reproduction of the drawings are excellent.—W. H. ANDERSON, *Agricultural Research Service, Washington, D. C.*

A NEW SPECIES OF THE GENUS HALTICOPTERA
(Hymenoptera, Pteromalidae)

By B. D. Burks, *Entomology Research Branch, U. S. Department of Agriculture, Washington 25, D. C.*

Dr. W. V. Balduf, of the University of Illinois, has for several years been studying the complex of insects associated with the hips of wild roses. In the course of his rearings, Dr. Balduf has obtained a large number of specimens of an undescribed species of the chalcidoid genus *Halticoptera.* This species is here described to make its name available for use in papers dealing with its biological relationships.

Halticoptera rosae, new species

Female.—Length 3.5-4.0 mm. Head black with bright green or faintly brassy metallic reflections; antennae mostly very dark brown, but sensory areas of flagellum tan, base of scape and apex of pedicel tan, and scape dark, metallic green; thoracic notum bright, metallic blue-green, areas around sutures slightly darkened, pleura and sternum black with faint brassy reflections; each leg with coxa black, but showing faint metallic green iridescence from certain angles, first trochanter dark brown, second yellow, femur dark brown to black, with very faint metallic green iridescence, and apex yellow; tibia yellow with faint darker shading in the middle, basal four tarsal segments yellow, apical segment and claws dark brown to black; propodeum bright metallic green, abdominal petiole and gaster black with faint metallic green reflections.

Mandible with all teeth stout, ventral tooth the longest, 2 intermediate teeth sub-triangular, dorsal tooth truncate and shorter than the intermediate teeth; clypeal teeth relatively long and acute at apices; mandibular depression on gena with anterior margin carinate on mesal third; length of fronto-genal suture one-half as great as height of compound eye; apices of scapes reaching level of ventral margin of anterior ocellus; length of interocellar line slightly greater than length of ocellocular line; relative proportions of lengths of parts of antenna: Scape 40, pedicel 10, ring segments 2, 2, funicle segments 7, 8, 8, 8, 7, 7, club 17.

Mesopraescutum with inconspicuous, sparsely set setae distributed over its surface, 4 to 6 long setae borne along inner margin of each axilla; scutellum with 4 long bristles on each antero-lateral area, subapical cross-furrow well marked, composed of deep pits which are not contiguous; femoral furrow of mesopleuron with minute punctures, areas anterior and posterior to this furrow with larger punctures; subalar area smooth and shining; relative lengths of wing veins: submarginal 27, marginal 14, postmarginal 10, stigmal 7, stigmal vein with a slender, relatively long apico-dorsal appendix; median sector of metanotum shagreened.

Propodeum with surface obscurely sculptured, almost smooth, lateral folds well developed, minutely scalloped, anteriorly almost reaching the broadly oval spiracles; petiole with medio-dorsal, longitudinal carina sometimes minutely interrupted in the middle, usually continuous, lateral spines prominent, acute; petiole as wide as long; first gastral tergite longer than all following tergites combined, its surface smooth, shining; second tergite faintly reticulated on basal half, following tergites with exposed surfaces sculptured; each cercus with 3 bristles.

Male.—Length 3.0-3.5 mm. Head and thorax bright metallic green, antennal scape yellow at base and shading to tan at apex, pedicel darkened at base, distally golden tan, funicle uniformly golden tan, club slightly darkened; coxae dark metallic green, legs beyond coxae bright yellow; petiole black, gaster dark metallic green. Enlarged terminal segments of maxillary palpus slightly longer than wide, apex of terminal segment nipple-like and hirsute; relative proportions of lengths of parts of antenna: scape 35, pedicel 12, ring segments 2, 2, funicle segments 7, 8, 8, 7, 7, 6, club 18; surface reticulation of propodeum stronger than in female; first gastral tergite occupying more than half the dorsal surface of gaster; each cercus bearing 4 long bristles.

Type locality.—Intersection of U. S. route 61 and Cascade River, Cook Co., Minn.

Types.—U. S. N. M. No. 62316.

Described from 58 ♀ and 48 ♂ specimens as follows: Holotype ♀, allotype ♂, and 13 ♀ and 9 ♂ paratypes, from type locality, June 17-Aug. 8, 1946, reared from hips of *Rosa acicularis bourgeauiana*, W. V. Balduf; 12 ♀ and 15 ♂ paratypes, intersection of U. S. route 61 and Pike Lake Road, Minn., July 8-Aug. 18, 1946, from hips of *Rosa acicularis bourgeauiana*, W. V. Balduf; 5 ♀ and 12 ♂ paratypes, intersection of U. S. route 61 and Temperance River, Minn., July 10-Aug. 1, 1946, from hips of *Rosa acicularis*, W. V. Balduf; 4 ♀ paratypes, Ely, Minn., July 4-11, 1947, from hips of *Rosa blanda*, W. V. Balduf; 2 ♀ and 3 ♂ paratypes, Bally Creek, Minn., July 11-27, 1946, from hips of *Rosa* (?) *blanda*, W. V. Balduf; 8 ♂ paratypes, Eaglenest, Minn., June 13-Aug. 3, 1945, from hips of *Rosa* sp., W. V. Balduf; 4 ♀ paratypes, Tower, Minn., July 23-Aug. 1, 1945, from trypetid in rose hips, W. V. Balduf; 4 ♀ and 1 ♂ paratypes, Madison, Wisc., July 8, 1946-July 9, 1947, from hips of *Rosa arkansana*, W. V. Balduf; 1 ♀ and 3 ♂ paratypes, Solon Springs, Wisc., June 27-30, 1947, W. V. Balduf; 2 ♀ and 3 ♂ paratypes, Chetek, Wisc., July 8, 1946-July 12, 1947, from hips of *Rosa* sp., W. V. Balduf; 1 ♀ paratype, Sarona, Wisc., June 24, 1946, from hip of *Rosa blanda* or *arkansana*, W. V. Balduf; 2 ♀ and 2 ♂ paratypes, Gordon, Wisc., June 12, 1946-July 6, 1947, from hips of *Rosa blanda glandulosa*, W. V. Balduf; 5 ♀ and 3 ♂ paratypes, Newport, R. I., Sept. 30, 1943, from *Rhagoletis basiola* (O. S.) in hips of *Rosa rugosa;* 1 ♀ paratype, Newport, R. I., Sept. 30, 1944, from *Rhagoletis alternata* (Fallén) in hips of *Rosa virginiana*.

Halticoptera rosae agrees with *goodi* Crawford in having the median sector of the metanotum shagreened and the propodeal spiracles broadly oval; in *goodi,* however, the sculpture of the surface of the propodeum is stronger than it is in *rosae;* the thoracic notum is bright metallic blue-green in *rosae*, but is dark bronzy green in *goodi;* and the antennal flagellum is tan in *goodi*, but is dark brown in *rosae*. In the males, the enlarged terminal segments of the palpus in *goodi* are twice as long as wide, rather than approximately as wide, as in *rosae;* the terminal palpal segment in *goodi* is elongate-acuminate, rather than nipple-like, as in *rosae*.

AUSTIN HOBART CLARK
1880-1954

Newsweek—International

Born on December 17, 1880 at Wellesley, Mass., Austin was educated at Newton High School and Harvard University; he was a typical New Englander. In 1906 he married Mary Wendell Upham who, until her death in 1931, was a wonderful wife and companion. She, and their two sons and three daughters, shared Austin's love of nature and biology. In 1933, he married Leila Gay Forbes who also enthusiastically shared his biological studies.

In 1901 Clark organized the first of several zoological expeditions, that to Margarita Island, Venezuela. In 1906-1907 he was acting chief of the scientific staff of the U. S. Bureau of Fisheries' SS Albatross, and in 1908 joined the Smithsonian Institution where he became curator of echinoderms in 1920. When he retired in 1950, he was made honorary associate in zoology.

During his scientific career of more than half a century he achieved recognition throughout the world as one of the greatest authorities on echinoderms. Mr. Clark was also widely known for his studies on his hobby—butterflies. In these, which included not only collecting and studying his specimens, but also the effect of wing radiation on photographic plates and the study of scent-glands, he enjoyed the enthusiastic help of his family.

Clark also held the important post of Director of the Press Service of the American Association for the Advancement of Science. In this position he was eminently successful in stimulating and encouraging accurate and understandable writing to make science popular and known to the layman.

Clark was a member of and served as president of many scientific societies in this country and was a fellow of the Royal Geographic Society. He was also a member of the Long Range Planning Commission of the Southern Association of Science and Industry as well as the noted Virginia Academy of Science. He served as scientific aide-de-camp to the Prince of Monaco during the latter's Washington visit in 1921 and was decorated Knight of the Order of Dannebrog by Denmark.

Research studies by this past president of our entomological society resulted in over 650 papers and books in oceanography, marine biology, ornithology and entomology and included important contributions to our knowledge of the odd *Peripatus.* These many publications are written in English, French, Italian, German and Russian. His *Monograph of the Existing Crinoids*, which appeared in bulletins of the U. S. National Museum, 1931-1950, established him as an outstanding zoologist. Other books by Austin are: *Animals of Land and Sea*, 1925 (revised, 1927); *Nature Narratives*, 1929-1931; *The New Evolution*, 1930; *Animals Alive*, 1948; and, with his wife Leila. *The Butterflies of Virginia*, 1951, based on personal surveys in every county in Virginia.

A member of the Cosmos Club, he played brilliant but companionable bridge there in the 1920's. He had a remarkably diverse learning; a member once said, ''We should have an up-to-date set of the *Encyclopaedia Britannica.*'' ''Why bother,'' answered another, ''Austin Clark is a member of the club.''

Austin was very helpful to young scientists and foreign visitors. The chairman of this committee recalls with pleasure Saturday night beans-and-brown-bread suppers at his home, summer Sunday evening talks on the roof of the old Cosmos Club and one memorable night in 1920 at Bill Mann's bachelor apartment when Africa was discussed with explorer Edmund Heller.

In the passing of Austin Clark on October 28, 1954, the world has lost an outstanding scientist, a gentleman and a friend.

THOMAS E. SNYDER, *Chairman*
HAROLD H. SHEPARD
J. F. GATES CLARKE

PUBLICATIONS OF AUSTIN H. CLARK (*prepared by Leila Clark*)

1906. The effects of inbreeding, cross-breeding, and selection upon the fertility and variability of Drosophila. Contributions from the Zoölogical Laboratory of Harvard College, no. 117, *in* Proc. Amer. Acad. Arts & Sciences, 41, no. 33:729-786, tables 1-28. May. (Joint author with W. E. Castle & others.)

1913. Revision of the American species of *Peripatus*. Proc. Biol. Soc. Wash. 26:15-20. Jan. 18.

——. Notes on American species of *Peripatus*, with a list of known forms. Smiths. Misc. Coll. 60(17):1-5. Jan. 25.

——. Three interesting butterflies from eastern Massachusetts. Proc. U. S. Nat. Mus. 45:363-364, pl. 12. June 13.

1913. Piccole note su degli Onychophora. Zool. Anz. 42(6):253-255. July 18.

1914. Sopra una piccola collezione di Onychophora da Australia. Zool. Anz. 43 (7):316-319. Jan. 7.

——. Notes on some specimens of a species of onychophore (*Oroperipatus corradoi*) new to the fauna of Panama. Smiths. Misc. Coll. 63(2):1-2. Feb. 21.

——. On some onychophores (*Peripatus*) from the Republic of Panama. Zool. Anz. 45(4):145-146. Dec. 4.

1915. The present distribution of the Onychophora, a group of terrestrial invertebrates. Smiths. Misc. Coll. 65(1):1-25. Jan. 4.

——. A note on the occurrence of *Epiperipatus imthurmi* (Sclater). Proc. Biol. Soc. Wash. 28:179-184. Nov. 29.

1925. Man's chief competitors, the insects. More about insects. *In Animals of Land and Sea:* 49-81. There are many other references to insects throughout the book.

——. Some unusual and interesting butterflies from eastern Massachusetts. Psyche 32(6):293-298. December.

1926 Carnivorous butterflies Smith. Inst. Ann. Rept. for 1925, pp 4[illegible] 508 figs

——. Notes on the odors of some New England butterflies. Psyche 33(1):1-5. Feb.

——. Our giant moths. Sci. Mo. 23:385-397, figs. 1-19. Nov.

1927. Fragrant butterflies. Smiths. Inst. Ann. Rpt. 1926: 421-446, pls. 1-13.

——. Notes on the melitaeid butterfly *Euphydryas phaëton* (Drury) with descriptions of a new subspecies and a new variety. Proc. U. S. Nat. Mus. 71(11):1-22, pls. 1-5. April 22.

1928. Notes on some butterflies from New England. Psyche 35(4):226-228. Dec.

1929. The butterflies of the District of Columbia. Smiths. Inst. Explorations and Field-Work, 1928: 101-108, figs. 89-93.

——. Why a butterfly? [and 21 other brief popular articles on insects]. *In his* Nature Narratives, 1:47-107.

[Note on the first record of the European house cricket (*Gryllis domestica*) at Greenfield, Mass.] Journ. Wash. Acad. Sci. 19(2):49. Jan. 19.

——. On certain forms of common American butterflies. Psyche 36(1):28-33. March.

——. Preliminary list of the butterflies of the District of Columbia. Proc. Biol. Soc. Wash. 42:113-116. March 25.

——. *Peripatus* from the Island of Montserrat. Proc. Ent. Soc. Wash. 31(7): 139. October.

1930. Notes on some local butterflies. Proc. Ent. Soc. Wash. 32(5):80-82. May.

——. The world and the butterfly. Sci. Mo. 30:536-537. June.

1931. Bachelor butterflies (and 14 other brief popular articles on insects), *In Nature Narratives* 2:56-82.

——. Some observations on butterfly migrations. Sci. Mo. 32:150-155. February.

——. Notes on the behavior and migration of the milkweed butterfly. Journ. Wash. Acad. Sci. 21(8):171-172. April 19.

1931. Selling entomology. Sci. Mo. 32:527-536. June.

1931. The extirpation of one butterfly by another. Sci. Mo. 33:173-174. August.
——. A new subspecies of *Poanes massasoit* Scudder. Annals Carnegie Mus. 21 (1):7-9, fig. 1. Nov. 14.
1932. The butterflies of the District of Columbia and vicinity. U. S. Nat. Mus. Bull. 157. ix + 337 pp., 64 pls. Feb. 13.
——. The forms of the common Old World swallowtail butterfly (*Papilio machaon*) in North America, with descriptions of two new subspecies. Proc. U. S. Nat. Mus. 81(11):1-15, pls. 1-8. July 12.
1934. Observations on the butterflies of Apple Orchard Mountain, Bedford County, Virginia. Proc. Biol. Soc. Wash. 47:177-180. Oct. 2.
1935. Arctic butterflies. Smiths. Inst. Ann. Rept. 1934:267-296, pls. 1-7.
——. The butterflies of Virginia. Smiths. Inst. Explorations and Field-Work 1934:33-36, figs. 28-31.
1936. Some butterflies from eastern Virginia. Journ. Wash. Acad. Sci. 26(2): 66-70, figs. 1-14. Feb. 15. (Leila F. Clark, joint author.)
——. Notes on the butterflies of the genus *Enodia* and description of a new fritillary from Peru. Proc. U. S. Nat. Mus. 83:251-259, pl. 22. April 11.
——. Who's who among the butterflies. Nat. Geog. Mag. 69:679-692, pls. 1-8. May.
——. The gold-banded skipper (*Rhabdoides cellus*). Smiths. Misc. Coll. 95(7): 1-50, pls. 1-8. May 6.
——. The nest of *Odynerus tempiferus* var. *macio* Bequaert, with notes on the habits of the wasps. Proc. U. S. Nat. Mus. 84:89-95, table 1. November 24. (Grace A. Sandhouse, joint author.)
——. The swallowtail butterflies. Smiths. Inst. Ann. Rept. 1935:383-408, pls. 1-14.
1937. The butterflies of Virginia. Smiths. Inst. Explorations and Field-Work 1936:47-52, figs. 40-45.
A new subspecies of the nymphalid butterfly *Polygonia faunus*. Proc. U. S. Nat. Mus. 84:219-222, pl. 10. April. 9.
——. Records of *Argynnis diana* and of some other butterflies from Virginia. Journ. Wash. Acad. Sci. 27(5):209-213. May 15. (Carroll M. Williams, joint author.)
——. Preliminary list of the butterflies of Virginia. Proc. Biol. Soc. Wash. 50:87-92. June 22. (Leila F. Clark, joint author.)
——. Potent personalities—wasps and hornets. Nat. Geog. Mag. 72(1):47-72, pls. 1-8, 18 illus. July.
——. Surveying the butterflies of Virginia. Sci. Mo. 45:256-265. September.
——. On some onychophores from the West Indies and Central America. Proc. U. S. Nat. Mus. 85:1-3. Nov. 5.
1938. The butterflies of Virginia. Smith. Inst. Explorations and Field-Work 1937:77-80, figs. 80-82.
——. Butterflies from Virginia and the District of Columbia. Proc. Ent. Soc. Wash. 51:1-6. Feb. 18. (Leila F. Clark, joint author.)
——. Notes on Virginia butterflies. Proc. Biol. Soc. Wash. 51:177-182. Nov. 3. (Leila F. Clark, joint author.)
1939. Butterflies of a wood road, Suffolk, Virginia. Ent. News 50(1):1-5. January. (Leila F. Clark, joint author.)

1939. Butterflies from Virginia. Proc. Biol. Soc. Wash. 52:172-184. Dec. 15. (Leila F. Clark, joint author.)
1940. Butterflies of Virginia. Smiths. Inst. Explorations and Field-Work 1939: 63-66, figs. 68-73.
1941. Butterflies of Farmville, Virginia. Journ. Wash. Acad. Sci. 31(1):38-40. Jan. 15. (Frank W. Trainer, joint author.)
——. Some early butterfly records from Georgia. Proc. Ent. Soc. Wash. 43(4): 80-85. April. (Leila F. Clark, joint author.)
——. The genus *Colias* in North America (Lepidoptera: Pieridae). Ent. News 52(7):185-187, 8:220-225. July and Oct.
——. Notes on the American representatives of the butterfly genus *Argynnis*. Journ. Wash. Acad. Sci. 31(9):381-384. Sept. 15.
——. Notes on some North and Middle American danaid butterflies. Proc. U. S. Nat. Mus. 90:531-542, pls. 71-74. Nov. 4.
——. Butterflies of Virginia. Smiths. Inst. Explorations and Field-Work 1940: 57-60, figs. 59-62.
1944. A new butterfly from the Solomon Islands. Proc. Biol. Soc. Wash. 57: 95-96. Nov. 30.
——. Butterflies of the Southwest Pacific. 5 pp., mimeographed.
1946. The onychophores of Panama and the Canal Zones. Proc. U. S. Nat. Mus. 96:205-213. Feb. 21.
——. Two new butterflies from the Admiralty Islands. Proc. Biol. Soc. Wash. 59:119-120. Oct. 25.
1947. The interrelationships of the several groups within the butterfly superfamily Nymphaloidea. Proc. Ent. Soc. Wash. 49(6):148-149. June 11.
1948. Surveying the butterflies of Virginia—from the human as well as the scientific viewpoint. Author's abstract of his address as retiring president of the Enotmological Society of Washington. Proc. Ent. Soc. Wash. 50(3): 74-76. March.
——. Classification of the butterflies, with the allocation of the genera occurring in North America north of Mexico. Proc. Biol. Soc. Wash. 61:77-84. June 16.
——. The Insects. Insect foods. Carnivorous insects. Paraistic insects. Aquatic insects. *In Animals Alive,* :109-149, 227-235. There are many other references to insects in the book.
——. Long and short of the insect world. Condensed from a chapter of the book, *Animals Alive.* Sci. Digest 24(4):11-15. October.
——. A new subspecies of *Glaucopsyche lygdamus.* Proc. Ent. Soc. Wash. 50(7): 176-178. Oct. 18.
1950. Foreword to The Butterflies of Georgia, by Lucien Harris, Jr. Georgia Soc. of Naturalists, Bull. No. 5. 1 p.
——. Hübner's "Florida." Lepidopterists' News 4(6-7):62.
——. Lepidopterous larva feeding on exudations from woolly aphids. Lepidopterists' News 4:52.
1951. The butterflies of Virginia. Smiths. Misc. Coll. 116(7):vii + 239 pp., 30 pls., col. frontisp., fold map. (Leila F. Clark, joint author.)
——. Butterflies of the Marshall Islands. Proc. Ent. Soc. Wash. 53:43-44. February.

1951. The organization and the first annual meeting of the Lepidopterists' Society in New York. Proc. Ent. Soc. Wash. 53:114. April.
——. "A Field Guide to the Butterflies of North America East of the Great Plains," by Alexander B. Klots (review). Sci. Mo. 72:408. June.
1952. The first record of a butterfly migration in America. Lepidopterists' News 6(1-3):42. Oct. 8.
——. Leland Ossian Howard (1857-1950). Cosmos Club Bull. 5(12):2-4. Oct.

MABEL COLCORD

(1872-1954)

With the death of Mabel Colcord in a Philadelphia Hospital on June 4, 1954, the Entomological Society of Washington lost an old friend who had been on its membership rolls since the 409th meeting, March 7, 1929.

Daughter of Samuel Marshall and Elisabeth (Rodman) Colcord, she was born in Boston on December 24, 1872. After eight years in public schools she attended Arthur Gilman's School for Girls in Cambridge, Massachusetts, leading a rather restricted life in the home of an aunt during this four-year period. A year in high school at Needham, Massachusetts completed her elementary education. An excellent student, she was sent to Radcliffe College from which she graduated in 1895 with the degree of A.B. Miss Colcord majored in Latin and Greek and in after years she used to maintain (and prove it) that certain pages of the *Index to the Literature of American Economic Entomology* had a definitely Homeric rhythm.

The years from 1895 to 1898 were spent as a teacher in both private and high schools. The loss of both father and mother in the same year left her much depressed and uncertain about her future plans. She did not wish to return to teaching and finally decided to enter the New York State Library School where she was a student from 1900 to 1902.

Miss Colcord held her first library positions in 1901 and 1902 as assistant in the Young Men's Association Library, Albany, N. Y., and in the New York State Traveling Library Division. In 1902 she went to the State University of Iowa as Assistant Cataloger, and from 1903-1904 served that library as Assistant in Charge. Her long association with entomology began with her appointment to the Bureau of Entomology as "Scientific Assistant in Library Science," effective July 9, 1904. Miss Colcord remained as a bureau librarian until all the bureau libraries were consolidated with the Main Library of the Department in February, 1942. She continued to work in the field of entomology, acting as Chief of the Entomological Unit of the Bibliography Division until her retirement on June 30, 1942.

Miss Colcord came to the Bureau of Entomology trained in Library Science but with very little knowledge of her subject field. Three years later, in 1907, a memorandum from Dr. L. O. Howard contained the following significant comment: "She has familiarized herself with the conditions and needs of the Bureau and with the general subject of entomological literature with a rapidity that is surprising and very gratifying." In 1904 the library was little more than a collection of books, uncataloged and with a charging system somewhat startling to a trained librarian. The entomologist detailed to watch over the "Library" simply took down the book and replaced it with a slip of paper on which he wrote its title. He saw no necessity for recording the borrower's name because only *one* specialist had a right to be interested in *that* book. Miss Colcord met the situation with tact and humor, never yielding her objective of installing approved library procedures. Under her guidance the library became known as an outstanding collection, recognized and consulted by entomologists in this country and abroad.

Tact was also required to maintain the delicate balance between her duty to Dr. Howard as Chief of the Bureau and her duty to Miss Claribel Barnett as head of the Department Library system. Great respect and liking for both Dr. Howard and Miss Barnett, as well as her own integrity, guided her through this difficult situation. She was always able to hold her own with a quiet dignity or to inject a humorous retort to dissolve tensions that became too acute. Dr. Howard with his usual perspicacity never underrated her, nor she him, although she never hesitated to reprove him for scattering ashes on her library floor. The two were singularly congenial and understood each other so that a friendship grew up over the years which endured until his death.

Bureau workers learned to appreciate the quality of this small woman with her quick intelligence, her capacity for hard work, her genuine interest in them and in their troubles; and they delighted in her irrepressible sense of humor. Even old Dr. Chittenden who used to grumble, "All these librarians think of is keeping their books on the shelves," would overturn all the litter on his desk for her in a frantic hunt to find a book lost in the clutter. C. F. W. Muesebeck writes, "To the older entomologists in the Department of Agriculture the library of the old Bureau of Entomology, for so many years under the direction of Miss Colcord, is one of their fond memories. It was a pleasant and comfortable place in which to work, with Miss Colcord or one of her assistants ready and able to provide the needed guidance even in the more complex problems. Miss Colcord, in fact, nearly always sensed the peculiar character of the need in troublesome cases and miraculously, as it seemed to the entomologists, tracked down the required literature. This was done, too, in a way so effortless, so friendly, so understanding, that the scientist soon came to look upon her, not as a librarian, but as a collaborator in his job. She has been greatly missed." Members of her own staff who watched her and learned from her certainly realized Miss Colcord's skill as a research reference worker. She combined a large store of information with the imagination to see several angles of approach to a subject, and exercised unlimited patience in following various leads—she took pleasure in the search.

It was the good fortune of American entomologists to have the record of economic work, begun by Samuel Henshaw and Nathan Banks, continued by Miss Colcord from *Index II* (1915-1919) *of the Index to the Literature of American Economic Entomology* through *Index VI* (1935-1939). She has told how Dr. Howard called her into his office one day and said, "I'm going to ask you to continue the work of getting out the Index to Economic Entomology." "It came just like that," she said, "and for the moment I was completely staggered, but Dr. Howard seemed to think I could do it, so I told him I would tackle it." It was a formidable task to add to an already heavy load, but she "tackled" it with her usual pluck and driving energy. Each five-year cumulation reflects her determination to insure ever greater assistance to busy workers and her alert awareness of new subject headings needed to keep pace with the rapidly expanding field of economic entomology.

Family relationships meant a great deal to Miss Colcord and she gave generously from her modest income to help with medical bills or with the education of younger members. She valued her friendships, too, and the years only served to deepen and strengthen these ties. A sick friend could be certain of a cheerful visit and a friend in misfortune of sincere sympathy and practical aid. "Is there anything I can do?'' was no meaningless phrase from her. An active member of the Church of the New Jerusalem (Swedenborgian), Miss Colcord gave freely of her time for many years to care for the Church Library.

Miss Colcord was a Fellow of the American Association for the Advancement of Science, and a member of the American Association of Economic Entomologists, the Entomological Society of Washington, the Biological Society of Washington, the American Library Association, the District of Columbia Library Association, the Bibliographical Society of America, the Agricultural History Society, and the American Association of University Women. On June 23, 1945, by action of the Iota of Massachusetts, she was made a member of Phi Beta Kappa at Radcliffe College. This action was taken in recognition of her high attainments in liberal scholarship and with particular reference to the compilation of the *Index*.

Miss Colcord had been in poor health for about two years and it is good to record that the affection and assistance she needed were gladly given by her cousin and friend, Dr. Jessie A. Rodman. After several heart attacks Miss Colcord passed quietly away. Funeral services were held in Philadelphia and she was buried in the family lot in Mount Auburn Cemetery, Cambridge, Massachusetts. Mabel Colcord's vivid personality will not be forgotten by those who knew her. She was a wonderful companion and, as one of her oldest friends wrote, ''added good cheer and merriment to any company.''

Ina L. Hawes, *Chairman*
Doris H. Blake
J. S. Wade

SOCIETY MEETINGS

The 640th regular meeting of the Society was held in Room 43 of the U. S. National Museum, Thursday, December 2, 1954, attended by 53 members and 18 visitors. President Ashley B. Gurney opened the meeting at 8 p.m. and the minutes of the previous meetings were read and approved.

The Society voted the following to membership: *Dr. W. V. Garner*, Iowa State College, Ames, Iowa; *Dr. J. U. McGuire*, Biometrical Service, Plant Industry Station, Beltsville, Md.; *Mr. Harold D. Nelson*, Stored Product Insect Investigations, Agricultural Marketing Service, U. S. Dept. of Agriculture, Washington 25, D. C.; *Mr. Clarence W. Travis*, Municipal Center Building, 3rd and C Sts., N.W., Washington 1, D. C.

The president referred to the banquet held at the Cosmos Club November 13, 1954 in celebration of the Centennial of Professional Entomology, sponsorsd jointly by the Entomological Society of Washington, the Entomological Society of America and the Insecticide Society of Washington. K. A. Haines served as chairman of the Banquet Committee. More than 170 persons attended, including numerous visitors from outside the area. Dr. W. M. Mann, Director of the National Zoological Park, was toastmaster. Dr. A. L. Strand, president of Oregon State College, gave the principal address. Other speakers were Dr. Robert Glen, David G. Hall and the presidents of the three sponsoring Societies, A. B. Gurney, H. H. Ross and R. W. Sherman.

In the absence of nominations from the floor, the slate presented by the nominating committee was elected for the year 1955. Names of the new officers appear on the inside front cover of Vol. 57, No. 1 of the *Proceedings*.

President Gurney extended thanks to the officers with whom he had worked and wished good luck to the incoming president.

The death of Mr. J. M. Singleton in Brownsville, Texas on Nov. 22, 1954, was announced. After graduating from Clemson College where he studied entomology, Mr. Singleton was given a temporary appointment by the Federal Horticultural Board and was assigned to the project for the suppression and Horticulutral Board and was assigned to the project for the suppression and eradication of the pink bollworm. He served in that capacity about a year, after which he was stationed on the Mexican border in the Division of Foreign Plant Quarantines. Because of his intense interest in the work and his demonstrated ability, he was rapidly elevated to positions of increasing responsibility and trust, serving in the ports of El Paso, Hidalgo, Brownsville, and New Orleans. On May 16, 1940 he was brought to Washington, D. C. and on February 3, 1941 was made Supervisor of the Atlantic Coast ports with headquarters in New York. He held this position with distinction until he succeeded Mr. O. D. Deputy as Supervisor of the Mexican border and was placed in charge of that important district in 1953. Mr. Singleton always had an interest in young men coming into the service and the success which has been experienced in the in-service training of these men on the Mexican border and the Atlantic and Gulf Coast districts is in a large measure due to his enthusiasm and helpfulness. During World War II in addition to managing the Atlantic Coast district, no mean task, he took on the additional responsibility of heading a survey for possible new foreign insect pests that might have gained a foothold in the general vicinity of ports of entry around the periphery of the United States. This resulted in the location of a number of unrecorded insect pests of foreign origin and the enrichment of the national insect collection. While it was not possible for him to attend many meetings of this Society, he read the *Proceedings* with a great deal of pleasure and interest and never lost an opportunity to urge those interested in entomology to become members of the Society. His passing represents a distinct loss to the important field of plant quarantine entomology. (Mr. Sasscer's abstract)

Copies of proposed changes in Article III, Section 1 of the constitution increasing the life membership fee from $50 to $75 and the sustaining membership fee from $100 to $150 were passed among the members and visitors at the meeting.

Dr. Oman reviewed Dr. Melville Hatch's talk, "Entomology in Search of a Soul," published in a recent issue of the *Annals of the Entomological Society of America*. He also spoke briefly about the popularity of insect collecting in Japan and exhibited a doll with a bamboo stick with adhesive to catch flies. President Gurney exhibited Volume 12 of the *Index to American Economic Entomology* which contains a portrait of Miss Mabel Colcord. Dr. Jack Jones announced that he had discovered four large vesicles filled with fluid in the thorax of *Anopheles* larvae. He asked that anyone having knowledge of the purpose or nature of these vesicles communicate with him.

Dr. José Carvalho, Entomologist, Museo Nacional, Rio de Janeiro, Brazil, currently working at the National Museum, spoke on "Entomological Explorations in the Amazonia." The primitive natural state of the fauna and flora of the Amazon valley is virtually untouched; humans have not yet disturbed its natural equilibrium. Entomologists are faced with the hazardous factors of high humidity and temperature, great distances, precarious means of transportation, apparatus to reach high levels in the forest, and two diseases, malaria and yellow fever. Wise choice of good labor, food and equipment assist the explorer in many important ways. At least five natural ecological habitats are encountered: equatorial forest, caatinga, savanna, campos and marsh, and the very large volume of fresh water in rivers and lakes. The best season for entering these areas is at a time when water reaches its highest level in the local rivers. (Speaker's abstract.)

Adjournment was at 9:30 p.m.—R. H. FOOTE, *Acting Recording Secretary.*

The 641st regular meeting of the Society was called to order by President T. L. Bissell in Room 43 of the U. S. National Museum Thursday, Jan. 6, 1955 at 8:00 p.m. with fifty-one members and 23 visitors in attendance. The minutes of the previous meeting were read and approved.

The following committee appointments were announced by President Bissell: Program, F. L. Campbell, Kelvin Dorward, Elizabeth Haviland, and Floyd F. Smith in addition to the elected chairman, J. F. G. Clarke; Notes and Exhibitions, G. W. Wharton, Chairman, C. F. Rainwater, W. B. Wood and C. W. Sabrosky; Membership, E. R. McGovern, Chairman, B. A. App, E. W. Baker, J. R. Foster, M. P. Jones, and P. A. Woke; Memoirs, W. E. Bickley, Chairman, C. H. Hoffmann, R. A. St. George, and R. H. Foote; Reserve Stock, Helen Sollers, Rose Warner, and H. J. Conkle (ex officio); Auditing, D. G. Hall and L. S. Henderson; Advertising, R. H. Nelson and G. S. Langford.

The following new members were elected: *Royce B. Knapp*, Cereal and Forage Insects Section, Entomology Research Branch, Agricultural Research Center, Beltsville, Md.; *Paul H. Arnaud*, Department of Entomology, 406th Medical General Laboratory, APO 500, San Francisco, Calif.; *Ervin H. Kardos*, Department of Entomology, Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington 25, D. C.; *C. W. Shockley*, Economic Insect Survey Section, Plant Pest Control Branch, Plant Industry Station, Beltsville, Maryland.

The Society voted to change Article III, Section 1, of the Constitution, according to the proposal presented at the 640th meeting.

President Bissell announced that William N. Sullivan, Jr. and Lyle D. Goodhue have received the 1954 Achievement Award of the Chemical Specialties Manufacturers' Association in recognition of their work in developing aerosol insecticides.

Reports on activities and papers given at the Entomological Society of America meetings at Houston were made by B. A. Porter and C. W. Sabrosky.

The first speaker, Dr. E. N. Cory, told of "Orchids and their Pests." Insects and the virus diseases they transmit are major limiting factors in the growing of orchids. According to the latest census figures this activity amounts to more than eight million dollars annually in the U. S.; it is estimated that there are approximately 30,000 amateur growers in this country. There is possibly an equal number in Hawaii but the number in tropical America is not known. Dr. Cory showed slides illustrating the principal insect pests and the types of injury they cause, and many species of orchids commonly used in crossbreeding. (Secretary's abstract.)

''Weather and Mosquito Abundance in Alaska'' was discussed by Dr. R. I. Sailer, Entomology Research Branch, U. S. Dept. of Agriculture. The serious nature of the mosquito problem in Alaska is generally recognized and has been the subject of investigation by the Alaska Insect Control Project conducted by the Entomology Research Branch, U. S. D. A. To a very great extent the problem is one of learning how to live and work most effectively in the regions where arctic and subarctic *Aedes* are prevalent. The fact that they cause little or no trouble over wide areas in some years suggested need for further information concerning causes of population fluctuation. Two summers of field work, in part supported by the Arctic Institute of North America, has demonstrated that a useful correlation exists between departure from normal precipitation during a period of 36 months prior to May 1 and mosquito abundance in an area during the following mosquito season. Dr. Sailer then added that predictions appeared to be most reliable when low populations were indicated. The greater inaccuracies observed at the other extreme had comparatively little practical significance because any population level requires full mosquito protection, the effectiveness of which is not materially affected by variation in mosquito abundance above that level. (Speaker's abstract.)

L. C. McAlister of Ohio was a visitor.

The meeting adjourned at 10:00 p.m.—KELLIE O'NEILL, *Recording Secretary.*

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Insects

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of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

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THE

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ORGANIZED MARCH 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings.*

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Members shall be persons over 18 years of age who have an interest in the science of entomology. Annual dues for members are $4.00; initiation fee is $1.00 (U. S. currency).

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VOL. 57 JUNE 1955 NO. 3

STUDIES ON THE REUTERELLINE PSOCIDS
(PSOCOPTERA)

By EDWARD L. MOCKFORD, *University of Florida, Gainesville.*

The subfamily Reuterellinae is discussed in only a single paper on Western Hemisphere psocids (Mockford, 1952), in which records of a single undetermined species of *Reuterella* are presented. Through examination of material from Florida and the West Indies, I have found four additional New World species, all of which are new; three of these I regard as representing a new genus. The addition of this genus necessitates some modification of the definition of the subfamily. It is the purpose of this paper to describe the new genus and species, to present life-history data for some of these (in part supplementing the morphological diagnoses), to present a key to the world species of Reuterellinae, to discuss the identity of the North American *Reuterella* referred to above, to re-define the subfamily and summarize evidence bearing on its taxonomic position, and to discuss the geographical distribution of the group.

KEY TO THE WORLD SPECIES OF REUTERELLINAE

1. Color pattern of dorsal surface of abdomen a conspicuous white cross against a brown background (Pearman, 1936, pl. I, fig. 7). Body bearing numerous stout, spiniferous setae. Males apterous .... *Nepiomorpha* ... 2
   Color of dorsal surface of abdomen not at all as above, usually a single shade throughout membranous portions. Males of bisexual species winged 3
2. Head uniformly chestnut brown except for paler clypeus. Margin of subgenital plate with a distinct median process (Pearman, 1936, pl. I, fig. 12) and this bearing seven to nine stout setae. Inner valve of gonapophyses of ninth abdominal segment with a distinct, rather wide notch in apex, readily visible when valve is flattened ...... *N. crucifera* Pmn.
   Head pale brown and cream in color. Margin of subgenital plate scarcely prolonged medially (fig. 15) and this region bearing four to six stout setae. Inner valve of gonapophyses of ninth abdominal segment with narrow notch in apex, not at all visible when valve is flattened except in macropterous forms .... *N. peripsocoides*, n. sp.
3. Males with wings unciliated and lacking an areola postica. Subgenital plate bearing slender median process. Inner margin of female paraproct bearing short 'duplex spines' in close proximity to a long, stout spine (figs. 1, 2, 12) .... *Palmicola*, n. gen. ... 4

Males with wings ciliated on veins; areola postica present in forewings. subgenital plate lacking median process. Inner margin of female paraproct lacking 'duplex spines' but bearing two long spines in same region .... *Reuterella* End. (monotype: *R. helvimacula* End.)

4. Head of single specimen (female) buffy yellow. Numerous long, upright setae on dorsum of abdomen. Pigmented areas of subgenital plate shaped as in fig. 14. Jamaican species .... *P. robinae*, n. sp.
   Head some shade of brown. Setae of dorsum of abdomen short, lying flat. Florida species 5
5. Pigmented area of subgenital plate shaped as in fig. 9. Duplex paraproctal spines of females better developed than in following species (fig. 2). A bisexual species of north-peninsular Florida ....*P. aphrodite,* n. sp.
   Pigmented area of subgenital plate shaped as in fig. 8. Duplex paraproctal spines of females poorly developed (fig. 1). A parthenogenetic species of south-peninsular Florida ....*P. solitaria,* n. sp.

Reuterella helvimacula Enderlein

Leptella helvimacula Enderlein, 1901, Zool. Yahrb., Abt. Syst. 14:537-548, pl. 35.
Reuterella helvimacula Enderlein, 1903, Zool. Anz. 27:131-134.
Caecilius corticis Pearman, 1924, Ent. Mo. Mag. 60:58-61.

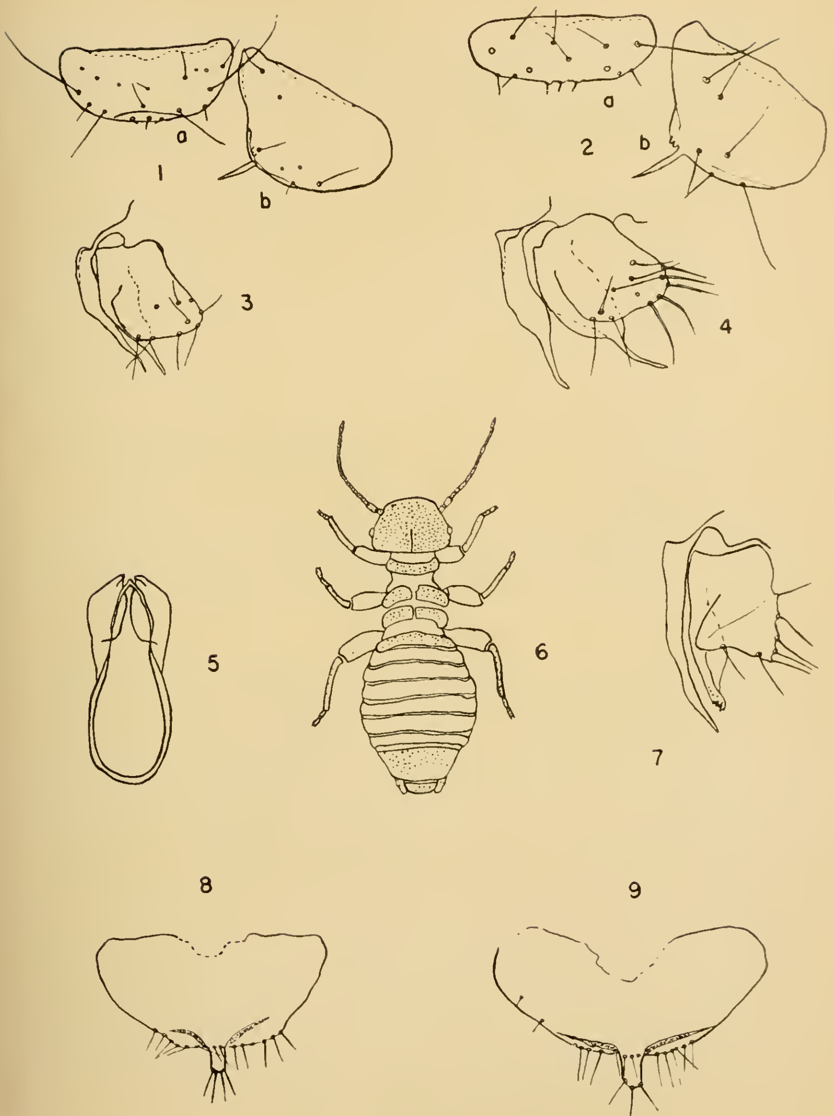
A comparison of female genitalic characters, coloration, size, and proportions was made between specimens of this species sent from England by Mr. J. V. Pearman and Indiana specimens of *Reuterella* sp. The only differences found were (1) slightly smaller size of the Indiana specimens, and (2) presence of only two large setae on each of the processes of the subgenital plate in contrast to three on some of the British specimens. I therefore regard the Indiana specimens as examples of *helvimacula*. I have examined specimens from Illinois collected by K. M. Sommerman and have no doubt that they are the same species.

Nepiomorpha peripsocoides, new species

Diagnosis.—Differs from *N. crucifera* Pearman in pale brown and cream color of head, shorter central process of subgenital plate, and fewer setae on this region, narrower notch in apex of inner valve of gonapophyses of 9th abdominal segment, presence in thoracic tergites of fuscous subcuticular pigment in apterous forms and brown cuticular pigment in macropterous forms, head more prolonged and narrowed in front of eyes, and relatively somewhat longer phallic frame. Macropterous females fairly frequent, whereas winged forms not known for *N. crucifera.*

Holotype Female.—Macropterous. Measurements: total body length 1.39 mm.; forewing length 1.43 mm.; antennal length 0.56 mm.; hind femur + trochanter 0.34 mm.; hind tibia 0.40 mm.

Morphology (from macropterous paratypes and holotype).—Antennae ten-segmented, but apical segment with a constriction before its middle suggesting an incipient division. Antennal segments in ratio 0.42: 1.00: 1.79: 1.79: 0.89: 0.74: 0.58: 0.68: 0.47: 1.58. Antennal sensilla small and difficult to distinguish, apparently distributed as follows: small one lacking appendage in middle of F_1, small



Palmicola solitaria, n. sp. Fig. 1a (♀), epiproct; fig. 1b (♀), paraproct; fig. 3 (♀), gonapophyses; fig. 8 (♀), subgenital plate. *Palmicola aphrodite,* n. sp. Fig. 2a (♀), epiproct; fig. 2b (♀), paraproct; fig. 4 (♀), gonapophyses; fig. 5 (♂), phallic frame; fig. 6 (♀), dorsal view of paratype (intact); fig. 9 (♀), subgenital plate. *Nepiomorpha peripsocoides,* n. sp.: fig. 7 (♀), gonapophyses.

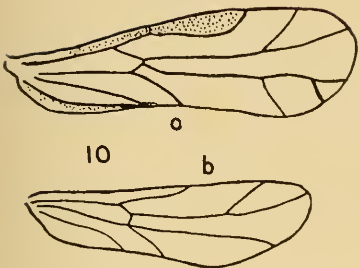
one with short seta on apex of F_3, small one lacking appendage near apex of F_6. Eyes fairly large with many small facets. Ocelli well-developed. Maxillary rods terminating in a pair of denticles, one truncated, the other acutely pointed. Thorax of usual form for macropterous psocids: meso- and meta-thorax with bulging tergal lobes; prothorax small. Rasp-type coxal organ present on bulging inner surface of posterior coxa. Tibial spurs absent. Tarsi similar to those of *N. crucifera* but hind basitarsus somewhat longer than apical segment. Forewings considerably exceeding tip of abdomen when at rest. Venation (fig. 11) of *Peripsocus* type, i.e. lacking an areola postica, but this partially present (with no connection to M) in some specimens. Rs broadly joined to M in hindwing. Axillary vein lacking in hindwing. Abdomen shaped and sclerotized as in *N. crucifera*. Paraprocts bearing duplex spines on inner margin, but one of these spines much smaller than other. Sensory area of paraproct bearing trichobothria, and these with 'basal rosettes' in form of irregular ovoid areas. Gonapophyses (fig. 7) as in *N. crucifera*, but gonapophysis of 8th segment somewhat longer relative to others, and notch in apex of inner valve of gonapophysis of 9th segment very slender. Subgenital plate (fig. 15) with sclerotized and pigmented area shaped much as in *N. crucifera*, but apical process much shorter and bearing fewer (4-6) setae.

Ciliation.—'Spiniferous setae' present on vertex and front, mesotergal lobes, radius basad of its branching, M distal to its juncture with Rs, Cu most of its length, and Ax most of its length. Truncated setae on outer surfaces of tibiae near femora; remainder of tibiae bearing normal, acuminate setae. Setae of abdomen normal.

Color.—Head pale brown (cuticular pigment) in occipital region, with a wide stripe of the same color extending forward in middle and another wide area extending forward on each side to include eyes; area between white; clypeus pale brown. Eyes blue-black. Ocellar interval darker than remainder of median band. Scape and pedicel colorless; flagellum pale brown. Tergal lobes dark brown; wings colorless. Abdomen medium brown (cuticular pigment) on first tergite, from eighth tergite to tip, and on pigmented area of subgenital plate. A broad longitudinal white band from second to 7th tergites inclusive, and a broad transverse white band including most of tergites three and four. Remainder of tergites with fuscous subcuticular pigment. Venter of abdomen colorless except for subgenital area.

Allotype Male: Apterous. Measurements: total body length 1.02 mm.; antennal length 0.43 mm.; hind femur + trochanter 0.25 mm.; hind tibia 0.31 mm. Differs from holotype in complete lack of wings, smaller size, lack of ocelli, much fewer and relatively larger facets in compound eyes, and thorax of nymphal type with closely adherent segments and flat tergites. Thoracic tergites mostly colorless with a few small subcuticular fuscous areas. Phallic frame similar to that of *N. crucifera* but relatively somewhat longer.

Palmicola aphrodite, n. sp. Fig. 10a (♂), forewing; fig. 10b (♂), hindwing; fig. 16 (♀), antenna. *Nepiomorpha peripsocoides*, n. sp. Fig. 11a (♀), forewing; fig. 11b (♀), hindwing; fig. 15 (♀), subgenital plate. *Palmicola robinae*, n. sp. Fig. 12 (♀), epiproct (left), paraproct (right); fig. 13 (♀), gonapophyses; fig. 14 (♀), subgenital plate; fig. 17 (♀), antenna.



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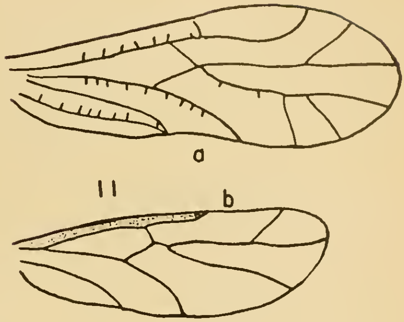

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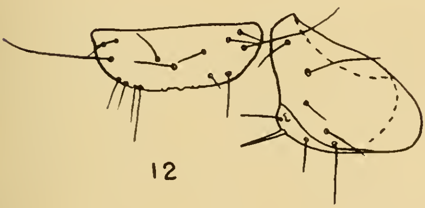
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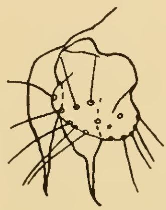
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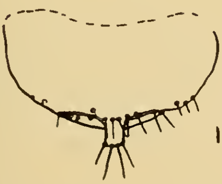
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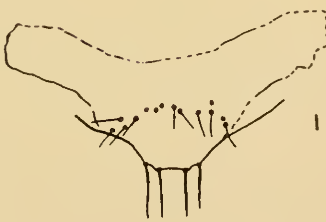
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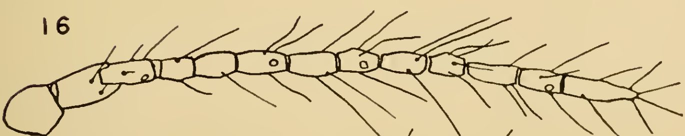
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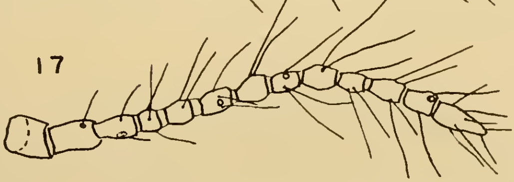
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Variation.—Apterous females occur which are similar to the allotype in lacking ocelli, having fewer and larger facets of compound eyes, thorax of nymphal type, and in coloration. The median process of the subgenital plate is somewhat shorter than in macropterous forms. The duplex paraproctal spines are equal in length. The sensory area of the paraproct is represented only by a round, pale area lacking trichobothria. The coxal organ is absent, and spiniferous setae occur on all abdominal segments in addition to the thorax and head.

Type Locality.—Florida, Sarasota County, Myakka River State Park. Holotype, allotype, 1 ♂ and 5 apterous ♀ paratypes taken August 30, 1951 on trunks of *Sabal palmetto.*

Other Paratypes.—Type locality, 3 ♂, 7 apterous ♀, April 12, 1952, same habitat as above. Florida, Alachua Co., Newnan's Lake, on side of wooden shed, 37 apterous ♀, April 19, 1952, 2 apterous ♀, 11 macropterous ♀, June 18, 1952. Florida, Alachua County, Gainesville, 1 ♂, 3 apterous ♀, October 8, 1952 on north side of brick building.

Disposition of Types.—Holotype, allotype, 1 ♂ and 2 ♀ paratypes in U. S. National Museum. Two ♀ paratypes in Florida State Museum at Gainesville. Two ♀ paratypes in each of the following private collections: K. M. Sommerman (Orlando, Florida), J. V. Pearman (Aston Clinton, England), A. Badonnel (Paris, France), A. M. Nadler (New York City). The remaining paratypes will be retained in my collection.

Biological Notes.—Like *N. crucifera*, these insects spin no web and live in loose groups, the individuals being usually not in contact. Eggs are laid in large groups, one such group containing about 150 eggs; eggs are oval in shape, about 0.37 mm. in length, and each is covered with fine particles of debris. Hatching occurs through a slit at the narrow end of the egg.

Genus **Palmicola**, new genus

Females apterous and otherwise neotenic; males macropterous and adultoid. Male venation characterized by absence of Cu_1 in forewing and absence of Ax in hindwing; a long R-M crossvein in hindwing. Ciliation absent from wings. Duplex spines present on paraprocts, very short on females, longer on males. Mouthparts and genitalia of *Reuterella* type except that subgenital plate terminates in a single central process. Female epiproct nearly three times as wide as long and bearing in addition to other ciliation a pair of long, slender setae, one near each lateral margin, and three short, stout setae on posterior margin. Genotype: *Palmicola aphrodite,* new species.

Palmicola aphrodite, new species

Diagnosis.—A bisexual species. Differs from *P. robinae,* n. sp., in larger size, general darker coloration, lack of long upright hairs on abdominal tergites, deeper anterior impression in pigmented area of subgenital plate, and relatively larger duplex paraproctal spines. Differs from *P. solitaria,* n. sp., in bisexuality, deeper anterior impression in pigmented area of subgenital plate, relatively larger paraproctal spines, relatively wider gonapophyses, and lack of habit of spinning individual egg webs.

Holotype Female.—Apterous. Measurements: total body length 1.24 mm.; antennal length 0.46 mm.; hind femur + trochanter 0.25 mm.; hind tibia 0.28 mm.

Morphology (from paratypes and holotype).—Antennae 13-segmented; segments in ratio 0.60: 1.00: 0.67: 0.47: 0.60: 0.73: 0.73: 0.60: 0.67: 0.60: 0.67: 0.67: 1.13. Antennal sensilla distributed as follows: one lacking appendage near apex of F_1, one bearing short seta near apex of F_4, one lacking appendage (?) near apex of F_6, one lacking appendage near apex of F_{10}. Eyes rather small, with few large facets. Ocelli and frontal sutures absent. Maxillary rods terminating in a pair of blunt stubs. Thorax of apterous form with flat tergal lobes, but these well separated. Coxal organ absent. Tibial spurs present on all legs, two on front and middle, three on hind. Basitarsi about half as long as apical segments. Abdomen rounded, and sclerotized on first tergite and from eighth to tip. Paraprocts (fig. 2) bearing short duplex spines immediately above a long spine. Sensory area of paraproct absent. Epiproct (fig. 2) with usual ciliation for the genus and not much other. Gonapophysis of eighth and inner lobe of gonapophysis of ninth segment (fig. 4) terminating in long, slender, back-curved processes. Subgenital plate with sclerotized and pigmented areas shaped as in fig. 9, with a deep anterior median impression. Apical process of subgenital plate bearing three or four setae at its terminus.

Color (in alcohol 17 months).—Antennae, legs, head, thoracic tergites, and sclerotized portions of abdomen dull brown (cuticular pigment); eyes purplish-black. Membranous portions of abdominal tergites pale red-brown (sub-cuticular pigment). Abdominal sternites colorless except for pigmented area of subgenital plate.

Allotype Male: Macropterous. Measurements: total body length 1.08 mm.; forewing length 1.02 mm.; antennal length 0.50 mm.; hind femur + trochanter 0.25 mm.; hind tibia 0.28 mm. Differs from holotype in macroptery, slightly smaller size, relatively longer antennae, relatively larger eyes and smaller facets, presence of ocelli, bulging tergal lobes of pterothoracic segments, presence of paraproctal sensory areas bearing trichobothria, longer duplex paraproctal spines, and in epiproct being only about twice as wide as long. Venation (fig. 10) characterized by lack of Cu_1 in forewing and lack of Ax in hindwing; an R-M crossvein present in both wings, longer in hindwings. Wings bare of ciliation. Pterostigma and costal cell proximal to it densely covered with minute denticles, these less dense over remainder of wing membrane including hindwing. Phallic frame oblong, rounded anteriorly. Aedeagal arch acute; external parameres quite wide and pointed apically.

Variation.—Some males occur with M in both forewings unbranched, others with M two-branched. In some males Rs and M meet almost at a point in forewings.

Type Locality.—Florida, Alachua County, Newnan's Lake. Holotype, allotype, and 7 ♀ paratypes taken as nymphs on trunk of *Liquidambar* and *Pinus*, reared to adults in laboratory, and killed October 4, 1952.

Other Paratypes.—Type locality, 10 ♂, 7 ♀, mostly taken as nymphs and reared in laboratory, killed from March 14 to August 17,

1952. Florida, Alachua County: Lake Alice, 12 ♀ taken on tree trunks as nymphs and reared to adults in laboratory, killed October 4, 1952; Gainesville, 8 ♀ on north side of brick building from September 22, 1952 to March 1, 1953. Florida, Marion County, near Eureka, 2 ♀ on trunks of *Sabal palmetto* April 10, 1954.

Disposition of Types.—Holotype, allotype, and one pair of paratypes in U. S. National Museum. One pair paratypes in Florida State Museum at Gainesville. One pair paratypes in collections of K. M. Sommerman (Orlando, Florida), and J. V. Pearman (Aston Clinton, England). Two ♀ paratypes in collections of A. Badonnel (Paris, France) and A. M. Nadler (New York City). The remaining paratypes will be retained in my collection.

Biological Notes.—These insects are solitary and live under small webs spun on the bark of trees. Food consists of lichens under the web, and a new web is spun when the food supply under the old one becomes exhausted. Adult webs are seldom over 15 mm. in greatest diameter. Courtship and copulation were observed once when I forced a male to enter the web of a virgin female. After entering the web, the male stopped and scratched rapidly on the floor of the web with his forelegs several times. The female started running about the web and attacked the male with rapid thrusts of the body. Then she ran to the opposite end of the web and remained quiet until the male began scratching the web again. As before, the female responded by running about the web, and after a few seconds ran to the male and mounted his back from behind in such a way as to push his wings out from their resting position. The male raised the tip of his abdomen and they copulated for slightly over a second, facing in the same direction. The female crawled off the male's back after copulation.

It is evident that much of the female's precoital behavior was elicited by the male's scratching on her web rather than the male's presence, alone. Two weeks after the copulation, I scratched gently on the floor of the female's web with a needle. The female approached the needle closely but did not attack it. I then forced a penultimate nymph of *Archipsocus parvulus* (about the same size as the male *P. aphrodite* and bearing long wing pads) into this female's web, and I scratched the floor of the web gently with a needle near the *Archipsocus*. The *P. aphrodite* female approached the *Archipsocus* nymph, and attacked it with rapid thrusts of the body, and mounted its back. From this observation it appears that a visual simulus, though not very exact, and a tactile stimulus consisting of vibrations produced by web scratching are sufficient to elicit the copulatory response in females of *P. aphrodite*. These observations also suggest that females of this species may copulate more than once.

Eggs are laid under the dwelling web but usually not in contact with each other. They are oval in shape, about 0.40 mm. in length, and are covered with tiny particles of debris. Eggs were laid two days after copulation and about a week after the female became adult.

This female laid 17 eggs which hatched in about 23 days at room temperature; nymphal life lasted about 30 days.

Palmicola solitaria, new species

Diagnosis.—Differs from *P. robinae*, n. sp., in lacking long upright hairs on abdominal tergites, darker coloration, and slightly deeper median impression in pigmented area of subgenital plate. Differs from *P. aphrodite*, n. sp., in apparent lack of males, shallower median notch in subgenital plate, smaller duplex paraproctal spines, and in the habit of spinning individual egg webs.

Holotype Female.—Apterous. Measurements: total body length 0.90 mm.; antennal length 0.34 mm.; hind femur + trochanter 0.22 mm.; hind tibia 0.25 mm.

Morphology (from holotype and paratypes).—Antennae 13-segmented; segments in ratio 0.75: 1.00: 0.75: 0.50: 0.58: 0.75: 0.75: 0.67: 0.75: 0.58: 0.75: 0.67: 1.17. Antennal sensilla distributed as follows: one beyond middle of F_1, one beyond middle of F_4, one near apex of F_6, one at apex of F_{10}; all apparently lacking appendages. Eyes rather small, with few large facets. Ocelli and frontal sutures absent. Maxillary rods terminating in a pair of points separated by a shallow notch. Thorax of apterous form, as in *P. aphrodite* females. Coxal organ absent. Three tibial spurs on front and middle, four on hind legs. Basitarsi slightly shorter than apical segments. Abdomen rounded and sclerotized as in *P. aphrodite.* Paraprocts (fig. 1) bearing very short duplex spines immediately above a long spine. Sensory areas of paraprocts absent. Epiproct (fig. 1) with usual ciliation for the genus plus numerous other setae. Gonapophysis of eighth and inner lobe of gonapophysis of ninth segment (fig. 3) terminating in long, slender, straight processes. Subgenital plate with sclerotized and pigmented area shaped as in fig. 8, with a shallow anterior median notch. Apical process of subgenital plate bearing four setae at its terminus.

Color (in alcohol 30 months).—Antennae, legs, thoracic tergites, and first abdominal tergite pale brown (cuticular pigment); eyes black. First abdominal tergite and eighth to tip of abdomen medium brown (cuticular pigment); remainder of abdominal tergites dull red-brown (subcuticular pigment). Abdominal sternites colorless except for pigmented area of subgenital plate.

Type Locality.—Florida, Sarasota County, Myakka River State Park. Holotype and 1 ♀ paratype taken August 30, 1951 on trunks of *Sabal palmetto.*

Other Paratypes (all from Florida).—Type locality, 28 ♀ either taken April 12, 1952 on trunks of *Sabal palmetto* or collected subsequently from reared material taken then. Highlands County: Highlands Hammock State Park, 3 ♀ August 14, 1952 on trunks of *Sabal palmetto.* Hendry County: about 5 miles north of Devil's Garden, 1 ♀ April 16, 1954 on trunks of *Sabal palmetto;* Clewiston, 3 ♀ on *Ficus* trunks April 16, 1954. Glades County: 8.6 miles south of Brighton on Indian Reservation road, 1 ♀ April 18, 1954 on trunk of *Sabal palmetto.* Indian River County: Vero Beach, 3 ♀ April 18, 1954 on trunks of *Sabal palmetto.*

Disposition of Types.—Holotype and 2 ♀ paratypes in U. S. National Museum. Two ♀ paratypes in each of collections listed under 'Disposition of Types' for *P. aphrodite.*

Biological Notes.—These insects are solitary and live under small webs similar to those of *P. aphrodite* in size and appearance. Like *P. aphrodite,* they feed on lichens under the web and spin a new web when the food supply under the one in use becomes exhausted. They are apparently obligatorily parthenogenetic, as they were reared in the laboratory through three generations without the appearance of males.

To determine the response of females of this species to males of *P. aphrodite,* I forced a male of the latter to enter webs of two females of the former. In neither case did these females exhibit a positive response to this male, but in both cases the females finally ran out of their webs as a result of disturbances caused by the male.

Eggs of *P. solitaria* are about the same size and shape as those of *P. aphrodite.* There is no debris on their shells, but each egg is completely covered by a tiny, dense, white web. These webs appear to the naked eye as tiny white spots in the dwelling web. Eggs were found at Highlands Hammock State Park, Florida, in August.

Palmicola robinae, new species

Diagnosis.—Differs from *P. aphrodite* n. sp. and *P. solitaria* n. sp. in paler coloration especially of head, presence of numerous long, upright hairs on all abdominal tergites, and shallower anterior median notch of pigmented area of subgenital plate. Differs from *P. aphrodite* also in smaller size. Antennae (fig. 17) bearing relatively longer setae than in other two species (*P. aphrodite,* fig. 16).

Holotype Female.—Apterous. Measurements: total body length ± 0.98 mm.; antennal length 0.40 mm.; hind femur + trochanter 0.22 mm.; hind tibia 0.23 mm.

Morphology.—Antennae 13-segmented; segments in ratio 0.91: 1.00: 0.82: 0.54: 0.54: 0.82: 0.73: 0.64: 0.73: 0.64: 0.73: 0.73: 1.27. Antennal sensilla distributed as follows: one (two together?) near apex of F_1, one in middle of F_4, one slightly beyond middle of F_6, one at apex of F_{10}; all apparently lacking appendages. Eyes rather small with two facets. Ocelli and frontal sutures absent. Maxillary rods terminating in a pair of toothed points, separated by a rather deep notch. Thorax of apterous form as in *P. aphrodite.* Coxal organ absent. Three tibial spurs on front and middle, four on hind legs. Basitarsi slightly greater than half length of apical segments. Abdomen sclerotized as in *P. aphrodite* and about the same shape. Paraprocts (fig. 12) bearing very short duplex spines above a long spine. Sensory areas of paraprocts absent. Epiproct (fig. 12) with usual ciliation for the genus (some setae dislodged in mounting) plus numerous other setae. Gonapophyses (fig. 13) of typical form for the genus. Terminal process of gonapophysis of eighth segment straight, that of inner valve of gonapophysis of ninth segment bent (artifact?). Outer valve of gonapophysis of ninth segment bearing more setae than in other two species. Subgenital plate (fig. 14) with very pale pigmented area scarcely showing an anterior median impression; its apical process bearing four setae terminally.

Color (in alcohol 20 months).—Generally pale brown in sclerotized portions (cuticular pigment), but head dull yellow. Membranous abdominal tergites pale red-brown. Eyes black.

Type Locality.—Jamaica: Hardwar Gap (altitude over 4000 ft.). Holotype and one nymph taken in July, 1952, on bark of tree in cloud forest.

This species is named for Mrs. Robin Krivanek who collected the type in addition to other psocids in Jamaica.

Disposition of Type.—The holotype will be retained in my collection until topotypes can be obtained.

Definition and Taxonomic Position of the Reuterellinae

As used in this paper, the Reuterellinae may be defined as a group of psocids characterized as follows: 13 or fewer antennal segments; two tarsal segments; usually all, and always some females of each species apterous; antennae of apterous forms much reduced in length; gonapophyses of a type in which all three valves are well developed and those of the eighth segment terminate as long, slender processes; subgenital plate bearing a transverse row of setae; male genital armature an oblong, symmetrical phallic frame with well developed external parameres; wings with little or no ciliation.

The quality and quantity of characters in this definition strongly suggest that the group is monophyletic, and a definition based on the inclusion of any other known psocid species would lower the probability of monophyly. Hence I have chosen to exclude *Graphocaecilius*, *Hemicaecilius*, and *Reuterella neglecta* Roesler (1935). According to Pearman (in litt.) the latter species is not a *Reuterella*.

The history of the taxonomic position of the Reuterellinae may be summarized briefly as follows:

1. Enderlein (1903)—erected Reuterellinae as monotypic subfamily of Caeciliidae.
2. Badonnel (1943)—placed *Reuterella* in Elipsocidae with no subfamilies.
3. Roesler (1944) — placed Reuterellinae in Pseudocaeciliidae. Divided it into two tribes: Graphocaeciliini including *Hemicaecilius* and *Graphocaecilius;* Reuterellini including *Reuterella* and *Nepiomorpha*.

I would consider the Reuterellinae to be a subfamily of Elipsocidae, distinguishable from other Elipsocid groups by possession of only two tarsal segments.

Geographical Distribution of the Reuterellinae

Reuterella helvimacula is found in England, northern Germany, Finland, the Vosges Mountains in France, Polish Galicia (Carpathian Region), and in Switzerland (Badonnel, 1943:86). In North America, it has been taken in one locality in Indiana and one in Illinois. This wide and spotty distribution suggests that the species is a relict, perhaps with a more nearly continuous distribution in the Pleistocene. There is little possibility of its introduction by man from Europe as its North American localities of occurrence are very remote from human habitation.

The two species of *Nepiomorpha*, *N. crucifera* in Ceylon and *N. peripsocoides* in Florida, are both found in peripheral regions at the southern ends of continents. This genus, then, is probably another relict group, and its present distribution suggests a northern origin.

The genus *Palmicola* appears to be confined to the Caribbean Region including Florida. *P. aphrodite* occurs in north-peninsular Florida, *P. solitaria* occurs in south Florida, and *P. robinae* occurs on Jamaica. That the species are allopatric and very similar to each other morphologically suggests that they have arisen recently.

The entire facies of the Reuterellinae—its very distinct genera of few species, and its far-flung, spotty distribution—suggest that it is a group of great antiquity which probably is becoming extinct.

Summary

The Reuerellinae appears to be a monophyletic group of three genera (*Reuterella* End., *Nepiomorpha* Pmn. and *Palmicola* n. gen.) and six species, four of which are first described herein. Taxonomically, Reuterellinae is best considered a subfamily of the Elipsocidae. The Reuterellinae appears to be an ancient group and some of its representatives probably had wider ranges in the past than at present.

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ANNOUNCEMENT

The American Museum of Natural History has established a Southwestern Research Station on the eastern slope of the Chiricahua Mountains, near Portal, Cochise County, in southeastern Arizona at an elevation of 5400 feet. The station is designed to make research facilities available to workers in all branches of science who are interested in the flora and fauna of that area. Details may be obtained from Dr. Mont A. Cazier, American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y.

REPORT ON A COLLECTION OF BITING MIDGES OF THE GENUS CULICOIDES FROM GUATEMALA

(Diptera, Heleidae)

By Willis W. Wirth, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

A study has been made of midges of the genus *Culicoides* Latreille collected by Colvin L. Gibson and Werner F. Ascoli, of the Laboratory of Tropical Diseases, National Institutes of Health, on detail to the Panamerican Sanitary Bureau, who were interested in their possible role as vectors of the filaria of human onchocerciasis in Guatemala. The collections were made principally in the municipalities of San Pedro Yepocapa and Acatenango, Department of Chimaltenango, at elevations between 2700 and 6300 feet. The geographical and climatic characteristics of this area are very well summarized by Dalmat (1950). They do not differ greatly from those around Huixtla (2300 feet elevation), State of Chiapas, Mexico, where Dampf collected most of the species described by Macfie (1948). Since a number of the same species are involved, the Gibson and Ascoli collection afforded a fine opportunity to supplement Macfie's descriptions with material from essentially the same faunistic area.

Gibson and Ascoli (1952) recently presented notes on the feeding habits of the four anthropophilic species of *Culicoides* in this area: *gibsoni* Wirth, *diabolicus* Hoffman,[1] *paraensis* (Goeldi) and *stigmalis* Wirth. Of these species, *paraensis* was the most numerous and annoying, biting man at all hours and under any weather conditions. *C. gibsoni* fed on man under about the same conditions as *paraensis*, but was comparatively rare. *C. stigmalis* fed most frequently between 4:30 and 6:00 P.M. under partly overcast skies and during warmer periods. *C. diabolicus* fed only during or immediately after light rain.

Gibson and Ascoli dissected 929 wild-caught specimens of these species in the onchocerciasis area of Guatemala without finding any microfilariae. They found microfilariae in 58 of 305 (19.0 percent) *stigmalis* and in 1 of 47 (2.1 percent) *diabolicus*, but in none of 10 *gibsoni* and 385 *paraensis* that had been allowed to feed on persons heavily infected with *Onchocerca volvulus*. However, the comparative scarcity of *diabolicus* and the fact that microfilariae could not complete their development in *stigmalis* make it seem unlikely that the species are important vectors in Guatemala.

In addition to the 1858 *Culicoides* specimens that had fed on man and were reported in their paper, Gibson and Ascoli collected 851 specimens feeding on man and horse (or mule) and at light. The species and numbers collected are shown in tables I and II.

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[1]Reported by Gibson and Ascoli as *guttatus* (Coquillett), based on my erroneous determination. I have since satisfied myself that true *guttatus* is restricted to southern Brazil and that the Guatemala specimens collected by Gibson and Ascoli represent *diabolicus* Hoffman which was described from Panama.

All the biting collections at the lower elevation were made on man, whereas those at the higher elevation were mostly on horse or mule. In order of frequency, the species that bit man were *paraensis, pachymerus* (?), *stigmalis, diabolicus, gibsoni* and *debilipalpis,* whereas those that fed on horse or mule were *luteovenus, diabolicus* and *debilipalpis.*

TABLE I. *Culicoides* species collected in vicinity of San Pedro Yepocapa, Guatemala (elevation approximately 2770 feet).

Species	Number of Times Collected On Man	At Light	Number of Specimens Collected
debilipalpis Lutz	1	1	2
diabolicus Hoffman	6	—	12
germanus Macfie	—	2	7
gibsoni Wirth	2	4	16
jamaicensis Edwards	—	1	1
pachymerus Lutz (?)	12	—	66
panamensis Barbosa	—	2	26
paraensis (Goeldi)	13	1	159
poikilonotus Macfie	—	2	99
propriipennis Macfie	—	2	49
pusillus Lutz	—	1	1
stigmalis Wirth	7	—	10
New species near *obsoletus*	—	2	3
Number of collections made	22	3	

TABLE II. *Culicoides* species collected in vicinity of Acatenango, Guatemala (elevation approximately 5320 feet).

Species	Number of Times Collected On Horse	At Light	Number of Specimens Collected
cova-garciai Ortiz	—	1	1
daedalus Macfie	—	1	1
debilipalpis Lutz	2	—	3
diabolicus Hoffman	20	15	200
gibsoni Wirth	—	2	2
luteovenus Root and Hoffman	29	18	199
panamensis Barbosa	1	6	10
Species near *copiosus* R. & H.	—	4	4
Number of collections	49	25	

The species composition of the collections at light may be compared more directly. There are enough records of *luteovenus* and the species near *copiosus* to show their preference for the higher altitude and enough *germanus, pachymerus* (?), *paraensis, poikilonotus, propriipennis* and *stigmalis* were taken to indicate their preference for the lower elevation. The species *gibsoni, diabolicus, panamensis,* and *pusillus* probably occur throughout the altitudinal range, but the other species were taken too rarely to permit generalization on their habit. The species taken at light only were, in order of abundance, *poikilonotus, propriipennis, germanus,* new species near *obsoletus, pusillus* and *jamaicensis* at 2770 feet; the species near *copiosus, daedalus* and *cova-garciai* at 5320 feet; and *panamensis* at both elevations.

Notes on the Species

Culicoides daedalus Macfie

Culicoides daedalus Macfie, 1947, Ann. Trop. Med. and Parasit. 42: 83.

One male taken at light at Acatenango, June 22, 1951, fits Macfie's figure and description except that the distal pale spot in cell R_5 meets the wing margin in its full breadth, the two distal pale spots in the anal cell are connected by a pale area and the apices of the parameres are not twisted so tightly. There are four almost equally long bristles in the hind tibial comb.

Culicoides germanus Macfie

Figure 1

Culicoides germanus Macfie, 1941, Ent. Mo. Mag. 76: 27.

Five males and two females taken at light at Finca San Rafael, San Pedro Yepocapa, April 3 and July 26, 1951, were identified as *germanus*. This species, which Macfie described from British Guiana from a female, is distinguished from other members of the *debilipalpis* group by the practically bare wings, hairy eyes, the female antennae with the flagellar segments in a continuous series of the same length, distal sensory tufts on segments 3, 8, 9 and 10, the palpi with a small, deep pit, the hind tibial comb very oblique, with one long and four rather short bristles, and with two equal oval spermathecae. Apparently the male has never been described and the genitalia may be characterized as follows:

Male genitalia (fig. 1). Ninth sternite with slight mesal emargination, the ventral membrane bare; ninth tergite tapering to well-developed apicolateral processes. Basistyles with foot-shaped ventral roots, dorsal roots stout and nearly as long; dististyles slender and nearly straight. Aedeagus with basal arch to about one-half or two-thirds of total length, the apex apparently with a rounded dorsal lobe and several indistinct, sharp distal points below. Parameres with small basal knobs, the stems slightly swollen at bases, sinuate and gradually narrowed to simple, abruptly recurved, filamentous apices.

Culicoides gibsoni Wirth

Figure 2

Culicoides gibsoni Wirth, 1952, Jour. Parasit. 38: 246.

This species was described from females taken by Gibson and Ascoli at San Pedro Yepocapa in the course of their onchocerciasis studies. In the present collection five males were taken, one in association with five females biting man at Finca Nimaya (2800 feet), San Pedro Yepocapa, November 9, 1950, the other four at Finca San

Rafael, San Pedro Yepocapa, April 3 and July 26, 1951, at light. The female has distal sensory tufts on antennal segments 3, 8, 9, 10, and 11 and the hind tibial comb with four bristles. The genitalia of the hitherto unknown male are described as follows:

Male genitalia (fig. 2).—Ninth sternite with a distinct rounded mesal excavation, the membrane between it and the aedeagus bare; ninth tergite slightly longer than basal breadth, the apicolateral processes short and broadly separated. Basistyles with ventral roots long and pointed with a small caudal hook near base, dorsal roots slender and nearly as long; dististyles slender and slightly curved to pointed apices. Aedeagus with basal arch to two-thirds of total length; the basal arms curved and slender; a pair of submedian, subapical projections arising near their point of union with the distal, median portion, the latter quite slender. Parameres with large basal knobs, stems very slightly swollen and distinctly bent at their middle; each abruptly recurved beyond a slight ventral pouch at distal three-fifths with apex gradually tapered to a fine point with a subapical fringe of fine barbs.

Culicoides jamaicensis Edwards

Figure 3

Culicoides loughnani var. *jamaicensis* Edwards, 1922, Bull. Ent. Res. 13: 165; Barbosa, 1947, An. Soc. Biol. Pernambuco 7:21; Fox, 1949, Bull. Brooklyn Ent. Soc. 44: 32.

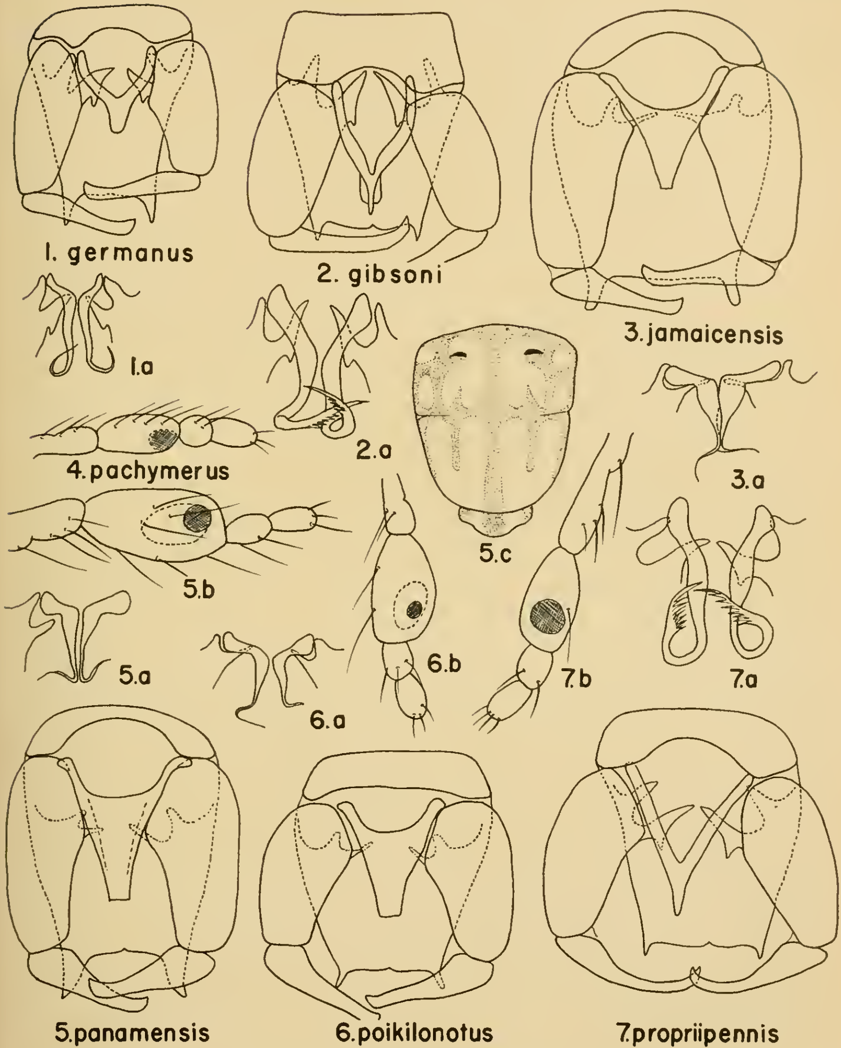
One male captured at light at Finca San Rafael, San Pedro Yepocapa, April 3, 1951. The male genitalia (fig. 3) closely resemble those of a male in the National Museum from St. Croix, Virgin Islands, except that the apicolateral processes are only about one-half as long and are not so slender. Barbosa's figure, apparently of the St. Croix specimen, shows the apicolateral processes too stout at the base and the aedeagus too stout and not tapering enough at the tip. *Culicoides copiosus* Root and Hoffman described from Mexico, is very close to *jamaicensis* but has the mesonotum more subshining, has only one pale spot at the apex of the anal cell and has the membrane posterior to the male ninth sternite spiculate.

Culicoides pachymerus Lutz ?

Figure 4

Culicoides pachymerus Lutz, 1914, Mem. Inst. Oswaldo Cruz 6: 83.

This species was described from five females collected on the Rio Negro, Brazil. The specimens were poorly preserved except for the wings and legs and Lutz' description gives few details except for leg characters and his excellent figures of the wing and hind leg. However, it may be possible to recognize *pachymerus* on the basis of the distinctly swollen fore and hind femora; legs with femora pale, the knees dark, the tibiae brownish with broad sub-basal pale bands, the tarsi yellowish; wing with the greatly elongated second radial cell apparently dark to the apex, cell R_5 with the characteristic oblique dark subapical mark distinctly enclosing the rounded distal pale spot



Guatemala *Culicoides,* male genitalia with parameres drawn separately (a), and figures of female palpus (b) and mesonotal pattern (c) for some species. Fig. 1, *germanus;* fig. 2, *gibsoni;* fig. 3, *jamaicensis;* fig. 4, *pachymerus* (?); fig. 5, *panamensis;* fig. 6, *poikilonotus;* fig. 7, *propriipennis.*

which does not reach the wing margin; distal pale spot in cell M_1 oval, nearly but not quite reaching wing margin; pale spot in anal cell also not reaching wing margin; macrotrichia scarce and confined to that part of wing distad of apex of second radial cell; body length 1.2 mm., wing 0.7 mm.

Culicoides caprilesi Fox, described from a female collected at Mount Marahuaca, Venezuela, differs from *pachymerus* mainly in wing markings, the distal pale spot in cell R_5 being extended in the form of an inverted U to the wing margin and a subapical dark band extending forward to the second radial cell cutting off a small round pale spot at the costal margin just past the tip of this cell; the wing may be just a little hairier and the body is slightly longer (1.4 mm.).

Culicoides uniradialis Wirth and Blanton and *C. kintzi* Wirth and Blanton are closely related to the above two species, having the characteristic greatly swollen femora and oblique markings in cell R_5, but they both differ from the others in their paler wing markings which include the apex of the second radial cell in *kintzi* or more than one-half of the greatly elongate single radial cell of *uniradialis*, the distal pale spots meeting the wing margin in cells R_5, M_1 and anal cells, as well as in cells M_2 and M_4. These two species, moreover, have distal sensory tufts on antennal segments 8, 9 and 10. Length of *uniradialis* 1.1 mm. (wing 1.1 mm.), of *kintzi* 1.0 mm. (wing 0.9 mm.).

Sixty-six females, all taken biting man in twelve separate collections at San Pedro Yepocapa, are probably *pachymerus* Lutz. They may be briefly characterized as follows:

Length 0.86 mm. (wing 0.75 mm.) Eyes broadly separated, bare; antennae with distal sensory tufts on flagellar segments 3, 9 and 10; palpi (fig. 4) very short and pale, segments in proportion of 5:10:20:6:8, third segment very slightly swollen, with a small, very shallow, sensory pit on distal half. Mesonotum (alcoholic specimens) tawny yellowish brown, apparently with a pair of elongate, submedian spots on anterior half paler. Legs stout, fore and hind femora especially swollen; pale yellowish, femora and tibiae except extreme bases of the latter, more or less brownish, especially at knees, hind tibial comb with four bristles. Abdomen yellowish, indistinctly banded with gray, darker at apex; two small, subequal, pyriform, well-sclerotized spermathecae. Wing with radial cells very long and narrow, second radial cell to 0.68 of wing length, slightly paler at apex; a few scattered macrotrichia in apices of cells R_5 and M_1; the pattern of light and dark spots as figured by Lutz very obscure, the distal pale spot in cell R_5 rounded, rarely with a narrow pale extension from anterior edge to wing margin.

Culicoides panamensis Barbosa

Figure 5

Culicoides panamensis Barbosa, 1947, An. Biol. Soc. Pernambuco 7: 22.

Culicoides alambiculorum Macfie, 1948, Ann. Trop. Med. and Parasit. 42: 81. NEW SYNONYMY.

Barbosa (loc. cit.) described *panamensis* from two males and six females (on slides) collected by J. Zetek (no. 4667) in June, 1940 on

Barro Colorado Island, Canal Zone, from flowers of *Heliconia mariae*. One of the males was marked as the type by Barbosa although he did not make such designation nor list the other specimens in his paper. Barbosa gave a figure of the genitalia of the holotype male, and evidently took the female description and a figure of the palpus from one of the slide-mounted females he did not list. The female mentioned in his paper is a pin-mounted specimen labelled "Barro Colorado Island, C. Z., Jan.-Mar., 1944, Zetek no. 5126." This specimen, for which Barbosa gave a figure of the mesonotal pattern, is another species and has been made a paratype of *Culicoides carpenteri* Wirth and Blanton.

A series of seven males and nineteen females from Finca San Rafael, San Pedro Yepocapa, April 3 and July 26, 1951, and ten females from Acatenango, May 5 to August 8, 1951, all taken at light, are identical with the Panama specimens of *panamensis*. They also agree very well with Macfie's description of *Culicoides alambiculorum*, described from females from Chiapas, Mexico, which therefore becomes a synonym. Descriptive notes based on these two specimens follow:

Wing very hairy, with markings as figured by Macfie; no evident mesonotal pattern; pale markings of the legs confined to narrow subapical bands on fore femora and sub-basal ones on all tibiae, four rather long bristles in hind tibial comb; distal sensory tufts on segments 3, 11, 12, 13 and 14 of female antenna; female palpus (fig. 5b) with third segment strongly swollen, a large, deep pit opening through a small pore on distal end; spermathecae very unequal and retort-shaped.

A figure (fig. 5) is given of the male genitalia of a Guatemala specimen for comparison with Barbosa's, which was made from a specimen obliquely flattened on a slide.

Culicoides poikilonotus Macfie

Figure 6

Culicoides poikilonotus Macfie, 1947, Ann. Trop. Med. and Parasit. 42:82.
Culicoides cacozelus Macfie, 1947, idem. 42: 85. NEW SYNONYMY.

Macfie described *poikilonotus* and *cacozelus* each from a single female taken on May 28 and June 5 respectively at El Vergel, Chiapas, Mexico, in a light trap. Macfie separated these species only on the difference (which he figured) in wing markings; the former having the pale spot on vein M_2 extending across the vein into cell M_2, the latter with the pale spot lying entirely in front of the vein. He further stated that they "are so similar that it may be questioned if they are distinct species, or two forms of a single species. Here I have regarded them as distinct, pending the examination of further specimens, especially males."

I have studied two series totalling 54 males and 45 females taken at light on April 3 and July 26, 1951, at Finca San Rafael, San Pedro Yepocapa, which agree well with Macfie's descriptions of *poikilonotus* and *cacozelus*. The extensive pale mesonotal patches (fig. 6c) and the female palpal structure (fig. 6b) are very distinctive. The distal sensory tufts of the female antennae are found on segments 3, 5, 11, 12, 13 and 14. One long and three quite short bristles in hind tibial comb. The female spermathecae are subequal and nearly spherical. There is great variation in the extent of the pale spot on vein M_2, with all intergrades between the types figured by Macfie representing his two species. I can only conclude, therefore, that one somewhat variable species is involved, for which the name *poikilonotus* has page precedence.

Ortiz (1952) has described the female of a species from San Felipe, Yaracuy, Venezuela, which he identified as *cacozelus*. This female, however, must belong to another, probably new, species since it differs from *cacozelus* in having but one distal pale spot in the anal cell and the third palpal segment is not so broad with the pit shallower and opening broadly.

Male genitalia (of *poikilonotus* from Guatemala, fig. 6).—Ninth sternite a narrow transverse band, without mesal excavation or spiculate membrane; ninth tergite short, tapered, the apicolateral processes slender, somewhat variable in length (the shorter type figured) and with bases widely separated. Basistyles with ventral and dorsal roots very small, the former slender and hardly visible; dististyles nearly straight, with slightly narrowed, bent-in apices. Aedeagus very broad and stout, the basal arch attaining from one-fourth to one-half of total length, the distal portion with sides tapering gradually to a broad, truncate apex. Parameres small, the bases expanded laterad, the stems bulbous basally and abruptly bent caudad and strongly tapered to very slender, twisted, filamentous points.

Culicoides propriipennis Macfie

Figure 7

Culicoides propriipennis Macfie, 1948, Ann. Trop. Med. and Parasit. 42: 84.

Macfie described this species from a single female taken in a light trap at San Cristobal, Chiapas, Mexico. Gibson and Ascoli took 32 males and 17 females at Finca San Rafael, San Pedro Yepocapa, April 3, and July 26, 1951, at light. Descriptive notes: Mesonotum with conspicuous, large, pale patches; wing as figured by Macfie, but the two distal spots in cell R_5 vary in size and often partially fuse, the third pale spot at wing margin in cell M_1 sometimes faint or lacking; legs with knees dark, narrow subapical pale bands on fore and mid femora and sub-basal bands on all tibiae; four long bristles in hind tibial comb; female antennae with distal sensory tufts on segments 3, (8), 9, 11, 12, 13 and 14; female palpus (fig. 7b) with third segment short and swollen, bearing a broad, shallow sensory pore.

Male genitalia (fig. 7).—Ninth sternite with broad mesal excavation, the membrane bare; ninth tergite tapered, the apico-lateral processes very short, slender and widely separated. Basistyles with large, foot-shaped ventral roots and wedge-shaped dorsal roots about one-half as long; mesal margins of basistyles with scattered fine spinules; dististyles curved with slender apices. Aedeagus V-shaped, the anterior fork to about three-fifths of total length, the basal arms straight, the posterior disto-median lobe slender with simple apex. Parameres very large, their bases knobbed, stems slightly swollen and sinuate, the slender apices abruptly bent ventrad with a subapical fringe of barbules which is basally broadened but distally attenuated to a slender filament.

Culicoides new species near **obsoletus** (Meigen)

Three specimens were taken of this species which is being described in a separate paper by Wirth and Blanton on Panama *Culicoides*. One male and one female were taken at light at Finca San Rafael, San Pedro Yepocapa, April 3, 1951 and one female was taken at light at Finca Las Victorias, 3500 feet, San Pedro Yepocapa, December 1, 1950.

Culicoides species near **copiosus** Root and Hoffman

Four females were taken at lights at Acatenango, elevation 5320 feet, April 27, July 10 and 26, and September 4, 1951. The condition and brevity of the series do not permit description of the species, although it is probably new.

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BOOK NOTICE

MONOGRAPHIE SYSTEMATIQUE, PHYLOGENETIQUE ET ZOOGEOGRAPHIQUE DES HYMENOPTERES CRABRONIENS, by Jean Leclercq. 371 pp., 40 text figs., 84 maps. Paper covers, 8vo., offset publ., 1954. $14.00.

This important work is indispensable to the taxonomist engaged in identification of wasps and, in addition, is of great interest to the student of zoogeography. Several short preliminary chapters discuss morphology, phylogeny and ethnology of the crabronine wasps. These are followed by three lengthier chapters on the zoogeography of the Crabronini of the world, and of Belgium and neighboring countries, with a set of 84 maps illustrating generic and specific distributions. The section of most interest to the taxonomist comprises three appendices which consist of a key to the included genera, a synonymic catalog of the 84 genera and subgenera and 700 species, and a systematic tabulation of the known nesting habits and pray preferences. The catalog includes references to all papers published subsequent to Kohl's work (1915) for the Palaearctic species or to Dalla Torre's catalog (1897) for species of the other major regions, as well as citations to all the orginal descriptions. The volume may be obtained from John D. Sherman at the price quoted above, or from Classey in England or Reitter in Germany.—KARL V. KROMBEIN, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

THE RECOGNITION OF SPECIES OF DICHORDOPHORA PROUT
(Lepidoptera, Geometridae)

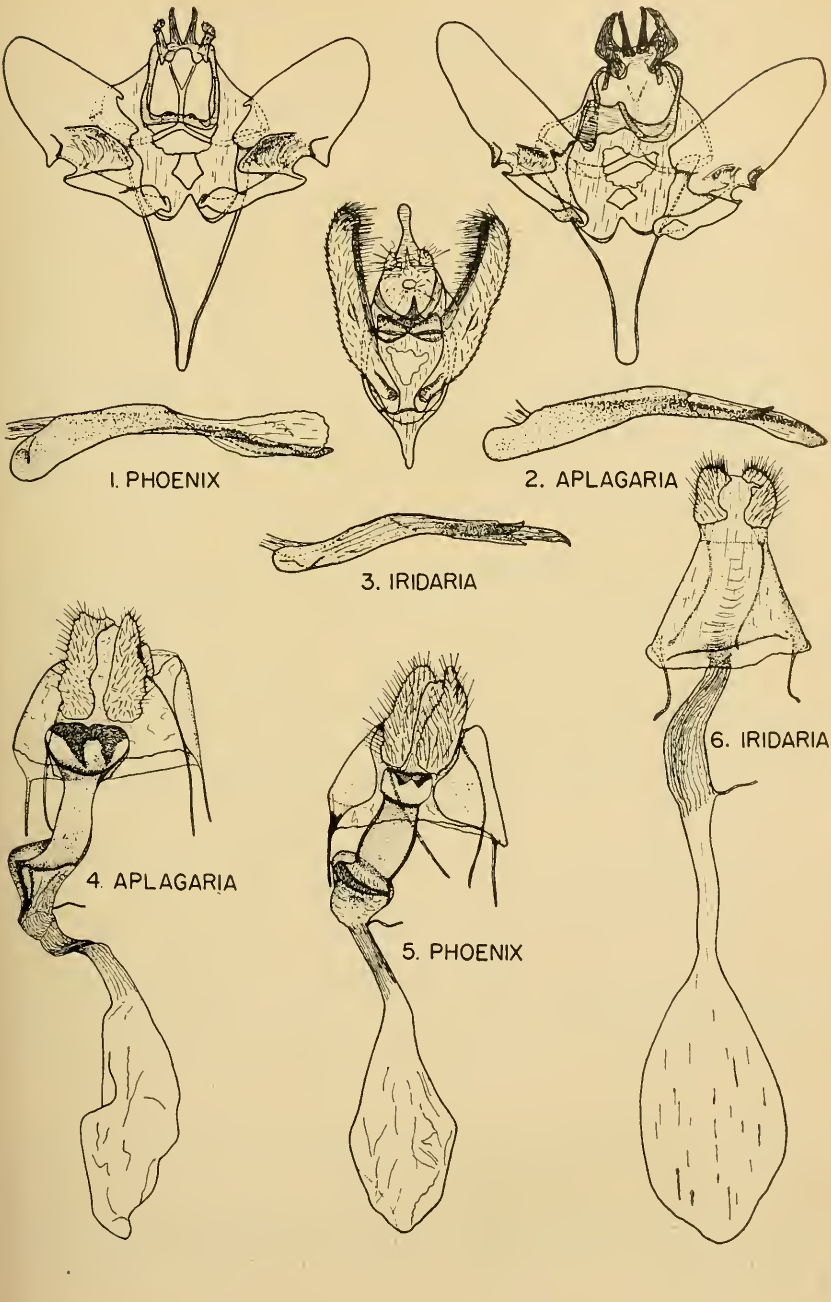
By E. L. Todd, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

In the process of routine determination of a group of specimens from Montezuma Castle National Monument, Arizona, submitted by John C. Cook, a specimen of *Dichordophora phoenix* (Prout) was discovered. *D. phoenix* was not represented by named material in the collections of the United States National Museum. A check of the series of *Dichorda rectaria* (Grote), a superficially similar species, revealed two more specimens, a male and a female, and sixteen other specimens were located in a drawer of unidentified Geometridae. Drawings of the genitalia (figs. 1 and 5) were sent to D. S. Fletcher of the British Museum (Natural History) for comparison with the genitalia of the holotype female and a male in that collection. Mr. Fletcher made this comparison and stated in a letter to me that the drawings agree with the genitalia of the type and a male from the Rothschild collection.

Dichordophora Prout (Genotype, *Dichorda* (?) *phoenix* Prout, in Wytsman, Genera Insectorum, Fasc. 129, p. 128, 1912) was described in 1913 (Novitates Zoologicae, vol. XX, no. 2, p. 437) when a male specimen became available to Prout. Of the many diagnostic characteristics of the generic description, the absence, in both sexes, of the frenulum and the median spurs of the hind tibia will permit the separation of *Dichordophora phoenix* from the species of *Dichorda* Warren (Genotype, *Geometra iridaria* Guenée, Species Général des Lépidoptères, vol. IX, p. 344, 1857).

In 1933 Prout *in* Seitz, Gross-Schmetterlinge der Erde, Bd. 8, Lief. 553, p. 70, referred *Dichorda aplagaria* Dyar (Proc. U.S.N.M., vol. 38, no. 1742, p. 261, 1910) to *Dichordophora*. He pointed out that males of *aplagaria*, unlike males of *phoenix*, possess median spurs on the hind tibiae. Females agree with the males in this characteristic. Therefore, the absence of median spurs on the hind tibiae is not of generic value and useful only in the separation of *phoenix* from *aplagaria* and the species of *Dichorda* Warren. The genitalia of both sexes (figs. 2 and 4), while specifically distinct from those of *phoenix* (figs. 1 and 5), support Prout's assignation of *aplagaria* to this genus.

Dichordophora phoenix (Prout): fig. 1, ventral aspect of ♂ genitalia with aedeagus removed and shown in lateral aspect; fig. 5, ventral aspect of ♀ genitalia. *Dichordophora aplagaria* (Dyar): fig. 2, ventral aspect of ♂ genitalia with aedeagus removed and shown in lateral aspect; fig. 4, ventral aspect of ♀ genitalia. *Dichorda iridaria* (Guenée): fig. 3, ventral aspect of ♂ genitalia with aedeagus removed and shown in lateral aspect; fig. 6, ventral aspect of ♀ genitalia.


1. PHOENIX
2. APLAGARIA
3. IRIDARIA
4. APLAGARIA
5. PHOENIX
6. IRIDARIA

The genitalia of *Dichorda iridaria* (Guenée) (figs. 3 and 6) are illustrated for comparative purposes.

Because females of the species of *Dichorda* and *Dichordophora aplagaria* lack a frenulum and possess median spurs on the hind tibia, it is desirable that some other diagnostic characteristic be employed to separate the two genera. Since the genitalia are very different, they may be used for this purpose, but for simple, rapid determination some other character is desirable. In the past the postmedian line of the forewing has been used. In the species of *Dichorda* the postmedian line usually is more oblique than in the two species of *Dichordophora*. The difference is, however, a matter of degree and therefore not completely satisfactory. Another character, the coloration of the antero-dorsal surface of the femora and the tibiae of the forelegs, may be used to supplement or replace usage of the postmedian line. In *Dichorda* the apex of the femur and the apical one-half of the tibia are brown, the remainder of the leg white or white with pale brown spots. In *Dichordophora* the femur and usually the tibia are uniformly pink. In some specimens the tibia may have irregular, indistinct, longitudinal patches of white, but the tibia never has a distinct, dark, apical patch.

In addition to the characteristics given above, distribution may be an aid to the determination of the species of *Dichordophora*. At the present time *phoenix* is known only from Arizona and *aplagaria* from Mexico and Guatemala.

Colored illustrations of the adults of *Dichordophora phoenix* (Prout), *D. aplagaria* (Dyar) and *Dichorda rectaria* (Grote) may be found in Seitz, Gross-Schmetterlinge der Erde, vol. 8, pl. 6e and 8l, 1933. It should be noted that the costal margin of the forewing of *aplagaria* is not always as dark as in the illustration.

IXODES DENTATUS (MARX) COLLECTED FROM MAN

(ACARINA, IXODIDAE)

During the latter part of May 1954, a slightly engorged nymph of *Ixodes dentatus* was found attached to the neck of a child in Washington, D. C. The child lived adjacent to Rock Creek Park, where there are numerous rabbits and birds. As far as known, this is the first record of the species becoming attached to man. My determination of the specimen was verified by Dr. F. C. Bishopp.

I. dentatus, particularly abundant along the Atlantic Coast to Cape Cod, is a common parasite of cottontail rabbits. It has also been collected from muskrat, deer, meadow mice and other mammals and birds. The species may serve as a carrier of tularemia among rabbits, and the possibility that it might transmit that disease, or Rocky Mountain spotted fever, to man should not be overlooked.—HELEN SOLLERS, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

NEW RECORDS OF HORNIA MINUTIPENNIS RILEY, WITH NOTES ON ITS BIOLOGY

(Coleoptera, Meloidae)

By George E. Bohart[1] and Richard B. Selander[2]

Introduction

Blister beetles of the genus *Hornia* Riley are highly specialized parasites of the bee genus *Anthophora.* In addition to being physogastric, lacking wings, and having rudimentary elytra, these beetles are unique among the New World Nemognathinae in spending their adult life entirely within the nest of their host. Female beetles (fig. 11) mate, oviposit, and die within the cell which they have occupied as larvae. Males (fig. 10) vacate their cell to search out females. In doing so they tunnel outside of and parallel to the cell series in which they have developed (fig. 8) and enter cells containing female *Hornia* either through a terminal hole made by the female (fig. 7) or through a lateral opening which they themselves excavate. Neither sex feeds in the adult stage. First instar larvae leave the nest and crawl over the ground in the immediate vicinity of the nesting site, frequently maintaining their hold by spinning a silken thread from the anal opening. They subsequently attach themselves to adult bees directly from the ground and are carried into the nests, where they parasitize the next generation of their host, each larva consuming first the egg and then the provisioned food material in the cell.

Because of their peculiar habits, *Hornia* beetles are rarely encountered by collectors, although available evidence indicates that the genus is not particularly rare in nature. The more important works dealing with the genus are Linsley's (1942) revision and the rather complete biological accounts of *H. minutipennis* Riley and *H. boharti* Linsley published by Linsley and MacSwain (1942). The species *H. minutipennis* is one of the most widely distributed blister beetles in North America, ranging across the United States and extending northward into Canada. In the literature *H. minutipennis* has been recorded from California, Montana, Alberta, Colorado, Missouri, District of Columbia, and New York. We are now able to fill a wide distributional gap by recording this species from several localities in Wyoming, Idaho, and Utah. These records are presented below, together with some biological observations made on the species in Utah.

New Records

In Wyoming *Hornia* adults have been recovered from cells of *Anthophora occidentalis* Cresson at two localities in the Wind River Basin, Fremont County. The first collection, made at a nesting site 5 miles south of Lander, about 5400

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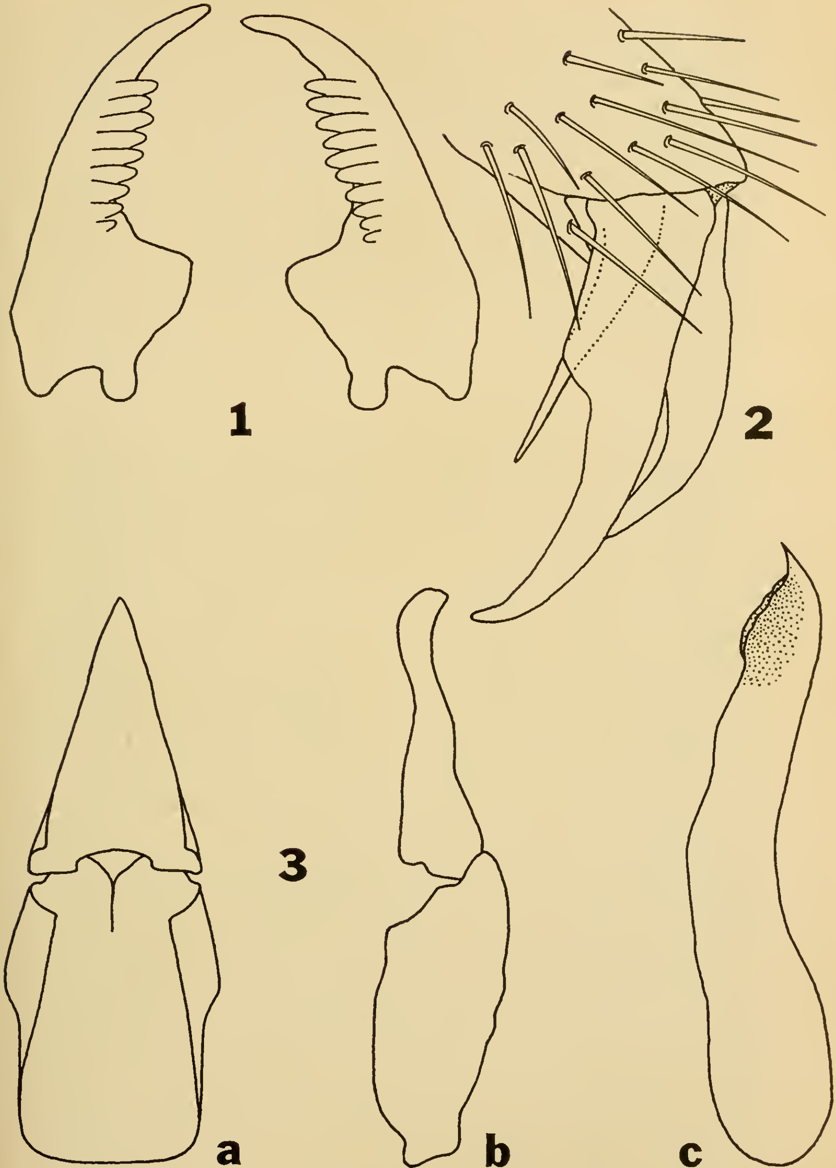
feet, on August 25, 1954, consisted of an adult found dead in an unopened cell. Five other cells examined contained *Hornia* fecal pellets and exuvia, but no living specimens were found. The nest is in a clay bank produced by a road-cut. Abandoned *Anthophora* cells at this site have been used extensively by *Osmia texana* Cresson, a species apparently immune from attack by *Hornia* but parasitized in the same locality by a species of *Nemognatha*. The second collection of *Hornia* in Wyoming was made on the same date as the first, at Pavillion, 5960 feet. At this locality two pupae were removed from *Anthophora* cells found in the bank of a small eroded gully. One of the pupae was injured but the other one developed into a fully colored adult on September 2.

Idaho records of *H. minutipennis* are based on collections made by W. F. Barr, who had intended originally to publish his own records. He collected *H. minutipennis* at three localities. The first of these is near a series of hot springs 9 miles northeast of Mountain Home, Elmore County. Here a single specimen of *Hornia* was found in a cell of *Anthophora bomboides neomexicana* (Cockerell). Cells of *A. occidentalis* from a nesting site several miles south of Lewiston, Nez Perce County, yielded a number of *Hornia*, including larval specimens. The third locality, also in Nez Perce County, is near the summit of Central Grade. According to Dr. Barr, there is some question as to whether the host of *Hornia* at this locality is *A. occidentalis*, *A. b. neomexicana*, or both. Three adult males from the Central Grade nesting site, found dead in cells in August, 1953, were sent to the authors and have been compared with material from Wyoming and Utah. The specimens are in poor condition, but they are apparently identical with Utah and Wyoming specimens.

Working in Utah, we have found *H. minutipennis* parasitizing *A. occidentalis* in six nesting sites. Observations at these sites have been made at irregular intervals since 1949. On several occasions living *Hornia* have been studied in the laboratory, but no intensive rearing program has been attempted.

Three of the *Hornia* localities in Utah are in Cache County, in the northern part of the state. One of the host nesting sites occupies a hard clay layer of a high bank at the mouth of Logan Canyon, 4500 feet, near the campus of the Utah State Agricultural College. The bank faces south, overlooking a large reservoir at a distance of about 100 feet. The site is extensive and apparently quite old, but the population of *Anthophora* is reduced at the present time, occupying only a small part of the available nesting area. The second site is on a west-facing wall of a clay gully about 100 feet from the Hyrum Reservoir, which is some 10 miles southwest of the nesting site in Logan Canyon. The third site occupies a southeastern exposure on a clay bank in an old gravel pit near Hyde Park, a few miles north of Logan. This is an extensive site inhabited by both *A. occidentalis* and *A. b. neomexicana*. Both species are parasitized by the *Hornia*. *Osmia texana*, which nests commonly in the *Anthophora* burrows, is parasitized by *Tricrania stansburyi* (Haldeman) and a species of *Nemognatha* but not by the *Hornia*.

A fourth nesting site of *A. occidentalis* with *Hornia* parasites has been found in central Utah at a locality 16 miles north of Mt. Pleasant in extreme southern Utah County. The site occupies a low clay bank facing a small canal to the west. Again at this locality there is evidence of considerable previous activity on the part of the bee, but the present population is small. When last visited, in 1951, it appeared to be on the verge of extinction.



Hornia minutipennis Riley. Fig. 1, mandibles of first instar larva; fig. 2, hind tarsal claw of adult male; fig. 3, genitalia of adult male: a, tegmen, ventral view; b, tegmen, lateral view; c, median lobe, lateral view.

A fifth parasitized nesting site occupies clay banks on both sides of a small stream in Red Rock Canyon, near Parowan, Iron County, in the southwestern corner of the state. The sixth *Hornia* locality is in west central Utah, at Johnsons Pass, 5500 feet, Stansbury Mountains, Tooele County. The nesting site, which occupies a stream cut, was located in 1954 and is the latest of the *Hornia* localities to be discovered in Utah.

With exception of the site north of Mt. Pleasant, *Hornia* localities in Utah are within the Great Basin, as is the Idaho locality in Elmore County. All nesting sites of *Anthophora occidentalis* studied in Utah have been found to be moderately or heavily parasitized by *Hornia*. Of 138 cells examined at Red Rock Canyon in 1950, 21 (15.2 percent) contained *Hornia* beetles. Thirteen (38.2 percent) of 34 cells from the Logan Canyon site examined on September 14, 1949, were infested with *Hornia*.

Taxonomy

Some confusion exists as to the status of the two subspecies of *Hornia minutipennis* recognized in Linsley's revision of the genus. Linsley assigned Colorado and California populations to the race of *H. m. occidentalis* Linsley on the basis of both adult and first instar larval characters. However, his conclusion concerning the supposed absence of a basal spine (fig. 2) on the tarsal claws of eastern adults of the species is erroneous. J. W. MacSwain first informed us of this in 1950 (*in litt.*), and the junior author has since verified this information by the examination of specimens, including the holotype of *H. minutipennis* in the collection of the U.S.N.M. The degree of sclerotization of the first and second abdominal tergites of the male appears to be quite variable and is of no particular diagnostic value in separating races of *H. minutipennis.* As far as we have been able to ascertain, there are no adult characters which would justify the recognition of racial groups within the species. First instar larvae are available from two localities in Utah. These larvae agree with Linsley's diagnosis of the race of *H. m. minutipennis,* except that they have nine or ten teeth on each mandible rather than eight. According to Dr. MacSwain (*in litt.*), who has examined some of our material, it now appears that two races of *H. minutipennis* may be recognized. but that the name *H. m. occidentalis* must be restricted to Pacific Coast populations. Presumably, the races are distinguishable only on the basis of the first instar larvae. If the two races are distinct, host specificity is apparently not responsible since *H. m. minutipennis* parasitizes at least three species of *Anthophora.* On the other hand, *Anthophora occidentalis* is parasitized by both *Hornia neomexicana* (Cockerell) and *H. m. minutipennis.* Furthermore, various subspecies of *Anthophora bomboides* Kirby are parasitized by both *H. m. minutipennis* and *H. m. occidentalis.*

Hornia minutipennis Riley. Fig. 4, fifth instar larva, partially removed from fourth instar exuvia; fig. 5, fourth (left) and fifth (right) larval instar exuvia and pupa; fig. 6, adult female, enclosed by exuvial capsule, in *Anthophora* cell. Note characteristic fecal pellets produced by *Hornia* larva.

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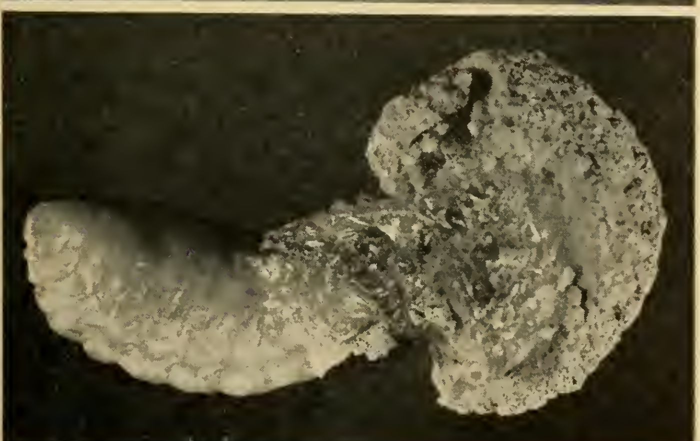

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Photographs for Figs. 5, 6, 9 and 10 are by W. P. Nye, and those for Figs. 4, 7, 11 and 12 by M. D. Levin.

Biological Observations

There is considerable discrepancy between our data on the seasonal distribution of the various stages of *H. m. minutipennis* in Utah and the data presented by Linsley and MacSwain for *H. m. occidentalis* in California. In Utah oviposition occurs in mid-June and eggs hatch in early July, the latter period coinciding with the height of the nest building activities of *A. occidentalis.* The larval period of Utah populations appears to be of two months duration at most, so that the pupal stage is normally reached by early September and the adult stage is attained by mid-September. It appears, then, that although *H. m. minutipennis* in Utah oviposits about 2 months later than the West Coast race, its larval period is a month shorter, and, consequently, there is a lag of only about 1 month at the time of pupation and the appearance of the adult stage.

Adult *Hornia* overwinter in a capsule formed by the exuvia of the fourth and fifth instar larvae. Generally, the posterior end of the capsule is cemented to the fecal mass at the bottom of the bee cell (fig. 6). When removed from cells and kept in the laboratory, adult beetles usually emerged from their capsule through the posterior end, in the manner reported by Hocking (1949) for *H. minutipennis* in Canada. Under natural conditions the capsule is ruptured anteriorly and the exuvia are worked backward by the adult, a method of emergence described by Linsley and MacSwain.

According to the latter authors, adult *H. m. occidentalis* readily feign death when disturbed. We have observed that when exposed to strong light adult *H. m. minutipennis* sometimes draw the head and legs in against the body and remain motionless for a few seconds, but no comparable behavior is evident when they are otherwise molested. Adults crawl freely over the hand when picked up and immediately attempt to right themselves when places on their back. If the head or thorax is touched the beetles usually move the abdomen convulsively and open their mandibles in an attempt to grasp the disturbing object. At such times and also in other situations (fig. 9) they occasionally emit a drop of clear liquid from the mouth.

Copulation of *Hornia* adults has been observed frequently. In most respects our observations on this activity are in agreement with those of Linsley and MacSwain. However, it should be noted that courtship activity was noted in one instance when a male was observed to knead the abdomen of a female with his mandibles and legs, although not roughly enough to rupture the cuticle, prior to attempting actual copulation. Response by the female consisted of increased respiratory movement of the abdomen. When placed together males and females copulated freely, the females ovipositing in the intervals between the reception of males. Copulation is accomplished with both

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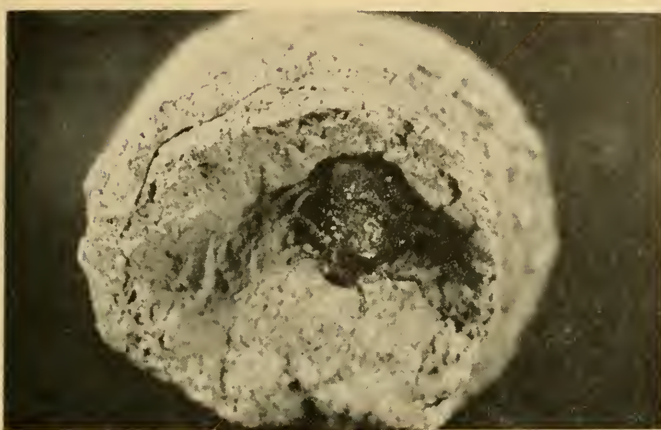
Hornia minutipennis Riley. Fig. 7, adult female looking out of hole in cap of *Anthophora* cell; fig. 8, adult male tunneling parallel to *Anthophora* burrow; fig. 9, copulating pair (Notice drop of liquid issuing from mouth of female).



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parties facing the same direction (fig. 9) and usually lasts from three to eight minutes.

The incubation period of eggs deposited by confined females averaged about 24 days. Under natural conditions the female beetle nearly fills her cell with eggs. As oviposition progresses the abdomen shrinks, and, when all eggs have been deposited, it is reduced to a small mass of wrinkled membrane (fig. 12). Because eggs are laid over a considerable period of time, eggs in various stages of development as well as fully developed first instar larvae may be found within the same *Anthophora* cell. Presumably, the early hatching larvae remain quiescent within their natal cell until hatching is complete. Near Mt. Pleasant on July 14, 1950, a number of cells filled with eggs and first instar larvae of *Hornia* were uncovered, but no larvae were present at the time within the tunnels, on the surface of the nesting bank, or on adult bees. Observations made on egg clusters in open dishes indicate that the first instar larvae instinctively tend to remain with the cluster for a day or more after hatching, but under natural conditions the earlier hatching larvae probably remain in their cell for a week or more. Because the hatching of eggs begins at the bottom of the cell, it is likely that the earlier hatching larvae are forced to await the hatching of eggs and the emergence of larvae above them before they can reach the exit hole prepared in the cell cap by the female beetle.

After completing oviposition the now badly withered female stations herself at the exit hole, which she partially plugs with her head, maintaining this position even after death (fig. 7). This action is probably a defense against the entrance of nest predators such as clerid larvae. The hole does not seem to be plugged tightly enough to prevent the *Hornia* larvae from leaving.

On June 15, 1951, while observing the behavior of adult *Hornia* obtained from the Red Rock Canyon nest, we witnessed an interesting encounter between two males. At the time, the males were crawling over and about a large female confined to a sand filled dish. At short intervals the males approached one another and made feeble grasping motions with their mandibles. Finally, one of the males succeeded in sinking his mandibles into his adversary's abdomen, and although the attacked individual tried to dislodge the hold and grasp the body of the attacker with his mandibles, he was unable to accomplish either. During the next few minutes the attacker dragged his opponent over the surface of the sand, meanwhile almost burying his head in the wounded abdomen. After releasing his victim the male crawled toward the female. The injured beetle remained motionless, with a clear liquid pouring freely from the wound. About five minutes later the uninjured male returned to its victim and the two beetles inter-

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Hornia minutipennis Riley. Fig. 10, adult male; fig. 11, adult female, before oviposition; fig. 12, adult female (dead) after oviposition.

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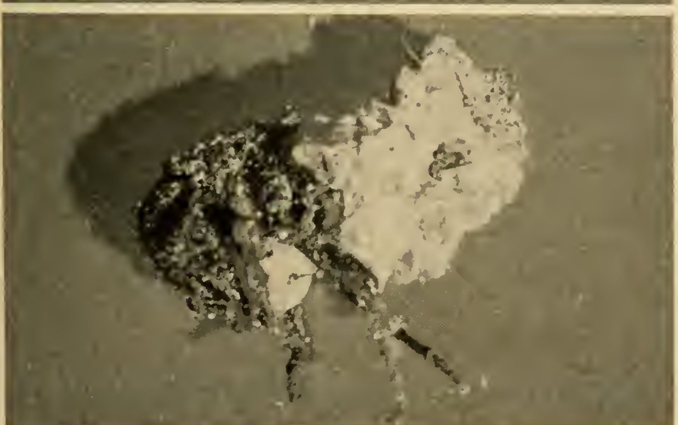

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locked mandibles for a few seconds. Several hours afterward it was apparent that the injured beetle was dying.

Combat between males of the family Meloidae does not seem to have been observed previously, or at least it appears that accounts of such activity have not been published. Members of several genera of Lyttinae which we have observed show no combative tendency at all. However, antagonism between males of several species of *Nemognatha*, *Zonitis*, and *Gnathium* (Nemognathinae) has been observed by the junior author on several occasions. In the case of *Hornia*, where mating takes place in extremely confined quarters, a combative instinct on the part of males may have adaptive significance.

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BOOK REVIEW

INSECT FACT AND FOLKLORE, by Lucy W. Clausen, American Museum of Natural History and Columbia University. xiv + 194 pp., ill. The Macmillan Company, New York, 1954. $3.50.

For those having little or no knowledge of entomology Miss Clausen has written an entertaining introduction to the insect world. It is a small volume, combining a primer of entomology with anecdotes and world folklore concerning insects and their relationship to the life of man.

Miss Clausen's efforts are directed to initiating the layman into the subject of entomology by brightening the rudimentary scientific data with the more exotic aspects of the subject. Thus the book may appear rather naive to a practicing or even amateur entomologist. It may, however, succeed in its stated purpose of arousing the curiosity of those who might undertake more serious studies in the field.

On the whole Miss Clausen has performed a valuable service for the profession in emphasizing the importance of entomological science and the role it plays in everyday life. Especially is this true in the chapter of her book devoted to the progress of the science and its potential.

"Probably no other field in the range of biological endeavor, except medicine and bacteriology, offers so much promise to the young biologist today," Miss Clausen says.

Miss Clausen is widely known for her work in the Department of Public Instruction of the American Museum of Natural History. In addition she is a lecturer at the College of Pharmacy, Columbia University. In 1953 she became the first woman president of the New York Entomological Society.—R. E. Warner, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

PARASITES OF POTATO-INFESTING APHIDS AND OF SOME OTHER APHIDS IN MAINE

By W. A. Shands,[1] G. W. Simpson,[2] F. S. Roberts,[3] and C. F. W. Muesebeck[4]

Field collections of parasitized aphids were made between 1942 and 1950 in connection with research on the biology and control of potato-infesting aphids in Maine. Most of the collections were from northeastern Maine near Presque Isle in east-central Aroostook county, although some were from the central part of the State. The number of collections varied from year to year.

Most of the collections were from secondary host plants but some were from primary hosts. Host plants included potatoes (*Solanum tuberosum* L.), wild rutabaga (*Brassica campestris* L.), wild radish (*Raphanus raphanistrum* L.), hemp nettle (*Galeopsis tetrahit* L.), lamb's-quarters (*Chenopodium album* L.), smartweed (*Polygonum lapathifolium* L.), field sorrel (*Rumex acetosella* L.), oxeye-daisy *Chrysanthemum leucanthemum* var. *pinnatifidum* Lecoq and Lamotte), English peas (*Pisum sativum* L.), alder-leaved buckthorn (*Rhamnus alnifolia* L'Hèr.), Canada plum (*Prunus nigra* Ait.), swamp rose (*Rosa palustris* Marsh.), and rugose rose (*R. rugosa* Thunb.).

The parasitized aphids were placed in vials and held at room temperature until adult parasites emerged. Then the parasites were preserved with the aphids from which they emerged, by filling the vials with 30-percent alcohol.

Parasites were reared from the following aphids during this period:

Buckthorn aphid .... *Aphis abbreviata* Patch
English grain aphid .... *Macrosiphum granarium* (Kby.)
Foxglove aphid .... *Myzus solani* (Kltb.) = *convolvuli* (Kltb.) = *pseudosolani* (Theob.).
Green peach aphid .... *Myzus persicae* (Sulz.)
Pea aphid .... *Macrosiphum pisi* (Harris)
Potato aphid .... *Macrosiphum solanifolii* (Ashm.)
Turnip aphid .... *Rhopalosiphum pseudobrassicae* (Davis)
Hyalopterus atriplicis L.
Capitophorus spp., believed to be mostly *potentillae* (Wlkr.) *tetrarhodus* (Wlkr.), and *poae* (Gill.).

Table 1 shows the total number of each species of parasite reared from each species of aphid, grouped according to primary and hyperparasites. According to Smith (1944), Clausen (1940), and others, all species of Aphidiinae are primary parasites. The hyperparasites have been so designated by Haviland (1920, 1921, 1922), Spencer (1926), Ferrière and Voukassovitch (1928), Griswold (1929), Dunn (1949),

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[4]Entomology Research Branch, U. S. D. A., Washington 25, D. C.

and others. On the other hand, Folsom and Bondy (1930) stated that *Pachyneuron siphonophorae* is an important primary parasite of *Aphis gossypii* Glov., and Ullyett (1938) reported that *Charips* sp. occasionally is a primary parasite.

Table 1. Numbers of parasites reared from aphids at Presque Isle, Maine, 1942-50.[1]

Species of Parasite	Buckthorn aphid	Green peach aphid	Potato aphid	Foxglove aphid	*Capitophorus* spp.	Pea aphid	English grain aphid	*Hyalopterus atriplicis*	Turnip aphid
Primary parasites									
BRACONIDAE									
Aphidiinae	----	1	----	----	----	----	----	----	----
Praon sp.	----	5	13	2	2	----	1	----	----
Praon aguti Sm.	----	**2**	3	**1**	----	----	----	----	----
Praon americanus (Ashm.)	----	**1**	----	----	----	----	----	----	----
Praon simulans (Prov.)	----	5	7	----	----	28	----	----	----
Aphidius spp.	3	9	62	1	5	----	1	----	2
Aphidius avenaphis (Fitch)	----	8	**3**	----	**8**	----	----	----	----
Aphidius nigripes Ashm.	**3**	**17**	170	----	**1**	----	----	----	----
Aphidius nigriteleus Sm.	**1**	14	**8**	**2**	**62**	----	----	----	----
Aphidius ohioensis Sm.	----	----	**8**	----	----	----	----	----	----
Aphidius phorodontis Ashm.	----	5	----	----	----	----	----	----	----
Aphidius pisivorus Sm.	----	**2**	**35**	----	----	----	----	----	----
Aphidius rosae Hal.	----	**4**	153	----	----	----	----	----	----
A. (Lysiphlebus) testaceipes (Cress.)	32	----	----	----	----	----	----	----	----
Diaeretus rapae (M'Int.)	**7**	309	2	----	**1**	----	----	**5**	20
Trioxys sp.	**1**	----	----	----	----	----	----	----	----
Hyperparasites									
PTEROMALIDAE									
Sphegigasterinae									
Asaphes fletcheri (Cwfd.)	----	10	**23**	**2**	**1**	**1**	----	----	**1**
Asaphes rufipes Brues	----	----	**5**	----	----	----	----	----	----
Pachyneurini									
Coruna clavata Wlkr.	----	----	**11**	----	**2**	----	----	----	----
Pachyneuron sp.	----	----	**1**	----	----	----	----	----	----
Pachyneuron siphonophorae (Ashm.)	----	----	1	----	----	----	----	----	----
CYNIPIDAE									
Charipinae									
Charips sp.	----	**10**	**1**	----	**1**	----	----	----	**1**
Charips brassicae (Ashm.)	----	**6**	**6**	----	**10**	----	----	----	1
Alloxysta sp.	----	----	----	----	**1**	----	----	----	**2**
CERAPHRONIDAE									
Lygocerus sp., probably *niger* How.	**2**	**8**	35	----	**8**	----	----	----	----

[1]Bold face numerals indicate what appear to be new parasitization records prior to 1950.

The parasitizations observed in these studies were compared with those for the United States and Canada as published by MacGillivray and Spicer (1953), Muesebeck *et al.* (1951), Thompson (1944), Spencer (1926), Wheeler (1923), Smith (1919), Hauser *et al.* (1917), and Melander and Yothers (1915, 1916). In Table 1 bold face type is used to indicate what appear to be new parasitization records prior to 1950. These new records may be less accurate for the hyperparasites than for the primary parasites, since the literature frequently records the primary parasite as the host rather than the aphid from which the hyperparasite emerged. No effort in our study was made to determine the identity of the parasite from which the hyperparasite emerged. There are 4 new records for primary parasites of the potato aphid, 5 for the green peach aphid, 3 for the buckthorn aphid, 4 for *Capitophorus* spp., 2 for the foxglove aphid, and 1 for *Hyalopterus atriplicis.* Of the records for hyperparasites all are new except *Asaphes fletcheri*[1] for the green peach aphid, *Pachyneuron siphonophorae* for the potato aphid, and *Charips brassicae* for the turnip aphid.

At least 13 species of primary parasites and 9 species of hyperparasites were reared. Among the primaries at least 10 species were reared from the green peach aphid, 9 from the potato aphid, 6 from the buckthorn aphid, 5 from *Capitophorus* spp., 3 from the foxglove aphid, 2 from the English grain aphid and the turnip aphid, and 1 from the pea aphid and *Hyalopterus atriplicis.* Among the hyperparasites at least 7 species were reared from the potato aphid, 6 from *Capitophorus* spp., 4 from the green peach aphid, 4 from the turnip aphid, and one each from the buckthorn, foxglove, and pea aphids. None were reared from the English grain aphid or *Hyalopterus atriplicis.*

Some of the parasites showed a considerable specificity for certain species of aphids, although specificity by the hyperparasites probably was for the primary parasite rather than for the aphid. Among the primary *Aphidius* parasites, (*Lysiphlebus*) *testaceipes* and *Trioxys* sp. were reared only from the buckthorn aphid, *Aphidius phorodontis* only from the green peach aphid, and *Aphidius ohioensis* only from the potato aphid. *Diaeretus rapae* was reared almost entirely from the green peach aphid with only 2 specimens from the potato aphid, whereas *Aphidius rosae* was confined largely to the potato aphid. Among the hyperparasites, *Pachyneuron siphonophorae* and *Asaphes rufipes* were confined to the potato aphid, *Alloxysta* sp. to the turnip aphid and *Capitophorus* spp., and *Coruna clavata* to the potato aphid and *Capitophorus* spp.

The data in Table 2 indicate that the potato and green peach aphids were more commonly parasitized than were the buckthorn and foxglove aphids. Field observations corroborated this indication.

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[1]*Asaphes americanus* Gir. is a synonym.

It appears that the relative abundance of the various species of parasites differed from year to year, but this may have been due partly to differences in aphid abundance and the numbers collected. *Praon americanus, Aphidius phorodontis, Trioxys* sp., *Pachyneuron siphonophorae*, and *Alloxysta* sp. were represented in only 1 year; *Aphidius* (*Lysiphlebus*) *testaceipes, A. ohioensis*, and *A. avenaphis* 2 years each; *Praon aguti* 3 years; *Asaphes rufipes* 4 years; *Coruna clavata* 5 years; and *Aphidius nigriteleus, Aphidius pisivorus* and *Asaphes fletcheri* 6 years each; *Praon simulans, Aphidius nigripes*, and *A. rosae* 7 years each; *Charips brassicae* 8 years; and *Diaeretus rapae* and *Lygocerus* sp. 9 years each.

Table 2. Total numbers of parasites reared from each species of aphid at Presque Isle, Maine 1942-50.

Species of aphid	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total
					Primary parasites					
Aphis abbreviata	0	6	2	0	1	2	2	31	3	47
Myzus persicae	4	3	204	40	86	19	9	5	12	382
Macrosiphum solanifolii	18	34	35	84	38	137	76	7	35	464
Myzus solani	0	0	2	2	0	0	0	0	2	6
Capitophorus spp.	0	1	1	47	5	17	6	2	0	79
Macrosiphum granarium	0	0	0	0	0	0	2	0	0	2
Macrosiphum pisi	0	4	22	0	0	0	0	1	1	28
Hyalopterus atriplicis	0	0	0	0	0	5	0	0	0	5
Rhopalosiphum pseudobrassicae	0	2	3	0	1	11	5	0	0	22
Total	22	50	269	173	131	191	100	46	53	1035
					Hyperparasites					
Aphis abbreviata	0	0	0	0	0	0	0	0	2	2
Myzus persicae	8	1	13	1	5	0	1	0	5	34
Macrosiphum solanifolii	11	15	6	2	7	22	9	4	7	83
Myzus solani	0	0	0	0	1	0	0	0	1	2
Capitophorus spp.	0	2	1	2	4	12	2	0	0	23
Macrosiphum granarium	0	0	0	0	0	0	0	0	0	0
Macrosiphum pisi	0	1	0	0	0	0	0	0	0	1
Hyalopterus atriplicis	0	0	0	0	0	0	0	0	0	0
Rhopalosiphum pseudobrassicae	0	1	1	0	0	2	1	0	0	5
Total	19	20	21	5	17	36	13	4	15	150

Parasites reared in greatest numbers were those found every year. In general the total number of individuals of a species was proportional to the number of years it was represented. There was a large year-to-year variation in the percentage of parasitized aphids infested with hyperparasites.

B. D. Burks, A. B. Gahan, and L. H. Weld, of the former Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, identified the specimens of Pteromalidae and Cynipidae. Many assistants were employed seasonally by the Maine Agricultural Experiment Station for collecting the parasitized aphids.

Table 3. Total number of each species of parasite reared from aphids at Presque Isle, Maine 1942-1950.

Parasite	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total
Primary parasites										
BRACONIDAE										
Aphidiinae	----	1	----	----	----	----	----	----	----	1
Praon sp.	----	3	1	1	4	2	6	2	4	23
Praon aguti Sm.	----	----	----	4	1	----	----	1	----	6
Praon americanus (Ashm.)	----	----	----	----	----	1	----	----	----	1
Praon simulans (Prov.)	1	9	22	2	----	4	----	1	1	40
Aphidius spp.	18	30	6	7	7	7	2	3	3	83
Aphidius avenaphis (Fitch)	----	----	----	16	----	----	3	----	----	19
Aphidius nigripes Ashm.	----	----	9	23	18	70	37	2	32	191
Aphidius nigriteleus Sm.	----	----	18	38	7	17	6	1	----	87
Aphidius ohioensis Sm.	----	----	----	----	----	5	3	----	----	8
Aphidius phorodontis Ashm.	----	----	5	----	----	----	----	----	----	5
Aphidius pisivorus Sm.	----	----	7	15	1	4	7	----	3	37
Aphidius rosae Hal.	----	----	12	42	19	52	24	3	5	157
A. (*Lysiphlebus*) *testaceipes* (Cress.)	----	----	----	----	----	1	----	31	----	32
Diaeretus rapae (M'Int.)	3	7	189	25	75	27	12	2	4	344
Trioxys sp.	----	----	----	----	----	----	----	----	1	1
Total	22	50	269	173	132	190	100	46	53	1035
Hyperparasites										
PTEROMALIDAE										
Sphegigasterinae										
Asaphes fletcheri (Cwfd.)	10	9	----	----	4	7	4	----	4	38
Asaphes rufipes Brues	----	----	----	----	1	2	1	----	1	5
Pachyneurini										
Coruna clavata Wlkr.	----	----	2	----	----	7	1	2	1	13
Pachyneuron sp.	----	----	----	----	----	----	----	1	----	1
Pachyneuron siphonophorae (Ashm.)	----	----	----	----	----	1	----	----	----	1
CYNIPIDAE										
Charipinae										
Charips sp.	----	----	8	1	3	1	----	----	----	13
Charips brassicae (Ashm.)	3	2	1	1	1	11	3	----	1	23
Alloxysta sp.	----	----	----	----	----	3	----	----	----	3
CERAPHRONIDAE										
Lygocerus sp.	6	9	10	3	8	4	4	1	8	53
Total	19	20	21	5	17	36	13	4	15	150
Percent of parasitized aphids from which hyperparasites were reared	46.3	28.6	7.2	2.8	11.4	15.9	11.5	8.0	22.1	13.0

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NOTES ON THE LARVA OF HAEMAGOGUS JANTHINOMYS DYAR (Diptera, Culicidae)

By William H. W. Komp, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

The larva of *Haemagogus janthinomys* Dyar was not described in the original description (Dyar, 1921). There it is stated: "The larva is described in the monograph (Howard, Dyar and Knab, 1912-1917) under the name "*capricornii*" (vol. iv, 877, 1917) and also figured (pl. 126, fig. 438, 1912)." In the description of the larva under "*capricornii*" it is stated: ". . . both pairs of dorsal head-hairs in twos, the lowest pair situated rather low down on the face. . . ." A later description by Dyar (1928) is nearly the same: "Head-hairs in twos, situated low on the face." The figures given by Dyar (1928) of the larval head and terminal segments (plate 32, fig. 103) are the same as those in plate 126, fig. 438, in the second volume of the monograph (2).

Only two larval skins of *H. janthinomys* are associated with the type series of adults from Trinidad, B. W. I., in the U. S. National Museum collection. One skin is on a slide numbered 17.1, which produced one of the two type males designated in the original description. The other skin is on a slide numbered 2269 (Urich 17.3), which produced one of the four paratype males.

The head-capsules of both of these skins are badly crushed under the cover-glasses. The larva which produced one of the type males (17.1) has the two anterior head-hairs present and single; the right posterior head-hair is missing, and what may be the left posterior hair is double. This hair may be extraneous, as it does not arise from an insertion in the head-capsule. Neither the anterior nor posterior head-hairs are visible on slide 2269 (Urich 17.3). It is thus apparent that an error of observation was made in describing the head-hairs of the larva of *H. janthinomys*. Further evidence confirming this is presented below.

In August 1945 the writer collected hairy *Haemagogus* larvae from tree holes at St. Ann's, a suburb of Port of Spain, Trinidad, B. W. I., the type locality for *H. janthinomys*. These larvae had both pairs of head-hairs single. A male reared from one of these larvae had the typical short-beaked mesosome of *H. janthinomys*.

In March 1944, according to Kumm et al. (1946), Jorge Boshell visited the forests near the presumed type locality of *H. spegazzinii* Brèthes, near Ledesma, Province of Jujuy, Argentina, and obtained *Haemagogus* females. Eggs from these in due course produced adult males which had short-beaked mesosomes like those of *H. janthinomys*. On this evidence Kumm et al. reduced *janthinomys* to a synonym of *H. spegazzinii* Brèthes 1912.

Kumm et al. further state that the larvae of *H. capricornii, H. spegazzinii* and its subspecies *falco*, are indistinguishable. They present a table listing many of the morphological characters of 525 larvae of *H. spegazzinii falco;* in practically all of this long series the anterior and posterior head-hairs were single. Very few species of *Haemagogus* have larvae in which either the anterior or posterior head-hairs are double. If this character were present and stable in *H. janthinomys,* it would serve as a most convenient marker to separate this larva from the other two *Haemagogus* larvae with densely villose integument, namely *capricornii* and *spegazzinii falco.* Unfortunately this character is not present in *janthinomys* (=*spegazzinii*) as is shown by the evidence given above.

H. spegazzinii has rather a wide range, extending northward from Ledesma in northern Argentina, through Brazil (Kumm and Cerqueira, 1951) and into French Guiana (Floch, 1950) and Trinidad. Intergrades between *spegazzinii* and *spegazzinii falco* have been reported from Brazil by Kumm and Cerqueira (1951). In Panama and Costa Rica, only *spegazzinii falco* has been found by Galindo and his co-workers (Galindo et al., 1951). Kumm and his associates (1946) state that *spegazzinii* and *spegazzinii falco* have been found naturally infected with the virus of yellow fever in endemic areas of this disease in Brazil and Colombia.

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BOOK REVIEW

MOSQUITO CULTURE TECHNIQUES AND EXPERIMENTAL PROCEDURES, by Helen Louise Trembley (Mrs. Kenneth M. Durkee, 113 Sonora Avenue, Danville, California). American Mosquito Control Association Bulletin No. 3, 1955. 73 pp., 17 illus. May be purchased from C. T. Williamson, 16 Orowac Avenue, Islip, New York. Price $2.00.

The author is an entomologist who has had more than 15 years of experience in the U. S. Department of Agriculture and the National Institutes of Health in the culturing of mosquitoes under controlled conditions, and in disease transmission. This bulletin is an account of her personal experiences and a summary of her intensive search of the literature. General and specific techniques and equipment are described for the culturing of 63 species (8 genera) through consecutive generations and for 26 species reared from immature stages to the adult.

The 425 references cited, the majority of which are annotated, are listed under four categories: rearing; development and behavior; disease transmission and other experimental studies; and general reference works. Heretofore, this vast amount of information has not been assembled in a separate publication.

The publication is characterized by its thorough treatment of the subject and its simplicity of presentation. The relatively informal style will be appreciated especially by the non-English speaking scientists who will find the bulletin easy to translate.

Miss Trembley and the American Mosquito Control Association are to be congratulated on making so valuable a contribution to the fields of research and control of mosquitoes and mosquito-borne diseases.—ERNESTINE B. THURMAN, *Division of Research Grants, National Institutes, of Health, Bethesda, Maryland.*

SOCIETY MEETINGS

The 642nd regular meeting of the Society, attended by 27 members and 8 visitors, was held in Room 43 of the U. S. National Museum on February 3, 1955. President T. L. Bissell called the meeting to order at 8:00 P.M., and the minutes of the previous meeting were read and approved.

Reports for 1954 were given by the Treasurer, the Corresponding Secretary, the Custodian, and the Editor. These appear elsewhere in this issue.

E. L. Todd gave a note on a new cotton pest, *Acontia dacia* Druce, whose damage has been reported from Texas and Louisiana. Its known distribution, its discovery as a cotton pest, and its differentiation from *A. terminimaculata* (Grt.) and other species of *Acontia* were discussed.

F. S. Haydon circulated a collection of Korean insects.

The khapra beetle, *Trogoderma granarium* Everts, was briefly discussed by W. H. Anderson. Originally described from India, this beetle damages stored grain, especially barley, and other products in certain southwestern states and in countries outside the U. S. Its populations in some warehouses become unbelievably large. (Author's abstract.) Dr. Anderson stated that the quart of larvae he exhibited might have come from as small an area as a foot or two in one warehouse and would therefore not satisfy the specialist's demand for an adequate sample of the distribution of the species.

President Bissell exhibited large rhinoceros beetles collected alive in Maryland in January during the clearing of rotted stumps. A dead beetle was found in a cell 3 or 4 inches long, evidently made by the larva.

In recognition of outstanding service to entomology, C. F. W. Muesebeck and H. G. Barber were voted to Honorary Membership. Mr. Barber has been a member in good standing since 1894.

The address of the retiring president, A. B. Gurney, was entitled "A Nevada Grasshopper Quest, and Lessons Learned About Grasshopper Abundance." A very unusual migratory swarm of the Nevada sage grasshopper, *Melanoplus rugglesi* Gurney, was found in central Nevada in 1939. The migration has moved northwesterly and has since virtually run its course after about 5 years of activity in southeastern Oregon. Dr. Gurney visited the infested area in 1949 and again in 1953; the latest trip, made partly in company with Dr. Claude Wakeland, shed considerable light on the preferred habitats of the solitary phase. With the aid of kodachrome slides the speaker reviewed the identity, distribution, habitat preferences and probable population responses of *rugglesi* to climatic changes. He emphasized the advantages in the present study of close cooperation among control workers, taxonomists and ecologists, and the benefits obtained by the taxonomist who pursues some of his work in the field. A comprehensive report on *rugglesi* and its allies is in preparation. (Author's abstract.)

Dr. C. L. Remington of Yale University was introduced.

The meeting adjourned at 10.07 P.M.—KELLIE O'NEILL, *Recording Secretary.*

The 643rd regular meeting of the Society was called to order by President T. L. Bissell in Room 43 of the U. S. National Museum at 8:00 P.M. on Thursday, March 3, 1955, and was attended by 35 members and 18 visitors. The minutes of the previous meeting were read and approved.

William E. Bickley reported for the Memoirs Committee, expressing the hope that additional manuscripts will be submitted for consideration as Memoir No. 5.

A letter of greeting to the Society from W. Dwight Pierce recalled his election to membership fifty years ago and told of his present work.

The appointment of R. H. Nelson as Executive Secretary to the Entomological Society of America was announced by the President.

T. J. Spilman reviewed the introductory volume of *Insects of Micronesia* by J. Linsley Gressitt.

S. R. Dutky told of parasitic nematodes found on codling moths. This note is to be published elsewhere in the Proceedings.

According to A. B. Gurney, Miss Sophy Parfin has succeeded in rearing larvae of certain genera of Myrmeleontidae; some of these have not previously been associated with adults. Dr. Gurney also mentioned newspaper and magazine advertisements offering egg-cases of praying mantids for sale. He concluded that while mantids are often valuable in gardens they have little effect on certain highly injurious pests. (Speaker's abstract.)

The yellow clover aphid was described as a new pest of alfalfa in the Southwest by R. G. Dahms. The insect has been known in eastern U. S. for several years, but not considered serious. Its appearance and rapid spread in Arizona, New Mexico and southern California on alfalfa resulted in five million dollars worth of damage during the first year. The aphid kills young plants, causes older plants to shed leaves, and produces honeydew which causes mold to grow on the plants and makes alfalfa almost impossible to dry for baling. Other alfalfa-growing states are watching it closely. (Secretary's abstract.)

W. E. Bickley announced publication by the American Mosquito Control Association of Helen Louise Trembley's bulletin entitled *Mosquito Culture Techniques and Experimental Procedures.*

The principal paper, "Photoperiodic Responses of Plants and Animals," was given by Dr. H. A. Borthwick, Principal Plant Physiologist at the Beltsville Plant Industry Station. In plants photoperiodism controls production of flowers and fruits; formation of runners, tubers and bulbs; abscission of leaves and coloration of parts of plants. In animals it regulates reproduction, change of color of feathers or fur, moulting and, to some extent, migration. The daylength stimulus is perceived by the leaves of plants; in animals photoperiodic perception occurs in the eye or region of the eye and the reaction is believed to operate through the pituitary. Light from the red part of the spectrum is most effective in promoting flowering of long-day plants or inhibiting flowering of short-day ones. In each case far red light (wavelength about 7350 A) reverses the action of red. This reversible reaction also regulates other light-controlled responses of plants, such as seed germination, that are not photoperiodic. Wavelength requirements for control of photoperiodic responses of animals have not been adequately determined. Such information would materially improve our knowledge of the physiology of animals and would indicate whether the basic reactions controlling photoperiod in plants and animals are identical or different. (Speaker's abstract.) In the following discussion R. I. Sailer, A. B. Gurney, R. B. Withrow, W. E. Bickley, F. F. Smith, J. F. G. Clarke, Ina Hawes, W. B. Wood, T. L. Bissell and F. L. Campbell took part.

Visitors introduced were Dr. R. B. Withrow, Chief of Radiation and Organisms Division, Smithsonian Institution, Mr. and Mrs. J. W. Bongberg, and G. H. Plumb. The meeting adjourned at 10:11 P.M.—LOUISE M. RUSSELL, *Acting Recording Secretary.*

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1954

TREASURER

General Fund		
Cash on hand January 1, 1954	$ 8.32	
Receipts from all sources during 1954	3621.16	
Total		$3612.84
Expenditures during 1954	3366.05	
Cash and securities on hand December 31, 1954	246.79	
Total		3612.84
Memoir Publication Fund		
Cash and securities on hand January 1, 1954	$4525.45	
Receipts and earnings during 1954	957.69	
Total		$5483.14
Expenditures during 1954	75.54	
Cash and securities on hand December 31, 1954 (inc. 2400.00 of restricted principal)	5407.60	
Total		$5483.14

Respectfully submitted,
P. X. PELTIER, *Treasurer*

Copies of the complete Treasurer's report, approved by the Auditing Committee, are on file with the Corresponding Secretary and the Treasurer.

CUSTODIAN

During 1954 the value of items sold by the Custodian amounted to $543.67. These consisted of 2 copies each of Memoirs 1 and 2, 15 of Memoir 3, and 52 of Memoir 4; 20 entire volumes and 117 miscellaneous numbers of the Proceedings; 4 copies of the Traver mite paper; 1 each of sets of unbound papers on mites, Coleoptera and mosquitoes.

Contributions from various sources amounted to 16 entire volumes and 39 miscellaneous numbers.

As the end of the year the status of the 4 Memoirs was as follows:

Memoir	*Original Issue*	*Sold to Date*	*On Hand 12/31/54*
No. 1	300	179	121
No. 2	300	239	61
No. 3	510	234	276
No. 4 1st Printing	784	82	702
No. 4 2nd Printing	626	272	354

Respectfully submitted,
H. J. Conkle, *Custodian*

Copies of the Custodian's complete report are on file with the Corresponding Secretary, the Treasurer and the Custodian.

EDITOR

Six numbers of Volume 56 of the *Proceedings*, a total of 320 pages, were published in 1954. Seventeen pages were devoted to advertising and 303 pages to scientific papers, notes, book reviews and minutes of meetings. This is in contrast to 336 pages published in 1953, all of which were devoted to scientific papers and notes, obituaries, book reviews, and minutes of meetings. During 1954, 18½ published pages were paid for by their authors; in 1953, 39 pages were paid for by their authors. Volume 56 contained 40 original contributions (excluding book reviews, obituaries and minutes) averaging 8 pages in length; Volume 55 contained 48 averaging 7 pages.

Respectfully submitted,
B. D. Burks, *Editor*

CORRESPONDING SECRETARY

Membership — January 1, 1954 (adjusted figure)			498
Reductions:			
Resigned	17		
Retired	1		
Dropped	8		
Deceased	7		
Total		33	
Additions:			
Elected to membership	39		
Reinstated	1		
Total		40	
Net gain in membership, 1954			7
Total membership, Dec. 31, 1954			505
Classes of Membership			
Active, dues paying (16 have not paid since 1951)			486
Life			5
Retired			12
Honorary			2
Total			505

The membership is distributed among 42 states, the District of Columbia, 5 territories and 20 foreign countries.

Circulation of the Proceedings (December 1954 issue):

Via U. S. mail	
States (poundage rate — unstamped)	375
District of Columbia (poundage rate, unstamped)	33
U. S. Territories (poundage rate, unstamped)	18
Foreign countries, stamped	141
Via chain mail	113
Total	680
Distribution:	
To members	465
To subscribers	215
Total	680

The Proceedings go to members and subscribers in 47 states, the District of Columbia, 5 territories and 41 foreign countries.

Respectfully submitted,
LOUISE M. RUSSELL, *Corresponding Secretary*

Date of publication, Vol. 57, No. 1, was February 28, 1955.
Date of publication, Vol. 57, No. 2, was May 16, 1955.

UGUST 1955 VOL. 57, NO. 4

PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

U. S. NATIONAL MUSEUM
WASHINGTON 25, D. C.

PUBLISHED BIMONTHLY

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(Continued inside front cover)

THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings.*

MEMBERSHIP

Members shall be persons over 18 years of age who have an interest in the science of entomology. Annual dues for members are $4.00; initiation fee is $1.00 (U. S. currency).

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

Published bimonthly beginning with February by the Society at Washington, D. C. Members in good standing are entitled to the *Proceedings* free of charge. Non-member subscriptions are $5.00 per year, both domestic and foreign (U. S. currency), payable in advance. All remittances should be made payable to *The Entomological Society of Washington.*

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PROCEEDINGS OF THE

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SOME NOTES ON THE WASPS OF KILL DEVIL HILLS, NORTH CAROLINA, 1954

(Hymenoptera, Aculeata)

By Karl V. Krombein, *Arlington, Virginia*

The wasp fauna at Kill Devil Hills, Dare County, North Carolina has been the subject of a series of papers (Krombein 1950, 1953a, 1953b) listing its composition, habitat preferences and the behavior of some of its members. The earlier papers were based respectively on collections and observations made during 1948, 1950 and 1952. The present contribution is based on similar observations and collections made between June 21 and July 3, 1954. It lists the few species of wasps captured during 1954 which were not taken in previous years and details most of the biological observations.

It was sunny during the day and hot for the entire two weeks. Before this period there had been a prolonged drought for about a month, so that the top few inches of sand were quite dry. About 650 specimens of wasps were collected in the families considered in these papers, representing 114 species and subspecies.

I am indebted to my wife for assistance with some of the photography of the behavior of *Bicyrtes quadrifasciata* (Say), and to my father for helping with some of the collecting. I am also grateful to various specialists for identification of the prey or parasites of the wasps as follows: E. W. Baker (Acarina), H. W. Capps (Lepidoptera), W. J. Gertsch (*Philodromus* in Araneae), A. B. Gurney (Orthoptera), B. J. Kaston (Araneae except *Philodromus*), C. W. Sabrosky (Diptera), and R. I. Sailer (Hemiptera).

Wasps New to the Kill Devil Hills List

The following nine species were not collected in previous years and bring the total number of species and subspecies known from this area to 192 in the families of wasps treated in this series of papers. Those new to the North Carolina State List or Supplements thereto (Brimley 1938, 1942; Wray 1950) are preceded by an asterisk in the following list.

Family **VESPIDAE**

Eumenes fraternus Say. 4 ♀ ♀, 1 ♂; June 22 and 30; in woods; not worn.

**Symmorphus walshianus* (Saussure). 1 ♀; June 27; in woods; not worn.

Family **POMPILIDAE**

**Psorthaspis mariae* (Cresson). 2 ♀ ♀; June 23 and July 1; in woods; slightly worn.

Evagetes parvus (Cresson). 1 ♂; June 21; in woods; quite worn. Recorded in State List as *Psammochares* (*Nannopompilus*) *argenteus* (Cresson), a synonym.

**Agenioideus* (*Gymnochares*) *birkmanni* (Banks). 1 ♀, 1 ♂; June 21 and 23; in woods; the female worn, the male only slightly so.

**Pompilus* (*Anoplochares*) *similaris* (Banks). 2 ♂ ♂; June 23 and 27; in woods; the earlier one fresh, the later worn.

Family **SPHECIDAE**

**Plenoculus davisi atlanticus* Viereck, new status. 4 ♀ ♀, 1 ♂; June 30 and July 1; on barrens on sand with very sparse vegetation; some fresh and some worn. This subspecies has been taken in coastal areas from Connecticut to North Carolina and in Texas. The basal abdominal tergites are distinctly punctate, and the propodeum and abdomen have the silvery pubescence very sparse as contrasted to the nominate race.

Podalonia violaceipennis (Lepeletier). 1 ♀, 6 ♂ ♂; June 21-30; flying over rather sparsely vegetated areas on barrens; some worn and some fresh.

Gorytes (*Pseudoplisus*) *phaleratus* Say. 1 ♀; June 23; in woods; unworn.

Biological Observations on Some Wasps

Family **VESPIDAE**

Wooden trap nests were set out on June 21st in the woods and on the barrens in such situations as in tree crotches, on branches, and on stubs of dead limbs of trees. They were taken up on July 3rd. The nests were made from blocks of soft, straight-grained wood measuring 20x20x180 mm. or 20x20x140 mm. The longer ones each contained a boring of 6.4 or 4.8 mm. diameter, 150 mm. long; and the shorter a boring of 3.2 mm. diameter, 65 mm. long. The trap nests were put out in sets of three, one of each diameter boring in each set. Several of these traps were utilized during this 12-day period by solitary vespids as described below. In discussing these nests the cells are numbered in sequence, the one constructed at the inner end of the boring being designated as the first cell.

Rygchium megaera (Lepeletier)

A female of this species utilized one of the 6.4 mm. diameter trap nests (nest F-4) in open woods. This nest had been tied to the dead stub of a pecan limb together with a 4.8 mm. nest (F-5) which was utilized by a female of *Stenodynerus* (*Parancistrocerus*) *histrio* as reported below.

This trap was split on July 9th to observe the development, the split occurring along a plane which permitted only 5 cm. of the boring nearest the entrance to be seen. The cell nearest the entrance was incomplete and its bottom was 4.5 cm. from the entrance. It contained a shriveled wasp egg, suspended from the top of the boring 10 mm. from the inner end of the cell, and 6 fresh, paralyzed, black lepidopterous larvae. These were identified as the last or penultimate instar of *Nephopteryx nyssaecolella* (Dyar), a phycitid leaf roller on black gum.

The trap was split along a different plane on July 15th which permitted observation of the other cells. Altogether there were 5 completed cells measuring respectively 22, 22, 22, 21 and 20 mm. long in order of construction. There were a few grains of sand at the end of the boring. The partitions closing the cells were of sand grains cemented together, 2-3 mm. thick at the sides and about 1 mm. thick in the middle, except that the partition closing cell 5 had a very thin coating of mud above the sand grains. The cocoons were complete though thin, white, and excluded the meconium and prey remains. Each was flush with the inner end of the cell and extended to within 4 mm. of the partition closing the cell.

On July 9th there was an active, full grown wasp larva in cell 5, which had not yet begun to spin its cocoon. On July 15th all cells contained prepupae enclosed in cocoons, that in cell 1 having been crushed during splitting. The wasps remained in the prepupal stage during the summer and fall, and the trap was placed in an exposed spot outdoors in Arlington, Virginia, for the winter. On April 18th the wasps were still in the prepupal state. The prepupa in this species remains plump and never assumes the dehydrated, flaccid appearance which characterizes the prepupa of *Ancistrocerus a. antilope* (Panzer) which has entered diapause. The trap was still kept outdoors, but was now examined every few days to record development. By April 25th the wasps had transformed to the pupal stage, and were entirely pale except for light tan eyes. The eyes were darker on May 2nd, and the body except appendages had become infuscated by May 6th. The appendages had darkened by May 9th. Adult females eclosed in cells 3, 4 and 5 on May 11th, and in cell 2 on May 12th. These adults remained in their cells until May 16th, by which date the female in cell 5 had broken through the partition capping her cell.

Both sexes of this species have been taken at Kill Devil Hills during each of my previous visits, which occurred from late May or early June until early August. It is possible, therefore, that occasionally there is a partial or complete second generation, even though the single rearing reported above indicates only a single generation.

Stenodynerus (Stenodynerus) ammonia histrionalis (Robertson)

One of the 6.4 mm. diameter nests (Nest E-25) on the barrens was used by a female of this species. This trap had been tied in a horizontal position 60 cm. above the ground near the base of a branch of a scrubby *Quercus marilandica*. The nest was in the full sun and was oriented with the entrance to the southeast.

The boring had been only partially utilized when the trap was taken up on July 3rd. This was determined when the trap was split on July 9th to observe the development. There were seven cells in the boring, measuring 11, 11, 12, 12, 14, 14 and 10 mm. respectively from first to seventh. The partitions between the cells were of sand grains cemented firmly together, and were 1 mm. thick except for the partitions capping the sixth and seventh cells which were 2 mm. thick. There was a wasp prepupa in the first cell on July 9th, but the second to seventh cells had been invaded by miltogrammine maggots of *Amobia floridensis* (Tns.), which had destroyed the wasp eggs or larvae present in those cells. The flies were in the pupal state on July 9th. The cocoon cap made by the wasp larva in the first cell was spun against the inner surface of the partition closing the cell. The walls and inner end of the cell had been lined with silk which also covered the caterpillar frass and the meconium voided by the wasp larva at the inner end of the cell.

The wasp in the first cell had transformed to the pupal stage by July 17th, and was fully colored by July 31st. There was a heavy infestation of unengorged adult mites belonging to *Pyemotes* (=*Pediculoides*) on this pupa on July 31st. They were fully engorged in several days and had killed the wasp. The latter had developed enough so that it could be identified positively as a female *S.* (*S.*) *ammonia histrionalis* (Robt.). The scanty data available suggest that from five to six weeks are required during the summer for the complete cycle from egg to adult.

Desiccated lepidopterous prey remains in the second to seventh cells were identified as belonging to a species of Tortricidae. It was not possible to determine the number of specimens of prey used to stock an individual cell.

Stenodynerus (Stenodynerus) krombeini Bohart

One of the 4.8 mm. diameter nests (Nest E-17) on the barrens was used by a female of this species. This nest had been tied in a horizontal position 60 cm. above the ground near the base of a branch of a scrubby *Quercus marilandica*. The nest was exposed to the full sun and was oriented with the entrance to the southeast.

The boring had been only partially utilized when the trap was taken up on July 3rd, as was determined when it was split on July 9th to observe the development. There were two cells at the end of the boring, 17 and 18 mm. long respectively, which were capped by partitions, 2 mm. thick, of sand grains cemented firmly together. The wasp had begun a third cell, for an egg was suspended by a slender thread 4 mm. beyond the partition capping the second cell. The wasp larvae had lined the walls and inner end of the cells with silk, and both cells had a silken cap toward the outer end, 1.5 mm. inside the closing partition in the first cell, and 7 mm. from the closing partition in the second. The wasp larvae had covered with silk the caterpillar frass excreted by the stored prey, and each had voided its meconium at the inner end of the cell and covered it with silk.

When the trap was split open on July 9th the immature wasps in the first and second cells were in the prepupal stage. They had transformed to pupae by July 17th, on which date they were creamy white except for reddish-brown eyes. On July 31st there was a fully emerged but teneral adult female in the first cell and a fully colored female pupa in the other cell. Both were infested with clusters of numerous engorged adult mites belonging to *Pyemotes*. The wasps did not develop further and were killed by the mites within a few days. The available data indicate that the cycle from egg to adult requires a month to five weeks during the summer.

The specimens of prey were entirely consumed by the wasp larvae. The pellets of frass voided by the prey indicate that lepidopterous prey was provided, which would be normal for wasps of this genus.

Stenodynerus (Parancistrocerus) histrio (Lepeletier)

A female of this species constructed a couple of cells in a 4.8 mm. diameter nest (Nest F-5) in open woods. This nest had been tied in a subhorizontal position a meter and a half above the ground on the dead stub of a pecan limb. The nest was in full shade and the opening was toward the east.

The trap was split on July 9th to observe the development. There were two cells at the end of the boring, 19 and 18 mm. long respectively, each containing a wasp prepupa. There was a thin layer of mud at the end of the boring, and the partitions capping the cells were ½ mm. thick and composed mostly of mud with a few interspersed sand grains. There was a shriveled wasp egg in what would have been the third cell, suspended by a slender thread from the wall 4 mm. from the partition closing the second cell. The walls and ends of the cells were sheathed with silk, the latter also covering the larval meconium of the wasp at the inner end of the cell and a few pellets of frass from the prey.

The wasps in the first and second cells had transformed to pupae by July 15th. On that date the one in the first cell was dead, and that in the second was entirely pale except for the brownish eyes. By July 30th the pupa in the second cell was fully colored, but was infested by adult mites belonging to *Pyemotes*. It had been killed by these mites several days later, but had developed sufficiently so that it could be identified as a male *S.* (*P.*) *histrio* (Lep.). The available data indicate that the cycle from egg to adult requires a month to five weeks during the summer.

The specimens of prey were entirely consumed by the wasp larvae, but the pellets of frass voided by them were of lepidopterous origin.

When the trap was split on July 9th there were two active adult mites on the wasp prepupa in the first cell, and one such mite on the prepupa in the second cell. On July 15th one female and one male were recovered from the second cell and preserved for future study, but none could be found in the first cell. These mites belong to the genus *Kennethiella*, the species of which are external parasites of several genera of solitary Vespidae. The female in the second cell had deposited nearly 50 eggs on the wasp pupa by July 15th, but the eggs were destroyed by the *Pyemotes* mites which gained access to the nest between July 15th and 31st. This species of *Kennethiella* is distinct from a species recovered from a nest of *Stenodynerus* (*Parancistrocerus*) *perennis anacardivora* (Rohwer) in Florida (Krombein and Evans, in press).

Family **POMPILIDAE**

Sericopompilus apicalis (Say)

A worn female (7254 H), 9 mm. long, was captured on the barrens at 4:10 p.m. on July 2nd as she attempted to fly with a small paralyzed spider 5.6 mm. long. The prey was an adult female of a plant-dwelling thomisid, *Philodromus washita* Bks.

Episyron posterus (Fox)

This species, as in previous years, was one of the most abundant pompilids both in the woods and on the barrens. Most of the individuals captured on the barrens were males, while most of those noted in the woods were females. Observations were made on the nesting or prey transport of five females in the latter habitat. All were using epeirid spiders as prey as follows: 62754 A, a somewhat worn female 8.5 mm. long, the spider a juvenile female 7.7 mm. long of a species of *Neoscona*, on June 27th at 2:20 p.m.; 62954 D, an unworn female 9.5 mm.

long, the spider probably the same species as that recorded for 7254 A but smaller, at 3:45 p. m. on June 29th; 63054 B, a somewhat worn female 9 mm. long, the spider an adult female 10.5 mm. long of *Eustala anastera* (Walck.), on June 30th at 1:40 p.m.; 7254 A, an unworn female 8 mm. long, the spider a juvenile female 8 mm. long of a species of *Araneus*, at 10:20 a.m. on July 2nd; and 7254 B, an unworn female 9 mm. long, the spider an adult female 5.6 mm. long of *Eustala cepina* (Walck.), at 10:25 a.m. on July 2nd.

Three of the females cited above, 62754 A, 7254 A and 7254 B, were captured with their paralyzed prey during or after transport. One female (62754 A) had cached her spider several centimeters off the ground in a plant in the angle formed between a leaf petiole and the margin of the rounded leaf.

Some data were obtained on burrow construction and provisioning by the other two females, 62954 D and 63054 B. In both cases the burrows penetrated the sand at an angle of 45° to the horizontal, 62954 D in a northerly direction, the other in a southerly direction. Each ended in a small rounded cell 7.5 and 6 cm. below the surface respectively. Both burrows had been entirely filled with sand flush to the surface.

No egg could be found on the spider stored by 63054 B. The wasp egg had been placed obliquely on the right side of the venter of the abdomen of the spider stored by 62954 D. The spider was completely paralyzed and was incapable of reflex movements that evening. The wasp egg hatched on July 1st and the larva was sucking fluid from the spider's abdomen that evening. The larva was still feeding with its head inside the abdomen the next evening. By the evening of July 3rd the abdomen had been completely devoured and the larva was now feeding externally on the cephalothorax. It had eaten the spider completely by the next evening and was beginning to spin its cocoon, so it was preserved at that time for future taxonomic study.

Anoplius (Lophopompilus) atrox (Dahlbom)

A slightly worn female (7254 E), 14.5 mm. long, was captured at 11:40 a.m. on July 2nd in a rut in the woods road. She was struggling to free her paralyzed prey, a giant fishing spider 21 mm. long, from some fine tree roots in which it was entangled. This pisaurid spider was a female in the penultimate instar of *Dolomedes tenebrosus* Hentz.

Family **SPHECIDAE**

Chlorion (Palmodes) daggyi (Murray)

Some behavioral and life history data were obtained on two females, 62454 A, a worn specimen, and 62454 B, an unworn specimen. The former was observed at 1:45 p. m. on June 24th dragging a paralyzed adult male grasshopper to her burrow between the ruts of the woods road. She came to the surface a minute or so after pulling her prey into the burrow and began to fill in. Some sand was flung backward beneath her body with her forelegs, but most of it was pulled down from the burrow ceiling. She pressed the loose sand down with her head, accompanied by audible buzzing. Several centimeters at the top of the burrow were left unfilled. She flew off at 1:51 to clean herself on a shrub 10 meters away, and I captured her at that time. The burrow entrance was 2.5 cm. in diameter, and the burrow went in at an angle of 30° to the horizontal in a northerly direction. The grasshopper was in a cell 5 cm. below the surface.

The other female (62454 B) was just filling in her burrow under pine needle litter at the edge of the woods road at 2:44 p. m. on June 24th. She was captured when the burrow was filled almost to the surface. This burrow also went in at an angle of 30° to the horizontal and ended in a cell 5 cm. below the surface, but it penetrated the sand in a westerly direction. The prey in this case was similarly colored, but a female.

The wasp egg on each grasshopper was appressed to the lower part of the left side of the thorax above the hind coxa, and measured respectively 4.5 and 4.2 mm. long. Both grasshoppers exhibited jerky reflex movements that evening and had voided excrement several times. Both eggs hatched on the 26th and the wasp larvae were sucking fluid from the thorax that evening. The larvae had devoured all the prey except for a few fragments by the evening of June 29th, and 62454 A had started to spin a cocoon. The other larva was preserved at that time for subsequent taxonomic study. The prey fragments of both tettigoniids were determined as belonging to a species of *Atlanticus*.

The cocoon of 62454A had been completed by the evening of July 1st. A male wasp 18 mm. long emerged from the cocoon on July 26th.

A network of loose threads attached the cocoon proper to the edge of the rearing tin and to the sand. The outer envelope is fusiform, 26 mm. long and 7 mm. wide in the middle, the tail abruptly narrowed 4 mm. from the end. It is composed of an irregular network of fairly close threads varnished over with a secretion which turns the silk dark brown. Beneath this outer envelope is a continuous thick silken thread which begins at one end and covers the entire wall in a moderately close coil (approximately 0.5 mm. between each convolution). Inside this coil is an inner envelope of varnished silk identical with the outer envelope. The larval meconium occupies the constricted tail end of the outer envelope, the inner cocoon being short fusiform and 19 mm. long. At the head end of the outer cocoon is a small opening. About 2 mm. inside this opening is a cap 1 mm. thick composed of thick silken threads criss-crossing to form a rather close, though open, mesh. The head end of the inner cocoon has at the tip a small circular area of tightly spun golden silk with a tiny depression in the middle. However, this pore is varnished over on the inside of the inner cocoon. The adult wasp escaped from the cocoon by cutting transversely through the two envelopes 6 mm. from the end of the inner cocoon to form an irregular cap.

Sphex procerus (Dahlbom)

A cocoon of this species was found on June 30th in a cell 6 cm. below the surface during the excavation of a burrow of *Bicyrtes quadrifasciata* (Say) (62954 A). This burrow was in the area between the wheel ruts of the sand road through the woods. A male of *Sphex procerus* emerged from this cocoon between July 8th and 13th.

This species also spins a double cocoon. The outer envelope is composed of very fragile, light brown silk, similar in texture to the cocoon of *Sceliphron caementarium* (Dru.), and in this specimen was about 25 mm. long. The inner cocoon is also very fragile, 21 mm. long, and more or less fusiform with a blunt head end and a tapering tail end 2.5 mm. long containing the larval meconium. The outer surface of the inner cocoon is a very light brown with a matted appearance, and the inner wall is varnished light brown. There is no pore at the head end. The wasp, which was 26 mm. long, escaped by cutting transversely through the two envelopes about 4 mm. from the head end of the inner cocoon.

Bicyrtes quadrifasciata (Say)

A small colony of several dozen females was found along the sand road through the woods. The nesting sites were in a stretch of the road about 100 meters long which was exposed to the sun during most of the day. Most of the nests were constructed in the raised area of dry sand between the wheel ruts. I did not start to make nesting observations before June 27th, but somewhat worn males were present on June 21st, and somewhat worn females were collected on the following day. I did not observe any actual matings, but males were actively cruising up and down the road for the entire period during most of the day, and occasionally one would pounce on one of the nesting females on the ground and attempt to mate.

The nesting burrows were rather constant in several features. In every case the burrow was started on a horizontal surface (fig. 1). The eight burrows I dug up penetrated the sand at an angle between 30° and 45° to the horizontal. The cells were horizontal in position, elongate fusiform in shape, from 2.2 to 2.5 cm. long and 1.3 cm. high, and were at distances varying from 6 to 10.8 cm. below the surface. There was only one terminal cell in each burrow except in one case. In this latter nest (62954 A) there was a burrow going into the sand toward the northwest at an angle of 30° to the horizontal, and terminating 8 cm. below the surface in a cell containing 10 specimens of prey and a wasp egg which was injured during my excavation. There was a plug of loose sand about 2.5 cm. long above this terminal cell, and then a lateral burrow off toward the east 10.5 cm. long at an angle of 30° to the horizontal. This lateral burrow also contained some loose sand and terminated in a cell containing 11 specimens of prey, but no wasp egg could be found.

Most burrow construction took place during the morning, though at least two females were observed excavating burrows during the afternoon. Since the burrows were dug in pure sand, the excavation required very little time and was completed in an hour and a half in the two examples which were timed from beginning to end of the construction. After a female selects some particular spot on the surface she inclines her body at an angle of about 30° to the horizontal with her head near the sand, and supporting herself on the mid and hind legs begins to dig out the sand with her forelegs, flinging the loose sand beneath and behind her body some 22 to 30 cm. As the burrow deepens, the loose sand accumulates in the burrow behind her body and is pushed out to the surface periodically by her abdomen and hind legs and then is dispersed over the area behind the entrance as noted above. The excavated sand is spread over such an area behind the entrance that no mound or pile of sand is formed. After the burrow and cell have been dug, the wasp comes to the surface head first and begins to make a temporary closure in the top centimeter or so of the burrow by raking sand with her forelegs beneath her body and into the burrow. Usually she flies up several times to inspect the degree of concealment, returning to scratch more sand over the entrance from several directions until the surface is completely smooth with no trace of the entrance. Then she makes one or several short reconnaissance flights in the immediate area, ascending slowly in irregular spirals to a height of about 3 meters, and finally disappears to hunt for her first prey, a nymphal pentatomid or coreid in the second to fifth instars.

Bicyrtes quadrifasciata (Say): fig. 1, female beginning to excavate burrow, June 27; fig. 2, a different female (62954 A) in flight with a paralyzed nymph, probably of *Archimerus alternatus* (Say), June 29—note that prey is clasped with both mid and hind legs; fig. 3, another female (62854 B) just after alighting at concealed burrow entrance with paralyzed nymph of *Archimerus alternatus* (Say), June 28—note that prey is now held by mid legs only; fig. 4, the same female a moment later as she digs through the loose sand concealing the burrow entrance. About 1.6 x.

I was able to make an accurate record of the elapsed time between completion of the burrow and bringing in of the first prey in two cases. This was 25 minutes for 62854 A and 18 minutes for 62954 A. Of course, it is quite possible that these two females may not have gone directly from burrow construction to prey hunting, but may have visited flowers before beginning to hunt. Seven provisioning flights, or at least the elapsed time between bringing in of successive nymphs, were timed for 62954 A, 62854 C and 7154 C, and these varied from 7 to 35 minutes, with a mean elapsed time of 16½ minutes per flight.

The wasp in flight with her prey (fig. 2) clasps it beneath her, head forward and venter up, with her mid and hind legs, most of the bug being beneath her abdomen. She almost invariably approaches the burrow from two to three meters above the surface, and from a direction opposite to that in which the burrow penetrates the ground. Reaching a point several meters above and behind the entrance she descends extremely slowly in a straight line to the concealed burrow entrance, making a noticeably loud humming noise as she descends. She alights right at the entrance(fig. 3), still clutching the bug beneath her, and rapidly scratches the loose sand out of the way with her forelegs (fig. 4) and disappears inside with her prey. Photographs taken with the aid of electronic flash apparatus demonstrate that during the process of opening the entrance the wasp clutches the bug beneath her abdominal venter with the mid legs only, digs with her forelegs, and steadies her body by bracing her hind legs against the sides of the burrow. Usually less than half a minute is required for her to place the bug in the cell. She emerges head first, and walking forward away from the burrow scratches sand beneath and behind her to cover the entrance. Then she flies off without making a reconnaissance flight. One female (62954 A) approached her burrow several times with prey in the manner described above, but at least once she brought a bug to the entrance, flying only a few centimeters above the ground for some distance. However, the approach from a pronounced height is the usual procedure, and has been noted by other observers (Parker 1917; Rau and Rau 1918; Smith 1923).

After the cell has been completely stocked with prey, the wasp fills about two centimeters of the burrow adjacent to the cell with loose sand. She then comes to the entrance head first and rakes in some sand beneath her to fill the top few centimeters of the burrow. One female (62854 C) flew out several times and hovered over the area to inspect the degree of concealment. Each time she returned, backed into the burrow and raked in more sand. After the burrow is filled flush with the surface, the wasp scratches sand beneath her toward the entrance from several different spots until the entire area is smoothed over. None of the sand in the burrow is compacted and is much looser than the adjacent sand. Consequently the observer who knows the general location of the burrow can always find the entrance by blowing gently on the surface, thus displacing the filled-in sand faster than the surrounding sand and uncovering the burrow entrance.

I excavated a total of nine cells, four of which were fully stocked with prey. Each cell, completely stocked or not, had a mixture of nymphs of several instars, and in every case but two, of two or more species. The contents of these cells are as shown in Table 1. Specimens of each instar of each species represented were identified as follows: COREIDAE—*Archimerus alternatus* (Say) [2nd, 3rd (9 mm. long) and 4th (14.6 mm. long) instars] and *Leptoglossus oppositus* (Say) [3rd (9 mm. long) instar]; and PENTATOMIDAE—*Euschistus tristigmus* (Say) [4th and 5th (8 mm. long) instars], *Thyanta custator* (F.) [4th (5.6 mm. long) and 5th instars], *Brochymena carolinensis* (Westw.) [3rd (10.5 mm. long) instar], and *Dendrocoris humeralis* (Uhl.) [5th instar].

In addition to the prey records listed above, two females were captured while flying with their prey. One (7154 A) was taken in the woods carrying a paralyzed fourth instar nymph of the pentatomid, *Edessa florida* Barber, and one

(7154 D) was captured on the barrens with a third instar nymph of *Brochymena carolinensis* (Westw.).

From Table 1 it will be noted that the number of nymphs in completely stocked cells varied from 9 to 14. In connection with the total number of nymphs required to bring a larva to maturity, mention should be made that the larvae of 62854 A and 62854 B which came from only partially stocked cells, were reared to maturity by adding nymphs from other cells to the rearing tins containing these two larvae. Thus, 62854 A was brought to maturity by adding one third instar and two fourth instar nymphs of *Archimerus* to those listed in Table 1, and 62854 B by adding one fourth instar of *Archimerus* and two fifth instar of *Euschistus* to the nymphs listed in Table 1.

TABLE 1. Contents of excavated cells by species and instar. Cells marked with an asterisk were completely stocked.

	COREIDAE		PENTATOMIDAE			
	Archimerus	*Leptoglossus*	*Euschistus*	*Brochymena*	*Thyanta*	*Dendrocoris*
62854 A	3 in 3rd 1 in 4th		1 in 4th			
62854 B	4 in 3rd 1 in 4th		1 in 4th			
62854 C*	2 in 3rd 4 in 4th		3 in 5th			1 in 5th
1st cell 62954 A	7 in 3rd 1 in 4th		2 in 4th			
2nd cell 62954 A	1 in 2nd 8 in 3rd 2 in 4th					
62954 E	3 in 3rd 3 in 4th	1 in 3rd	1 in 5th			
7154 B*	3 in 3rd 3 in 4th			2 in 3rd	1 in 5th	
7154 C*	13 unidentified nymphs infested with miltogrammine maggots					
7254 C*	10 in 3rd 1 in 4th				3 in 4th	

There is one additional matter requiring comment in connection with the prey recovered from the cells listed in Table 1. That is, that nymphs of *Archimerus alternatus* were recovered from each cell in which the contents were identified specifically, and that nymphs of this species constituted the majority of prey in each cell. It appears that there was a decided preference at this season among members of this *Bicyrtes* colony for *Archimerus*. Probably this species was sought for primarily (because it was the most readily available?), the other species of Coreidae and Pentatomidae stored being randomly met with in the search for *Archimerus*. A corollary supposition is that probably only one or several plants may be visited in searching for prey.

The specimens of prey were rather thoroughly paralyzed by the wasp, and were capable of only very weak reflex actions of the legs and antennae. The paralysis was permanent and some specimens from the first cell of 62954 A were kept alive in a rearing tin full of sand for two and a half weeks. They might have been kept alive even longer, but the sand in this tin was inadvertently allowed to dry out and the specimens were dead when examined three weeks after having been paralyzed.

A female requires all of one day and part of another to excavate a burrow, stock the cell completely and make a final closure. The beginning and end of the entire process were observed for only two individuals, 62854 C and 7254 C. The former began excavation of her burrow at 10 a.m. on June 28th, made a temporary closure and reconnaissance flight at 11:25, and was observed making the final closure at 1:55 p.m. on June 29th. The other wasp probably began her excavation about 9 a.m. on July 2nd, for she made a temporary closure and reconnaissance flight at 10:30 a.m. The final closure was made at 1:25 p.m. on July 3rd. Five other females were observed excavating their burrows on one day and still bringing in prey on the following day more than 24 hours later.

Only one deviation was noted from the practice of a female to construct a single cell at the end of a burrow. This female (62954 A) was first observed at 10 a.m. on June 29th while she was excavating her burrow. She completed this, filled in the entrance, and made the usual reconnaissance flight at 10:20. She returned with her first bug at 10:38, and then brought in successive specimens of prey at 10:49, 10:56, 11:19, and 11:27. Additional observations at this site were discontinued for a while, but the wasp was noted bringing in another bug at 2:29 p.m. on the same date. At 2:41 she began to excavate a lot of sand from the burrow, just as though she was engaged in constructing a burrow. This process was still going on at 3:05 when I left for a short time. When I returned at 3:26 there was a temporary closure of sand at the burrow entrance. This burrow was excavated at 3 p.m. on June 30th, and was found to consist of a single cell at the end of the first burrow, and a second cell at the end of a lateral burrow as described in the second paragraph. There was an injured wasp egg in the cell at the end of the main burrow which may have been injured during excavation. The first cell probably was completely stocked for there was loosely packed sand above it to the junction of the main and lateral burrows. No egg was recovered from the cell at the end of the lateral burrow. The wasp was captured at 3:35 p.m. when she flew in with another nymph. This wasp was aberrant also in one other respect. She was the only one noted that occasionally approached her burrow flying only a few centimeters above the ground.

It was determined during the excavation of several cells that the egg is laid on the first nymph brought in. This nymph is placed on its back at the far end of the cell. The egg is deposited on the thoracic sternum, usually on the midline between the fore and mid coxae, and stands upright. In one case it was laid on the abdominal sternum mesad of the apex of the left hind coxa. In those cells where uninjured eggs were recovered, the contents of the cell were placed in a depression in damp sand in an ointment tin for rearing.

The duration of the egg stage was not determined exactly, for the rearing tins were examined only once a day in the evening. The available data indicate that the egg stage lasts between 1½ and 2½ days.

Upon hatching, the larva remains attached at the oviposition site by the tip of its abdomen. It reaches over and begins to feed on a nymph adjacent to the one to which it is attached. The larva remains attached to this first nymph as it grows and continues to feed on the other nymphs stored for it. The larva usually devours all the contents of the cell before spinning its cocoon. The larval stage lasts between two and three days Three reared females (62854 A, 62854 B, 7154 B) emerged from cocoons from August 12th to 15th, 42 days after the larvae had begun to spin, so the total cycle from egg to adult requires almost seven weeks at this time of the year.

The cocoons of the three reared specimens are fusiform in shape, and vary in length from 17 to 20 mm. and in width from 6.5 to 7 mm. They are constructed of a single layer of sand grains held firmly and closely together by a network of pale brown silk. Encircling the cocoon at the midpoint is a series of from five to seven scattered pores of which the method of construction and use are unknown. Each of these pores on the outer surface of the cocoon appears as a tiny tube of about 0.2 mm. diameter. On the inner surface the pore is represented by a low raised mound of black material (of meconial origin?) surrounded by a thin rim of white substance about 1 mm. in diameter. The larval meconium is voided at the tail end of the cocoon. The adult wasp emerges by cutting an irregular cap at the head end about 2 or 3 mm. from the tip.

This wasp is parasitized to some degree by the miltogrammine fly, *Senotainia rubriventris* Macq. Specimens of this fly were reared from two (7154 B and 7154 C) of the nine cells which I dug up. There was only one miltogrammine maggot in cell 7154 B, so I was able to rear the wasp to maturity. The habits and life cycle of this fly are discussed in detail in a section which follows on the biology of the Miltogrammini.

Several observers have published observations on the nesting habits, prey preferences and life cycle of this species (Parker 1917, p. 134; Rau and Rau 1918, pp. 41-42; Rau 1922, p. 28; Smith 1923, pp. 238-246; Rau 1934, p. 260; Krombein 1953a, p. 287). The noteworthy differences from the information recorded above may be summarized as follows. Both Rau and Rau in Kansas and Smith in Mississippi found burrow construction in sand much as I have described it. However, Rau and Rau state that the two burrows they excavated were 12 and 17 inches long, the cell of the latter being 9½ inches below the surface, and Smith found the cell to be about 6 inches below the surface. Rau and Rau record the prey as several species of nymphal Pentatomidae in Kansas, Rau (1934) records the wasp flying with a nymph of the coreid, *Anasa tristis* (DeGeer) in Missouri, Parker found it using nymphs of the pentatomid, *Nezara* in Ohio, and Krombein caught it with a nymph of the pentatomid, *Nezara viridula* (L.) at Kill Devil Hills, N. C. Smith records the following nymphs as prey in Mississippi and states that they were of various sizes and instars, but gives no figures as to the average number of nymphs found in a completely stocked cell: Pentatomidae—*Acrosternum hilare* (Say), *Brochymena quadripustulata* (F.), and *Euschistus* sp.; Coreidae—*Archimerus calcarator* (F.), *Leptoglossus phyllopus* (L.), *Chariestrus antennator* (F.) and *Acanthocephala femorata* (F.); and Reduviidae—*Zelus* sp. and *Apiomerus* sp. Smith also states that the leaf footed plant bug [*Leptoglossus*] and the green soldier bug, [probably *Acrosternum*] were stored most commonly. Smith is the only other worker who has published information on the duration of stages in the life cycle. The averages (extremes in parentheses) he gives for the various stages are 2 days (1-3 days) for the egg, 6 days (3-14 days) for the larval, and 25 days (15-40 days) for the pupal.

Biological Observations on Some Miltogrammini (Sarcophagidae)

I obtained a limited amount of information on the behavior and host relationships of some of these interesting wasp inquilines during the observations on wasp biology which are reported in the preceding section.

Amobia floridensis (Townsend)

Members of this genus apparently may have as hosts almost any wasp which builds clay cells or uses earth in the construction of cell partitions in pre-existing cavities in wood. Allen (p. 11) reports that this particular species has been reared from clay cells of *Sceliphron caementarium* (Dru.) and the type series of *Sarcomacronychia trypoxylonis* Tns., a synonym of *floridensis,* was reared from clay cells of *Trypoxylon politum* Say. It preys also on wasps which nest in pre-existing cavities and make earthen partitions between the cells, for I reared it from three of the wooden trap nests used by solitary vespids as reported in the preceding section.

The first of these nests (E-26) had a 4.8 mm. diameter boring and had been tied 60 cm. above the ground near the base of a branch of scrubby *Quercus marilandica* on the barrens. It contained 10 cells built by an unknown solitary vespid with the cell partitions of sand grains cemented firmly together, and with a closing plug of sand grains 4.5 mm. thick. When the nest was split on July 9th, eight dipterous puparia were found near the plug closing the entrance. During the larval stage they had made a shambles of the interior of the nest, breaking through the cell partitions, destroying all the wasp eggs or larvae, and feeding on the lepidopterous prey stored for the wasp larvae. Fragments of the latter were identified as belonging to a species of Tortricidae. Four females and four males of *A. floridensis* emerged from the puparia from July 15th to 17th.

The wooden trap nests had been placed in a cardboard carton after they were collected from the field on July 3rd. When they were examined on July 9th it was found that eight dipterous maggots had emerged from two of the nests (E-25, E-38) and had transformed to puparia in the carton. Four females and three males of *A. floridensis* emerged from these puparia from July 20th to 22nd. *Stenodynerus ammonia histrionalis* (Robt.) was the host wasp in Nest E-25. The maker of the other nest is unknown, though presumably it was a solitary vespid, for remains of some of the prey stored by the wasp comprised five specimens of a species of Olethreutidae and nine specimens of a species of Gelechiidae. The latter nest contained only three cells from 19 to 21 mm. in length. It had been tied in a horizontal position to a branch of a scrubby live oak 38 cm. above the ground on the barrens in full sun with the entrance to the southwest.

From the data reported for Nest E-26, a calculation can be made that the entire cycle from deposition of the dipterous larvae in the nest to emergence of adult flies requires not much more than three weeks, and probably less. This trap nest was set out on June 21st and probably several days elapsed before the host wasp began to nest in it, and certainly it took a few days for the wasp to construct and stock 10 cells. The flies began to emerge on July 15th.

Senotainia rubriventris Macquart

Allen (p. 26) records this species as having been reared from *Bicyrtes quadrifasciata* (Say) and from an unidentified wasp which stored grasshoppers. It was also captured after entering a burrow of *Oxybelus quadrinotatus* Say. Undoubtedly it preys upon a wide variety of ground-nesting wasps, for this summer I captured two females (63054 A, 7254 F), each trailing closely behind a hunting female pompilid, *Anoplius cylindricus* (Cr.), on the barrens at 9:30 a.m. on June 30th and at 2:38 p.m. on July 2nd respectively. During my observations of *Bicyrtes quadrifasciata* I saw specimens of this fly dash rapidly into burrows right on the heels of a female wasp laden with her hemipterous prey, and come out seconds later but before emergence of the wasp. These flies did not trail the wasp, but lay in wait for her at the burrow entrance.

One fly dashed into a burrow after a *Bicyrtes* (7154 C) at 12:30 p.m. on July 1st along the woods road. This burrow was excavated at 11 a.m. on July 2nd, some time after the wasp had made a final closure, and it contained 13 paralyzed hemipterous nymphs, an undamaged wasp egg on the first nymph in the cell, and at least 10 dipterous maggots, four each on two nymphs and one each on another pair. Ten hours later the wasp larva had hatched but was not yet feeding. On the following evening the dipterous maggots were quite large and were feeding on the bugs like typical sarcophagid maggots, but the wasp larva could not be found, presumably having been destroyed by the maggots. All the miltogrammine maggots had entered the sand in the rearing tin to pupate on the evening of July 4th. On July 18th six females and eight males of *S. rubriventris* emerged, and there was also one dead puparium in the sand in the tin.

One miltogrammine larva was found in the cell of another *Bicyrtes* (7154 B) when it was excavated at 11:15 a.m. on July 2nd. This cell contained also nine paralyzed hemipterous nymphs and an uninjured wasp egg. A male *S. rubriventris* emerged from this rearing tin on July 20th, and the wasp larva also was able to transform and emerged as an adult on August 15th.

Senotainia litoralis Allen

Presumably this species is rather similar to *rubriventris* in behavior and life history. There are no available host records. I captured two females on the barrens while they were closely trailing wasps. One (62654 A) was following a hunting female pompilid, *Anoplius apiculatus pretiosus* (Bks.) at 3:40 p.m. on June 26th, and the other (7354 A) was shadowing a preyless *Microbembex monodonta* (Say) as she opened her burrow at 10:25 a.m. on July 3rd.

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BOOK REVIEW

THE EVOLUTION AND TAXONOMY OF THE SARCOPHAGINI, by Selwyn S. Roback. Illinois Biological Monographs, vol. 23, nos. 3-4, v + 181 pp. University of Illinois Press, Urbana, 1955.

This appears to be a careful and well-documented classification, with a bibliography of 305 titles and 34 well-executed plates of figures, of which all but one are original. However, only 4 species are illustrated for the first time, and the work is more incomplete than its title would indicate. From a study of 145 species, chiefly Nearctic, the author has recognized and keyed 35 genera which are distributed among 2 tribes and 12 subtribes. Nine of the supergeneric names are new, but they are not identified as such. Seven new Nearctic genera, with 4 new subgenera, are established from *Sarcophaga*.

The student using this should bear in mind that 119 generic names proposed before 1937 and referred to the tribes Agriini, Stephanostomatini (=Sarcophagini) and Moriniini by Townsend (1937-38, *Manual of Myiology*, Vols. 5 & 6) are omitted, and that no provision is made for the Melanophoridae (*sensu* Townsend) (=Rhinophorinae, *sensu* Séguy), which would key nearly as a group to Sarcophaginae in Roback's previous classification (1951, *Ann. Ent. Soc. Am.* 44: 327-361).

Townsend indicated in 1917 that a study of females and larvae would be essential to classify this group, and that the life-history stages (of the saprophagous species) can be easily reared from gravid females. It is disappointing to see a modern classification based purely on the males when the other stages of many species certainly are available.

Certain generic names are misspelled, and there is only a short paragraph on all previous classifications. The terminology is partly unfamiliar, but Chart I homologizes the terminology of various authors (except Lopes and Aldrich).

No reviewer can hope to satisfy all his critics, and the tendency is to be hypercritical when one is close to the subject. The classification of this group is difficult; the reviewer will point out that he does not have a better system.—HAROLD R. DODGE, *U. S. Forest Service, Federal Building, Missoula, Mont.*

NEW REARED BRACONIDAE FROM TRINIDAD
(Hymenoptera)

By C. F. W. Muesebeck, *U. S. National Museum, Washington, D. C.*

In the course of studies concerned with the biological control of *Ancylostomia stercorea* (Zeller), a phycitid which is a serious pest of pigeon peas in Trinidad, several new parasites have been reared for which names have been requested. Three new Braconidae which have been submitted to me for identification are described here, and in addition, a second new *Phanerotoma* which is very similar to the one from *Ancylostomia*.

Bracon cajani, new species

From *Bracon thurberiphagae* (Mues.), which often parasitizes the same host, this species may be distinguished at once by its smooth and polished abdomen, the complete lack of notaulices, and the much longer ovipositor which is nearly or quite as long as the thorax and abdomen combined.

Female.—Length of type about 3.5 mm. Head, thorax and abdomen smooth and polished, with only the face delicately alutaceous and mat; face receding; temple receding slightly, much narrower than eye; antennae usually 23- to 28-segmented; suture at base of scutellum very fine pitted; propodeum without the usual short median longitudinal keel or carina at apex; second tergite (fig. 3) with a shallow, somewhat curved, longitudinal groove each side toward lateral margin, and with posterior margin strongly sinuate.

Yellowish ferruginous; antennae, including scapes, black; mesopectus, and lateral mesonotal lobes posteriorly, sometimes more or less blackish; hind tibiae at extreme apices and hind tarsi black; tegulae yellow; wing bases blackish; forewing somewhat infumated toward base, hyaline apically, veins dark, stigma light brown but outlined with dark brown.

Male.—Essentially like the female, but with the fifth or sixth tergites, or both, sometimes blackish medially.

Type.—U. S. National Museum No. 62539.

Type locality.—St. Augustine, Trinidad, B. W. I.

Described from the following material, all reared from *Ancylostomia stercorea* (Zeller) in pigeon peas by F. D. Bennett except as otherwise noted: Three ♀♀ (including type) and two ♂♂, St. Augustine, Trinidad, February 1952; two ♀♀, Paradise Mt., Trinidad, March 1953; four ♀♀ and seven ♂♂, Paradise Mt., Trinidad, January 1952; ten ♀♀ and five ♂♂, Tacarigua, Trinidad, December 1951, F. J. Simmonds; two ♀♀, Arouca, Trinidad, December 1951, F. J. Simmonds; eight ♀♀ and three ♂♂, St. Augustine, Trinidad, May 5, 1949, E. McC. Callan; one ♀ and three ♂♂, St. Augustine, Trinidad, June 9, 1942, R. G. Fennah, and two ♀♀, Paradise Mt., Trinidad, March 1952.

Apanteles etiellae isolatus, new subspecies

Structurally this appears to be identical with typical *etiellae* Viereck, but it may be distinguished at once by its clear hyaline stigma. In *etiellae* the stigma is dark brown.

Type.—U. S. National Museum No. 62542.

Type locality.—St. Augustine, Trinidad, B. W. I.

Described from the following specimens, all reared from *Ancylostomia stercorea* (Zeller) in pigeon pea; Eleven ♀♀ (including type) and six ♂♂, St. Augustine, Trinidad, May 5, 1949, E. McC. Callan; one ♀ and two ♂♂, Tacarigua, Trinidad, December 1951, F. J. Simmonds; three ♀♀, St. Augustine, Trinidad, February 1952, F. D. Bennett; five ♀♀ and two ♂♂, Paradise Mt., Trinidad, January and March 1952, F. D. Bennett; three ♀♀ and two ♂♂, St. Augustine, Trinidad, June 1942, R. G. Fennah; three ♀♀, Grenada, March 1954, F. D. Bennett, five ♀♀ and three ♂♂, British Guiana, February 1954, F. D. Bennett; two ♀♀ and one ♂, Virgin Gorda, V. I., February 1954, and two ♀♀ and one ♂, Roseau, Dominica, B. W. I., May 1954, F. D. Bennett.

Phanerotoma bennetti, new species

Distinguished from the following species, which it closely resembles superficially, in having the second abscissa of the radius much longer than the first, in its shining clypeus, and in usually having only the apex of the scutellum black.

Female.—Length about 4 mm. Face more than twice as wide as long from base of antenna to clypeal fovea, very finely rugulose; eyes large and prominent; malar space less than half as long as clypeus and shorter than distance from clypeal fovea to eye; clypeus very large, smooth and shining, with only scattered and very shallow punctures, its lower margin broadly rounded; extreme width of temple less than half width of eye; frons and vertex transversely rugulose on a delicately granular surface; antenna 23-segmented, the apical segments somewhat flattened, much shortened and narrowed. Mesoscutum uniformly granularly rugulose; notaulices weakly suggested anteriorly; disc of scutellum with fine longitudinal sculpture; propodeum finely granular, with an incomplete transverse carina slightly before middle and a few short rugae extending forward from it; pleura finely granular and dull; hind coxa shining, a little alutaceous on outer side; hind tibia strongly thickened apically, its longer calcarium more than half as long as hind metatarsus; first abscissa of radius much shorter than second and shorter than width of stigma; second abscissa of radius nearly or quite as long as second intercubitus and much more than half as long as first intercubitus; recurrent vein entering first cubital cell very near apex; basal vein and cubitus widely separated at origin or parastigma. Abdomen longitudinally rugulose; third tergite slightly longer than first and much longer than second; first with two longitudinal carinae originating at basal lateral angles and converging caudad, obsolescent on apical fourth of tergite; ovipositor sheath only very little exserted.

Yellow; stemmaticum, apices of antennae, apical spot on scutellum and a smaller one on middle of metanotum, blackish; third tergite rather reddish yellow; wings hyaline, forewing with a small, faintly fuscous blotch below stigma and another in the region of the nervulus; hind tibia yellowish brown at base and dark brown on apical two-fifths.

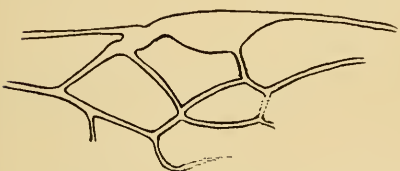
Male.—Like the female except that the antennae are longer and more slender.

Type.—U. S. National Museum No. 62540.

Type locality.—Paradise Mt., Trinidad, B. W. I.

Described from the following specimens, all reared from *Ancylostomia stercorea* (Zeller) in pigeon peas: Three ♀♀ (including type) and two ♂♂, Paradise Mt., Trinidad. March 1952, F. D. Bennett; one ♀, Arouca, Trinidad, December 31, 1951, F. J. Simmonds; one ♀, St. Augustine, Trinidad, February, 1952, F. D. Bennett; one ♂ St. Augustine, Trinidad, May 17, 1949, E. McC. Callan; one ♂, Tacarigua, Trinidad, December 1951, F. J. Simmonds; one ♀, British Guiana, February 1954, F. D. Bennett; and one ♀ and three ♂♂, St. Augustine, Trinidad, June 9, 1942, R. G. Fennah.

I am pleased to name this species for Mr. F. D. Bennett who has done some excellent work in the field of biological control of insect pests, first in Bermuda and more recently in Trinidad.



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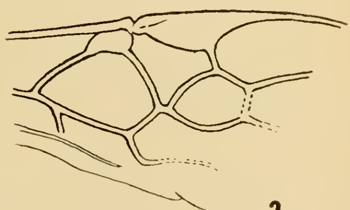

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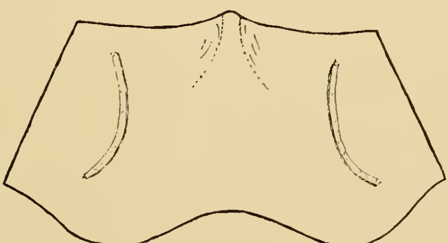

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Fig. 1; *Phanarotoma nigripelta,* central portion of forewing. Fig. 2; *Phanerotoma bennetti,* central portion of forewing. Fig. 3; *Bracon cajani,* second abdominal tergite.

Phanerotoma nigripelta, new species

In having the disc of scutellum evenly granular and entirely black, and in the relatively short abscissa of radius, this form differs from all known related species.

Female.—Length nearly 4 mm. Face at narrowest point twice as wide as its length to base of clypeus; temple finely granular, about half as wide as eye; antenna shorter than body, 23-segmented, much narrowed at apex, some of the segments of apical third not or barely as long as broad; mesoscutum evenly granular and opaque; notaulices indicated only at anterior margin of mesoscutum; disc of scutellum uniformly finely granular and dull, not at all longitudinally sculptured as in *bennetti;* propodeum granular, medially and posteriorly also more or less coarsely reticulate; pleura finely, evenly granular and mat; first abscissa of radius as long as the second which is less than half as long as first intercubitus; recurrent vein interstitial with first intercubitus or entering extreme base of second cubital cell; inner calcarium of hind tibia barely half as long as hind metatarsus. Abdomen strongly longitudinally rugulose striate; first and third tergites subequal in length, the second shorter; first tergite with two prominent carinae arising at basal lateral angles, converging and growing gradually weaker caudad, sometimes attaining posterior margin of tergite.

Honey yellow; apical eight or ten segments of antenna infuscated; a black, roughly quadrate spot on scutellum taking in all of the disc; metanotum with a much smaller, median black spot; abdomen with an interrupted blackish streak down middle beginning near middle of first tergite; wings hyaline, forewing weakly infuscated behind stigma and behind first discoidal cell; legs very pale with only apices of hind tibiae a little brownish.

Type.—U. S. National Museum No. 62541.

Type locality.—St. Augustine, Trinidad, B. W. I.

Described from four ♀♀ reared April 8, 1954 from a lepidopterous larva on *Tephrosia* by F. D. Bennett.

FIRST PRECISE LOCALITY RECORD OF HESPEROCIMEX COLORADENSIS LIST FROM MEXICO

(Hemiptera, Cimicidae)

On August 24, 1954, several hundred specimens of *Hesperocimex coloradensis* List were collected 18 miles southeast of Guaymas, Sonora, Mexico, from a nest containing well-feathered nestling Purple Martins (*Progne subis*). The nest was located in an abandoned woodpecker's hole, 15 feet above the ground in a cactus identified as *Pachycereus pecten-aboriginum.* The bedbugs were collected by R. E. Ryckman, C. P. Christianson, and D. Spencer.

This is the first specific locality record of this species from Mexico. List (1925, Proc. Biol. Soc. Wash. 38:103-110) pointed out that Horvath (1912, Am. Mus. Natl.-Hist. Nat. Hungary 10:257-262) had a specimen of this species labeled ''Mexico'' but had it confused with *Oeciacus vicarius.* The only other record for *H. coloradensis* is given by List from Colorado Springs, Colorado, collected by W. D. Edmonston. Professor List indicated (*in litt.*) that he had returned to Colorado Springs a few years ago in search of the bug but was unsuccessful in finding it.

The authors acknowledge with appreciation the assistance of Drs. R. L. Usinger and F. A. Pitelka of the University of California, Berkeley, for identifying the bedbugs and the host, and Professor Edmund C. Yaeger, Riverside, California, for identifying the cactus. Specimens of *H. coloradensis* have been placed in the California Academy of Sciences, in the California Insect Survey, Berkeley, and in the United States National Museum. A live colony is being maintained for research purposes in the Department of Entomology, School of Tropical and Preventive Medicine.—Robert D. Lee and Raymond E. Ryckman, *Department of Entomology, School of Tropical and Preventive Medicine, Loma Linda, California.*

A REDESCRIPTION OF ACLERDA ISCHAEMI RAMAKRISHNA AND THE DESCRIPTION OF A NEW AFRICAN ACLERDA

(Homoptera, Coccoidea)[1]

By Harold S. McConnell, *University of Maryland, College Park*

Since the publication of a paper by this author, "A classfication of coccid family Aclerdidae" (1953), material of the two species considered below has become available.

Aclerda ischaemi Ramakrishna

Figure 1

Aclerda ischaemi Green, 1930 (1929), MS Ramakrishna, Ayyar T. V. Agricultural Research Institute, Pusa, Bull. 197: 52.

Aclerda imperata Green, 1930 (1929), MS Ramakrishna, Ayyar T. V. Agricultural Research Institute, Pusa, Bull. 197: 52. *Nomen nudum.*

In 1929 Ramakrishna published the following note in Bulletin 197, page 52 of Agriculture Research Institute, Pusa: "123. *Aclerda ischaemi* Green, MS. Habitat. On Stem of *Ischaemum hirtum.* Sengleteri, found with *Diaspis barbatus* G."

The note was accompanied by a pen sketch of a scale on a piece of the host. Apparently Ramakrishna sent this scale to E. E. Green for identification, who considered it to be an undescribed species and gave it the manuscript name *ischaemi,* which Ramakrishna published as indicated above. The pen sketch which accompanied the locality and host data is apparently adequate to validate the name *ischaemi* with Ramakrishna as the author.

Some unmounted specimens which are said to be part of the original collection of this species were received through the courtesy of the Entomology Staff of the Agricultural College and Research Institute, Coimbatore, South India, labeled as follows, "*Aclerda ischaemi* Green, MS on *Ischaemum hirtum.*" More recently some unmounted specimens labeled as follows, "*Aclerda ischaemi* Green, MS on *Ischaemum hirtum,* Tinnevelli Hills, 3000 feet, India, Coll. Ramakrishna, 12/VII/1921, No. 221A" was received from the British Museum through the courtesy of Mr. J. D. Doncaster of the Museum, and Dr. D. J. Williams of the Commonwealth Institute of Entomology.

On the same page of the publication in which Ramakrishna recorded *Aclerda ischaemi,* he recorded the name *Aclerda imparatae* Green, MS, giving only the host, locality, and date of collection for the material, as follows: "Habitat. On *Imperata arundinaceum,* Janjore, (Farm Manager, Collr.)." This is clearly *nomen nudum.* Three mounted specimens of this material, labeled as Ramakrishna recorded the name, were also received from the British Museum. They are clearly the same as *ischaemi.*

Habit.—The insects occur behind the leaf sheath of the hosts above the nodes; both males and females are found in this position. The young adult females are 2 to 3.5 mm. long and 0.60 to 1.5 mm. wide, flat, light brown in color, frequently with a considerable amount of white powdery wax beneath and along the margins. The older and fully mature females are larger, 8 to 10 mm. long and 4 to 5 mm.

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[1]Scientific Article No. A-504. Contribution No. 2621 of the Maryland Agriculture Experiment Station. (Department of Entomology, Project No. H-56.)

wide, convex, especially the abdomen; heavily sclerotized, ranging in color from brown to nearly black. Male test thin and glossy in appearance with a small amount of loose threads and powdery wax along the margins.

Adult Female.—The mounted adult females vary greatly in length and width, depending upon the stage of maturity. Young females 2.1 mm. to 3.6 mm. in length, and 0.66 mm. to 1.6 mm. in width, most of the specimens widest at the mid-abdominal area, tapered toward the anterior end, which is rounded; posterior end more abruptly narrowed, with sides nearly straight and serrate, the apex pointed, the angle between the sides somewhat more than 90° in the young specimens, and much more than 90° in the older specimens, caudal sclerotized area rather narrow, with only a few ridges and furrows, the margins serrate.

Setae.—The tuberculate marginal setae arranged in a band two to four irregular rows of setae wide around the body, the setae set close together in young specimens and more widely separated in older specimens; the band usually about two rows of setae wide at the anterior end, wider on the thorax and most of the abdomen, and two irregular rows wide at the posterior ends of the band, the latter set close together just above the margin; the ends of the band about three times the width of the anal plate anterior to the anal cleft. The setae vary somewhat in shape and size, the average is about nine μ long and six μ wide; those on the posterior parts of the band are somewhat shorter and appear stouter; the apex of these setae vary from rather pointed to quite blunt, and some of them are somewhat truncate.

The dorsal invaginated setae on each side of the abdomen widely spaced on the caudal sclerotized area, much more closely spaced on the membranous area anterior to the caudal area, and forward along the submargins where they are present sometimes nearly to the plane of the posterior spiracles, 75 to 80 each side; the setae variable in length and diameter, those on the caudal sclerotized area only slightly more than half as wide and considerably longer than those on the membranous part of the abdomen, the latter somewhat dumbbell shaped, about 12 μ long, with the apex projecting slightly above the derm, in the older specimens the lumens appear to have fine sculpturing.

Body setae more numerous on the ventral surface than on the dorsum and most of them longer and stouter; the ventral setae vary from stout and spine-like to rather small and acutely pointed.

Ducts and Pores.—Macrotubular ducts on both dorsal and ventral surfaces; the dorsal ducts noticeably larger, arranged in a submarginal band three to four ducts wide on most of the body, widened considerably on the posterior part of the abdomen, and some mingled with the marginal setae, these ducts about 15 μ long, the inner end distinctly flared and sclerotized, about two times as wide as the external opening; the ducts of the ventral band smaller but similar in shape, about 12 μ long and six or seven μ wide, the band one to two irregular rows wide at the anterior end of body, gradually becoming wider toward the posterior, the band ends at about the plane of the genital opening. Microtubular ducts present on the ventral surface only, mesal to the marginal tuberculate setae, mingled with the ventral macrotubular ducts, the band extending from the head to about the midpoint of the abdomen, these ducts apparently absent on the posterior half of the abdomen, a group of about 20 are present on the derm at the base of the beak;

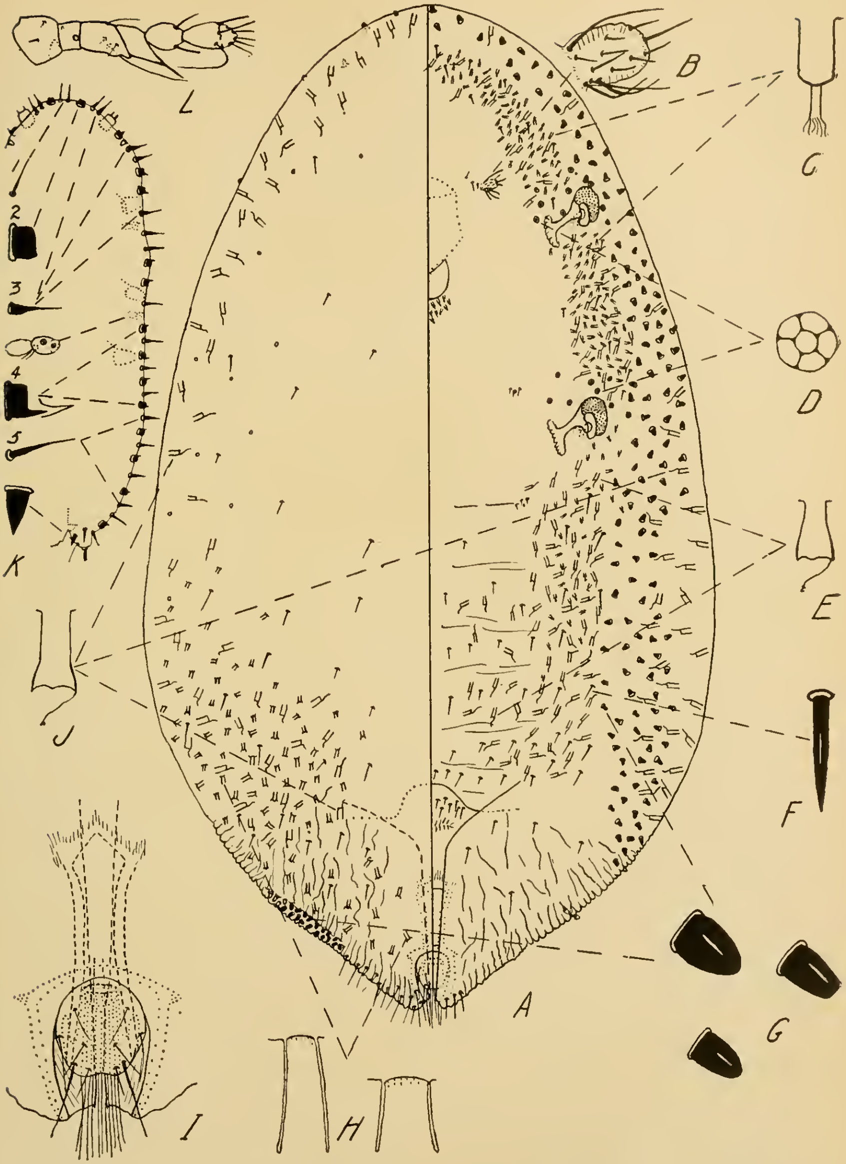

Fig. 1, *Aclerda ischaemi* Ramakrishna. Adult. a, body outline (early adult), left dorsal, right ventral, with microanatomical details, x60; b, antenna, x750; c, ventral microtubular duct, x1000; d, quinquelocular disc pore, x1000; e, ventral macrotubular duct, x750; f, ventral submarginal seta, x1000; g, marginal tuberculate setae, x750; h, dorsal invaginated setae, x750; i, anal complex, dorsal view, x160; j, dorsal macrotubular duct, x1000. Larva. k, lateral margin, with types of setae (greatly enlarged) showing their arrangement, x75; l, antenna, x160.

the band of ducts four to five irregular rows wide on the head and somewhat narrower on the abdomen; the ducts small, the tube about four microns long and half as wide, the tube and internal filaments together six to eight microns long.

Quinquelocular disc pores present on the derm anterior and lateral to the spiracles and in the atrium of the spiracles, none elsewhere on the body, the number on the derm quite variable and scattered, those at the anterior spiracle varying from five to 13 and those at the posterior spiracles four to 12. Simple dorsal disc pores few in number, these on the submargins anterior to the caudal sclerotized area.

Anal Complex.—Anal cleft about one and one-half times as long as wide on the dorsal surface, the invaginations from the cleft heavily sclerotized, usually with a variable length tubercle from each anterior lateral angle of the invagination, more prominent in fully mature specimens. Anal plate slightly longer than wide, about 75 microns long, basal portion widest, evenly rounded, then gradually narrowed toward the apex which is about half as wide as the base, apex variable in shape from deeply emarginate to sometimes truncate, with four or five setae on each side, two on the anterior third and three near the apex, the posterior lateral seta much longer and stouter than the others. Anal ring about half as wide as the anal plate, anal ring setae about two times as long as the anal plate. Anal tube apodeme about three times as long as the anal plate, the arms heavily sclerotized, posterior half sub-parallel, anterior half gradually widened, somewhat diamond shaped, the anterior end of the apodeme abruptly narrowed.

Antenna a conical tubercle, the base about 30 μ wide, and 12 to 15 μ high, with two or three short stout setae on the derm mesal to the base, with eight to 10 variable length setae on the cone, the longest ones about 35 μ long. Mouth framework prominent and heavily sclerotized, beak 1-segmented, rounded, wider than long. Spiracles prominent, atrium large, round, with a sickle-shaped band of pores on the upper wall, the bar variable, L-shaped or T-shaped. Evidence of leg vestiges sometimes present on the mesothoracic and metathoracic segments; they may appear as a group of three to five, small, with or without a sclerotized spur.

Larva.—Length 0.6 mm. to 0.8 mm., width at the thoracic area 0.2 mm. to 0.3 mm., anterior end rounded, slightly narrowed opposite the antennae and at the anterior spiracles; abdomen with margins approximately parallel, anal lobes definitely protruded. Antennae 6-segmented, stout, rather short, 140 to 160 μ in length; the basal segment globular and largest; II smallest, III asymmetrical, the posterior margin produced so that it is one-third to one-half longer than the anterior margin; IV, asymmetrical, the posterior margin greatly produced, terminating in a strong seta-like spur; V and VI spindle-shaped, VI longest, with a whirl of variable-sized setae below the apex, one quite long, apex with six to eight setae of variable sizes. Legs slender, tarsus approximately half as long as the tibia, tarsal digitules exceeding the claws by nearly one-third their length, faintly knobbed, claw digitules exceeding the claw, claws slender, nearly straight except at the base. Beak quadrate, wider than long. Spiracles rather large, cylindrical, most of them with two multilocular disc pores, one within the atrium and one at the margin, which is sometimes outside the atrium, and sometimes absent; bar long and narrow. Ventral microtubular ducts few in number, these arranged singly on the submargins of thorax and anterior abdominal segments.

Marginal setae of five fairly well defined types, varying from slender conventional setae to those that are button-shaped, and wider than long; there is some variation in the shape among the setae of the several types, which are arranged in definite sequences on the margins. The five types of setae are as follows: (1) slender conventional type setae (only two of this type); (2) button-shaped, broader than long, with a tiny apical marginal spur, sometimes without any evidence of a spur; (3) with a strongly inflated base, smaller than (2), with a marginal extension one to two times as long as the width of the base; (4) similar to (2) but with a variable marginal mucronate spur, usually shorter than width at base; (5) stout, spike-like setae, most of them evenly tapered, sometimes the basal portion somewhat enlarged, these principally on the abdomen. The marginal setae arranged as follows: the anterior marginals (those between the eyes) 10 in number, the median pair like (1), about 15 μ long; the submedian pair like (2) sometimes with a minute marginal spur, the next two pairs are quite variable in shape and length, usually similar to (3), but they may be shorter with the basal half more inflated; the preocular pair like (4); the anterior lateral marginals (those between the eyes and the anterior spiracles) five on each side, the first two and fifth like (3) and the third and fourth like (4); the interspiracular marginals (those between the spiracles) five in number on each side, the first, second, and fifth setae like (5) and the third and fourth like (4); the abdominal marginals (those between the posterior spiracles and the anal lobes) 16 in number, types (4) and (5) alternating, except the posterior pair, the ultimate seta is like (2) (sometimes with a minute spur) and penultimate seta is like (5). The anal lobe dorsal setae three in number on each side, the median seta short, stout, somewhat narrowed at the base, then the apical half tapered to the acute apex; the lateral pair similar to (5) above but somewhat smaller. Anal lobe apical setae nearly as long as the body.

Male.—The wax test thin and glossy with a small amount of threads and powdery wax on the margins. The adult male winged, rather strongly sclerotized throughout; antennae 10-segmented, the two basal segments globular, the second strongly reticulated, the other eight imbricated and with numerous long stiff setae. Legs slender, tarsi and tibiae with numerous stout, stiff setae, claw digitules long and slender. Spiracles small, bar vase-shaped, with three quinquelocular disc pores outside the atrium. Body setae few in number, most of them small; dorsal abdominal setae arranged in segmental rows of four to seven setae, ventral setae fewer and smaller; marginal setae rather numerous, large and stout, especially on the posterior segments where there are five to eight on each side. Basal piece of penis sheath quadrate, apical piece funnel-shaped, the narrowed apical portion with numerous light-staining pore-like structures. The penis sheath is rather short, the anterior end is narrowed, while the posterior end is much broader.

The adult females of this species are similar to *A. zoysiae* McC., and *A. balachowskyi* described below as a new species. The larvae are similar to *A. coganicola* McC. and *A. balachowskyi*. The apparent relationship of these species will be discussed more in detail at the end of this paper.

This species was redescribed from mounted adult females, larva and males from the two lots referred to above. An adult female from the

British Museum lot was selected and labeled lectotype; the other adult females, larvae, and males from both lots were labeled as lectoparatypes. The British Museum specimen was designated as the lectotype since that lot of unmounted material had the same data as that published by Ramakrishna. The designation of a lectotype in this instance is not in strict accord with the International Code definition of a lectotype, since neither lot was specifically labeled as type material. The procedure followed seems to be a practical solution of the problem, since it is reasonably certain that the specimens at hand are part of those with which both Ramakrishna and Green were dealing.

The lectotype was deposited in the British Museum, lectoparatypes were returned to the Agricultural College and Research Institute, Coimbatore, South India and The British Museum; additional lectoparatypes were deposited in the United States National Collection of Coccids, and the author's collection.

Aclerda balachowskyi, new species

Figure 2

The material on which this species is based was received from Dr. A. Balachowsky, Pasteur Institut, Paris, who kindly granted permission to describe it. It is labeled as follows: "On *Anadelphia arrecta,* Fulaya-Kindia, Guinea, French West Africa, 18-II-1953, Mr. Valardelo, Collector."

Habit.—The material was preserved in alcohol, with most of the specimens separated from the host material, which consists of short pieces of the basal part of the plant about one-half inch long, with a few specimens attached to the host. Most of the specimens are fully developed, and nearly all contain embryos. The mature females are quite convex, varying from nearly round to about two times as long as wide, with the ventral surface rather flat; at least some of them with considerable wax on the ventral surface. A few young adults were present, which are flat, and oval in shape. The fully mature females are 2.75 to 3.5 mm. long and 1.5 to 3.0 mm. wide. The early adults are 1.5 to 1.75 mm. long and about 0.75 mm. wide.

Adult Female.—The dimensions of mounted adult females approximately as indicated above. The fully mature specimens rounded, except the posterior apex which is pointed; the early adults, nearly two times as long as broad, the anterior end well rounded; the posterior end more angular, with much more than 90 degrees between the side, the apex broadly notched. The caudal sclerotized area rather narrow with a few straight, longitudinal ridges and furrows along the margins of both surfaces, some farther forward tend to be wavy and transverse; the posterior margins fairly straight and serrate.

Setae.—The tuberculate marginal setae arranged in a band around the body two to four irregular rows wide, except along the posterior margin where it is one or two irregular rows wide, and at the anterior end where the band is two irregular rows wide, the posterior ends of the band about two times the width of the anal plate anterior to the midpoint of the anal cleft; the setae vary somewhat in size and shape. The larger ones about nine μ long, and six μ wide, some are

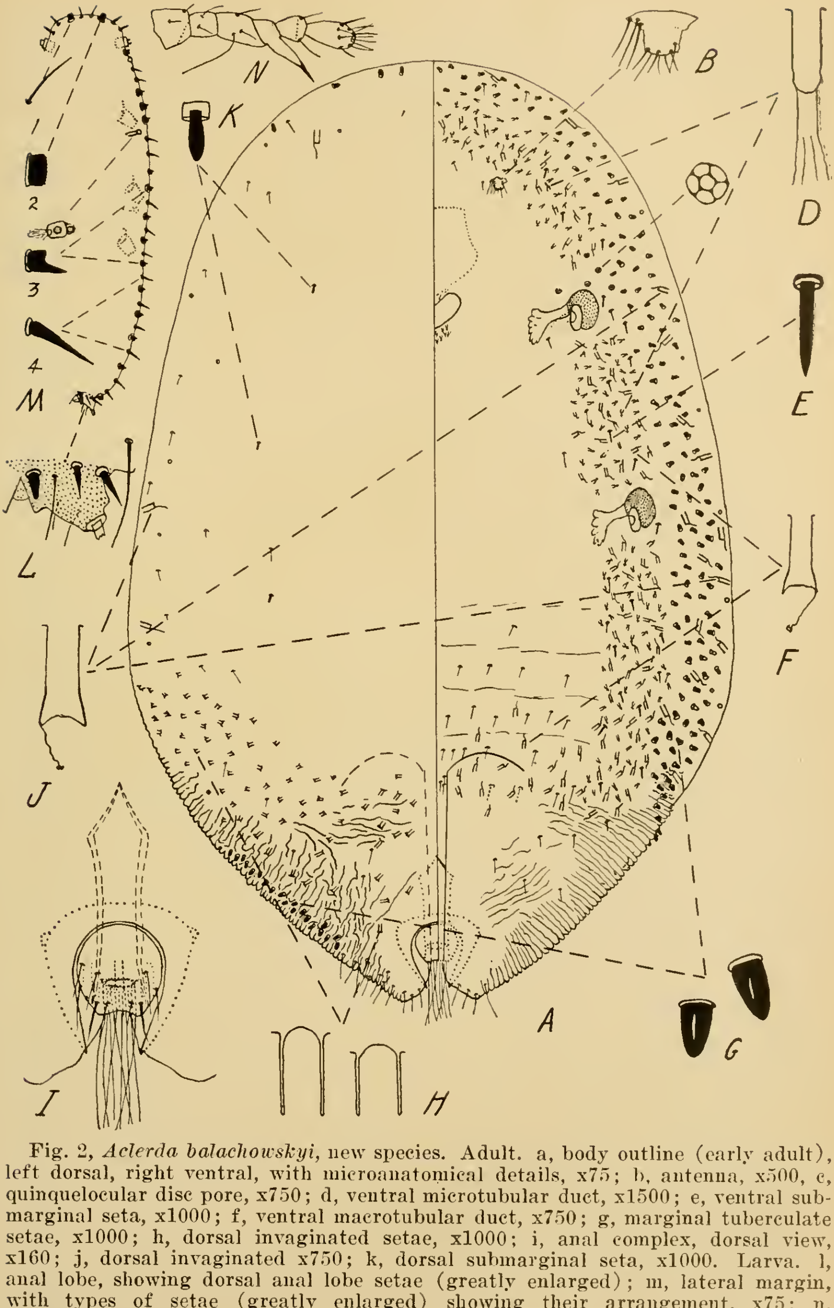

Fig. 2, *Aclerda balachowskyi*, new species. Adult. a, body outline (early adult), left dorsal, right ventral, with microanatomical details, x75; b, antenna, x500, c, quinquelocular disc pore, x750; d, ventral microtubular duct, x1500; e, ventral submarginal seta, x1000; f, ventral macrotubular duct, x750; g, marginal tuberculate setae, x1000; h, dorsal invaginated setae, x1000; i, anal complex, dorsal view, x160; j, dorsal invaginated x750; k, dorsal submarginal seta, x1000. Larva. l, anal lobe, showing dorsal anal lobe setae (greatly enlarged); m, lateral margin, with types of setae (greatly enlarged) showing their arrangement, x75; n, antenna, x160.

considerably smaller, especially those on the caudal margins of the abdomen; they are broadest at about the midpoint, with the base slightly narrowed, and rather gradually narrowed from the midpoint to the blunt, rounded apex; there are about 20 conventional-shaped setae between the ends of the band of tuberculate marginal setae and the anal cleft, each about 30 μ long.

Body setae few in number; the dorsal setae slender to flagellate in form on the caudal sclerotized area of the abdomen, 20 to 25 μ long, anterior to this they are stouter and much shorter, nine to 12 μ long, and spike-like or digitate, most of them on the marginal and submarginal area, but without any apparent segmental arrangement; ventral setae similar in form and size to the stouter dorsal setae, and having a transverse segmental arrangement on the abdomen.

The dorsal invaginated setae 60 to 70 in number on each half of the abdomen, rather widely spaced on the caudal sclerotized area, more numerous and more closely spaced on the adjacent membranous area and forward along the abdominal submargins; the setae variable in length and diameter, depending on their position on the abdomen, they appear longer and more slender on the heavily sclerotized caudal area, the longest ones about 15 μ long, and shorter ones eight to ten μ long, all with the dome-shaped apex projecting above the surface of the derm.

Ducts and Pores.—Macrotubular ducts present on both surfaces; the dorsal ducts noticeably larger, few in number, these on the submargins, most of them mingled with the marginal tuberculate setae, only an occasional duct occurs on the caudal sclerotized area; ventral macrotubular ducts smaller, much more numerous, in a band three to four irregular rows wide submarginal to the marginal tuberculate setae, the band ending at about the anterior margin of the caudal sclerotized area, and with a few ducts in transverse segmental rows on the mid-abdominal segments. Microtubular ducts on the ventral surface only, distributed similar to the ventral macrotubular ducts, and mingled with them, except that there are none in transverse segmental rows, and in addition there is a group at the base of the beak; the ducts about five μ long, with an internal prolongation nearly as long as the duct, the ducts arranged in a band four to five ducts wide, the band ends at the anterior margin of the caudal sclerotized area.

Quinquelocular disc pores present in small numbers anterior and lateral to the atrium of the anterior pair of spiracles, usually three to seven; they are usually absent at the posterior spiracles, sometimes a single duct may be present.

A few simple disc pores are present on the dorsal submargins.

Anal Complex.—Anal cleft rather unusual in appearance in that it appears as a wide apical notch, somewhat like a flattened inverted V; shallow invaginations from the lateral margins of the cleft heavily sclerotized. The anal plate small, about as wide as long, approximately circular, 72 μ in diameter, the posterior apex with a broad shallow notch or emargination, with four or five setae on the posterior half of each side, all similar in length and size except the lateral seta which is smaller and shorter; anal ring about half as wide as the anal plate, anal ring setae about two times as long as the anal plate, anal tube apodeme about three times as long as the anal plate, the arms straight and parallel, except at the anterior end where they diverge, the apex abruptly narrowed.

Antennae with a broad base and a narrower tuberculate projection from about the center of the base, there are three or four large setae on the mesal portion of the base and five or six smaller setae on the tuberculate projection. Mouth framework prominent and heavily sclerotized, beak rounded, wider than long. Spiracles prominent, atrium with a somewhat sickle-shaped band of pores on the upper wall, the bar L-shaped. No evidence of leg vestiges observed.

Larva.—Length about 1.0 mm. and width 0.2 to 0.3 mm. wide at the thorax; anterior end rounded to truncate, narrowed at the antennae, and opposite the anterior spiracles; sides of the abdomen subparallel; anal lobes definitely protruded, but short and sclerotized. Antennae 6-segmented, stout, about 160 μ long; basal segment largest, II shortest and smallest, III asymmetrical, with the posterior margin one-third to one-half longer than the anterior margin, IV asymmetrical, short, the posterior margin greatly produced and terminating in a long slender spur which is about three times as long as the anterior margin, the apex of the spur extending to about the midpoint of the apical segment; V and VI spindle-shaped, VI somewhat larger and about one-half longer. Legs slender, tarsus about half as long as the tibia, tarsal digitules slender, faintly knobbed, exceeding the claw, claw digitules slightly knobbed, exceeding the claw by one-third its length. Spiracles rather large, cylindrical, with two multilocular disc pores, one apparently outside the atrium, a few ventral microtubular ducts present on the abdomen and thorax, usually one or two on each side of the thorax, and two to four on each side of the abdomen, never more than one on the side of a segment, sometimes apparently entirely absent.

Marginal setae of four well defined types varying from slender conventional setae to those that are button-shaped and wider than long. Some variation occurs in the shape of all these types of setae except conventional form; the setae arranged in definite and constant sequence on the margin. The four types are as follows: (1) slender conventional setae (only two of this type); (2) button-shaped, broader than long and without an apical marginal spur, the discal apex papillate; (3) somewhat similar to (2) but smaller in diameter, and longer, and with a marginal apical spur that is variable in size and length. These marginal setae arranged as follows: the anterior marginals (those between the eyes) 10 in number, the median pair like (1), 15 to 20 μ long; the submedian pair like (2), about four μ long and 12 μ in diameter, the next two pairs like (4), but sometimes they appear to have the basal portion larger, the preocular pair like (3). The anterior lateral marginals (those between the eyes and anterior spiracles) five on each side, the first two pairs like (4) and the other three pairs like (3). The interspiracular marginals five in number on each side, the first two and fifth like (4) and the third and fourth like (3). The abdominals (those between the posterior spiracles and the anal lobes) 16 in number on each side, types (3) and (4) alternating, except the posterior pair where the ultimate seta is like (2) and the penultimate seta is like (4), sometimes an extra seta may occur in the anterior groups of setae. The anal lobe dorsal setae three in number on each lobe, the median seta short and stout, somewhat narrowed at the base, the apical half narrowed, the apex bluntly rounded; the other two setae placed anterior to the median seta, and in about the same plane near the anterior lateral margin of the lobe, the lateral seta larger and longer, both similar in shape to (4) but smaller. The apical seta somewhat longer than the abdomen.

Male.—Only the glossy test observed.

Type Locality.—Fulaya-Kindia, Guinea, French West Africa, on *Anadelphia arrecta.*

Types.—Holotype, an early adult female, deposited in the United States National Collection of Coccids. Paratypes, numerous adult females, most of them fully mature, a few early adults, and numerous larvae, some returned to Dr. Balachowsky, some deposited in the United States National Collection of Coccids, and some in the authors collection, all collected on *Anadelphia arrecta,* Fulaya-Kindia, Guinea, French West Africa, Mr. Valardelo, collector.

The adult females of the two species considered above, and *A. zoysiae* McC. are similar, and some difficulty may be encountered in differentiating them. *A. ischaemi* and *A. balachowskyi* both run best to couplets 16 and 20 of the McConnell key (1953), despite both having the angle between the sides of the posterior end of the body greater than 90°. *A. balachowskyi* can be separated from the other two species by the paucity of dorsal macrotubular ducts, there being only 20 to 30 and most of these intimately associated with the marginal tuberculate setae; further, there are practically no ducts on the caudal sclerotized area; the anal plate is nearly round while the plate of *A. ischaemi* and *A. zoysiae* is more elongate and tapered toward the posterior apex. *A. ischaemi* and *A. zoysiae* are very similar, and when adequate material of all the stages becomes available, it may be found that *A. zoysiae* is a synonym of *A. ischaemi.* The most striking difference is in the marginal tuberculate setae, the setae of *A. zoysiae* are smaller and more acutely pointed and the body setae are smaller.

The larvae of *A. coganicola* McC., *A. ischaemi,* and *A. balachowskyi* are similar, but the larva of *A. zoysiae* is unknown to the author. The larvae of the first three species will run to couplet 4 of the McConnell key (1953). The anterior marginals of *A. balachowskyi* and *A. coganicola* are quite similar, differing principally in the form the submedian pair of button-like setae; in *A. balachowskyi* nearly all of them have a minute lateral spur, while in *A. coganicola* they are without a spur; these two species have different shaped median dorsal anal lobe setae; in *A. coganicola* it is short and thumb-shaped, while in *A. balachowskyi* it is larger, longer, with the apical half tapered to a round, blunt apex. *A. ischaemi* differs from the other two species principally in having the two preantennal pairs of setae of the anterior marginal group longer and the basal part less inflated, and also in the shape of the fifth seta of the anterior lateral group of setae; it is like the first and second setae rather than like the third and fourth.

This species is named for Dr. A. Balachowski, eminent French coccidologist, who supplied the material upon which the species is based.

Reference

McConnell, Harold S., 1953. A classification of the coccid family Aclerdidae. Maryland Agricultural Experiment Station Bulletin A-75:1-121.

A NEW SPECIES OF AGNOCORIS FROM ILLINOIS, AND A SYNOPSIS OF THE GENUS IN NORTH AMERICA
(HEMIPTERA, MIRIDAE)[1]

By THOMAS E. MOORE, *Illinois Natural History Survey, Urbana*

The name *Agnocoris* was first applied to this group of insects by Reuter, who proposed it in 1875 as a subgeneric epithet in the genus *Cyphodema* Fieber to include the single European species, *rubicundum* (Fallén). Later, 1896, Reuter transferred this species to the genus *Lygus* Hahn. Since that time *Agnocoris* has been considered a subgenus of *Lygus*. Wagner and Slater (1952) reviewed the species of *Lygus* (*Agnocoris*) for the world, illustrated parts of the male and female genitalia, and pointed out that the eastern and mid-western United States form that had been known as *Lygus rubicundus* (an eastern European species) was a distinct entity and should be referred to the available name, *pulverulenta* Uhler, 1892.

The figures of male genitalia in the paper by Wagner and Slater are not all oriented in the same fashion, making comparison difficult. Figure ''A'' of ''Plate I'' of this paper is a mirror image of the proper orientation of that aspect, and the subapical protuberance which appears in the drawing is present neither on the type specimen[2] nor on any specimen that I have seen, and consequently is probably an artifact. Also, figure ''G'' of this same plate shows the ''vesica'' (appendage) as a twisted structure. This is not actually the case, but that effect is sometimes produced by the membranes enveloping the structure.

A phylogenetic study of American and European genera of the tribe Mirini Hahn has led the author to raise *Agnocoris* to full generic rank. It seems most probable that *Agnocoris*, *Lygus* (restricted to include only subgenera *Lygus*, *Exolygus*, and *Orthops*), and *Capsus* evolved from a common ancestor, each of the three lines becoming as distinct from one as from the other. Due to a lack of external diagnostic characters one must resort to characters of the internal genitalia for the separation of *Agnocoris* species.

Appreciation is extended to Dr. R. I. Sailer for comparison of drawings with the lectotype of *Agnocoris pulverulenta* and for the loan of specimens from the United States National Museum.

Agnocoris Reuter, 1875

Diagnostic characters: Aedeagus with one right vesica appendage, gonopore sclerite fused to right vesica lobe, coiled-spring structure of gonopore present, ejaculatory reservoir narrowly tubular. Female genitalia as characterized and illustrated in Slater (1950) and Wagner and Slater (1952).

Genotype: *Agnocoris rubicunda* (Fallén), type by monotypy.

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[1]This paper is a joint contribution of the Section of Faunistic Surveys and Insect Identification, Illinois State Natural History Survey, and the Department of Entomology, University of Illinois.

[2]Personal communication from Dr. R. I. Sailer.

The gender of this generic name is feminine.

The genus contains three closely related North American species and two occurring in Europe. *Agnocoris pulverulenta* is a northern North American species whose range, hosts, and feeding period overlap those of the southern species, *A. rossi*, at least in Illinois (fig. 4). The known ranges of the three North American species are indicated in figure 5. The common host of this complex is willow (*Salix* spp.). Both Illinois species are recorded from *Salix amygdaloides*.

Agnocoris pulverulenta (Uhler), new combination

This is in part the species recorded by Knight (1941) as *Lygus rubicundus* (Fallén), and the Illinois records from this bulletin not listed for *A. rossi* apply to this species. As noted on the map in fig. 4, the two species occur together in Illinois at Elizabethtown, Hardin County, and West Union, Clark County. Since the publication of the above article *A. pulverulenta* has been collected from Apple River Canyon State Park, New Milford, and White Heath, Illinois, and West Quincy, Missouri. This material is deposited with the Illinois State Natural History Survey.

Parts of the male genitalia of *A. pulverulenta* are illustrated in fig. 2.

Additional Records.—Fort Yukon, Alaska, July 18, 1951, R. I. Sailer, 1♂, 3♀. DeBeque, Colorado, July 29, 1922, E. R. Kalmbach, 1♂, 1♀. Washington, District of Columbia, June 7, 1884, P. R. Uhler Collection, 1♀; November 14, 1885, 1♂ [from Uhler's cotype series]. Ames, Iowa, July 2, 1929, H. Mills, 1♂. Plummers Island, Maryland, July 24, 1903, 1♀; July 5, 1908, E. A. Schwartz, 1♂. Las Vegas, New Mexico, August 12, H. S. Barber, 1♀. Juarez, Chihuahua, Mexico, El Paso, Texas, August 10, 1940, on onion tops, 1♂; August 12, 1940, on mustard top, 1♂; August 5, 1943, with radishes, 1♂. El Paso County, Texas, November 2, 1936, T-1895, peach foliage, 1♀. All of these specimens are deposited in the United States National Museum.

Agnocoris rossi, new species

This species is closely related to *A. pulverulenta* (Uhler). The coloration, size, and external morphology of the two species are so similar that they defy definition on these bases. *A. rossi* differs from *A. pulverulenta* in the following manner:

Male (fig. 1).—Left vesica lobe nearly as long as right, a patch of sclerous teeth preceding the apical constriction; right vesica lobe prolonged beyond gonopore sclerite; vesica appendage proportionately more narrow and elongate; gonoforceps as in figure, left gonoforcep with apex more attenuate and lacking ventral hook and notch.

Female.—At present indistinguishable from *A. pulverulenta* except by association with males.

Types.—Holotype, ♂, Grand Tower [Jackson Co.], Illinois, June 1, 1913; allotype, ♀, Grand Tower, Illinois, July 11, 1909. Holotype and allotype deposited in the collection of the Illinois State Natural History Survey. Paratypes.—Illinois: Alton, July 19-21, 1932, on *Salix*.

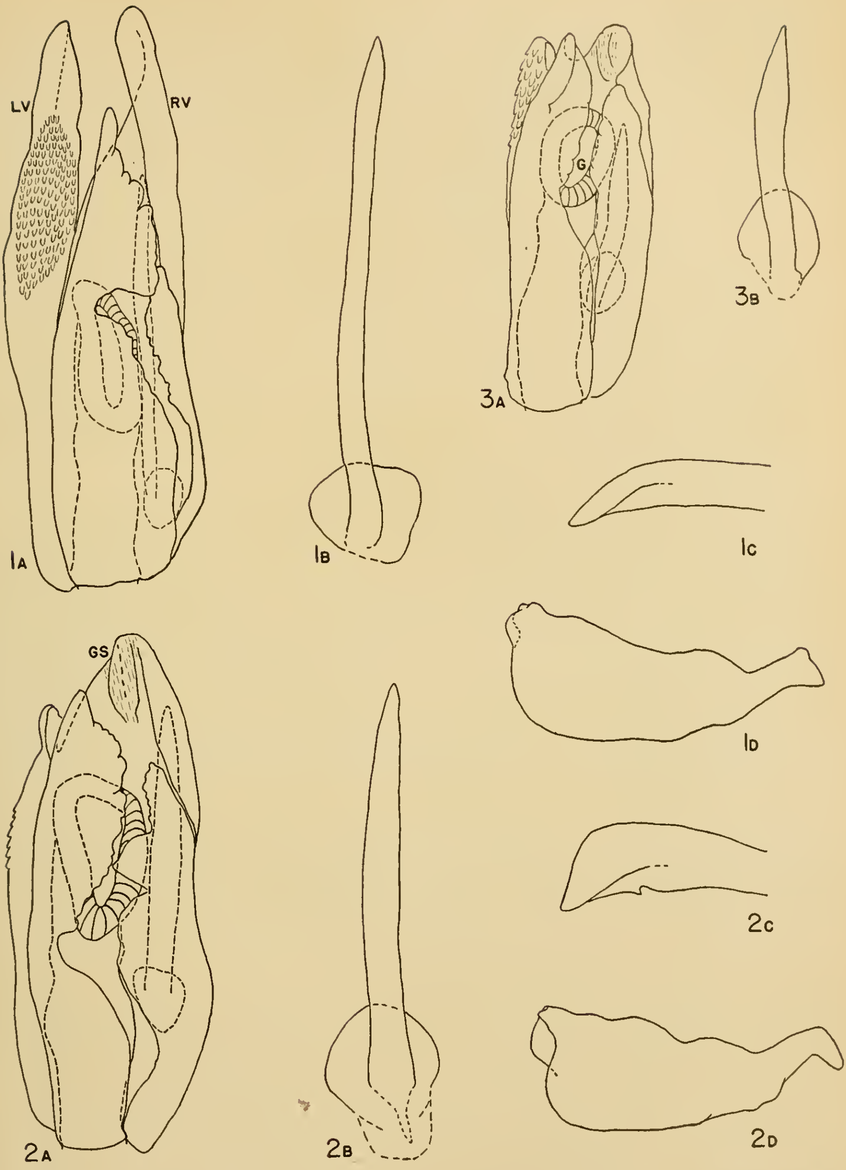

Fig. 1, *Agnocoris rossi* (oblique aspect of aedeagus); fig. 2, *A. pulverulenta*; fig. 3, *A. utahensis*.

A, apex of aedeagus, viewed from open side of gonopore; B, vesica appendage, viewed from back of aedeagus; C, apex of left gonoforcep, oblique, inner lateral aspect; D, right gonoforcep, outer lateral aspect.

G, gonopore; GS, gonopore sclerite; LV, left vesica lobe; RV, right vesica lobe.

Ross & Dozier, 2♂, 2♀; Browns, July 24, 1930, Knight & Ross, 1♂; Elizabethtown, June 22-24, 1932, Ross, Dozier & Park, 1 teneral ♂; Grafton, June 26, 1934, along river, DeLong & Ross, 1♂, 3♀; Grand Tower, June 27, 1906, willow, 4♂, July 12, 1909, on willow, 2♂, 2♀; Harrisburg, June 15, 1934, at light, DeLong & Ross, 3♂; Havana, August 14, 1907, river shore, 1♂, June 13, 1913, 1♂, July 12, 1932, on *Salix*, Dozier & Park, 3♂, 4♀, June 20, 1936, swamp, Mohr & Burks, 1♀; Herod, July 24, 1930, Knight & Ross, 1♂; Horseshoe Lake, July 11, 1935, on cypress, DeLong & Ross, 2♂, 1♀; Meredosia, August 22, 1917, tree trunk, 2♂; Mounds, August 16, 1951, on *Fagus grandifolia*, Ross & Stannard, 1♂; Mt. Carmel, Wabash Co., June 12, 1890, Accession Number 15745, Marten, 1♂; Springfield, July 8, 1931, T. H. Frison, 1♂; Thebes, June 29, 1909, at light, 1♂, 1♀; West Union, June 26, 1932, on *Salix*, Ross, Dozier & Park, 2♂; York, July 23, 1932, on *Salix*, Dozier & Park, 2♂, 1♀. Paratypes are deposited at the British Museum (Natural History), the California Academy of Science, the Canadian National Museum, the Illinois State Natural History Survey, and the United States National Museum.

Additional Records.—Illinois: Beardstown, June 10, 1932, Ross & Mohr, 1♀; Cairo, July 27, 1930, Knight & Ross, 1♀; Carbondale, July 19, 1909, 1♀; Dongola, May 19, 1917, on willow, 1♀; Golconda, June 22, 1932, on *Salix*, Ross, Dozier & Park, 1♀. Alexandria, Louisiana, March 12, 1912, B. R. Coad, in spanish moss, Hunter No. 3461, 1♂. Webster Groves, Missouri, July 12, 1903, at light, Satterthwait, 1♂, Walnutlog, Tennessee, July 16, 1919, W. L. McAtee, 1♂, 1♀. Brownsville, Texas, November 24, 1910, in house in S. Tex. Garden, 1♀; October 16, 1939, Mexico in gray moss, 3♂. The specimens from Illinois and the female from Texas are in the collection of the Illinois State Natural History Survey. The others are deposited in the United States National Museum.

The specimens from Alton, Beardstown, Browns, Cairo, Carbondale, Dongola, Golconda, Grafton, Grand Tower, Harrisburg, Havana, Herod, Meredosia, Mount Carmel, Springfield, Thebes, and York, Illinois, were recorded by Knight (1941) as *Lygus rubicundus*.

Agnocoris utahensis, new species

This species is also closely related to *A. pulverulenta*. The small series at hand averages slightly smaller and seems to be slightly redder than a corresponding number of *A. pulverulenta*, but the species overlap on both characters. *A. utahensis* differs from *A. pulverulenta* by the characteristics listed below:

Male (fig. 3).—Left vesica lobe slightly shorter than right, its sclerous teeth extending almost to apex of lobe; right vesica lobe not prolonged beyond gono-

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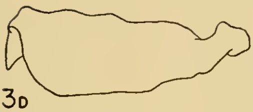
Fig. 3, *Agnocoris utahensis*: C, apex of left gonoforceps, oblique, inner lateral as pect; D, right gonoforcep, outer lateral aspect. Fig. 4, chart of known distribution of *A. rossi* and *A. pulverulenta* in Illinois. Fig. 5, chart of known distribution of *Agnocoris* species in North America.



3D

3C

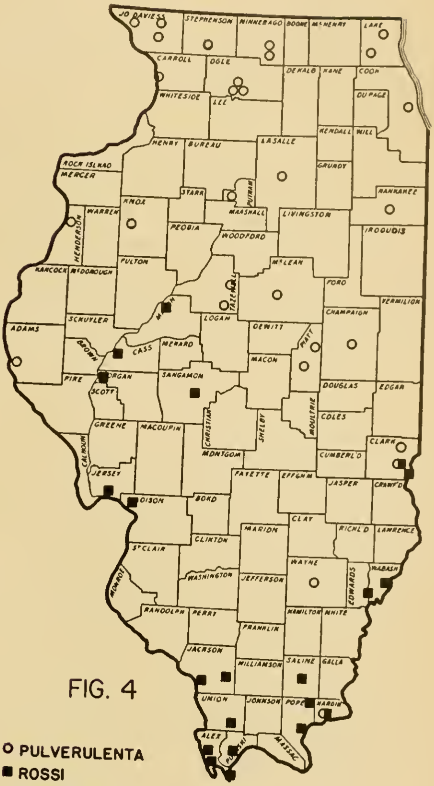


FIG. 4

O PULVERULENTA
■ ROSSI
▲ UTAHENSIS

FIG. 5

pore sclerite; vesica appendage relatively short and stout; gonoforceps as in figure, apex of left gonoforcep more attenuate but notch and hook present.

Female.—As in the case of *A. rossi,* at present indistinguishable except by association with males.

Types.—Holotype, ♂, Ogden [Weber Co.], Utah, May 16, 1915, A. Wetmore; deposited in the United States National Museum. Allotype, ♀, and 1 ♀ paratype, same data as for holotype.

Additional Records.—Peralta, California, May 3, 1945, 13637, R. Dickson, 875, *Salix,* 1♂, 1♀. The Dalles, Oregon, June 25, 1921, C. C. Sperry, 2♂, 2♀. One male and one female from The Dalles, Oregon, are deposited at the Illinois State Natural History Survey; all others are deposited in the United States National Museum.

Key to World Species for *Agnocoris* Males

1. Apex of left gonoforcep lacking a ventral hook or notch (fig. 1, C); vesica appendage as in fig. 1, B .... *rossi*
   Apex of left gonoforcep bearing a ventral hook and notch (fig. 2, C); vesica appendage proportionately shorter and thicker 2
2. Specimens collected in North America 3
   Specimens collected in Europe 4
3. Left vesica lobe much shorter than right, its outer margin bearing only a few sclerous teeth quite removed from apex (fig. 2, A); vesica appendage as in fig. 2, B; right gonoforcep with apex broadly rounded below (fig. 2, D) .... *pulverulenta*
   Left vesica lobe nearly as long as right and bearing numerous sclerous teeth extending almost to its apex (fig. 3, A); vesica appendage as in fig. 3, B; right gonoforcep with apex pointed hook-like below (fig. 3. D) .... *utahensis*
4. Vesica appendage relatively long and thick, distinctly wider at middle than at base (*cf.* Wagner and Slater, 1952, pl. I, p. 275, I) .... *rubicunda*
   Vesica appendage relatively short and thin, not wider at middle than at base (*cf. ibid.,* H) .... *reclairei*

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THE OCCURRENCE OF HAEMAGOGUS BOSHELLI IN PANAMA
(Diptera, Culicidae)

By W. H. W. Komp, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Maryland.*

In view of the renewed interest in yellow fever and its mosquito vectors in Panama, Costa Rica, Nicaragua, and Honduras from 1948 to date (1954), the hitherto unrecorded presence of a species of *Haemagogus* in Panama is here reported.

Haemagogus boshelli was described by E. Osorno-Mesa (1944) from Bahia Solano, Chocó, Colombia, in 1944. This locality is on the Pacific coast of Colombia, south of Cupica, in the Intendencia of Chocó. This part of Colombia has a high rainfall, in some places having over 200 inches annually.

During a survey of the mosquito fauna of a number of the Pearl Islands in the Bay of Panama, the writer also visited a small airfield near the village of Jaqué, on the Pacific coast of Panama, southeast of Guarachiné, about fifty miles from the Colombian border, in the Province of Darién. Three days, July 3, 4, and 5, 1945, were spent collecting mosquitoes at this locality. While the primary consideration was the collection of *Anopheles,* it became evident immediately that *Haemagogus* mosquitoes were present in such numbers as to be a pest. Adults were extremely abundant in the tangle of vines and aroids on fallen trees in a rice-field south of the runway and in nearby forested areas. The females attacked avidly at ground level at all times of the day, even during transient showers. Many were collected in a chloroform-tube while biting, and males were taken in a collecting-net.

Larvae were found in almost every "container-habitat" examined. Among these were tree holes, fallen palm spathes, fruit husks, coconut shells, tin cans, and in water-holding crevices between the buttressed roots of a species of *Ficus* or wild fig. Fortunately, a large series of larvae was obtained, from which adults were reared in the laboratory. It then became apparent, even without microscopical examination, that an aberrant species of *Haemagogus* had been encountered. The claspers (dististyles) of the male terminalia of *H. boshelli* are greatly hypertrophied and exserted, as shown so well in the figure accompanying Osorno's description. Examination of larval skins served to confirm the identification.

At the time of collection, it was thought that the species concerned was *H. chalcospilans* Dyar, which had been collected in numbers a few days previously on San José Island in the Pearl Island group. *H. chalcospilans* somewhat resembles *H. boshelli* in the golden coloration of the coxae and trochanters, but the male terminalia are very different.

Any *Haemagogus* species that bites in numbers at ground level is suspect as a possible vector of jungle yellow fever, particularly if it occurs in an endemic region. Calvo and Galindo (1952) state: "It should be mentioned that in July 1952 a report was received of approximately 100 deaths, caused by a fever of unknown origin but with a symptomatology similar to that of yellow fever, among the native population of the Alto Bayano and around the source of the Chucunaque River between the Provinces of Panama and Darién.'' This area is not far from the Pacific coast of Darién, where *H. boshelli* was found.

So far as the writer is aware, the only records for *H. boshelli* are those given in Osorno's original description (1944) and by Kumm et al. (1946) (Bahía de Solano, Bahía de Utria, El Valle, and Napipi, Colombia. All these places are on the Pacific coast of the Intendencia of Chocó, in northwestern Colombia. The species is not recorded from Panama by Galindo and his coworkers as late as 1951 (1950,1951). Hitherto the species has been considered rare, and it possibly is confined to regions of high rainfall in northwestern Colombia and along the Pacific coast of Panama near the Colombian border. It is in just such sparsely settled areas, where transport and communication are difficult, that localized outbreaks of jungle yellow fever may occur and be unrecognized by the health authorities. Calvo and Galindo (1952) make a plea for a careful study in the Province of Darién, to determine whether an ''enzootic area'' of yellow fever may exist there.

If such an area is found, *H. boshelli* should be viewed as a possible vector of sylvatic yellow fever, because of its local abundance, and its propensity to bite man at all times of the day.

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ANNOUNCEMENT

The 12th annual meeting of the American Mosquito Control Association, Inc., is to be held in the Edson Hotel, Beaumont, Texas, February 5-8, 1956. A practical application of mosquito control methods and equipment is being stressed in the program planning.

SARCOPHAGID FLIES PARASITIC ON REPTILES[1]

(Diptera, Sarcophagidae)

By Harold R. Dodge, *U. S. Forest Service, Federal Building, Missoula, Montana*

The genus *Cistudinomyia* Townsend (1917) is based on *Sarcophaga cistudinis* Aldrich (1916), a species which has been reared only from land turtles in eastern North America. Until now it has been the only sarcophagid known to parasitize reptiles, at least in North America.

The recent discovery of a second species parasitic on reptiles is credited to Dr. James A. Oliver, who sent larvae from a subcutaneous lesion on an American chameleon, *Anolis carolinensis* Voight, to Mr. C. W. Sabrosky in 1952. Mrs. Doris H. Blake was the first to rear the adult. She found a parasitized American chameleon in October, 1953, from which she reared a pair of flies, presumably of the same species, on December 1, 1953. These she brought to Mr. Sabrosky for determination, and he transmitted them to the writer.[2] Aside from host relationships, broad male front, and fourth abdominal segment reddish, this species differs markedly from *cistudinis* and appears to represent a new genus and species.

Anolisimyia, new genus

This new genus may be separated from other genera of Sarcophagidae known to the writer by the combination of the following characters: hind coxa pilose posteriorly, propleuron pilose, prosternum and postalar declivity bare, three posterior dorsocentral bristles, anterior acrostichals absent, and male mid femoral comb and hind tibial villosity lacking. The absence of spiracle 7 in the female is also unusual. Other characters are as described and figured for *A. blakeae*, the genotype, which follows:

Anolisimyia blakeae, new species

(Figs. 1, 2, 3, 4, 5, 6, 7)

A small species with legs, base of antennae, abdominal segment 4 and epaulets reddish. In Aldrich (1916) it keys, together with *Sarcophaga ignipes* Reinhard, to couplet 3 of Group D. Both differ from the species included by Aldrich by the legs being entirely reddish, the absence of outer vertical bristles, and other characters. It differs from *ignipes* by the bare prosternum, the anterior acrostichal bristles absent, and in characters of the genitalia. In volume 2 of Townsend's "Manual of Myiology" (1935), the male keys to *Fletcherimyia* and *Eufletcherimyia* but does not agree with the key characters of either, since the propleuron is pilose but the prosternum bare; the female runs to *Fletcherimyia* (type *Sarcophaga fletcheri* Aldrich), but has very different genital sternites. Female *fletcheri* has the first genital tergite broad and preciptious, shield-shaped.

Male.—Length 6.8 mm.; body greyish, with legs and 4th visible segment of abdomen reddish.

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[1]From the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Savannah, Georgia.

[2]See Mrs. Blake's note, this issue.—Ed.

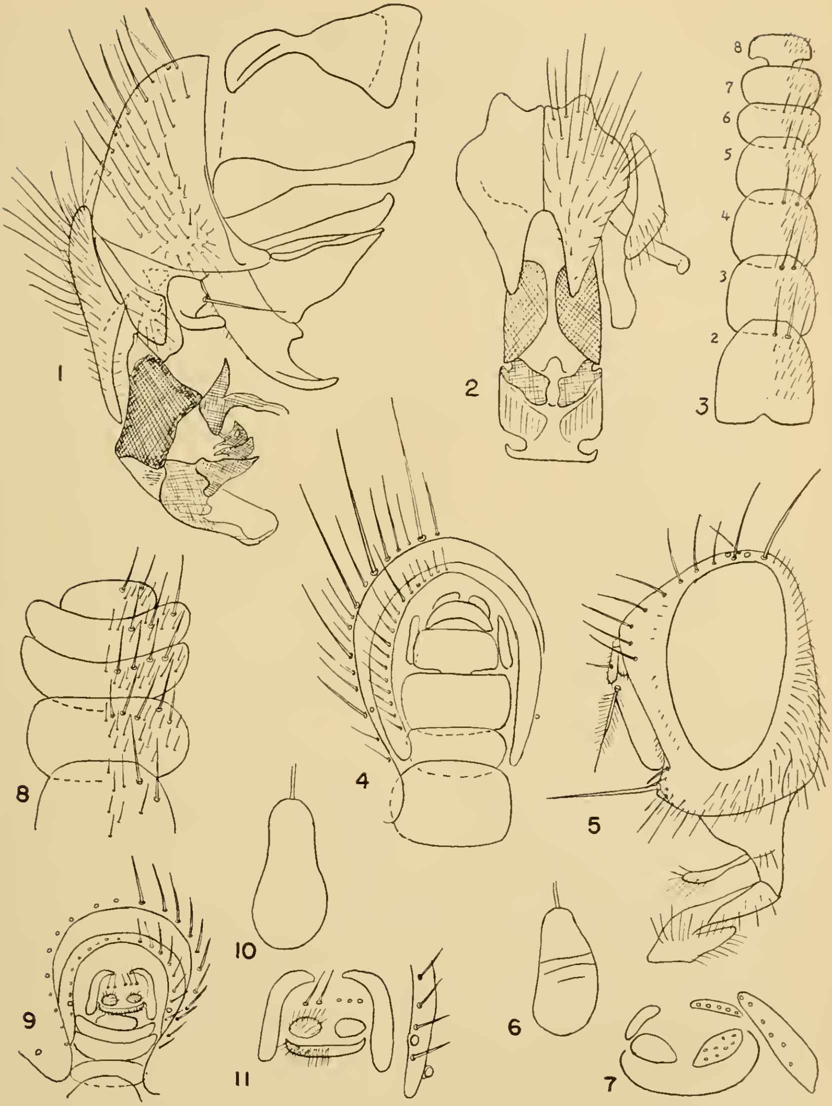
Head (Fig. 5) greyish, with two postocular rows of black setae, the rest of the occiput and metacephalon clad with pale hairs; outer vertical and proclinate fronto-orbital bristles absent; front broad, 0.24 of head width, frontal rows of about nine bristles, moderately divergent anteriorly; antenna reddish, the apical half of the third segment darkened; arista with short basal segments, third segment thickened on basal two-fifths, long plumose over two-thirds its length; parafrontal and parafacial areas nearly bare, each with about six very fine setules; clypeus dished; epistoma warped forward; vibrissae slightly above the epistoma; facial ridges bare except adjacent to the vibrissae; cheeks clad with dark hair, nearly a third as wide as the eye height; palpus reddish; haustellum shorter than the third antennal segment. Head about two-thirds as long as high, the vibrissal axis somewhat shorter than the antennal axis.

Thorax grey, with three dark stripes and no submedian prescutal markings. Chaetotaxy: acrostichals 0:1; dorsocentrals 2:3; intraalars 1:2; supraalars 1:3; humerals 2; notopleurals 4, the first and third very small; sternopleurals 3; scutellars: two marginal, one dorsal preapical, no apical.

Abdomen grey, the fourth segment reddish, abdominal markings a changeable pollinose pattern, not strongly set forth, with elongate oval, median dark spots on the intermediate segments when viewed from behind. Median marginal bristles on third segment; a marginal row on the fourth; first genital segment with an interrupted marginal row of 6. Genital segments (Figs. 1, 2) yellowish, of medium size, the first slightly larger, the second with only bristly hairs, cleft to its basal sixth by the perianal membrane. Spiracle 6 in membrane before the first segment; spiracle 7 on the segment. Forceps yellow basally, the apices darker, straight, well-separated, tapered to blunt tips. Accessory plate yellow, with a triangular apical free portion and slender basal portion. Claspers yellow, subequal in length and size, the posterior pair divergent, slender and curving beyond the large subbasal bristle, the anterior pair nearly parallel in ventral view, with apices somewhat flattened and twisted. Penis apparently of three segments, subequal in length, the basal stalk yellow, more slender than the others, completely sclerotized; the distal segments mostly darkened but with considerable membranous areas at the joint and the apex flattened, brownish. Anteriorly the distal segment bears at its base a pair of disk-shaped black lobes which are wedge-shaped in lateral view and which connect by a pair of small, black sclerites to the anterior process, which spans the distal two segments and encloses a rather large, triangular membranous area, as seen in lateral view. The anterior process has a median tongue-shaped body with six coarse serrations in its apical margin and a pair of divergent arms with tips incurved, arising from near its base. Fifth sternite yellow, with divergent, flattened arms and a median pair of pads with sparse setules but no bristles.

Wings hyaline, with dark brown veins; costal spine vestigial; costal segments 1 to 6, respectively, 2.6/4.7/2.5/6.5/3.5/.3; vein 1 bare; vein 7 with 7-8 setules reaching nearly to the anterior cross vein above and two setules below; epaulet reddish; squama bare, white, with a small, brownish, median cloud. (The posterior cross vein of each wing bears a small spur vein directed towards the body; however, this is considered to be a mutant character.)

Legs reddish, including the coxae and the bases of the tarsi, but the latter are



Anolisimyia blakeae, n. sp.: fig. 1, male genital composite, lateral view; fig. 2, male genital composite, posterior view; fig. 3, female abdominal sternites 2-8, ventral view; fig. 4, female genitalia, ventral view; fig. 5, male head, lateral view; fig. 6, female spermatheca; fig. 7, female cerci and environs, postero-ventral view.

Cistudinomyia cistudinis (Aldrich), female: fig. 8, sternites 4-8; fig. 9, genital segments, postero-ventral view; fig. 10, spermatheca; fig. 11, cerci and environs, postero-ventral view.

darkened apically. Femora and tibiae non-villous; middle femur without comb; middle tibia with two anterodorsal and no anteroventral bristles.

Female.—Length 6 mm. Outer vertical bristle absent, as in the male; proclinate frontoorbitals 2; front 0.29 of head width; chaetotaxy of thorax and legs identical to the male except that the middle tibia bears one anterodorsal and an anteroventral bristle at the middle of its length. Palpi, squamae and coloration identical to the male. Posterior cross veins without spur veins.

Genital segments (Figs. 4, 7) reddish, concealed from above; sternites 6-8 simple, oval, setulose, not intimately fused; sternite 9 lacking; sternite 10 subtriangular, setulose; there are no thickened areas in the bursa copulatrix. First genital tergite a narrow, inverted U-shaped band, pollinose, setulose, with a marginal row of numerous small bristles, not constricted or divided mid-dorsally; second genital tergite represented by a pair of lateral setose plates opposite the cerci, which latter appear to be divided, the dorsal portion bearing the coarsest setae. Spermathecae 3, each oval, with 2-3 wrinkles at about its middle. Spiracle 6 in the membrane; spiracle 7 apparently absent (no spiracles can be distinguished on the first genital tergite).

Puparium.—Length 6-6.5 mm.; dark brown, cylindrical, with posterior spiracles set in a deep concavity.

Holotype ♂ and allotype ♀, Wilmington, North Carolina, reared ex chameleon, December 1, 1953, Doris Blake, collector. Deposited in the U. S. National Museum, Type Number 62300.

Cistudinomyia cistudinis (Aldrich)
(Figs. 8, 9, 10, 11)

Sarcophaga cistudinus Aldrich, 1916, *Sarcophaga* and Allies, p. 278; Knipling, 1937, Proc. Ent. Soc. Wash. 39:91-101.

Cistudinomyia cistudinis Townsend, 1917, Proc. Biol. Soc. Wash. 30:48.

Concerning this species, Knipling (1937) has given a very good account, with eight references, and described and figured the larvae in all instars. He recorded it as parasitizing *Gopherus polyphemus, Chrysemys picta, Terrapene* sp. and *Testudo* sp. Efforts to rear it in an alligator, goats or sheep, and dead fish were unsuccessful.

Female genitalia.—(Figs. 8, 9, 10, 11). Genital segments in posteroventral position, concealed from above, yellow, pollinose. First genital tergite inverted U-shaped, less than half as long as the fourth tergite, not weakened or constricted mid-dorsally, with sparse setules and a marginal row of about 18 bristles; spiracle 6 in the membrane near the anterior margin of the tergite, spiracle 7 in the posterior margin, between the lower two marginal bristles. Second genital segment also inverted U-shaped, but broadly vestigial mid-dorsally, devoid of bristles or setulae. Sternites 6 and 7 transverse, slightly broader than sternite 5, with an interrupted row of 8 to 10 marginal bristles; sternite 8 narrower, transversely oval, with two pairs of marginal bristles; sternite 10 subtriangular, sclerotized, densely setose; cerci ordinary, setose; above each cercus are 2-3 strong bristles arranged in a transverse row, each arising from a small sclerotized platelet. Bursa copulatrix without sclerotized thickenings; spermathecae 3, ordinary, oval, dark brown, the walls smooth, with fine spiral thickenings internally.

Distribution.—Plainfield, New Jersey (type); Georgia, Florida, Mississippi and Houston, Texas (Knipling).

Material examined.—College Station, Texas, H. J. Reinhard; McPherson and Chautauqua Counties, Kansas, R. H. Beamer; Wray, Colorado, July 10, 1948, host *Terrapene ornata* (predet. M. T. James); Dauphin and Cumberland Counties, Pennsylvania (larvae in Carnegie Museum); New River, North Carolina, G. & R. Bohart (a mated pair, the female of which is figured); Cuthbert, Georgia, P. W. Fattig; Orlando, Florida, G. & R. Bohart; Hilliard, Florida, J. D. Beamer.

Variation.—The male from Orlando, Florida, has the fourth segment completely dark instead of yellowish, but in other respects agrees with the other material examined.

Summary

Anolisimyia blakeae, new genus and species, is described from flies reared from larvae in a subcutaneous lesion in a chameleon, *Anolis carolinensis* Voight. Distributional data are given for the turtle parasite, *Cistudinomyia cistudinis,* and the female genitalia of that species is described.

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Knipling, E. F., 1937. The biology of *Sarcophaga cistudinis* Aldrich (Diptera), a species of fly parasitic on turtles and tortoises. Proc. Ent. Soc. Wash. 39(5): 91-101.

Townsend, C. H. T., 1917. New genera and species of American muscoid Diptera. Proc. Biol. Soc. Wash. 30:43-50.

NOTE ON THE REARING OF ANOLISIMYIA BLAKEAE, A SARCOPHAGID FLY FROM THE AMERICAN CHAMELEON, ANOLIS CAROLINENSIS VOIGHT[1]

(Diptera, Sarcophagidae)

On Monday, the 26th of October, 1953, we were driving home in the general vicinity of Petersburg and Richmond, Virginia, from a trip through the Carolinas when a small American or False Chameleon, *Anolis carolinensis* Voight, appeared on my shoulder, very green and frightened. Presumably he came from a considerable mass of Spanish moss which we had gathered early that frosty morning in Brunswick Co., North Carolina, about 7 or 8 miles south of Wilmington, on the road to the Orton Plantation, and which was stored in the back of the car. When we reached home we put the lizard in a cloth-covered glass, meaning to take him to the zoo at the first opportunity. During the next 2 or 3 days we put several flies in the glass and he certainly ate one or two of them. Then he began to shed skin on Wednesday or Thursday (he never completed the operation) and became sluggish and did not take any more of the flies. We exhibited him to visitors Friday evening, the 30th of October, and feel pretty sure that he was

[1]See page 183.—Ed.

then alive. The next morning, the 31st, my husband noted that he was not moving and thought he might be chilled, so he set the glass on a mildly warm register. A little later, he took the lizard out and found him dead. As he held the little animal in his hand in the sunlight he noted a heaving of the left flank and thought for an instant that he might have revived, but as we watched, something whitish came through the skin on the back near the left shoulder. It wriggled back and forth several times and then snapped out—a maggot about 8 mm. long. The whole operation of emerging may have taken a minute. The next morning when we looked in we could see no maggot, and on picking out the lizard, we found a hole in the belly which had not been there before. During the day I observed 17 maggots (all at once) going around and around in the glass. I put in some damp sand and soon they all disappeared in the sand. On December 1st, two flies, a male and a female, emerged, and on December 5th they were both dead. To date, March 11th, no others have transformed, although the pupae have the appearance of being alive. Dr. H. R. Dodge, to whom the adult flies were sent by Mr. C. W. Sabrosky, has informed me that they are a new genus as well as new species of sarcophagid fly.—Doris H. Blake, *U. S. National Museum, Washington, D. C.*

BOOK REVIEW

THE EVOLUTION OF AN INSECT SOCIETY, by Derek Wragge Morley, Hampstead, England. Cloth, 8 vo., 215 pp., 55 illus., 3 tables and 1 chart. Charles Scribner's Sons, N. Y., 1955. Price $3.50.

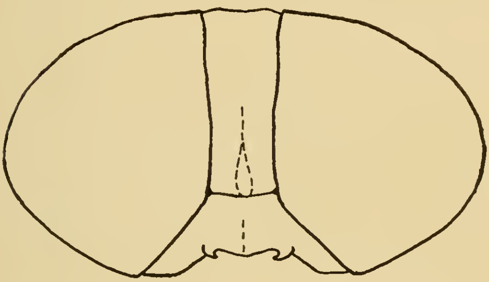
In a very interesting but simple manner the author describes what transpires in an ant commune of the common European wood ant, *Formica rufa L.*, from the time of the establishment of the first colony until the present time, many years later. In following this chronological and lucid account the reader learns how ant colonies are founded, how they develop and reach maturity, and even how some perish! The account covers every detail of ant life such as the marriage flight, the founding of a colony, the construction of the nest, the nursing and care of the young, foraging, fighting, and even some of the psychical aspects. The author also shows why the wood ant (one of the most highly specialized types) is more successful than a primitive ponerine ant. He indicates that much of the success of the wood ant is due to the numerous and prolific queens and therefore their numerous brood which drive the workers to labor feverishly to care for the queens, brood and the nest. He also states that there are in each colony certain workers ("excitement center ants") which have a higher degree of nerve development and energy than their less active, lethargic companions. It is these ants which spark the colony into greater accomplishments! Occasionally the reader will discover some interesting parallels between an art society and a human society. The numerous illustrations add to the interest of the book as also do the chart and tables. There are, however, certain technical names, the correctness of which may be questioned; for instance *Acanthomyops niger* for *Lasius niger*.

The book is especially recommended to those who wish to learn the various factors that operate in the founding and maintaining of an ant community. The simple terminology and brevity of the book make it easily readable.—Marion R. Smith, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

CRYPTOTYLUS STONEI, A NEW TABANID FROM VENEZUELA
(Diptera, Tabanidae)

By J. Maldonado Capriles, *College of Agriculture and Mechanic Arts, Mayagüez, P. R.*

The author is greatly indebted to Dr. Alan stone, of the Entomology Research Branch, U. S. Department of Agriculture, for the identification of this and other tabanids collected by the author in Venezuela, for the checking of the manuscript, and for other valuable suggestions that made possible the publication of this paper.



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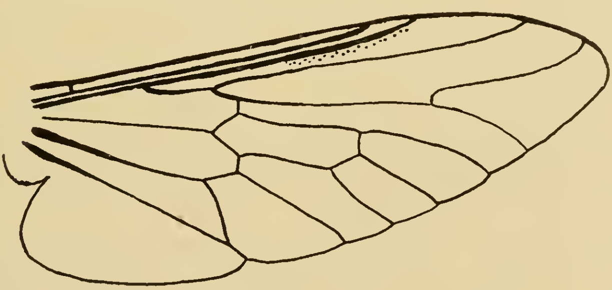

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Cryptotylus stonei, n. sp.: fig. 1, front view of head; fig. 2, lateral view of antenna; fig. 3, wing venation.

Cryptotylus stonei, new species

Female.—Length 13.5 mm.; wing 13.0 mm. Brownish orange above, anterior portions of thorax and abdomen somewhat paler; face, thorax and first three abdominal sterna lighter, yellow orange. Without any greenish tinge. Frontal callus, subcallus and frons concolorous, lighter than mesonotum, frons with short erect black hairs. First two antennal segments light brownish-orange, third slightly darker. Palpus uniformly yellow brown, with decumbent, short, black hairs. Labrum-epipharynx light brownish-yellow; labium and labella shiny black. Mesonotum with slightly decumbent blackish pile; pteropleura with blackish brown pile, remaining parts of pleura with golden yellow pile, this longer than that of mesonotum. Wings hyaline; costal cell and stigma yellowish; stigma narrow; veins dark brown. Halter with yellowish shaft, grayish brown knob. Legs yellow, tarsi darker; pilosity of coxae, hind femur below, and basal under portion of hind tibia yellowish, the rest black. Pile of dorsum of abdomen entirely dark, first three abdominal sterna with yellow pilosity at base and with scattered black hairs on apical margin; rest of segments with longer and mixed yellow and black hairs, black hairs predominating.

Frons less than three times as high as basal width, the sides very slightly diverging above, with a very shallow concavity before upper end (fig. 1). Frontal callus narrow, somewhat indistinct, about one third width of frons at base, dorsal extension reaching almost to middle of frons; subcallus not elevated, smooth or with a few shallow diagonal corrugations. Dorsal angle of third antennal segment strong but slightly produced forward (fig. 2); second segment with a strong spine in upper anterior angle. Palpus moderately stout at base, tapering apically. Proboscis less than three-fourths as long as height of head. Labella rather long, reaching to middle of proboscis. Wing venation as in figure 3; no stump vein at base of vein R4.

This species seems closer to *Cryptotylus luteoflavus* (*Bellardi*) and *C. cauri* Stone than to the other four known species (*C. unicolor* Wiedemann, *C. princeps* (Bréthes), *C. limonus* (Townsend), and *C. pallidipalpis* Stone) because of the shape of the third antennal segment and the predominance of black hairs on the palpus. It can be separated from *luteoflavus* by the lack of stump in R_4 and broader frons and from *cauri* by the longer extension of the frontal callus and the predominating blackish color.

There is very little variation among the 28 specimens at hand. In four of the specimens the first two antennal segments are dark brownish orange instead of light, the mesonotum is lighter in three of the specimens and much darker in one—otherwise all follow very closely the color pattern of the holotype.

Holotype.—♀, from the mouth of the Cunucunuma River, affluent of the Orinoco River, Territorio Amazonas, Venezuela, S. A.; collector J. Maldonado Capriles; April 3, 1950. U. S. N. M. No. 62896.

Paratypes.—27 ♀♀ distributed as follows: 10 at the U. S. N. M.; 5 at the Museo de Ciencias Naturales, Caracas, Venezuela; 6 in the collection of the College of Agriculture and Mechanic Arts, Mayagüez, Puerto Rico; and 6 in the author's collection.

Reference

Stone, A., 1944. Some Tabanidae from Venezuela. Bol. Ent. Venez., Caracas. 3 (3):125-138.

THE NYMPH OF MACRODIPLAX BALTEATA (HAGEN)
(Odonata, Libellulidae)

By George H. Bick, *Zoology Department, Tulane University, New Orleans, La.*

Needham and Fisher (1936) described the nymph of *Macrodiplax balteata* (Hagen) by supposition from a single immature individual taken from the stomach of a duck near Wilson, Florida. Needham (1945), with seven "fresh specimens" on hand from Sarasota, Florida, stated that certain features in the 1936 individual were due to compression in the stomach of the duck. In 1947 Dr. Westfall collected 12 individuals from Bayport, Florida. Dr. Westfall has kindly loaned me all of the above specimens, none of which have been reared.

In 1950, Mr. James Aycock collected four *balteata* nymphs from a large rock pit at Hollywood, Broward County, Florida and reared two males and two females to transformation. One individual molted once before transforming. These exuviae and their associated adults are in my collection and are labelled: B47D, male; B48D, male; B47A, female; B57A, female.

There is no description of *Macrodiplax balteata* based on reared material at present in the literature. *Macrodiplax* was not included in Byers' (1936) key to the genera, and the individuals on hand can not be determined to genus either in Needham and Fisher (1936) or in Wright and Peterson (1944). Therefore a redescription of *Macrodiplax balteata* from reared material is required. The following description is based on four reared ultimate exuviae. Supplementary notes on the single penultimate exuvia and on the above 20 individuals which were not reared follow the description.

Nymph of **Macrodiplax balteata** (Hagen)

Measurements.[1]—Total length, 21.7-24.0 mm.; length of abdomen, 12.7-13.6 mm.; of head, 3.5 mm.; of hind femur, 5.8-6.3 mm.; width of head, 6.9-7.0 mm.; of abdomen, 7.3-7.9 mm.

Rather large, not conspicuously hairy; abdomen narrowly ovate and slightly wider than head; mostly flax colored.

Head.—Somewhat darker anterior to the frontal suture. Widest at rear margin of eyes; width at eyes twice the mid dorsal length. Caudo-lateral margins rounded; with several stout setae but not hairy. Rear of head with about 30 short setae in five ill-defined rows on either side of the mid-dorsal line. Posterior margin very slightly concave and not hairy. General dorsal surface without hairs. Eyes rounded laterally; not elevated; their caudal margins extend posterior to the middle of the head. Antennae 7-segmented; very sparsely hairy; the basal segment slightly darker than the more distal ones.

[1]All observations, measurements and drawings are from exuviae preserved in 70% alcohol. They were studied with a Spencer dissecting microscope equipped with 9X oculars, with 1X, 2X and 3X objectives, and with an ocular net reticule ruled into 0.5 mm. squares. Drawings were made with the aid of the reticule and cross-section paper. Color terminology follows Maerz and Paul (1950).

Labial suture[2] at anterior ¼ of the mesosternum. Palpal setae: 12_2 & $_311$, 12_1 & $_212$, 11_2 & $_212$, 12_2 & $_212$. There is a group of small spiniform setae on each palpus near its juncture with the prementum. Distal border of the palpus with 10 very shallow crenations, each bearing 2-5 setae; the setae are considerably longer than the depth of the crenations. Inner margin with 9-12 widely spaced setae, the edge minutely crenulate. Outer margin without hairs or setae. Movable hook long and slender, subequal in length to the nearest palpal seta.

Mid-dorsal length of prementum, 6.1 mm.; basal width, 1.6 mm.; distal width, 5.2 mm. (measured with labium removed but unflattened). There is an oak colored triangular patch on the prementum near its juncture with each labial palpus. Four or five short, stout setae at the disto-lateral margins of the prementum; just posterior to these are one or two smaller setae. Premental setae: $19_1 + {}_220$, $21 + 21$, $20 + {}_121$, $18_1 + {}_119$. The outer nine are so closely spaced that their basal sockets could scarcely fit in the intervening spaces. The inner ones are more widely spaced and their basal sockets could easily fit in the intervening spaces. The distal margins of the prementum meet at an angle considerably greater than 90 degrees. There is a small median projection as in many *Libellula* species. There are but 6-8 evenly spaced setae at the distal margin of the median lobe on either side and the actual edge is minutely crenulate.

Thorax.—Almost uniformly flax colored. Prothoracic ridge well elevated and with numerous short setae but with scarcely any hairs. Cervical processes minute. Wing buds extend to the middle of abdominal segment VI. There is a patch of setae at the antero-lateral portion of the mesosternum and a smaller but similar patch on the prosternum.

Legs uniformly flax colored. A dense fringe of long hairs on posterior surface of pro- and mesotibia, very few hairs on metatibia. Three tarsal segments on all legs. Hind femur extends to the posterior margin of abdominal segment VI. Divided setae are present distally on all tibiae; about 10 on the protibia; approximately 8 in two ill defined rows on the mesotibia; approximately 12 on the metatibia. Divided tarsal setae only on the protarsus. The three protarsal segments combined have an anterior row of approximately 18 divided setae.

Abdomen.—Narrowly ovate, not depressed, widest at juncture of segments VI and VII. Mostly flax colored but there are two ill defined oak colored spots on either side of the mid-line on V throughVIII and the medial third of IX is oak colored. The dorsal spines on VI, VII and VIII are darker than all else dorsally.

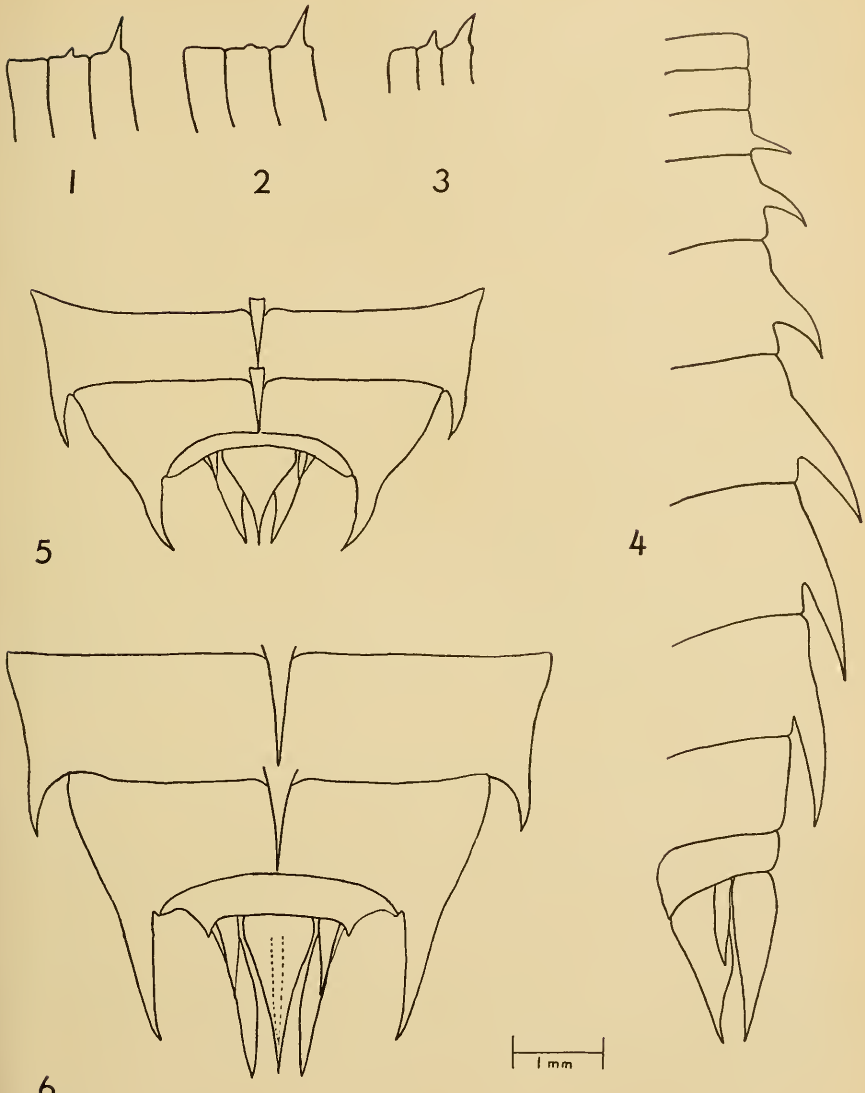
Almost devoid of hairs both dorsally and ventrally but with numerous small spinules on the dorsum. Lateral margins of III through V with inconspicuous setae which become progressively more numerous and pronounced on VI, VII and on the lateral margins of the spines on VIII and IX.

Triangular sclerites (Schmidt, 1951) are present on abdominal segments III, IV and V. All are triangular and increase in size posteriorly.

Dorsal abdominal spines present on II or III through VIII, increasing in size posteriorly. On two of the four exuviae very minute projections[3] (figs. 1 and 2) were present on II. The other two individuals (fig. 4) showed no projection of

[2]I am following the terminology proposed by Corbet (1953) in describing the labium.

[3]The term spine seems scarcely appropriate for so minute a projection.



Nymph of *Macrodiplax balteata.* Figs. 1 and 2, lateral view of abdomen, variation in dorsal spines of segment II (fig. 1, reared exuvia B49A; fig. 2, B47D); fig. 3, lateral view of abdominal segments I, II, III, Needham and Fisher specimen; fig. 4, lateral view of abdomen, reared exuviae, B57A and B48D; fig. 5, dorsal view of posterior abdominal segments of Needham and Fisher specimen; fig. 6, dorsal view of posterior abdominal segments, reared exuvia, B57A.

any sort on the dorsum of II. All spines posterior to segment II are acutely pointed. On III the spine projects dorsally and scarcely extends beyond the middle of the segment. On the more posterior segments the spines point posteriorly. The spine on IV scarcely extends to the posterior border of that segment, that on V extends to the anterior ¼ of VI, on VI and VII the spines reach the bases of the spines of the following segments, on VIII the spine extends to or just beyond the posterior margin of segment IX.

Lateral spines (fig. 6) are present on abdominal segments VIII and IX. Their axes are very nearly parallel to the mid-line of the body; their tips are garnet brown. The spines on VIII (axial length, 0.8 mm.; basal width, 0.3 mm.) are ½ the mid-dorsal length of that segment and extend to ½ the mid-dorsal length of IX. Their lateral margins are straight, the medial ones slightly concave. The spines on IX (axial length, 1.8 mm.; basal width, 0.5 mm.) are 1.7 times the mid-dorsal length of that segment and extend beyond the tips of the lateral abdominal appendages but do not reach the tips of either the superiors or inferiors. The lateral margins are straight; the posterior ⅔ of the median margins are very slightly concave.

Lengths of abdominal segments VIII, IX, X along the mid-dorsal line are 1.5, 1.0 and 0.4 mm. respectively.

Lengths of abdominal appendages: superior, 2.0 mm.; inferiors, 2.0 mm.; laterals, 1.0 mm. All are sharply pointed and colored garnet brown at the apices. The superior is broad at the base and tapers to a sharp point; it is elevated along the mid-line to form a rather definite keel. There are 4-6 short stout setae in the mid-line and long hairs at the lateral margins of the superior, The lateral margins of the inferiors are slightly incurved and bear several stout setae; their inner margins bear numerous long hairs. The laterals are without hairs or setae.

The one penultimate exuvia (total length, 17 mm.; wing pads extend to base of IV) showed substantially the same features as described above. However, the following should be noted.

Palpal setae: 12_2 & $_2 11$; premental setae: $18_1 + 18$. There is a minute dorsal spine on abdominal segment II and the dorsal spine on VIII extends well beyond the posterior margin of IX. Each femur is faintly marked with 3 darker bands.

There is a confusing variation in the shape of the abdomen which showed no correlation with size. It is not depressed in any of the reared exuviae but is strongly depressed in the Needham and Fisher specimen. Some of both Sarasota and Bayport nymphs are depressed, others are not, yet all specimens are clearly conspecific.

The color pattern of the Bayport and Sarasota nymphs is similar to that of the exuviae but their coloration in general is more pronounced. For this reason, the dorsal spines on VI, VII, and VIII of the Bayport and Sarasota nymphs are about the same color as the oak of much of the abdomen, whereas the spines of the reared exuviae are markedly darker than the rest of the abdomen. Each femur of the nymphs shows 3 oak colored bands in contrast with the femora of the exuviae which are not banded.

There is variation in the presence or absence of abdominal spines on II. They were present (figs. 1 and 2) in 2 of the ultimate exuviae, absent (fig. 4) in the other 2. A minute spine is present in the penultimate exuvia and there is a definite one in the Needham and Fisher specimen (fig. 3). Likewise the Bayport and Sarasota nymphs showed variation in this character. The spine is absent in all 8 of the mature nymphs (wing pads extend to VI or VII). However, 6 of the younger nymphs (wing pads extend to IV or to V) had spines on II and 6 did not. This variation makes this character invalid in differential diagnosis.

The lateral spines on IX are strongly incurved in the Needham and Fisher specimen (fig. 5). However, Needham (1945) stated that their incurvature was probably due to compression within the duck's stomach, and that on fresh specimens (the Sarasota material mentioned in this paper) these spines were directed straight rearward. Ouh study of the Sarasota and Bayport series as well as the reared exuviae showed that the lateral spines on IX are directed straight rearward in all individuals. Hence both characters, dorsal abdominal spine on II and the incurvature of the lateral spines on IX, used by Wright and Peterson (1944) to differentiate *Macrodiplax* and *Leucorrhinia* are invalid.

The dorsal spines on VIII of the reared exuviae extend to or beyond the posterior border of IX. This is true of the Needham and Fisher specimen, of the penultimate exuvia, and of all (8 individuals) of the Bayport and Sarasota nymphs with wing pads extending to VI or VII. However, in 3 of the 12 younger nymphs (wing pads extend to IV or V) these spines extend only to the middle of IX. The extent of the dorsal spine on VIII along with the number of premental setae appears to offer a more reliable means of differentiating *Leucorrhinia* and *Macrodiplax* than has hitherto been proposed.

The reared ultimate exuviae run to couplet 15 in Wright and Peterson (1944) but here difficulty is encountered because of the variation in the abdominal spines on II and because of the straight lateral spine on IX. This situation can be corrected if couplet 15 is modified as follows:

15. Dorsal abdominal spines on segment 8 extend to or beyond caudal margin of segment 9; 18-21 premental setae .... *Macrodiplax*
    Dorsal abdominal spines on segment 8 extend only to the middle of segment 9; 13-15 premental setae .... *Leucorrhinia* (in part)

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NOTE ON FILTER-FLIES
(DIPTERA, PSYCHODIDAE)

The purposes of this article are to: record a definite technical name for a filter-fly; to remark upon the occurrence of a species at Chapel Hill, N. C., and to call to attention publications on psychoda-flies that appear to be outside the ordinary reading of entomologists.

The name, *Telmatoscopus albipunctatus* (Williston), has been provided by Dr. Alan Stone, who kindly identified several specimens taken at different seasons. These occurrences extended from early April to late October, a period during which the flies were noted in the half-house occupied by me. Ordinarily they are seen one or two at a time, but on occasion come into the house in large numbers. From June 18 to 21, 1953, I killed hundreds nightly in my bedroom. Whether few or many, they attempt to enter the eyes, ears, nostrils, and mouth, particularly just after lights are turned off. With such proclivities, their abundance, and their foul breeding places, they would seem likely to become of interest from a public health point of view.

The small numbers usually seen in houses probably breed in plumbing traps or tanks, though these habitats would seem most hazardous. They frequent tree-holes also, but their main breeding place in this neighborhood is the bed of a trickling-filter at a municipal sewage-disposal plant. They are a nuisance to employes there and sometimes swarm at dusk so as to invade passing automobiles and nearby homes. Upon occasion, probably when wind-borne, they reach areas half a mile from the plant. Ordinary window-screening is no bar to their entrance.

The city manager calls them filter-flies and gray filter-flies, but in the literature, are named also drain-, moth-, psychoda-, and trickling-filter-flies. The publications to which I refer are books on sewage disposal, and while they deal mostly with control methods, they treat life-histories of the flies briefly and may contain some original matter. At any rate, they are sources of informational accounts on Psychodidae that should not be neglected.

Works available here comprise the following books all published in New York, N. Y.: (the page references being to principal statements, there being others in most cases), Babbitt, Harold E., *Sewerage and Sewage Treatment,* 1952:616; Imhoff, Karl, and Gordon M. Fair, *Sewage Treatment,* 1940:105; Keefer, C. E., *Sewerage-Treatment Works,* 1940:288-292; Fuller, George W. and James R. McClintock, *Solving Sewage Problems,* 1926:400; Metcalf, Leonard, and Harrison P. Eddy, *American Sewerage Practice,* second edition, Vol. 3, 1916:610; and Steel, Ernest W., *Water Supply and Sewerage,* 1938:553.—W. L. McATEE, *3 Davie Circle, Chapel Hill, N. Car.*

A NEW NASAL MITE FROM A KOREAN WOODPECKER
(ACARINA, EPIDERMOPTIDAE)

By TED TIBBETTS, *Department of Zoology, University of Maryland, College Park*

During 1953, while attached to the 5th Air Force in Korea, I had the opportunity to examine a number of birds for nasal mites. These birds were taken in a heavily wooded area of the Korean National Forest, approximately 4000 feet in elevation and 20 miles west of Uijongbu.

Several species of birds were parasitized by mites belonging to the family Rhinonyssidae, but one woodpecker (*Dryobates* sp.) was parasitized by a mite belonging to the family Epidermoptidae.

Boyd (1949) described a new genus and species of Epidermoptidae collected from the nasal cavity of a ring-billed gull from Galveston, Texas. Furman and Tarshis (1953) reviewed the literature on Epidermoptidae and described a new species in the genus *Microlichus* taken from hippoboscid flies parasitizing quail in California. Dubinin (1953) also presented an excellent review of the families Epidermoptidae and Freyanidae and described a new genus of epidermoptid from birds.

Epidermoptids are usually found on the skin of birds or their ectoparasites, although Thurman and Mulrennan (1947) found *Dermatophagoides crassus* on rats in Florida. Now it is evident that some of these mites have adapted themselves to live in the nasal passages of birds.

The Epidermoptidae are closely associated with the Psoroptidae. The genital opening of the Psoroptidae is, in general, transverse, slightly arch-shaped and pointing anteriorly, while that of the Epidermoptidae is, in general, triangle-shaped with the rounded apex pointing anteriorly. The exception is in the internal parasites of the genus *Pneumocoptes* and *Turbinoptes.* In the *Pneumocoptes* the genital opening is longitudinal, and in the *Turbinoptes* it is transverse. The following key to the genera is based upon females and has been modified from Furman and Tarshis (1953) and Dubinin (1953).

KEY TO THE GENERA OF EPIDERMOPTIDAE

1. Genital opening an inverted "V" 2
   Genital opening either transverse or longitudinal 8
2. Anterior genital sclerite free, situated behind posterior ends of apodemes II; apodemes III and IV face obliquely forward; posterior of body not bilobed .... *Dermatophagoides* Bogdanow, 1864
   Anterior genital sclerite fused to apodeme I 3
3. Anterior genital sclerite fused to middle portion of apodemes I so that two long processes of the apodemes project posteriorly from points of attachment; sharp toothlike processes on tibiae I and II; posterior of body with a pair of protuberances bearing setae .... *Strelkoviacarus* Dubinin, 1953

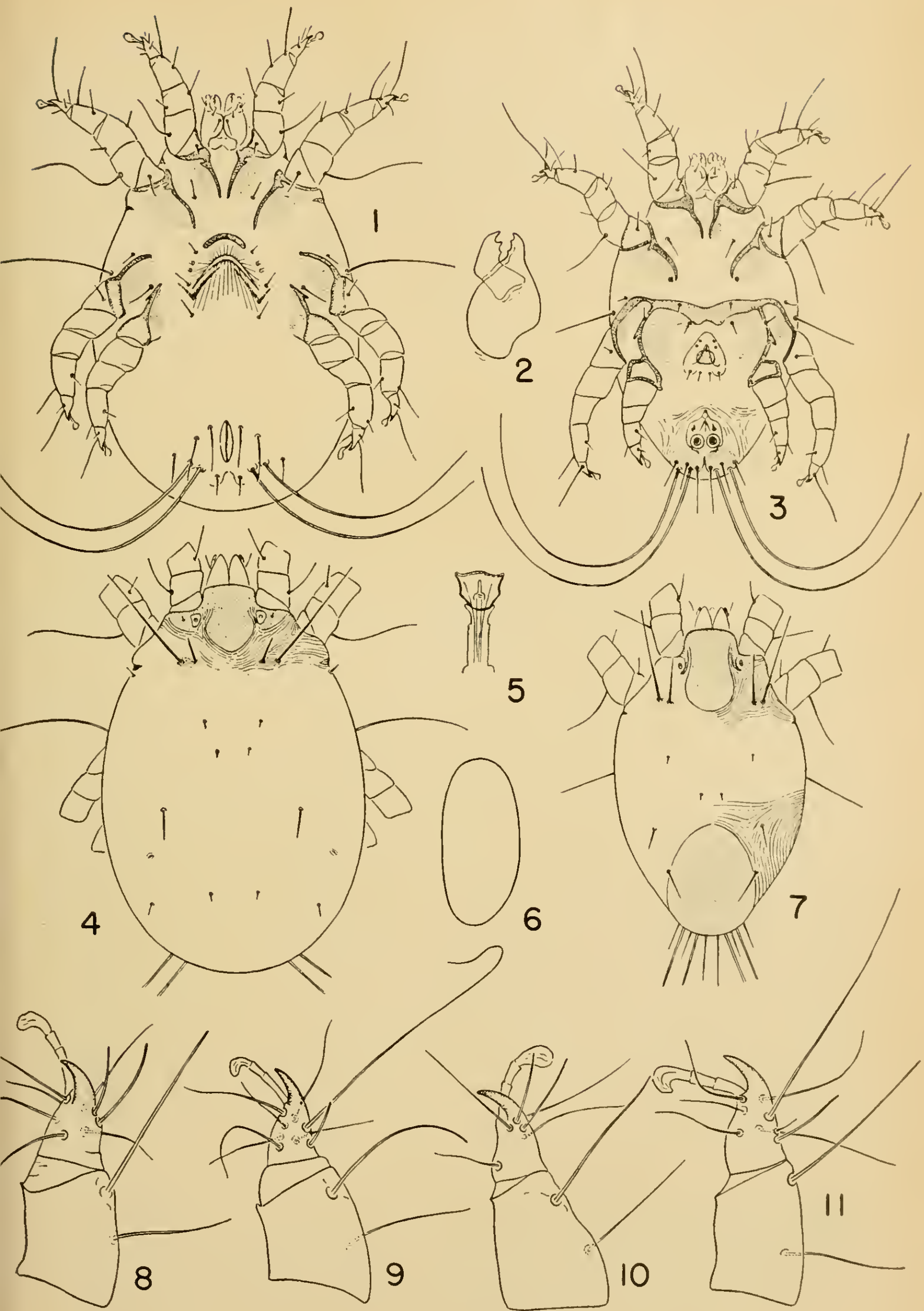
Anterior genital sclerite connected to posterior ends of apodemes I 4
4. Distal clawlike spines of tarsi absent or vestigial 5
Distal clawlike spines on tarsi highly modified on tarsi I 7
5. Tarsi and femora III and IV with reflexed, hooklike processes; coxal apodemes III and IV transverse ....*Dermation* Trouessart and Newmann, 1888
Tarsi normal; coxal apodemes III and IV point obliquely forward 6
6. Distal clawlike spines present on all tarsi; distal segment of palpi with large membranous growth ....*Epidermoptes* Rivolta, 1876
Clawlike spines not present on tarsi; palpi without membranous growth ....*Rivoltasia* Canestrini, 1894
7. Hysterosomal plate present; clawlike spine on tarsus II ....*Microlichus* Trouessart and Newmann, 1888
Hysterosomal plate absent; clawlike spine absent on tarsus II ....*Myialges* Sergent and Trouessart, 1907
8. Gential opening transverse; coxal apodemes not enlarged ....*Turbinoptes* Boyd, 1949
Genital opening longitudinal, with vulva margins wrinkled; coxal apodemes cover entire venter ....*Pneumocoptes* Baker, 1951

Dermatophagoides sorensoni, new species

Diagnosis.—Body oval, with few setae; dorsal shields present; legs of equal length; legs I and II of similar width but thicker than legs III and IV, which are of equal width; tarsi short, each bearing few setae, one large clawlike spine, one small clawlike spine, and an elongated, segmented, distally-expanded pretarsus; sexual dimorphism as illustrated; genital sclerite of female neither wide nor U-shaped and not surrounding genital opening; apodemes of coxae III of male united in a transverse band anterior to genital opening.

Female (fig. 1).—Body oval, with few setae. Skin soft, with striae. Anterior dorsal plate present, 118 μ long and 163 μ wide. Two lateral depressions, with one pore and one seta each, located on each side of the plate (fig. 4). No suture visible between proterosoma and hysterosoma. Eyes lacking. Posterior extremity of body rounded. Anal opening pointing subterminal; genital opening triangular, anteriorly, lying between coxae III. Body length from posterior margin to anterior margin of the dorsum 455 μ; body width 292 μ. Gnathosoma conspicuous from above; chelicerae strongly chelate (fig. 2); pharyngial support can be seen at base of gnathosoma. *Legs*. The five-segmented legs attached to venter with anterior pairs of coxae separated from posterior pairs. Legs I and II directed forward and outward, legs III and IV directed posteriorly. All legs of similar length, less than one half that of body. Legs I and II of equal width but stouter than legs III and IV, which are also of equal width. Epimera I not united. Genital apodeme short, neither U-shaped nor surrounding genital opening. Tarsi I and II of each sex (figs. 8, 9, 10, 11) each with a single distal clawlike spine or extension of segment; tarsi III and IV each with a large and a small spine.

Dermatophagoides sorensoni, n. sp.: fig. 1, venter of female; fig. 2, chela, female; fig. 3, venter of male; fig. 4, dorsum of female; fig. 5, pretarsus of female; fig. 6, egg; fig. 7, dorsum of male; fig. 8, tibia and tarsus I, female; fig. 9, tibia and tarsus II, female, fig. 10, tibia and tarsus I, male; fig. 11, tibia and tarsus II, male.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Flask-shaped elongated segmented pretarsus (fig. 5) arises laterad of the single spine on tarsi I and II, and from between the paired spines on tarsi III and IV. *Body setae.* Venter of body with thirteen pairs of setae, consisting of one medio-lateral pair 129 μ long, one pair anterior to apodemes of coxae II, one pair anterior to apodemes of coxae III and IV, respectively, three spiniform pairs flanking genital opening, two spiniform pairs on each side of anal opening, and four terminal pairs. Two pairs of the terminal setae extremely long, the longest being 270 μ in length. Dorsum with seven pairs of setae, one short pair in lateral depression of dorsal plate, two pairs in propodosomal area, the longest pair being 126 μ long; four pairs in hysterosomal area, the longest pair only 23 μ long.

Male (fig. 3).—The male differs from the female in body size and in the character of the genital and anal region. Two dorsal plates present (fig. 7). Length of male from base of gnathosoma to posterior end of hysterosoma 251 μ; width 234 μ; the longest anal seta 285 μ long. Posterior dorsal plate 129 μ long and 117 μ wide; two pores located on lateral margins of plate. Anterior dorsal plate 138 μ wide and 120 μ long; two lateral depressions, with one pore each, located on lateral margins of plate. Anal suckers located on each side of anus. Apodemes of coxae III united in a transverse band anterior to genital opening.

Egg (fig. 6).—During the process of mounting, an egg was expelled; the egg is 184 μ long and 90 μ wide.

Type material.—Holotype ♂ and allotype ♀ from the nasal cavity of a woodpecker (*Dryobates* sp.) collected near Uijongbu, Korea, October 10, 1953. Holotype, allotype, and two paratypes deposited in the U. S. National Museum, Washington, D. C. U. S. National Museum No. 2203.

Remarks.—Two males and four females were collected from the nasal cavity of a woodpecker. These mites are very small and colorless and can be found by observing the nasal membrane of the bird under a dissecting microscope and watching for a movement in the nasal fluids caused by the mites. This species is easily separated from the other genera in that the tarsi have two clawlike spines on each leg and epimera I are not united. The genital opening is triangular. It can be separated from other species of *Dermatophagoides* in that the tarsi have double clawlike spines, the genital sclerite of the female does not surround the genital opening, and epimera III of the male are connected to form a transverse band anterior to the genital opening. The mite was named after Professor C. J. Sorenson, Emeritus Professor, Utah State Agricultural College, Logan, Utah, who has contributed an outstanding service to the institution and to the state of Utah. I also wish to express my sincere gratitude to Drs. E. W. Baker and G. W. Wharton for their suggestions and criticisms during my work on this paper.

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A NEW LEPTOPODID FROM INDIA
(HEMIPTERA, LEPTOPODIDAE)

By CARL J. DRAKE, *Ames, Iowa*

During the course of studying shore-bugs of the family Leptopodidae in the British Museum (Natural History), I found an undescribed species of the genus *Leptopus* Latreille in the unsorted accession from India. In addition I also came across several specimens of the rare *Leptopus horvathi* Drake and Hottes from Kamaon, Kaldwani District, India, collected by H. G. Champion. The latter was described from Madagascar. It also seems desirable to point out that Drake and Hoberlandt (1951) failed to include the occurrence of *Leptopus spinosus* Rossi in western United States. According to Usinger (1951), this leptopodid was accidentally introduced into California and is now widely dispersed along the Pacific Coast of that state.

Leptopus decus, new species

Small, obovate, black, shining, hemelytra grayish testaceous with numerous small brownish spots and two much larger subapical dark brown spots (one in each outer corium); embolium pale testaceous, without markings; head black, fore part of vertex and entire front fulvous, a median longitudinal sulcus in front of eyes, a subbasal spot near inner margin of each eye, and a large callose just back of ocelli flavous; ocelli continguous within, placed obliquely on top of a brownish tubercle with surfaces sloping downward laterally; head beneath fuscous, with two extremely long testaceous spines on each side, also with several smaller testaceous spines and long bristly hairs on gula; eyes very large, blackish fuscous, slightly convergent anteriorly, widely separated. Rostrum pale testaceous with last segment brownish; segment I beneath with an extremely long pair of slender testaceous spines on each side; II broader, with shorter lateral spines; III much slenderer, tapering apically; proportions: I, 28; II, 20; III, 13. Antennae testaceous, segment 1 one and one-third times as long as second, the other segments missing.

Pronotum blackish fuscous to black, shining, the explanata margins testaceous with outer edge embrowned; collar constricted, not raised anteriorly, narrower than fore lobe; anterior lobe much narrower than hind lobe, divided longitudinally by a median sulcus into right and left lobes, without distinct punctures; hind lobe convex, deep black, quite shining, coarsely punctate, almost as long as front lobe without collar. Scutellum a little wider at base than median length, blackish, deeply broadly impressed in the middle at the base, with apex elevated and pale testaceous. Hemelytra coarsely punctate, slightly constricted near the base, widest at middle, roundly narrowed apically; embolium rather narrow, punctate; membrane pale with a slight brownish shade, composed of four cells. Acetabula grayish testaceous, sometimes slightly brownish, each anterior acetabulum with a long testaceous spine. Venter fuscous, shining, the segments margined behind with testaceous. Middle and hind legs very long, slender, testaceous. Fore legs much shorter, stouter; femora stout, armed beneath on both front and hind margins with four or five long testaceous spines, also with several much shorter spines; tibiae also armed beneath with three or four marginal spines on each edge, also with some shorter spines. Hemelytra and pronotum sparsely clothed with rather long, pale, erect hairs. Length, 3.20 mm.; width, 1.30 mm.

Type (male): Punjab Karnal, India, Feb., 1928, P. J. Barraud, in British Museum. *Paratype:* 1 specimen, same data as type.

Separated from *Leptopus horvathi* Drake and Hottes by the smaller size, shorter appendages and scattered, long, erect, pale testaceous hairs on dorsal surface. *L. scitulus* Drake is more elongate, with fewer erect hairs on dorsum, brownish color with the whitish testaceous hemelytra prominently marked with dark fuscous.

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A CORRECTION

After the completion of a recent, not yet published study on the classification of the larvae of the Ptinidae, it occurred to me that a mistaken identification might have been made of the larvae of the anobiid genus *Gastrallus* in the collection of the U. S. National Museum. On due revision of the material, I found that the specimens, in reality, are ptinid larvae, possessing all the taxonomic characters by which they are recognized, and not anobiid larvae. Consequently the reference of the larvae to the genus *Gastrallus* was wrong in my paper on the anobiid larvae in the U. S. National Museum. (Böving, Adam G., 1954, Mature larvae of the beetle-family Anobiidae, Dan. Biol. Medd. 22:146-147, pl. 40.) The main lot of the larvae in the Museum is labelled: "*Gastrallus* sp, probably *G. laevigatus* Oliv. (imagines det. by W. S. Fisher) in seeds of *Callistemon lanceolatum* from France; U. S. Seed-house, 2 XII 1929." These larvae were not reared, but merely determined by association with the imagines of *Gastrallus* sp. from the same lot. The other larvae in the Museum named *Gastrallus* sp. were determined by comparison with the larvae in the main lot. Unfortunately, the wrong identification of all the larvae was made inattentively, without recalling the fact that J. C. M. Gardner had reared, figured and, in his precise and competent way, described the unquestionably true anobiid larva of *Gastrallus birmanicus* var. *insulcatus* Pic. from dead wood of many species of trees in Dehra-Dun, India. (Gardner, J. C. M., 1937, Immature stages of Indian Coleoptera (22), Indian Forest Records, III(6): 134.)—ADAM G. BÖVING, *Washington, D. C., May, 1955.*

GRADUAL NEST SUPERSEDURE WITHIN THE GENUS OSMIA
(HYMENOPTERA, APOIDEA)

By GEORGE E. BOHART, *U. S. Department of Agriculture, Entomology Research Branch, Logan, Utah.*[1]

In Utah it is fairly common for cell series started in wood tunnels by *Osmia* (*Osmia*) *lignaria* Say to be completed by *Osmia* (*Cephalosmia*) *californica* Cresson. The two species choose the same types of nesting places, and their activity periods overlap, although *californica* has a later activity peak by a week or two. Burrows that contain cells of both species usually show an abrupt supersedure by *californica*. Whether this results from aggressive behavior of the superseding bee or merely follows the disappearance of the original nest builder from other causes has not been determined.

Work by the two species can be easily distinguished by the characteristics in Table 1.

TABLE 1. Distinctions in nesting habits of *Osmia lignaria* and *californica* in Cache Valley, Utah

Species	Usual pollen	Pollen mass	Egg placement	Partitions
lignaria	*Hydrophyllum*	Lopsided layered lump	Vertically in top of pollen mass.	Mud
californica	*Balsamorhyza*	Tightly packed cylinder	Horizontally near center of pollen mass.	Mixture of mud and leaf pulp

One nest, collected by M. D. Levin in Cub River Canyon near Franklin, Idaho, in May 1954, had been worked on simultaneously for several days by a bee of each species. As shown by Figure 1, the first four cells contained eggs and were provisioned largely by *lignaria*, although there was some pollen collected by *californica* in the fourth cell. The fifth, sixth, and seventh cells were provided with eggs and provisioned chiefly by *californica*. However, about half the pollen in the fifth cell was collected by *lignaria*. Most of the first partition was made by *lignaria*, but a small hanging fragment (perhaps torn away by *lignaria*) was made by *californica*. The next partition was made by *lignaria* but surfaced above by *californica*. All succeeding partitions, including the massive terminal plug, were made by *californica*.

Gradual supersedure by one species of bee over another has been observed a number of times in bumble bees, although none of the species are known to supersede habitually. In the Meliponinae the genus *Lestrimelitta* (Schwartz, 1948) makes a practice of gradually superseding the nests of *Trigona*.

Perhaps such close association between species as that exhibited by these two *Osmia* bees could lead in time to the development of the cuckoo type of parasitism characteristic of many bee genera.

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[1]In cooperation with the Utah Agricultural Experiment Station.

REFERENCE

Schwarz, H. F., 1948. Stingless bees (Meliponidae) of the Western Hemisphere. Bull. Amer. Mus. Nat. Hist. 90:173-181.

Photographs by W. P. Nye

Fig. 1. a: Nest of *Osmia californica;* one pollen mass opened to show egg and egg pocket. b: ''Mixed'' nest constructed by *Osmia lignaria* and *californica* (exposed eggs laid by *lignaria*). c: Nest of *Osmia lignaria.*

ADDITIONAL RECORDS FOR BRACHYPANORPA CAROLINENSIS (BANKS)

(MECOPTERA, PANORPIDAE)

A male of this species, kindly donated to the USNM by R. L. Hoffman, was collected by him at Mt. Rogers, Virginia, July 28, 1954 at an elevation of 5500 feet. According to Mr. Hoffman, the specimen was taken while sweeping ferns (*Dennstaedtia, Dryopteris, Osmunda*) in a red spruce (*Picea rubens*) and balsam *(Abies balsamea)* forest with a ground cover of moss. The specimen differs from five other males in the USNM collection in the possession of a blackish triangular spot between the antennae and a longitudinal blackish brown streak over the frons, clypeus and labrum. The wing membrane is darker, reminiscent of *oregonensis* (McLachlan), and the apices of the claspers are more blackish.

Since my identification of the 1954 specimen, Mr. Hoffman informed me of another male in the Virginia Polytechnic Institute collection from Mt. Rogers, collected on June 27, 1953 at about 5000 feet by E. C. Turner, well below the spruce-fir forest.

Carpenter (1953, *Psyche* 60:32) has given Linville Falls, North Carolina as the northernmost record and Union Gap, Georgia the southernmost, with records existing for these two states only. This extends the northernmost record about 95 miles and the length of the narrow strip of mountainous country, in which it seems to be confined, from 120 to about 215 miles and adds a third state, Virginia, to the distribution.

This species is particularly interesting because, as pointed out by Carpenter (*loc. cit.*, p. 154), there is a predominance of more or less flightless females with wings shorter than the abdomen, collected before 1920 and in 1938, and of females able to fly and with wings longer than the abdomen, collected since 1951. This has given rise to the speculation that the selective advantage of the long-winged female over the short might account for the change in wing length after 1938. It will be interesting to note the wing length of females from Mt. Rogers and other localities when they become available.—SOPHY PARFIN, *U. S. National Museum, Washington, D. C.*

ANNOUNCEMENT

The Tenth International Congress of Entomology will be held in Montreal on August 17-25, 1956. Following the Congress a number of excursions to places of entomological interest will be arranged.

All those hoping to attend the Congress and wishing to obtain further information should communicate as soon as possible with the Secretary, Mr. J. A. Downes, Division of Entomology, Science Service Building, Ottawa, Ontario, Canada.

SOCIETY MEETING

The 644th regular meeting of the Society, held in Room 43 of the U. S. National Museum on Thursday, April 7, 1955, was attended by 49 members and 16 visitors. President T. L. Bissell called the meeting to order at 8:00 P.M., and the minutes of the previous meeting were read and approved.

President Bissell announced that Price Piquett will succeed R. A. Nelson as advertising manager of the *Proceedings*. Mr. Nelson has resigned to become Executive Secretary of the Entomological Society of America.

The following were voted to membership: *Ross T. Bell*, 9766 T. S. U., Frederick, Md.; *Richard A. Boettcher*, 4803 Guilford Rd., College Park, Md.; *Dr. Kenneth*

W. Cooper, Head, Department of Biology, University of Rochester, Rochester, N. Y.; *Dr. Louis G. Gentner,* Southern Oregon Branch Experiment Station, 5595 Pacific Highway South, Medford, Ore.; *Mr. Norman G. Gratz,* Entomologist, Division of Sanitation, Ministry of Health, Jerusalem, Israel; *Dr. Robert H. Jones,* Department of Entomology, University of Wisconsin, Madison 6, Wis.; *Robert D. Murrill,* Insect and Rodent Control Section, National Institutes of Health, Bethesda, Md.; *Ted Tibbets,* Moab, Utah; *Alfonso Varela,* Entomologist, Division of Agriculture, Pan American Union, Washington 6, D. C.; *Joseph Thomas Whitlaw, Jr.,* 405 E. Melbourne Ave., Silver Spring, Md.

The Royal Ontario Museum of Zoology and Paleontology, Toronto, requires the assistance of interested entomologists in a study of Monarch butterfly migration, according to a recent letter from Dr. F. A. Urquhart, Director. Cooperators would be supplied with the small gummed labels to be attached to the edge of the wing to mark the butterflies. Interested persons should contact Dr. Urquhart for further information.

K. V. Krombein projected close-up pictures of the nesting behavior of a solitary wasp, *Bicyrtes quadrifasciata* (Say), taken with a 35-mm., single-lens reflex camera and electronic flash.

H. R. Dodge illustrated a technique for sweeping small insects that prevents loss of scales and fine hairs.

''The Chemistry of Pesticides'' by D. E. H. Frear was reviewed by H. H. Shepard. J. S. Wade reviewed ''Aplied Entomology'', revised and rewritten by H. T. Fernald and H. H. Shepard and now in its fifth edition. E. R. Sasscer related interesting incidents from the lives of Edward Burgess, H. A. Hagen, A. S. Packard, S. H. Scudder and W. M. Wheeler. These are recorded in ''Mount Auburn Biographies'', a book by F. W. Russel. The President recommended ''Free Trade'', Dr. H. H. Ross's presidential address to the Entomological Society of America at Houston, Texas, in 1954. It appears in Vol. 1 of the Bulletin of the ESA.

As an example of letters that brighten an entomologist's day, President Bissell exhibited an inquiry from a pants company about control of ants in its product. (Insects in the sample submitted proved to be termites.)

First of the principal papers of the evening was ''Use of Insects in the Development of New Respiratory Protective Devices,'' by Dr. Robert A. Fulton and Dr. Floyd F. Smith, both of the Entomology Research Branch, U. S. Department of Agriculture, Beltsville, Md. A method has been developed to determine the efficiency of respiratory protective devices against toxic insecticides. Aphids and spider mites detect small quantities of the organic phosphate vapors (under 1 ppm.) which are considered safe for use. As a result of this work, new filtering and absorbing materials have been developed and incorporated into practical respirators, which are now available for protection against all of the common insecticides. (Speakers' abstracts.)

''The Prevalence of Mimicry Patterns in the Hymenoptera,'' was the subject of Dr. Henry Townes, of North Carolina State College. The Hymenoptera are mostly active, diurnal insects, and as such, concealing color patterns are of little use and rather uncommon among them. An active insect moving across a varied background is conspicuous regardless of its color, so that ruptive and mimicry patterns are the commonest types. The percentage of mimicry patterns is usually underestimated, in part because biologists become accustomed to these patterns and usually think of them as inherent to taxonomic units rather than as the result of mimicry. The fallacy of this attitude is shown by the fact that unrelated genera within one region tend to converge towards the same color patterns, while in distant regions they tend also to converge towards certain color patterns, but usually different ones. A further analysis of this situation shows that certain color patterns have their own distributions, and within any area, a given color pattern tends to enforce itself on those species that might be considered susceptible to its influence. The principle is well illustrated by many widely distributed species whose range includes more than one pattern area. Within each pattern area covered by such species there is a tendency to develop subspecies, each conforming with the local color pattern and recognized by it. (Speaker's abtract.)

Visitors were Frank P. Sivik and Dale Habeck, North Carolina, and Felipe McClang, Manila.

The meeting adjourned at 10:10 P.M.—Kellie O'Neill, *Recording Secretary.*

Date of publication, Vol. 57, No. 3, was July 8, 1955.

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A PROPOSED CLASSIFICATION OF THE TROMBIDIFORME MITES (ACARINA)

By F. CUNLIFFE, *Pinellas Biological Laboratory, Inc., St. Petersburg, Fla.*

The scheme of classification presented here has been developed by analyzing other systems and studying the tarsi, gnathosoma, genitalia, palpi, and body setation. In the past, Canestrini, Oudemans, Vitzthum, and others placed too much reliance upon a single character, the tracheal system. Although this led to a relatively well-balanced classification, careful study indicated that many of the units were not homogenous.

Baker and Wharton (1952) used several characters in their family diagnoses, but did not consider the tarsus. The writer began a study of the genera of the family Pterygosomidae in 1952 and realized that the tarsi were of importance taxonomically. This study indicated that the striated sensory setae of the tarsi differ among genera, as do the tarsal claws. Yet, all seemed to follow the same general pattern within the family, a pattern which could not be found elsewhere. A cursory examination showed that the same thing was true in most families, and that families could be identified by tarsi alone in most cases. Examination of the suborders Onychopalpida, Mesostigmata, Ixodides, Trombidiformes, and Sarcoptiformes showed that the tarsal claws are distinctive for each suborder.

The following scheme is based upon a study of the tarsal characters, aided by other characters as listed by Baker and Wharton in their family diagnoses. Although the tarsi indicate family or superfamily rank, it is difficult or impossible except in a few cases to use the structure for written key characters. Through the study of the tarsi, homogenous groupings were arranged, and these were further strengthened by the other characters. A tarsal pattern not fitting into a superfamily scheme indicated that other characters should be studied, and usually these other characters were also indicative of taxonomic differences. In the superfamily Tydeoidea, for example, the family Paratydeidae has clawlike pulvilli, entirely different from the rayed, padlike pulvilli of other families, and also has an external peritreme. Although both these characters indicate that the family could belong in a superfamily of its own, a conservative approach is used here and the Paratydeidae is retained within the Tydeoidea, at least until other related families are established. Several other similar situations exist throughout the suborder.

In the proposed classification the names for the various categories were changed as little as possible. Names above familial rank have not been subject to standardization and consequently little uniformity is to be found. An attempt has been made to clarify this situation, but until definite rules are established, it is expected that these names may be subject to change by other workers.

Proposed Classification of the Trombidiformes

Supercohors *HETEROSTIGMATA* Berlese, 1899

These are very small mites, at times with inconspicuous gnathosoma, with tiny needlelike chelicerae, and minute palpi lying closely appressed to the gnathosoma; the peritreme in the female opens onto the propodosoma behind the gnathosoma, whereas the male lacks a tracheal system; the mites may or may not possess the usual four pairs of legs; the tarsal claws and pulvilli are distinct for the group in that the paired claw arises from a membranous base and the pulvillus is a broad membranous structure stretching between the two claws; in some cases tarsus I possesses only a single clawlike pulvillus arising from a stalked membranous base, which may be greatly reduced. Tarsus I possesses striate rodlike sensory setae. In *Podapolipus* the legs are degenerate. Specimens of this genus were not available for study and therefore the presence or absence of sensory setae is not known. The bodies may show signs of segmentation. The claws and pulvilli seem much like those of the Mesostigmata, but when the two groups are compared they can be easily separated. No other group of Trombidiforme mites has this type of membranous pulvillus.

Cohors **TARSONEMINA** Canestrini and Fanzago, 1877

With the characters of the supercohors.

Superfamily **Tarsonemoidea** Ewing, 1934

With the characters of the supercohors.

Families.—Podapolipodidae Oudemans, 1931; Scutacaridae Oudemans, 1916; Pyemotidae Oudemans, 1937; Tarsonemidae Kramer, 1877.

Supercohors *PROSTIGMATA* Kramer, 1877

The tracheae open anteriorly at the base of the chelicerae; peritremes may or may not be present, either projecting freely or coalesced with the body wall, and occasionally found within the cheliceral base; all but a few specialized mites possess the striated sense organ on tarsus I; the claws and a padlike, or rarely clawlike, pulvillus are usually present and are distinct for this group, and in many cases are of taxonomic value to the family or generic level; the body setae are few and are arranged in transverse rows; the life cycle of the mite is simple, homeomorphic, all stages being similar.

Cohors **ENDEOSTIGMATINA** Grandjean, 1937

The lack of stigmata or peritremes centering at the base of the chelicerae is a basic character for separating this group from the others; the palpi do not have the thumb-claw complex but otherwise are highly developed as to types of sensory setae; the chelicerae have opposed chelae that may be modified and bizarre; distinct propodosomal pseudostigmata and pseudostigmatic organs are present, but sclerotized shields are absent; the body setae are arranged in transverse rows, with few exceptions, and the body is soft, unarmored, and may show signs of segmentation; the legs have many setae; the tarsi may or may not have claws and/or pulvilli.

Superfamily **Pachygnathoidea**, new superfamily

At present with the characters of the cohors.

Grandjean (1939) did not believe that the families of Endeostigmata should be included in a single superfamily because characters common to the families were also common throughout the Acarina, and each family was distinct from the others. To conform with the rest of the classification the above superfamily is proposed; but, as suggested by Grandjean, several superfamilies may be involved. However, until other families are discovered, it is thought best to leave the families under the one heading. Phylogenetically, although the mites retain such primitive characters as soft bodies, remnants of body segmentation, and simple palpi, the development of sensory setae indicates that the pachygnathids are highly developed.

Families.—Pachygnathidae Kramer, 1877; Lordalychidae Grandjean, 1939; Nanorchestidae Grandjean, 1937; Sphaerolichidae Grandjean, 1939; Alicorhagiidae Grandjean, 1939; Terpnacaridae Grandjean, 1939.

Cohors **PROMATINA**, new cohors

The tracheal system of this group is distinct, with or without peritremes; although body setation indicates body segmentation, the actual segmentation is not discernible; the propodosoma may have sensory setae or pseudostigmatic organs but not distinctly so; the bodies are usually well-developed, in many cases with sclerotized areas or plates.

Subcohors **EUPODOSTIGMATA**, new subcohors

This group contains prostigmatic mites with an internal tracheal system but no external peritremes, and simple palpi in which the last segment is terminal and without a thumb-claw complex.

Superfamily **Eupodoidea** Banks, 1894

These mites have a small lobe with a pair of setae on the anterior portion of the propodosoma; the chelicerae are either simple, opposed, or partially chelate for piercing; the palpi are simple; the tarsi possess striate sensory setae lying flat rather than erect in a special membranous area (the rhagidial organs); the tarsal claws are simple, rayed, and the pulvillus is padlike and rayed laterally.

Families.—Eupodidae Koch, 1842; Penthalodidae Thor, 1933; Rhagidiidae Oudemans, 1922.

Superfamily **Tydeoidea**, new superfamily

These mites have simple palpi; the chelicerae are fused, the fixed chela is degenerate; the movable chela is small and styletlike; and the genital opening may or may not have genital suckers. The tarsi are characteristic in possessing few setae, a simple, erect striate rodlike sense seta (two in Paratydeidae), and rayed claws with padlike pulvilli (except in the Paratydeidae where the pulvilli are clawlike and the claws are simple).

Families.—Tydeidae Kramer, 1877; Speleognathidae Womersley, 1936; Ereynetidae Oudemans, 1931; Paratydeidae Baker, 1949.

Superfamily **Cunaxoidea**, new superfamily

This group contains those mites in which the palpi may be highly developed for grasping or for use as sense organs (or ''feelers''); the gnathosoma is usually elongate, snoutlike; the chelicerae are separate and hinged at the base, movable laterally scissorslike; the movable chela is small. Tarsus I posssses more than one rodlike sensory seta; claws and pulvilli are present but differ structurally in the two families.

Families.—CUNAXIDAE Thor, 1902; BDELLIDAE Dugés, 1834.

Superfamily **Halacaroidea**, new superfamily

These are, with few exceptions, salt-water mites, probably related to the Cunaxidae; the body possesses few setae, and there are no specialized sensory setae; usually four dorsal plates are present; the longitudinal genito-anal region is enclosed in plates and has three pairs of genital suckers; the gnathosoma is not elongate as in the Cunaxidae and Bdellidae; the chelicerae are retractile, not arranged to move laterally as in the two families just mentioned; the fixed chela is not well developed; the palpi are similar to those of the Cunaxidae in having the distal segment clawlike, without sensory setae. The târsi possess claws and clawlike pulvilli; the leg setae are few in number and none is obviously specialized as a sense ''organ'' (this may be a result of the water habitat, the mite depending upon other (?) structures for sense perception).

Family.—HALACARIDAE Murray, 1877.

Subcohors **STOMATOSTIGMATA** Oudemans, 1906

These mites are heavily sclerotized and have few body setae; the propodosoma has four pseudostigmata and sensory setae, a pair of lenslike eyes laterally, and in some forms, a large lenslike lateral organ; the genital and anal openings are covered by plates, and two pairs of genital suckers are present; the palpi are simple but characteristic; the chelicerae are strong and have opposed chelae; the legs are the most divergent character, the coxae forming distinct ventral plates. Tarsus I possesses two claws arising directly from the tarsus, but there is no pulvillus present, whereas tarsi II, III, and IV have clawlike pulvilli; the legs are setaceous; tarsus and tibia I are both covered by fine tactile setae, and dorsally tarsus I has a single striate, rodlike sensory seta and a specialized branched seta (famulus); a slender rodlike sense seta is found on tibia I.

Superfamily **Labidostommoidea** Ewing, 1934

With the characters of the subcohors.

Family.—LABIDOSTOMMIDAE Oudemans, 1904.

Subcohors **ELEUTHEROGONA** Oudemans, 1909

This group of prostigmatic mites contains those families which possesses an external peritreme as well as internal tracheae, and a palpal thumb-claw complex.

Superfamily **Caeculoidea** Ewing, 1934

These mites are related to those possessing a distinct thumb-claw complex on the palps, the palpal tarsus being long, well developed, and the tibial claw being not much more than a specialized spine; the chelicerae are stout, the movable chela is strong and sicklelike, and only a remnant of the fixed chela is left; the body usually has seven dorsal shields; laterally and ventrally on the propodosoma there is a pseudostigmata and its sensory seta; two pairs of lenslike eyes are present; there are only a few body setae that do not appear to lie in a definite transverse pattern; the genital opening is longitudinal and without genital suckers. The legs are characteristic in having the inner margin of the first pair of legs with long setae arranged on tubercles to give the mite the ''rake-legged'' effect. The tarsi possess claws but lack pulvilli; the striate sensory setae are small, deeply buried within characteristic pits both on the fore tarsi and tibiae; other leg setae are diagnostic for the superfamily.

Family.—CAECULIDAE Trouessart, 1892.

Superfamily **Raphignathoidea** Grandjean, 1944

The palpal thumb-claw complex is constant throughout this superfamily except in one family, the Cryptognathidae; there are no dorsal scutal sensory areas on the propodosoma; the chelicerae may or may not be fused medially; the movable chela is small, styletlike, for piercing, and the fixed chela is never strongly developed. The tarsal claws are simple; the pulvilli are present, with tenent hairs similar to those found in the Tetranychoidea (the family Pomerantziidae does not possess pulvilli but may belong elsewhere). Baker and Wharton (1952) placed the Stigmaeidae and the Caligonellidae into synonymy with the Raphignathidae. The results of Summers' and Schlinger's work (1955) and of the studies made here justify the retention of the three families.

Families.—RAPHIGNATHIDAE Kramer, 1877; STIGMAEIDAE Oudemans, 1931; CALIGONELLIDAE Grandjean, 1944; CRYPTOGNATHIDAE Oudemans, 1902; POMERANTZIIDAE Baker, 1949.

Superfamily **Tetranychoidea** Rekk, 1952

This superfamily is readily distinguished from the other Trombidiforme mites possessing the palpal thumb-claw complex in having the movable chelae very long, needlelike, strongly recurved proximally, and set in the fused cheliceral bases, the stylophores; tarsal claws and pulvilli may possess tenent hairs; the genital opening is transverse and not longitudinal as in most mites.

Families.—TETRANYCHIDAE Donnadieu, 1875; TUCKERELLIDAE Baker and Pritchard, 1953; TENUIPALPIDAE Berlese, 1913 (= PHYTOPTIPALPIDAE Ewing, 1922); LINOTETRANIDAE Baker and Pritchard, 1953.

Superfamily **Anystoidea**, new superfamily

This superfamily has the palpal thumb-claw complex, the chelicerae are hinged posteriorly so that they are free to move laterally, and the movable chelae are small and not opposed to the remnants of the fixed chelae. Other characters are variable and are used for the family diagnosis.

Families.—ANYSTIDAE Oudemans, 1902; PSEUDOCHEYLIDAE Oudemans, 1909; TENERIFFIIDAE Thor, 1911; PTERYGOSOMIDAE Oudemans, 1910.

Superfamily **Cheyletoidea**, new superfamily

Many of these mites have the palpal thumb-claw complex; the movable chela is straight, styletlike and of varying lengths; the basal portions of the chelicerae are fused with the gnathosoma so that they are not visible as in other groups. The families included here that do not have the palpal thumb-claw complex are a little more specialized morphologically and biologically than are the Cheyletidae; they can all be related by the structure of the gnathosoma, by the similar nature of the tarsal claws and pulvilli, or by the aedeagus that is to be found similarly placed, although most other characters may differ.

Families.—Cheyletidae Leach, 1815; Myobiidae Megnin, 1877; Demodicidae Nicolet, 1855; Heterocheylidae Trägårdh, 1950.

Subcohors **TETRAPODILI** Bremi, 1872

These mites have no demonstrable tracheal system; there are only two pairs of legs placed anteriorly, with the transverse genital opening located just behind the posterior or second pair of legs; the chelicerae are tiny, styletlike, and the palpi are very simple and lie coalesced to the rostrum; the setal pattern of the legs is highly simplified, tarsus I possessing two dorsal and one ventral setae, and the tibia and genu each having a single dorsal seta; the tarsal claws have been lost and no remnants can be found; the pulvillus is highly developed, many rayed, and used as a claw (''feather claw'' of Keifer); dorsally above the pulvillus is a rodlike seta (''claw'' of Keifer) which is possibly homologous to the dorsal median rodlike sensory seta of the more normal types found in other families.

Superfamily **Eriophyoidea** Ewing, 1934

With the characters of the subcohors.

Family.—Eriophyidae Nalepa, 1898.

Supercohors ***PARASITENINI,*** new supercohors

These are large red mites; the palpal thumb-claw complex is well developed; a specialized sclerotic area is usually present on the propodosoma on which are located sensory setae; the body is densely covered with short setae, not arranged in transverse rows; the leg segments have many setae, both tactile and sensory; the tarsal claws are always present; the pulvillus is rarely present and may be quite modified; the larvae, almost without exception, are heteromorphic.

Cohors **PARASITENGINA** Oudemans, 1909

With the characters of the supercohors.

Superfamily **Erythraeoidea** Grandjean, 1947

These mites usually have heteromorphic larvae; there is a well developed palpal thumb-claw complex; the movable chelae are strong, long, straight, and needle-like; the propodosomal sensory setae are located on sclerotized sensillary areas; the body is densely covered with short setae, not arranged in transverse rows; genital suckers may or may not be present; tarsi and tibiae and all leg segments are covered with many tactile setae, and the tarsi and tibiae I have many striate sensory setae scattered among these tactile setae; the tarsi have claws but no pulvilli.

Families.—Erythraeidae Oudemans, 1902; Smarididae Kramer, 1878; Calyptostomidae Oudemans, 1923.

Superfamily **Trombidioidea** Banks, 1904

These are large mites with heteromorphic larvae; with well developed palpal thumb-claw complex; the chelicerae are distinctive in that the movable chela is strong, short, hooklike, with distal teeth; the stigmata open at the base of the chelicerae and usually are without free peritremes; the body is densely covered with many short setae; a crista metopica or sclerotized sensory area is usually present on the propodosoma and usually only a single pair of sensory setae is present; there are genital suckers; the legs are covered with many setae; the tarsal claws are always present; the pulvillus may be present or absent.

Families.—TROMBIDIIDAE Leach, 1815; TROMDICULIDAE Ewing, 1944.

Cohors **HYDRACHNELLAE** Latreille, 1802

This group of mites has been reviewed by Viets (1936) and is not included in this discussion. Although the larvae are similar to those of the Parasitengina, the adults vary greatly in structure of the palpi, body and leg setation, and genitalia.

A KEY TO THE FAMILIES OF TROMBIDIFORME MITES

1. Body elongate, wormlike, annulate 2
   Body normal, rounded, not wormlike nor annulate 3
2. With only two pairs of legs; genitalia located just behind second pair of legs; plant feeders .... **Eriophyoidea** .... ERIOPHYIDAE
   With four pairs of legs; female genital opening between fourth pair of legs; male genital opening on anterior dorsum of body; skin parasites .... DEMODICIDAE 33
3. Gnathosoma with minute palpi lying closely appressed laterally; with tiny, styletlike chelae; with the usual four pairs of legs, or with fewer; stigma of female opening behind gnathosoma on propodosoma; male without stigma or tracheae; pulvillus usually a membranous flaplike organ attached to claws .... **Tarsonemoidea** 4
   Gnathosoma usually conspicuous, with large chelicerae; palpi usually well developed; rarely without fours pairs of legs; stigma opening at base of chelicerae; pulvillus free, padlike, or clawlike, arising from tarsus 7
4. Both males and females with four pairs of legs 5
   Females with one to three pairs of legs; males with three, seldom four, pairs of legs .... PODAPOLIPODIDAE
5. Anterior dorsal body plate not forming a broad rooflike covering over mite; leg IV not ending in many whiplike setae 6
   Anterior dorsal body plate forming a broad rooflike covering over mite; leg IV ending in many whiplike setae; tarsus IV may be long, attenuated, bearing claws .... SCUTACARIDAE
6. Leg IV of female with claws and modified membranous pulvillus .... PYEMOTIDAE
   Leg IV of female ending in terminal and subterminal whiplike setae .... TARSONEMIDAE
7. Without a palpal thumb-claw complex 8
   With a palpal thumb-claw complex 26
8. Rodlike sensory setae of tarsus I lying flush (usually) with tarsus in a specialized membranous area; anterior portion of propodosoma with a tubercle bearing a pair of setae .... **Eupodoidea** 9
   Rodlike sensory setae of tarsus I erect, arising from a small circular membranous base (absent in the Halacaridae) 11

9. With small and sometimes distorted cheliceral shears 10
With large, opposed cheliceral shears .... RHAGIDIIDAE
10. Soft bodied, without projection over gnathosoma .... EUPODIDAE
Hard, sclerotized, and with a projection over gnathosoma .... PENTHALODIDAE
11. Cheliceral bases fused, or if not fused, not capable of a lateral, scissorslike motion over gnathosoma 12
Chelicerae free, attached at base and free to move scissorslike laterally across gnathosoma .... **Cunaxoidea** 25
Chelicerae free, retractile; distal segment of palpus clawlike; marine mites .... **Halacaroidea** .... HALACARIDAE
12. Propodosoma without obvious pseudostigmata and pseudostigmatic organs 13
Propodosoma with one or two pairs of distinct, differentiated pseudostigmata and pseudostigmatic organs; chelae opposed; small, softbodied .... **Pachygnathoidea** 20
13. Soft bodied; coxae not forming apodemes; chelicerae not opposed 14
Strongly armored; coxae forming characteristic apodemal patterns; chelicerae strong, opposed .... **Labidostommoidea** .... LABIDOSTOMMIDAE
14. Chelicerae long, whiplike .... TENUIPALPIDAE 35
Chelicerae short, needlelike 15
15. First pair of legs normal, for walking 16
First pair of legs adapted for clasping hairs of host .... MYOBIIDAE 33
16. Gnathosoma normal, not enclosed in a tube .... **Tydeoidea** 17
Gnathosoma enclosed within a sheath formed by an extension of the body wall .... CRYPTOGNATHIDAE 39
17. With two pairs of genital suckers 18
Without genital suckers 19
18. With a pair of long, fine sensory setae on both propodosoma and hysterosoma; without peritremes; pulvillus padlike .... EREYNETIDAE
With sensory setae on propodosoma only; with peritremes; pulvillus clawlike .... PARATYDEIDAE
19. Legs with netlike armor; movable chelae minute, almost invisible; cheliceral bases may be fused with gnathosoma .... SPELEOGNATHIDAE
Legs without netlike armor; movable chelae larger, visible; cheliceral bases always free and prominent .... TYDEIDAE
20. With three pairs of genital suckers 21
With two pairs of genital suckers 22
21. With a single pair of sensory setae on propodosoma .... TERPNACARIDAE
With two pairs of sensory setae on propodosoma .... PACHYGNATHIDAE
22. With two pairs of sensory setae on propodosoma 23
With a single pair of sensory setae on propodosoma; tarsal claws lacking, pulvillus clawlike .... ALICORHAGIIDAE
23. Tarsi with claws and/or pulvillus 24
Tarsi without claws; pulvillus clawlike; legs IV adapted for jumping .... NANORCHESTIDAE
24. Tarsi I-IV with claws and pulvilli; without eyes; anterior pair of sensory setae in special depression; distal portion of fixed chela almost lacking .... LORDALYCHIDAE
Tarsus I with claws and without pulvillus; tarsi III-IV with claws and

pulvilli; with two pairs of eyes; no special depression for sensory setae; chelae normal .... SPHAEROLICHIDAE

25. With two pairs of genital suckers; palpi long, turned inward, distal segment usually clawlike, adapted for grasping .... CUNAXIDAE

With three pairs of genital suckers; palpi long, elbowed, with distal setae .... BDELLIDAE

26. Body densely clothed with setae; larvae usually hetermorphic 42

Body setae relatively few, arranged in transverse rows; larvae homeomorphic 27

27. Body strongly armored, with several dorsal shields; setae on leg I so arranged as to give a rakelike effect; chelicerae short, thick, with strong sicklelike movable chelae and weak fixed chelae .... **Caeculoidea** .... CAECULIDAE

Body not so constructed 28

28. Chelicerae free, hinged at base so as to move scissorslike laterally over gnathosoma .... **Anystoidea** 29

Chelicerae not so constructed, fused, with needlelike movable chelae 32

29. Palpal thumb low, not prominent 30

Palpal thumb long, prominent, movable chela distal and hooklike .... ANYSTIDAE

30. Without genital suckers 31

With three pairs of genital suckers; dorsal sensory setae may be set in distinctive pseudostigmata; tarsal claws large, serrate .... TENERIFFIIDAE

31. Tarsi with or without claws and/or pulvillus; claws never with tenent hairs; free living .... PSEUDOCHEYLIDAE

Tarsi with claws but without pulvillus; claws with tenent hairs; usually parasitic on lizards, rarely on arthropods .... PTERYGOSOMIDAE

32. Cheliceral bases closely fused with gnathosoma and without indication of suture; peritreme present on gnathosoma, usually M-shaped, predators or parasites .... **Cheyletoidea** 33

Cheliceral bases fused with each other but not with gnathosoma, suture present; peritremes usually present on anterior portion of propodosoma; predators or plant feeders 34

33. With well-developed palpi and well-developed claw-thumb complex; peritreme obvious, M-shaped, on gnathosoma; tarsal claws and pulvilli present, rarely absent .... CHEYLETIDAE

Palpi and palpal thumb weakly developed; tarsus I without claws or pulvillus; other tarsi with large, disc-shaped pulvilli; ectoparasites of arthropods .... HETEROCHEYLIDAE

Palpi small, simple; legs I highly modified for clasping hairs of host .... MYOBIIDAE

Body wormlike, annulate; with four pairs of legs; mite adapted for living in skin of vertebrate hosts .... DEMODICIDAE

34. Chelicerae fused to form extrusible stylophore; movable chelae long, curved, whiplike; genital opening transverse .... **Tetranychoidea** 35

Chelicerae may be fused but not extrusible as above; movable chelae short, styletlike but never whiplike; genital opening longitudinal .... **Raphignathoidea** 38

35. Palpus with thumb-claw complex 36
Palpus simple, without thumb-claw complex .... TENUIPALPIDAE
36. Eyes present 37
Eyes absent .... LINOTETRANIDAE
37. Dorsum of hysterosoma with 36 fan-shaped setae; the caudal end of body with a series of flagelliform setae .... TUCKERELLIDAE
Dorsum of hysterosoma with not more than 24 setae; the caudal end of body without a series of flagelliform setae .... TETRANYCHIDAE
38. With pulvillus and no genital suckers 39
Without pulvillus and with three pairs of genital suckers; tarsus I with several rodlike sense organs .... POMERANTZIIDAE
39. Gnathosoma not enclosed by a tube 40
Gnathosoma enclosed by a tube formed by an extension of the body wall; with two pairs of genital suckers; palpus without thumb-claw complex .... CRYPTOGNATHIDAE
40. Peritremes not reaching into chelicerae 41
Peritremes reaching into chelicerae; palpal thumb-claw complex not strong .... CALIGONELLIDAE
41. Coxae arranged into two distinct groups (I-II and III-IV); female genital and anal openings contiguous .... STIGMAEIDAE
Coxae contiguous; female genital and anal openings slightly separated .... RAPHIGNATHIDAE
42. Movable chelae long, straight, extrusible .... **Erythraeoidea** 43
Movable chelae short, strong, hinged at base .... **Trombidioidea** 45
43. Without genital suckers; with sensillary area and/or shield on propodosoma 44
With genital suckers; without sensillary areas on propodosoma; palpi small, entire gnathosoma can be withdrawn into body cavity .... CALYPTOSTOMIDAE
44. Gnathosoma small, capable of being withdrawn into body; propodosoma usually elongate anteriorly .... SMARIDIIDAE
Gnathosoma large and cannot be withdrawn in the body; propodosoma not elongate anteriorly .... ERYTHRAEIDAE
45. Adults not figure-8-shaped; with numerous setae on tectum when present; larvae usually with more than one dorsal shield; seta on palpal coxa of larva usually anterior to palpal femur .... TROMBIDIIDAE
Adults usually figure-8-shaped; with one only or two setae on tectum; larvae with a single dorsal plate with rare exceptions; seta on palpal coxa of larva posterior to palpal femur .... TROMBICULIDAE

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A REDESCRIPTION OF NOTHRUS QUADRIPILUS EWING AND ITS RELATIONSHIPS TO OTHER SPECIES OF THE GENUS[1]
(ACARINA, ORIBATEI, CAMISIIDAE)

By TYLER A. WOOLLEY, *Colorado A. & M. College, Fort Collins.*

Currently the genus *Nothrus* C. L. Koch, 1835, is recognized by a long, thread-like pseudostigmatic organ and a weakly swollen hysterosoma with upturned edges. Willmann (1931) cited these particular features together with a median rostral cleft as characteristics of the genus. Ewing (1917) used setal insertion tubercles of the hysterosoma to differentiate *Nothrus* from other genera in the subfamily Nothrinae. In an earlier writing Ewing (1909) described *Nothrus quadripilus* as a new species without discussing any of these features. He did indicate that *N. quadripilus* had a short, clavate pseudostigmatic organ and he mentioned a long, simple bristle adjacent to the pseudostigmatic organ without naming the bristle specifically.

The species *Nothrus quadripilus* Ewing, 1909, has the weakly swollen hysterosoma typical of the genus. According to Ewing's description, however, the pseudostigmatic organ is short and clavate and differs from other such organs in the genus, if the description is correct. The long, propodosomal bristle which Ewing mentioned is not like the other dorsal setae, but resembles the pseudostigmatic organ characteristic of the genus. These differences constitute sufficient justification for the following redescription.

Nothrus quadripilus Ewing
(Figures 1, 2)

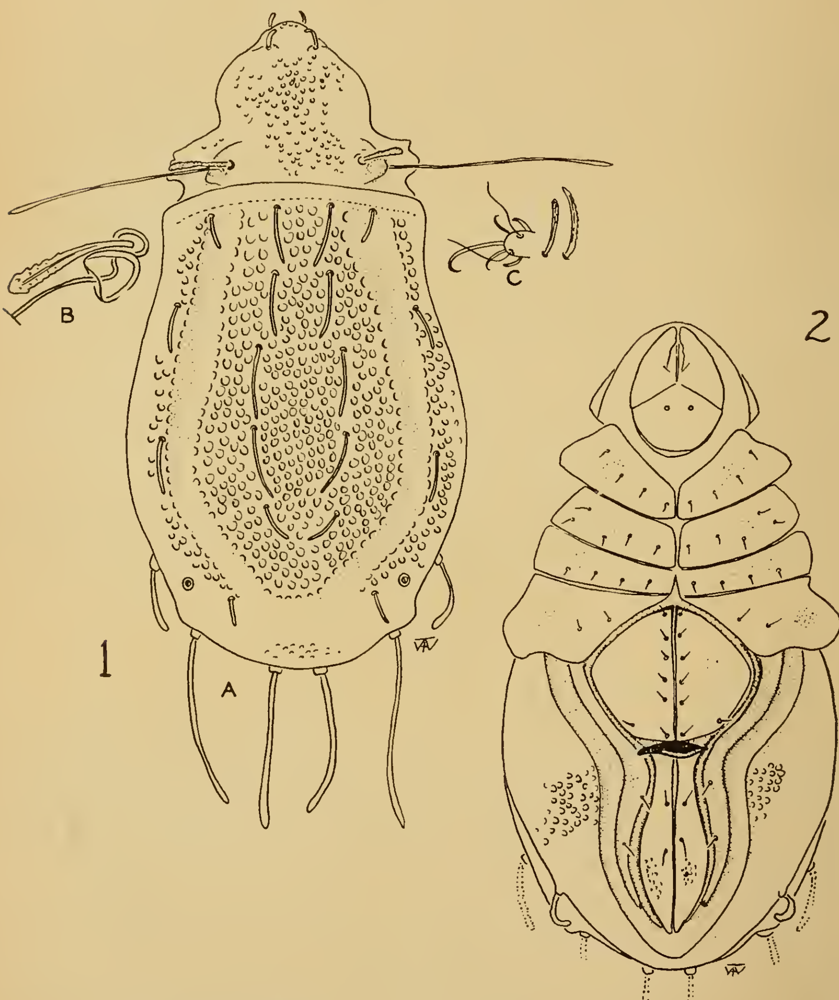
Ewing, H. E., 1909. Jour. N. Y. Ent. Soc. 17: 131.

Diagnosis.—Rostrum without a medial notch; pseudostigmatic organ long, thread-like, as long as width of propodosoma and inserted in a raised lateral prominence; interlamellar hairs stout, clavate, inserted close to pseudostigmata; posterior margin of hysterosoma with four long, subequal bristles; raised medial part of hysterosoma surrounded by a shallow trough. Differs from European species in the length of the four posterior hysterosomal bristles and absence of rostral notch.

Description.—Chestnut brown. Propodosoma longer than broad, broadly joined to hysterosoma, deeply indented at level of leg I, surface areolate. Rostrum blunt, without median cleft in anterior margin; rostral hairs short, simple, decurved. Lamellae absent; lamellar hairs stout, rough, decurved and pressed close to lateral edges of rostrum, inserted in slight prominences and about their length from anterior margin of rostrum. Interlamellar hairs stout, somewhat clavate, inserted slightly mediad of pseudostigmata (Fig. 1B). Pseudostigmata cup-like, in latero-posterior margins of raised projections of propodosoma, inner margin nearly

[1]The National Science Foundation provided funds for this research, for which the author is extremely grateful. The writer is also indebted to Dr. E. W. Baker for pencil drawings of a cotype of *Nothrus quadripilus* Ewing and to the U. S. National Museum for the loan of a cotype specimen used for the description.

directly below insertions of interlamellar hairs. Each pseudostigmatic organ as long as width of propodosoma at level of pseudostigmata, a simple long thread, curved anteriorly at insertion, then projected directly laterad (Figs. 1A, 1B).



Nothrus quadripilus Ewing: fig. 1a, dorsal view, legs omitted; fig. 1b, left interlamellar hair, pseudostigmata and part of pseudostigmatic organ of a cotype specimen, dorsal aspect; fig. 1c, claws of tarsus I of a cotype, and two types of setae on legs; fig. 2, ventral view, legs omitted.

Hysterosoma slightly broader than propodosoma, somewhat rectangular, with indented antero-lateral margins and a rounded posterior end. Notogastral plate overlaps propodosoma slightly. Central part of dorsal surface of hysterosoma raised, surrounded by a shallow trough; surface areolate, the areoli larger than those of propodosoma; dorsal setae in two rows as indicated in Fig. 1A; a bristle at postero-lateral margin of hysterosoma, inserted in a raised tubercle; what appears to be a glandular fissure between last two bristles of each outer row, closer to posterior bristle; posterior margin of hysterosoma with four long, slightly curved bristles, subequal in length and somewhat clavate, inserted in raised tubercles.

Camerostome oval, mandibles chelate, bristle insertions as in Fig. 2. Apodemes I form a broad collar around posterior margin of gnathosoma; apodemes of all legs broad plates, joined medially, extended laterally in slight projections; apodemes III and IV with a triangular cleft at medial margins; all apodemes finely granular and with simple setae as illustrated in Fig. 2. Ventral plate indented around genital and anal covers to form a narrow groove; finely areolate.

Genital plates triangular, in a trapezoidal space formed by apodemes IV and indented margins of ventral plate, finely granular, with six pairs of setae on medial margins, one additional seta in postero-lateral angle of each plate, antero-medial margin of each plate a sclerotized point.

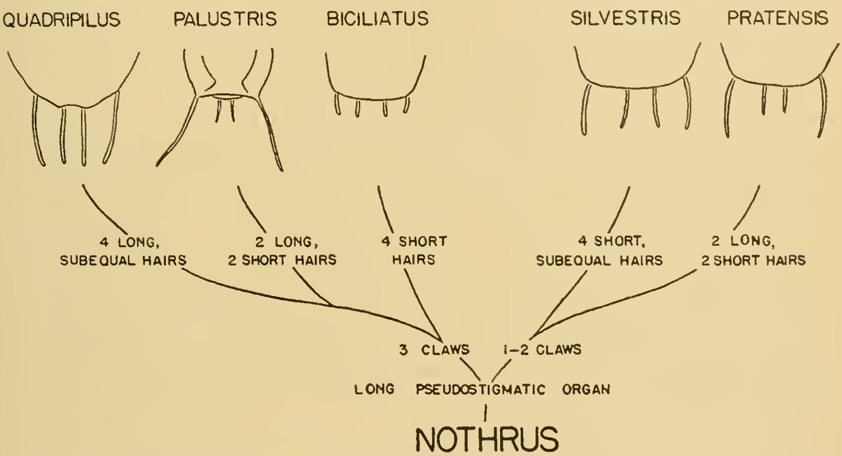


Fig. 3. Suggested interspecific relationships in the genus *Nothrus*. (Diagrammatic sketches after Ewing, Sellnick and Willmann.)

Anal plates finely areolate, long and narrow, lateral margins indented in anterior third, each plate with two setae. Two pairs of setae of ventral plate inserted lateral to anal plate near its indented margin. A rough, curved seta on lateral margin of ventral plate near level of posterior tip of anal plates and inserted in a tubercle (Fig. 2).

Legs stout, areolate, with heavy bristles; tarsi tridactyle, a long median claw and two shorter lateral claws; tarsus I with two fine, dorsal setae near tip (Fig. 1C).

Length 814μ, hysterosoma 614μ; width 428μ.

In trash. Collected by C. R. Crosby at Columbia, Mo.

Discussion.—Critical study of a cotype specimen of *Nothrus quadripilus* Ewing shows that the insertions of the interlamellar hairs approximate the pseudostigmata so closely that they may be confused with the latter (Fig. 1B). The interlamellar hairs are similar to the other clavate setae of the propodosoma and hysterosoma. The pseudostigmatic organs are long and thread-like, characteristic of the genus. Apparently Ewing (1909) in his original description of *N. quadripilus* confused the interlamellar hairs with the pseudostigmatic organs. The "clavate pseudostigmatic organ" indicated by Ewing is actually the interlamellar hair and the "very long, simple bristle, as long as the cephalothorax itself" is the pseudostigmatic organ.

Examination of the tarsal claws of the cotype reveals the presence of three claws instead of the single one described by Ewing (1909). The lateral claws are slender and hair-like, but they differ from the leg setae in being simple and distinctly decurved (Fig. 1C). The number of claws serves to separate species of the genus into two groups which are shown in Fig. 3 (Sellnick, 1929; Willmann, 1931).

The hysterosomal setal pattern of the cotype varies slightly from Ewing's description and illustration. The outer rows of dorsal setae are lateral to the shallow trough on the dorsum of the hysterosoma except for the anterior bristle of the right row. The latter seta is in the broadened valley of the trough (Fig. 1A).

Comparisons of the pseudostigmatic organs, the hysterosomal setae and the tarsal claws reveal the following relationships between the species of the genus *Nothrus*. The American species, *N. quadripilus* Ewing, and the European species *N. palustris* C. L. Koch, and *N. biciliatus* C. L. Koch are more closely related to each other than they are to *N. silvestris* Nic. and *N. pratensis* Sell. (both European species). The species *N. quadripilus* Ewing and *N. palustris* C. L. Koch appear to be more nearly related to each other than to any of the other species. Suggested interspecific relationships based on morphological characteristics are illustrated in the accompanying dendrogram (Fig. 3).

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ANNOUNCEMENT

Short papers consisting of less than two double-spaced typewritten pages, without illustrations, are welcome and will receive prompt publication in the *Proceedings*.

AN ANNOTATED LIST OF WASPS COLLECTED IN FLORIDA, MARCH 20 TO APRIL 3, 1954
(Hymenoptera, Aculeata)

By Karl V. Krombein[1] and Howard E. Evans[2]

Last year we presented a list of the wasps collected in Florida by a party of five hymenopterists from March 29 to April 5, 1953 (Krombein and Evans, 1954). In the spring of 1954 the authors, with C. M. Yoshimoto, a graduate student at Cornell University, made a similar collecting trip from March 20 to April 3. During this trip we revisited the localities which proved to be most productive or interesting in 1953, and also worked at several new stations. After working up the 1954 material we found that we had obtained so many species not taken in 1953 that we decided to present a supplemental list, together with our notes on biology and behavior of some of the species.

We collected 167 species and subspecies in seven families in 1953,[3] and 163 species and subspecies in nine families in 1954. However, 55 of those collected in 1954 were not taken in 1953. In the following list, which includes all species and subspecies taken in 1954, we have indicated for each the localities in which it was taken, the number of specimens collected at each station, and the preferred habitat where any was apparent. All species were diurnal except for the mutillid *Photomorphus paula* (Brad.) and the rhopalosomatid *Olixon banksii* (Brues). We have included also one sight record, *Podium carolina* Roh.

Our itinerary, with the number of species taken at each locality, was as follows:

Paradise Key, Everglades National Park, Dade County—March 22-23; in and on the edge of dense hammock forest; 28 species.

Cape Sable, Everglades National Park, Monroe County—March 24-25, 27; on salt flats with sparse to moderately dense, mostly decumbent vegetation several miles west of Flamingo; these flats were quite moist this year as compared with 1953; 16 species.

Key Largo, Monroe County—March 26; mostly along edge of dense jungle vegetation; 17 species.

Florida City, Dade County—March 26; open pine-palmetto area; 1 species.

Marco, Collier County—March 28; on white beach sand with sparse vegetation, and a few on thistle honeydew along roadside; 31 species.

Olga, Lee County—March 29-30; sandy flats with sparse to moderately dense, mostly decumbent vegetation; 46 species.

LaBelle, Hendry County—March 30; as above; 13 species.

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[3]Actually we recorded only 166 species and subspecies in our earlier paper, but H. K. Townes informs us that the females from Orlando recorded in that paper as the pompilid *Minagenia julia* (Brim.) are in fact a new species. The males we identified as *julia* from Lake Placid and Juniper Springs were confirmed as that species by Townes.

Bermont, Charlotte County—March 30; mostly on thistle honeydew along roadside; 10 species.

Arcadia, DeSoto County—March 30-31, March 20-21 (Krombein only); sandy flats with sparse to moderately dense, mostly decumbent vegetation along Peace River; 50 species.

Lake Placid, Highlands County—April 1; mostly on avocado blossoms, a few on thistle honeydew, and some in open pine-oak woods; 50 species.

Fort Pierce, St. Lucie County—April 2; mostly on sandy areas covered with sparse to moderately dense low vegetation; 40 species.

Vero Beach, Indian River County—April 2; a few specimens on open sandy areas; 3 species.

Orlando, Orange County—April 3, March 20 (Krombein only); sandy flats with sparse to moderately dense, mostly decumbent vegetation; 33 species.

Determinations in the Pompilidae, except some Pepsinae, are by the junior author, and in the other families by the senior author. The names of families, species, and subspecies collected for the first time in 1954 are preceded by an asterisk.

Family **CHRYSIDIDAE**

**Hedychridium fletcheri* Bod. Orlando (2 ♂♂); on sand.

**Chrysis* (*Trichrysis*) *parvula* F. Orlando (1 ♀).

Chrysis (*Chrysis*) *conica* Br. Olga (1 ♀).

Chrysis (*C.*) *montana* Aar. (?). Olga (2 ♀♀), Arcadia (4 ♀♀), Orlando (2 ♀♀); on sand.

**Chrysis* (*C.*) sp. Paradise Key (1 ♀)

**Chrysis* (*Pyria*) *smaragdula* F. Lake Placid (1 ♂); on avocado blossoms.

Family **TIPHIIDAE**

Tiphia floridana Robt. Lake Placid (1 ♀); on avocado blossoms. The wings are strongly yellowish rather than infuscated.

**Tiphia waldenii* Vier. Orlando (1 ♀).

Myzinum maculatum (F). Fort Pierce (13 ♂♂).

Methocha (*Methocha*) *stygia* (Say). Olga (32 ♀♀, 6 ♂♂), Arcadia (1 ♀); females and some males on sand, other males flying over sand, one pair in copula on ground. A very homogeneous series except in size, and at Olga presumably parasitic on larvae of *Cicindela trifasciata tortuosa* Lec. [det. O. L. Cartwright], the only adult cicindelid taken there.

Family **MUTILLIDAE**

Photomorphus paula (Brad.). Marco (1 ♂), Arcadia (8 ♂♂); all attracted to gasoline lanterns at night on sand; a search was made for females but none was found.

The senior author made the following notes on seasonal activity, and on behavior of the males. This species has a very short period of activity above ground, at least at this time of the year when the nights are still rather chilly. Specimens were taken at 7:22 p.m. at Marco and between 7:42 and 8:37 p.m. at Arcadia. All specimens appeared to have transformed recently to the adult stage, and it is probable that the spring emergence began during our trip. None was taken at Arcadia the evening of March 20th, though the identical locality yielded eight specimens the evenings of March 30th and 31st. The males are very poor fliers, and it was noted that most of them ran on the surface of the sand toward the lantern with their wings beating, and tumbled around erratically when they got on the white sheet spread on the ground under the lantern. The females seem to be not at all positively phototropic. Those taken the night of April 2, 1953, were not attracted to gasoline lanterns, but were found by walking over the sand and shining a flashlight obliquely over the surface.

Sphaeropthalma pennsylvanica pennsylvanica (Lep.). Lake Placid (1 ♂); visiting thistle honeydew.

*"*Photopsis*" sp. Cape Sable (1 ♀); crawling on damp salt flats during day. Apparently an undescribed female which cannot be allocated to the proper genus until the male is known.

Pseudomethoca frigida torrida Krom. LaBelle (1 ♀).

Pseudomethoca sanbornii acetis (Fox). Olga (3 ♀♀), LaBelle (3 ♀♀), Arcadia (3 ♀♀), Fort Pierce (2 ♀♀), Orlando (5 ♀♀); crawling on sand.

Pseudomethoca simillima (Sm.) Arcadia (1 ♀), Orlando (3 ♀♀); on sand.

Dasymutilla asopus cassandra Mick. Marco (1 ♀), Olga (3 ♀♀), Bermont (1 ♀), Orlando (2 ♀♀); on sand.

Dasymutilla chattahoochei Brad. Marco (1 ♂), Arcadia (1 ♀, 3 ♂♂), Orlando (1 ♀, 5 ♂♂); males flying low over sand, females on sand.

Dasymutilla cypris (Bl.). Orlando (3 ♀♀); on sand.

Dasymutilla nigripes (F.). LaBelle (1 ♂), Arcadia (1 ♀), Fort Pierce (1 ♂), Vero Beach (1 ♀), Orlando (7 ♀♀); males flying over sand, females on sand.

Dasymutilla occidentalis occidentalis (L.). Key Largo (1 ♀); on ground.

Dasymutilla vesta sappho (Fox). Cape Sable (5 ♀♀), Key Largo (1 ♂), Marco (2 ♀♀, 2 ♂♂), Olga (1 ♀), LaBelle (2 ♀♀, 1 ♂), Arcadia (4 ♀♀, 4 ♂♂), Lake Placid (4 ♀♀, 1 ♂), Fort Pierce (3 ♀♀), Orlando (3 ♀♀); females crawling on sand or mud, males flying over ground.

**Timulla (Timulla) barbigera barbigera* (Brad.). Orlando (1 ♀); on sand.

Timulla (T.) dubitata dubitata (Sm.). Vero Beach (1 ♀); on sand.

Timulla (T.) ferrugata (F.). Olga (2 ♀♀, 2 ♂♂), LaBelle (1 ♀), Arcadia (2 ♀♀), Fort Pierce (1 ♀), Orlando (1 ♀); females on sand, males flying over sand.

Timulla (T.) floridensis (Bl.). Lake Placid (1 ♀, 1 ♂), Fort Pierce (1 ♀).

Timulla (T.) ornatipennis (Brad.). Olga (1 ♀), Orlando (1 ♀); on sand.

**Timulla (T.) rufosignata* (Brad.). Cape Sable (7 ♀♀, on salt flats), Bermont, (1 ♂, on thistle honeydew).

Timulla (T.) vagans rufinota Mick. Cape Sable (2 ♀♀); on salt flats.

**Ephuta pauxilla pauxilla* Brad. Marco (1 ♂); on thistle honeydew.

Ephuta sabaliana sabaliana Schust. Cape Sable (100 ♀♀, 1 ♂, on surface of damp salt flats), Bermont (7 ♂♂, on thistle honeydew).

This species has been known heretofore only from the male sex. The putative female will be described in a separate contribution. One of us (KVK) spent most of his time during our three days at Cape Sable in collecting a series of females and in attempting to learn something of the habits. The salt flats were so moist this year on March 24th and 25th that a person's weight would cause water to ooze slightly into the resultant footprint. Later in the dry season, and this process was becoming evident on March 27th, the surface tends to dry into irregularly shaped cakes of mud several inches wide, half an inch or so thick, and separated by cracks up to a quarter of an inch or more wide. The moist conditions which prevailed during our visit in 1954 perhaps caused females to come to the surface in large numbers. Under drier conditions, such as obtained during our visit in 1953 when we collected only one female, it is supposed that specimens may rarely come to the surface, but crawl around in the cracks and under the cakes of mud seeking their hosts.

The females were extremely abundant crawling on the surface of bare strips of damp mud up to several feet in width and from 10 to 100 or more feet in length. Only scattered individuals were taken in the morning, and there was a noticeable increase in numbers during the afternoon until about 4:30, 31 specimens having been taken between 3:05 and 4:36 on March 27th during overcast conditions. Specimens were equally active during both sunny and overcast conditions. These females do not feign death when approached or disturbed by the collector, as do those of *Ephuta spinifera* Schust. (personal observation by KVK at Kill Devil Hills, North Carolina). Several females were observed entering perpendicular burrows of about an eighth of an inch in diameter, but they always emerged within a few seconds. It is not known whether these may have been burrows of the host, emergence burrows of the mutillid itself, or habitations of some other animal, for there were no other visitors to the particular burrows inspected by the *Ephuta*. On March 27th a few other females were observed exploring cracks and the lower edges beneath some of the small cakes of mud which were forming from evaporation.

It has been supposed that the hosts of some species of *Ephuta* are various small halictine bees. These small bees invariably leave their burrow entrances open while they are absent gathering nectar and pollen. Consequently, they would constitute admirable hosts for a mutillid such as *Ephuta s. sabaliana* which lacks a tarsal comb, and is therefore, rather unsuited for exploiting species of aculeate Hymenoptera which do plug the burrow entrances when leaving the nesting site. T. B. Mitchell, who has examined the bees collected by the senior author at Cape Sable, advises that the halictines comprise an apparently new species of *Lasioglossum* (*Chloralictus*), *L.* (*C.*) *tegulare* (Robt.) and *L.* (*C.*) *halophitum* (Graen.).

Most of the specimens apparently had emerged very recently for the vestiture was perfect and the mandibles unworn. However, there were about a dozen specimens which had been active for quite a time as evidenced by the absence or worn condition of some of the vestiture, and the eroded tips of the mandibles. On the other hand, since we did not find males present in quantity it does not seem probable that any of the females had just emerged.

An almost fruitless search was made for males. Halophytes adjacent to the strips of bare mud frequented by the females were swept to no avail, no males could be found visiting flowers in any of the adjacent areas, nor were any attracted to the light of a gasoline lantern the evening of March 24th. An attempt was made from 9 a.m. to 4:30 p.m. on March 25th to attract and concentrate males by spraying a solution of honey and water on the semiprostrate halophytes adjacent to the bare areas on which females occurred, but this attracted only a few males of *Anoplius fraternus* (Bks.) and some Diptera. Finally, at 10:39 a.m. on March 25th the only male *Ephuta* taken at Cape Sable was captured while it was crawling near the edge of a large bare area of mud, an area where several females had been taken during the preceding half hour. It was a specimen of *s.*

sabaliana, and is presumed to be the opposite sex of the female taken here in such large numbers.

Ephuta slossonae slossonae (Fox). Arcadia (1 ♀), Vero Beach (1 ♀); on sand.

Ephuta stenognatha stenognatha Schust. LaBelle (2 ♂♂).

*Family **RHOPALOSOMATIDAE**

**Olixon banksii* (Brues). Arcadia (1 ♀); attracted to gasoline lantern at night on sand shortly after dark.

Family **SCOLIIDAE**

Campsomeris (Campsomeris) plumipes fossulana (F.). Lake Placid (2 ♂♂), Orlando (3 ♂♂).

Family **VESPIDAE**

**Vespula (Vespula) squamosa* (Dru.). Lake Placid (2 ♀♀, 5 ☿☿); on avocado blossoms.

Polistes annularis (L.). Paradise Key (1 ♀), Arcadia (1 ♀); around or in wooded areas.

Polistes bellicosus Cr. Paradise Key (1 ♀), Cape Sable (4 ♀♀); in open woods or fields.

Polistes exclamans exclamans Vier. Key Largo (1 ♀), Lake Placid (1 ♀, on avocado blooms).

Polistes hunteri hunteri Beq. Cape Sable (4 ♀♀), Key Largo (1 ♂), Marco (1 ♀), LaBelle (1 ♀), Lake Placid (1 ♀); ubiquitous.

Polistes metricus Say. Cape Sable (3 ♀♀), Florida City (2 ♀♀), Key Largo (3 ♀♀), Marco (1 ♀), Olga (1 ♀); ubiquitous.

Polistes rubiginosus Lep. Paradise Key (1 ♀), Olga (1 ♂).

Mischocyttarus (Kappa) cubensis cubensis (Sauss.). Paradise Key (3 ♀♀), Key Largo (4 ♀♀), LaBelle (3 ♀♀); around or in wooded areas.

**Zethus (Zethusculus) slossonae* Fox. Cape Sable (1 ♀), Key Largo (2 ♀♀, 1 ♂), Fort Pierce (3 ♀♀); around or in wooded areas or vegetation.

Zethus (Zethusculus) spinipes variegatus Sauss. Key Largo (2 ♀♀), Arcadia (1 ♀), Lake Placid (1 ♀, 4 ♂♂), Fort Pierce (1 ♀); around or in wooded areas or vegetation.

Eumenes fraternus Say. Olga (1 ♀), Orlando (1 ♀).

**Eumenes smithii smithii* Sauss. Marco (1 ♀).

Pseudodynerus quadrisectus (Say). Paradise Key (5 ♀♀, 2 ♂♂), Key Largo (1 ♀, 1 ♂), Fort Pierce (1 ♂); around or in wooded areas.

Monobia quadridens (L.). Paradise Key (4 ♀♀), Olga (1 ♀), Lake Placid (1 ♂, on avocado blossoms); mostly around or in wooded areas.

Rygchium annulatum arvense (Sauss.). Arcadia (1 ♂); flying over sand.

**Rygchium foraminatum apopkense* (Robt.). Paradise Key (2 ♀♀); in woods.

**Rygchium fusum fusum* (Cr.). Lake Placid (1 ♂); on avocado blossoms.

Rygchium megaera (Lep.). Paradise Key (1 ♀), Key Largo (1 ♀, 1 ♂); in or around wooded areas.

Rygchium turpe (Sauss.). Lake Placid (1 ♂); on avocado flowers. Subspecifically distinct from typical *turpe*.

Pachodynerus erynnis (Lep.). Key Largo (1 ♀, 5 ♂♂), LaBelle (4 ♂♂), Arcadia (1 ♂), Lake Placid (3 ♂♂), Fort Pierce (5 ♀♀, 4 ♂♂); mostly in or around wooded areas.

Leptochilus tylocephalus tylocephalus (Boh.). Paradise Key (1 ♀, 4 ♂♂), Cape Sable (1 ♂), Key Largo (1 ♀, 1 ♂), Marco (1 ♀), Fort Pierce (6 ♀♀, 11 ♂♂); ubiquitous.

Stenodynerus (*Stenodynerus*) *ammonia ammonia* (Sauss.). Marco (2 ♀♀, 1 ♂), Fort Pierce (2 ♀♀, 2 ♂♂); around wooded areas on vegetation.

Stenodynerus (*S.*) *australis* (Robt.). Lake Placid (1 ♂); on avocado blooms.

**Stenodynerus* (*S.*) *clypeolatus floridanus* (Robt.). Marco (1 ♂), Fort Pierce (2 ♀♀, 3 ♂♂); on vegetation and visiting flowers in fields.

Stenodynerus (*S.*) *fundatiformis fundatiformis* (Robt.). Olga (1 ♀), Fort Pierce (3 ♀♀, 1 ♂); on vegetation and visiting flowers in fields.

**Stenodynerus* (*S.*) *lineatifrons* Boh. Lake Placid (1 ♀).

**Stenodynerus* (*Parancistrocerus*) *bicornis bicornis* (Robt.). Lake Placid (3 ♂♂); on avocado blossoms.

Stenodynerus (*P.*) *fulvipes rufovestis* Boh. Paradise Key (1 ♀, 1 ♂), Cape Sable (2 ♂♂), Key Largo (6 ♀♀, 10 ♂♂), Arcadia (1 ♂), Fort Pierce (7 ♀♀, 2 ♂♂); mostly in and around wooded areas, but some visiting vegetation and flowers in open fields.

**Stenodynerus* (*P.*) *histrio* (Lep.). Paradise Key (3 ♀♀), Fort Pierce (3 ♀♀, 1 ♂), in and around woods.

Stenodynerus (*P.*) *pedestris bifurcus* (Robt.). Paradise Key (1 ♀), Lake Placid (1 ♀); former in woods, latter on avocado flowers.

Stenodynerus (*P.*) *perennis anacardivora* (Roh.). Paradise Key (4 ♀♀, 5 ♂♂), Key Largo (1 ♀, 3 ♂♂), Lake Placid (1 ♀, 1 ♂); the latter pair visiting avocado blooms, the others in and around woods.

On March 22nd, about 3 p.m. one of us (KVK, No. 32254 A) caught a female of *anacardivora* hovering before the tip of a dead twig along a trail on the southwest edge of Paradise Key in rather open country. Upon examination it was found that the twig, which *in situ* was nearly horizontal, was hollowed out at the tip and had a partition of debris 5 mm. below this excavated tip. The twig was then broken in two about 35 mm. from the tip and a dozen small, paralyzed lepidopterous larvae were found stuffed into a cell which was determined later to be the innermost of the three cells in the nest. These larvae were identified subsequently by H. W. Capps as four specimens (6.4 to 7.8 mm. long) of a single species of Olethreutidae, and eight specimens (4.1 to 5.1 mm. long) of a single species of Gelechiidae.

The rest of the nest was preserved intact for rearing, since it could not be established whether the female hovering before the tip of the twig was the mother engaged in closing the nest, or just another female, perhaps not even of the same species, searching for a place to start a nest.

On April 14th a small section was split off from the side of the outermost cell to observe the stage of development. On that date the cell contained a rather well-colored wasp pupa with only its head end enclosed in a frail silk sheath. Numerous immature mites were crawling actively on the surface of the pupa. A male of *anacardivora* emerged on April 19th, and there was also recovered a comatose, probably moribund, adult female mite from this outermost cell. On April 23rd a male *anacardivora* emerged from the middle cell. Two comatose and one dead adult female mites were recovered from this cell. Most of the mite hypopi were found in the acarinarium at the base of the second tergite of the two adult male wasps. K. W. Cooper, who has examined these adult mites and associated hypopi, informs us that they are a species of ensliniellid, close to but distinct from *Kennethiella trisetosa* (Coor.), which commonly infests the solitary vespid, *Ancistrocerus antilope antilope* (Panzer). Apparently these are the first adult mites which have been recovered from *Parancistrocerus* nests.

After emergence of the adult wasps it was possible to split the entire section of twig and to obtain the measurements of the wasp nest. The twig was roughly 6 mm. in diameter, and had been hollowed out, presumably by another insect, to a depth of 50 mm., the burrow being 1.8 mm. in diameter. The female wasp had put a partition, 0.5 mm. thick and composed of tiny fragments of pith and other vegetable matter, 5 mm. above the abruptly constricted bottom of the burrow. The first cell, the third from the tip, was 15 mm. long, and the shriveled wasp egg, attached by a long filament to the top of the cell, was placed 4 mm. from the base of the cell. The second cell was 11 mm. long, and the third, or outermost, 14 mm. long. There was an empty space 5 mm. deep above the partition closing the third cell. The partitions between the cells and at the top were from 0.5 to 1 mm. thick in the center, and as much as 3 mm. thick at the sides, and were composed of tiny fragments of pith, other vegetable matter, and some particles of dark soil. The partial silken cocoon in the third cell had been spun 4 mm. below the partition closing the cell. The walls of the cell were varnished over, not covered with silk, and the larval meconium was voided at the base of the cell.

The only published observation on the biology of typical *perennis* (Sauss.) is that by Rau (Bull. Brooklyn Ent. Soc. 30: 110, 1935), who records rearing wasps at St. Louis, Missouri, from a twig nest having mud partitions between the cells.

Stenodynerus (*P.*) *saecularis rufulus* Boh. Lake Placid (1 ♂); on avocado blooms.

Family **POMPILIDAE**

**Dipogon* (*Deuteragenia*) n. subsp. of *papago* (Bks.) [det. Townes]. Paradise Key (2 ♂♂); on foliage along trail in hammock.

Priocnemis (*Myrmecosalius*) *cornica* (Say). Arcadia (4 ♀♀, 3 ♂♂), Olga (20 ♀♀, 13 ♂♂); on sand.

**Priocnemis* (*M.*) *minuscula* (Bks.). Olga (1 ♂); on sand.

**Ageniella* (*Ameragenia*) *salti* (Bks.). [det. Townes]. Paradise Key (1 ♂).

**Ageniella* (*Ageniella*) *accepta* (Cr.) [det. Townes]. Marco (1 ♂); on thistle honeydew.

**Ageniella* (*A.*) *conflicta* Bks. [det. Townes]. Marco (1 ♀); on thistle honeydew.

**Ageniella* (*A.*) *mintaka* Brim. [det. Townes]. Lake Placid (1 ♂); on thistle honeydew.

**Ageniella* (*A.*) *partita* Bks. Orlando (1 ♀); on sand.

**Ageniella* (*Priophanes*) n. subsp. of *facta* (Cr.) [det. Townes]. Arcadia (1 ♂).

Minagenia julia (Brim.) [det. Townes]. Lake Placid (1 ♂); on thistle honeydew.

Evagetes mohave (Bks.). Arcadia (1 ♀).

Evagetes n. sp. (Dreisbach MS). Marco (2 ♂♂), Olga (6 ♀♀, 9 ♂♂), Ft. Pierce (2 ♀♀, 1 ♂).

Sericopompilus apicalis (Say). Lake Placid (3 ♂♂), Ft. Pierce (4 ♀♀, 1 ♂);

on vegetation and on avocado blossoms.

Episyron posterus (Fox). Olga (2 ♀♀, 3 ♂♂), Arcadia (1 ♂), Lake Placid (1 ♀), Ft. Pierce (1 ♀); mostly on sand.

**Episyron snowi* (Vier.). Olga (1 ♂); on sand.

**Poecilopompilus interruptus interruptus* (Say). Paradise Key (1 ♀), Olga (1 ♂), Lake Placid (3 ♂♂); last named series on avocado blossoms.

Tachypompilus ferrugineus ferrugineus (Say). Lake Placid (1 ♀); on avocado blossoms.

Anoplius (Notiochares) amethystinus atramentarius (Dahlb.). LaBelle (1 ♀, 15 ♂♂).

**Anoplius (Arachnophroctonus) apiculatus autumnalis* (Bks.). Orlando (1 ♀); on sand. This subspecies inhabits central U. S., including the Gulf coast from La. to western Fla.; the above specimen fits this subspecies perfectly, although all others taken south and east of Orlando represent subspecies *pretiosus* or intergrades.

Anoplius (A.) apiculatus pretiosus (Bks.). Marco (2 ♀♀, 1 ♂), Olga (3 ♀♀), Arcadia (5 ♀♀), Ft. Pierce (4 ♀♀); on sand.

Anoplius (A.) marginalis (Bks.). Marco (2 ♀♀), Olga (6 ♂♂), Arcadia (3 ♂♂), Lake Placid (4 ♂♂), Ft. Pierce (4 ♀♀, 7 ♂♂).

Anoplius (A.) relativus (Fox). Olga (5 ♂♂), LaBelle (1 ♂).

Anoplius (A.) semirufus (Cr.). Ft. Pierce (1 ♀).

Anoplius (Pompilinus) cylindricus (Cr.). Marco (3 ♀♀, 3 ♂♂), Olga (1 ♂), Arcadia (2 ♀♀), Ft. Pierce (1 ♀).

Anoplius (P.) fraternus (Bks.). Cape Sable (36 ♀♀, 53 ♂♂); on salt flats. Extensive observations were made on the behavior and life history of this species. These have been reported in a separate contribution by the present authors and C. M. Yoshimoto (1955).

Anoplius (P.) krombeini Evans. Olga (14 ♀♀, 49 ♂♂), Arcadia (1 ♀); on sand.

**Anoplius (P.) marginatus* (Say). Arcadia (1 ♂); on sand.

Anoplius (P.) splendens (Dreisbach). Marco (1 ♀), Olga (1 ♀, 3 ♂♂).

Anoplius (P.) stenotus stenotus (Bks.) Marco (12 ♀♀, 11 ♂♂), Olga (16 ♀♀, 31 ♂♂), Bermont (1 ♂), Arcadia (2 ♀♀, 2 ♂♂), Ft. Pierce (4 ♂♂), Orlando (4 ♀♀); mostly on sand and low vegetation; one male on thistle honeydew.

A worn female of this species, 8.1 mm. long, was observed (KVK, no. 33054 A) at 12:23 p.m. on March 30th at Olga dragging a paralyzed spider toward her burrow entrance a couple of inches away. Several times the wasp set down the spider and ran into the burrow, returning immediately. At 12:24 she pulled the spider into the burrow by its spinnerets. The wasp was captured before she had filled in the burrow. The burrow had a diameter of an eighth of an inch, and penetrated the sand in a southerly direction at an angle of 60° to the horizontal. The excavated sand was piled in a low mound about the burrow entrance. The burrow was lost in the dry shifting sand during excavation with a trowel, but the spider, cut in half by the trowel, was recovered. It was an immature, 10.7 mm. long, of a species of *Lycosa* [det. H. K. Wallace]. The wasp egg, if there was one on the spider, was lost during exhumation of the burrow contents.

**Anoplius (P.)* sp. Lake Placid (1 ♀); on sandy road in woods.

**Anoplius (Anoplius) ventralis ventralis* (Bks.). Olga (2 ♀♀, 3 ♂♂), Ft.

Pierce (3 ♀♀, 2 ♂♂).

Aporinellus apicatus (Bks.). Marco (2 ♂♂), Lake Placid (1 ♀).

Aporinellus fasciatus (Sm.). Marco (3 ♀♀, 1 ♂), Olga (1 ♀), Ft. Pierce (4 ♀♀, 1 ♂).

**Aporinellus sinuatus* Evans. Marco (1 ♀); on sand.

Aporinellus taeniatus taeniatus (Kohl). Marco (3 ♀♀, 7 ♂♂), Olga (7 ♀♀, 14 ♂♂), Arcadia (2 ♀♀), Lake Placid (3 ♀♀, 1 ♂), Orlando (4 ♂♂); on sand, low vegetation, and thistle honeydew.

Paracyphononyx funereus (Lep.). Cape Sable (1 ♂), Marco (1 ♂), Olga (1 ♀, 22 ♂♂), LaBelle (1 ♀), Lake Placid (1 ♀), Fort Pierce (3 ♀♀, 8 ♂♂).

Family **SPHECIDAE**

Solierella inermis (Cr.). Arcadia (4 ♀♀, 1 ♂); on sand.

Solierella peckhami (Ashm.). Arcadia (1 ♀); on sand.

Nitelopterus slossonae (Ashm.). Marco (1 ♀), Bermont (2 ♀♀), Arcadia (11 ♀♀, 23 ♂♂), Orlando (8 ♀♀, 6 ♂♂); on sand.

One of the females at Bermont (HEE no. 811) was seen flying with a small, immature salticid spider, *Habrocestum pulex* (Hentz) [det. H. K. Wallace]; the spider was held underneath and was even smaller than the wasp. Presently she arrived at her nest, which was in the side of a sandy ridge along the road. The spider was deposited on the ground while she dug out the entrance and entered the nest; then she came out and grasped the spider by the legs and dragged it into the nest. She remained inside for only a few seconds, then came out and raked some sand over the entrance, after which she was captured. The burrow was oblique and quite short, only about 5 cm. long, and terminated in a small cell in which the spider was found. There was no egg on the spider, and presumably the wasp would have provided one or more additional spiders before laying her egg. The legs of the spider had not been amputated.

Tachytes (Tachytes) rufofasciatus Cr. Olga (1 ♂); on sand.

**Tachytes (Tachynana) minutus* Roh. Olga (1 ♀, 1 ♂); on sand.

Tachytes (Tachyoides) mergus Fox. Arcadia (3 ♀♀); on sand.

**Larropsis* n. sp. Lake Placid (1 ♂); on avocado blossoms.

Tachysphex apicalis Fox. Lake Placid (1 ♀, 5 ♂♂), Fort Pierce (1 ♀), Orlando (2 ♀♀); some visiting avocado blossoms, others on sand.

Tachysphex minimus (Fox). Arcadia (1 ♂); on sand.

Tachysphex punctifrons (Fox). Arcadia (2 ♀♀, 8 ♂♂); on sand.

Tachysphex similis Roh. Marco (4 ♀♀), Olga (2 ♀♀), Arcadia, (4 ♀♀, 6 ♂♂), Fort Pierce (1 ♀), Orlando (3 ♂♂); on sand.

One of us (HEE no. 743) took a female at Marco with her prey, an immature slant-faced grasshopper of the genus *Radinotatum* [det. H. E. Evans]. She was proceeding forward over the sand behind the beach, straddling the grasshopper and holding it in her mandibles by the base of the antennae.

Tachysphex sp. No. 2. Arcadia (14 ♀♀, 1 ♂), Lake Placid (1 ♀), Orlando (1 ♀); on sand. Same as *Tachysphex* sp. No. 2 of Krombein and Evans (1954).

Tachysphex sp. No. 3 Marco (2 ♂♂), Olga (3 ♀♀, 1 ♂), Arcadia (4 ♀♀, 5 ♂♂), Orlando (3 ♀♀, 5 ♂♂); on sand. Same as *Tachysphex* sp. No. 3 of Krombein and Evans (1954).

**Tachysphex* sp. No. 4 Arcadia (2 ♂♂); on sand.

**Motes aequalis* (Fox). Arcadia (1 ♀), Orlando (1 ♀); on sand.

Motes argentata (Beauv.). Cape Sable (1 ♀), Key Largo (1 ♀), Marco (12 ♂♂), Olga (14 ♀♀, 17 ♂♂), Bermont (1♀, 2 ♂♂), Arcadia (9 ♀♀, 12 ♂♂), Lake Placid (1 ♂), Fort Pierce (2 ♂♂), Orlando (4 ♀♀, 10 ♂♂); on salt flats, most common on sand, and visiting thistle honeydew.

One of the females at Olga (HEE no. 808) was seen closing her nest on the side of a sandy ridge along a ditch. She was seen many times to fly a short distance from the nest (up to a foot) in the search for small twigs, plant pieces, seeds, and lumps of earth; these were carried forward and placed in the burrow. Finally she scraped sand and debris in various directions over the filled burrow and prepared to fly away, when she was taken. The burrow was found to be about 8 cm. long; the upper 3 cm. were filled with debris, the remainder of the burrow with sand. The cell contained two adult crickets (not identified; probably a species of *Nemobius*) which were rather incompletely paralyzed, both moving the legs vigorously when removed from the cell. The egg was laid on one of them ventrally between the middle and hind legs; one end was attached to the sternum and the other extended along the side of one of the hind femora. When examined the next day (March 30) the egg had hatched and the larva was feeding. Growth was rapid and only three days later (April 2) the cocoon had been spun. An adult female emerged from this cocoon May 15, 44 days after the cocoon was spun.

A second female, a worn specimen, was captured with her prey (KVK no. 32954 A) at 1:20 p.m. on March 29th at Olga. The wasp was hopping over the sand carrying a paralyzed cricket, a nymph of a species of *Nemobius* [det. A. B. Gurney]. The wasp was 9.7 mm. long, the cricket 8.7 mm.

Motes muesebecki Krom. Bermont (2 ♀♀, 5 ♂♂), Arcadia (1 ♀, 1 ♂), Lake Placid (3 ♀♀, 6 ♂♂), Fort Pierce (1 ♀, 1 ♂), Orlando (5 ♀♀, 3 ♂♂); mostly on sand, a few visiting thistle honeydew.

Motes vinulenta muspa Pate. Paradise Key (1 ♂), Cape Sable (1 ♀), Marco (1 ♂), Olga (6 ♀♀, 12 ♂♂), Bermont (1 ♀, 4 ♂♂), Arcadia (1 ♀, 5 ♂♂); mostly on sand, one on salt flats, and a few at thistle honeydew.

Trypoxylon (Trypoxylon) adelphiae Sandh. Paradise Key (1 ♂).

Trypoxylon (Trypargilum) collinum Sm. Paradise Key (4 ♀♀), Key Largo (1 ♀, 1 ♂); around wooded areas.

Trypoxylon (T.) johannis Rich. Arcadia (1 ♀).

**Mimesa (Mimumesa) longicornis* (Fox). Olga (3 ♂♂), Fort Pierce (1 ♀); flying over sandy areas with low vegetation.

Chlorion (Ammobia) ichneumoneum fulviventre (Guér.). Paradise Key (1 ♀).

**Chlorion (A.) lucae* (Sauss.). Olga (1 ♂).

**Chlorion (Isodontia) auripes* Fern. Olga (1 ♀), Lake Placid (3 ♂♂); the latter on avocado flowers.

**Chlorion (I.) cinereum* Fern. Paradise Key (1 ♀, 4 ♂♂); in open wooded area.

**Chlorion (I.) exornatum* (Fern.). Paradise Key (1 ♂), Arcadia (1 ♂), Lake Placid (2 ♂♂).

Chlorion (I.) harrisi Fern. Paradise Key (1 ♀).

Chlorion (Priononyx) pubidorsum (Costa). Marco (2 ♀♀, 1 ♂), Olga (4 ♀♀), Lake Placid (1 ♂); mostly flying over sandy areas.

**Chlorion (Palmodes) daggyi* (Murr.). Fort Pierce (1 ♀, 1 ♂).

Sphex aureonotatus (Cam.). Arcadia (1 ♀, 1 ♂).

**Sphex conditor* (Sm.). Lake Placid (1 ♂); on avocado blossoms.

Sphex placidus (Sm.). Olga (3 ♀♀, 2 ♂♂), Arcadia (1 ♂), Orlando (1 ♂); mostly flying over sandy areas.

Sphex urnarius floridensis Fern. Paradise Key (2 ♂♂).

Sceliphron caementarium (Dru.). Paradise Key (1 ♀, 1 ♂), Lake Placid (1 ♂, on avocado flowers), Fort Pierce (1 ♂).

Chalybion californicum (Sauss.). Arcadia (1 ♀).

Podium carolina Roh. Paradise Key (1 ♀); at edge of woods. A sight record.

Alysson melleus Say. Olga (16 ♀♀, 27 ♂♂), Arcadia (1 ♀), Orlando (4 ♀♀, 1 ♂); on sand.

Didineis texana (Cr.). Olga (1 ♂), Fort Pierce (2 ♂♂); on sand.

**Nysson* (*Epinysson*) sp. Arcadia (1 ♂); flying over sand. Close to but distinct from *hoplisivora* Roh., and probably a new species.

**Sphecius* (*Sphecius*) *hogardii hogardii* (Latr.). Lake Placid (1 ♂); on avocado blossoms. The most northern record for this subspecies which has been known hitherto only from the West Indies and Florida Keys.

Dienoplus citipes Krom. Orlando (2 ♀♀, 3 ♂♂); on sand.

Psammaecius denticulatus (Pack.). Arcadia (1 ♀, 1 ♂), Fort Pierce (1 ♂); flying over sand.

Psammaecius sp. Bermont (1 ♂). Same as *Psammaecius* sp. of Krombein and Evans (1954).

Gorytes (*Pseudoplisus*) *phaleratus* Say. Fort Pierce (1 ♀).

**Stictiella serrata* (Handl.). Lake Placid (1 ♂).

Bembix cinerea (Handl.). Cape Sable (40 ♀♀, 4 ♂♂). Only a small sampling was taken of the very large population of this species present on the salt flats. Most of the flight observed was in the vicinity of two large colonies, about 100 feet apart, one containing about 200 nests, the other more than 300, both situated in bare spots which were elevated a few inches above the general level of the flats. Within each colony the nests were very close together, the entrances sometimes not more than 10 cm. apart, more often from 15 to 30 cm. apart; the nests were closest toward the center of the colony and more scattered toward the periphery. Each nest was clearly evident at all times, since the mound of earth at the entrance was never leveled by the wasp, and stood out dark against the sun-baked white surface of the salt flats. Over 90 percent of the nests were oriented in the same direction, the burrow directed toward the east, the earth thrown up toward the west. Over each of these colonies many individuals were in flight from about 9 in the morning to about 5 in the afternoon.

The extended notes taken on the activity of *cinerea* by the junior author can only be summarized briefly here. Like most *Bembix*, this species preys upon flies[4] and is relatively unselective as to species, or even family, of flies taken. By far the most common prey of *cinerea* in this area were the horseflies *Tabanus lineola* Fabr. and *T. vittiger caymanicus* Fairchild; both sexes of horseflies were taken in about equal numbers and all seemed to be in a fresh, recently emerged condition. Somewhat less commonly taken were *Tabanus nigrovittatus* Macq., the stratiomyid

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[4]Determinations of the dipterous prey were made as follows: Tabanidae by L. L. Pechuman, Muscoidea by C. W. Sabrosky and Ephydridae, Syrphidae, Bombyliidae and Stratiomyidae by W. W. Wirth.

Eulalia sp., and the calliphorid *Phaenicia cluvia* (Walk.); also taken were a few specimens each of *Tubifera albifrons* (Wied.) (Syrphidae), *Hedriodiscus dorsalis* (Fabr.) (Stratiomyidae), *Anthrax anale* Say (Bombyliidae), *Dimecoenia austrina* (Coq.) (Ephydridae), *Lispe* sp. (Muscidae), and *Cistogaster* sp. (Larvaevoridae). Fully provisioned nests contained from 9 to 17 flies.

Twenty-two nests were dug out. All were of simple construction, consisting of a short burrow, at about a 45° angle with the surface, leading to a small terminal cell. The average length of the burrow, including the cell, was 21 cm., the range of variation from 16.5 to 26.5 cm. The average depth of the cell from the surface was 10.2 cm., the range of variation from 7.5 to 12.8 cm. The burrow diameter varied from 9 to 11 mm., the cell diameter from 14 to 17 mm., and the cell length from 45 to 60 mm. A small inner closure of earth was always found just before the cell. The entrance to the burrow was closed during the night hours, but left open throughout the active period of the day. Several nests were found to have two cells from a single burrow, the second one in every case having been constructed after the first was fully provisioned and sealed off. Eggs were found in several cells, and the egg was always found to be in an upright position glued to the base of the wing of a fly. Apparently the egg hatches in about two days. A few additional flies may be brought in before the egg hatches; after hatching they are brought in rather rapidly, and the cell may be fully provisioned within three days after hatching.

In last year's report it was noted that the mutillid *Dasymutilla vesta sappho* (Fox) had been seen entering the nests of *Bembix cinerea*. This was again noted in 1954, and one *sappho* male was reared from a cocoon taken from a last year's *cinerea* nest, thus removing any doubt of its parasitic relationship.

Bembix spinolae (Lep.). Fort Pierce (2 ♀♀).

Philanthus ventilabris F. Fort Pierce (1 ♀, 5 ♂♂).

**Cerceris austrina* Fox. Lake Placid (41 ♂♂); on avocado flowers.

Cerceris sp. Marco (1 ♀). Same as "close to *C. robertsonii* Fox" in Krombein and Evans (1954).

**Cerceris* sp. [det. Scullen]. Lake Placid (1 ♂). Dr. Scullen advises us that this is nearest to *blakei* Cr., but is apparently undescribed.

**Crabro rufibasis* (Bks.). Olga (1 ♀), Bermont (1 ♀), Lake Placid (1 ♀), Orlando (1 ♀); some flying over sand.

**Ectemnius* (*Hypocrabro*) *chrysargyrus* (Lep. & Br.). Lake Placid (1 ♀); on avocado blossoms.

**Ectemnius* (*H.*) *10-maculatus tequesta* Pate. Olga (1 ♂), Lake Placid (5 ♀♀, 3 ♂♂); the latter mostly at avocado blossoms.

Ectemnius (*H.*) *excavatus excavatus* (Fox). Paradise Key (14 ♂♂), Lake Placid (6 ♂♂); the former in woods, the latter at avocado blossoms.

Ectemnius (*H.*) *scaber rufescens* Krom. Lake Placid (1 ♂); on avocado flowers.

**Ectemnius* (*H.*) *texanus ais* Pate. Key Largo (4 ♀♀, 2 ♂♂), Fort Pierce (24 ♀♀, 6 ♂♂); around wooded areas and visiting flowers.

Oxybelus emarginatus Say. Olga (1 ♂), Lake Placid (1 ♂), Orlando (1 ♂); mostly on sand.

*Family **DRYINIDAE**

**Gonatopus ashmeadi* Kieff. Arcadia (2 ♀♀); crawling on sand.

Appendix

A List of the Miltogrammini (Diptera, Sarcophagidae)

One of us (KVK) again attempted to collect all miltogrammine inquilines associated with the ground-nesting wasps. These records are included here to give some indication of the seasonal flight range of these flies. All specimens were taken on sand. The identifications were confirmed by C. W. Sabrosky.

Metopia lateropili Allen (?). Olga (2 ♀♀). Abdomen marked with yellow, but legs black.

Metopia leucocephala (Rossi). Olga (2 ♀♀), Arcadia (1 ♀).

Gymnoprosopa polita Tns. Orlando (1 ♀, 4 ♂♂).

Senotainia rubriventris Macq. Marco (1 ♂), Arcadia (1 ♀, 1 ♂), Orlando (1 ♀, 8 ♂♂).

Senotainia trilineata Wulp. Olga (1 ♂), Orlando (1 ♀, 1 ♂).

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NOTES ON THE HABITS OF OSMIA (NOTHOSMIA) SECLUSA SANDHOUSE

(Hymenoptera, Megachilidae)

By George E. Bohart, *Entomology Research Branch, U. S. Department of Agriculture, Logan, Utah.*[1]

Osmia (*Nothosmia*) *seclusa* Sandhouse is a dull, bluish-green, thick-headed species recorded from the Pacific Northwest and from Idaho and Utah (Figure 1). In northern Utah it flies principally in June and early July. In the area around Logan, Utah, it is most abundant along the well-drained valley margins and on the benches and low foothills, where it collects pollen primarily from *Penstemon leonardi* Rydb., *P. cyananthus* Hook., and various legumes such as *Astragalus cibarius* Sheld., *A. utahensis* T. & G., *Lupinus* spp., and *Medicago sativa* L. It is an efficient pollinator of alfalfa early in the bloom period.

The only nests discovered thus far were occupying the main nest burrows of *Diadasia diminuta* Cresson.[2] Six were found in a nesting site of *Diadasia* near Petersboro and two in Logan. Each site contained about fifty *Diadasia* nests (Figure 2).

The *Osmia* nests were made of masticated leaf material cemented with resin. They were composed of a single linear series of three to five cells cemented together to form a tube showing no external divi-

[1] In cooperation with Utah Agricultural Experiment Station.

[2] These bees usually nest in small aggregations on elevated flatheads where the soil is dry and the vegetation sparse.

sion into cells (Figure 3b). Each tube fitted snugly into a *Diadasia* burrow (Figure 3). Two of the *Diadasia* nests appeared to have been completed. In the others the *Osmia* bees had apparently driven the *Diadasia* away after only a few of their usual cluster of cells had been

Illustrations by William P. Nye

Fig. 1, *Osmia* (*Nothosmia*) *seclusa* Sandhouse (female). Fig. 2, nest entrances of *Diadasia diminuta* Cresson. Fig. 3a, chimney of *Diadasia diminuta* showing *Osmia seclusa* plug; 3b, nest tube of *Osmia seclusa;* 3c, side view of *Diadasia diminuta* chimney. Fig. 4, *Sphaeralcea coccinea* showing leaves multilated by *Osmia seclusa.*

constructed. They placed a double plug of nest material at the upper end of the cell series and another plug closing the entrance chimney of the *Diadasia*. The entrance plugs, which could be seen by looking into the chimneys, betrayed the presence of the *Osmia* nests.

Leaf material used for the nests was apparently gathered exclusively from *Sphaeralcea coccinea* (Pursh) Rydb. Several of these plants close to the *Diadasia* nesting sites had most of their leaves badly mutilated by the *Osmia* (Figure 4). *Sphaeralcea* was also serving as the sole pollen and nectar source of the *Diadasia*. Thus there are at least two reasons to believe that an abundance of *Sphaeralcea* favors the development of large populations of *Osmia seclusa*.

NOTES ON THE LARVA OF HAEMAGOGUS PANARCHYS DYAR (Diptera, Culicidae)

By William H. W. Komp, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

Haemagogus panarchys was described in 1921 by Dyar (1921) from two male and three female specimens sent him by Professor Francisco Campos R. The type locality is stated by Dyar to be El Salado, Guayaquil, Ecuador. The larvae were not sent to him.

The larva remained unknown until 1949, when Levi-Castillo (1949) published a description, together with figures showing the claws of the male, the pupa, parts of the male terminalia, and the head and terminal segments of the larva.

The drawing of the head of the larva shows the antennal hair double, an unusual characteristic of *Haemagogus* larvae, in which this hair is simple. In the accompanying description it is said that the subterminal [antennal] hair is composed of two elements. The statement is also made: "Piel densamente espiculosa o velluda," which, translated, is: "Integument densely spiculose or hairy."

In a later description of the larva by Levi-Castillo (1951) the reference to the densely hairy integument is omitted, and in the figure of the head (Fig. 26) the antennal hair is not shown. The preclypeal spines, the post-clypeal hairs, the sutural and trans-sutural hairs and the supra-orbital hairs are likewise omitted.

A third description of the larva, almost literally transcribed from that of Levi-Castillo (1949), is given by Lane (1953), with inaccurate figures of the head and terminal segments of the larva, "based on Levi-Castillo 1949."

The material from which the following description is made consists of five mounted larval skins sent to the U. S. National Museum by Dr. Levi-Castillo. One of the skins is mounted on a slide, together with a pupal skin, and is labeled: *Haemagogus panarchys* Dyar/Ecuador 1944/ Roberto Levi-Castillo/. No definite locality is given. The other four larval skins are mounted two each under two coverglasses, and are labeled: *Haemagogus panarchys* Dyar/ Larva/ R. Levi-Castillo/ 1950/. No locality is given. The larval skins and the pupal skin are mounted apparently in some synthetic medium (polyvinyl alcohol ?), which has formed bubbles under the coverglasses, sometimes making it difficult to discern the larval characters. A single larval skin, collected by the writer near Guayaquil, Ecuador, IV-5-43, was also examined.

To make the following description of the larva more comparable with the only three published descriptions available (Levi-Castillo, 1949, 1951; Lane, 1953), the dorsal head-hairs will be lettered according to the system used by Carpenter et al. (1946, pp. 41-42), and also named according to their usage, with a few minor modifications.

Description of Larva of Haemagogus panarchys

Head.—Rounded, subglobose, widest through the eyes. Preclypeal spines thick, long, apex blunt. Antenna shorter than the head, almost cylindrical, with a few minute spines near base. Antennal hair single, inserted approximately at middle of shaft, and extending to apex of antenna. Ante-antennal hair (A) 3- or 4-branched, not extending to base of antennal hair. Postclypeal hair (d) a short multiple tuft of 8 to 12 elements, inserted between and slightly anterior to the lower (anterior) head-hairs (B). Anterior (lower, B) head-hair long, simple. Posterior (upper, C) head-hair slightly longer, simple. Sutural hair (e) single, long, slender. Trans-sutural hair (f) a tuft of 3-4-, about as long as sutural hair. Supra-orbital hair rather long, slender, simple.

Thorax.—Integument glabrous, not spiculose or hairy.

Abdomen.—Integument glabrous, not spiculose or hairy. Upper lateral abdominal hairs in two on segments II to VII, single on VIII. Dorsal intermediate abdominal hairs short multiple tufts. Comb of segment VIII of about 10 to 12 scales, in a nearly regular row; the larger, more central scales short, triangular, the apex rounded, sides and apex fringed with rather long spinules. Siphon short, little more than twice as long as wide, slightly tapering. Pecten of siphon with about 10 to 15 spines, the larger spines often with a long basal tooth, sometimes with a smaller sub-basal tooth. The siphon-tuft has 2 to 3 elements. Anal segment with incomplete saddle, posteriorly with 7 or more large sharp spines and many smaller spinules. Outer caudal hair long, single, about three times the length of the segment; inner caudal hair a multiple tuft, nearly as long as outer hair. Lateral hair of saddle variable, usually 3-branched. Ventral brush a variable number of long, branched hairs, arising from the barred area. Anal gills four, about as long as anal segment, rounded at tips.

It should be noted that the key to the larvae of the *Haemagogus* species of South America (Levi-Castillo, 1951, p. 12), which includes *H. panarchys,* is unusable, as the couplet leading to couplet 8, which in turn leads to the first part of couplet 9: ''Penacho ante-antenal con tres elementos largos . . . *H. panarchys*'' is missing. Also the figure of the terminal segments (Levi-Castillo, 1951, fig. 26) shows the comb of segment VIII with the scales in an irregular patch; actually they are in a more or less regular row, and much shorter than indicated in the figure. The lateral hair of the saddle is not indicated. Only 10 pecten-teeth are shown, and the siphon-tuft following them is shown as having 8 elements, while in the description there are said to be three.

Distribution.—The writer has adults reared from larvae collected by him near Guayaquil, Ecuador, in April, 1943, and larvae in poor condition from the ''Guayaquil Country Club'' (Dr. John Murdock, coll.). Levi-Castillo (1951) gives the distribution of *H. panarchys* as ''provincia del Guayas, Manabi, Los Rios y El Oro'' of Ecuador, and that it is found in great numbers in the coastal mountains of ''Chongón y Colonche.'' It probably has a wider distribution than indicated, but so far it has not been found elsewhere than in Ecuador.

Relationships.—The larva of *H. panarchys* closely resembles that of *H. equinus.* The number and arrangement of the head-hairs is nearly the same, within the limits of natural variation. The posterior margin of the dorsal saddle of the anal segment of *panarchys* is more spiculate than that of *equinus;* the individual comb-scales on segment VIII are longer, more pointed, and arranged in a more regular row than in the larva of *panarchys*.

This close relationship is reflected in the adults. The males of both species have palpi almost as long as the proboscis, and both sexes have a white knee-spot on the hind femur. The females have toothed claws on the fore and mid tarsi; postnotal setae are absent.

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BOOK REVIEW

INSECTS OF MICRONESIA, by Dr. J. Linsley Gressitt. Vol. 1, Introduction, pp. viii + 257, 1 map, 70 figs., 17 tables. Bernice P. Bishop Museum, Honolulu, 1954. Price $3.50 (U. S. currency).

This unusually fine volume attests to the thoroughness and industry of the author. Dr. Gressitt is not content to write and publish his many taxonomic papers but has now unselfishly presented us with an outstanding work which will provide a foundation of information on which others may build.

In this first volume the author introduces us to the magnitude of the task that lies ahead in his prospectus and then promptly drops us into the heart of Micronesia with his careful description and analysis of a fascinating area. This he embellishes with abundant photographs to illustrate the variety of habitats he describes and inserts for our help the many small maps of the more important atolls and islands. Nowhere will be found a more complete treatment of the ecology of the insects of the area, carefully discussed and graphically set forth in convenient tables.

For the economic entomologist there is a wealth of information on hundreds of pests found throughout the islands, all listed under their hosts. The author shows an unusual grasp of the subject in his treatment of the insects of the various orders in the economic category and we should be more willing to overlook the few misstatements which are revealed only by a very careful scrutiny.

The volume is concluded with a carefully prepared gazetteer and complete index. Congratulations to Dr. Gressitt for an excellent piece of work!—J. F. Gates Clarke, *U. S. National Museum, Washington, D. C.*

BOOK REVIEW

APPLIED ENTOMOLOGY, by H. T. Fernald, Late Professor of Entomology, University of Massachusetts, and Harold H. Shepard, Entomologist, U. S. Department of Agriculture. Fifth edition. 8 vo., cloth, 385 pp., 269 illus., McGraw-Hill Book Co., N. Y., 1955. $7.00.

It is always with particular pleasure that attention is directed to the publication of a new entomological book, or its revision, when written by one of our local membership. Originally issued in 1921, this book is already well known in its various revised editions of 1926, 1935 and 1942. It is therefore not necessary here to enlarge upon its scope, since it follows the general arrangement of previous editions. However, much of the text has had to be rewritten due to the fact that that development of the new organic insecticides has revolutionized insect control since the fourth edition appeared in 1942. The chemical control of a number of major pests has become practical for which previously no effective method was known. In this field greater advances were made since the Second World War than in the previous quarter century or more. Insecticides such as DDT, benzene hexachloride, and organic phosphorus compounds in large measure replaced lead arsenate, calcium arsenate, lime-sulfur and nicotine sulfate. The discussion of these matters covers not only the organic and inorganic insecticides, but also includes brief resumes of latest usage of various types of control, methods of application, dosage, diluents, safeguards to be used, Government regulation of insecticides, and the like. Particular attention is given to latest findings in recent extensive tests with synthetic organic compounds. Specific control measures are indicated for more injurious pests, and a section is added on other animal pests related to insects. Well-selected references accompany each subject subdivision to facilitate further study where desired. Appropriate attention also is given to anatomy, physiology and development; likewise more area is alloted to parasitic Hymenoptera in this than in previous editions. The fact that this book has been of sufficient usefulness to be now in its fifth edition is abundant evidence —is, in fact, the acid test—of its excellence.—J. S. WADE, *Collaborator, U. S. Department of Agriculture, Washington, D. C.*

BOOK NOTICE

THE MEGACHILINE BEES OF CALIFORNIA, by Paul D. Hurd, Jr. and Charles D. Michener. Bull. Calif. Ins. Survey, vol. 3, 247 pp., 112 maps, 24 pls. $3.50. Univ. California Press, Berkeley.

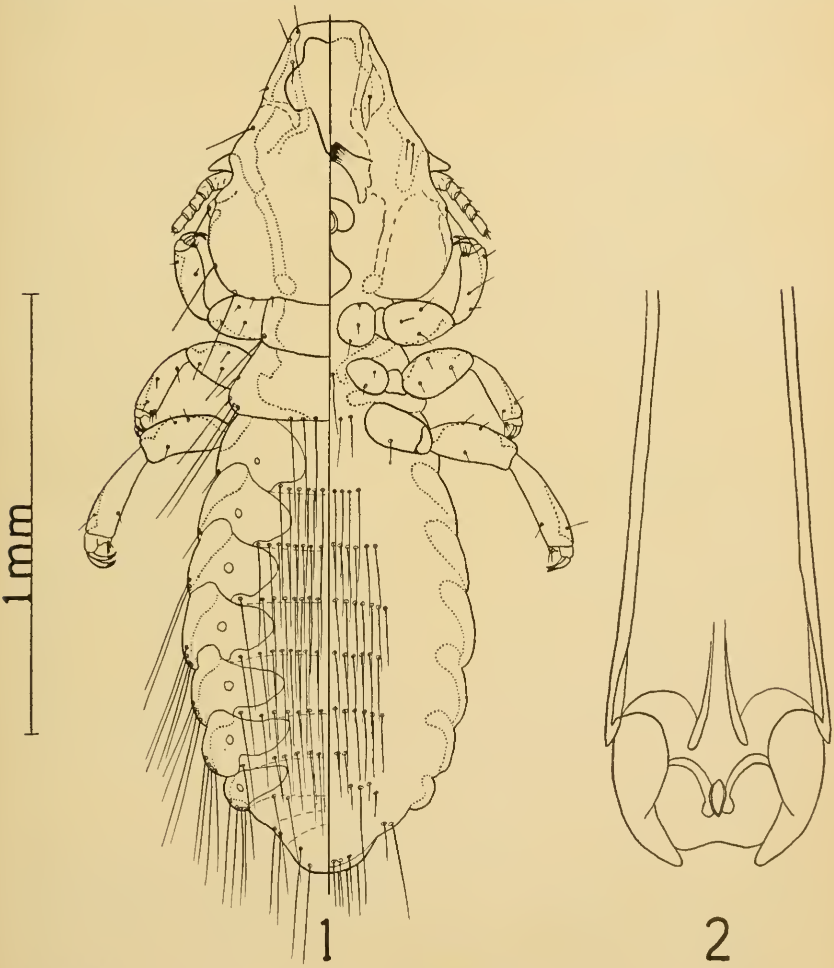
This contribution continues the high standard set by preceding numbers of this useful guide to the California insect fauna. It contains a brief introduction discussing the bionomics, floral relationships, distribution and taxonomy, followed by keys to the American genera and to the California species except in the genera *Osmia*, *Megachile* and *Coelioxys*. The treatment accorded the species belonging to the other genera consists of a citation to the original description, references to published synonymy, detailed California records, a brief specific diagnosis, and a brief statement of the bionomics where such information is available. The complete ranges of many of the species are shown on accompanying maps, and many structural details are also figured.—KARL V. KROMBEIN, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

A NEW MALLOPHAGAN FROM THE SCREECH OWL
(PHILOPTERIDAE)

By K. C. EMERSON, *Stillwater, Oklahoma*

Strigiphilus otus, new species
(Figures 1, 2)

Male.—Dorsal anterior plate prominent, anterior margin indented and sharply pointed posteriorly. Hyaline margin wide. Prominent dorsal antennal sutures



Strigiphilus otus n. sp., male: fig. 1, dorsal-ventral view; fig. 2, genitalia.

mid-way between antennae and the hyaline margin, each extending inward one-third width of head. Trabeculae well developed. Antennae filiform, without noticeable sexual dimorphism. Temples convexly rounded, each with two long setae and two short setae; posterior margin of head bare. Prothorax short, wide, and armed dorsally with one long seta on each posterior lateral angle. Pterothorax one-third as long as wide with six long median setae dorsally on the posterior margin, and three long setae in the posterior lateral angles. Prominent tergal plates on abdominal segments II-VIII, separated medianly with setae in the posterior lateral angles only. One row of long setae medianly on the posterior margins of tergites II-VII. Dorsal and ventral chaetotaxy as shown in figure 1. Genitalia as shown in figure 2.

Female.—Approximately the same size as the male. Chaetotaxy, except for the vulva, same as in the male. Lateral margins of the vulva each with six or seven long setae, four short median setae, and remainder of vulva bare.

Type host.—*Otus asio gilmani* Swarth, Sahuaro Screech Owl.

Type material.—Holotype ♂ and allotype ♀, collected by Dr. Allan R. Phillips at Phoenix, Arizona from *Otus asio gilmani* Swarth, have been deposited in the U. S. National Museum. Paratypes: 3 ♀, 5 ♂ from *Otus asio gilmani* Swarth, Sahuaro Screech Owl, collected at Phoenix, Arizona by Dr. Allan R. Phillips; 7 ♀ from *Otus asio gilmani* Swarth, Sahuaro Screech Owl, collected by Dr. Allan R. Phillips at Tucson, Arizona; 1 ♀ from *Otus asio* (probably *hasbroucki* Ridgway), Hasbrouck's Screech Owl, collected at Dallas, Texas; 11 ♀, 4 ♂ from *Otus asio naevius* (Gmelin), Eastern Screech Owl, collected by Francis Harper at Rensselaerville, N. Y.; 2 ♀, 1 ♂ from *Otus asio naevius* (Gmelin), Eastern Screech Owl, collected at Beltsville, Maryland, by Frank R. Smith; 1 ♀, 2 ♂ from *Otus asio kennicotti* (Elliot) Kennicott's Screech Owl, collected by Alexander Walker at Tillamook, Oregon; 10 ♀, 10 ♂ from *Otus asio* (probably *kennicotti* (Elliot), Kennicott's Screech Owl, collected at Vancouver, British Columbia by Dr. G. J. Spencer.

Discussion.—This species is closely related to *Strigiphilus speotyti* (Osborn). The two forms are approximately the same size in both sexes, and the male genitalia are similar. *S. otus* n. sp. has short, stout tergal plates; chaetotaxy of the long setae on the abdominal sternites is: II-8, III-12, IV-14, V-12, VI-12, VII-2; and the vulva has six or seven long setae on the lateral margins. *S. speotyti* (O.) has long slender tergal plates; chaetotaxy of the long setae on the abdominal sternites is: II-12, III-16, IV-20, V-14, VI-2, VII-0; and the vulva has four long setae on the lateral margins.

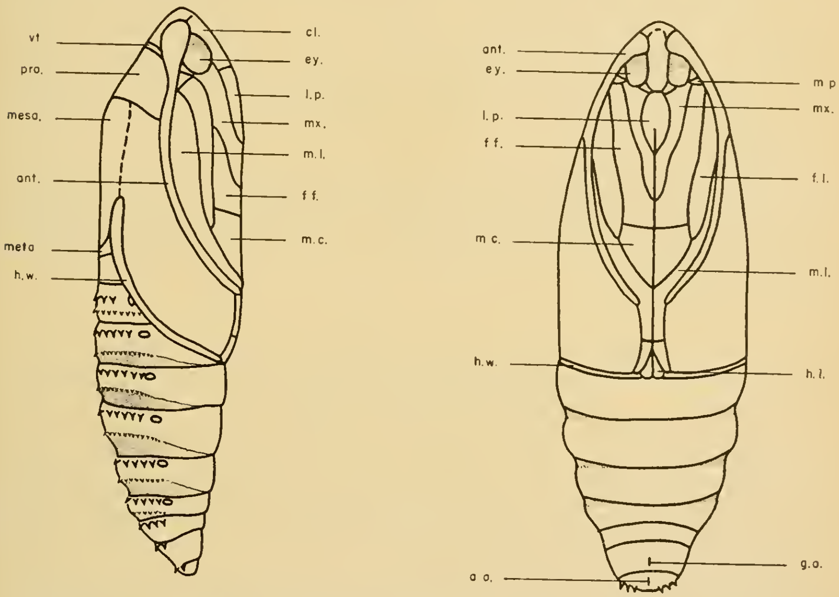
ANNOUNCEMENT

Those who plan to attend the Tenth International Congress of Entomology in Montreal August 17-25, 1956, may obtain details by writing directly to the Secretary, Mr. J. A. Downes, Division of Entomology, Science Service Building, Ottawa, Ontario, Canada.

THE PUPAL MORPHOLOGY OF THE LOCUST TWIG BORER
(LEPIDOPTERA, OLETHREUTIDAE)

By WM. H. BENNETT, *N. Y. State College of Forestry, Syracuse, N. Y.*

The pupa of the locust twig borer, *Ecdytolopha insiticiana* (Zell.), is formed within a silken cocoon and covered by humus, mineral soil or leafy material. It generally occurs upon or near the soil surface, but sometimes between leaves of the living tree. Because of an overlapping of generations, pupation may occur at any time during the summer season. Winter is passed as a larva or pupa within the cocoon, generally one-half to one inch below mineral soil.



Ecdytolopha insiticiana (Zell.), pupa: fig. 1, left, lateral view; right, ventral view. See text for explanation.

DESCRIPTION OF COCOON

The composition of the cocoon differs according to the material available to the last-instar larva. It may be a tough, fibrous, wool-like covering of humus, or it may assume the various colors and textures peculiar to mineral soils. Sometimes silk is spun within a dried, curled-up leaf or between fresh leaves. Occasionally a combination of leaf material and soil is used.

The cocoon is bean-shaped, oval and approximately 13 by 7 mm. in size.

DESCRIPTION OF PUPA

Pupa (Figure 1) cylindrical, oval, varying from 10.0 to 12.2 mm. in length, and 2.6 to 3.0 mm. in width; general color yellow-brown. Most characteristics of imago present, folded and closely appressed to each other and to the body. Head, thorax and abdomen distinct, without pubescence.

Head.—Vertex reduced, separated from frons by transverse epicranial suture. Frons rounded, smooth, separated from clypeus by indistinct epistomal suture. Compound eyes and antennal bases laterad to frons. Antennae long, slender, converging ventrally at about two-thirds of wing length; reaching just beyond mesothoracic coxae. Labroclypeal suture not visible. Mandibulary sclerites and maxillary palpi present as small triangular areas adjacent to compound eyes. Maxillae attaining one-third of wing length, distinguished from maxillary palpi by sutures which separate at dehiscence. Labial palpi and clypeal region clearly indicated.

Thorax.—The three thoracic segments distinct on dorsal side, extending somewhat laterally. Prothorax a narrow band, constricted slightly at middle. Mesothorax much larger than prothorax. Front wings indistinctly separated from mesothorax, reaching fourth abdominal segment ventrally. Prothoracic and mesothoracic legs folded between antennae and maxillae. Distinct ridge at mid-dorsal line of prothorax and mesothorax. Metathorax narrower than mesothorax. Hind wings protruding just beyond apices of fore-wings and covered ventrally by metathoracic tarsi.

Abdomen.—Ten abdominal segments distinct, first seven segments bearing spiracles. Double row of dorsal spines present on segments 2 to 7. Segments 8 to 10 with one row of spines dorsally. Posterior end of abdomen bluntly rounded; no cremaster present. Anal and genital openings slit-like, the latter apparently single in both sexes.

NOTE ON A PARASITIC NEMATODE FROM CODLING MOTH LARVAE, CARPOCAPSA POMONELLA

(Lepidoptera, Olethreutidae)

In October 1954, Dr. Walter Hough observed considerable mortality among codling moth larvae on banded apple trees in an orchard at Stevens City, Virginia. He submitted samples of these larvae to the Insect Pathology Laboratory for diagnosis and upon examination these were found to contain nematodes and a characteristically associated bacterium.

The nematode closely resembles *Neoaplectana chresima* Steiner but differs from it sufficiently so that Dr. Steiner considers it a new species.

Experimentally the nematode has shown a very wide host range producing fatal infections in many insects. Among the insect species found to be very susceptible were *Galleria mellonella, Pseudaletia unipuncta, Ephestia elutella, Neodiprion* sp., *Lasioderma serricorne, Pyraustia nubilalis* and *Nauphoeta cinerea.* Less susceptible to infection were *Termes* sp., *Blatella germanica* and *Periplaneta americana.* Honey bee adults were found to be resistant to infection.

The nematode has been reared in large numbers employing *Galleria mellonella* larvae as the host; yields in excess of 100,000 infective-stage nematodes per infected wax moth larva are commonly obtained. The infective stage nematodes are recovered from the dead insects by means of the nematode trap devised by the late G. F. White.—S. R. Dutky, *Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland* and W. S. Hough, *Winchester Research Laboratory, Winchester, Virginia.*

A NEW SPECIES OF PARALEPTOPHLEBIA FROM THE SOUTHEAST (Ephemeroptera, Leptophlebiidae)[1]

By Lewis Berner, *Department of Biology, University of Florida, Gainesville.*

While studying the mayflies of Piney River, Amherst County, Virginia, in 1953, Miss Jean Pugh collected three males and one female, as well as several subimagoes, of a very distinctive species of *Paraleptophlebia*. In the spring of 1954 during a collecting trip in west-central Alabama, I found adult males of the same species. A careful study of described species in this genus clearly shows that these mayflies represent a new species, the description of which is given below.

It is interesting to note that the Virginia specimens are from the Blue Ridge Province of the Appalachian Highlands while the Alabama mayflies were from a stream located well within the Coastal Plain. The stream from which the second collection came was a tributary of the Tombigbee River which extends northward into the Appalachian Plateaus. The pathway for the movement of insects between these physiographic provinces appears to be clearly established through the southwardly draining stream systems of the Appalachian Highlands. It is also surprising that this distinctive species should not have been previously taken, yet within a space of less than a year be collected on two occasions from such widely separated localities.

Paraleptophlebia jeanae new species
(Figures 1, 2)

Paraleptophlebia jeanae can be differentiated from all other species of the genus by the very distinctive shape of the male genitalia.

Male (*holotype*).—Body length, 6.8 mm.; mesothoracic wings, 6.4 mm.; caudal filaments, 7.8 mm. *Head.* Eyes large, contiguous dorsally; upper half orange brown, lower half black. Vertex brown. Lateral ocelli large, usual brownish color at base; median ocellus much smaller than laterals. Blackish-brown marks extend laterally from the lateral ocelli; just in front of each eye they form a heavy dark mark below the eye and above the antennal base. The triangle thus formed extends medioventrally toward the frontal carina. Frontal carina brown; frontal shelf translucent, pale. At the juncture of the shelf with the face, there is a blackish-brown line extending the full length of the shelf. Basal segments of antennae brown; flagellum pale. *Thorax.* Shining blackish brown; no distinctive marks present. Wings: Milky; longitudinal veins colorless, crossveins indistinct. Brownish color at the extreme base of the forewing, the color extending into the basal portion of the costa and slightly beyond the humeral brace, and in the radius as far as the humeral brace. Hind wing likewise with a brown coloration in its extreme base. Legs: Foreleg pale, femur with a slight brownish tint over the surface becoming deeper brown at the extreme distal end; tibia pale except in the basal portion and at the tip; tarsi pale, claws pale. Middle and hind legs pale, but with a faint brownish tinge; femora with a deeper tinge at the distal end; claws slightly dusky. Coxae of all legs brown. *Abdomen.* Brown; middle abdominal segments not extensively pale as in many other species of *Paralep-*

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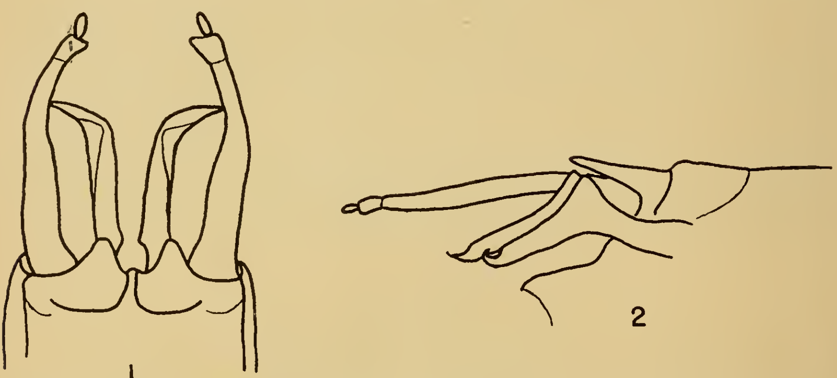
tophlebia. First abdominal tergite blackish brown. In the middle of tergites 2-8 there is a pair of blackish-brown, submedian streaks; a faint pale area between them on tergites 2-6; on 7 and 8 the clear areas become obsolescent. The anterior portion of tergites 2-7 being pale, a large, W-shaped, pale area is formed by the position of the geminate streaks. At the upper edge of the W, the pale area extends along the anterior border of the tergites to the lateral margins. Posterior half of tergites 2-7 colored with blackish brown which is more intense laterally but less intense posterior to the submedian dark lines. Tergites 8-10 almost completely brown. On tergite 9 there is a black, median streak in the anterior half, the remainder is brown overlayed with blackish-brown markings laterally. 10th tergite has a pair of blackish-brown marks at the posterolateral angles. At the lateral margins of tergites 2-7, the pale anterior border extends to the posterior



Paraleptophlebia jeanae, n. sp., male genitalia: fig. 1, ventral view; fig. 2, lateral view with ventral side up.

margin as a triangular pale area; just medial to the pale triangle, there is a heavier, blackish-brown line that extends from the posterior margin obliquely forward towards the median line. Sternites 2, 3, and 9 brown; others white. Ganglionic areas marked with orange. Forceps pale except at the extreme base; second segment considerably expanded medially (figure 1). Penes without a reflexed spur. In profile, there is a distinct curvature which appears to be almost elbowlike in the middle of each penis lobe (figure 2); each penis lobe with a distinct, thin process directed ventrally as a platelike structure. This plate begins at about the forceps base and extends distally to just beyond the elbow. Tips of penes terminate in outwardly directed sharp tips which are clear; remainder of penes brownish. Penes united only at the extreme base. Caudal filaments pale; basal segment of each filament brown; heavy spines at the joints in basal half give the tails a faintly annulate appearance.

Female (*allotype*).—Body length, 6.8 mm.; mesothoracic wings, 6 mm.; caudal filaments, 6.4 mm. *Head.* Shaded as in the male. *Thorax.* Lateral and posterior margins of the pronotum outlined in blackish brown. Mesonotum brown. Legs: Fore femur shaded with brown; deeper brown at distal end; tibia pale except at the extreme base where it is brownish; tarsal segments with very narrow markings at each joint producing narrow annulations; claws dusky. Other legs pale;

tarsal segments unmarked. Wings: Longitudinal veins more distinct than in male but still pale. *Abdomen.* Abdominal markings like those of male except that the white areas of the male are brown in the female. Sternites 2-8 rusty brown; pale at mid-posterior margin. 9th sternite pale. Caudal filaments as in male.

Variations in male paratypes: Forelegs have femora distinctly washed with brown; tibia dark brown at the femorotibial joint and with a slight concentration of brown pigmentation at the distal end; tarsal segments show a faint indication of annulations at the joints. Abdominal color pattern with the pale areas at the anterior portion of tergites 2-7 less extensive than in holotype. Lateral line of abdominal segments 1-8 outlined in blackish brown. Virginia specimens are more deeply colored than the Alabama ones and the pigmentation of the abdomen shows a purplish tinge. One specimen noted with a median, dark line on tergite 10.

Holotype.—Male imago preserved in alcohol. Alabama, Sumter County, 12 miles west of Demopolis on U. S. Highway 80; April 13, 1954; collected by C. D. Hynes and L. Berner. In the University of Florida Collections.

Allotype.—Female imago preserved in alcohol. Same data as that of holotype.

Paratypes.—6 ♂♂, 2 ♀♀, same data as that of holotype. 3 ♂♂, 1♀, Virginia, Amherst County, Piney River; March 8, 1953; collected by Miss Jean Pugh. All paratypes preserved in alcohol in the University of Florida Collections.

The Alabama specimens of *Paraleptophlebia jeanae* were taken at a clear, sand-bottom creek which had steep banks of eroded shale. It was cool under the overhanging trees, many of which had the roots exposed along the banks of the stream. At the road over the creek there was a high bridge constructed with broad, flat, cement abutments on which the adult mayflies were found resting. Most of the specimens were apparently undergoing their subimaginal molt. Some subimagoes were also taken that appeared to have just emerged. The collections were made between 9:30 and 11:00 a.m. At the time the collections were made the water temperature was 68°F. and the stream had a pH of 6.7. The water was slightly turbid.

A number of nymphs of *Paraleptophlebia* were taken at the Alabama stream at the same time that the adults were collected. These may be the immatures of *Paraleptophlebia jeanae*, but an adult female of a second species of the genus was also taken along with those of *P. jeanae* making the association doubtful. I am, therefore, not including the description of these nymphs.

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BOOK REVIEW

A REVISION OF THE PSYCHODIDAE (DIPTERA) IN AMERICA NORTH OF MEXICO, by Larry W. Quate. University of California Publications in Entomology 10(3):103-273, 1955.

The North American representatives of this interesting family of small "moth-flies" have been extremely difficult to determine because of the inadequacy of the previous keys and descriptions. This excellent work now changes the situation completely. Dr. Quate has done a difficult task superbly, studying the types of most of the previously described species, and presenting excellent keys, descriptions and figures for the 78 known species of the Nearctic Region. These are placed in three subfamilies and eight genera, and two of the species have subspecies. There is one new monotypic genus, 31 new named species or subspecies, and 17 new synonymies. In addition to the keys and descriptions of the genera and species, this volume contains an interesting historical review of the taxonomy of the family, a discussion of the techniques used for collection and study, a well illustrated section on the structures used in classification, and 18 pages of descriptions and figures of the immature stages. This work will greatly stimulate interest in the family and we can expect rapid advances in our knowledge of the taxonomy, biology, and distribution of the North American species, with this valuable work used as the basic starting point for such studies.—ALAN STONE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

BOOK REVIEW

THE PLANT QUARANTINE PROBLEM. A General Review of the Biological, Legal, Administrative and Public Relations of Plant Quarantines with Special Reference to the United States Situation, by W. A. McCubbin. Cloth, 8 vo., 255 pages, 3 text figures, 9 drawings, biblography, table of contents, index. Ejnar Munksgaard, 1954. Copenhagen, Denmark. American Distributors, The Chronica Botanica Co., Waltham 54, Mass. (as Vol. XI, Annales Cryptogrammi et Phytopathologici). Price, $4.80 (32 Danish kv., 33/9 sh.)

As the title indicates, the author has assembled in a single volume a complete summary of plant quarantines and their operation, as well as a source book of collected information on various phases of plant quarantine work. The author's observations are based on more than 30 years experience in the plant quarantine field, first with the State of Pennsylvania and then with the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture.

The book is written in a scholarly, very readable style. The subject matter is logically and clearly presented. There are eight chapters: introduction; biological background; social and economic relations; legal features; administrative aspects;; examination of a current quarantine; appraisal and outlook; and world situation. Each chapter is divided into sub-headings for ready reference. There is also an appendix of 34 pages that gives an historical summary of Federal Plant Disease Quarantines that includes discussions of black stem rust, chestnut blight, citrus canker, dutch elm disease, golden nematode, white pine blister rust and other diseases.

This book should be extremely interesting and useful to plant quarantine officials and associated workers, as well as scientists, teachers, agricultural and community leaders, writers and editors. It is an outstanding contribution toward a better understanding of the subject of plant quarantines.—P. X. PELTIER, *Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C.*

CARL HEINRICH 1880-1955

Carl Heinrich, 75, American entomologist, poet, writer, student of music, history, literature and philosophy, died of a heart attack at Garfield Memorial Hospital in the City of Washington on May 31, 1955.

Born April 7, 1880, at Newark, New York, he was the son of Paul and Clarissa (Brandt) Heinrich. His father was a talented musician, mathematician and lawyer, and was for a time private secretary to Grover Cleveland in the former president's law firm. Coming to this country from Germany, he was naturalized in 1877, admitted to practice as attorney in all the courts of the State of New York in 1878 and as a Counselor of the Supreme Court of New York in 1880.

The family moved to Omaha, Nebraska, when the child was six months old. There the father served as auditor for the Burlington Railroad, and the boy attended the Omaha schools through high school. Many of the famous musicians of that period, while there or passing through on tour, would stop over for visits with the family, and it would not be unusual for them, accompanied by his father, to sing and play most of the night. Doubtless it was contacts with such artists that were responsible for his deep interest in music.

He won a scholarship and attended the University of Chicago from 1898 to 1901, studying Greek and Greek drama. On leaving he went to New York, intending to study music composition under Edward

McDowell, but before that opportunity came, the famous teacher became ill and died. Heinrich deplored the displacement of classical education by technology and the emphasis placed on it in modern school curricula.

Following his student days Heinrich issued a volume of his own poems under the title "Moods and Moments," published by the Abbey Press of New York and London in 1901. It is a 12mo cloth-bound volume of 200 pages, and, unlike usual amateurish effusions of this kind, it proves to be of definite excellence. Now out of print, the Library of Congress copy bears call number PS3515E29M7.

He was married on August 23, 1903, to Mary Elizabeth Schubert of Washington, D. C. He is survived by a sister, Marie Louise Lang, of Pasadena, California; a son, Colonel Joseph Edward Heinrich, and grandson, Carl Heinrich, of Red Bank, New Jersey; and a daughter, Clara Heinrich, of Washington, D. C. His wife, his daughter Anna and his son Carl preceded him in death several years ago.

He came to the City of Washington in 1902 and was associated with various commercial organizations for several years. His 36 years of service in the U. S. Department of Agriculture began in 1913 and terminated with his retirement at age 69 on June 30, 1949. After this he continued to work toward the conclusion of what he considered to be his most important contribution to taxonomy, a monographic work on the American moths of the subfamily Phycitinae. His often-expressed desire that he live to see it published was not granted, but it was in press, and he reviewed the galley proof shortly before his death. A monumental work, it is being published by the Smithsonian Institution.

His many years of work in the U. S. National Museum in Washington not only identified him with that institution, but also afforded him abundant opportunity for acquaintance and association of world-wide scope with professional colleagues. Following a brief period in the field of applied entomology, he entered upon his studies in the classification of the Lepidoptera. These were continued and augmented throughout his period of public service, and won for him the honored place he has so long held in that field of research. He was also one of the pioneer workers on the immature stages of this order and the first to establish characters by which many of the economic pests such as the European corn borer and the pink bollworm could be identified with certainty. His numerous technical papers dealing with such species are authoritative and are widely used throughout the world.

Any discussion of this phase of his work would be incomplete did it not make mention of his helpfulness to the steady stream of incoming visitors and investigators from widely separated areas, as well as to the younger specialists as they were added to the staff. He was also helpful to numerous Bureau field men, who in preparation of papers on their economic work welcomed his cooperation in supplying needed technical descriptions of the various life history stages of the insects under discussion. These descriptions, prepared with Teutonic thoroughness and meticulous care, always added to the interest and the usefulness of these papers. The inspectors of the Division of Foreign Plant Quarantines likewise remember with deep gratitude the substantial value of his aid in the identification of border collections, and his personal guidance which enabled them to identify the more commonly intercepted pests themselves.

It is of interest to recall that it was his good fortune during his years of museum work to have colleagues such as Aldrich, Banks, Barber, Busck, Caudell, Crawford, Cushman, Clark, Dyar, Ewing, Fisher, Gahan, Hopkins, Howard, Knab, Pergande, Schwarz, and Viereck. He possessed a wide circle of other friends and acquaintances; these increased in number with the passing of years through the contacts made by him during numerous field trips to entomological stations here and abroad. One of his field assignments was as special representative of the Department to Guatemala in 1929 to investigate an incorrect report of the occurrence of the European corn borer. From 1935 to 1945 he was assistant Division leader of the then Division of Insect Identification. He also served as editor of the Lepidoptera Section of Biological Abstracts for 23 years.

It is noteworthy that he became a member of our Society in 1912; this was before his appointment to government entomological work. For several years thereafter Society meetings were held in old Sangerbund Hall; they were small in attendance and quite informal. He was an habitually faithful meeting-goer and participated actively in deliberations. He was Editor of the Proceedings from 1924 to 1926 inclusive, and his brief editorial comments bearing on entomological and related problems still possess interest and value. He was also a member of the American Association for the Advancement of Science and of the Biological Society of Washington. He was a member of the Cosmos Club from 1924 to 1932, inclusive.

In 1929 he issued a work of fiction, philosophical in scope, entitled "The Orphan of Eternity, or the Katabasis of Lord Lucifer Satan." This volume was published by Louis Carrier and Company, Ltd., of New York and Montreal. It is an octavo cloth bound book of 303 pages and is now out of print; the Library of Congress copy bears call number PZ3H36420r.

He was an avid reader, particularly in history, literature and art, often rereading works by favorite authors many times. Subsequent to retirement he undertook preparation of a series of 105 articles on various subjects of public interest; these were published in the News and Courier of Charleston, South Carolina, one of the oldest newspapers in the South, from January 8, 1953, to April 14, 1955. All were of characteristic excellence and were widely read and appreciated.

It is fitting to add that no biographical sketch of him would be complete that did not clearly emphasize over and over again his gregariousness, his hearty congeniality as host to visiting friends and his genuine gift for friendships. There are many who will bear pleasant memories of associations with him. Carl Heinrich will be greatly missed.

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J. S. WADE, *Committee Chairman*
HAHN W. CAPPS

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 57 DECEMBER 1955 NO. 6

SOME NEW SPECIES AND RECORDS OF NORTH AMERICAN SCARABAEIDAE[1]

(COLEOPTERA)

By HENRY F. HOWDEN, *Department of Zoology and Entomology, University of Tennessee, Knoxville.*

The purpose of this paper is to describe three new species of Scarabaeidae belonging to the genera *Rhombonalia*, *Anomalacra*, and *Stephanucha* and to record several species not previously reported from North America.

One new record and specimens of one of the undescribed species were taken by the writer in southern Texas. For furnishing the other material included in this paper, the writer is indebted to Drs. George D. Butler, Jr., and Floyd G. Werner of the University of Arizona and to Dr. J. N. Knull of the Ohio State University. I would also like to express my gratitude to Mr. Hugh B. Leach who compared the undescribed species with related species in the California Academy of Science, to Mr. E. R. Leach of Piedmont, California, who examined the *Stephanucha*, and to Mr. O. L. Cartwright of the U. S. National Museum who examined the new species and concurred with the writer that they were undescribed. Thanks are also due Mr. O. Z. Oliver who aided with the preparation of the plate.

Rhombonalia Casey

Casey, 1915. Memoirs on the Coleoptera, VI: 5.

The species described below keys to the genus *Rhombonalia* in Casey's generic key (1915, p.3) of the Anomalini. However, the characters used by Casey to delimit the genus probably should be modified slightly.

Robinson (1941, p.132) in his description of *Rhombonalia adscita* notes that "the four anterior tarsi are cleft thus bringing this genus closer to *Anomala*." In the opinion of the writer the two genera are very close, since some of the species belonging to the genus *Anomala* occasionally lack the cleft tarsal claws. The narrow ligula is in some species of *Rhombonalia* shallowly emarginate approaching to a small degree the rather broadly emarginate ligula of *Anomala*. Other characters given by Casey seem to vary only slightly.

All of the known species of *Rhombonalia* are light tan, with the exception of the species described below which is dark brown.

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[1]This work was in part supported by grant No. 1723 from the Penrose Fund of the American Philosophical Society.

Rhombonalia butleri new species
(Figure 8)

Male (*holotype*): Length, 11.6 mm.; greatest width, 6.5 mm. Dorsal color brown to dark brown with the vertex, margin of the clypeus, and part of the posterior margin of the pronotum brownish black. Brown elytra mottled with circular, irregularly spaced, brownish black spots. Pygidium darker anteriorly and posteriorly. Labrum 1 mm. wide and slightly emarginate. Clypeus (fig. 8) sharply reflexed anteriorly, less so laterally. Sides of the clypeus distinctly narrowed behind. Posterior clypeal suture vaguely indicated, not at all raised. Clypeus coarsely punctate on disk, the punctures not separated by more than their own diameter. Behind the clypeus the frons is slightly indented and coarsely rugosely punctate, the punctures becoming smaller and less distinct on the vertex.

Pronotum shiny, vaguely alutaceous, with scattered coarse punctures; completely narrowly margined with lateral margins slightly more arcuate anteriorly than posteriorly. Pronotum widest in posterior half, almost twice as wide as long at widest point, and quite convex. Posterior pronotal margin sinuate. Scutellum wider than long, only slightly elongate; vaguely concave with a few scattered punctures.

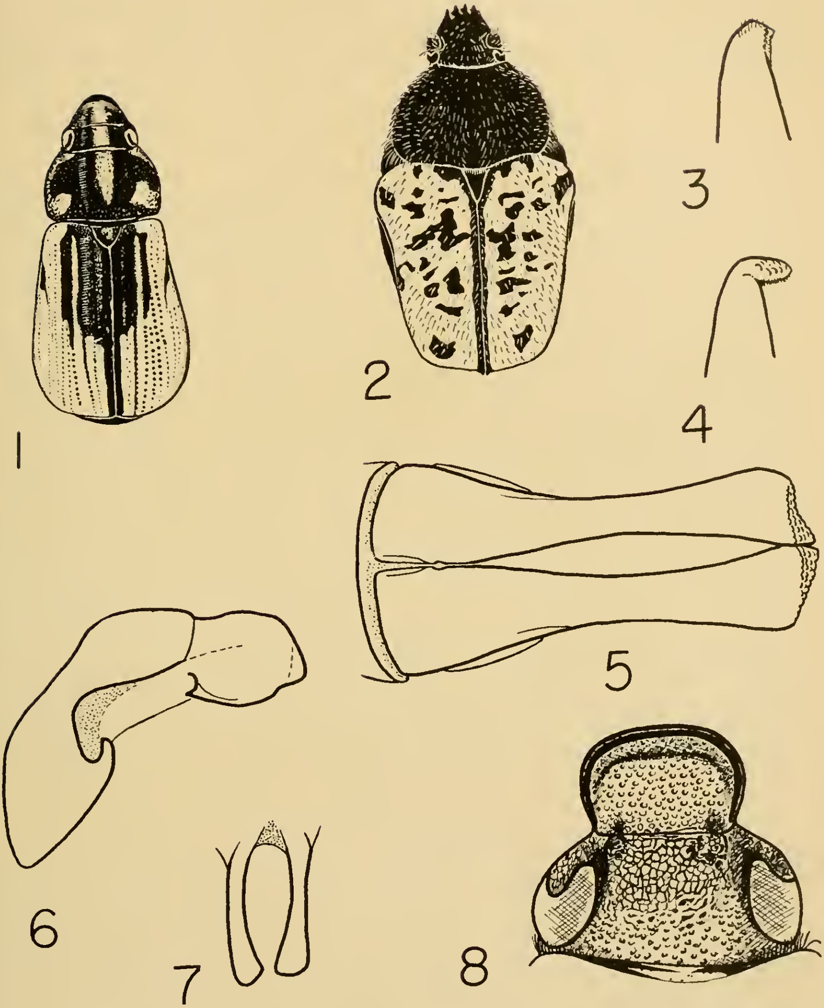
Elytra shiny, finely alutaceous with fine scattered punctures. Six vaguely indicated striae between suture and humeral umbone. Intervals rounded, three innermost ones transversely rugose. Elytra flared, widest in posterior third. Pygidium transverse with scattered punctures centrally, the area between the punctures being vaguely alutaceous. Dorsally the punctures become larger and irregular in outline with interspaces noticeably alutaceous. On either side of the midline the large dorsal punctures bear long yellow setae, there being about 16 setae on each side. Along the apical margin of the pygidium, there are also long scattered yellow setae and some vague punctures.

Ventral color brown to dark brown with coxae, femora and tibiae yellowish brown to brown. Ligula long and narrow as is the case with all the species of *Rhombonalia*. Antennal club 1-½ times as long as stalk, last segment of club on outer surface shallowly but closely punctate, the bottoms of the punctures noticeably shiny. Prosternum narrowly separating the anterior coxae with a small median keel. Meso-and metasternum hairy with numerous distinct but shallow punctures. Abdominal segments shiny medially becoming alutaceous laterally. Except for the terminal segment there is an irregular row of coarse seta-bearing punctures across each segment. At the lateral margins the punctures become more irregular and the rows lose their continuity.

Anterior tibiae bidentate, tarsi with terminal segment enlarged with claws simple as is characteristic of most of the genus. Meso- and metafemora with scattered long setae over their entire surface. Meso- and metatibiae each with only one definite outer transverse carina slightly post-median in position. The mesotibiae quite slender, the metatibiae thickened and enlarged. Posterior tarsi longer and heavier than either the anterior or middle tarsi.

Female.—Unknown.

Type material.—Holotype, ♂, Cochise Stronghold, Dragoon Mts., 4,850 ft., Ariz. Oak-juniper zone, July 21, 1949, at Light, F. Werner and W. Nutting. (Deposited on loan from the University of Arizona collection in the California Academy of Sciences.)



Anomalacra werneri n. sp.: fig. 1, holotype male; fig. 6, lateral view of male genitalia; fig. 7, apical view of tips of parameres. *Stephanucha anneae,* n. sp.: fig. 2, holotype male; fig. 4, tip of male genitalia; fig. 5, dorsal view of parameres. *Stephanucha areata* (Fab.): fig. 3, tip of male genitalia. *Rhombonalia butleri* n. sp.: fig. 8, head of holotype male.

Rhombonalia butleri can be separated from the other North American species by its dark color, indented clypeal suture, by the shape of the clypeus (see Fig. 8), and by the transversely rugose elytral intervals.

This species is named in honor of Dr. George D. Butler, Jr., who has been of great help in the accumulation of information on Arizona Scarabaeidae.

Anomalacra Casey

Casey, 1915. Memoirs on the Coleoptera, VI: 10.

Casey based this genus on characters exhibited by a single Mexican species, *Anomalacra cuneata* Casey. The species described here will key to *Anomalacra* (Casey 1915, p.3), but if placed in this genus several of the delimiting characters should be redefined.

In the species described below the labrum is very thin, almost invisible, the clypeus is elongate, thin and reflexed apically, being in this respect similar to *Anomalacra cuneata*. The ligula, while angularly emarginate anteriorly, is only slightly wider than long and in this respect seems related to *Anomala*. Since the type of *Anomalacra, A. cuneata*, is a female, several of the characters mentioned by Casey apply only to that sex. The slender anterior tarsus with the larger tarsal claw toothed at the outer third of the lower edge is characteristic only of the females. The males of the present species (the male of *cuneata* is unknown to the writer) have the anterior tarsus thickened with the larger claw cleft as is typical of males in the genus *Anomala*. If it were not largely for the elongate clypeus and very thin labrum, the genus *Anomalacra* probably should be considered synonymous with *Anomala*. However, until some intergradation of these characters with those of *Anomala* can be shown, the writer believes that the genus *Anomalacra* should be considered valid. The species described below is its only North American representative.

Anomalacra werneri new species

(Figures 1, 6, 7)

Male (*holotype*).—Length 7.3 mm.; greatest width 4.0 mm. Dorsal color yellowish tan mottled with dark brown. The head, disc of pronotum, scutellum, sutural interval and elytral margins dark brown. (fig. 1.) Labrum very thin, almost invisible. The clypeus, which overhangs the labrum, is remarkably elongate and sharply reflexed anteriorly, being only slightly reflexed laterally. Posterior clypeal suture slightly indented, extending in a straight line across the head. Surface of the clypeus slightly raised medially and rather evenly coarsely punctate, the punctures being slightly larger laterally and posteriorly. Head between the eyes coarsely punctate, the punctures being separated by 2 to 3 times their own diameter, becoming smaller along the posterior margin of the head. Edge of the eye canthus forming a very obtuse angle with the edge of the clypeus, the point of their juncture being slightly raised.

Pronotum quite convex, the surface evenly coarsely punctate, the punctures fewer and smaller medially. Area between the punctures shiny and slightly alutaceous. Midline of the pronotum vaguely indented. Laterally and posteriorly the pronotum is margined, the anterior margin becoming obsolete near the midline. Anterior pronotal angles acute, posterior angles obtuse. Lateral margins posteriorly almost parallel, but in the anterior half rather strongly convergent. Posterior margin of pronotum very vaguely bisinuate. Scutellum coarsely punctured, the punctures being similar to those of the pronotum.

Seven elytral striae between suture and humeral umbone. The second and fifth being very imperfect, indicated by rows of irregular punctures. Intervals convex, the ones adjacent to the second and fifth striae being somewhat less rounded. Posteriorly the elytra are slightly flared, being widest in the apical third, and it is at this point that the greatest width of the beetle was measured. Pygidium brown, rather uniformly scabrous. Parallel to the basal edge of the pygidium is a row of short indistinct setae. The apical margin of the pygidium bears a row of rather prominent setae, otherwise bare.

Ventral surfaces yellowish brown. Ligula almost as wide as long, shallowly emarginate and vaguely concave. Antennal club as long as stem; the club itself is long and slender, the outer surface of the last segment being finely punctured, the punctures separated by about their own diameter. Dark lines between punctures give a reticulate appearance. Middle coxae almost contiguous. Metasternum coarsely punctured laterally, becoming almost impunctate medially; posterior portion of midline sulcate. Abdominal segments with large shallow scattered punctures, the surface between these punctures becoming finely alutaceous laterally. Across each abdominal segment is an irregular row of setae which becomes more irregular laterally. The last abdominal segment is extremely narrow and slightly emarginate.

Fore tibiae bidentate. Apical tarsal segment enlarged with larger claw cleft as typical of males of genus *Anomala*. Mesotarsal claws with larger claw cleft but claw not enlarged as in anterior tarsus. Posterior tarsal claws simple. Meso- and metatibiae not noticeably thickened and of approximately the same length as their respective femora. Meso- and metatarsi slightly longer than their respective tibiae.

For details of male genitalia see figs. 6 and 7.

Female (*allotype*).—Length 8.5 mm.; greatest width 4.3 mm. Dorsal color and markings similar to male, but with the brown areas reddish instead of dark brown. Characters of head similar to those of male, the clypeus being slightly broader and more rounded. Pronotum with punctures more scattered and slightly smaller than holotype, the convexity of thorax even more apparent than in male. Punctures of scutellum and elytra smaller but otherwise the general configuration of the scutellum and elytra is like the holotype. Sides of the elytra less flared than in male, but widest point is still in posterior third. Shape of pygidium differs considerably from that of male, being almost a third again as long and considerably more convex. The surface is still more scabrous, the apical and basal setae are as described in male, but over the surface of the pygidium there are a few scattered setae. Ventrally the color, punctures and setae are quite similar to those described for the male. The antennal club is shorter being only two-thirds as long as stem. The anterior tarsi are not as enlarged as they are in male, and the larger tarsal claw instead of being cleft, has a small tooth directed anteriorly. The mesotarsal claw is more deeply cleft and shorter than that of male. The meso- and metatarsi seem relatively shorter than in the male, being approximately the same length as the tibiae. Abdomen of female when viewed in profile is convex in outline, while in males the abdominal profile is concave. Last abdominal segment, while still narrow, is broader than that of male and is only very slightly emarginate.

Type material.—Holotype, ♂, Cochise Stronghold, Dragoon Mts., 4850 ft., Ariz., Oak-juniper zone, July 21, 1949. F. Werner and W. Nutting. (Type deposited on loan from University of Arizona collection in Calif. Acad. of Sciences). Allotype, ♀, with same data as type (Univ. of Ariz. collection). Two ♂ paratypes, 2 miles southwest Patagonia, Ariz., 4050 ft., willow-cottonwood zone, July 30, 1948, F. Werner, W. Nutting. (One paratype Howden collection, one paratype Univ. of Ariz. collection).

Variation.—The two male paratypes are 6.5 and 7.5 mm. in length and 3.5 and 3.7 mm. in width. General configuration is quite similar to that described for the holotype, but the markings of both paratypes are much more obscure. Dorsal color of both paratypes is a more even yellowish brown, the head of one being evenly brown, the other being darker between the eyes. Thoracic pattern is similar to that described for the holotype. Elytral markings on one of the paratypes is similar to the holotype, but only light brown. In the other paratype the markings are so vague as to be almost invisible. The characteristics of the head of both paratypes are similar to those of the male, but in the pronotum there is some variation. In one specimen the punctures are slightly less numerous and smaller, resembling closely those of the allotype. In the other paratype, the pronotal margins instead of being parallel in the posterior half are slightly convergent and sinuate. The configuration of the elytra is similar in all the specimens, but in one paratype the strial punctures are almost entirely lacking, and instead of punctures, the second and fifth striae are obscured by irregular transverse wrinkles. (The elytra of this specimen seem to be aberrant.) In all other respects the two male paratypes appear practically identical to the holotype. This species can be easily separated from the only other species in the genus, *Anomalacra cuneata* Casey, by its much smaller size, brown markings, and characteristic ligula.

It gives me a great deal of pleasure to name this species in honor of Dr. Floyd Werner who has sent me many interesting Arizona specimens.

Stephanucha Burmeister

Burmeister, 1842. Handbuch der Entomologie, III:349.

The North American representatives of this genus have, on occasion, been included in the genus *Euphoria*. While similar to *Euphoria*, the species belonging to the genus *Stephanucha* (*sensu stricto*) can be readily identified by the presence of four reflexed spiniform teeth at the anterior edge of the clypeus.

Stephanucha anneae new species
(Figures 2, 4, 5)

Male (*holotype*).—Length 13.5 mm.; greatest width 7.8 mm. Dorsal color of head, pronotum, and scutellum black. Elytra dull yellowish brown, with irregular black markings. Clypeus anteriorly quadridentate, the teeth being sharply reflexed upward and longer than wide. The two median teeth are closer to each other than to the lateral teeth and are anterior to them. Behind these teeth the clypeus is densely, rugosely punctate with a small concavity on either side of the median line. Posteriorly on each side near the base of the clypeus, there is a small tooth overhanging the antennal insertion. The posterior clypeal suture is indistinct, the front and vertex of the head, being only slightly less punctate-rugose than the clypeus. Both the clypeus and head bear scattered long yellowish setae.

Pronotum heavily punctate, more so anteriorly. Pronotal disc shining. Laterally, between pronotal angles, there is a gray pruinose band approximately half a millimeter wide concealing almost entirely any lateral punctures. Near the posterior part of the midline is a dull impunctate area. Laterally and posteriorly the pronotal punctures bear scattered yellow setae; however, the median anterior third is almost bare, and the few setae in this area are short. Sides of pronotum just behind the anterior angles are slightly sinuate, and in the posterior half are almost parallel. The base of the pronotum is slightly sinuate on either side of the scutellum, being truncate in the area above the scutellum. Scutellum smooth, elongate, faintly shining.

Each elytron with two vague costae between suture and humeral umbone. Surface finely punctate and very feebly shining. Most of the punctures bear short, very fine yellow setae. Yellowish brown elytra marked in black in following manner (fig. 2): sutural costa around scutellum and two-thirds of elytral base, humeral umbone, apical protuberance and scattered spots along the two vague costae. Elytral apices vaguely pruinose, but not heavily punctate. Pygidium shiny black only along basal edge and median apical area. On either side of the midline there is a large pruinose spot varying from gray to white. The surface of the pygidium is finely, rugosely punctate with sparse yellowish white hairs.

Ventral surfaces brownish black, thorax almost entirely black. Antennae reddish brown except for basal two segments which are brownish black. Antennal club almost ⅓ longer than stem. Ventral surfaces of head and thorax rather densely hairy. Lateral parts of metasternum rugose-punctate towards the midline. Metasternum with a vague median sulcus running over half its length. Much of the center of the metasternum is almost devoid of hairs, and between the punctures is shiny. Abdominal segments smooth and shining medially, while laterally each segment is basally punctate. Also laterally at the point where the abdomen curves under the elytra, there is a small pruinose spot on each of the first four abdominal segments. Abdominal hairs which are present in many of the lateral punctures are noticeably shorter than many of the thoracic hairs.

Legs brownish black, being slightly lighter at tibial apices. Fore tibiae tridentate, the upper tooth being almost median in position. Middle and hind legs very similar to those of *Stephanucha areata*.

Male genitalia (figs. 4 and 5) with apices sharply curved downward and more widely flared than the genitalia of *Stephanucha areata* (fig. 3).

Female.—Unknown.

Type material.—Holotype, ♂, two miles south Los Olmos Creek and U.S. Rt. 77, Texas, May 31, 1954. H. F. Howden and W. Cloyd. (Type deposited in U.S. National Museum.) Paratype, ♂, same data as type (Howden collection).

Variation.—There is remarkably little variation between the holotype and the paratype. The length of the paratype is 13.3 mm., greatest width 7.5 mm. Pronotal setae are more pronounced anteriorly, but are short and fine as in the holotype. The lateral pruinose area of the pronotum is slightly more evident, but does not quite reach the anterior angles. The markings on the elytra are almost identical to that of the type, only the outline of the scattered spots varying slightly. Ventral aspects seem to be almost identical with the holotype with the exception of the setae which seem slightly longer in the paratype.

The two specimens were taken by Mr. Cloyd flying along the edge of a railroad embankment paralleling U.S. Route 77, approximately 2 miles south of Los Olmos Creek. Several other specimens were seen flying over the low and sparse vegetation in the area. The habitat was very sandy with open patches of white sand, being similar to that in which *Stephanucha areata* occurs in the southeast.

It gives me a good deal of pleasure to name this species after my wife who has been of tremendous help to me on many occasions.

Stephanucha anneae can be easily separated from the two closest species *S. areata* Fabr. and *S. pilipennis* Kr. by the following characters. *S. anneae* is larger than either of the two species, the black markings on the elytra cover considerably less area than on any specimens of the other two species the writer has examined. Dorsal setae are shorter and sparser than is the rule for *areata* and considerably shorter than *pilipennis*. *S. anneae* is more closely related to *areata* than to *pilipennis*, but is easily separated on any of the above characters.

The three species mentioned below do not appear to be recorded in the literature as occurring in North America. More than a single specimen has been seen of each of the following species:

Onthophagus incensus Say. Palm Jungle, Brownsville, Texas, June 1, 1954, H. F. Howden.

Cyclocephala lunulata Burmeister. Nogales, Arizona, August 4, 1953, D. J. and J. N. Knull.

Euphoria canescens Gory and Perch. Atascosa Mt., Arizona, October 3, 1938, R. A. Flock.

Reference

Robinson, Mark, 1941. Studies in the Scarabeidae of North America (Coleoptera). Pt. II, Seven new species of Scarabeidae. Trans. Amer. Ent. Soc. 67:131-136.

SPECIES OF THE PALLIPES GROUP OF NEBRIA IN THE EASTERN UNITED STATES

(Coleoptera, Carabidae)

By Ross T. Bell, *Department of Zoology, University of Vermont, Burlington*

The *pallipes* group in the genus *Nebria* was erected by Casey for *N. pallipes* Say, and two very similar species, *N. lacustris* Casey and *N. expansa* Casey. *N. appalachia* Darlington is evidently a member of the same group. It is probably restricted to the southern Appalachians. It is readily distinguished by its small size and by other characters, and will not be considered in this paper, the purpose of which is to clear up the confusion between *pallipes* and Casey's two species.

In *N. pallipes,* the apex of the elytron is rounded and curves evenly to the suture (fig. 1). In the other two species, the apex is pointed, and the elytron is emarginate between the apex and the suture (fig. 2). Casey separates his two species by their general proportions. *N. lacustris* is described as smaller and shorter than *N. pallipes,* with a smaller head and prothorax and with deeper elytral striae. *N. expansa* is described as differing from both preceding species in being longer, with a larger head and prothorax, and with shallower elytral striae. Banninger (1925) lists only *lacustris,* indicating that he considered *expansa* to be a synonym. After examining the materials in the United States National Museum, including the types of both species, I believe that *expansa* is at most a poorly defined geographic race of *lacustris.* Typical *lacustris* is from more northern localities, but typical *expansa* and intermediates are represented from both southern and northern localities.

The coleopterist in the eastern United States is thus faced with the problem of recognizing two very similar species, *Nebria pallipes* Say and *N. lacustris* Casey. Published records for *N. pallipes* are of little value unless it is certain that the authors were able to recognize the other species. The structure of the tip of the elytron, as described above, is a good character. It can be examined on live specimens in the field by inserting the edge of a light colored piece of paper under the tip of an elytron. Bänninger (1925) points out two additional differences. In *N. pallipes,* the anterior marginal seta of the pronotum is absent (fig. 5). This seta is present in *N. lacustris* (fig. 6). In *N. pallipes,* there is a pair of well defined light spots on the vertex. These spots are absent in *N. lacustris.*

I have found that the shape of the tip of the aedeagus is of use in separating the males. In *N. pallipes,* the tip is obtusely rounded (fig. 3), while in *N. lacustris,* it is acutely pointed (fig. 4).

Casey gave no locality records for *N. pallipes,* but listed *N. lacustris* from Bayfield, Wisconsin, and Minnesota, and *N. expansa* from Indiana and Texas. Records by other authors for "*N. pallipes*" are useless, for many of them may actually be for *N. lacustris.* Therefore, I will record the ranges of the two species as known to me from my own collections and from examination of the specimens in the United States National Museum. "R. T. B." indicates specimens in my personal collection. All other specimens cited are in the United States National Museum. Those specimens marked with an asterisk tend toward the typical form of *N. lacustris,* rather than toward *expansa.*

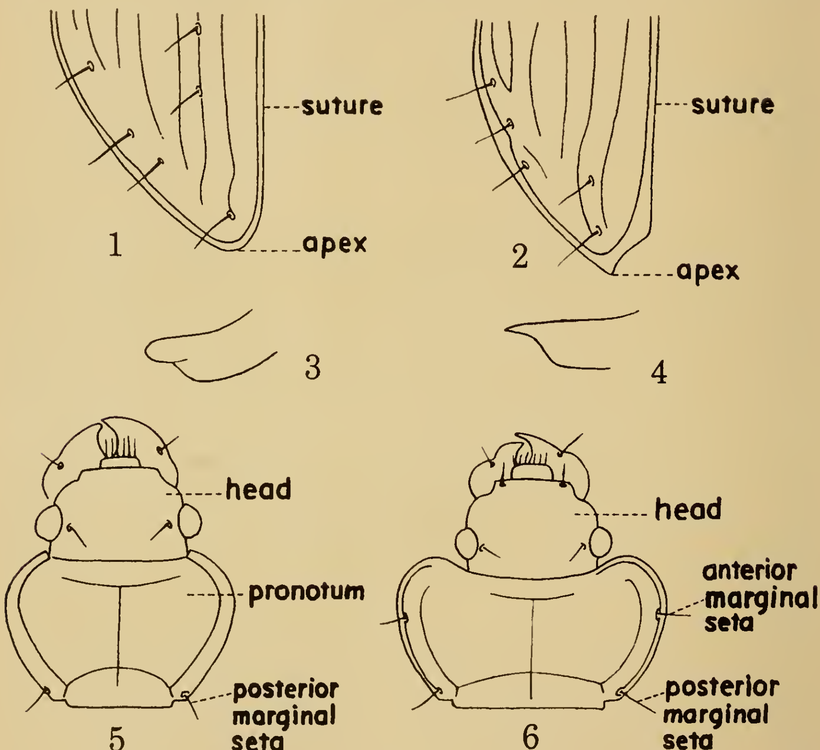


Fig. 1, *N. pallipes,* tip of left elytron; fig. 2, *N. lacustris,* the same; fig. 3, *N. pallipes,* tip of aedeagus; fig. 4, *N. lacustris,* the same; fig. 5, *N. pallipes,* head and pronotum; fig. 6, *N. lacustris,* the same.

Nebria pallipes Say

District of Columbia: Washington (M. L. Linell)

Illinois: Danville, Fox Ridge State Park, Kickapoo State Park (R.T.B.)

Indiana: The Shades State Park, Turkey Run State Park (R.T.B.)

Kentucky: Mammoth Cave National Park (R.T.B.)

Maryland: Cabin John (J. Swade), Frederick (R.T.B.)

Massachusetts: Montgomery (Wickham)

New York: New Windsor, West Point (Robinson)

North Carolina: Linville Falls, Round Knob, Retreat (F. Sherman)

Pennsylvania: Germantown, Glenside, Lancaster (Auyer), Lower Merion, Swarthmore, West Park (Kalker), Wyoming.

Virginia: Dead Run in Fairfax Co., Nelson Co. (Robinson), Rosslyn (F. H. Chittenden)

West Virginia: Grafton (Hubbard and Schwarz)

Nebria lacustris Casey

District of Columbia: Washington (M. L. Linell)

Illinois: Grape Creek, Kickapoo State Park, Muncie (R.T.B.)

Indiana: The Shades State Park (R.T.B.)

Maryland: Buckeystown (R.T.B.), Plummer's Island (Fisher, McAtee, Warner).

Massachusetts: No locality* (Belfrage)

Minnesota: No locality* (Casey)

New Hampshire: Mount Washington* (C. V. Riley)

New Jersey: No locality* (J. B. Smith)

New York: Buffalo (C. Vikely), Colden (Wickham), Fulton Co.*

North Carolina: Retreat* (Hubbard and Schwarz)

Ohio: Cleveland (Wickham)

Ontario: Drumbo (R.T.B.), Toronto (Wickham)

Pennsylvania: Lehigh Gap (George M. Greene)

Texas: No locality (Casey)

West Virginia: Fort Pendleton (W. L. McAtee), Grafton (Hubbard and Schwarz)

Wisconsin: Bayfield* (Casey), Wyalusing State Park (R.T.B.)

Thus far *N. pallipes* has not been taken in the Great Lakes Region or west of the Mississippi. Otherwise, the ranges of the two species appear to overlap completely. It has been my experience, both in Illinois and Maryland, that there is a marked difference in habitat. *N. pallipes* occurs along small temporary or permanent streams in densely wooded ravines, while *N. lacustris* is typical of the shores of larger streams and rivers.

References

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Casey, T. L., 1913 Memoirs on the Coleoptera, IV: 55.

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BOOK NOTICES

Maurice T. James. The blowflies of California. Bull. of the Calif. Insect Survey 4(1): [1]-[34]. 1955. Univ. Calif. Press, Berkeley, $0.50.

Paul D. Hurd, Jr. The Carpenter Bees of California. Bull. of the Calif. Insect Survey 4(2): [35]-72. Univ. Calif Press, Berkeley, $0.50.

These two paper-covered issues continue the popular and useful series of California Insect Survey Bulletins. Both contain appropriate keys to aid in identification of the insects concerned, and both detail the known California collection records.—Ed.

THE OCCURRENCE OF AEDES CANADENSIS (THEOBALD) IN ALASKA

(DIPTERA, CULICIDAE)

In recent years, there has been considerable interest in the mosquitoes of Alaska. Mosquito surveys by personnel of the Alaska Insect Control project, the Arctic Health Research Center and other groups have established a reasonably complete check-list of Alaskan mosquitoes. However, in spite of extensive collecting, *Aedes canadensis* has not been reported from the territory. This is contrary to expectation because the species is one of the most widely distributed mosquitoes in North America and has been taken from many areas with environments similar to those encountered in Alaska. Carpenter and LaCasse (Mosq. No. Amer., 1955) record the species from 42 states in the U. S. and 13 provinces and territories in Canada. Freeman (Can. Dept. Nat. Def. Res. Bd., Env. Protection Tech. Rept. 1, 1952) reports Canadian collections from Norman Wells and Yellowknife, N. W. T. as well as Dawson and Whitehorse, Y. T.

During the summer of 1955, the authors collected many biting females of *Aedes* in order to obtain eggs. Previous surveys in Alaska have usually been limited to larval collections, due to difficulty in identifying females of the dark-legged group. These difficulties have been resolved by the work of Vockeroth (Can. Ent. 86:241-255, 1954).

On July 23, 1955, females of *Aedes canadensis* were collected while biting at milepost 160 on the Steese Highway, two miles south of Circle. This is a slight extension beyond the previous northern record from Norman Wells, N.W.T. The habitat was similar to the white spruce climax forest described by Jenkins (Mosq. News 8:140-147, 1948). Birch, small shrubs and sphagnum dominated the vegetation. Twenty-five *A. canadensis* were collected during a two hour period. *Aedes decticus* was the dominant biting mosquito in this area. Other species collected include *A. excrucians, communis* and *riparius*. On July 24, 50 females of *canadensis* were collected at the same locality during a two hour period.

On July 26, a heavy population of *A. canadensis* was encountered at milepost 337 on the Richardson Highway near Eielson Air Force Base. More than 200 biting females were collected in less than an hour. The vegetation consisted of larch, scrubby black spruce and sphagnum ground cover. Many larvae of species other than *canadensis* were collected at this site in 1947 and 1948 by members of the Alaska Insect Control Project. However, in late July, 1955, *canadensis* was easily the dominant pest mosquito at this site. Other species taken included *A. fitchii* and *communis*.

In 1951, Lt. Robert A. Hedeen collected larvae in the vicinity of Palmer that appeared to be *A. canadensis*. However, subsequent rearing of material from this larval habitat produced only *A. stimulans* (W. C. Frohne, personal communication).

Specimens of *A. canadensis* from Alaska are deposited in the U. S. National Museum.

Thanks are due to Dr. Alan Stone, Entomology Research Branch, U. S. Department of Agriculture, for confirmation of identification.—GEORGE B. CRAIG, JR., *Entomology Branch, Chemical Corps Medical Laboratories, Army Chemical Center, Md.* and ROBERT L. PIENKOWSKI, *498th Medical Company (Preventive Medicine) (Separate), Fort George G. Meade, Md.*

TWO NEW SPECIES OF CULICOIDES FROM CHEBOYGAN COUNTY, MICHIGAN
(DIPTERA, HELEIDAE)[1]

By ROGER W. WILLIAMS,[2] *School of Public Health and Administrative Medicine, Columbia University, New York, N. Y.*

During the summer of 1954 studies were initiated on the Heleidae of the Douglas Lake region of Cheboygan County, Michigan. Three previously undescribed species of *Culicoides* were recovered. Two are described herewith. The third species was represented by a single male specimen the genitalia of which is preserved on a slide in the collection of the U. S. National Museum.

The techniques of mounting and measuring were the same as those described by Wirth and Blanton (Jour. Wash. Acad. Sci. 43 (3): 69-77, 1955), with one exception. Antennae of the first species were studied in glycerin without a coverslip so that they could be rolled and moved easily. The clearing action of the glycerin was such that the antennal sensoria could be studied in detail. For this purpose 18X eyepieces and a 45X objective were utilized. It was nearly impossible to see all the sensoria on all of the segments while an antenna was in any given position; as a result it was necessary to study each segment in different positions. After considerable study in this manner some doubt still exists as to the exact number of sensoria appearing on segments 3 and 15. Wirth and Blanton use Tillyard's modification of the Comstock-Needham system for designating the wing veins. This procedure is followed here: thus Cu_1 and Cu_2 of some workers become M_{3+4} and Cu_1, respectively, and cell Cu_1 becomes cell M_4.

Culicoides sphagnumensis, new species
(Figures 1, 2, 3, 4, 5, 6)

Female.—Length 1.43 to 1.63 mm.; wing 1.43 mm. by 0.66 mm.

Head dark brown, eyes bare, narrowly separated, ratio of separation to diameter of facet in center of eye, 7:12. Antennae with scape dark, pale flagellar segments in proportion of 25:15:15:15:15:15:17:18:45:53:53:56:85; sensoria appear as follows (Fig. 1)[3]: at least 6 on segment 3 (possible 7 or 8); 3 or 4 and 5; 2 on 6, 7, 8, 9, 10; 4 on 11, 12, 13, 14; and either 6, 7 or 8 on segment 15. Palpal segments (Fig. 6) in proportion 21:40:47:18:20, third segment greatly swollen with a large sensory pit.

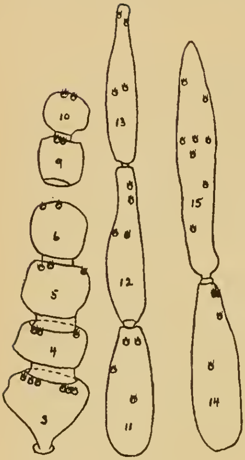
Mesonotum (Fig. 2) dark brown with appressed hairs; a lighter central area which broadens caudally contains markings which are variable[4]. Humeral pits

[1]Contribution from the University of Michigan Biological Station.

[2]I wish to express my sincere thanks to Dr. W. W. Wirth, U. S. Dept. Agriculture, for his aid and many helpful suggestions and to Mr. J. A. Downes of the Canadian Department of Agriculture for permission to mention his collecting records of *C. sphagnumensis.*

[3]The apparent position on any given segment is, of course, dependent upon the position of the segment on the slide.

[4]The figure includes most of the markings seen in alcoholic specimens; any or all of these markings may be missing and no specimen seen had them all.



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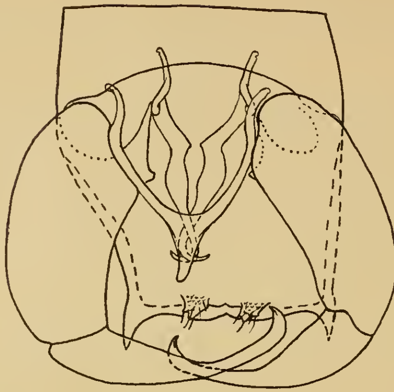

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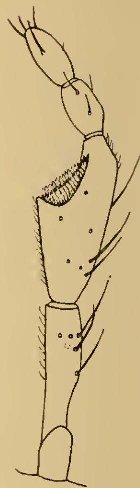

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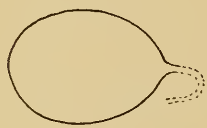

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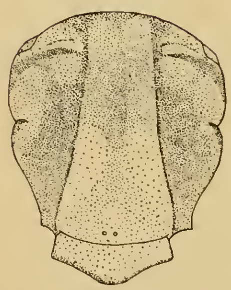

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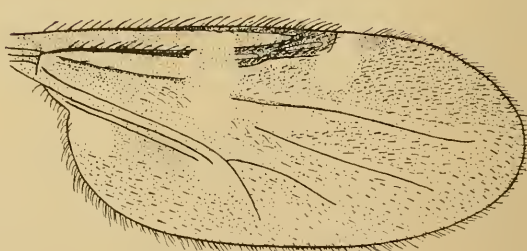

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Culicoides sphagnumensis n. sp.: fig. 1, female antenna illustrating number and location of sensoria on flagellum (segments 7 and 8 are similar to 6); fig. 2, mesonotum of female; fig. 3, spermatheca; fig. 4, female wing; fig. 5, male genitalia; fig. 6, palpus of female.

in lighter areas. Lighter spot directly behind pit area and an elongate lighter area ventrad to it which extends back across the suture. Scutellum and postscutellum outlined in dark brown. Mesopleura tan or light brown with an elongated somewhat triangular dark spot, the apex of which points towards the wing base; sternopleura and pteropleura dark brown. Legs light brown, trochanter outlined in dark brown, dark knee spot at junction of femora and tibia, tibia with a lighter band at proximal end next to knee spot, comb on distal extremity of hind tibia appearing as a narrow dark brown band.

Wing (Fig. 4) with anterior radial cells usually complete, second radial cell may be incomplete; costa to 0.61 of wing length. Macrotrichia long and numerous except in the basal portion and in costal cell. Anterior margin of wing with a light spot over r-m cross vein extending well beyond media, a spot at the end of the second anterior radial cell extending ⅔ or more to vein M_1. Cell M_1 with a single somewhat elongated light spot at base, the size variable; cell M_4 with a light spot which usually has a rather ill-defined border; anal cell with a pale spot of variable size at distal end of anal veins and another spot at cell base. Halteres pale.

Abdomen dark brown, lighter on ventral surface, spermatheca (Fig. 3) one, large and oval.

Male genitalia (Fig. 5).—Ninth sternite broadly and fairly deeply excavated, the membrane bare; ninth tergite quadrate with medium sized, widely separated apicolateral processes, mesal cleft somewhat variable in size but always present. Basistyles stout, ventral root exceedingly small, represented by a slight projection, dorsal root long and tapering; dististyle with apical half more narrow than basal half, tips sharp and incurved. Aedeagus with basal arch approximately ¾ of total length, the basal arms slender and curved in and out near base; distal portion broader at base tapering to rounded end. Parameres long with small lateral notch at basal extremity, a mesal point, sometimes appearing quite sharp, at slightly less than half the length; the basal portion of the distal half somewhat swollen, tapering to hooked ends which are usually interlocked.

Types.—Holotype ♀, allotype ♂, *Sphagnum* mat at edge of the pond at Bryant's Bog on the south shore of Douglas Lake, Cheboygan Co., Michigan, July 6 to August 10, 1954, R. W. Williams (recovery cage). Type in U.S.N.M. Paratypes: 15 ♀♀, 15 ♂♂, same data as type; 15 ♀♀, 15 ♂♂ same data as type, but in the Canadian National Collection, Division of Entomology, Department of Agriculture, Ottawa, Canada.

Mr. J. A. Downes, of the Canadian Department of Agriculture, sent me four females of this species which he had collected in a light trap at Rowanton Depot, Quebec, on July 30, and August 4, 1954.

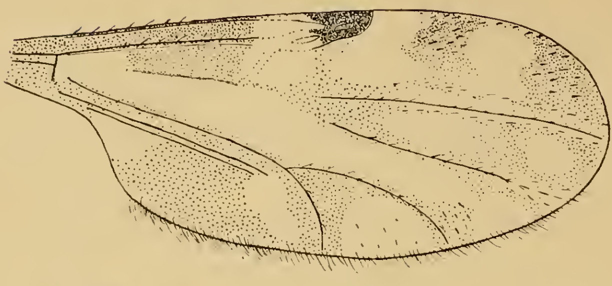
Because of the apparent association of this species with the moss genus *Sphagnum,* the name *sphagnumensis* appeared appropriate.

C. sphagnumensis is related to *alaskensis* Wirth, *canithorax* Hoffman, and *crepuscularis* Malloch, but differs from these speices in wing spot pattern, possessing more light spots than the first (a spot in cell M_4 and 2 spots in the anal cell) and less than the latter two (such as only 1 light spot in cell R_5). The mesonotal pattern, although not distinctive in itself, differs from the others in possessing a well defined median longitudinal stripe which broadens caudally. The male genitalia lacks an obvious spiculate membrane on the ninth sternite which the other three species possess.

Culicoides furensoides, new species
(Figures 7, 8, 9, 10, 11, 12)

Female.—Length 1.21 mm.; wing 1.03 mm. by 0.49 mm.

Head brown; eyes bare, narrowly separated, ratio of separation to diameter of



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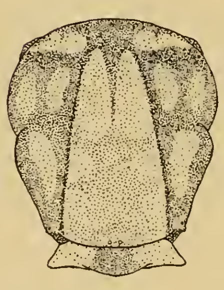

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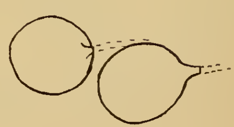

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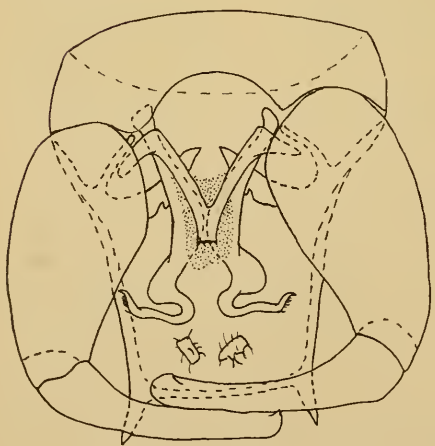

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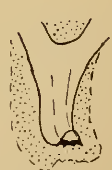

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Culicoides furensoides n. sp.: fig. 7, female wing; fig. 8, mesonotum of female; fig. 9, palpus of female; fig. 10, spermatheca; fig. 11, male genitalia; fig. 12, enlarged tip of aedeagus.

facet in middle of eye 7:10. Antennae with scape dark, pale flagellar segments in proportion of 17:16:16:18:18:20:20:20:20:23:23:23:34, single distal sensoria appearing on segments 3, 8, 9 and 10. Palpal segments (Fig. 9) in proportion of 10:25:31:16:18, third segment but scarcely swollen, small sensory pit near apex.

Mesonotum (Fig. 8) with appressed hairs, darker brown sides with a lighter central area broadening slightly caudally; a narrow, elongate, tapering dark brown line proceeding to suture in cephalic-mesal portion of center area with almond-shaped light spots on each side; caudal half of center area with two pairs of lateral light spots. Humeral pits in light area; prescutum with two light spots and scutum with two, but only the dorsal elongate one is seen from above. Scutellum dark brown in middle; postscutellum dark brown. Notopleura darker brown in center; mesopleura with an elongated somewhat triangular brown spot; sternopleura and pteropleura brown. Legs light brown with trochanter outlined in dark brown and dark knee spot at the junction of femora and tibia; broad lighter band below knee spot on tibia, apex of tibia with a faint, slender, dark band.

Wing (Fig. 7) with anterior radial cells complete; costa to 0.485 of wing length. Macrotrichia not numerous, greatest number on distal half of wing particularly in cell R_5, along distal wing margin and wing veins. Anterior margin of wing with light spot over r-m cross vein falling short of media; first radial cell entirely in this light area while the second is in a very dark spot; cell R_5 with a large light spot at end of costa, which has a constriction on its distal border, and a second light spot in the distal half of cell which does not touch the border of the cell and which tends to be somewhat concave on its distal border and convex on the proximal border; cell M_1 with two light spots, the distal one not touching the border; base of cell M_2 with a long light streak, which at the base extends into the base of the radial cell, and a second rounded spot broadly attaining wing margin; cell M_4 with a large rounded spot; anal cell with a basal pale spot and an elongated constricted spot extending from the distal end of anal veins nearly to border of wing. Halteres pale.

Abdomen brown, spermatheca two, subequal, subspherical (Fig. 10).

Male genitalia (Figs. 11, 12).—Ninth sternite short with narrowly rounded mesal excavation, the posterior membrane bare: ninth tergite constricting rather sharply at basistyles with rather widely separated, large apicolateral processes; mesal cleft absent. Basistyles stout, ventral roots stout and boat-hook shaped, dorsal roots about the same length but not as stout; dististyles nearly straight, not sharply bent at tip and with a small point. Aedeagus short and stout, arms with a right angle bend at base, the ratio of the length of the piece beyond the bend to the arms and to the apex is in the proportion of 11:25:15; apex (Fig. 12) curved up and back, with four flattened subapical spines just before the rounded tip; the apex and distal portion of the arms surrounded by a membrane. Parameres with bases broadened, stems expand mesally to apex of aedeagus, distal halves with large lateral pouches beyond which they become narrow and sinuous, tapering to sharp apical points with six subapical lateral hairs, the basal one somewhat set apart from the others.

Types.—Holotype ♀; allotype ♂, *Sphagnum* mat at edge of the pond at Bryant's Bog, Cheboygan County, Michigan, July 22, 1954, R. W. Williams (recovery cage). Type in U.S.N.M. Paratypes: 1 ♀, 1 ♂, same data as type.

The male genitalia is perhaps more similar to that of *furens* (Poey) than to any other described species in the eastern United States, thus the name *furensoides*—like *furens*. However, it differs from that of *furens* by possessing a prominent right-angled basal appendage on each arm of the aedeagus. The mesonotum lacks the multi-spotted appearance of *furens*, and a notable distinction in wing markings between these two species is the presence of only 2 spots in cell R_5 in *furensoides* as opposed to the 3 in *furens*.

A NEW GENUS AND SPECIES OF NORTH AMERICAN CYNIPOIDEA (Hymenoptera)

In the key to the Eucoilinae on p. 112 in my "Cynipoidea (Hym.) 1905-1950" a provisional new genus E was proposed for small robust species with an unusually short, closed radial cell (not twice as long as broad), wing pubescent and ciliate, mesoscutum smooth, disk rounded behind and not striate, abdomen with a ring of hairs at base. Single collected specimens from widely separated localities had been seen and in a few cases there was a record of the specimen having been reared from leaf miners. In June, 1953, Mr. George P. Wene of the Lower Rio Grande Valley Experiment Station at Westlaco, Texas, sent a small series with a definite rearing record, and it is from this material that the genus is named and a species described.

Ganaspidium pusillae, new genus, new species

Female.—Body black, smooth, bare except for white pubescence on sides of pronotum, propodeum, on metapleura and base of tergite II. Head from above transverse, 37 units wide by 20 units long, occiput concave, cheeks not broadened behind eyes; from in front as high as broad, malar space striate, about one-half eye, antennae 13-segmented with a definite 9-segmented club, length 1.5 times width of head, segments 3 and 4 equal. Mesoscutum smooth. Scutellum disk smooth, rounded behind with a row of marginal hairs, cup large, well-elevated with a small pit behind. Wing pubescent, ciliate, length 1.9 times width of head, distally broad (over 5 times width of radial cell), radial cell 1.5 times as long as broad, marginal vein not as heavy as others, cubitus obsolete. Abdomen sessile, little longer than thorax, length to height to width as 38:25:19. Length 0.8-1.15 mm. Average of four, 1.0 mm.

Male.—Similar to female with antenna filiform, 15-segmented, length 2.6 times width of head, segments 3 and 4 equal. Length 0.95-1.05 mm. Average of six, 0.98 mm.

Types.—U.S.N.M. No. 62839. Type female, allotype and 4 paratypes.

Host.—Reared from the serpentine leaf miner, *Liriomyza pusilla* (Meig.), infesting black-eyed peas at Monte Alto, Texas. The leaves were collected May 12, 1953, and the cynipids emerged May 29 and 30. Other parasites emerged before the cynipids. Ice cream cartons were used in rearing.—By Lewis H. Weld, *Arlington, Va.*

A NEW SPECIES OF CERATOPOGON FROM WEST AFRICA
(DIPTERA, CERATOPOGONIDAE)

BY BOTHA DE MEILLON[1] AND WILLIS W. WIRTH[2]

Ceratopogon (Brachypogon) senegalensis sp. nov.
(Fig. 1)

Male. Length 0.9 mm., wing 0.7 mm. by 0.3 mm. Head and thorax shining brownish black; abdomen yellowish at base, brownish toward apex; antennal

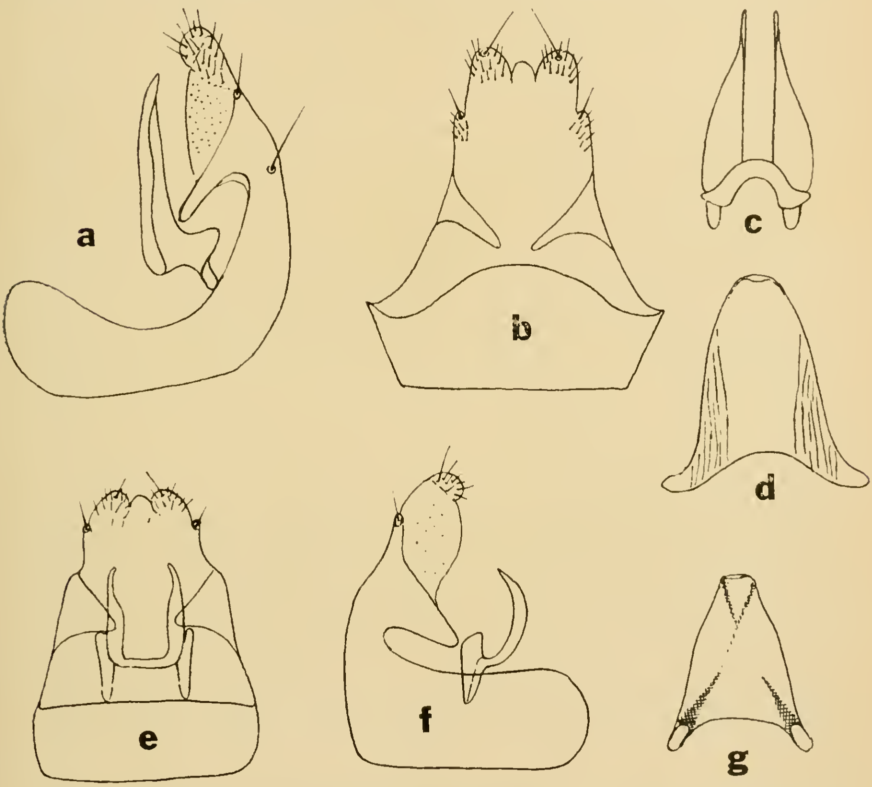

Fig. 1. *Ceratopogan* (*Brachypogon*) *senegalensis* sp. nov: *a*, 9th segment and paramere in side view (note the arm from the tergum projecting towards the paramere); *b*, 9th segment in ventral view; *c*, parameres in ventral view; *d*, aedeagus in ventral view. *Ceratopogon* (*Brachypogon*) *corius* de M. & H.: *e*, 9th segment and parameres in ventral view; *f*, 9th segment and paramere in side view; *g*, aedeagus in ventral view.

flagellum and legs yellow, hind femur darker; halter with white knob and brown stem; wing milky white, apex of radial veins brownish infuscated. *Eye* pubes-

[1]South African Institute for Medical Research, Johannesburg.
[2]Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.

cent. *Antenna* segments 4 to the base of 13 fused as in *corius* de M. & H. 1954 and the relative lengths of segments 13 to 15 as in that species. *Palpus,* third segment swollen, with long, spoon-shaped sensilla in a cluster on inner side near apex. *Mesonotum* with a few short strong setae in rows, otherwise bare. *Scutellum* with 4 long brown bristles. *Legs* moderately strong, with sparse, moderately long hairs; fore and hind tibiae with dense fine setae and a beard of long bristles at tip on inner side; hind basitarsus with ventral beard of closely set spinelike bristles. Segments of hind leg from femur in proportion of 50:50:25:10: 9: 5: 9. Tarsal ratio 2.5. Claws simple and short, a third as long as 5th segment; empodium small but distinct, with sparse branches. *Wing* with neither macrotrichia nor microtrichia; radial cells reduced, first absent, second only barely perceptible, ending just before middle of wing; r-m cross vein long and oblique; M_1 nearly straight with basal section of M, M_2 entirely absent; mediocubital fork narrow, at level of base of 1st radial cell; fringe long on posterior margin of wing. *Terminalia*: 9th sternum about twice as broad as long, caudal margin rounded over base of aedeagus; 9th tergum conical with a median projection from each side which appears to articulate with the parameres; coxites simple; style long, arcuate and pointed, as long as the coxite, nearly bare; aedeagus long, reaching nearly to the apex of the 9th tergum, conical, with heavily pigmented anterior arch, basal arms stout. Parameres a pair of long, tapered, valvelike plates joined basally by a strong bridge; each paramere with a basal dorsal projection which appears to articulate with the projection from the 9th tergum as mentioned above.

Holotype ♂, Dakar, Senegal, 29th June, 1945 (Coll. Eldon Newcomb). Type Number 61315, U.S.N.M.

This species is obviously very closely related to *corius* de M. & H., 1954, described from Cape Province, South Africa. The only appreciable differences are to be found in the male terminalia. In the original examination of *corius* the complicated nature of the parameres was not appreciated. The new species differs in having the 9th sternum somewhat produced medially and not straight, the 9th tergum conical and less rounded, the parameres broader, longer and placed closer together and the basal dorsal projection smaller. These differences are best appreciated by comparing the accompanying illustrations.

Of the 13 undoubted species of *Ceratopogon* now known to occur in the Ethiopian region, *senegalensis* is the first to be described from outside southern Africa.

THE TAXONOMIC STATUS OF HAEMAGOGUS JANTHINOMYS DYAR
(Diptera, Culicidae)

By W. H. W. Komp, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Maryland*

In a short article published in 1921, Dyar described briefly several new species of the genus *Haemagogus* Williston. In the introduction, he admitted that the treatment of the genus in the fourth volume of the monograph of Howard, Dyar and Knab had been inadequate. Four species were described (*equinus*, *albomaculatus*, *splendens*, and *capricornii*), and the distribution of these was stated to be much wider than is now known to be the case.

Dyar (1921) describes the peculiar method used for associating males with females, as follows:. . . ''The species were classified first by the females and then a male of each supposed species was mounted for examination and figuring. The result seemed complete; but really several species passed unnoticed by this method. The disadvantage resulting from more careful examination is that some of the older species cannot be recognized at present, being described from females and no male being at hand from the type localities.''

As a result of this unusual method, females entirely unrelated to the males were associated under one species name. A case in point is *Haemagogus janthinomys* Dyar, 1921. This species was described as follows:

''*Haemagogus janthinomys*, new species. Head blue, mesonotom green, abdomen dark purple, with the usual play of colors; pleura silvery scaled; abdominal lateral spots silvery, joined on the basal segments, with more or less silver dorsally on the posterior segments; legs dark violet to black, the femora white and silvery below towards base. Male proboscis thick on the basal half, the apical portion curved; palpi about one-fifth its length. Claws of female simple. The male hypopygium is figured as *capricornii*, plate 24, figure 165 of the monograph.

Types, two males, paratypes, 4 males and 3 females. No. 24335, U. S. Nat. Mus.; Trinidad, B. W. I. (F. W. Urich, breeding Nos. 17, 21, 22, B-1, B-3); June, 1905 (A. Busck).''

The larva is described in the monograph under the name *capricornii* (vol. IV, 877, 1917) and also figured (Pl. 126, Fig. 438, 1912). The larvae were bred from ''tree-holes.''

The material in the U. S. National Museum, from which Dyar described *Haemagogus janthinomys*, proves to be a mixture of two species, *janthinomys* Dyar and *splendens* Williston. The evidence for this is presented below.

Upon examination of the 10 specimens mentioned above, it was found that the Busck specimen is a female, mounted in balsam on a slide. The slide label bears the name ''*albomaculatus*,'' but this has been crossed out and renamed ''*capricornii*.'' It has not been relabeled ''*janthinomys*.'' No locality is given on the label, which does not bear a type number. It is not part of the paratype series. This female has toothed claws on the tarsi of the front and middle legs; the postnotum is without setae.

The other nine specimens bear red labels with the Museum number 24335, and are either types or paratypes.

In order to describe each of these nine specimens, they will be given letters from A to I, to avoid confusion with numbers which may be on pins or slide labels.

Specimen A is a co-type male; the pin bears a label: ''*capricornii*,'' probably in Dyar's handwriting, and other labels: 17.1/ Trinidad, W. I./F. W. Urich, collector/see Slide 219. The terminalia have been removed.

Specimen B is a paratype male, numbered 17.2, collected by Urich in Trinidad. The abdomen and most of the thorax are destroyed, but the densely plumose antennae are present. No slide ticket number is on the pin, and no associated male terminalia can be found in the Museum collection.

Specimen C is a paratype male, numbered 17.3, collected by Urich in Trinidad. The pin has a slide ticket label numbered 2269, indicating that a slide of the terminalia has been made. This slide is present in the Museum collection.

Specimen D is a paratype male, numbered B-1.7, collected by Urich in Trinidad. The terminalia have been removed, but no slide ticket number is on the pin, and no associated male terminalia can be found.

Specimen E is a paratype male, numbered B-3.8, collected by Urich in Trinidad. The antennae and four legs are missing. No side label is on the pin, and no associated male terminalia can be found.

Specimen F is a paratype female, without breeding number, collected by Urich in Trinidad. Only the fore and middle legs are present, but one middle leg lacks the hind tarsi. The three remaining tarsal claws are without teeth. The postnotum bears setae.

Specimen G is a paratype female, numbered 21-1, collected by Urich in Trinidad. Only one hind leg is present, and this is without the last four tarsal segments. The postnotum is without setae.

Specimen H is a paratype female, numbered 22-1, collected by Urich in Trinidad. All legs are present, and the tarsal claws of the fore and middle legs are without teeth. The halteres are crossed over the postnotum, so that setae, if present, cannot be seen.

Specimen I is a co-type male, without breeding number. The pin bears four labels: Trinidad, W. I./F. W. Urich, collector/1464/type No. 24335, U. S. N. M. The specimen has had the terminalia removed.

Only two larval skins from the series can be found in the collection. One is of a co-type male, specimen A above; the slide bears the data: St. Ann, Trinidad, W. I./F. W. Urich/17.1/219. The other skin is of a paratype male, specimen C above; the slide is labeled: Trinidad, W. I./F. W. Urich/17.3/2269. The integument of both these larval skins is densely hairy, and the comb-scales are attached to a plate. The description of these larvae by Dyar is faulty, but this matter will be considered elsewhere.

Two male terminalia, from specimens A (a co-type) and C (a paratype), are in the unit box in the U. S. N. M. collection, together with the whole female mounted on a slide, collected by Busck, mentioned above. There should be present the terminalia of specimens B (17.2); D (B-1.7); E (B-3.8), and a specimen I, without breeding number. None of the first three males bear slide tickets on the pins.

Specimen I, a co-type male, has a slide ticket number 1464, indicating that a slide of the male terminalia had been made. A search of the collection showed that the slide had been transferred to the unit box containing specimens of *Haemagogus splendens* Williston. The original slide label bears the data: *Haemagogus janthinomys* Dyar/Trinidad, W. I./F. W. Urich/1464. The upper part of this label has been pasted over with a new label: *Haemagogus celeste* D. & N. T. The labeling is in Dyar's hand writing.

It is not known why Dyar did not mention this specimen in his description of *Haemagogus celeste* Dyar & Núñez-Tovar, 1926. All that is noted in this description is the statement: "Two males are before us, Maracay, Venezuela, November 11 and 15, 1926 (M. Núñez-Tovar)." No type specimen of *H. celeste* was designated in the original description. A lectotype of *H. celeste* has been selected by Stone and Knight (1955).

H. celeste has been shown to be a synonym of *H. splendens* Williston by Kromp, 1954. The female paratype specimen F and H of *H. janthinomys* noted above may also be *H. celeste* (*-splendens*), as they have simple claws. Paratype female G is in such poor condition as to be unrecognizable. It is impossible to identify the male specimens B (17.2), D (B-1.7) and E (B-3.8), as the terminalia have been removed, but no corresponding slides can be found. The Busck female noted above may be *H. janthinomys*, as it has toothed claws on front and mid tarsi.

Dyar never published his subsequent designation of a single type of *H. janthinomys*, which he did by labeling slide 17.1 of the male terminalia as "Type." A lectotype of *H. janthinomys* has been selected by Stone and Knight (1955).

The figure of the male terminalia of *H. janthinomys*, given as *capricornii* in the monograph of Howard, Dyar and Knab, and repeated by Dyar (1928) as *janthinomys*, are inadequate to differentiate this form from others, such as *H. capricornii* and *H. spegazzinii falco*. The shape of the claspette filament is incorrectly represented, and the mesosome is not shown. The fine spicules on the ventral surface of the mesosome, below the short pointed tip, are easily visible in the slides of the terminalia of the type and paratype male (specimens A and C above). These spicules are present in *H. spegazzinii* and its subspecies *falco*. They are well shown in a photomicrograph of the mesosome of the type, by Cerqueira.

The distribution of *H. janthinomys*, which Kumm et al. (1946) say is a synonym of *H. spegazzinni*, is very wide. It ranges from northern Argentina (Jujuy) into Bolivia, and through southeastern Brazil through the Amazon valley; Floch reports it from French Guiana, and the material collected by Urich extends its range into Trinidad. In some parts of its range, particularly northward and westward, it is replaced by its subspecies, *spegazzinii falco* Kumm et al., 1946. Kumm and Cerqueira report intermediate forms from northwestern Brazil. Galindo et al. report the subspecies *falco* from Panama and Costa Rica.

Wherever *H. spegazzinii* or its subspecies *falco* have been found, they have been associated with epidemics of jungle yellow fever. In southern Brazil, *spegazzinii* seems to be the form involved, while in Colombia, Panama, and Costa Rica, *falco is* involved. Both forms have been found infected in nature with yellow fever virus, and are probably the principal vectors of the sylvatic form of the disease.

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BOOK NOTICE

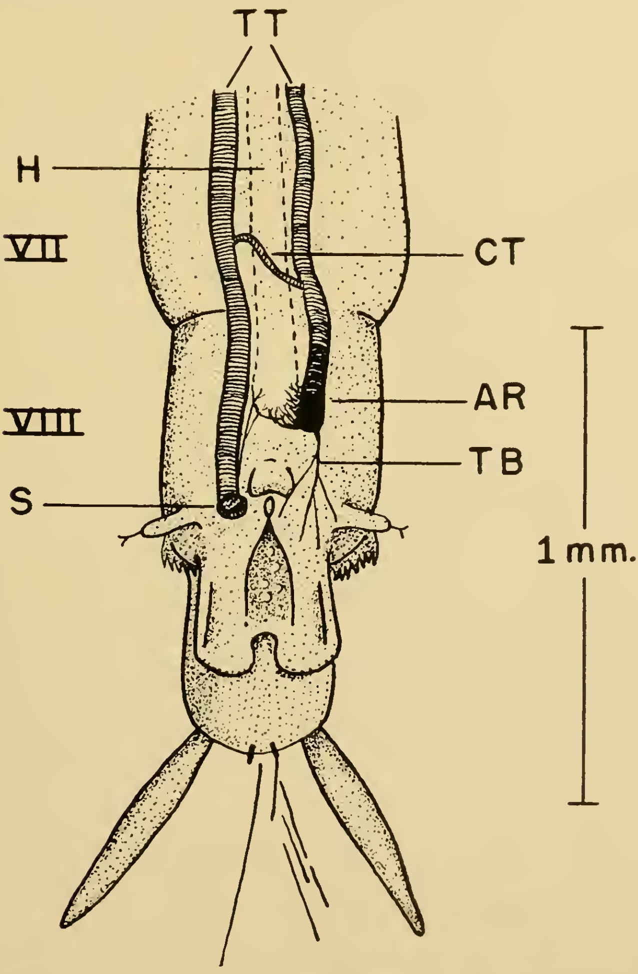
THE NATURAL HISTORY OF TSETSE FLIES, by Patrick A. Buxton. London School of Hygiene and Tropical Medicine Memoir No. 10. xx plus 816 pp., 165 text figures, 47 plates, crown quarto edition. H. K. Lewis & Co., Ltd. London. Price ???

This account of the biology of the flies belonging to the genus *Glossina* is by far the most exhaustive of any work now extant. The book includes chapters on anatomy, systematics, distribution, populations, ecology, metabolism, reproduction, relation to disease and control. Plates show typical breeding places and habitats of various *Glossina* species. Although the author admits that his detailed and local knowledge "in no way competes" with that of several field researchers upon whose work he draws freely throughout the volume, he claims a wide experience in many parts of tropical Africa in the problems of tsetse and trypanosomiasis.—Ed.

NOTES ON A UNISPIRACULATE ANOPHELES QUADRIMACULATUS SAY LARVA
(Diptera, Culicidae)

By Jack Colvard Jones, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

In connection with studies on heart rates of *Anopheles quadrimaculatus* Say, a young fourth stage larva was encountered possessing only a single spiracle, the left one. As shown in figure 1, the right dorsal longitudinal tracheal trunk ends, not as a spiracle, but as a rounded, slightly enlarged, dark, closed tube (AR) just beyond the



Dorsal view of a portion of *Anopheles quadrimaculatus* larva showing aberrant trachea (AR), normal left spiracle (S), the slanting cross trachea (CT). H-heart; TB-tracheal branch proceeding posteriorly and ventrally (slightly schematic).

intersegmental region within the anterior part of abdominal segment VIII. The cross trachea (CT) in abdominal segment VII slants posteriorly rather than forming its ordinary Ω shape between the two tracheal trunks (TT). In normal larvae the terminal chamber of the heart is invested in numerous fine tracheae which branch out in separate bundles (*ca.* 16 in all) from around the spiracles themselves and along the trunks dorsal and posterior to the heart itself. Inspection of the aberrant larva showed that the terminal portion of the heart (H) was attached principally to a thick mass of fine tracheae branching out from the blind end of the aberrant right tracheal trunk, and that it received only a single bifurcated tracheal branch from the normal trunk. With the exception of the tracheal aberration, the larva was morphologically normal.

A series of examinations were made on this larva to determine whether it was physiologically abnormal. It was observed to feed, swim about, and defecate normally. It was normal with respect to the homostrophic reflex, reflex diving, and the akinetic state. See Jones (1954) for descriptions. The heart rate was normal (mean number of beats was 79.4/minute) during one hour of continuous observation. Internal organs appeared normal at magnifications of 100 and 240 X.

The larva was placed in a dish of water and fed daily on dog food and yeast (1:1). Three days later it pupated normally and subsequently successfully emerged as an externally normal adult female, but died on the day of emergence.

The writer could find no references in the literature describing this particular abnormality in mosquito larvae. Apparently it is rare in *Anopheles quadrimaculatus*, for only one other similar case has been found in a four year period of routine examinations of these larvae.

Buck (personal communication) says that tracheal aberrations are not at all uncommon among insects but the literature on the subject seems scant. As yet unpublished calculations by Buck and Keister indicate that one posterior spiracle in *Phormia* larvae would be sufficient for meeting their normal oxygen requirements. It is obvious, in the case reported in this paper, that the unispiraculate larva was able to meet its oxygen needs.

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A NEW SARCOPHAGID PARASITE OF NOMIA BEES
(*Diptera*)

By MAURICE T. JAMES, *State College of Washington, Pullman*

The following new genus and species of Miltogramminae is being published at this time in order to make the name available for use in the publication of biological studies. I am greatly indebted to Dr. H. J. Reinhard for reviewing the manuscript, for suggestions as to the relationship of this genus, and for the suggestion of a suitable generic name. Dr. Reinhard had independently arrived at the conclusion that a new genus was involved in this form, but he graciously declined the invitation to coauthorship.

Euphytomima, new genus

Head from side view subquadrate, the front moderately sloping, the length at the antennae subequal to that at the oral margin; front and vertex almost equibroad, the front of the male somewhat narrowed medially, the vertex a little over the eye width; frontale narrowing from vertex to lunule, at the midpoint about half the width of the front. Frontal bristles in a single row of about seven on each side stopping at antennal base; a few setulae outside the main rows; frontale bare; 1 to 2 proclinate and 1 reclinate frontoorbitals; 1 pair of proclinate ocellars; inner verticals strong, sometimes duplicated; outer verticals moderately long. Parafrontals broad, bare; cheeks broad. Face concave; epistoma moderately protuberant and well narrowed from clypeus; vibrissae well above oral margin, feebly developed, not much stronger than the bristles on the vibrissal ridge below them, shorter and no stronger than the frontals. Facial ridges bare. Antennae short, less than one-third head height, the apex distant from the vibrissae by about the length of the second antennal segment; arista bare, porrect, almost as long as the antenna, its last segment thickened on the basal half. Eyes bare. Proboscis moderately slender; length of haustellum about two-fifths head height; palpi slender, clavate, a little longer than the haustellum. Thoracic chaetotaxy: acrosticals, 0, 1; dorsocentrals 2 or 3, 3; intraalars, 1, 1; supraalars, 1, 2; humerals, 2; notopleurals, 2; postalars, 2 (a strong, long discal, a weaker lateral); scutellars, 3 laterals (the intermediate weaker), no true apicals, 2 discals; mesopleurals, about 5; pteropleural, 1 (weak); sternopleurals, 1, 1; hypopleurals, about 4. Propleura and prosternum bare. First posterior cell of wing distinctly open in the margin; fifth vein bare; third vein below with a single seta at the base, above setulose almost half-way to the small cross-vein; bend of fourth vein abrupt, forming an angle of about 135°; distance from posterior cross-vein to bend of fourth vein about equal to length of the cross-vein. Squamae bare; the lower one large. Abdomen ovate, transversely banded; first and second apparent segments each with a row of weak marginal bristles or strong marginal setulae; third and fourth with strong marginal bristles; no discals. Male hypopygium relatively large, as in *Eumacronychia;* first genital segment of female divided dorsally, the genital segments telescoped into the apparent fourth abdominal.

Genotype: Euphytomima nomiivora, new species.

This genus is most closely related to *Euphyto* Townsend, from which it may readily be distinguished by the open first posterior cell; the details of thoracic chaetotaxy are also quite different. It traces to *Eumacronychia* in Townsend's key; to *Senotainia,* imperfectly, in Allen's key; and, except for the bare parafacials, to couplet 22 of Curran's key, where it fits neither alternative. The general habitus, and particularly the cross-banded abdomen and the prominent male genitalia, suggest *Eumacronychia;* the antennal structure is more nearly that of *Senotainia;* but the differences from both genera are striking. The poorly developed vibrissae and the presence of two strong and an intermediate weak lateral scutellar, with no true apical scutellars, will readily distinguish *Euphytomima* from both those genera.

Euphytomima nomiivora, new species

Male.—Head mostly black, the face yellow, the lunule, inner areas of the parafacials, oral margin, and cheek grooves merging into yellowish-red; densely cinereous-pollinose except the lunule, the sides of the epistoma, and the vibrissal ridge; frontale densely pollinose as the parafrontals but appearing dull blackish when viewed from behind. Antenna black, apices of second and third segments reddish brown; arista black, micro-pubescent. Head bristles and setulae all black. Head measurements of holotype in micrometer units (30=1 mm.): head height 60, head width, 67; width of vertex 29, front at midpoint 26, frontale at midpoint 13, front at lunule 28; minimum width of parafacial 10, of gena 14; eye height 42. Thorax black; the mesonotum, scutellum, upper parts of pleura, and most of the sternopleuron densely cinereous-pollinose; at most indications of two presutural vittae within the dorsocentral rows. Bristles of mesonotum strong, those on the sides and toward the scutellum (except the acrostichals) in general much stronger than those on the central area; middle pair of lateral scutellars about half as long as either the basal or apical pair of the series and much weaker; position of apical scutellars occupied by a pair or small group of setulae. Legs black; hind tarsus tending obscurely toward reddish brown. Wings hyaline, somewhat yellowish toward base; veins yellowish on basal half, becoming brown on apical half. Halteres yellow, knobs somewhat darker. Squamae white, the lower pair large, more than twice as long as the upper, reaching beyond the middle of the first abdominal segment. Abdomen black, the apical half of the fourth and the genital segments reddish yellow; second, third, and fourth segments each with the basal half densely cinereous-pollinose, these pollinose cross-bands somewhat incised medially; genital segments, particularly dorsally, with whitish pollen which is conspicuous only in certain lights; rest of abdomen subshining, with some inconspicuous pollen laterally. Genitalia simple; inner forceps slender, contiguous, from dorsal view almost parallel-sided on the subapical half, blunt apically and gradually broadening toward the base, blackish and shining apically, with scattered hairs and with a strong tuft of forward-curved setulae on each side at the base; inner forceps slender, yellow, evenly curved inward. Length, 6.5-7.5 mm.

Female.—Head measurements of allotype: Head height 60, head width 66; width of vertex 30, front at midpoint 30, frontale at midpoint 15, front at lunule 32; minimum width of parafacial 12, of gena 16; eye height 42; length of second antennal segment 9, of third 11, of second and third combined (with allowance for overlap) 18, of arista 16. First abdominal segment with a narrowly interrupted basal transverse pollinose band. Genital segments reddish yellow, shining dorsally, with some whitish pollen laterally Otherwise, except sexually, as described for the male.

Holotype.—Male, Cache Co., Utah, Aug. 15, 1954 (G. E. Bohart); State College of Washington type collection no. 184. Allotype, female, same data. Paratypes: 7♂, 2♀, same data; 1♂, 1♀, Niland, Imperial Co., California, April 25, 1949, at light (L. W. Quate); 1♀, Furnace Creek, Death Valley, California, April 1, 1951 (P. D. Hurd), and 1♀, same data (J. W. MacSwain); 1♀, Salton Sea Beach, Imperial Co., California, April 22, 1951 (E. I. Schlinger); 1♀, Globe, Arizona, May 1, 1943.

This species is being reared from *Nomia* by Mr. John B. Plant, Logan, Utah, who will publish a report on its biology and host relationships.

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NOTES ON THE CUBAN COCKROACH, PANCHLORA NIVEA (L.)
(Orthoptera, Blattidae)

The Cuban cockroach is often brought to temperate areas on tropical fruits, especially bananas, and it is well known to entomologists for its attractive, pale-green color. For many years the name *Panchlora cubensis* Saussure, 1862, has been applied widely to this insect, but recent investigations show that name to be a synonym of *P. nivea* (L.), 1758. My examination of the situation was prompted by a review of roach names for the new edition of the "Common Names of Insects" (Bull. Ent. Soc. Amer., vol. 1, no. 4, 1955).

In 1865 Brunner (Nouv. Syst. Blatt., p. 244) listed *cubensis* as a synonym of *nivea*, and the synonymy was accepted by Saussure himself in 1870 (Miss. Sci. Mex. et Amer. Cent., pt. 6:102), and by Kirby, 1904 (Syn. Cat. Orth. 1:153). However, Shelford (Trans. Ent. Soc. London, 1907 [issued in 1908] pp. 457, 463) discussed the type locality and interpreted and described characters of the Linnaean type of *nivea* (a male from Surinam in the Degeer Collection, Stockholm) in such a way that entomologists assumed that *nivea* was a certain South American species which does not occur in the West Indies. Thus, the validity of *cubensis* was thought to have been established.

This interpretation was accepted by Rehn and Hebard, 1927 (Bull. Amer. Mus. Nat. Hist. 54:245-254). However, Princis, 1949 (Opuscula Ent. 14:66) and 1950 (Norsk Ent. Tidsskr. 8:130), pointed out that his study of the type of *nivea* disclosed that Shelford's interpretation was misleading, and that in reality the type of *nivea* is the common species called *cubensis*. Although I know of no recent study of Saussure's type of *cubensis* (a female from Cuba), information contained in Saussure's original description (Rev. et. Mag. Zool., ser. 2, vol. 14, p. 230, 1862) is of importance in fixing its identity, and it appears that *cubensis* has been interpreted correctly by Princis, and that *cubensis* is a synonym of *nivea*. Saussure described the type of *cubensis* as 24 mm. long, including wings, and the interocular space as reddish, wrinkled, and about 0.4 mm. wide. Only three species of *Panchlora* are known to occur in the West Indies (Rehn and Hebard, loc. cit.) and an examination of specimens of these species in the U. S. National Museum (all identified by Hebard) shows that the only one of the three with an interocular space in the female agreeing in width and wrinkling with the description of *cubensis* is the one to which that name has been applied. Greater Antillean females of about 24 mm. overall length agree particularly well in the width of the interocular space.

Panchlora nivea is a widespread Neotropical roach, and in many areas it is the most common member of the genus. Hebard (Mem. Amer. Ent. Soc. 2:198, pl. 8, figs. 2-5, 1917) has redescribed it, using the name *cubensis*. Within the United States it appears to be established outdoors in the vicinity of Brownsville, Texas (Hebard, Trans. Amer. Ent. Soc. 68:272, 1943), though whether as a native or an established adventive is uncertain. Elsewhere in this country it is seen only as a stray and is not known to have become established. Several of the many other Neotropical species of *Panchlora* occasionally are intercepted at United States ports by quarantine inspectors, but in terms of total interceptions *nivea* is found more frequently than any of the others. However, certain species are intercepted regularly from a few areas, and in those areas alone they may outrank *nivea* in the number of interceptions. *P. nivea* is one of the "plain green" species, though there are whitish lateral submarginal lines on the pronotum and basal third of the tegmen (front wing), and in some specimens there is a black dot near the apex of each tegmen. A moderate sized but inconspicuous spur near the middle of the ventro-posterior margin of the hind femur is a valuable recognition feature, though it occurs in at least one other green species. —Ashley B. Gurney, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

NORTH AMERICAN LEPTOCHILUS OF THE TRINODUS GROUP (HYMENOPTERA, VESPIDAE)

By RICHARD M. BOHART, *University of California, Davis*

The genus *Leptochilus* Saussure can be divided into a number of species groups which hardly seem to merit the rank of subgenera. In North America there are about eleven of these groups of which seven, identified by representative species, have been outlined—*rufinodus*, *tylocephalus*, *minutissimus*, *lissosomus*, *erubescens*, *congressus*, and *propodealis* (Bohart, 1940, 1942, 1948). An eighth group, composed of 11 species, is considered here. Holotypes will be deposited in the California Academy of Sciences and paratypes in the collections of the U. S. National Museum, Museum of Comparative Zoology at Harvard, University of Kansas and University of California at Berkeley and Davis.

The *trinodus* group differs from other *Leptochilus* by a combination of five key characteristics: The second abdominal sternite has no median longitudinal suture, the scutellum is rounded above rather than sharply crested, the female and male mandibles are 5- and 4-toothed respectively, the vertex bears 1, 3 or 5 swellings more or less developed, and the second abdominal tergite is never swollen to any extent toward the apex. Other characters of importance are the presence of a curved, ridge-like tooth on either side of the posterior surface of the propodeum above, the unmodified mid femora of the males, the puncturation of the second tergite which leaves no definite impunctate band toward the apex, and the roundly excised apex of the male clypeus, the sharp teeth of which are separated by about the length of the first flagellar segment. These and the preceding 5 points are not repeated in the species descriptions. The presence of vertex swellings is an obvious feature of most species in the group. These are often knob-like and shiny, and usually consist of a single one just behind and between the lateral ocelli and one on each side of the head adjacent to the uppermost point of the compound eye.

The species frequent dry, sandy areas and are often taken at flowers of *Eriogonum*. Many other plants are visited, also. The nesting habits are unknown and on the whole the species are considered to be rare. As an indication of this, I have seen about 400 specimens of the group during the examination of about 120,000 individuals of North American solitary Vespidae. The species may be common at times, however, as proved by a single collection of 40 males and 25 females of one species by P. D. Hurd and J. W. MacSwain near Olancha, Inyo County, California.

The group is predominantly western in distribution with only two species occurring east of the Rocky Mountains and only one of these extending to the southeastern United States.

Key to Leptochilus of the Trinodus Group

Males

1. Last antennal segment stoutly curved in profile, thick at base and usually apically blunt or rounded (fig. 2) 2
   Last antennal segment slender, thin in profile and usually rather sharply pointed (fig. 1) 5
2. Median swelling just behind ocelli about as well developed or less so than lateral swellings 3
   Median swelling considerably more developed than lateral ones 4
3. The three vertex swellings all prominent, shiny and knob-like, sometimes bearing a pale spot; apical cell of wing usually with apical two-thirds clouded (fig. 7) (W.U.S.) .... *trinodus* n. sp.
   The three vertex swellings low, punctured; apical cell of wing usually with apical one-third clouded (fig. 8) (W. U. S.) .... *occidentalis* n. sp.
4. Head conspicuously swollen in ocellar area, median ocellus not visible in lateral view of head; third antennal segment less than 1.5 times as long as second segment (E. Texas to Fla.) .... *monolobus* R. Bohart
   Head not so swollen, median ocellus barely visible in lateral view; third antennal segment about 1.5 times as long as second segment (Calif. to S. D. and W. Texas) .... *singulus* n. sp.
5. Second sternite with a v-shaped baso-median depression or a shallow median hollow; one or more vertex swellings discernible 6
   Second sternite not so depressed or hollowed 7
6. Second sternite with a v-shaped basal hollow; apical band of tergite II with large scattered punctures; last antennal segment shorter than eleventh ventrally (fig. 1); free edge of clypeus blackened; median vertex swelling transverse (S. Calif., E. Calif., Ariz.) .... *bechteli* n. sp.
   Second sternite with a large shallow median depression; apical band of tergite II densely punctured, last antennal segment as long as eleventh ventrally; free edge of clypeus white; median vertex swelling moderate, somewhat longitudinal (S. Calif.) .... *cavatus* n. sp.
7. Second tergite with an oblique spot attached to the apical band (fig. 5); black and white, no red markings; no discernible vertex swelling (Calif. in central Sierras south to San Bernardino Mts.) .... *schlingeri* n. sp.
   Second tergite without an attached oblique spot 8
8. Metathorax almost entirely red laterally; very small species; clypeus with lateral side (touching compound eye) about as long as apico-lateral side (Calif.) .... *gibboceps* n. sp.
   Metathorax not almost all red laterally 9
9. Interocellar area with a rough raised tubercle inside each ocellus; humeral margin carinate; markings whitish-yellow (central Calif.) .... *arenicolus n. sp.*
   Interocellar area rather even; humeral margin not carinate; markings whitish and sometimes reddish 10
10. Clypeus about 1.5 times as broad as long, apical incision evenly rounded; vertex swellings small but developed equally; propodeum and abdominal segment I usually red-marked (Idaho and Calif., usually at moderate elevations) .... *williamsi* n. sp.

Clypeus about 1.3 times as broad as long, apical incision somewhat angled; middle vertex swelling visible, laterals hardly discernible; propodeum and segment I usually not red (Calif. in coastal mts. and lower Sierras) .... *umbifer* n. sp.

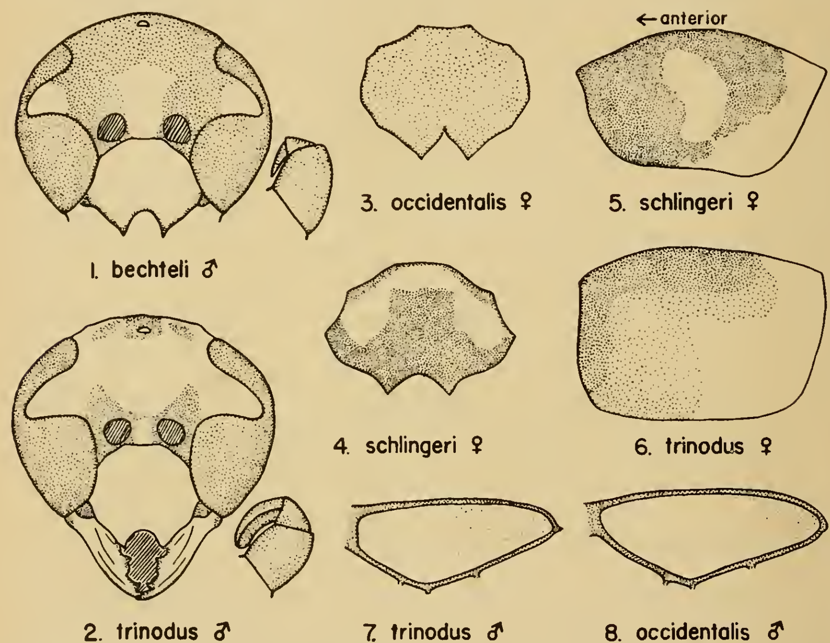
FEMALES

1. Markings yellow, no red; clypeus marked with yellow (fig. 4); vertex swellings not discernible 2
   Markings whitish and usually reddish; clypeus all black to red (fig. 3) 3
2. Tergite II with an attached oblique spot (fig. 5); interocellar area nearly flat .... *schlingeri* n. sp.
   Tergite II without an oblique spot; interocellar area raised and rough .... *arenicolus* n. sp.
3. Apex of clypeus roundly incised (as in fig. 4) 4
   Apex of clypeus with angular incision (as in fig. 3) 6
4. Vertex tubercles moderately developed and shiny; vertical front of pronotum with a median smooth area topped by a cluster of 6-8 large punctures; head about 1.8 mm. wide (S. Calif.) .... *cavatus* n. sp.
   Vertex tubercles weak, punctured; vertical front of pronotum with scattered punctures; head smaller 5
5. Head about 1.2 mm. broad; body unusually slender (Calif.) .... *gibboceps* n. sp.
   Head about 1.5 mm. broad; body moderately slender (Idaho & Calif. at moderate elevations) .... *williamsi* n. sp.
6. Middle vertex tubercle distinct and better developed than lateral ones 7
   Middle vertex tubercle, if distinct, not better developed than lateral ones 8
7. Body largely red and clear pale ivory (Calif. to S. D. and W. Texas) .... *singulus* n. sp.
   Body largely black as a rule, whitish markings dingy (E. Texas to Fla.) .... *monolobus* R. Bohart
8. Middle vertex tubercle somewhat transverse; second sternite with a v-shaped basomedian depression (S. Calif., E. Calif., Ariz.) .... *bechteli* n. sp
   Middle vertex tubercle round or longitudinal; second sternite without such a depression 9
9. Vertex tubercles all well developed, expecially the lateral ones; apical cell of forewing about one-half clouded (fig. 7) (W. U. S.) .... *trinodus* n. sp.
   Vertex tubercles low and weak 10
10. Head 1.6 to 2.1 mm. broad, about as long as broad; apical cell of forewing usually less than one-half clouded (fig. 8) (W. U. S.) .... *occidentalis* n. sp.
    Head 1.3 to 1.5 mm. broad, longer than broad; apical cell of forewing with a rather diffuse cloud, darkest apically (Calif. in coastal mts. and lower Sierras) .... *umbifer* n. sp.

Leptochilus trinodus, new species

Male.—Black, marked with ivory and rust-red. Ivory are: mandible basally, clypeus, front to ocelli, spots on vertex swellings, postocular spot, pronotum mostly, pleural spot, tegula mostly, scutellum and postscutellum mostly, fore and mid femora and all tibiae partly, broad irregular apical margins of tergites

I, II, IV, V, that on II with a broadly attached lateral spot, apex of sternite II. Red are: flagellum, pronotum below humeral angle, mesopleuron partly, propodeum, legs partly including all of coxae and hind femur, sternite I and basal half of tergite I, tints in other areas, costa toward base. Scape, pedicel, tarsi, darker areas of abdomen, reddish brown. Most wing veins dark brown, apical cell of forewing with a brown cloud on apical two-thirds (fig. 7), membrane otherwise nearly clear. Body well punctured, including clypeus, front, notum and abdomen. Pubescence short, most conspicuous on face, silvery. Last antennal segment stoutly



Figs. 1 and 2, front view of head and side view of antennal tip: figs. 3 and 4, clypeus; figs. 5 and 6, side view of abdominal tergite II; figs. 7 and 8, apical cell of forewing.

curved in profile, thick at base, flattened toward apex which is narrowly rounded (fig. 2); three prominent, smooth vertex swellings; humeral carina distinct except in middle; tergite II about as long as broad. Aedeagus with distinct lobes at median expansion (fig. 9), paramere broad at apex. Length to apex of second tergite 5.5 mm.

Female.—Clypeus all red, front red with three ivory spots, ocellar area black, vertex knobs red or black, postscutellum and genal area red, tergite II black, red and ivory (fig. 6). Clypeal incision angular but narrowly rounded at apex of angle. Interantennal area with a weakly defined ridge. Head 1.8-2.1 mm. broad, body about 6.5 mm. long to apex of tergite II.

Holotype.—Male, 3 miles south of Olancha, Inyo Co., California, Aug. 6, 1948 (P. D. Hurd, J. W. MacSwain).

Paratypes.—39 males, 25 females, same data as holotype.

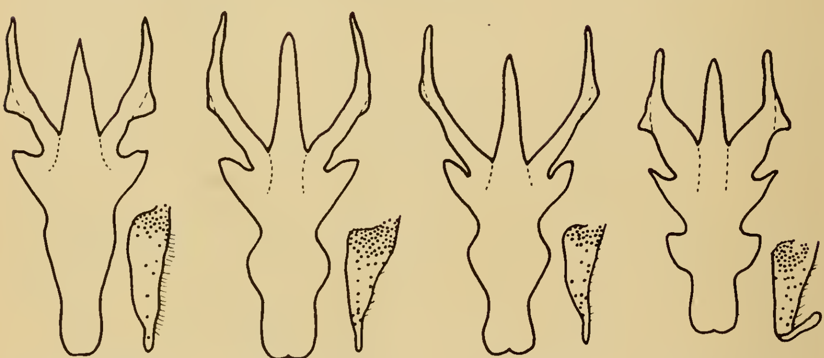
Other material studied.—(All from California) MONO CO.: 5 males, Oasis, March 27, 1934 (P. H. Timberlake). INYO CO.: 6 males, 1 female, Panamint Springs, July 15, 1953 (R. M. Bohart, E. I. Schlinger); 1 female, Olancha, May 19, 1937 (C. D. Michener); 1 female, Darwin Falls, July 15, 1953 (R. M. Bohart, E. I. Schlinger); 1 male, Death Valley, April 27, 1950 (D. Davis); 1 male, Argus Mts., June 4, 1939 (R. M. Bohart); 1 female, Lone Pine, June 13, 1937. KERN CO.: 1 male, Red Rock Canyon, August 21, 1954 (R. Snelling); 1 male, Rosamond, July 23, 1940 (D. E. Hardy). SAN BERNARDINO CO.: 1 male, 1 female, Kramer Junction, 14 miles east, July 21, 1950 (J. W. MacSwain); 1 male, Yermo, May 23, 1940 (G. E. Bohart); 3 males, 29 Palms, April 14, 1938 (R. M. and G. E. Bohart); 1 female, Twenty Nine Palms, August 29, 1934 (P. H. Timberlake); 1 male, Manix, 22 miles north, April 26, 1953 (P. D. Hurd); 1 female, Atolia, July 9, 1950 (R. M. Bohart). RIVERSIDE CO.: 1 female, Whitewater, July 9, 1950 (J. W. MacSwain); 5 males, 1 female, near Indio, April 30, 1949 and April 30, 1950 (E. G. Linsley, J. W. MacSwain, R. F. Smith); 1 male, Palm Springs, May 2, 1953 (R. M. Bohart); 1 female, Dos Palmos, Mar. 28, 1934 (H. S. Gentry). SAN DIEGO CO.: 3 males, 2 females, Borego, April and May, 1950-1954 (C. D. MacNeill, L. W. Quate, G. A. Marsh, J. G. Rozen). IMPERIAL CO.: 2 males, Westmorland, May, 1932 (H. S. Gentry); 1 male, 2 females, San Felipe Creek, July 8, 1933 (H. S. Gentry). OUT-OF-STATE material assigned to this species is as follows: 1 male, Mesilla Park, New Mexico, May 6, 1909 (C. N. Ainslie); 2 females, 10 miles south of Toltec, Arizona, June 21, 1953 (T. R. Haig); 1 male, El Paso, Texas, June 9, 1942 (E. C. Van Dyke).

Discussion.—The color is subject to considerable variation with red giving way to black and vice versa. Some males have the vertex tubercles black. Females tend to be more red and less ivory than males. Characteristic of the species are the three rather equally developed vertex tubercles, the angular clypeal incision in the female, the large last antennal segment in the male and the apical wing cell two-thirds clouded.

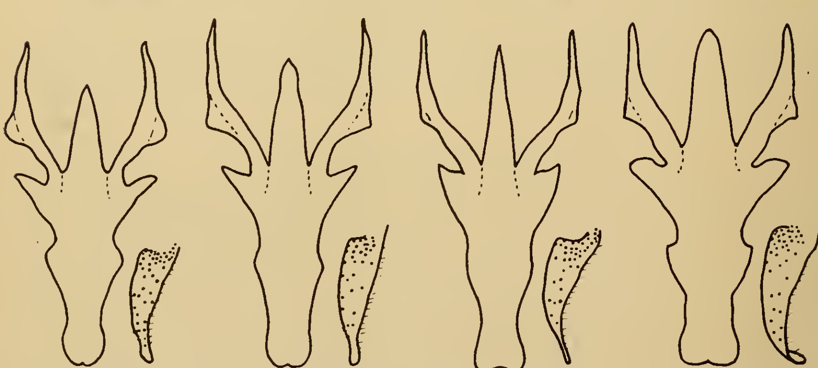
Leptochilus occidentalis, new species

Male.—Black or dark brown, marked with ivory as follows: Clypeus, mandible spot, ocular spot, postocular dot, humeral margin irregularly, pleural spot, tegula mostly, two scutellar dots, fore and mid femora and tibiae partly, apical margins of tergites I, II and IV and sternite II laterally. Reddish brown are: flagellum, paler beneath, legs partly, costa, stigma. Wing membrane extensively stained with yellowish brown, apical cell with a dark cloud in apical one-third but with some stains (fig. 8). Body well punctured including clypeus, front, notum and abdomen, propodeum with smooth area on either side of middle. Pubescence short, inconspicuous, silvery. Last antennal segment stoutly curved in profile, thick at base, flattened towards apex which is narrowly rounded; three low, punctured ocular swellings and a suggestion of paired interocellar swellings; humeral carina

9. trinodus 10. occidentalis 11. singulus



12. bechteli 13. cavatus 14. williamsi 15. monolobus



16. umbifer 17. gibboceps 18. schlingeri 19. arenicolus

Figs. 9-19, aedeagus in flattened view and lobe of right paramere.

distinct except at middle; tergite II about as long as broad. Aedeagus stout and with lobes of medium expansion weakly developed, paramere broad at apex (fig. 10). Length to apex of second tergite 6.0 mm.

Female.—Mandible mostly, clypeus sometimes at apex, propodeum extensively, first tergite basally, marked with red. Other areas sometimes red-tinted; clypeus mostly black; tergites III and V sometimes with whitish marks. Clypeal incision sharply angular (fig. 3). Interantennal ridge moderately distinct. Head 1.6-2.1 mm. broad; body about 7.0-7.5 mm. long to apex of tergite II.

Holotype.—Male, Summit Camp, Lassen Co., California, July 9, 1949 (W. F. Ehrhardt).

Paratypes.—(All from California) LASSEN CO.: 1 male topotype. June 28, 1949 (J. W. MacSwain); 1 female, Bridge Creek Camp, July 9, 1949 (F. Morishita); 1 female, Bridge Creek Camp, July 14, 1954 (R. M. Bohart). SHASTA CO.: 2 males, 1 female, 5 miles east of Burney, June 9, 1941. MONO CO.: 1 male, Mammoth, July 9, 1933 (G. E. and R. M. Bohart). ALPINE CO.: 2 males, Wolf Creek, July 15, 1948 (R. M. Bohart); 1 male, Hope Valley, July 18, 1948 (J. W. MacSwain). EL DORADO CO.: 1 female, Chile Bar, July 5, 1948 (J. Abul-Hab). NEVADA CO.: 1 female, Boca, June 28, 1954 (R. M. Bohart).

Other material examined.—21 males, 34 females from the following localities: CALIFORNIA: Olancha, Kearsarge and Big Pine, Inyo Co.; Randsburg, Kern Co.; Greenhorn Mts., Tulare Co.; Kramer Junction and Victorville, San Bernardino Co.; Altadena, Los Angeles Co.; Riverside, San Gorgonio Pass, San Jacinto Mts., and Gavilan, Riverside Co.; Buckman Springs, San Diego Co. NEVADA: Charleston Mts., Mt. Montgomery, Carlin, Emigrant Pass. ARIZONA: near Jacob Lake. UTAH: Dugway, Spanish Fork, Oak Creek Canyon, LaSal National Forest. NEW MEXICO: Ruidoso, Pecos. COLORADO: Teller Co., Florissant, Pinecliffe, Monarch Pass. WYOMING: Jenny Lake, Green River. OREGON: Tumalo Reservoir.

Discussion.—The low, punctured vertex swellings, sharply angular clypeal incision in the female, restriction of the cloud in the apical wing cell and peculiar aedeagus are distinctive. Some males have red markings about as in the female and conversely, females may have little red except on the mandibles.

Leptochilus singulus, new species

Male.—Agreeing with description of *trinodus* except as follows: Vertex and front a short way below median ocellus black; scutellum, genal spot, posterior pronotal angle, margin around white areas of second abdominal segment, scape and pedicel beneath, red; apical cell of forewing clouded in apical half. One prominent smooth median vertex swelling, lateral one indistinct and punctured. Aedeagus broadly and distinctly lobed at median expansion, subbasal lobes pointed; paramere moderately broad at apex (fig. 11). Length to apex of second tergite 5.0 mm.

Female.—Agreeing with description of *trinodus* except as follows: Vertex swellings as in male, median one black, lateral ones indistinct, red. Body more extensively red which is the dominant color. Head 1.7-1.9 mm. broad, body about 6.0 mm. long to apex of tergite II.

Holotype.—Male, 4 miles northeast of Camel Back Mt., Tooele Co., Utah, May 18, 1954 (H. E. Cott).

Paratypes.—9 males, 5 females, same data as holotype but collected May 18-26; 1 male, 10 miles east of Jensen, Utah, June 23, 1950 (C. D. Michener); 1 female, Goshen, Utah, August 16, 1940 (R. H. Beamer).

Other material examined.—SOUTH DAKOTA: 1 pair, Hot Springs, July 9, 1924 (H. C. Severin). TEXAS: 1 male, Llano Co., June 12, 1941 (J. E. Gillaspy); 1 male, Fort Stockton, July 5, 1917; 1 female, Donna, Aug. 10, 1933 (J. W. Monk); 1 female, Hidalgo Co., July 28, 1928 (R. H. Beamer); 1 female, Alpine, July 1, 1942 (H. A. Scullen); 1 male, 2 females, Marathon, July 7, 1942 (E. C. Van Dyke, H. A. Scullen). NEW MEXICO: 1 female, near Las Cruces, June 18, 1942 (H. A. Scullen); 1 male, Organ, July 3, 1940 (L. C. Kuitert); 1 female, Aden, July 12, 1917; 1 female, near Lordsburg, June 17, 1942. ARIZONA: 1 male, Santa Rita Mts., April 29, 1953 (R. M. Bohart); 1 male, Tuba City, July 18, 1937 (R. P. Allen); NEVADA: 7 males, Mt. Montgomery, June 21, 1942 (R. M. and M. R. Bohart). IDAHO: 1 female, Hot Springs, Owyhee Creek, June 16, 1948 (W. F. Barr). CALIFORNIA: 1 male, Olancha, Inyo Co., May 20, 1937 (F. L. Blanc).

Discussion.—This species is closely related to *monolobus* but differs in details of antennal structure and head shape as indicated in the key. The aedeagus is somewhat different, also. The range of the western species, *singulus*, approaches that of *monolobus* in Texas but they do not appear to overlap.

Leptochilus monolobus Bohart

(Fig. 15)

Odynerus heterospilus Cameron, 1908. Trans. Amer. Ent. Soc. 34:201, ♀, Lee Co., Texas (preoccupied).

Leptochilus monolobus Bohart, 1951. Family Vespidae in Muesebeck, C. F. W., et al. Hymenoptera of America north of Mexico. U. S. Dept. Agr. Monogr. 2:897.

Material studied.—TEXAS: 3 pair, Fedor, Lee Co., May 17, 1898 (Birkmann); 1 female, Lee Co., June, 1908. FLORIDA: 1 male, near Panama City Beach. July 19, 1938 (Hubbell-Friauf); 1 female, Orlando, March, 1944 (R. and G. Bohart).

Leptochilus bechteli, new species

Male.— Black, marked with ivory or yellowish-ivory as follows: Mandible basally, clypeus, interantennal and ocular spots, one on scape, postocular dot, humeral margin, pleural spot, tegula mostly, lines across scutellum and postscutellum, fore and mid femora and all tibiae partly, apical margins of tergites I, II, IV, V, dot on VI, apical band on sternite II. Reddish are: mandible and legs partly, antennal apex beneath, propodeum posteriorly, wing veins basally. Free margin of clypeus black-edged. Apical wing cell two-thirds clouded, membrane otherwise nearly clear. Body with large, rather scattered punctures, first two tergites becoming smooth toward base. Pubescence short, silvery pulverulent, most conspicuous on face. Last antennal segment small, flat, thin, not reaching base of eleventh (fig. 1); three shiny vertex swellings in addition to low interocellar pair, median swelling best developed, transverse and as wide as ocellar triangle; humeral carina distinct except at middle; tergite II somewhat broader than long; sternite II hollowed on basal two-fifths. Aedeagus relatively simple, paramere narrow apically (fig. 12). Length to apex of second tergite 7.0 mm.

Female.—Mandible, flagellum largely, propodeum mostly, first abdominal segment partly red. Clypeus and postscutellum black. Clypeal incision sharply angulate. Head 2.0 mm. broad; body 7.5 mm. long to apex of tergite II.

Holotype.—Male, Anza State Park, San Diego Co., California, April 23, 1951 (R. C. Bechtel).

Paratypes.—(All from California) SAN DIEGO CO.: 1 male, same data as holotype. RIVERSIDE CO.: 1 male, Dos Palmos, March 28, 1934 (H. S. Gentry); 1 female, 5 miles west of Indio, April 9, 1936 (E. G. Linsley). SAN BERNARDINO CO.: 1 female, Yucca Valley, August 20, 1936 (P. H. Timberlake). KERN CO.: 1 male, Tehachapi Pass, May 30, 1950 (H. E. Cott). INYO CO.: 1 male, Darwin Falls, July 15, 1953 (R. M. Bohart, E. I. Schlinger); 1 female, Inyo Mts., June 7, 1939 (R. M. Bohart).

Other material examined.—1 female, Red Rock, Arizona, July 8, 1952 (R. H. Beamer).

Discussion.—This strictly desert species is most easily recognized by the sparse puncturation toward the base of the second tergite and by the transverse median vertex tubercle. The hollowed V at the base of the second sternite occurs in both sexes, whereas in *cavatus* the depression is nearer the middle of the sternite and is seen in the male only.

Leptochilus cavatus, new species

Male.—Black and red, marked with ivory or yellowish-ivory as follows: Mandible basally, clypeus, scape within, broadly V-shaped interantennal spot, large ocular spot, postocular dot, pronotum broadly in front, pleural spot, tegula and scutellum mostly, stripe across postscutellum, legs partly, including mid coxa, broadly irregular margins of tergites I and II and sternite II, narrow margins of tergite IV and sternites III-V. Light rust-red are: flagellum (darker above), postscutellum below and propodeum mostly, basal one-half of tergite I (so that color bands from base are red, black, yellow-ivory and ivory), femora and tibiae partly. Wing veins brownish, lighter toward base; apical cell clouded on apical two-fifths, membrane otherwise nearly clear. Pubescence minute, pulverulent, silvery. Body rather finely but almost completely punctured, extending evenly to base of tergite II. Head slightly longer than broad; last antennal segment flat, thin, about reaching base of eleventh; three moderate vertex swellings, somewhat punctured, median one longer than broad; humeral edge angled but not distinctly carinate; tergite II about as long as broad; sternite II with a shallow but extensive median hollow. Aedeagus moderately stout, median expansion moderately developed, paramere narrow toward apex (fig. 13). Length to apex of second tergite 7.0 mm.

Female.—Mandible, clypeus, postocular spot, all coxae, lateral spot at base of tergite II light to dark reddish brown. Front with three ivory dots, no pale bands on postscutellum or abdominal segments III-V. Light red more extensive on propodeum and tergite I. Clypeal incision evenly rounded as in male; no hollow on sternite II. Head longer than broad, about 1.8 mm. broad, vertex tubercles well developed and smooth; body 7.0 mm. long to apex of tergite II.

Holotype.—Male, Banning, Riverside Co., California, June 26, 1952 (J. W. MacSwain).

Paratypes.—(All from California) RIVERSIDE CO.: 3 males, same data as holotype; 1 male topotype, June 27, 1952 (H. L. Mathis); 2 males, near Palm Springs, June 8, 1930 and May 6, 1946 (P. H. Timberlake); 1 male, Indian Wells, May 24, 1953 (A. Fukushima). SAN DIEGO CO.: 1 male, Borego, April 26, 1950 (C. D. MacNeill). LOS ANGELES CO.: 1 female, Lovejoy Buttes, May 11, 1944 (P. H. Timberlake). SAN BERNARDINO CO.: 2 males, 1 female, near Victorville, May 4 and May 12, 1939 (P. H. Timberlake); 1 female, 22 miles north of Manix, April 26, 1953 (G. A. Marsh).

Discussion.—Although this is a much larger species than *gibboceps*, there are several points of similarity such as the rounded clypeal incision and long head in the female, the weakly indicated humeral carina, and the reduced last antennal segment in the male. The hollowed second sternite of the male and well developed vertex tubercles in the female are distinctive.

Leptochilus gibboceps, new species

Male.—Agreeing with description of *cavatus* except as follows: obsolete band present on tergite III, V banded, sternites III-IV dark; spot in apical cell of forewing rather diffuse, membrane otherwise lightly brown-stained; three vertex swellings low and somewhat punctured; second sternite not hollowed. Aedeagus rather simple, median expansion slight, subbasal expansion sharp, paramere narrow apically, evenly spotted (fig. 17). Length to apex of second tergite 4.0 mm.

Female.—Mandible, clypeus, postocular dot, posterior seven-eighths of pronotum, postscutellum mostly, tergite I mostly, sternite I partly, large lateral spot on tergite II reddish. Clypeus and interantennal area sometimes black. Abdomen often more extensively reddish in place of black. Tergite II distinctly longer than broad in most specimens. Head about 1.5 mm. long and 1.2 mm. broad; body about 5.0 mm. long to apex of second tergite.

Holotype.—Male, La Crescenta, Los Angeles Co., California, July 13, 1939 (R. M. and G. E. Bohart).

Paratypes.—(All from Los Angeles Co., California) 8 males, 1 female, same data as type; 11 females, La Crescenta, August 7 and 21, 1938, August 14 and 28, 1939 (R. M. Bohart); 1 male, La Crescenta, June 26, 1934 (C. D. Michener); 6 males, 6 females, Mt. Wilson Road, July 24, 1939; 2 males, Altadena, July 1, 1945 (K. W. Cooper); 1 male, Tanbark Flat, July 14, 1950 (R. M. Bohart).

Other material examined.—(All from California) 1 male, Los Angeles Co. (D. W. Coquillett); 2 females, Modoc National Forest, Modoc Co., July 1927; 1 female, Cajon Junction, San Bernardino Co., August 10, 1953 (J. C. Hall); 1 female, 5 miles west of Palm Springs, Riverside Co., June 8, 1930 (P. H. Timberlake); 1 female, Borego, San Diego Co., April 30, 1954 (M. Wasbauer).

Discussion.—This species is closely related to *williamsi* and, apart from minor characters of color and size, the critical separation points are found in the male genitalia. In *gibboceps* the aedeagus is more slender with both median and subbasal expansions less developed. More diagnostic is the presence of black spots scattered evenly along the inner paramere edge in *gibboceps*.

Leptochilus williamsi, new species

Male.—Agreeing with the description of *cavatus* except as follows: Postscutellum black, tergite V banded, sternite IV unbanded; spot in apical cell of forewing rather diffuse, membrane otherwise lightly stained; propodeum red posteriorly only; three vertex swellings low and somewhat punctured; second sternite not hollowed. Aedeagus moderately stout, median expansion moderate and rounded, paramere narrow apically, inner edge with an unspotted area (fig. 14). Length to apex of second tergite 5.5 mm.

Female.—Body much more extensively red including mandibles, clypeus partly, prothorax behind, postscutellum, propodeum, first two tergites largely and second sternite partly. Vertex tubercles barely evident. Head about 1.9 mm. long and 1.7 mm. wide; body about 6.0 mm. long to apex of second tergite.

Holotype.—Male, Big Pine, Inyo Co., California, June 23, 1942 (R. M. Bohart).

Paratypes.—2 females, same data as holotype but one collected June 13, 1942; 4 males, 1 female, Lone Pine Creek, Inyo Co., California, June 6-7, 1939 (R. M. Bohart).

Other material examined.—CALIFORNIA: 1 male, Tuolumne Co., 3500 ft., June 9, 1938 (R. M. Bohart); 1 male, Tahoe, July, 1925 (F. X. Williams); 1 pair, Frazier Park, Kern Co., July 14, 1946; 2 males, 1 female, Tanbark Flat, Los Angeles Co., June-July, 1950 (F. X. Williams, A. T. McClay, R. M. Bohart); 1 male, La Crescenta, Los Angeles Co., June 26, 1934 (C. D. Michener); 1 male, 22 miles north of Manix, San Bernardino Co., April 26, 1953 (G. A. Marsh); 1 male, Indian Wells, Riverside Co., April 4, 1953 (A. Fukushima). OREGON: 1 female, Antelope Mt., Harney Co., 6500 ft., August 23, 1951 (D. K. Frewing). IDAHO: 1 male, Bear Pass Creek, Butte Co., July 26, 1947 (R. M. Bohart).

Discussion.—Closely related to *gibboceps* but differing as indicated under that species and in the key. The mid coxa of the male is usually marked with a small pale spot but may be dark. The mid coxa appears to be customarily dark in *trinodus, occidentalis,* and *singulus;* partly marked in *williamsi, umbifer* and *bechteli;* and all pale in the other species.

Leptochilus umbifer, new species

Male.—Agreeing with description of *cavatus* except as follows: three small spots across front, two spots on scutellum, none on postscutellum, tergite III partially banded, sternite V dark; only a little red on propodeum and tergite I near juncture; spot in apical cell of forewing rather diffuse, membrane otherwise lightly brown-stained; clypeal incision not perfectly rounded but slightly angular; three vertex swellings low and somewhat punctured; second sternite not hollowed. Aedeagus with median expansion rather angled, subbasal expansion wide but slender; paramere moderately narrow toward apex, inner edge with unspotted area (fig. 16). Length to apex of second tergite 4.5 mm.

Female.—More extensively red on propodeum and abdominal segment I; tergites III, V, VI, and sternites except laterally on II without pale marks; clypeus black and angularly incised. Vertex tubercles barely evident. Head about 1.8 mm. long and 1.6 mm. broad; body about 6.0 mm. long to apex of second tergite.

Holotype.—Male, 4 miles north of Quincy, Plumas Co., California, June 22, 1949 (P. D. Hurd).

Paratypes.—(Topotypical) 4 males, 5 females, June 20-July 13, 1949 (J. W. MacSwain, W. F. Ehrhardt, R. G. Howell, P. D. Hurd, E. I. Schlinger).

Other material examined—(All from California) TUOLUMNE CO.: 2 males, Tuolumne City, June 8 and June 22, 1953 (J. G. Rozen). MARIPOSA CO.: 1 male, Mariposa, June 13, 1938 (R. M. Bohart); 1 female, Mariposa, June 15, 1914 (F. W. Nunemacher). NAPA CO.: 1 male, Pope Valley, May 15, 1951 (E. I. Schlinger); 2 males, 1 female, Samuel Springs, May 28-30, 1953 (E. I. Schlinger, R. C. Bechtel). SANTA CLARA CO.: 1 female, San Antonio Valley, June 13, 1950 (H. E. Cott). MADERA CO.: 2 males, Bass Lake, June 6, 1938 (R. M. Bohart). MONTEREY CO.: 1 female, Bryson, May 18, 1920 (E. P. Van Duzee).

Discussion.—The distribution of this species seems to include the central coast ranges and moderate elevations in the Sierra Nevada. It resembles *gibboceps* and *williamsi* in many particulars but the angled clypeal incision of the female indicates a relationship to *bechteli.*

Leptochilus schlingeri, new species

Male.—Black, marked with ivory as follows: mandible at base, clypeus,, scape within, Y-shaped interantennal spot, ocular and postocular spots, humeral margin except medially, pleural spot, tegula mostly, two spots on scutellum, stripe on postscutellum, femora and tibiae partly and mid coxa mostly, irregular posterior margins of tergites I, IV and V, lateral posterior spots on tergite III and sternites II-V; tergite II with a sublateral oblique attached spot; flagellum dull reddish within; apical wing cell diffusely brown-stained, membrane otherwise lightly stained. Pubescence inconspicuous, pale. Puncturation moderate. Head about as broad as long, clypeus much broader than long; last antennal segment flat, thin, about reaching base of eleventh; vertex swellings not evident, interocellar area well punctured but flat; humeral edge weakly carinate; tergite II about as long as broad; sternite II not hollowed. Aedeagus moderately slender, subbasal expansion well developed, paramere narrow apically (fig. 18). Length to apex of second tergite 4.5 mm.

Female.—Pale markings dull yellow, mandible dark, clypeus black with basal inverted U of yellow, propodeum sometimes with a lateral spot, tergite II black and yellow (fig. 5), wings fairly darkly stained. Clypeus roundly incised but a little more deeply than in male (fig. 4). Head about 1.8 mm. long, body length to apex of second tergite about 5.5 mm.

Holotype.—Male, Tahoe, El Dorado Co., California, July, 1925 (F. X. Williams).

Paratypes.—(All from California) 1 pair, same data as holotype; 1 female, Webber Lake, Sierra Co., August 5, 1951 (E. I. Schlinger); 2 males, Strawberry, Tuolumne Co., July 15, 1951 (J. W. MacSwain); 1 male, Sagehen Creek, Nevada Co., July 21, 1954 (R. M. Bohart); 1 male, Boca, Nevada Co., July 3, 1954 (R. C. Bechtel); 1 female, Tokopah Valley, Sequoia National Park, Fresno Co., August 21, 1933 (C. D. Michener); 1 male, Mineral King, 8000 ft., Tulare Co., July 7, 1942 (R. M. Bohart); 1 female, Big Pine Creek, 7500 ft., September 12, 1942 (R. M. Bohart); 1 pair, Big Bear Valley, San Bernardino Co., August 7, 1932 and August 13, 1933 (P. H. Timberlake).

Discussion.—Although vertex tubercles are only slightly suggested in some specimens, this species clearly belongs to the *trinodus* group. It is recognized by the distinctive oblique spot on the second tergite.

Leptochilus arenicolus, new species

Male.—Agreeing with the description of *schlingeri* except as follows: Broad pale band on scutellum, lateral spot on propodeum, all coxae ivory- marked, tergite II with a broad pale W-shaped apical margin, tergites III and VI spotted, sternite II banded. Clypeus a little broader than long; interantennal ridge moderately sharp; interocellar area with a pair of rough, punctured tubercles, bridged behind front ocellus; humeral carina sharp, humeral angle projecting forward. Aedeagus rather stout, expansions well developed, paramere moderately narrowed toward apex (fig. 19). Length to apex of second tergite 5.5 mm.

Female.—Markings yellow and somewhat more extensive than in male. Mandible reddish to black, clypeus with a dark free edge and dark median spot, mid and hind coxae spotted, scape black. Clypeus roundly excavated at apex, considerably broader than long. Head about 1.9 mm. long, body length to apex of second tergite about 6.5 mm.

Holotype.—Male, Antioch, Contra Costa Co., California, September 9, 1935 (R. M. Bohart).

Paratypes.—11 female topotypes, September and October, 1935-1939 (G. E. Bohart, R. M. Bohart, E. C. Van Dyke, G. Ferguson).

Discussion.—The rough interocellar area is distinctive in the group. The projecting humeri and rather keeled interantennal ridge are found also in *occidentalis*, but the reduced antennal hook and roundly excised clypeus of *arenicolus* relate it to *schlingeri*.

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ANOPLOTERMES BRUCEI, NEW SPECIES, FROM BOLIVIA
(Isoptera, Termitidae)

At Rosario (Lake Rogagua), Bolivia in hills, November 1921, Dr. W. M. Mann, while on the Mulford Biological Expedition to the Amazon Basin, collected winged adults and workers of a new *Anoplotermes*. In 1926 (Proc. U. S. National Museum 68, art. 14:45, in key and listed p. 48) I had identified this termite as *A. pacificus* Fr. Mueller. However, the winged adult is smaller, the hyaline fontanelle is smaller and the ocelli are larger and closer to the eyes.

Anoplotermes brucei, new species

Winged, female adult.—Head dark castaneous brown, with dense long hairs. Fontanelle hyaline, round. Eye black, nearly round, projecting. Ocellus suboval, with projecting upper rim, separated from eye by a distance not quite equal to its long diameter. Post-clypeus light castaneous brown, bilobed, projecting, with long hairs.

Antennae yellow-brown, with 15 segments, third short.

Pronotum slightly lighter colored than head, saddle-shaped, sides rounded to posterior, with dense long hairs.

Wings smoky-gray, forewing nearer to cubitus than to subcosta, with two branches to apex, cubitus with 10 branches to lower margin of wing, occupies half of wing in width.

Legs yellow-brown.

Abdominal tergites castaneous-brown, with long hairs.

Measurements in mm.:

Length of entire adult	14.00
Length of entire dealated adult	7.50
Length of head (to tip of labrum)	1.70
Length of pronotum (to anterior corner)	0.80
Length of forewing	12.00
Length of hind tibia	1.50
Diameter of eye (long diameter)	0.25
Width of head (at eyes)	1.40
Width of pronotum	1.40
Width of forewing	3.00

Described from a series of winged adults collected with workers at the type locality.

A. brucei, comes close to *pacificus* in my key (Snyder, *loc. cit.*). This termite is named in honor of Ed. Bruce, president of E. L. Bruce Co., Memphis, Tenn., which company has contributed much to fundamental research.

Cotypes, winged adults.—Cat. No. 62912, U. S. National Museum.—Thomas E. Snyder, *Washington, D. C.*

ANTS OF THE GENUS PHEIDOLE, SUBGENUS HENDECAPHEIDOLE (HYMENOPTERA, FORMICIDAE)

By MARION R. SMITH, *Entomology Research Branch, United States Department of Agriculture, Washington, D. C.*

The subgenus *Hendecapheidole* was described by Wheeler in 1922 for those species of *Pheidole* which have 11 segments in the antenna of the worker, soldier and female. As genotype he designated *Pheidole tachigaliae* Wheeler (1921), a species described from Kartabo, British Guiana, on the basis of the worker, soldier and deälated female, and originally thought to have 12 antennal segments in all those castes. In the 1922 paper Wheeler also described *P.* (*H.*) *emersoni* from workers, a deälated female, and males collected from a termite nest in Kartabo. These were the only two species included in *Hendecapheidole* until 1925, when two others were assigned to the subgenus. One of these, *mendicula* Wheeler (1925), was based on numerous workers, two soldiers and two males collected on Barro Colorado Island, Canal Zone. The other, *Tetramorium* (*Cephalomorium*) *bahai* Forel (1922, Rev. Suisse de Zool. 30: 91), described from a single worker supposedly collected at Faisons, North Carolina, was assigned by Santschi (1925, Soc. Ent. Belg. Bul. et Ann. 65: 228) to *Hendecapheidole*. Being doubtful of Santschi's placement of the species when I prepared the section on ants in the Hymenoptera of America North of Mexico (1951, U. S. Dept. Agr. Monogr. No. 2, p. 833), I included *bahai* among the unrecognized forms of Myrmicinae.

Of the four species formerly considered to belong to *Hendecapheidole*, two are now known to be incorrectly placed in that subgenus. At my request, Charles Ferriere of the Museum d'Histoire Naturelle, Geneva, Switzerland, examined the holotype of *bahai* and found that, although it was a *Pheidole*, it had 12 segments in the antenna and was therefore not a *Hendecapheidole*. Both W. L. Brown and E. O. Wilson have examined the cotypes of *emersoni* in the Museum of Comparative Zoology, Cambridge, Massachusetts, and report them to be *Pheidole* but not members of the subgenus *Hendecapheidole*.

In this paper I give the known taxonomic and biological information concerning *Hendecapheidole*. I redescribe the soldier and worker of both *tachigaliae* and *mendicula*, and furnish keys for the identification of these castes. Wheeler's original description of the deälated female of *tachigaliae* and the male of *mendicula* are reproduced, since specimens of these two castes are not available to me.

Pheidole, subgenus **Hendecapheidole** W. M. Wheeler

Pheidole (*Hendecapheidole*) W. M. Wheeler, 1922, Amer. Mus. Novitates 46: 3, *worker, soldier, deälated female*, (not *male*).

Pheidole (*Hendecapheidole*) W. M. Wheeler, W. M. Wheeler, 1925, Biol. Bul. 49 (3): 174, *male*. Fig. 1 (d, head of *male*; e, antenna of *male*).

Type: *Pheidole tachigaliae* W. M. Wheeler. Orig. desig.

This subgenus is characterized especially by having 11 segments in the antenna of the worker, soldier and female and 12 segments in the antenna of the male. The soldier presents the best characters for specific recognition. The soldiers of both *tachigaliae* and *mendicula* have an antennal sulcus and also a high angular crest on the thorax in the vicinity of the humeral angles with a distinct anteroventrad and posteroventrad slope from this region. At present, species are known only from British Guiana and the Canal Zone. The available biological information is given under each species.

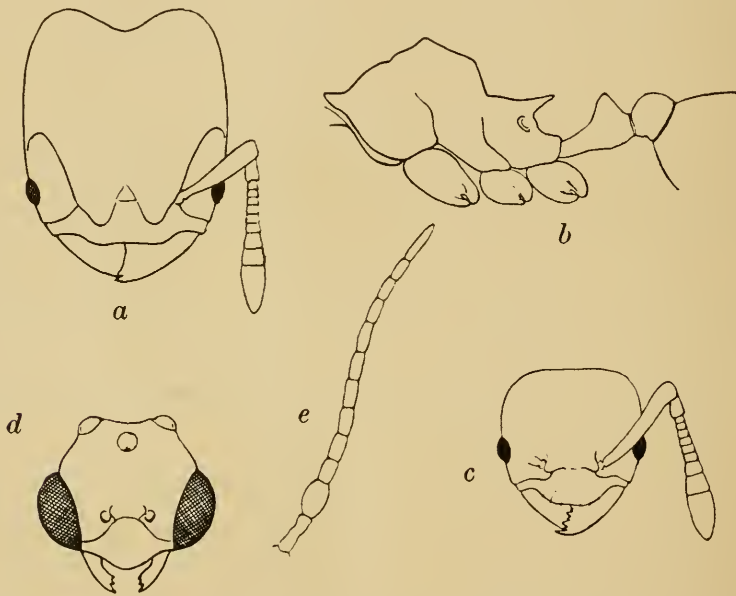


Fig. 1, *Pheidole* (*Hendecapheidole*) *mendicula* W. M. Wheeler; a, head of soldier, dorsal aspect; b, thorax and pedicel of same, in profile; c, head of worker, dorsal aspect; d, head of male; e, antenna of same. (After Wheeler).

Key for the Identification of the Soldiers

1. Dorsal surface of head with longitudinal rugulae; body light brown or reddish brown; British Guiana .... *tachigaliae* W. M. Wheeler
   Dorsal surface of head with transverse rugulae (some of which may even be concentric); body dark brown; Canal Zone; fig. 1 (a, b) .... *mendicula* W. M. Wheeler

Key for the Identification of the Workers

1. Head and thorax dark brown and with dense, punctulate sculpturing which gives these areas a subopaque effect; Canal Zone .... *mendicula* W. M. Wheeler
   Head and thorax light brown or yellowish brown and with dense but weak punctulate sculpturing which gives these areas a slightly shining effect; British Guiana .... *tachigaliae* W. M. Wheeler

Pheidole (Hendecapheidole) mendicula W. M. Wheeler

Fig. 1 (a, head of soldier; b, thorax, petiole and post-petiole of soldier; c, head of worker; d, head of male; e, antenna of male).

Pheidole (*Hendecapheidole*) *mendicula* W. M. Wheeler, 1925, Biol. Bul. 49 (3): 172-175, *worker, soldier, male.*

Soldier.—Length 1.6-2 mm. (1.3 mm. according to Wheeler).

Head subrectangular, distinctly longer than broad, with rounded occipital lobes and noticeably emarginate posterior border, the vertex with a longitudinal impression but without a frontal furrow extending from the impression to the frontal area. Frontal carinae strongly diverging posteriorly. Scape short, slender at base, noticeably enlarged apically, when fully extended attaining approximately half the length of the head; antennal club longer than the remainder of the funiculus. Greatest diameter of eye slightly more than 0.10 mm. and bearing therein approximately six ommatidia. Thorax widest through the humeral angles which are very pronounced. Posterior part of mesonotum almost perpendicular to the base of the epinotum. Epinotal spines well developed but scarcely half as long as the distance between their apices. Legs moderately short, with noticeably enlarged femora and tibiae. Petiolar node, in profile, strongly compressed anteroposteriorly; viewed from above and behind the node appears somewhat wedge-shaped and has a straight or excised superior border. Postpetiolar node broader than long, also broader anteriorly than posteriorly.

Dorsal surface of head very strikingly transversely rugulose (some of the rugulae often somewhat concentric). Epinotum largely punctulate. Pronotum and mesonotum irregularly rugulose-reticulate, with punctulate interspaces. Mandibles, clypeus, dorsal surfaces of petiolar and postpetiolar nodes, and gaster rather smooth and shining; dorsal surface of petiolar node frequently shining.

Hairs yellowish, suberect to erect, moderately abundant, many of them rather long. Scape of antenna also with a number of rather long hairs. Body dark brown, appendages somewhat lighter.

Worker.—Length 1.3 mm. (Wheeler gives the length as 1 mm.).

Head 1.10 times as long as broad, differing especially from the soldier in having more convex sides and a straight posterior border. Greatest diameter of eye less than 0.10 mm. and with about five ommatidia. Thorax with weakly developed humeri. Legs, petiole, postpetiole and gaster very much as in the soldier.

Head, thorax, lower portions of the petiole and postpetiole mainly coarsely and densely punctate, subopaque; mandibles, dorsal surface of petiolar and postpetiolar nodes and gaster smooth and shining but the clypeus punctulate and also longitudinally rugulose, subopaque.

Hairs light yellowish or grayish, moderately abundant but rather long. Scape with a few long hairs.

Body dark brown; mandibles, antennae and legs lighter.

"*Male.*—Length nearly 2 mm.

"Slender; head, including the eyes, as long as broad, narrowed behind, with straight sides and concave posterior border. Eyes and ocelli large. Mandibles and clypeus small, the former tridentate, the latter convex in the middle, with rounded anterior border. Antenna 12-jointed; scape very small and slender, scarcely longer than the swollen, ovoidal first funicular joint; joints 2-6 about twice as long as broad; 7-10 somewhat longer, the terminal joints slender and elongate. The funiculus tapers gradually to its tip. Thorax broader than the head, the mesonotum large, convex in front, as broad as long. Epinotum convex, with subequal base and declivity, rounding into each other. Petiole slender, parallel-sided, with very low and indistinct node; postpetiole somewhat broader, campanulate, as long as broad. Gaster and legs slender.

''Shining; head subopaque and very finely and densely punctate; pronotum also finely punctate but more shining.

''Pilosity yellowish, similar to that of the soldier and worker but shorter, especially on the legs, where the hairs are also more reclinate.

''Yellowish brown; dorsal surface of body darker; head black; mandibles, mouthparts, antennae, legs, insertions of wings and genitalia, pale yellow. Wings hyaline, with colorless veins and pterostigma.''

Type locality.—Barro Colorado Island, Canal Zone.

Types in the Museum of Comparative Zoology at Cambridge, Massachusetts.

In addition to a soldier and two worker cotypes of *mendicula*, I have studied four soldier and eight worker topotypes collected by I. Molino, August 22, 1923, and two soldiers and five workers from Cooper's Place, edge of Rio Aejeta, Canal Zone, August 19, 1923 by James Zetek, now in the National Museum. There is no biological information on the last two mentioned collections.

The species was described from a colony nesting in the soil immediately around the fungus chamber of the ant, *Sericomyrmex amabilis* W. M. Wheeler.

Pheidole (Hendecapheidole) tachigaliae W. M. Wheeler

Pheidole tachigaliae W. M. Wheeler, 1921, Zool. 3 (4): 148-150, *worker, soldier, deälate female.*

Pheidole (*Hendecapheidole*) *tachigaliae* W. M. Wheeler, W. M. Wheeler, 1922, Amer. Mus. Novitates 46: 3, *worker, soldier, deälate female.*—W. M. Wheeler, 1925, Biol. Bul. 49 (3): 175, *worker, soldier.*—W. M. Wheeler, 1942, Harvard Univ., Mus. Compar. Zool. Bul. 90 (1): 6, 67, 192.

Soldier.—Length 2 mm.

Head, frontal carinae, scape, eye, thorax, legs, petiole and postpetiole similar to *mendicula.*

Dorsal surface of head with longitudinal rugulae which diverge posteriorly, some of them even extending onto the occipital lobes. Sculpturing of body rather difficult to discern clearly because of the light body color; the epinotum, however, appears punctulate. Mandibles, clypeus, postpetiolar node and gaster rather smooth and shining.

Hairs of body similar to those of *mendicula* even to the scapes.

Body light brown or yellowish brown to reddish brown, the appendages and gaster lighter.

Worker.—Length 1.2 mm. (Wheeler gives the length as 1-1.1 mm.).

Remarkably similar to that of *mendicula,* differing mainly in the smaller and more slender epinotal spines with acuter tips, lighter body color (light brown or yellowish brown), and the weaker (punctulate) sculpturing, especially of the head and thorax.

''*Female* (*deälated*).—Length 2.5 mm.

"Head subrectangular, a little longer than broad, a little narrower in front than behind, with straight sides and posterior border. Frontal carinae and antennal scrobes as in the soldier. Antennae longer, the scapes reaching to the posterior third of the lateral borders of the head. Upper surface of the head convex, without vertical impression. Ocelli rather far apart. Thorax elliptical, as broad as the head, the mesonotum and scutellum flat above. Epinotum very small and sloping, with small teeth. Petiole and postpetiole much as in the soldier; gaster larger and more elongate.

"Sculpture, pilosity and color as in the soldier. There is a black spot on the ocellar triangle and the brown fasciae on the gaster are broader and darker. Wing insertions blackish."

Type locality—Kartabo, British Guiana.

Types in the Museum of Comparative Zoology, Cambridge, Massachusetts and in the U. S. National Museum.

I have studied only one soldier and two worker cotypes of *tachigaliae*.

This species was originally collected from a colony nesting in the leaf petiole of a species of *Tachigalia*. In a later paper (1922) Wheeler lists the species from the leaf petioles of *Tachigalia paniculata* Aublet and the stem-swellings of *Cordia nodosa* Lam. var. *hispidissima* Fres.

THE CORRECT TAXONOMIC STATUS OF PHEIDOLE (PHEIDOLACANTHINUS) BREVISPINOSA DONISTHORPE
(HYMENOPTERA, FORMICIDAE)

Careful study of a topotypic worker of *Pheidole* (*Pheidolacanthinus*) *brevispinosa* Donisthorpe indicates that it is the same species as *Cardiocondyla paradoxa* Emery. My reasons are: The specimen agrees in almost every detail with Donisthorpe's description of *brevispinosa*, and Emery's description and figures of *paradoxa*. It is from the proper type locality and was determined by Donisthorpe as *brevispinosa*. I have no hesitancy therefore in synonymizing *brevispinosa*. The synonymy is as follows:

Cardiocondyla paradoxa Emery, 1897, Term. Füzet. 20: 589, pl. 15, figs. 22, 23, *worker*. Type locality: Madang (Friedrich Wilhelm Harbour) formerly German New Guinea, now mandated territory. Types in Museo Civico di Storia Naturale, Genoa, Italy.

Pheidole (*Pheidolacanthinus*) *brevispinosa* Donisthorpe, 1948 (1947), Ann. and Mag. Nat. Hist. (Ser. 11) 14: 593, *worker*. Type locality: Maffin Bay, Dutch New Guinea. Types in British Museum (Natural History) and California Academy of Sciences. New synonymy.—MARION R. SMITH, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

A NEW SPECIES OF ATHIENEMANNIA FROM WESTERN NORTH AMERICA

(Acarina, Athienemanniidae)

By David R. Cook,[1] *Wayne University, Detroit, Michigan*

A collection made in a cold reocrene spring near the Montana State Biological Station during the summer of 1954 contained specimens of a new species of *Athienemannia*. Although these mites are the first representatives of the family Athienemanniidae taken in North America, one subfamily, Plaumanniinae, is endemic to South America. *Athienemannia*, the only genus in the subfamily Athienemanniinae, was formerly known only from Europe. It is becoming increasingly apparent that with adequate collecting in North America, more and more genera of water mites considered to be Palaearctic are found to have a Holarctic distribution. The author wishes to express appreciation to the Chicago Natural History Museum for the loan of specimens of the European species, *A. schermeri* Viets. The new species is quite distinct from previously described forms, but does not appreciably alter the original concept of the genus given by Viets (1920).

Athienemannia Viets

Athienemannia Viets, 1920. Arch. Hydrobiol. 12:813.

Generotype: *Athienemannia schermeri* Viets.

Chelomideopsis Romijn, 1920. Jaarb. Nathist. Genootsch. Limburg. 1919:5.

Generic Diagnosis: Dorsal and ventral shields present; integument porous; capitulum with a moderately developed rostrum; palps uncate, disto-ventral end of P-IV rounded; two long fine setae (antagonistic bristles) present at the disto-medial end of P-IV; III-Leg-5 with slight sexual dimorphism in males of the North American species, none in the European species; legs without true swimming hairs, although a few long thin setae may be present (fig. 4); genital acetabula numerous; in the female the acetabula lie on acetabular plates, these plates not fused with the ventral shield; in the male the acetabula are not on acetabular plates but lie free in the integument of the genital field; special setae-bearing pore canals on genital field laterad to acetabula in males.

Athienemannia brunsoni, new species

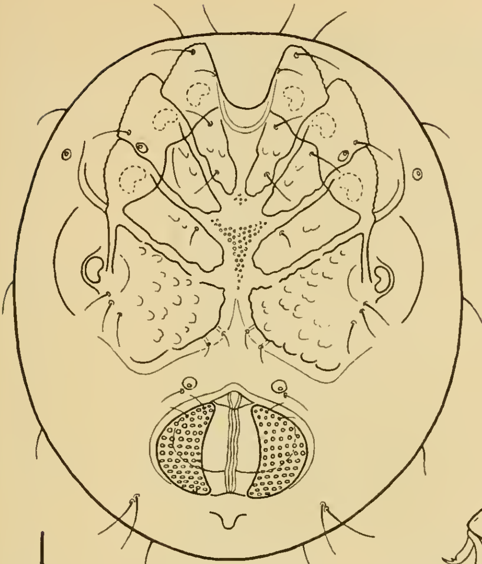
(Figs. 1, 2, 3, 5, 6,)

Male.—Length of ventral shield 724 μ; width of ventral shield 646 μ; length of dorsal shield 698 μ; width of dorsal shield 541 μ.

Ventral shield oval, slightly truncate at anterior end; dorsal shield oval, with three pairs of large laterally placed glandularia; median border of fourth coxae little reduced; genital acetabula numerous; acetabular area wide, with up to six acetabula in a horizontal row; width of acetabular area much more than one-half width of genital field (fig. 3); three pairs of anterior and one pair of posterior

[1]Contribution from the Department of Biology, Wayne University, and the Montana State University Biological Station.

Fig. 1, *A. brunsoni* n. sp., ventral view, female; fig. 2, *A. brunsoni* n. sp., third leg, male; fig. 3, *A. brunsoni* n. sp., genital field. male; fig. 4, *A. schermeri* Viets, third leg, male; fig. 5, *A. brunsoni* n. sp., palp, female; fig. 6, *A. brunsoni* n. sp., ventral view, male.



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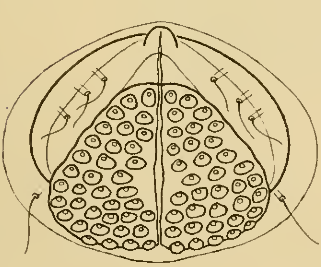

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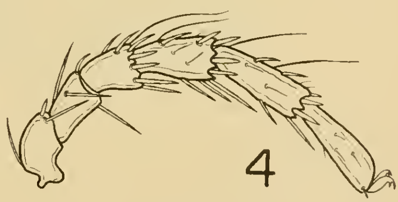

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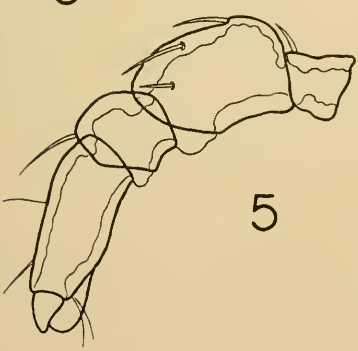

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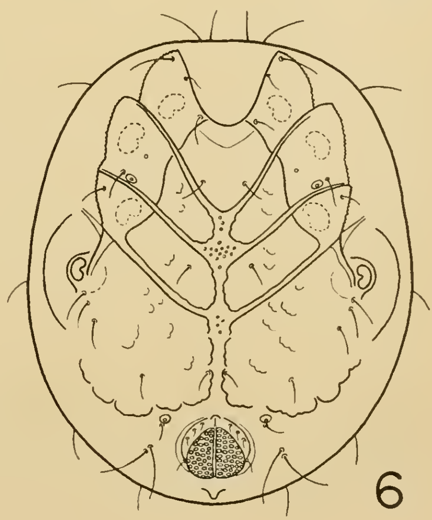

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setae-bearing pore canals present laterad to the acetabula; excretory pore on a tubercle slightly posterior to the genital field; III-Leg-5 exhibiting slight sexual dimorphism, this segment somewhat lengthened and bowed out on the ventral side; dorsal lengths of the segments of the third leg were: III-Leg-2, 64 μ; III-Leg-3, 72 μ; III-Leg-4, 112 μ; III-Leg-5, 212 μ; III-Leg-6, 168 μ; dorsal lengths of the segments of the fourth leg were: IV-Leg-4, 132 μ; IV-Leg-5, 196 μ; IV-Leg-6, 184 μ; palps typical of the genus.

Female.—Length of ventral shield 978 μ; width of ventral shield 873 μ; length of dorsal shield 925 μ; width of dorsal shield 768 μ.

Shape of dorsal and ventral shields very similar to those of male except in size; median border of fourth coxae reduced; two pairs of setae-bearing pore canals along inner side of fourth coxae; acetabula numerous, with up to six acetabula in a horizontal row; width of acetabular plate 80 μ; width between lateral borders of the two acetabular plates 279 μ; two setae on anterior portion of acetabular plate (this may not be constant for the species); no setae-bearing pore canals associated with the genital field; excretory pore on a tubercle just posterior to the genital field; field figure 5 shows chaetotaxy of palp, P-V somewhat foreshortened in drawing; legs moderately long, dorsal lengths of the first leg were: I-Leg-1, 72 μ; I-Leg-2, 76 μ; I-Leg-3, 82 μ; I-Leg-4, 100 μ; I-Leg-5, 120 μ; I-Leg-6, 139 μ.

Types.—Holotype male, collected in a small spring along the east shore of Flathead Lake, Lake County, Montana (T26N/R19W/S29) on June 28, 1954. Allotype female, same data. Both types will be deposited in the Chicago Natural History Museum.

Habitat.—A cold reocrene spring consisting of a series of cataracts two to three feet in height. Bottom mostly rock, but with areas of sand at the base of the cataracts. Aquatic mosses present on the rocks.

Remarks.—*Athienemannia brunsoni* is quite distinct from the European species, *A. schermeri* Viets and *A. fluvicola* Besseling, as the following comparisons will show. The latter species was erected by Besseling (1951) for a female specimen taken in Holland. Although the present author has examined specimens of *A. schermeri* only, the European species appear to be closely related and the following remarks should apply to both: *A. brunsoni* is considerably larger and the legs are longer. Males of the North American species show a slight sexual dimorphism of III-Leg-5. Figures 2 and 4 give a comparison between the third legs of *brunsoni* and *schermeri* males (both drawn to the same scale). Unfortunately the male of *fluvicola* is unknown. In both sexes of the new species the acetabular area is wider and has more acetabula in a row. In the female specimen of *A. schermeri* examined, the acetabular plate had a width of about 40μ, about one-half that of the *brunsoni* female.

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ERNEST RALPH SASSCER, 1882-1955

With the passing of Ernest Ralph Sasscer, July 7, 1955, the quarantine field here and abroad lost the individual who knew more than anyone else about how quarantine work should be prosecuted. He made a life study of quarantine needs, regulations and procedures. His contributions to the regulations and methodology, under which an attempt is made to prevent the shipment of insects and plant diseases from one country to another, were numerous and important. During the course of his work he developed vacuum fumigation with hydrocyanic acid gas. This process under his leadership became the standard procedure, making possible the entry of some plant materials that otherwise would be refused entry. He also found time for taxonomic work on scale insects, as in the early days of quarantine inspections scale insects were of major importance upon imported plants.

In recognition of his leadership the Department of Agriculture awarded him in 1953 its highest commendation in the form of its certificate of distinguished service. In 1951 he was the representative of the Department of Agriculture at the Food and Agriculture Organization of the United Nations meeting at the Hague in which the International Plant Protection Convention was drafted. He travelled widely in Europe to learn the growing conditions, the pest risks and the methods of handling and packing plant materials for export. He also served on an international commission in Mexico.

In 1953, Queen Juliana of the Netherlands, in recognition of his leadership in the development of plant protection work, conferred upon him the Officers' Cross of the Order of Nassau. Likewise, in 1954 the King of Belgium named him an Officer of the Order of the Crown for similar reasons.

Ralph Sasscer was born October 25, 1882, at Waldorf, Maryland, where he attended the public schools; later he attended McDonough Institute at La Plata from which he entered the Maryland Agricultural College, receiving the Bachelor of Science degree in 1904. He immediately entered the government service as a Scientific Aid in the Bureau of Entomolgy. He advanced rapidly through the various grades to Chief Inspector, Federal Horticultural Board in 1912 and Entomologist and Executive Officer in 1924. In 1928 he was appointed Entomologist in Charge of the Division of Foreign Plant Quarantines, Bureau of Entomology and Plant Quarantine. He continued in this capacity until his retirement in October, 1953. Despite a heavy load of responsibility he was able to attain the Master of Science degree from Maryland Agricultural College in 1913. Later he became the lecturer in Quarantine Entomology at the University of Maryland, the successor of the old Maryland Agricultural College.

Sasscer was active in organized entomology, being a member of the American Association of Economic Entomologists (of which he was president in 1939), the Entomological Society of America, the American Association for the Advancement of Science, the Biological Society of Washington, Sigma Xi, and the Entomological Society of Washington (of which he was president in 1918). He was a member of the Cosmos Club, the Columbia Country Club and the Masonic Order.

These are the achievements by which a man's record is measured by the public. The measure of the man himself is in the hearts of his friends and comes from the unselfish part he takes in the lives of those around him. He leaves a wife, daughter, son-in-law, a granddaughter, and a namesake grandson, all of whom adored him. One of Ralph's greatest characteristics was his exceptional regard for the welfare of those who worked for him. He had a large force located mostly at the ports of entry around the periphery of the nation; he knew them all personally; visited them as frequently as possible; knew their individual personal problems and was always sympathetic in helping them; he also knew each one's capabilities and was ever alert to advance the deserving and to make the service he headed a shining example for those who may follow in his footsteps.

E. N. CORY

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 645th regular meeting of the Society was called to order by President T. L. Bissell in Room 43 of the U. S. National Museum at 8:00 P.M. on Thursday, May 5, 1955. Forty-two members and 12 visitors attended. The minutes of the previous meeting were read and approved.

President Bissell announced that the June picnic meeting will be held at the Log Lodge, Beltsville, on June 1.

New members elected were: *Herbert S. Taylor,* 1369 Fair Ave., Columbus 5, Ohio; *David E. Donley,* 612th USAF Infirmary, Stewart AFB, Newburgh, N. Y.; *J. W. Bongberg,* Div. Forest Insect Research, U. S. Forest Service, Washington 25, D. C.; and PFC *Edward L. Mockford,* 9766 TU, Camp Detrick, Md.

W. E. Bickley stated that the Eurasian water chestnut, or water caltrop, *Trapa natans,* is now established in upper Chesapeake Bay. Francis M. Uhler, U. S. Fish and Wildlife Service, has reported that 4 separate beds totaling about 100 acres in the Gunpowder River area were observed in 1954, and that rapid increase in the infestation resulting in a major disaster can be expected unless prompt control action is taken. An infestation in the Potomac, lasting for about 25 years, was brought under control after $500,000 was spent in the operation of underwater mowers by the Army Corps of Engineers; mosquito control by the Public Health Service was also very expensive. Navigation, aquatic wildlife, and recreation in the fresh-water section of the Bay are threatened. The floating plants choke shallow areas and provide ideal conditions for mosquito breeding. The nuts produced by caltrop are spined and prevent the use of beaches by swimmers. (Speaker's abstract.)

J. S. Wade exhibited a copy of *The black flies (Diptera, Simuliidae) of Guatemala and their role as vectors of onchocerciasis* (Smiths. Misc. Coll. 125, No. 1, 1955) by Herbert T. Dalmat. Dr. Dalmat was introduced during the meeting by A. B. Gurney.

C. W. Sabrosky showed close-ups of *Cuterebra emasculator* Fitch taken by Gordon F. Bennett of the Ontario Research Foundation; he also exhibited general views of picturesque collecting areas in Norway that he and Mrs. Sabrosky visited during the summer of 1954.

R. A. St. George stated that considerable concern has been caused by outbreaks of 2 species of sawflies causing defoliation on timbered areas of Virginia and Maryland. Larvae were collected, and reared adults were identified by Dr. H. H. Ross, University of Illinois, as *Neodiprion americanus americanus* (Leach) from loblolly pine and *Neodiprion pratti pratti* Dyar from Virginia pine. All the larvae collected from Virginia pine transformed to adults the same fall, a possible indication that no adults of *pratti* would appear during the following year from this generation; the number of such collections, however, was quite limited. Mr. L. H. Hetrick, in a previous study of *americanus* on loblolly pine, found that only a small proportion of the prepupal larvae transformed to adults the same season and most of them remained as prepupal larvae until the next year.

Mr. J. M. Davis, Beltsville Forest Insect Laboratory, showed a motion picture in color illustrating the stages in the life history of *N. pratti* and damage caused by its larvae. The insect overwinters in the egg stage in the needles. Young larvae appear during the last of April and reach maturity during the latter half of May or early June, after which they drop to the ground to spin their cocoons in the duft. During late September they transform to pupae and to adults shortly afterward. Adults are present from early October to about the third week in

November. Female sawflies deposit eggs in the current year's needles; hatching larvae utilize the same needles for food the following spring. (Speaker's abstract.)

The principal paper of the evening was *Hemorrhagic Fever in Korea* by Dr. M. Hertig, Director of the Armed Forces Commission on Hemorrhagic Fever. Dr. Hertig's review of the work of the Commission was profusely illustrated with slides.

Visitors introduced were Dr. Hermann Peters of Heidelberg and Robert Z. Page. The meeting was adjourned at 10:15 P.M.—KELLIE O'NEILL, *Recording Secretary.*

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OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON

VOLUME 58

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1956

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

Organized March 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings.*

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Members shall be persons over 18 years of age who have an interest in the science of entomology. Annual dues for members are $4.00; initiation fee is $1.00 (U. S. currency).

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 58 FEBRUARY 1956 NO. 1

A NEW GENUS OF NEOTROPICAL MAYFLIES

(EPHEMEROPTERA, LEPTOPHLEBIIDAE)[1]

By JAY R. TRAVER, *University of Massachusetts, Amherst*

It has long been suspected by students of mayflies that certain Neotropical and Nearctic nymphs with *Thraulus*-like gills differed so much from nymphs of the genotype of the genus *Thraulus* (*Thraulus bellus* Eaton, 1881) as to be quite probably representative of one or more new genera. Likewise many adult mayflies, principally from the Neotropical fauna, which have been described in the genus *Thraulus*, do not conform in certain important features with adults of *T. bellus*. With the one exception noted below, none of these nymphs with *Thraulus*-like gills has been reared or otherwise associated with the proper adults, nor have the above adults described in '*Thraulus*' been known in the nymphal stage. Edmunds (1948) succeeded in rearing one species of such *Thraulus*-like nymphs, and showed these nymphs to be the immature stages in the life cycle of the adult specimens previously described as *Thraulus albertanus* McDunnough, 1931. Thus was established the correlation between nymphal and adult stages of one species of this Western Hemisphere '*Thraulus* complex.' Edmunds erected the genus *Traverella,* with genotype *T. albertana* (McD.), for this and allied species, in which the nymphs have the characters he depicted, and the adults possess on the forceps base, between forceps and penes, "a pair of caudally directed rod-like projections" (Edmunds, 1948). To this genus Edmunds transferred also in 1948 the species *presidiana* (Traver) 1934, described in *Thraulus.* In 1950, he transferred still other species of this complex to *Traverella: ehrhardti* (Ulmer) 1920; *maculipennis* (Ulmer) 1920; *versicolor* (Eaton) 1892; and *primanus* (Eaton) 1892. Sketches prepared for Edmunds by Kimmins, from type material in the British Museum, showed that Eaton's figures of the wings of *Thraulus bellus* were in some respects inaccurate. Comparison of these corrected figures with published figures of the wings of other Western Hemisphere species of '*Thraulus,*' plus discrepancies between nymphs known from these areas with the nymph of *T. bellus,* make it seem highly probable that the genus *Thraulus* does not occur in either the Nearctic or the Neotropical fauna.

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[1]Classification according to Edmunds and Traver, 1954. Proc. Ent. Soc. Wash. 56.

It has recently been my privilege to study a fine collection of mayflies, both nymphal and adult stages, from several areas in South America. Among these are many taken in the republic of Uruguay, by Dr. C. S. Carbonell and his colleagues, collected during the field trips organized by the Departments of Zoology and Entomology of the Facultad de Humanidades y Ciencias of Uruguay. Working with these specimens, I have been able to isolate still another genus whose nymphs have *Thraulus*-like gills, but are not of the genus *Thraulus* nor of *Traverella*. Although none of the nymphs had been reared, by a fortunate chance some of the adults have speckled wings with a distinctive pattern, and full-grown nymphs with similar venation and identical pattern of spots on their wings are among the collected material. The adults do not in any way resemble the true *Thraulus*. For this new genus I propose the name *Ulmeritus*,[2] designating as the genotype the new species herein described as *Ulmeritus carbonelli*.[3]

Ulmeritus, new genus

Eyes of male imago large, contiguous apically in middle area. Posterior margin of head obscured by these large eyes, as is also the basal portion of the pronotum. Head, with eyes, wider than any other part of body. Claws of all legs unlike, the blunt member of each pair being larger than the sharp-pointed member. In the type species, fore leg about as long as head, thorax and first four abdominal segments combined. Femur slightly shorter than tibia, tarsus three-fourths as long as femur. Tarsal joints in descending order range as: 2,3,4,5,1. Second leg slightly shorter than third; femur and tibia subequal, tarsus about one-third as long as either of the preceding segments; tarsal joints in descending order (not including lateral spines): 4,1 subequal to 2,3. The basal segment, not included in these measurements, is fused with the apical portion of the tibia. Third leg slightly more than four-fifths the length of the fore leg; femur and tibia subequal, tarsus one-fourth of femur or tibia; tarsal joints as in second leg, but fusion of basal joint with tibia not easily determined.

Fore wing about three times as long as its greatest width (length measured from apex to inner angle of anal margin). Basal costal cross veins well developed, in both sexes; about 12 cross veins in stigmatic area, all of which are complete and most are upright. No "sag" in stem of MA;[4] stem and fork subequal in length. MP_2 ends on a level with first fork of Rs, in membrane about midway between MP_1 and CuA, although it may approach more closely to the former; joined by slanting cross veins to each of these stems. CuA slightly upcurved only. CuP quite strongly arcuate toward anal margin; at its basal end, it does *not* curve upward to meet CuA, as is the case in *Atalophlebia*. First cubital intercalary straight, either ending in membrane and attached by cross veins to CuA and second intercalary, or seeming to run into CuA. Between this and second

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[2]I take pleasure in naming this genus in honor of Dr. Georg Ulmer, in recognition of his great contribution to the study of the mayflies of the world.

[3]This species I name in honor of Dr. C. S. Carbonell, Laboratorio de Entomologia, Universidad de la Republica, Montevideo, Uruguay.

[4]Designation of veins as in Edmunds and Traver, 1954, J. Wash. Acad. Sci. 44.

intercalary, a fairly long secondary intercalary joined by cross veins to adjacent stems. Second cubital intercalary slightly curved, especially at its proximal end, where it turns and runs into CuP. Two distinct anal veins, a third faintly indicated. Hind wing with a slight rounded prominence on costal margin not far from base; Sc parallels C from region of this prominence to apical margin, in this outer region slanting down slightly toward R. Stem of Rs ends free in membrane at approximately one-half the wing length; attached by cross veins to R and MA. MP is forked one-third of its length from the base; this is a relatively narrow fork containing an intercalary attached by cross veins. CuA turns downward somewhat toward CuP, basally; it is often joined by a weak cross vein to CuP at this joint. CuP and first anal converge to unite basally. Several cross veins behind CuA. Venation as in Figs. 1 and 2.

Forceps base rather narrow; on each side, an excavated area receives the proximal portion of each forceps limb. Forceps three-jointed. Basal joint strongly bowed, and enlarged proximally into a rounded projection on inner margin. Second and third joints relatively short, and approximately subequal. Penes erect; in type species, almost conical at apex, widened slightly at base; appressed to one another along inner margin for greater part of their length, in some specimens, in others divergent toward apex. A prominent spatulate or tongue-shaped process, arising near the apex of each division of the penes, extends downward on ventral side. Genitalia of type species as shown in Figs. 4, 5 and 6. Tails three. No specimen is available in which all three tails are complete, hence the lengths of these appendages relative to each other and to the body length cannot be determined.

Eyes of female widely separated. Posterior margin of head almost straight across middle area, but arching backward laterally toward hind margin of eye, so that it appears to be excavated in all but the lateral areas. Lateral ocelli larger than middle one. Pronotum excavated medially on posterior margin. Venation as in male. Fore leg, which appears a little longer relatively in proportion to the body length than fore leg of male, is somewhat longer than the third leg. Fore femur slightly longer than tibia, which is about one and one half times the length of the tarsus. Tarsal joints rank in descending order: 5, 1 (partially fused with apex of tibia), 2 and 3 subequal, 4. Second leg somewhat shorter than third; femur and tibia approximately subequal; tibia three and one half times length of tarsus; tarsal joints: 4, 1 and 2 subequal, 3 only a trifle shorter than 2. Femur and tibia of third leg equal in length, each being four times as long as the tarsus. Tarsal joints as in second leg. Subanal plate extends backward as far as or slightly beyond apex of tenth tergite; apical border emarginate, its lateral projections acute.

Nymph shows relationship to *Hermanella* Needham and Murphy, 1924; to *Thraulus* Eaton, 1881; to *Traverella* Edmunds, 1948; and to *Choroterpides* Ulmer, 1939. Head and body somewhat depressed. Head wider than abdomen. Head capsule narrows anterior to the antennae, but does not widen as much at the clypeus as in *Traverella.* Antenna two to two and two-fifths times as long as head. Lateral margins of head occupied largely by the mandibles. Mandibles, maxillary palps, triangular projection into which fits the basal joint of the palp, and crown of spines on galea-lacinia are all visible in dorsal view of head. See Fig. 13. Labrum much narrower than in *Hermanella* or *Traverella*, somewhat narrower than in

Choroterpides; quite similar to *Thraulus* in shape and size, and in possessing a well-defined median indentation. It differs from that of *Thraulus,* however, in the more sharply outlined indentation and the presence within this depressed area of several papillae or ''teeth'' (Eaton's figure shows but one such ''tooth'' within the indented area, in *Thraulus*). See Fig. 14. Sharp spine present on inner distal margin of galea-lacinial region of maxilla, as in *Traverella, Hermanella* and *Choroterpides;* seems intermediate in length between the short spine of *Traverella* and the long one of *Choroterpides.* No such spine occurs in *Thraulus.* Maxillary palp three-jointed; basal and middle joints subequal in length, distal joint slightly longer. Hairs present on both sides of second joint and on outer margin of basal joint. Distal joint heavily setose, but hairs not arranged in regular rows as in *Hermanella* and *Traverella.* Palp longer than that of *Thraulus,* but considerably shorter than in *Choroterpides;* does not closely resemble palp of any of the four genera mentioned. See Fig. 18. Mandibles quite strongly curved on outer margin, but not angulate basally, thus resembling *Thraulus* and *Choroterpides* rather than *Traverella* and *Hermanella.* See Fig. 10. Labium quite similar to that of *Hermanella.* Labial palp three-jointed; distal joint *much* shorter than those preceding, being not over one-eighth of second joint in length. See Figs. 9 and 16. Hypopharynx much as in *Thraulus.* See Fig. 8. Thus in respect to its mouthparts *Ulmeritus* resembles *Thraulus* as regards structures of labrum and hypopharynx, *Thraulus* and *Choroterpides* as to mandibles, *Hermanella* as to labium, while the galea-lacinial spine is reminiscent of *Hermanella, Traverella* and *Choroterpides.*

Pronotum slightly wider than head,, widest at anterior margin. Middle of mesonotum slightly wider than pronotum. Legs flattened; small spines on dorsal surface of femora and along inner dorsal margin of tibia; triangular flange at apex of each tibia somewhat more prominent than in other genera noted above. Cluster of pectinate spines at base of this flange on legs one and three; other pectinate spines among the nonpectinate ones along inner margin of tibia. Claws of all legs denticulate; in each case, largest denticle next to apex of claw, denticle next beyond it almost as large. Usually eight to nine large and four to five smaller denticles on first claw; on second, seven to eight large and five to six smaller ones; on third claw, six to eight large and three to four smaller ones. The largest of these denticles is not, however, as large relatively as in *Hermanella,* in which genus the first denticle is so large as to give the appearance of two subequal processes at apex of claw. See Figs. 11, 12 and 17.

Postero-lateral spines on abdominal segments five to nine; those on segments five and six relatively small, those on segments seven, eight and nine largest. On seven and eight, these spines flare out from the body somewhat more than any of the others. A minute indication only, of a similar spinous process, on segment four. Along the posterior margin of each tergite is a series of minute denticles. See Fig. 15. Gills show similarity to those of *Thraulus* and of *Traverella,* but differ in certain respects from each of these; and are quite unlike those of *Hermanella* and *Choroterpides.* Each of the seven pairs of gills is bilamellate, with deeply fringed margins; last pair smallest, first four pairs approximately subequal, fifth and sixth pairs decreasing in size toward the seventh. Posterior member of each pair of gills on segments one through six larger than the anterior member; on segment seven, posterior and anterior members approximately equal in size. See

Figs. 3 and 7. Gills differ from *Traverella* in that all pairs are bilamellate, with posterior member the larger; in *Traverella*, the lower member of the sixth and both members of the seventh pairs of gills are fibrilliform, and in all pairs, the posterior member is smaller than the anterior. In *Thraulus*, gills of the first pair differ in structure from all succeeding pairs, consisting of two deeply forked slender linear divisions; gills of the second pair are smaller than those immediately following; gills on segments two through seven similar in structure to those of *Ulmeritus*, and with anterior member of each pair smaller than the posterior. Tails three, subequal in thickness; median may be slightly longer than laterals (in no specimens were both laterals and median preserved in entirety); all tails finely spined at each joining. In mature nymph, tails as long as entire body, including head.

Ulmeritus carbonelli, new species

(Figs. 1-18, incl.)

Male imago (holotype).—Body 8½ mm.; wing 9 mm. General color light reddish brown, thorax more yellowish than abdomen; wings heavily spotted with blackish brown.

Head.—Ocelli pale, ringed with black at base. Interrupted black longitudinal markings along front of head. Antennal filament pale in distal third, basal two-thirds dusky; basal segments pale reddish brown. Upper portion of compound eyes orange, lower portion blackish. Black median streak visible on such portion of vertex as is not obscured by eyes. Ventrally, pale yellowish in posterior part, but area beneath eyes and antennae heavily shaded with black.

Thorax.—Pronotum heavily shaded with black along lateral margins, more narrowly along postero-lateral angles. Narrow black median and submedian streaks; dark shading on each side of median line at posterior margin. Narrow black line borders mid-portion of posterior margin. Anterior half of pronotum largely concealed beneath the large eyes. Blackish markings on prothoracic pleura, forming an interrupted streak upward from fore coxa. Mesonotum yellow; narrow black streak along central portion of midline; scutellum paler yellow, almost white; extensions of wing bases grayish. Mesonotal pleura light reddish brown adjacent to notum, yellowish next to sternum; much blackish shading above and around base of mesothoracic leg. Metanotum similar in color to upper part of mesopleura, with narrow black edging; blackish streaks and markings above and around base of metathoracic leg. Thoracic sternum yellowish to yellowish red. Black shading on median line of mesosternum near anterior and also near posterior margins; patch of dark submedian shading just anterior to base of mesothoracic leg .

Wings.—Venation of both wings as shown in Figs. 1 and 2. Both are heavily mottled and spotted with blackish brown, which in hind wing is more blackish than brown; pattern of markings shown on the above figures. Membrane of costal margin of fore wing strongly brown-tinged, this dark color evenly and regularly distributed in basal half of both costal and subcostal spaces; beyond bulla, restricted mostly to costal space. At base of costa in hind wing, a very small area in which membrane is faintly brown-tinged.

Legs.—Fore and middle femora yellowish at base, light reddish brown in mid-area, shaded with black on distal margins; narrow black lines along each lateral margin except near base. Third femur yellowish on hind margin, front margin shaded with gray. On all femora, traces of a grayish streak along mid-region on outer surface; on fore femur, an additional triangular dusky median mark. Fore tibia reddish yellow at base, yellow at apex, body of segment dark smoky brown; a black spot on ''knee.'' Tibiae of other legs yellowish, with similar black knee spot. Fore and middle tarsi and claws mainly deep smoky brown; all joinings on fore tarsus narrowly pale. Basal segment of hind tarsus, and parts of second and third segments, mainly yellowish, distal segments and claw pale smoky brown.

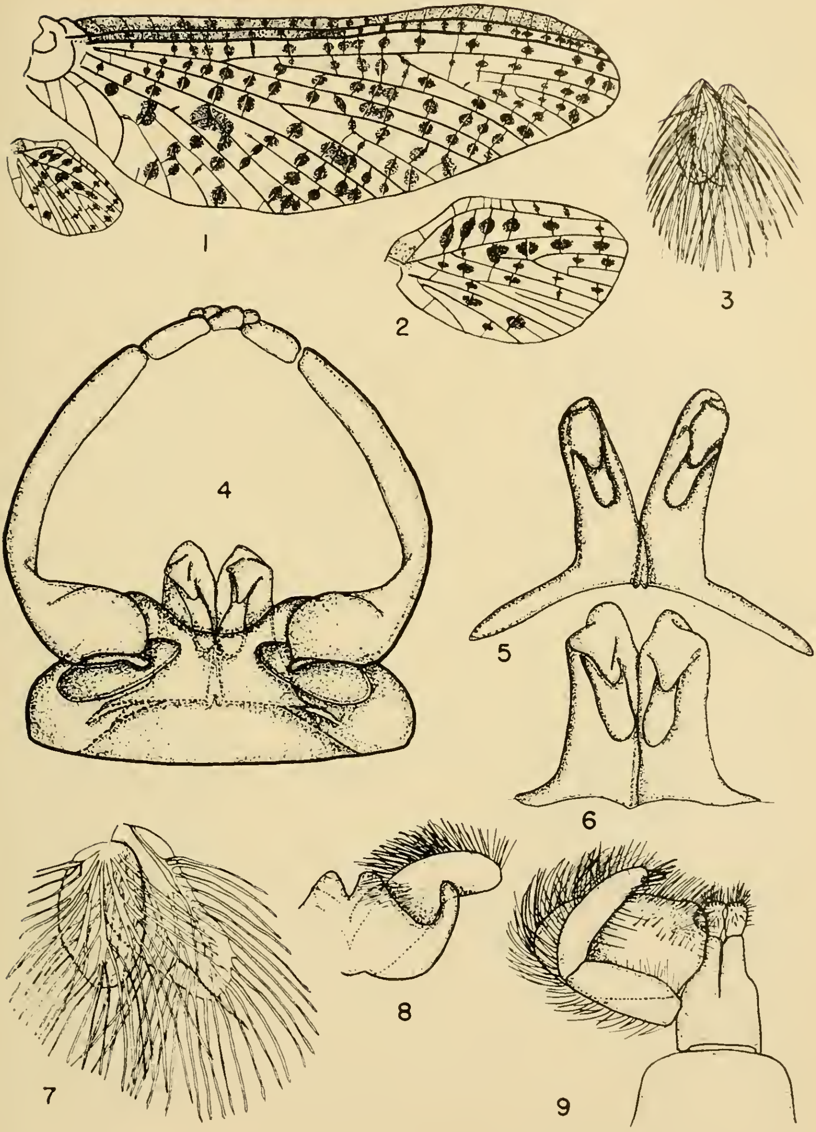
Abdomen.—Reddish brown, tergites one through seven shaded with brown which seems to have a faint purplish tinge. Abdomen appears pale-banded, as intersegmental areas of middle segments are pale. Posterior margins of tergites three through seven narrowly pale, with very narrow dark margin in mid-area only. Pale spots in antero-lateral angles of tergites two through seven; indistinct pale median line, faintly and narrowly margined with brown, on tergites three through seven; on middle tergites also, a pale somewhat triangular spot on each side of mid-line at anterior margin. Tergites eight through ten with yellowish shading. On eight and nine, the pale mid-areas at anterior margin are larger and appear as submedian patches on each side of mid-line, which on these tergites is narrowly black. Posterior margins of eight through ten narrowly blackish. A series of blackish longitudinal streaks along pleural fold. Abdominal sternites somewhat paler than tergites. Adjacent to pleural fold, an interrupted blackish brown streak on middle sternites, concentrated mainly just anterior to posterior margin of each segment. Following this, a yellowish brown region grades into darker mid-ventral markings, which consist of somewhat triangular dark brown patches with straight side adjacent to median line, oblique side extending outward and backward toward postero-lateral angle. Each such patch extends backward almost to posterior margin, but its outline is here more or less diffuse. Indications of similar but much less well developed dark markings occur on basal sternites. On apical sternites, dark markings seem confined to a narrow mid-ventral streak in anterior half of segment. Ganglionic areas pale on all sternites.—Wings, legs and genitalia on slides.

Tails.—Missing. See notes under male paratypes.

Genitalia.—As in Figs. 4 and 6. Forceps base, penes and basal half of long basal joint of forceps limbs light reddish brown; distal half of forceps limbs, and reflexed tongue-like processes on penes, dark smoky brown.

Specimen taken in Artigas Province, Sepultras, Uruguay, Jan. 15, 1952; C. S. Carbonell, et al., Colls. Attracted by light, at night, banks of Cuareim River. (Sample Number 10). In Entomological Collection of the Universidad de la Republica, Montevideo, Uruguay. Body in alcohol.

Male imagos, paratypes.—Three specimens. Differ from holotype as follows: Pale areas on middle abdominal tergites more prominent, appearing as pale median triangles based on anterior margin, surrounded laterally and posteriorly by brown areas; pale mid-dorsal streak wider than in holotype, the narrow dark line bounding it being now quite distinct in posterior half of middle tergites; on seven, these dark streaks distinct also next to anterior margin. Venter of abdomen paler than in holotype, the dark submedian triangles reduced so much as to be barely suggested. Spots on wings dark reddish brown, not as black-tinged as in



Ulmeritus carbonelli, n. sp. Fig. 1, wings of male imago, holotype; Fig. 2, hind wing of same, enlarged; Fig. 3, seventh pair of gills of nymph; Fig. 4, genitalia of male imago, holotype; Fig. 5, penes of male imago, paratype, enlarged; Fig. 6, penes of male imago, holotype, enlarged; Fig. 7, first pair of gills of nymph; Fig. 8, hypopharynx of nymph; Fig. 9, labium of nymph.

holotype. Forceps base light reddish brown. Penes yellowish, reflexed processes brownish. Forceps limbs pale reddish brown, mid-area of long basal joint still paler. Tails yellowish, narrowly black at joinings in basal area. Near base, each joining is rather widely black; then come alternate wide and narrow dark joinings; near tip, joinings same color as body of joint. Penes of one specimen shown in Fig. 5.

Same data as holotype. One specimen in Entomological Collection, Univ. de la Republica, Uruguay; two specimens in private collection of J. R. Traver.

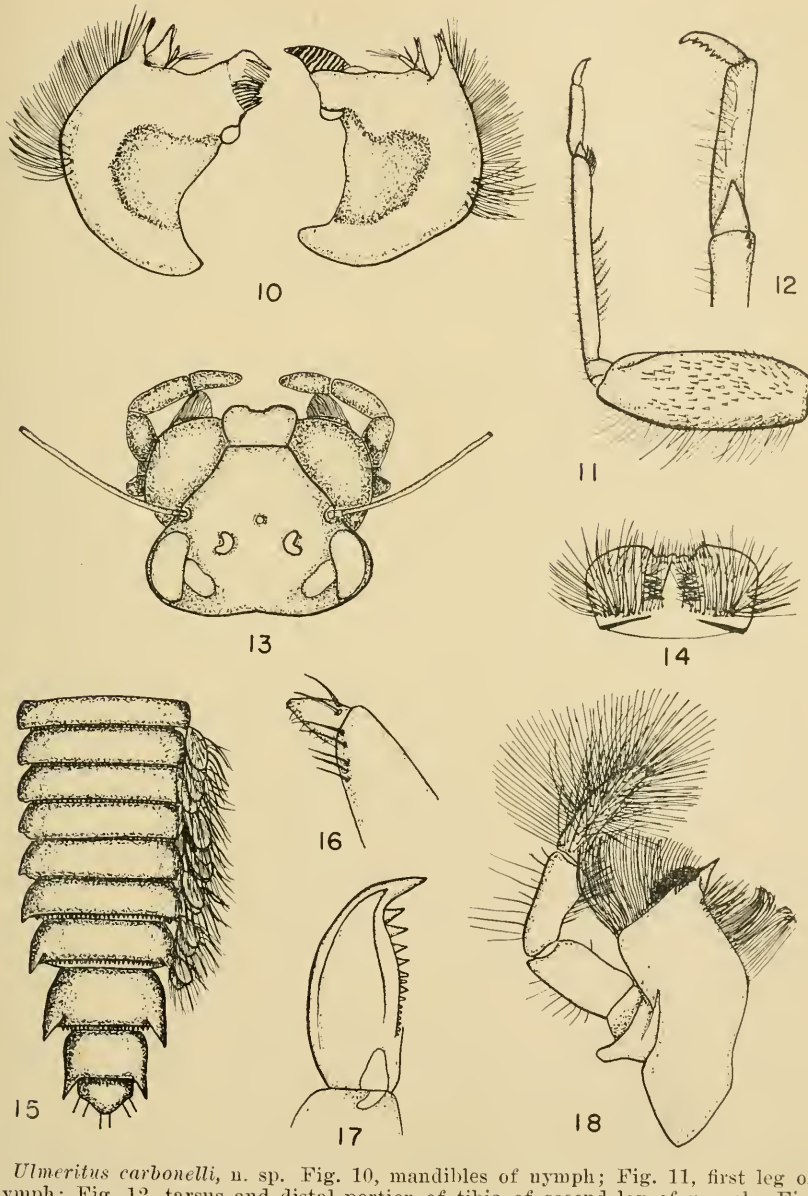
Female imago (allotype).—Body 7 mm.; wing 10 mm. General coloration as in male holotype, with usual sex differences. Compound eyes separated by distance approximately equal to three diameters of eye. Head and pronotum yellowish. Two transverse black lines on head. Membrane of wing tinted only in costal strip, where the color is somewhat more restricted and not as dark as in male. In hind wing, spots more black than brown, as in male; in fore wing, spots not as dark brown. General color of legs very much as in male. Basal joint of tarsus fused with apex of tibia, even in fore leg. Fore tibia, including basal joint of tarsus, very slightly longer than femur, tarsus slightly more than one-third of tibia. In middle and hind legs, femur and tibia subequal, tarsus about one-third of tibia. Pale mid-dorsal line on abdominal tergites one through three; on four through seven, pale median triangles, with base on anterior margin and apex not attaining posterior margin. On eight and nine, these triangles are shorter and divided by a narrow dark median line. Tergite ten has no dark markings. On abdominal sternites, a dark line parallels the pleural fold; median marks absent from apical sternites, and on basal and middle ones reduced to a pair of dark dots (on middle ones, extended into short streak), one on each side of midline almost at center of segment. Tails missing. Subanal plate, excavated on apical margin, extends very slightly beyond apex of tergite ten. Wings and legs mounted on slide, remainder of specimen in alcohol.

Same data as given for holotype. In private collection of J. R. Traver.

Female imagos, paratypes.—25 specimens. Body 7-9 mm.; wing 10-12 mm. These females exhibit some variation in size and stoutness of body, length of leg and wing, and in amount of pigmentation of body and wing. Yet the basic color pattern is maintained throughout the series, and does not vary greatly from that of the allotype. The following variations are considered worthy of mention. In some specimens, all abdominal tergites are dark-banded on posterior margins. There is a tendency for the dark spots in the fore wing to form two oblique dark bands across the wing, but these bands are not as fully developed as in those specimens designated as *Ulmeritus* sp. In none of the female paratypes is the membrane of the hind wing or the anal area of the fore wing brown-tinged, as is the case in *Ulmeritus* sp. Specimens in alcohol.

Same data as given for holotype. 13 specimens in Entomological Collection, Univ. de la Republica, Uruguay; 12 in private collection of J. R. Traver.

Subimagos of both sexes.—Similar to imagos aside from the usual differences in lengths of appendages, immaturity of genitalic structures, and in the paler thoracic



Ulmeritus carbonelli, n. sp. Fig. 10, mandibles of nymph; Fig. 11, first leg of nymph; Fig. 12, tarsus and distal portion of tibia of second leg of nymph; Fig. 13, head of nymph, dorsal aspect; Fig. 14, labrum of nymph; Fig. 15, abdomen of nymph, dorsal aspect; Fig. 16, distal portion of labial palp of nymph, enlarged; Fig. 17, claw of third leg of nymph, enlarged; Fig. 18, maxilla of nymph.

mesonotum, which exhibits the pale median and lateral areas often seen in subimagos. The thin layer of cuticle covering the wings imparts a pale grayish cast, which in dark specimens may be described as smoky.

Subimaginal specimens, none of which are designated as types, were collected by Dr. C. S. Carbonell and his colleagues, under auspices previously stated, as follows: three male and three female specimens, Province of Treinta y Tres, Quebrada de los Cuervos, Dec. 17, 1952, attracted by light, at night, on banks of Yerbal Chico stream; 12 males and three females, Jan. 13, 1952, other data as given for holotype; one male, Jan. 12, 1952, other data as for holotype. These specimens divided between the Entomological Collection, Univ. de la Republica, Uruguay, and private collection of J. R. Traver. (Samples 44, 13 and 15, respectively).

Nymph.—Ten specimens, all from Lavalleja, Uruguay. Many of these nymphs were within an instar or two of maturity, so that the wing pattern of spots and the venation of both wings could be accurately determined. In none of the male nymphs were the genitalia far enough developed to be of aid in determination, but the similarity of venation and of wing pattern to that of the adult specimens seems to prove without doubt that these are indeed the immature stages of the spotted-winged adults described above as *Ulmeritus carbonelli.* It is, indeed, the correspondence between nymph and adult which is the basis for the designation of the new genus *Ulmeritus.* Structural features of the nymph have been given above, in the characterization of the genus. Mouthparts are figured, also head, leg, gills and abdomen.

Head bright reddish brown, vertex and occiput more or less mottled with brown. Antennae yellowish. Thorax and abdomen likewise reddish brown, paler on venter except for the darker brown apical abdominal sternites. Pronotum margined and marked indistinctly on lateral portions with purplish brown; anterolateral angle of mesonotum, pleura and thoracic sterna likewise with brownish markings. On some specimens, traces of darker median and submedian lines on pronotum. Legs reddish brown; slightly darker along lateral margins and near tips of femora and tibiae, but without prominent dark cross bands or other conspicuous markings. Abdominal segments narrowly blackish brown on posterior margins, more distinct on tergites than on sternites; on tergite ten this margin is darker and wider than on those preceding. Gills purplish gray to deep purple. Tails light reddish brown, darker basally; in basal region only, joinings somewhat darkened.

All of these nymphs were taken in Lavalleja Province, at Arequita, Jan. 2, 1951, under submerged stones in shallow water of rapids of the Santa Lucia River. (Sample 6).

It is possible that this is the nymph referred to and figured by Esben Petersen (1912), from Argentina. Figures he gives of the gills, maxillae and labium of that nymph are quite similar to those shown in this paper for the nymph of *Ulmeritus.* The head of Esben Petersen's nymph differs considerably, however, and it is difficult to see how the figure he presents of the mandible can be homologized with that of *Ulmeritus.*

Ulmeritus species

Temporarily I place here a few specimens of *Ulmeritus* taken at Arequita, Lavalleja Province, Uruguay, by Dr. Carbonell and associates. It is proposed to keep these distinct from *U. carbonelli* until more is known of the amount of variation in size and color pattern of wing that may be expected to occur in the latter species. Two male subimagos and four females, two of these imaginal, are included here. One of these males was in the process of shedding the subimaginal cuticle at the time of death.

Male subimago (cuticle partially shed).—Body 9 mm.; wing 9 mm. Darker in coloration than similar stage of *carbonelli*, as the latter is at present limited. Thorax, including mesonotum, almost wholly dark reddish brown; meso and metanotal areas darker than pleura. In fore wing, the widely margined cross veins tend to be concentrated into two main regions forming irregular oblique bands across the wing, beginning at the costa. The narrower of these bands passes through the bulla, reaching the outer margin at the distal end of CuA; the wider band lies nearer the base of the wing, ending in and occupying most of the anal (or inner) margin. Within these two bands, margins on the cross veins are wider, while others in the fore wing tend to be narrower, than in corresponding areas on the wing of *carbonelli*. Moreover, the margins on cross veins in these two bands tend to run together, so that the spotted effect so evident on wing of *carbonelli* is lost or much obscured. Base of fore wing in anal region faintly but distinctly brown-tinged on membrane. Entire membrane of hind wing similarly brown-tinged; many cross veins in this wing are also more widely margined than in *carbonelli*. Middle and apical abdominal tergites with more definite blackish bands, which seem to occupy both anterior and posterior margins. Abdominal sternites tinged with pale reddish brown; pronounced dark shading along pleural fold; dark median markings reduced to a narrow transverse blackish streak at mid-line on anterior margin, and *very* faint dusky submedian streaks on middle segments. Tails brown, banded as in *carbonelli*. Tongue-like reflexed process from penis lobes seems somewhat shorter and less prominent than in *carbonelli*.

Female imago.—Body 9-10 mm.; wing 10-11 mm. Body somewhat longer and more robust than in females of *carbonelli*. Head and pronotum fawn-colored; two black transverse bands on head, in addition to frontal markings. Same tendency as in male, for margined areas in fore wing to form two oblique bands, but this band effect not as pronounced as in the males. Base of fore wing and all of hind wing except a narrow margin including and basad to costal projection, faintly but definitely brown-tinged. Lateral margins of pronotum dark; median and submedian streaks black. Abdominal tergites bright reddish brown; black marks on pleural fold. Sternites paler than tergites; ganglionic areas pale. On one specimen, short black transverse submedian dashes in mid-area, as in male. In the other imago, these dashes reduced to dots on basal segments. In both imago and subimago females, costal margins of fore wing and all margined areas of that wing appear more reddish than in most specimens of *carbonelli*.

Date of collection of these specimens: Jan. 2, 1951. Attracted to light at night, on banks of Santa Lucia River. Specimens divided between Entomological Collection, Univ. de la Republica, Uruguay, and private collection of J. R. Traver. (Sample 5)

Ulmeritus são-paulensis (Traver), new combination

Atalophlebioides são-paulense Traver, 1946. Rev. de Ent. 17:424.

It appears evident to me that the above species is congeneric with *Ulmeritus carbonelli,* and should therefore be transferred to this genus. Hind wing and male genitalia of *são-paulensis* are figured in the above mentioned paper. A comparison of the allotype of *são-paulensis* with that of *carbonelli* shows great resemblance as regards venation and principal margined cross veins. The following differences may be noted: In fore wing, costal margin less heavily infuscated; cross veins in disc of wing somewhat less widely margined; infuscations at fork of MP and at base of cubital intercalaries absent in part, and those marginings that remain are less extensive. CuP not as strongly arched as in *carbonelli.* In hind wing, only those cross veins in the subcostal space are margined. Hind wing somewhat longer and more pointed than in *carbonelli.* Genitalia of male bear considerable resemblance to those of *carbonelli,* differing in that the reflexed tongue-like process of the penes is smaller and more lateral in position, and the swelling at base of long basal joint of forceps limb is rather more pronounced. The nymphal stage of *são-paulensis* is not known.

Addendum

In May 1955, Georges Demoulin described the genus *Homothraulus,* with designation of *Thraulus misionensis* Esben Petersen as genotype (Bull. Inst. r. Sci. nat. Belg. 31(20): 11-13). The nymph he assigns to *Homothraulus* resembles that of *Ulmeritus* as regards structure of gills and mandibles, but differs (1) in possessing a single sharp spine in center of apical depression of labrum, and in shape and size of this depression; (2) in the lack of a prominent spine at inner apical angle of maxilla, in relative lengths of joints of maxillary palp, and in arrangement and density of hairs on these joints; (3) in greater relative width of head capsule at apical margin; and (4) in the asymmetry of MA of the fore wing.

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NEW RECORDS OF HIPPOBOSCIDS ON WOODCOCK [1]

(DIPTERA)

In connection with an ecological study of the woodcock, *Philohela minor,* certain ectoparasites were secured which represent new records.

Five Hippoboscidae were taken from a number of woodcock. Four were captured from birds taken in the Prescott Peninsula area of the Quabin Reservoir in Massachusetts. The fifth was obtained from a woodcock taken in South Amherst, Massachusetts.

An examination revealed that there were at least two species of these flies. In order to obtain specific determinations we sent specimens to Dr. J. C. Bequaert, Museum of Comparative Zoology, Harvard University, for study.

Dr. Bequaert indicated that all the flies from the Prescott Peninsula woodcock were *Ornithomyia fringillina* Curtis, whereas the specimen from South Amherst was *Lynchia americana* Leach.

An examination of the literature reveals that *Ornithomyia fringillina* had been reported from woodcock twice. One record was from Point Pelee, the second from Chateauguay River, both locations being in Ontario. While this fly had been reported from Massachusetts previously, these are the first records from woodcock in the state.

As regards *Lynchia americana*, this species has been found commonly on grouse and other birds but according to Dr. Bequaert had not been previously reported from woodcock.—W. G. SHELDON, F. R. SHAW and L. B. BARTLETT, *University of Massachusetts, Amherst.*

[1] A contribution from the University of Massachusetts Cooperative Wildlife Research Unit.

HUMAN MYIASIS DUE TO PHAENICIA SERICATA (MEIGEN) IN VIRGINIA

(Diptera, Calliphoridae)

Human infestations with fly larvae in the United States are reported so infrequently that the occasional unquestionable cases with reliable histories should be documented. West (The Housefly, 1951) and James (U.S.D.A. Misc. Publ. No. 631) both listed the green bottle fly, *Phaenicia sericata* (Meigen), as an important sheep maggot which occasionally attacked man. James mentioned that this species has been reported "to attack man in Europe, Africa, and Asia, and may produce a serious form of wound myiasis." The following case involving massive infestation of the navel of a baby boy in Virginia is therefore of some interest.

On May 17, 1955, Dr. A. Corpening, Director of Laboratories, of the Department of Health, Richmond, Virginia, sent the Communicable Disease Center some fly larvae for identification. These were identified as larvae of the green bottle fly, *Phaenicia sericata* (Meigen), and this determination was later confirmed by Mr. Curtis W. Sabrosky of the U. S. Department of Agriculture. Through the cooperation of Dr. Corpening, Dr. William B. McIlwaine, of Petersburg, Virginia, very kindly submitted the following short case history on May 31, 1955:

"Baby boy Davis was born in the Petersburg General Hospital on April 19, 1955, and left the hospital in excellent condition on April 27. The baby was first taken to its grandmother's in Petersburg and about a week later taken to its home in West Petersburg. This is a Negro settlement about three miles outside of the city limits.

"The baby was brought to my office on May 15 and at that time the navel, although perfectly healed, was filled with about fifty or sixty maggots. These were removed and sent to the State Laboratory in Richmond for examination. The navel was swabbed with an antiseptic and antibiotic ointment used. There was no evidence that there were any maggots on other parts of the body and the mother had not seen any more.

"I talked to the mother today who says that there has been no more evidence of maggots in the baby's navel or on other children. She had not noticed any abnormal amount of flies and as far as she knows the baby has not been exposed to flies in any way."

Balsam-mounted slides of third stage larvae from this case have been deposited in the collections of the Communicable Disease Center and the U. S. National Museum.—Harry D. Pratt, *Communicable Disease Center, Atlanta, Georgia.*

THE BITING MIDGES ECTOPARASITIC ON BLISTER BEETLES (DIPTERA, HELEIDAE)

By WILLIS W. WIRTH, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

The first account of heleid midges attacking beetles was published by Peyerimhoff (1917), who observed a species later described by Keiffer (1922) as *Atrichopogon meloesugans* attacking *Meloe majalis* Linnaeus in Algeria. The flies were observed to pursue these large meloid beetles in little swarms and to feed upon the yellow blood from their swollen abdomens without inconveniencing them in any way. In 1921 Hansen reported midges, which Edwards later (1923) determined as *Atrichopogon rostratus* (Winnertz), hovering over a *Meloe proscarabeus* Linnaeus in Denmark, and sometimes attacking it, especially on the soft skin between the first and second thoracic segments and on the under side. The beetle was seriously affected by the gnats' biting and rubbed its sides with its hind legs, but without getting rid of its tormentors. Edwards (l.c.) attributed the formidable proboscis of *rostratus* to these unusual blood-sucking habits, but stated that this species was usually taken on flowers of Umbelliferae. As I will mention later, at least some of Edwards' records are based on misdeterminations.

Following these reports there appeared a number of similar records of *Atrichopogon rostratus* attacking *Meloe violaceus* Marsham in Germany (Korschefsky, 1937) and Sweden (Heqvist, 1948) and *meloesugans* on the same beetle in Finland (Krogerus, 1936; Storå, 1938) and on it and *Meloe proscarabeus* in England (Blair, 1937, 1938). In 1937 Storå described another midge, *Atrichopogon oedemerarum*, from *Oedemera flavescens* (Linnaeus) and *Chrysanthia viridis* Schmidt and *C. viridissima* (Linnaeus), beetles of the closely related family Oedemeridae, in Finland. I believe that most, if not all, of the above records of *rostratus* are misidentifications of *oedemerarum* Storå.

Görnitz (1937) reported some very interesting experiments with the drug cantharidin obtained from meloid beetles. *Atrichopogon brunnipes* (Meigen) was regularly attracted to exposed plates containing cantharidin powder. This species is a member of the subgenus *Kempia*, with hairy eyes, and has never been observed actually to feed on blister beetles.

The only published notice of midges attacking meloids in America was by Farr (1954), who sent me specimens of an apparently undescribed species which he found attacking meloids at Amherst, Mass. There are specimens which I have identified as *oedemerarum* in the U. S. National Museum, collected on blister beetles in 1936 and 1937 by J. C. Bridwell. In the summer of 1953 I observed a third and apparently new American species attacking blister beetles in the Chiricahua Mountains of Arizona.

I am greatly indebted to the following persons who have made this study possible: L. G. Saunders of the University of Saskatchewan at Saskatoon and Edward I. Coher and Thomas H. Farr of the University of Massachusetts at Amherst for furnishing specimens; Paul Freeman of the British Museum (Natural History) in London, J. Collart of the Institut Royal des Sciences Naturelles de Belgique in Brussels, S. L. Tuxen of the Universitetets Zoologishe Museum in Copenhagen and Richard Frey of the Museum Zoologicum Universitates in Helsinki for the loan of cotypes and authentic material of the European species; Karl Mayer of the Biologische Zentralanstalt für Land und Forstwirtschaft in Berlin-Dahlem for calling my attention to Görnitz' studies and for furnishing me specimens from his own cantharidin captures; and G. B. Vogt and T. J. Spilman of the Entomology Research Branch in Washington for determinations and advice concerning the Meloidae and Oedemeridae.

My terminology is the same as I have used in an earlier paper (1952) on the Heleidae of California. The types of the new species are deposited in the U. S. National Museum in Washington, D. C., and paratypes will be furnished the British Museum, the University of Massachusetts, the Museum National d'Histoire Naturelle in Paris and the Institut Royal d'Histoire Naturelle de Belgique in Brussels.

Genus **Atrichopogon** Kieffer

Subgenus **Meloehelea** Wirth, new subgenus

The type species of this subgenus is *Atrichopogon meloesugans* Kieffer, and other included species are *Atrichopogon oedemerarum* Storå and the two new species described below. In addition to their meloid-attacking habit, these species are characterized by an unusually upcurved proboscis, a character which I presume to be adaptive for this feeding habit and possessed by no other species of the genus. In addition these species have in common characters which taken alone are also found in other species of *Atrichopogon*, but which in combination will set them apart:

Eyes bare; proximal flagellar segments very short and disciform, the last five segments of the antennae together only 1.8 to 2.3 times as long as the preceding eight combined; palpal pit deep, near middle of third segment; mesonotum with a distinct light-colored area, or fenestra, just ahead of each end of the scutellum, extending forward as narrower, slightly impressed lines to the anterior margin of the mesonotum; scutellum with four long bristles; costa extending 0.65 to 0.70 way to tip of wing; hind basitarsus very nearly 2.5 times as long as the second segment; tarsal claws simple, not toothed or bifid at apices; empodium long, with many long tenent hairs with disc-like apices; two subequal, pyriform spermathecae.

In this subgenus the male of only *meloesugans* is known and is described below, but since the male genitalia offer very poor characters in distinguishing species in other sections of the genus, it seems adequate for the present to recognize the meloid-attacking species as a subgeneric category based primarily on the female sex.

Key to Females of the Known Species of the Subgenus Meloehelea

1. Wing hairy to base, 30-50 macrotrichia in anal cell; head with axis of proboscis more nearly perpendicular to that of body; third palpal segment 2.9-4.0 times as long as broad 2

   Wing nearly bare at base, 10-15 macrotrichia in anal cell; head markedly forward protruding, the ventral surface elongated with axis of base of proboscis more nearly parallel to that of body; third palpal segment 2.4 times as long as broad 3

2. Mesonotum subshining dark brown with dark brown pubescence; legs browish; halter entirely pale yellowish; mandible stout distad, with about 20 large teeth and 6-7 minute distal ones. (Europe and North Africa) .... *meloesugans* Kieffer

   Mesonotum pruinose gray brown with pale yellowish pubescence; legs and often coxae, palpus, clypeus, antennal pedicel and humerus yellowish; halter with brown stem and white knob; mandible quite slender and pointed distad, with about 14 large teeth and 5 minute distal ones. (Europe and North America) .... *oedemerarum* Storå

3. Second radial cell 2.1 times as long as first; antenna shorter, last five segments 1.9 times as long as preceding eight combined; mandibles straight, the outer serrate margin slightly convex, with about 11 large teeth and 4-5 minute distal ones; third palpal segment with deep sensory pit. (Western North America) .... *epicautae*, new species

   Second radial cell 2.5-2.9 times as long as first; antenna long, last five segments 2.2-2.3 times as long as preceding eight combined; mandible broad and curved like a saber, the outer serrate margin straight to concave with 6-7 very large teeth and 4-5 minute distal ones; third palpal segment with shallow pit. (New England States) .... *farri*, new species

Atrichopogon (Meloehelea) meloesugans Kieffer

(Figure 1)

Atrichopogon meloesugans Kieffer, 1922, Arch. Inst. Pasteur Afr. Nord 2:495 (♀; Massif de Mouzaia, Algeria; figure ♀ antenna); Krogerus, 1936, Notulae Ent. 16:27 (Kuusano, Finland; habits); Blair, 1937, Ent. Mo. Mag. 73:143 (England); Blair, 1938, Proc. Trans. S. London Ent. & Nat. Hist. Soc. 1937-38, p. 84 (ditto); Storå, 1938, Acta Soc. Fauna Flora Fennica 60:256 (Finland).

Through the kindness of Paul Freeman of the British Museum (Natural History) I have been permitted to study two cotypes of Kieffer's series collected by Peyerimhoff in Algeria, as well as one of the specimens collected by Blair in South Devon, England, and determined as *meloesugans* by Edwards.

Critical characters observed on the pinned type material from Algeria: Color dark brown, including head, antenna, palpus, thorax, abdomen and hairs on the mesonotum; legs and wing dusky brownish-yellow; halter yellowish white. Antenna with the last five segments 2.0 times as long as the preceding eight combined. Hind basitarsus 2.5 times as long as the second segment. Wing 1.5 mm. long, costa to 0.71 length of wing, second radial cell 2.1 times as long as first; wing quite hairy, macrotrichia extending proximad of the intercalary fork in cell R5, to base of cell M1 and over nearly all of anal cell.

The female from S. Devon, England, was mounted on a slide and it agreed with the Algerian specimens with the addition of the following characters:

About 20 large teeth and 6-7 minute distal ones on the mandible; palpal segments in proportion of 10:30:50:20:20, third segment slender and 3.2 times as long as broad, the pit not so deep as in *oedemerarum* Storå, with a small sensory pore (fig. 1).

A male and a female specimen of *meloesugans* from Strelley, Notts, England, 3 November 1922, L. G. Saunders, reared from larvae, was kindly furnished for study by Dr. Saunders. The female differs slightly from the specimens noted above in having the third palpal segment very long and slender, 4.0 times as long as broad, with shallow sensory pit; antennal ratio 2.4; second costal cell 2.3 times as long as first; tarsal ratio 2.3 and the mandible more slender distad. The shallow palpal pit and small, numerous (20 plus 6) mandibular teeth are typical of *meloesugans*, however. The male specimen, apparently the first of this subgenus to be recognized, is characterized by the same up-curved proboscis as the female. In addition the tarsal claws are slenderer than in the female, with minutely bifid apices. The male genitalia are of the usual structure for the genus, without characteristic modifications. Ninth tergite rounded, without prominent apicolateral processes; ninth sternite with a single, irregular, transverse row of about 15 hairs; dististyles moderately stout distad and bearing a small, peg-like distal appendage just before the apex on the extensor side; aedeagus with the mesal lobe broad, caplike and bent ventrad.

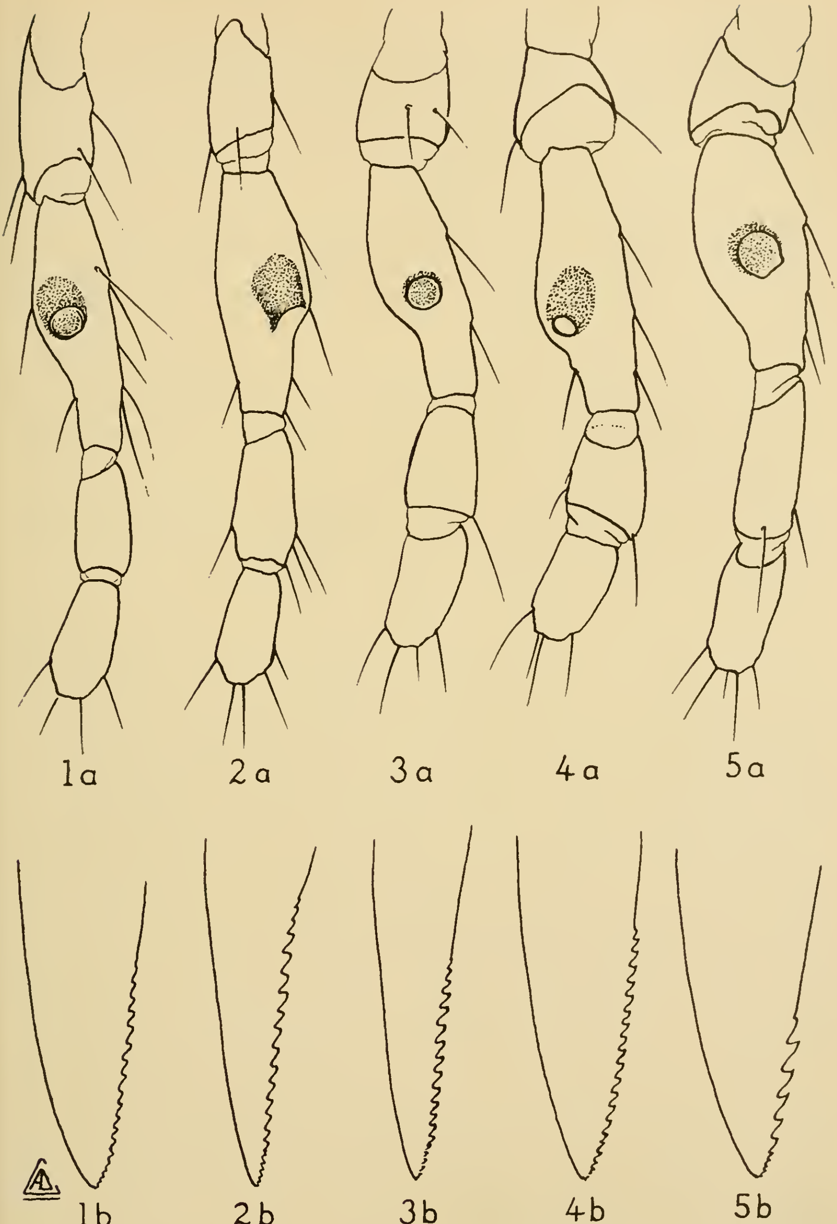
(Atrichopogon (Meloehelea) oedemerarum Storå

(Figures 2, 3)

Atrichopogon oedemerarum Storå, 1939, Notulae Ent. 19:16 (♀; N. Lojo, Kaikuma, Finland).

Atrichopogon rostratus of authors (not Winnertz, 1852); Edwards, 1923, Ann. Trop. Med. Parasit. 17:27 (Denmark, notes); Korschefsky, 1937, Arb. Phys. angew. Ent. Berlin 4:157 (Germany); Heqvist, 1948, Opusc. Ent. 13:47 (♀ fig., Sweden).

Through the courtesy of Richard Frey of the Museum Zoologicum Universitates of Helsinki, I have been able to examine four females of *oedemerarum* from Siilinjaroi and Kurkijoki, Tiensuu, Finland. To the original description I can add the following characters which will serve to distinguish this species from the other three in the subgenus:



Drawings by Arthur D. Cushman

Atrichopogon species: a, female palpus, b, apex of female mandible. Fig. 1, *meloesugans* Kieffer, from England; fig. 2, *oedemerarum* Storå, from Finland; fig. 3, *oedemerarum* Storå, from Massachusetts; fig. 4, *epicautae*, n. sp., from Arizona; fig. 5, *farri*, n. sp., from Massachusetts.

Antennal ratio 2.2; palpus long, the third segment (fig. 2) very slender, 3.5 times as long as broad, with a deep sensory pit opening beyond the middle of the segment; mandible quite slender and pointed distally, the serrate outer margin nearly straight and bearing about 14 large teeth and 5 minute distal ones (fig. 2).

I have also examined the following European specimens which agree quite well with *oedemerarum:*

One female (kindly loaned by Paul Freeman) from Cambridge, England, reared by L. G. Saunders, 6 February 1923 from larvae on damp wood, preserved in alcohol. This specimen was mounted temporarily on a slide in phenol, where the following features were observed:

Fourteen large teeth and 5 minute distal ones on mandible; palpal pit very deep; antennal ratio 2.2; tarsal ratio 2.2; costa to 0.65 wing length, second radial cell 2.3 times as long as first; wing 1.4 mm. long; mesonotal pubescence pale; palpi and legs including coxae yellow.

Two females were received in exchange from Willi Hennig of the Deutsches Entomologisches Institut, collected in Munich, Germany. These specimens have the mesonotum strikingly burnished gray pruinose; one was mounted on a slide for examination:

Mandible with 16 large teeth and 5 minute distal ones; antennal ratio 2.4; costa to 0.69 wing length (1.5 mm.); second radial cell 2.3 times as long as first; tarsal ratio 2.5; palpal segments in proportion of 10:10:38:20:20, third segment 3.1 times as long as broad, with a very deep pit opening by a narrow pore; macrotrichia covering nearly all of wing, except bare along veins.

Seven females (kindly loaned by S. L. Tuxen) from Frederiksdalskov ved Kulhus, Denmark, collected by H. Anthon 22 May 1937 on *Meloe violaceus* Marsham (beetle determined by T. Spilman).

The following specimens of *oedemararum* from North America are in the U. S. National Museum: *Virginia:* 17 females, Vienna, 7 July 1937, J. C. Bridwell, on *Epicauta fabricii* (Leconte); 4 females, Dunn Loring, 27 June 1936, J. C. Bridwell, on *E. fabricii* (Leconte); 1 female, Dead Run, 21 May 1914, R. C. Shannon. *Maryland:* 1 female, Plummer's Island, 19 May 1914, R. C. Shannon. *Massachusetts:* 3 females, Amherst, 1 July 1952, T. H. Farr and F. R. Shaw, on *E. fabricii* (Leconte). New Hampshire: 1 female, Mt. Washington, Mrs. Slosson. These specimens fall within the range of variation of the European material examined except that the sensory pit on the third antennal segment is considerably shallower (fig. 3). In each of the three longer American series, there is evidence of marked color variation, the most extreme pale specimens with all coxae, the palpus, clypeus, antennal pedicel and humerus of the mesonotum pale yellow.

In addition to the alcoholic specimen of *oedemerarum* recorded above I received on loan from the British Museum (Natural History) a pinned series of *Atrichopogon* not evidently associated in any way with meloids, determined as *rostratus* (Winnertz) by Edwards and in part reported by him in his 1926 paper. Some specimens in this series which have dark halteres and a short, straight proboscis are evidently misdetermined. The remaining specimens of the series, with very long, straight proboscis and pale halter knobs are identical with specimens I have received from the Institut Royal d'Histoire Naturelle de Belgique determined as *rostratus* by Goetghebuer. Characters of these specimens which agree with Winnertz' original description and together serve to exclude *rostratus* from *Meloehelea* ar the longer costa (attaining 0.78 of wing length, as measured by Winnertz from the extreme root of the wing), larger size (wing about 2.0 mm.), dark halter stem and milk-white knob and the virtual absence of macrotrichia in the mediocubital and anal cells of the wing. This species is also characterized by the presence of two, subequal, pyriform spermathecae; long, slender third palpal segment with a small sensory pit at the extreme tip and the teeth becoming progressively stronger toward the tip of the mandible. The North American *fusculus* (Coquillett) is very closely allied to, if not identical with, *rostratus*.

Atrichopogon (Meloehelea) epicautae, new species

(Figure 4)

Female:—Length about 1.75 mm., wing 1.4 mm. by 0.65 mm.

Head dark brown including all of antenna, clypeus and palpus. Eye bare. Antenna with flagellar segments in proportion of 12:10:10:10:10:11:11:12:30:32:35:35:50; last five combined 1.9 times as long as preceding eight combined, basal flagellar segments much broader than long, their length gradually increasing and width decreasing toward tenth segment which is nearly as long as broad; last segment with a long terminal nipple. Distal four palpal segments in proportion of 15:35:20:18, third or antepenultimate segment swollen in middle with deep pit and small sensory pore (fig. 4). About 11 large teeth on mandible, plus 4-5 minute distal ones (fig. 4).

Thorax dull dark brown, with sparse yellowish-brown pubescence; two very narrow pale brown lines extending forward from ends of scutellum; latter dark brown with four brown bristles. Legs including coxae dull brownish, mid and hind pairs slightly darker. Proportions of segments of hind leg from coxa distad 50:20:135:130:70:28:22:15:18; basitarsus thus 2.5 times as long as second segment. Claws simple.

Wing with costa extending two-thirds way to wing tip, first radial cell not quite half as long as second. Macrotrichia very sparse, in cell R5 extending only from end of costa along wing margin to wing tip and filling intercalary fork; present only in apical halves of cells M1, M2 and M4 and here well removed from the veins, only about a dozen hairs in anal cell in central region. No hairs on membrane of proximal half of wing except those in anal cell. Halter with brown stem and white knob.

Abdomen with the extensive pleural membrane yellowish, the narrow tergal and sternal plates dark brown. Spermathecae two, subequal, slightly pyriform.

Holotype female (Type no. 62405, U.S.N.M.), Rustlers Park, Chiricahua Mountains, Ariz., 25 June 1953, W. W. Wirth. Paratypes: 38 females, same data as type; 2 females, Eureka Calif., 22 May, H. S. Barber; 1 female, Kaslo, British Columbia, 18 June, R. P. Currie; 1 female, Bear Lake, British Columbia, 20 July 1903, R. P. Currie; 1 female, North Fork Ranger Station, Glacier National Park, Mont., 30 May 1926, H. G. Dyar (all in U.S.N.M. collection).

The Arizona specimens were attacking *Epicauta cinctipennis* Chevrolat (beetles determined by G. B. Vogt) which were damaging lupines at the top of a divide, at about 7000 feet elevation. The midges were observed to feed successfully on the beetles by alighting on plants beside them and reaching over with the proboscis to pierce the beetle at the base of a leg. Those which attempted to alight on the beetles were repelled as the beetles scrambled away over the foliage. Characteristic groups of the beetles would each have a little swarm of the midges flying a few inches overhead, resting on nearby foliage or attempting to feed.

The sparsely hairy wing and heavily toothed mandible ally this species with *farri* n. sp. which however, has longer distal antennal segments, a longer second radial cell and extremely heavily sclerotized and curved mandible with fewer teeth.

Atrichopogon (Meloehelea) farri, new species

(Figure 5)

Female:—Length about 1.2 mm., wing 1.3 mm. by 0.56 mm.

Head dark brown including antenna and palpus; eyes bare, broadly meeting above. Antenna with flagellar segments in proportion of 15:10:10:10:10:12:12:13:15:22:35:40:60; last five segments 2.3 times as long as preceding eight combined, distal segment with long terminal nipple. Palpal segments in proportion of 10:25:30:20:20, third segment scarcely swollen with pit less than half as deep as in *oedemerarum* Storå (fig. 5). Mandible very stout and markedly out-curved, the serrate outer margin concave, with about seven very large and four or five minute distal ones (fig. 5).

Mesonotum and scutellum subshining dark brown with very faint grayish luster, the pubescence dark gray; four dark brown bristles on scutellum. Pleuron and coxae dark brown; legs distally dull yellowish brown. Proportion of segments on hind leg from coxa distad 50:20:125:125:65:25:17:11:16, hind basitarsus 2.6 times as long as second segment.

Wing with costa extending 0.70 way to wing tip, second radial cell 2.5-2.9 times as long as first; macrotrichia very sparse and only a few on basal half of wing except on veins, about ten or fifteen in middle of anal cell. Halter with pale brown stem and white knob.

Abdomen dark brown, the pleural membranes paler. Two subequal pyriform spermathecae.

Holotype female, Amherst, Mass., 1 July 1952. T. H. Farr (Type no. 62406, U.S.N.M.). Paratypes: 5 females, Framingham. Mass., 18 June 1904, C. A. Frost, on *Epicauta torsa* (Leconte) (3 returned to C. W. Johnson collection at Boston University, 2 retained in U.S.N.M.); 3 females, Franconia, N. H., Mrs. Slosson.

I am pleased to name this species in honor of Mr. Thomas Farr, who published a note (1954) on the habits of these midges, which were attacking *Epicauta fabricii* (Leconte) at Amherst.

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AN EASTERN EXTENSION OF THE RANGE OF THE MOSQUITO CULEX APICALIS ADAMS [1]

(Diptera, Culicidae)

Culex apicalis Adams is a member of the subgenus *Neoculex*. Until 1948 it was assumed that this subgenus was represented in the United States by a single widely distributed species that was designated as *Culex apicalis*.

[1] The collections mentioned herein were made while working on projects supported by a research grant, E-507, from the Microbiological Institute of the National Institutes of Health, Public Health Service.

A few years ago, Dr. Richard Bohart discovered that the complex formerly known as *C. apicalis* actually consisted of several species. The results of this study were published in 1948 (Bohart, R. M., Ann. Ent. Soc. Amer. 41: 330-345). *Culex apicalis* Adams as recognized in this publication, was recorded only from California and Arizona in the United States. The most widely distributed species of this subgenus in this country is now designated as *C. territans* Walker.

During the past several years, the writer and his associates have had occasion to collect mosquitoes from many localities in Texas. Larval collections have been emphasized, but in most instances, some of the larvae were returned to the laboratory and reared to adults. During the course of studying this material, it was discovered that *Culex apicalis* had been collected from three localities in west Texas. The localities, collection dates and other data are as follows: Big Bend National Park in a spring-fed pond known as Oak Springs, 23 October, 1953; Alpine, 10 miles north, in puddles along Musquiz Canyon Creek, 27 June, 1954; Fort Davis, 25 miles north, in an isolated body of water in Wild Cherry Creek, 27 June 1954.

Adults were reared from two groups of larvae so that larval and adult features could be correlated. Dr. Richard Bohart kindly confirmed the determination of the material from Big Bend National Park.

So far as could be determined, this is the first time *C. apicalis* Adams has been reported from Texas. The species seems well established in the state as evidenced by its recovery from three localities. —Osmond P. Breland, *The University of Texas, Austin.*

NEW GENERIC SYNONYMY IN THE SCELIONIDAE

(Hymenoptera)

Soon after it was originally proposed, *Trichasius* Provancher was suppressed as a synonym of *Baeus* Haliday, and since then it has been so treated by virtually all workers in the Proctotrupoidea, including Muesebeck and Walkley, 1951 (*In* Muesebeck *et al*, U. S. Dept. Agric. Monogr., Agric. Monogr. No. 2, p. 695). That is incorrect, however. The genotype of *Trichasius*, which I recently had an opportunity to study, has the antennal club composed of six segments, the eyes hairy, the wings represented by tiny stubs, and the first and second tergites short, strongly transverse and longitudinally striate. In all respects it fits *Paragryon* Kieffer, which must now be suppressed as a synonym. Formal expression of the synonymy is as follows:

Trichasius Provancher, 1887. Addit. Corr. Faune Ent. Canada. Hymen., p. 209. Type, *Trichasius clavatus* Provancher, by monotypy.

Paragryon Kieffer, 1908. Ann. Soc. Sci. Bruxelles (2) 32: 189, 199. Type, *Paragryon pedestris* Kieffer, by designation of Kieffer, 1926. New synonymy.

—C. F. W. Muesebeck, *U. S. National Museum, Washington, D. C.*

NEW SPECIES OF CULICOIDES FROM WISCONSIN [1, 2]

(Diptera, Heleidae)

By Robert Henry Jones, *Section of Insects Affecting Man and Animals, U. S. Department of Agriculture, Box 232, Kerrville, Texas.*[3]

Wisconsin material belonging to the genus *Culicoides* was divided into 27 distinct specific groupings. Nineteen of these were previously described species. Of the remaining eight, three are herein described as new species. The residual five are not treated at this time as they are based on female material only and all but one of them is represented by only a few specimens. The female of *C. stilobezzioides* Foote and Pratt is here described for the first time. This species was previously known only from two male specimens collected in the state of New York. The characters used in the key to adult females give complete and definite identification for all but two of the included species. As indicated in the key, *C. spinosus* Root and Hoffman apparently consists of a complex of two species. *C. piliferus* Root and Hoffman is composed of a complex of three or more species insofar as can be ascertained from the Wisconsin material at hand. Only the reared material of this species has been definitely identified as *piliferus*. The holotypes and allotypes have been deposited in the U. S. National Museum. Paratypes have been placed in the following collections: U. S. National Museum (USNM), University of Wisconsin (UW), State College of Washington (WSC), Illinois State Natural History Survey (ISNHS), and in the author's collection (RHJ).

Key to Wisconsin Species of Culicoides[4]—Adult Females

1. Wings without light or dark markings, the area of the radial cells sometimes somewhat darker .... *stilobezzioides* Foote and Pratt
   Wings with at least two anterior light spots 2
2. (1) Second radial cell included mainly in a light spot 3
   Second radial cell included mainly in a dark spot 5
3. (2) Vein Cu_2 lying in a narrow light spot for its entire length .... *venustus* Hoff.
   Vein Cu_2 lying in a dark area, not bordered by a light spot 4
4. (3) Macrotrichiae present only on the distal half of wing, cell Cu_1 almost entirely an indistinct light spot .... *obsoletus* (Meig.)

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[1] The research leading to this paper was supported by a grant from the Wisconsin Alumni Research Foundation and was performed at the University of Wisconsin, Madison.

[2] The author is deeply grateful to Dr. Willis W. Wirth and to Dr. Irving Fox for checking the determination of Wisconsin species, especially to Dr. Wirth for his comprehensive study of this material.

[3] The bulk of this work was performed at the University of Wisconsin, Madison, and in the U. S. National Museum, Washington, D. C.

[4] Based primarily on structural characters, necessitating slide preparations.

Macrotrichiae also abundant basad of radial cells; cell Cu_1 almost entirely a distinct light spot, usually having a small dark spot in its center .... *yukonensis* Hoff.

5. (2) 1 spermatheca 6

2 or 3 spermathecae (if 3, aberrant of 2 spermathecae, rudimentary developed) 9

6. (5) Spermatheca elongate and curved horseshoe-like .... *variipennis* (Coq.)

Spermatheca round or oval 7

7. (6) Eyes widely separated, the closest facets across interocular space very widely separated. Wings with only two anterior light spots, or with additional ones indistinct .... *wisconsinensis* n. sp.

Eyes narrowly separated. Wings with distinct light spots in addition to the anterior two 8

8. (7) AR from 1.8 to 2.0, antennal segment 11 distinctly longer than segments 9 and 10 combined (measured together) and equal to at least 2½ of the proceding segments. Wings with no trace of light spots in tips of cells R_5, M_1, and M_2; no light spots present in cell M_2 at position under the end of the radial cells .... *sphagnumensis* Williams

AR from 1.2 to 1.7, antennal segment 11 shorter than or subequal to the length of segments 9 and 10 combined. Wings with light spots present in the tips of one or more of cells R_5, M_1, and M_2, usually a distinct light spot present in all of these cells distally; a light spot present in cell M_2 at position under the end of the radial cells .... *crepuscularis* Mall.

9. (5) Wings with three light spots along the anterior margin in cell R_5 .... *stellifer* (Coq.)

Wings with two or less light spots present in cell R_5 10

10. (9) Wings with two light spots present in cell R_5, the distal one small and placed at extreme posterior tip of cell .... *haematopotus* Mall.

Wings with less than two light spots in cell R_5; or if two light spots are present, the distal one is situated at the center of the cell, if situated at apex it is large and extends well basad 11

11. (10) Antennal segment 11 subequal to or longer than segments 9 and 10 combined (measured together), the ratio of 9 plus 10 over 11 being 1.0 (range 0.9 to 1.2); antennal segments 4 to 10 distinctly longer than wide 12

Antennal segment 11 distinctly shorter than segments 9 and 10 combined (measured together), the ratio of 9 plus 10 over 11 being from 1.3 to 2.0 (range 1.3 to 2.0); antennal segments 4 to 10 rounded or longer than wide 15

12. (11) Hind tibiae of uniform color, lacking the distinct broad apical light band in contrast to a dark center portion .... *travisi* Vargas

Hind tibiae distinctly banded, having narrow basal and broad apical light bands with the center portion distinctly darkened 13

13. (12) Wings with vein Cu_2 lying in a narrow light area or ending in a light spot .... *arboricola* R. & H.

Wings with vein Cu_2 lying completely in a dark area 14

14. (13) Wings with the light spot on crossvein large, extending well past vein M posteriorly .... *guttipennis* (Coq.)
Wings with the light spot on crossvein small, usually not reaching or barely touching vein M posteriorly .... *villosipennis* R. & H.
15. (11) Wings with the distal light spot in cell R_5 double .... *baueri* Hoff.
Wings with the distal light spot in cell R_5 single or absent 16
16. (15) Antennal segment 11 equal to or scarcely longer than segment 10. Wings with distinct light spots, distal one in cell R_5 large and situated at the middle of cell .... *dickei* n. sp.
Antennal segment 11 distinctly longer than segment 10. Wings variously marked with light spots 17
17. (16) Third palpal segment greatly swollen with a very distinct, deep, small sensory pit. Wings with light spots in addition to the two anterior ones present only along the posterior margin of the wing, the central disc of wing devoid of light spots .... *nanus* R. & H.
Third palpal segment not greatly swollen and without a distinct, deep, small sensory pit; or wings with additional light spots present on the central disc 18
18. (17) Mandibles with 11 or less teeth distally. Proboscis tapering to a small apex; mandibles usually indistinct, the narrow serrate tips frequently not visible 19
Mandibles distinctly with 13 or more teeth. Proboscis only slightly tapered, the apex usually rather broad; mandibles distinct, the broad serrate tips always visible under high power 21
19. (18) Hind tibiae distinctly banded, the center dark with narrow basal and broad apical light bands. Third palpal segment very short, somewhat swollen, subequal in length to tenth antennal segment .... *flukei* n. sp.
Hind tibiae lacking the broad apical light band in contrast to dark center portion. Third palpal segment distinctly longer than tenth antennal segment 20
20. (19) Tip of labrum with a distal membranous projection, this always visible and bearing several distinct hairs apically. Mandibles with 4 to 6 teeth .... *unicolor* (Coq.)
Tip of labrum without this distal membranous projection. Mandibles with 8 or more teeth (*spinosus* will key out in both sides of couplet no. 18, the form with few mandibular teeth possibly being a species distinct from the true form with more than 13 teeth (see couplet 22) .... *spinosus* R. & H.
21. (18) Spermathecae typical, having a distinct, sclerotized, broadened neck 22
Spermathecae without a distinct broadened neck; the short sclerotized portion of the duct adjacent to the spermathecae proper having parallel sides .... *piliferus* R. & H.
22. (21) Wings with only two anterior light spots. Spermathecae heavily sclerotized, ring usually distinctly present .... *biguttatus* (Coq.)
Wings with additional light spots present besides the anterior two, these usually distinct in at least anal cell and cell Cu_1. Spermathecae lightly sclerotized, ring very faint or absent. (see couplet 20) .... *spinosus* R. & H.

Culicoides dickei, new species [5]

(Figs. 1, 2, 3, 4, 5)

A small species, mesonotal disc with moderately distinct pattern; wings with the second radial cell included in a dark spot, with distinct light spots in addition to the anterior two, distal light spot in cell R_5 at middle of cell, far from apex; hind tibiae with distinct light banding; antennal segment 11 subequal in length to segment 10.

Female.—Wing length 1.1 mm., width 0.5 mm.

Eyes narrowly separated. AR 0.8, antennal segments 4 to 10 longer than wide, segment 11 subequal in length to segment 10, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.2, 1.8. Third palpal segment (fig. 5) slightly swollen with a medium sized, shallow sensory pit. Proboscis short, mandibles with 7 or 8 teeth distally.

Mesonotal disc with moderately distinct pattern of dark markings: area between humeral pits dark and giving rise to three broad dark bars posteriorly; one on median line, narrowing at the proscutellar depression; and a lateral one on each side, extending obliquely outwards from humeral pits to posterior level of the distinct prescutellar dark spots where they join laterally with dark areas along sides; these lateral dark bars joined laterally to sides at about their midpoint, thus defining two large light areas on each side. Anterolateral corners light colored, bordered posteriorly by a narrow dark line directed laterally from each humeral pit. Scutellum somewhat darkened centrally. Legs brown with distinct light banding; knees dark with distinct, narrow light bands based and distad to them, the apical one on hind femora indistinct; hind tibiae with distinct, broad, apical light band. Tibial comb with 4 large spines.

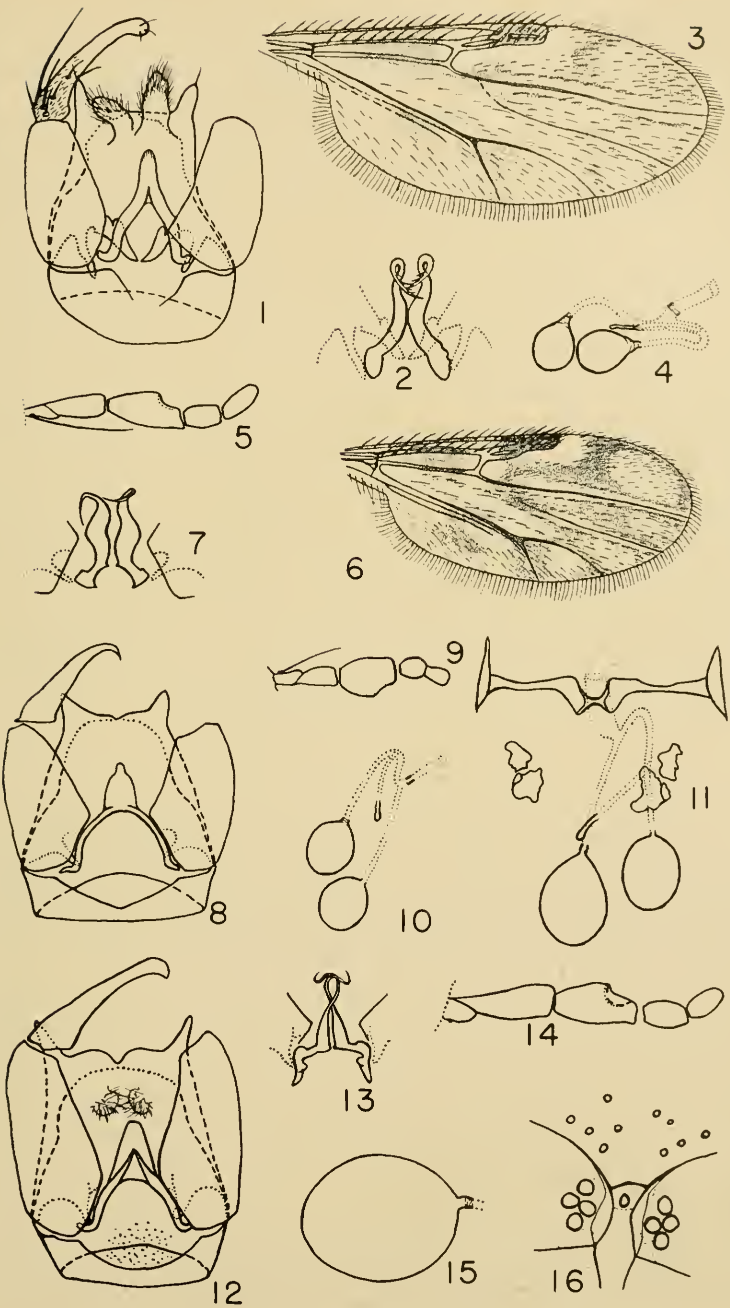
Wing (fig. 3) with second radial cell included in a dark spot; macrotrichiae sparse, denser in cell R_5 and at apex of wing. Wing light brown with the following distinct light spots: on crossvein, extending anteriorly to costa and posteriorly to or slightly through vein M; at tip of radial cells, extending posteriorly to the fold above vein M_1; a large light spot in cell R_5, situated centrally between the radial cells and apex of wing; a small one distally in cell M_1 and another in cell M_2, the one in cell M_1 well separated from wing margin; a light spot based in cell M_1, this indistinctly joined with the light area posterior to it in cell M_2, the basal portion of cell M_2 mainly a light area; and anal cell primarily a light area, divided into two transverse parts by a central darker area which does not distinctly attain posterior margin of wing. Crossvein light colored. Halteres with stem and basal part of knob browned, the apical portion of knob light yellow.

Spermathecae (fig. 4) two, oval, with distinct, broadened necks. Rudimentary spermatheca and ring present. Abdomen brown, cerci a lighter brown.

Male.—Similar to female, genitalia (figs. 1, 2). Ninth sternite emarginate,

[5]The author takes pleasure in naming this species after Dr. Robert J. Dicke. His interest in these flies initiated the author's study of them.

Figs. 1 to 5, *Culicoides dickei*, n. sp.; figs. 6 to 10, *C. flukei*, n. sp.; fig. 11, *C. stilobezzioides* Foote and Pratt; figs. 12 to 16, *C. wisconsinensis*, n. sp.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appearing cleft in some specimens, the membrane not spiculate. Ninth tergite with stout, well developed apicolateral processes, the apex slightly notched. Dististyles straight with slightly enlarged, rounded apices. Basistyles with inner margins straight, without patch of distinct spines; ventral roots stout and boat-hook shaped, the posterior projection short; dorsal roots straight, moderately stout and long. Aedeagus not distinctive, stout and more or less V-shaped, the apex broadly rounded. Parameres slightly divergent basally, stout for greater part of length, tapering into the slender, haired, recurved tips.

Types.—Wisconsin, Washburn Co., T39N-R12W-S32, light trap, R. H. Jones. *Holotype* ♀: 19-VI-1953 (pin, USNM). Allotype ♂: 23-VI-1952 (Jones No. 534, pin-slide, USNM). *Paratypes* 26 ♀♀ and 4 ♂♂: 1 ♀, 23-VI-1952 (Jones No. 679, alcohol-slide, RHJ); 18 ♀♀, 24-VI-1952 (Jones Nos. 731-2, alcohol-slide, 731 UW, 732 RHJ) (Jones Nos. 2194-5 & 2269, PD-slide[6], 2195 USNM, 2194 & 2269 UM) (alcohol, 1 WSC, 1 ISNHS, 9 USNM, 2 RHJ); 2 ♀♀, 29-VI-1952 (Jones No. 2261, PD-slide, UW) (alcohol, USNM); 1 ♀, 2-VII-1952 (pin, USNM); 2 ♀♀, 3-VII-1952 (pin, RHJ) (alcohol, USNM); 1 ♀, 7-VII-1952 (alcohol, UW); 1 ♀, 16-VI-1953 (pin, USNM, 2 ♂♂, 13-VI-1952 (Jones Nos. 442-3, pin-vial, 442 USNM, 443 RHJ); 1 ♂, 24-VI-1952 (Jones No. 686, alcohol-slide, UW); and 1 ♂, 19-VI-1953 (Jones No. 2144, pin-slide, USNM).

According to Wirth (personal communication), this species belongs to a group well represented in the Neotropical region by *debilipalpis* Lutz and other species. It is apparently not closely related to any of the other species occurring in Wisconsin.

Culicoides flukei, new species [7]

(Figs. 6, 7, 8, 9, 10)

A small species, mesonotum with distinct pattern; wings with second radial cell included in a dark spot, with distinct light spots in addition to anterior two; hind tibiae with distinct light banding; antennal segment 11 distinctly shorter than segments 9 and 10 combined; proboscis short with few teeth distally on mandible.

Female.—Wing length 0.9 mm., width 0.4 mm.

Eyes contiguous or very narrowly separated. AR 1.1, antennal segments 4 to 10 longer than wide, segment 11 distinctly shorter than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.3, 1.7. Third palpal segment (fig. 9) moderately swollen, short, subequal in length to antennal segment 10, with a small, indistinct, moderately deep sensory pit; the palpi very short with indistinctly defined segments. Proboscis very short, narrow apically; mandibles with 8 teeth distally.

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[6]PD is abbreviation for pin-dioxane, the thorax of specimens were taken through dioxane and pinned, the original collection alcoholic.

[7]The author takes pleasure in naming this species after Dr. Charles L. Fluke, who first stimulated the author's interest in the taxonomy of Diptera.

Mesonotal disc with a distinct pattern of dark markings which are so joined that they enclose the following distinct light areas: two oval, longitudinal spots narrowly separated by the dark median line, lying between anterior margin of disc and prescutellar depression; two lateral light areas on each side in a longitudinal line, the anterior pair more rounded and directed obliquely towards the humeral pits, the posterior pair elongate; the distinct prescutellar dark spots lying in a lighter area on each side of an indistinct median dark line; and the anterolateral corners distinctly light colored. Scutellum dark, with 4 large marginal and a number of smaller bristles. Legs dark brown with distinct light banding: knees dark with distinct, narrow light bands basad and distad to them, except for the hind femora where the apical light band is indistinct; tibiae with broad, apical light bands, very distinct on hind legs; tarsi light, hind basitarsus darkened. Tibial comb with 5 large spines.

Wing (fig. 6) with radial cells included in a dark spot; macrotrichiae rather sparse, evenly distributed. Wing dark brown with the following distinct light spots: a large rounded one on crossvein, extending anteriorly to costa and posteriorly slightly through vein M; a large spot at tip of radial cells, extending posteriorly almost to light area bordering vein M_1; a large light spot distally in cell R_5; two smaller spots at apex of wing, one in cell M_1 and another in cell M_2; a light spot in cell Cu_1 occupying most of center of cell, extending from vein Cu_1 anteriorly to posterior margin of wing; one in anal cell under MC fork; vein M_2 bordered by a short light spot centrally; vein M_1 bordered by a light spot originating under second radial cell, continuing narrowly to apex of wing; a small light spot above the MC fork, cell M_2 indistinctly light between this spot and one on crossvein; and the basal portion of wing light, this extending along posterior margin in anal cell to the light spot under MC fork. Crossvein yellowish in contrast to surrounding light spot. Halteres white, base of knob and stem browned.

Spermathecae (fig. 10) two, almost round, without a distinct neck, ducts sclerotized for short distance at juncture with spermathecae. Rudimentary spermatheca and ring present. Abdomen dark brown with distinctly darker sides, cerci light yellow.

Male.—Similar to female, genitalia (figs. 7, 8). Ninth sternite broadly emarginate, the membrane not spiculate. Ninth tergite with stout, well developed apicolateral processes, the apex slightly notched. Dististyles straight, evenly tapering to the internally curved, pointed apices. Basistyles with inner margins straight and without patch of distinct spines; ventral roots absent, dorsal roots short and relatively slender. Aedeagus with basal arms slender and arched in an even curve; apical portion broad for most of length, distally suddenly tapering to small blunt, nipple-like apex. Parameres with basal ends angled outward at about 45°, the basal tips enlarged; stem above basal angulation swollen and sinuate, tapering to the slender, recurved, bare tips.

Types.—Wisconsin, Dane Co., T7N-R9E-S16, R. H. Jones, 1954, reared from sugar maple treehole (with pupal exuvia unless otherwise noted). Holotype ♀: 30-V (pin, USNM). Allotype ♂: 30-V (Jones No. 2748, pin-slide, USNM). Paratypes 24 ♀♀ and 19 ♂♂: 1♀, 30-V, without exuvia (Jones No. 2744, pin-slide, RHJ); 2 ♀♀, 30-V (Jones No. 2758, pin-slide, RHJ) (pin, UW); 1♀, 11-VI (alcohol, UW); 7 ♀♀, 11-VI, with pupal and last larval exuviae (Jones Nos. 2770-4, 2777, & 2766, alcohol-slide; 2770-2 & 2774 USNM, 2773 RHJ, 2766 & 2777 UW); 2 ♀♀, 26-VI with pupal and last larval exuviae (Jones Nos. 2783-4, 2 slides; 2783 RHJ. 2784 UW); 11 ♀♀, 26-VI (alcohol; 5 USNM, 4 RHJ, 1 WSC, 1 ISHNS); 3 ♂♂, 11-VI, with pupal and last larval exuviae (Jones No. 2763, alcohol-slide, USNM) (Jones Nos. 2764-5, 2 slides, RHJ); 8 ♂♂, 11-VI (Jones Nos. 2767-9, pin-slide; 2767-8 UW, 2769 WSC) (alcohol, 5 USNM); 8 ♂♂, 26-VI (alcohol; 4 UW, 3 RHJ, 1 ISNHS).

A small treehole species slosely related to *guttipennis* (Coq.).

Culicoides wisconsinensis, new species
(Figs. 12, 13, 14, 15, 16)

A medium sized species, mesonotum with distinct pattern; wings with second radial cell included in a dark spot, with indistinct or no light spots in addition to the anterior two; one spermatheca; eyes widely separated.

Female.—Wing length 1.2 mm., width 0.5 mm.

Eyes (fig. 16) widely separated by a distance exceeding diameter of one facet, the closest facets across interocular space exceeding twice this diameter. AR 1.1, segments 4 to 10 longer than wide, segment 11 distinctly shorter than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.2, 1.6. Third palpal segment (fig. 14) slightly swollen with a medium sized, shallow sensory pit. Mandibles with 8 or 9 teeth distally.

Mesonotal disc pattern of distinct type, the definition obscure in specimens available. The two prescutellar dark spots distinct. Scutellum lighter laterally, with 5 large marginal and about 8 scattered smaller bristles. Legs brown, with indistinct, narrow lighter bands setting off the darkened knees. Tibial comb with 4 large spines.

Wing with second radial cell included in dark spot, macrotrichiae abundant over whole surface. Wing brown, area of radial cells and beyond light spot at tip of darker. Light spots very variable in specimens available, the two anterior light spots small and distinct; paratype (Jones No. 2117) with no additional light spots, other specimens with from indistinct to relatively distinct light spots present in varying numbers; holotype with most present as follows: two in anal cell, one at base and another small one under MC fork; and with light spots present along wing margin in cells Cu_1, M_1, and R_5, those at apices of cells M_1 and R_5 well separated from wing margin. Crossvein indistinct to slightly darker than surrounding light spot. Halteres white, the stem and base of knob browned.

Spermatheca (fig. 15) one, large and rounded, lightly sclerotized; duct with a distinct, moderately long, parallel sided, sclerotized portion adjoining spermatheca. Rudimentary spermatheca and ring absent.

Male.—Similar to female, genitalia (Figs. 12, 13). Very close to *crepuscularis* Malloch, the only apparent difference being in the parameres. Parameres with their bases turned outwards at close to 90°, the internal margin of the foot-like basal part deeply concave and with irregular contour; the main stem not at all swollen, tapering evenly into the slender, recurved, bare tips.

Types.—Wisconsin, Dane Co. *Holotype* ♀: T7N-R9E-S7, R. H. Jones, 4-X-1953, reared from peat muck edge of Lake Mendota, with pupal exuvia (Jones No. 2894, pin-slide USNM). *Allotype* ♂: same data as holotype (Jones No. 2043, pin-slide, USNM). *Paratypes* 3 ♀♀ and 8 ♂♂: 1 ♀, same data as holotype (Jones No. 2117, 2 slides, UW); 1♀, same data as holotype except 20-V-1954 and with pupal and last larval exuviae (Jones No. 2660, pin-2 slides, USNM); 6 ♂♂, same data as holotype (1, pin, USNM) (Jones No. 2031, pin-2 slides, UW) (Jones Nos. 2024 & 2034, pin-slide; 2024 RHJ, 2034 UW) (Jones Nos. 2122-3, alcohol-2 slides; 2122 USNM, 2123 RHJ); 1 ♂, same data as holotype except with pupal and last larval exuviae (Jones No. 2036, pin-slide, USNM); 1 ♂, same data as holotype except 20-V-1954 (Jones No. 2673, pin-slide, WSC); and 1 ♀, T-7N-R9E-S27-B2, R. J. Dicke, 17-VI-1954, light trap no. 4 (Jones No. 2918, alcohol-slide, RHJ). *Paratypic genitalia and pupal cases:* 2 ♂♂, same data as holotype (Jones Nos. 2056-7, slide, UW).

This species is closely related to *crepuscularis* Malloch.

Culicoides stilobezzioides Foote and Pratt
(Fig. 11)

Culicoides stilobezzioides Foote and Pratt, 1954, U. S. Public Health Monogr. No. 18:83.

A medium sized species, mesonotal disc without pattern; wings without light or dark markings; antennal segment 11 distinctly longer than segments 9 and 10 combined, segments 4 to 10 rounded; two spermathecae, with heavily sclerotized processes internally in region of spermathecae; parameres with long delicate hairs distally.

Female.—Wing length 1.5 mm., width 0.7 mm.

Eyes narrowly separated. AR 1.8, antennal segments 4 to 10 rounded, segment 11 distinctly longer than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.1, 1.1, 1.1, 1.6. Third palpal segment greatly swollen with a small, deep sensory pit. Mandibles with 16 teeth distally.

Mesonotal disc without a distinct pattern; three, longitudinal, narrow, darker lines usually visible in alcoholic material. Anterolateral corners light colored, prescutellar dark spots absent, area adjacent to scutellum broadly darkened. Scutellum concolorous brown with disc, with 7 large marginal and about 20 scattered smaller bristles. Legs dark brown, fore coxae and trochanters yellowed. Tibial comb with 5 large spines.

Wings without light or dark markings, the area of radial cells somewhat darker, macrotrichiae abundant over whole surface. Crossvein brown. Halteres brown, the apical portion of knob white to yellow.

Spermathecae (fig. 11) two, oval, ducts at most sclerotized for short distance at juncture with spermathecae. Rudimentary spermatheca present, ring absent. Unusual in possessing distinct, heavily sclerotized processes internally in a lateral position midway between the spermathecae and the bursa, these without any apparent connection to spermathecal system. Abdomen and cerci brown.

Allotype ♀: Wisconsin, Dane Co., T8N-R9E-S26-B4, R. J. Dicke, 9-VI-1954, light trap no. 8. *Additional specimens:* 548 ♀♀ and 155 ♂♂.

A NEW NAME IN CULICIDAE

(DIPTERA)

Since the subgeneric name *Dunnius* Edwards (Bul. Ent. Res. 21: 297, 1930) in the genus *Aedes* is preoccupied by *Dunnius* Distant (Fauna Brit. India, Rhynchota 1: 231, 1902) a new name is necessary for the subgenus. We propose the name *Pseudarmigeres,* new name. This name has reference to the resemblance of species of this subgenus to species of the genus *Armigeres.* The type of the subgenus is *Aedes argenteoventralis* var. *dunni* Evans.—ALAN STONE, *Entomology Research Branch, U. S. Department of Agriculture, and* KENNETH L. KNIGHT, *Bureau of Medicine and Surgery, Department of the Navy.*

NEW SYNONYMY IN THE BRACONIDAE

(HYMENOPTERA)

(Zamegaspilus Ashmead) = Xenarcha Foerster

Xenarcha Foerster, 1862. Verh. Naturh. Ver. Preuss. Rheinl. 19: 235. Type, *Colastes lustrator* Haliday, by monotypy and original designation.

Zamegaspilus Ashmead, 1900. Proc. U. S. Nat. Mus. 23: 141. Type, *Zamegaspilus hopkinsi* Ashmead, by monotypy and original designation. New synonymy.

The two genotypes are little-known species, and probably for that reason have not been compared before. They are clearly congeneric.

(Amicoplidea Ashmead) = Bracon Fabricius

Bracon Fabricius, Systema Piezatorum, p. 102. Type, *Ichneumon minutator* Fabricius, by designation of the International Commission on Zoological Nomenclature, under suspension of the Rules, 1945, Opinion 162.

Amicoplidea Ashmead, 1900. Proc. U. S. Nat. Mus. 23: 118. Type, *Phylax palliventris* Provancher, by monotypy and original designation. New synonymy.

Provancher's original placement of the type species in *Phylax,* and his subsequent transfer of it to *Zele* Curtis, misled later workers and induced Ashmead to propose the genus *Amicoplidea* for it in the Macrocentrinae. It has remained the sole species of that genus. Recent examination of Provancher's type showed it to belong rather to the Braconinae, and to be, in fact, the same as *Bracon auripes* Provancher, which now falls as a synonym.

(Bracon auripes Provancher) = Bracon palliventris (Provancher),
new combination

Phylax palliventris Provancher, 1880. Nat. Canad. 12: 174.

Bracon auripes Provancher, 1888. Addit. Corr. Faune Ent. Canada. Hymen., p. 372. New synonymy.

—C. F. W. MUESEBECK, *U. S. National Museum, Washington, D. C.*

A NEW CULICOIDES FROM PANAMA

(DIPTERA, CERATOPOGONIDAE)

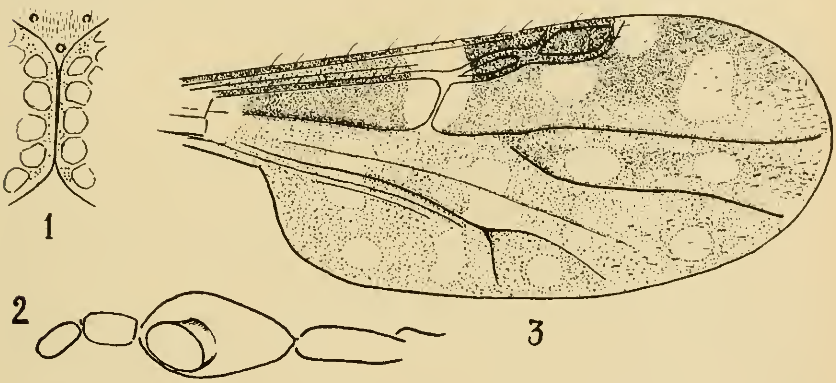
BY O. P. FORATTINI, *Universidade de São Paulo, São Paulo, Brasil.*[1]

We had the opportunity of examining a lot of *Culicoides* collected in Cerro Cefa, Panama, by Dr. G. B. Fairchild and found among the specimens one female which, we believe, belongs to an undescribed species. We decided to describe this species below.

Culicoides grahambelli, new species

(Figs. 1, 2, 3)

Head.—Eyes bare and dark, contiguous along the mesial line (fig. 1). Palpus nearly as long as proboscis, pigmented, segment III the largest, very swollen,



Culicoides grahambelli, new species. Fig. 1, eyes; fig. 2, palpus; fig. 3, wing.

bearing a deep sensory pit. Segments IV and V of the same length (fig. 2). Antenna with torus and flagellar segment I pigmented; next eight segments nearly equal; last five flagellar segments progressively slenderer from XI to XV. A.R. = 1,0. Sensorial tufts present in all the eight first flagellar segments.

Thorax.—Dark brown. Mesonotum brown with paler areas in the middle. Prescutellar depression with dark areas. Scutellum dark with a little pale area on sides, at margin. Pleura dark.

Legs.—Brown, with joints yellowish; distal portion of hind tibia with four bristles.

Wing (fig. 3).—Radial cells distinct, the second large and broader than the first. Veins distinct, macrotrichiae very rare but more abundant on cell R_5. Pale and dark spots distinct. Second radial cell completely covered by a dark area. Pale area over r-m crossvein from costa to vein M. Cell R_5 with three distinct light spots, two of them proximal and in relation with second radial

[1]From the "Departamento de Parasitologia da Faculdade de Higiene e Saúde Pública da U. S. Paulo, Brasil."

cell and touching R_{4+5} vein, the distal one totally included in cell R_5 but not touching the wing margin. Cell M_1 with two pale areas. Cell Cu with a light rounded area which completely includes it without touching the wing margin or vein Cu_1. A pale spot at bifurcation of Cu vein. Pale areas on anal cell. Halteres yellowish.

Abdomen.—Dark brown. Two slightly pyriform spermathecae, a third rudimentary one, and a chitinous ring also present.

Type—Holotype female. Registered in the Entomological Collection from the Department of Parasitology from Faculdade de Higiene e Saúde Pública of São Paulo, Brazil. N.-10706.

Type locality—Cerro Cefa, Panama, Central America, G. B. Fairchild col. (XII-1948).

It is with pleasure that we dedicate this species to Dr. Graham Bell Fairchild of the Gorgas Memorial Laboratory in Panama, C.A.

Taxonomic discussion—The morphological characters of *Culicoides grahambelli*, new species, place it near *C. debilipalpis* Lutz, *C. hoffmani* Fox, *C. ginesi* Ortiz, *C. cacozelus* Macfie, *C. caprilesi* Fox, *C. fluvialis* Macfie and *C. gorgasi* Wirth and Blanton.

It can be separated from the above mentioned species by the differential diagnosis mentioned below.

From *C. debilipalpis:* Eyes contiguous, second radial cell larger and broader than the first. Two evident pale spots in relation with vein R_{4+5}. Halteres yellowish. Sensorial pit on palpal segment III large and deep.

From *C. hoffmani:* Besides the aspect of second radial cell and pale spots in R_5 cell, it is of interest to note the presence of a nítid vein M_2 which is not substituted only by macrotrichiae as in this species.

From *C. ginesi:* Different distribution of light spots on wing, mesonotal pattern, and coloration of halteres which, in this species, are dark at base of knob.

From *C. cacozelus:* In this species one light spot of cell R_5 is situated on vein M_1, and the pale area of Cu cell is in relation to vein Cu_1. Such a pattern is not noted in our species.

From *C. caprilesi:* Besides the eyes, that in this species are well separated, we have the second radial cell and the light spots of R_5 cell as differential characters.

From *C. fluvialis:* In this species, the aspect of the distal pale spot in R_5 cell is sufficient for differentiation. It is interesting to note, also, the absence of a pale area above bifurcation of vein Cu, and the different shape of pale spots on anal cell.

From *C. gorgasi:* The mesonotal pattern, shape and distribution of pale areas in R_5 cell and the coloration of halteres are sufficient for separation.

From the above description and discussion we can further separate *Culicoides grahambelli*, new species, by the additional morphological characters: 1, eyes contiguous; 2, second radial cell of the wing, larger and broader than first; 3, three pale spots on R_5 cell, two of which are proximal and well individualized and in relation with second radial cell, and a more distal one, all inclued in this cell but not touching the wing margin.

NOTES ON MOSQUITOES FROM AN AREA OF ENDEMIC YELLOW FEVER IN COLOMBIA

(Diptera, Culicidae)

By William H. W. Komp,[1] *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

During the summer of 1935, the writer visited an area of endemic (jungle) yellow fever in the Intendencia of Meta, Colombia, in the eastern foothills of the Andes, to make a survey of the mosquito fauna of the region. The results of this survey were published in April 1936 (Komp, 1936a). Several new species were found in the area by the writer, and were later described. During the nearly 20 years since the publication of his results, mosquito taxonomy has advanced considerably, and several species misnamed by the writer have been described by others. These emendations and corrections will be noted below in their proper places, reference being made to the species as numbered in the original paper (Komp, 1936a).

No. 17. *Goeldia* n. sp. The larval skin and the corresponding female adult have been lost; no description of this larva has been published by the writer. What this species may be is not known.

No. 18. *Joblotia digitata* is now known as *Trichoprosopon digitatum* (Rondani). The genus has been revised by Stone (1944).

No. 20. *Psorophora ferox* Humboldt. Yellow fever has been transmitted by the bite of this species by N. C. Davis, using Asibi virus, but Whitman and Antunes (1937), who published Davis's experiments after his death, were unable to confirm his results. Whitman and Antunes say "The results with *Psorophora ferox* are confusing. Davis, in experiments reported in this paper (Whitman and Antunes, 1937) for the first time, was able to transmit yellow fever by the bite of this mosquito, but we have been unable to repeat these observations." *P. ferox* is no longer considered to be a vector of jungle yellow fever.

No. 25. *Haemagogus janthinomys Dyar.* Kumm *et al.* (1946) have shown that *janthinomys* is a synonym of *spegazzinii* Brèthes. Subsequent dissection of the male terminalia of specimens reared from larvae collected at Restrepo showed them to be the common subspecies *spegazzinii falco* Kumm *et al.* However, Dr. L. E. Rozeboom informs me that he later obtained males of *spegazzinii* near Villavicencio, some 20 kilometers from Restrepo. In 1944, when the writer visited the Yellow Fever Laboratory of the Rockefeller Foundation at Villavicencio, he collected from tree holes larvae which produced males of *Haemagogus regalis* (*lucifer* is a synonym (Komp, 1954)). Dr. Marston Bates then informed him that he suspected that about two percent of all adult *Haemagogus* collected in the Villavicencio region were *regalis*. The adult females of *regalis* are indistinguishable from those of *falco* or *spegazzinii.*

No. 26. *Aedes leucocelaenus* Dyar & Shannon. According to Galindo *et al.* (1952) the species obtained by the writer at Restrepo, and of which the male was described (Komp, 1938), is a new species. They state on page 531: "Komp has informed us (in a letter to H. T. dated April 18, 1951) that this illustration

[1]Deceased December 7, 1955. See obituary, p. 47.—Ed.

[of the male terminalia] was drawn from a male taken at Restrepo, Colombia. . . . This new species [from Restrepo] will be described by Komp separately.'' This has not yet been done. The form found in the Restrepo area was rare, and only a few larvae were collected from narrow, deep tree holes. Because of its rarity in the area, it is probably not an important vector of jungle yellow fever there. One of the forms found around Rio de Janeiro, Brazil, was found infected in nature in 1938 (Shannon *et al.*, 1938). It seems to be much more common in southern Brazil than it was in the Restrepo area.

No. 29. *Aedes angustivittatus* D. & K. This species was identified by larval characters given by Dyar (1928, p. 151). The thoracic ornamentation of the adult seems to be subject to considerable variation, in some specimens making it resemble *Aedes scapularis* Rondani.

No. 31. *Aedes scapularis* Rondani. Laemmert and Kumm (1950) infected monkeys with yellow fever by the bite of *A. scapularis.* It was also very common during an epidemic of yellow fever in the Valle do Chanaan, State of Espirito Santo, Brazil, in 1932.

No. 32. *Aedes terrens* Walker. This species is undoubtedly part of a complex, such as described for *A. leucocelaenus* by Galindo *et al.* (*1952*). The form found in Restrepo differs in the larva and male terminalia from material obtained in Panama, Costa Rica, Trinidad, and elsewhere in the Neotropical region. The writer has specimens of at least four forms of this complex; one of them from the Panama Canal Zone has the fifth hind tarsal segment of the adult white. In another very common form from Panama, reared from identical larvae, the mesonotum of the male may be silvered across anteriorly, or have the silvery scales separated by an area of dark scales. *A. thorntoni* D. & K., a member of the *terrens* complex, is known only from a few females collected at Bluefields, Nicaragua.

No. 33. *Aedes dominicii* Rangel & Romero Sierra. This species is *whitmorei* Dunn 1918. The writer obtained the type series from Col. Eugene Whitmore, for whom L. H. Dunn named the species. The series was deposited in the U. S. National Museum. *A. whitmorei* is a member of a subgenus of *Aedes* described as *Soperia* by the writer in 1936 (Komp, 1936b). The type series, according to Dyar (1928, p. 231) was ''bred from larvae said to have been found in a pool at Emerald Mines, Muzo, Colombia,'' and further, ''Major Dunn, who collected them, had one male but he did not give it to me. . .'' This specimen, belonging to the type series, was examined by the writer, and found to be a female without a head. The spermathecae had been crushed against the legs and extruded, giving the appearance of the two side-pieces of a male. The known breeding places of *A. whitmorei* are saxicolous bromeliads, and it is probable that one such plant, containing larvae, had fallen into a ground-pool, where Dunn collected them.

No. 34. *Aedes,* new species. This was subsequently described by the writer as *Aedes* (*Soperia*) *pseudodominicii* (1936b). In coloration it much resembles *A. whitmorei.* All the males were captured, and the mesonotal markings were rubbed. The male terminalia are quite different from those of *A. whitmorei.* Neither species has terminalia with claspettes. No associated larvae were obtained.

No. 35. *Aedes septemstriatus* D. & K. The larva of this species has not been described, as the writer's material has been lost.

No. 41. *Culex* (*Carrollella*) *iridescens* Lutz. Dyar (1928), in a key to the larvae of *Culex*, does not separate those of *secundus* from *iridescens* (see dichotomy 51b, p. 280). The subgeneric name *Carrollia* was given to *iridescens* by Lutz in 1905. The name *Carrollella* Lutz dates from 1921 (Dyar, 1928, p. 269). It is not known why Dyar used the subgeneric name *Carrollella* in "The Mosquitoes of the Americas" (1928, pp. 280-285).

No. 45. *Culex* (*Carrollella*) *infoliatus* B.-W. & B. The writer remains of the opinion that *bihaicolus* D. & N. T. 1927 is a synonym of *infoliatus*. As stated, Dyar found no characters whereby the larvae of the two supposed species can be distinguished, and "the single slide of the male terminalia of *bihaicolus* in the U. S. National Museum collection is in such poor shape that no details can be made out" (Komp, 1936a, p. 64). However, Lane (1953, p. 497) gives a key to the male terminalia of *bihaicolus* and *infoliatus*, and treats them as distinct species on pages 509 and 510, respectively.

No. 48. *Culex* (*Mochlostyrax*) *distinguendus* Dyar. This species was described (Dyar, 1928, p. 305) without a figure of the male terminalia. Rozeboom and Komp (1950, fig. 25) give a figure taken from the lectotype selected by them: Slide 2327 U. S. N. M. The material collected in Restrepo has been lost, but Dr. R. H. Foote of the U. S. National Museum has described the larvae (1954) from material obtained elsewhere.

No. 50. *Culex* (*Mochlostyrax*) *inhibitator* D. & K. This is probably *Culex erraticus* D. & K. 1905, according to King and Bradley (1937). They say (p. 355) "Several of the species described from the American tropics appear to be indistinguishable from *erraticus*, as now defined, and are provisionally included in its synonymy." The type locality for *inhibitator* is the island of Santo Domingo (Hispaniola).

No. 51. *Culex* (*Mochlostyrax*) *bastagarius* D. & K. This name has many synonyms, including *vapulans* Dyar 1920, *alfaroi* Dyar 1921, *innominatus* Evans 1924, and *cuclyx* D. & S. 1924. Rozeboom and Komp (1950) give a figure (Fig. 10) of the male terminalia.

No. 54. *Culex* (*Microculex*) sp. The terminalia of the male specimen were later dissected, and the species was found to be *C.* (*Microculex*) *stonei* Lane & Whitman 1943. Lane (1953, vol. 1, p. 521) gives the distribution as Trinidad, B. W. I., and states that *ocellatus* D. & K. 1905 is a synonym. The *C.* (*Microculex*) *ocellatus* of Theobald 1903 is a *Melanoconion*, later described as *C. automartus* Root (Rozeboom & Komp, 1950, fig. 59).

No. 67. *Anopheles* (*Nyssorhynchus*) *bachmanni* Petrocchi. This species is now known as *Anopheles* (*N.*) *triannulatus* Neiva & Pinto 1923. The latter name was given to an aberrant specimen, with extra black rings on the hind tarsi, such as occur in *A. albimanus bisignatus* and *trisignatus* Hoffman, from Mexico and the lower Rio Grande valley in Texas. The usual form of *triannulatus* has only the base of the fifth hind tarsal segment black.

No. 68. *Anopheles* (*Nyssorhynchus*) *tarsimaculatus* Goeldi. This is *A.* (*N.*) *rangeli* Gabaldon *et al.* (1940). It was determined as such by examination of the male terminalia. The distribution given by Russell, Rozeboom and Stone

(1943, p. 49) as Trinidad, B. W. I., is erroneous, the locality being La Trinidad, Venezuela. The writer has seen specimens collected by F. M. Root from this locality, in the collection of the School of Hygiene and Public Health, Johns Hopkins University. *A. rangeli* was not found in Trinidad, B. W. I., during an extensive survey by Downs, Gillette and Shannon (1943, p. 29).

No. 69. *Anopheles* (*Nyssorhynchus*) *albitarsis* Arribalzaga. This is *A.* (*N.*) *pessoai* Galvão & Lane (1936). Lane (1953) makes *A. pessoai* a synonym of *A. braziliensis* (Chagas) 1907, but gives no reason for the change in nomenclature. Russell, Rozeboom and Stone (1943, p. 48) give the name as *pessoai* and the incorrect date 1937, as does Lane in Boyd's ''Malariology,'' Vol. 1, p. 403, 1949.

No. 77. *Anopheles* (*Kerteszia*) *boliviensis* Theobald. Dr. Ernesto Osorno M. (Komp and Osorno M., 1936) ''in January, 1936 . . . succeeded in breeding from larvae found in bromeliads near Restrepo two males of this species. The corresponding larval skins were preserved. . . . In *boliviensis* the single elements of the palmate hair are slender, lanceolate, with pointed tips. . . . The obvious differences separating the species from the common *A. bellator* of Panama [now known to be *neivai* H., D. & K. (Komp, 1937)] are, in the female, the presence of scales on the abdominal segments. . . .'' No other species of *Kerteszia* has scales on the abdominal tergites. This species occurs also in Peru and Bolivia (Songo, Bolivia, is the type locality).

No. 78. *Anopheles bellator* D. & K. A mixture of species was described here. The larvae collected by Dr. Jorge Boshell from uncut bamboo stems produced females, which the writer later described as *A.* (*K.*) *bambusicolus* (Komp, 1937). The larvae collected from saxicolous bromeliads by Dr. E. Osorno-Mesa produced adults of a species later described as *A.* (*K.*) *homunculus* by the writer (1937). This species is also found in Trinidad, B. W. I. The writer also described (1937) *A.* (*K.*) *anoplus* from a single male produced from a larva collected at Restrepo by Dr. Osorno. ''This larva was found in a bromeliad, and was thought to be the same as that of *homunculus*. However, on examining the male terminalia, the mesosomal leaflets found in *homunculus* were not present in *anoplus*, although the form of the ventral lobe is nearly the same. . . .'' Lane (1953, p. 287) makes *anoplus* a synonym of *homunculus*, stating ''The leaflets [of the mesosome] can be vestigial or absent.''

Regarding *A. bambusicolus*, the writer again found larvae in uncut bamboo internodes, some at 35 feet from ground level, north of Villavicencio, Colombia, in 1944. Unfortunately, no males were reared from these larvae. Lane (1953) gives figures (265, p. 282) of the male genitalia of *A. bambusicolus*, with the legend ''. . . based on Coutinho 1946, thesis, 78, figs. 11 and 12. . .'' Two theses by Coutinho are quoted in Lane's references, neither dated 1946. One is dated 1947 (Fac. Med. S. Paulo (Thesis) 53), and the other is dated 1950 (Fac. Med. S. Paulo (Thesis) 58). However, the files of the U. S. National Museum on Culicidae contain a thesis by Coutinho dated December 1947 (Coutinho, 1947), which gives distributional data only, stating on page 74 that *A. bambusicolus* was found in Londrina, State of Paraná, Brazil. This thesis contains no figures. If Coutinho presented two theses, one in 1947 and one in 1950, the files of the U. S. National Museum contain no evidence of the 1950 Coutinho thesis mentioned by Lane. We suspect an error of citation by Lane. The male genitalia of *A. bambusicolus* were described and figured by Coutinho (1946), but the figure given in this paper bears no resemblance to that copied by Lane (1953) and given as figure 265 (page 282). The question remains unsolved as to the origin of the latter figure, as it is entirely different from the one originally presented by Coutinho (1946).

Addenda

In addition to the Anopheline species mentioned above, males of *A. pseudopunctipennis* Theobald were captured in the forest near Villavicencio by the writer in 1944; larvae of *A. darlingi* Root were collected from roadside pools with grass along the road from Villavicencio to Restrepo during the same period. In spite of the presence of this dangerous vector, malaria did not seem to be a problem either in Restrepo or Villavicencio. Altogether, about 20 species of Anopheles are known from the Restrepo-Villavicencio area. Bates (1949) refers to the colonization of *A. strodei* Root in his Villavicencio laboratory, and Antunes (1937) found *Anopheles* (*Lophopodomyia*) *squamifemur* at Vega Grande; Municipio of Restrepo, in 1935.

Summary

This paper corrects certain errors of identification made by the writer in 1936 (Komp, 1936a), and gives bibliographical references to several new species of mosquitoes later described by him and others from the Restrepo-Villavicencio area in Colombia. Some notes on revised nomenclature are given, as well as the relation of some species to sylvan yellow fever.

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ANNOUNCEMENT

Short scientific articles, not illustrated, two double-spaced typewritten pages in length, are welcome and will usually receive prompt publication. References to literature should be included in the text.

COMPARATIVE BIONOMICS OF TWO SPECIES OF HELIODINES ON MIRABILIS [1]

(Lepidoptera, Heliodinidae)

By Clifford Wester, *112 Park Ave., Stroudsburg, Pa.*

Introduction

In the years 1947 through 1953, I investigated the life histories of a number of insects found associated with the wild four-o'clock plant, *Mirabilis nyctaginea* (Michaux) MacMillan, in central Illinois. Below I present, in a comparative way, the main results of my studies on the taxonomic and bionomic differences between two congeneric micromoths, *Heliodines nyctaginella* Gibson, whose larva feeds on the leaves of *M. nyctaginea*, and *Heliodines ionis* Clarke, which develops as a borer in the stalks of *M. nyctaginea*.

Recognition

In the original description of the adult *Heliodines ionis*, Clarke (1952) stated that these two species of *Heliodines* are so similar superficially that they may be separated only by the absence of the narrow black area on the basal portion of the forewing of *ionis*. In the course of my observations, I discovered supplementary superficial characteristics on the antennae, on the wings, and in the alar expanse as follows: the antennae of *ionis* are entirely black, while those of *nyctaginella* have faintly white tips; the costal spots on the forewing of *ionis* are all approximately of the same size, while the two anterior costal spots on the forewing of *nyctaginella* are larger than those on the posterior portion of the wing; the alar expanse of *ionis* is about 9 to 12 millimeters (Clarke, 1952), while that of *nyctaginella* is about 8 to 10 millimeters.

Generations per Year

Nyctaginella probably has five generations per year, while *ionis* probably has only three. This statement is based on data secured by rearing in the laboratory the larvae of both species, and noting the time required for their development; and from observing the emergence of the adults in the field.

The Eggs

The eggs of both species are oval in form, and are approximately the same in size. Those of *nyctaginella* are pale lemon yellow in color, and the chorion is deeply punctate. The eggs of *ionis* are a pale salmon color, and the chorion is sculptured with a reticular pattern.

H. nyctaginella lays its eggs on the petiole of the leaf, the underside of the blade along the midrib, or on the upperside of the blade near the base. *H. ionis* lays its eggs on the axillary bud that grows in the axil of each leaf. The eggs of *nyctaginella* hatch in about three days, while those of *ionis* hatch in about four days.

[1]This article is part of a thesis submitted to the Faculty of the Graduate College of the University of Illinois in partial fulfillment of the requirements for the degree of Doctor of Philosophy, 1954.

The Larvae

Both species have five feeding-growing stadia in each generation. *H. ionis* has one additional stadium, making a total of six, in the third generation, during which the larvae do not feed, and do not grow. This is the overwintering stage for this species.

The newly-hatched larvae of *ionis* are waxy white in color with blackish-brown heads and cervical shields. The second, third, and fourth instars maintain this appearance, except that the anal plate becomes blackish-brown. In the fifth stadium, the larvae are spotted in appearance, white with mottled medium-brown heads, and have dark brown cervical shields, anal plates, and pinacula. At the beginning of the sixth stadium of the third generation, they become pale lemon yellow with head capsules of the same color, except the adfrontal areas and the mouth parts, which are russet brown. The cervical shields, anal plates, and pinacula are not pigmented, and are of the same color as the body.

The first three instars of *nyctaginella* are waxy white in color with blackish-brown heads and cervical shields, and bear a close superficial resemblance to the corresponding instars of *ionis*. The fourth instar of *nyctaginella* has three color phases. Immediately after moulting, the body is dull greenish brown. As the head capsule darkens in color, the body gradually changes to a dirty yellowish white. Just prior to the fourth moult, the body becomes tawny in color. The color of the head capsule is the same as that of the earlier instars. The fifth instar also has three color phases. Immediately after the fourth molt, the body is dark walnut-brown. This color gradually changes to golden-brown. When the larva is nearly full grown, the body becomes seal-brown. The cervical shield remains blackish-brown, but the head capsule of the fifth instar is medium-brown.

The larvae of *nyctaginella* are leaf-skeletonizers, and feed on the mesophyll of the leaves of the wild four-o'clock plant, but do not eat the veins. They also feed on the flower buds when these are present. The larvae of each stadium, except the first, construct webs under which they feed. The webs made on the bud-clusters are quite shapeless in form, and are found between the involucres. Those made on the leaves are thin sheets of silken meshwork stretched across the depression on the upper side of the leaves formed by the angle of the blades at the midribs. Each web is attached at all points on the leaf surface except at the petiole, where there is an opening through which the larva leaves the web after it has consumed nearly all the plant tissue under the web.

When the webs are first constructed, they are almost transparent, but as the larvae feed, they deposit feces on them, so that by the time most of the leaf material has been consumed, the webs are covered with black fecal material.

The newly-hatched larvae feed on either the underside of the blade, or on the upperside, depending on where the eggs from which they are hatched were laid. However, towards the end of the first stadium, all are found on the upperside of the leaf. This instar does not construct webs, but the larvae feed as they move about over the leaf. The other instars feed only on the upperside of the leaf. The larval feeding period is about twelve days.

The larvae of *ionis* are borers in the stems of the wild four-o'clock plant. The newly-hatched larvae enter the stem at the base of an axial bud, and always tunnel downward in the stem, where they feed on the succulent pithy center. The tunnels are nearly straight, and of about the same diameter as the larvae creating them. The fecal pellets are packed in the tunnels in the wake of the feeding larvae.

Near the end of the fifth stadium, the larvae hollow out cavities, or cells, in the stems. This is accomplished by continuing to feed at one location, and by packing the fecal pellets at the two ends of the feeding area. The result of this activity is a hollow chamber that may measure up to six centimeters in length and eight millimeters in diameter in the larger stems. The larvae pupate in these cavities. The larval feeding period is about twenty-five days.

The Prepupal Period

When the larvae of *nyctaginella* reach full growth, they cease feeding, and lie motionless under the web for a period of about five hours. At the end of that time, they leave the web, travel to the ground, and pupate there.

When the larvae of *ionis* reach full growth, they cease feeding, and begin to cover the interior of the hollow chambers in the stems with silk. When the cells are completely lined with silk, the larvae chew an exit hole through the stem, and then spin a silk septum across the cell just behind the exit hole. Behind this septum, the larvae pupate. The exit holes will be used by the adult moths to escape from the interior of the stems. In the case of the overwintering generation, the exit holes are not made until the following spring just prior to pupation.

Overwintering

H. nyctaginella overwinters in the pupal stage, probably under plant debris near the host plant. *H. ionis* overwinters in the larval stage inside the silk-lined cavities in the plant stems. Soon after the cells are completely lined with silk, the larvae of the third, or overwintering, generation shed the mottled medium-brown head capsule and spotted postcephalic cuticle of the fifth stadium to become pale lemon yellow in color, which is characteristic of the sixth stadium. They overwinter in this stage without feeding or growing.

Shelford (1929) proposed that the term "diapause" be used where insects enter a state of dormancy due to internal factors, and that the term "hibernation" be used for overwintering due to external factors, such as low temperatures or lack of food. If these terms be accepted in this sense, it may be that both *nyctaginella* and *ionis* enter the winter in a state of diapause, and complete their overwintering in a state of hibernation. It seems probable that *ionis* enters the winter in diapuase, since it begins to build its winter cells as early as the latter part of August, and the larvae become dormant as early as the first week in September in central Illinois. At that time, the temperature is well above freezing, and there is sufficient food available. In nature, the period of dormancy continues until about the middle of May, at which time pupation begins to occur. However, larvae brought into the laboratory in November and kept indoors, pupated early in January. Larvae brought into the laboratory late in February, pupated early in March.

A similar condition was noted in *nyctaginella*. Some of the pupae formed in the laboratory early in September emerged as adults from late in January to early in March. Most of the pupae formed in the laboratory emerged as adults by late April. In nature, the adults do not appear until early May in central Illinois.

It may be that both *nyctaginella* and *ionis* enter the winter in a state of diapause, but at some time during the winter, the factor, or factors, that induce diapause cease to function, and the two species complete their period of dormancy in a state of hibernation.

Summary

Although the adults of *nyctaginella* and *ionis* are superficially similar in habits and appearance, and some similarity exists among their eggs and their larvae, a study reveals some outstanding differences between the two species. The larvae of *nyctaginella* are leaf-skeletonizers, while those of *ionis* are borers. *H. nyctaginella* completes five generations per year, while *ionis* has only three. *H. nyctaginella* overwinters as a pupa, while *ionis* spends the winter in the larval stage.

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BOOK NOTICE

THE WORLD OF BEES, by Gilbert Nixon. 214 pp., 16 figs. Philosophical Library, N. Y., 1955. $4.75.

This book presents in a general way basic information on the life history and behavior of both solitary and social bees, most of which occur in England. There are more than twenty chapters discussing such topics as metamorphosis, adaptations of the bees to pollen and nectar collecting, habits of various kinds of solitary and social bees, symbionts and parasites of bees, senses and flight of bees, and others. This is an entertaining and factually accurate introduction to the fascinating world of bees, and is recommended to the layman or beginning entomologist.—KARL V. KROMBEIN, *Entomological Research Branch, U. S. Department of Agriculture, Washington, D. C.*

WILLIAM H. WOOD KOMP
1893 - 1955

Medical entomology lost one of its most outstanding and devoted workers and our Society one of its oldest members by the death on December 7, 1955, of Dr. W. H. W. Komp. William Komp was born March 16, 1893, of American parents in Yokohama, Japan, where his father was a buyer for an American import company. He came to the United States with his parents at an early age, lived in New York City for several years, then in Rutherford, New Jersey, where he attended high school. He showed unusual interest in natural history as a boy and accumulated a large collection of insects.

After a year at Massachusetts State College and New York University, young Komp transferred to Rutgers University, New Brunswick, New Jersey, to major in economic entomology under the direction of Dr. Thomas J. Headlee. He received the Bachelor of Science degree in 1916 and the Master of Science degree in 1917. He continued his graduate studies toward a doctor's degree on a competitive fellowship at Cornell University during 1917-1918.

His studies interrupted by the war, he accepted a commission in the Regular Corps of the Public Health Service in 1918, served in extra-cantonment mosquito control on the Gulf coast of Mississippi and in other control activities in that state until 1921. His earlier experience during summer vacations with Dr. Headlee, draining marshes for mosquito control in New Jersey, adequately qualified him for this assignment. In 1921 he was detailed as an assistant to Dr. Marshall A. Barber. Together they studied many phases of malaria in the southern states during the following years, and participated in the development of the use of Paris green as a mosquito larvicide and the staining of thick blood films for use in large-scale malaria surveys. In late 1924 Komp and Barber traveled to Honduras, where they assisted in a malaria survey at one of the hospitals of the United Fruit Company. During this, his first of many trips in the American tropics, Komp's earlier interest in mosquito taxonomy was enormously stimulated by the tremendous number of mosquito species he encountered there. With Dr. Barber and Dr. Herbert Clark, then a Navy physician, Komp spent additional time in Haiti for the United Fruit Company and the Public Health Service. While on these visits he collected mosquito material at every opportunity, and during his annual leaves spent considerable time at the U. S. National Museum with Dr. Harrison G. Dyar. He had early recognized the value of species differentiation and accurate identifications in control, and continued throughout his career to collect material wherever and whenever he had the opportunity, and to pursue taxonomic studies at night and on weekends and holidays.

From 1926 to 1929, Komp assisted Barber in the investigation of malaria among the Pueblo Indians in New Mexico, after which Barber left the Public Health Service to study yellow fever in West Africa, and Komp returned to further mosquito control work in Georgia. In 1930, again in company with Dr. Clark, he traveled to the Coto region of Panama, where he studied the epidemiology of an indigenous monkey malaria.

Early in 1931 Komp was detailed to the Gorgas Memorial Laboratory, where he spent the next 16 years of his entomological career. During this time he studied, with Dr. Clark, the possibility of the control of tropical malaria by the use of drugs. Much of this work took place in the vicinity of five small native villages on the banks of the upper Chagres River. Reports on the progress of this long-term experiment were published each year of the ten years. During this time he demonstrated the cyclical nature of malaria in Panama and contributed important information on the use of atabrine as an antimalarial. It was also during this period that Komp became thoroughly familiar with the mosquito fauna of the area, and over a period of five years developed the basic steps in his well-known microdissection and staining techniques for the study of the male terminalia of mosquitoes.

In 1935 Dr. Fred Soper of the Rockefeller Foundation borrowed his services from the Public Health Service for a mosquito faunal survey of a jungle yellow fever outbreak area in Restrepo, Colombia. This proved to be one of the most physically rigorous but at the same time most rewarding experiences of his tropical career. Living conditions were hard, but Komp accumulated the larvae and associated adults of a vast number of South American mosquito species during this five-month tour of duty and by doing so contributed a great deal to our knowledge of Neotropical mosquitoes. The following year he conducted a mosquito survey of Guayaquil, Ecuador, a well-known center of yellow fever. In 1937 he was appointed a Traveling Representative of the Panamerican Sanitary Bureau. During this period Komp, while identifying large numbers of mosquitoes from various sources, discovered the presence in British Honduras of *Anopheles darlingi*, the principal vector of malaria in the Amazon basin. He participated in an expedition to Stann Creek, the source of this material, where he found additional *darlingi*. In 1941 he went to Trinidad, where he studied bromeliad malaria, and then to the Galapagos Islands, where he encountered and recorded many interesting medically important insects other than mosquitoes.

By this time, as a result of intensive collecting throughout the Caribbean Area, Komp had obtained sufficient material to publish "The Anopheline Mosquitoes of the Caribbean Region." This comprehensive and careful work was illustrated with original drawings of all stages of the 22 species of the region, and contained workable keys to the species in English and in Spanish. Its completion was timely, and it was considered to be of such value to the war effort that it was published first by the Army Medical Department as a "House Document" of Congress in 1942, and later as a Bulletin of the National Institute of Health. It remains the definitive work on the subject.

In 1942 he returned to Washington to receive a new assignment, this time as Consultant in Malariology for the Division of Health and Sanitation of the Institute of Inter-American Affairs. In this role he traveled in almost every South American country, consulting with local authorities on methods of malaria survey and control, and collecting throughout the area himself. During this time he served also as chairman on a Committee on Entomology of a Board established by the Commanding General, Caribbean Defense Command, to study the effectiveness of DDT applied from airplanes in *Anopheles* control.

Returning to the United States in 1947, he turned to taxonomic studies of the Neotropical mosquitoes of which he had an extensive collection. Included were a large number of new species of several genera which he set about to describe in preparation for proposed revisions of several important genera. In November of 1948 he was appointed to the Board of Scientific Advisers of the Gorgas Memorial Institute, a position to which he was reappointed each year thereafter. Trips in 1949 to Guatemala and British Honduras, and in 1951 to Costa Rica interrupted his hours over a microscope, but his return once more brought him to his beloved taxonomic studies. He collaborated with Dr. L. E. Rozeboom of the Johns Hopkins School of

Hygiene and Public Health in the revision of the *Culex* genus *Melanoconion*. His untimely death brought to an end a monographic revision of the genus *Haemagogus* on which he had been engaged for some time.

Dr. Komp was a fellow of the American Association for the Advancement of Science, and a member of the American Mosquito Control Association, the American Society of Tropical Medicine and Hygiene, the Entomological Society of America, the Entomological Society of Washington, and the Chi Psi fraternity. He was especially honored by membership in the exclusive American Academy of Tropical Medicine, the Washington Academy of Medicine, and the Sociedad Venezolano de Ciencias Naturales. Komp served as vice-chairman and acting chairman of the National Malaria Society (1940-1941) while that organization was known as the National Malaria Committee, as a member of the Board of Directors (1947-1949), as Vice-President (1950) and as President-elect (1951). To Komp goes a large share of credit for the accomplishment of the mission of the Society, which amalgamated with the American Society of Tropical Medicine just before his term as President.

While an undergraduate at Rutgers he met and married Mildred Crowell, who at the time was director of Camp Fire Girls' activities. They shared an interest in birds, a favorite study of Mrs. Komp. Dr. Komp is survived by his wife, a daughter Anita (Mrs. Harry M. Williams) and a granddaughter, Connie, of Baltimore, Maryland, and a sister, Mrs. C. R. Comes, of Long Island, N. Y.

William Komp liked symphonic and classical choral music, an interest which he may have inherited from his paternal grandfather, who had immigrated to the southern United States from Essen, Germany. As a boy in New York he sang in the Boys' Choir of St. Thomas' Episcopal Church. He was bass soloist in The Clock Church in New Brunswick, a leader of his college glee club, a member of the Fife and Drum Corps at Rutgers, directed the choir of the Episcopal Cathedral in Ancon, Canal Zone, and sang second bass in the Washington, D. C., Choral Society. He once sang a solo in Carnegie Hall. Photography, both still and motion, was a favorite hobby. In earlier days he did portrait work. In Latin America he made many colored movies of the people at work, of fiestas, and scenery, and of his own family.

In recognition of his achievements, his alma mater, Rutgers University, on October 6, 1955, conferred upon him the honorary degree of Doctor of Science.

His death at the age of 62 years terminated a life of research and benefaction in which he was active until the last day. Bill Komp will be greatly missed by a host of friends throughout the world.

PAUL A. WOKE, *Chairman*
ALAN STONE
RICHARD H. FOOTE

LIST OF PUBLICATIONS OF W. H. W. KOMP

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LAWRENCE PECK ROCKWOOD, 1886-1955

Lawrence Peck Rockwood, 69, widely known American entomologist and writer and member of our Society since 1918, died at Forest Grove, Oregon, on April 14, 1955.

Born at Waterbury, Connecticut, on October 13, 1886, he was son of Charles Henry and Alba Peck Rockwood. He was also great-grandson of Professor William Dandridge Peck (1763-1822) of Harvard, who is recorded by Dr. L. O. Howard as being "our first native scientific entomologist," and who, in addition to writing numerous entomological publications from 1795 to 1819 inclusive, was also first instructor in entomology to Thaddeaus William Harris (1795-1856).

With such an inherited background it is not a matter of surprise that from early boyhood onward, the youth became more and more interested in natural history, particularly in plant, bird and insect life, and in making various collections within the scope of these studies. He was graduated in 1912 from the Massachusetts Agricultural College with the degree of Bachelor of Science in Biology.

On August 30, 1912, he entered the service of the United States Department of Agriculture, Bureau of Entomology, Division of Cereal and Forage Insect Investigations, under the leadership of Professor F. M. Webster (1849-1916). For a brief period he was associated in temporary work on wireworms with James A. Hyslop, then in charge of the Hagerstown, Maryland, laboratory. Soon, however, he became associated with P. H. Timberlake at the Salt Lake City, Utah, laboratory from 1912 to 1915 in colonization of alfalfa weevil parasites, then being shipped by Dr. W. R. Thompson from Europe. In 1915 he moved to the Forest Grove, Oregon, laboratory and entered upon investigations, with C. W. Creel, of various alfalfa and clover insect pests, and, upon resignation of Mr. Creel July 28, 1919, was placed in charge of that laboratory.

In the years of highly productive work that followed, his studies were on general agriculture, botany, plant pathology and climatology. For a considerable period his major entomological investigations included taxonomy of certain Orthoptera and larval and adult Phalaenidae, and development of entomogenous fungi. While he conducted investigations of and published on Hessian fly, wheat stem maggot and other cereal pests, his work gradually tended more toward clover and alfalfa insects. Eventually he became generally identified with control of forage crop pests of the Western United States, and more particularly those of the Pacific Northwest. This honored place he has long held in that field of research, and his technical papers, some times in joint authorship with associates, have become well known and are widely used.

In addition to papers already noted dealing specifically with certain cereal pests, as well as those on various individual forage crop insects, he likewise published on pea aphids, Western spotted cucumber beetle, ladybird beetles, wireworm and alfalfa weevil fungi, and others.

His leadership at the Forest Grove, Oregon laboratory continued until his retirement from public service on October 31, 1948. It was characteristic that he continued thereafter with the Department as a Collaborator, without pay, for the remainder of his life, and lived to publish on research he had previously performed.

His memberships, in addition to that in our Society, include Phi Kappa Phi, Gamma Sigma Delta (Oregon chapter 1927), American Association of Economic Entomologists, Entomological Society of America, and Ancient Free and Accepted Masons. He was a Fellow of the American Association for the Advancement of Science.

On December 9, 1916, he was united in marriage with Miss Ethel Maude English (deceased 1946). Their children, Mary Rockwood Cowan, Major William Peck Rockwood, and Harry English Rockwood, and six grandchildren and one brother (Nathan C. Rockwood), have survived him.

He was a man of high ideals and sterling qualities of mind and heart. Quiet, unassuming, friendly, a good citizen and a loyal friend, he was definitely of the student type, and he had numerous intellectual interests in addition to his scientific studies. A lover of books and an omnivorous reader in world literature, it was his good fortune to have a remarkably exact, almost photographic memory of what he had read, and his ability to relocate needed data to volume and page at times made him the envy and the despair of less gifted colleagues. His attainments in scholarship, his high character, and his kindliness won for him over the years many friends who were appreciative of his intrinsic worth. They held him in high regard and will long cherish his memory.

JOSEPH WADE

BOOK REVIEW

LINK, V. B., 1955. A History of Plague in the United States. Public Health Monograph No. 26, pp. 1-120.

This excellent history presents in a single publication the most detailed account to date of the various outbreaks of plague in San Francisco, Seattle, the Gulf Coast cities and Los Angeles. In addition there are accounts of plague epidemics in 1912 and 1921 in Puerto Rico and from 1900 to date in Hawaii—both United States possessions where the Public Health Service has carried out important control and research studies. Entomologists will be particularly interested in Chapter XII, *Modern Plague Control Methods*, with its emphasis on rodent flea control by 10% DDT dusting followed by the newer rodenticides, and in Chapter V, *Plague in Wild Animals*, with its detailed history of sylvatic plague in this country. The photographs showing collection and shipment of ectoparasites and the laboratory phases of plague isolation work are among the finest ever published. The summary tables contain much detailed information of interest including a listing of known human plague infections in United States from 1900 to 1951, totaling 523 cases with 340 deaths. There have been no human cases of plague reported in this country during 1952, 1953 and 1954.

The final chapter, *Treatment and Prophylaxis of Plague*, discusses the value of killed and avirulent live vaccines and the remarkable results achieved with the new drugs, sulfadiazine and streptomycin, when treatment is begun in the early stages of the disease.—HARRY D. PRATT, *Communicable Disease Center, U. S. Public Health Service, Atlanta, Georgia.*

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 647th regular meeting of the Society was held in Room 43 of the U. S. National Museum on Thursday, October 6, 1955, and was attended by 41 members and 20 visitors. President T. L. Bissell called the meeting to order at 8:00 PM and the minutes of the previous meeting were read and approved.

President Bissell announced the deaths of *L. P. Rockwood, Ralph Sasscer* and *Carl Heinrich.*

E. N. Cory, R. H. Nelson and Alan Stone will comprise the committee to present nominations at the November meeting for officers for 1956, President Bissell announced.

The following new members were elected: *David G. Kissinger*, Dept. of Entomology, University of Maryland, College Park; *Dr. Roy J. Parker*, 8511 Tahona Drive, Silver Spring, Md.; *George H. Berg*, Room 319, Custom House, New Orleans 16, La.; *Billy A. Butt*, Entomology Branch, U.S.D.A. Research Center, Beltsville, Md.; and *Ellis Gilmore Macleod*, Star Route, Dayton, Md.

R. H. Nelson circulated a copy of a brochure prepared by the Entomological Society of America on opportunities in entomology.

For the benefit of the younger members, T. E. Snyder talked briefly about the personalities of some of the distinguished members recently lost by the Society. Dr. Marlatt's integrity and fearlessness, Ralph Sasscer's friendly helpfullness, and Carl Heinrich's hospitality at the Annex meetings in his home in the early 1930's are outstanding traits that highlight the memories of these men. After the regular Society meetings, members were invited to Carl's home where he, his daughter Clara, and his wife entertained his friends and their wives. At these Annex meetings the spirit and enthusiasm of the early days of the Society at the Sängerbund Hall were recaptured. Some members were field naturalists, a disappearing group. Dr. Mann says he learned much entomology from the inspiring talks of the late Dr. Schwarz and from the lively discussions which followed. (Speaker's abstract.)

The first of the principal speakers of the evening was Mr. Robert Mitchell, Fish and Wildlife Service, who spoke about *The Control of Insects by Birds and Mammals*. Because birds bear such high aesthetic appeal to man, their practical value has been greatly overemphasized, sometimes to the point of their being considered indispensable. Much of the supporting evidence regarding their importance has been based on the insect content of bird stomachs, combined with hypothetical calculations on the fecundity of insects. Undoubtedly the aggregate number of insects consumed is tremendous, but the significance and effectiveness of such feeding in respect to insect control and crop protection is extremely difficult to appraise because of the complex relationships among hosts, parasites, predators, disease, weather, and other factors affecting insect populations. Instances were cited in which insectivorous birds and mammals have definitely played an important role in insect control and crop protection. The indispensability of these agents, however, is questionable. (Speaker's abstract.)

International Malaria Control Projects were described by Mr. Donald R. Johnson of the Division of International Health, Public Health Service. There are two principal sources of international assistance available to economically underdeveloped countries of the world for malaria control operations. These are (1) the multilateral associations such as the World Health Organization and United Children's Funds and (2) the bilateral programs of the International Cooperation Administration. The U. S. Government presently is extending malaria control assistance to 17 countries, including the Philippines, Formosa, Vietnam, Cambodia, Laos, Indonesia, Thailand, Pakistan, India, Nepal, Iran, Ethiopia, Liberia, Mexico, Ecuador, Colombia and Honduras. In addition, several other programs are contemplated during the present fiscal year. The total U. S. cost for bilateral programs is approximately 8.5 million dollars per year. These monies are used to provide technical assistance, insecticides, sprayers and other equipment needed for the programs. The principal method of malaria control is by the application of residual insecticides to the inside wall surfaces of the houses. DDT and dieldrin wettable powders are the two materials being relied upon at present for this residual application. Antimalarial drugs are also used but to a lesser extent than insecticides. The problem of resistance has complicated the success of the malaria control programs and presently is most serious in Greece and Indonesia. An effort is being made to obtain malaria eradication in many countries before the presently available chlorinated hydrocarbon insecticides are no longer effective. Color slides were shown by Mr. Johnson to demonstrate malaria control operations in a number of Asian countries. (Speaker's abstract.)

Visitors presented to the Society were *Dr. Kenneth E. Frick, Mr. Richard Streckenbach, Mr. Colin Campbell* and *Mrs. Donald R. Johnson.*

The meeting was adjourned at 10:07 PM.—KELLIE O'NEILL, *Recording Secretary.*

The 648th regular meeting of the Society was called to order by President T. L. Bissell at 8:00 PM in Room 43 of the U. S. National Museum on Thursday, November 3, 1955. Fifty-seven members and twenty-nine visitors attended. The minutes of the previous meeting were read and approved.

Alan Stone for the Nominating Committee announced the nominations for offices to be filled at the Annual Meeting. (Note: Officers for the year 1956 are presented on the inside front cover.—Ed.)

The following new members were elected: *Bohdan Maksymiuk*, Forest Insect Laboratory, Agricultural Research Center, Beltsville, Md.; *Dr. Kenneth E. Frick*, Irrigation Experiment Station, Prosser, Wash.; *Colin E. Campbell*, 7820 Glenbrook Road, Bethesda, Md.; and *Miss Helle Starcke*, 4000 Cathedral Ave., N.W., Apt. 630B, Washington, D. C. Miss Starcke and Mr. Maksymiuk were introduced during the meeting.

The desirability of changing the December meeting date, which coincides with that of the Entomological Society of America in Cincinnati, was discussed. It was agreed to leave the decision to the Executive Committee, which President Bissell announced would have its scheduled fall meeting on November 8.

Elizabeth Haviland spoke briefly about Theodore J. Auzoux, distinguished French anatomist, who was born in France in 1797 and died in Paris in 1880. His greatest fame came from the popularizing of anatomy. He made models of human and animal organs; these could be taken apart. A two-foot model of a silkworm made in Dr. Auzioux's shop was exhibited. The fact that this model has been at the University of Maryland for many years was illustrated by an early photograph of an entomology class. The photograph was of a class taught by Willis G. Johnson; Thomas B. Symons, a former member of this Society, was a student at that time. (Speaker's abstract.)

The recent death of Harvard physiologist W. J. Crozier, who did much of his work on insects, was announced by F. L. Campbell. The relationship between temperature and animal activities was the basis of Dr. Crozier's studies.

R. H. Nelson exhibited a copy of *Sarcophaga and Allies in North America,* published by the Thomas Say Foundation in 1916. A number of copies of this supposedly out-of-print book were recently found and bound by the Entomological Society of America; this represents a lapse of nearly 40 years between publication and binding.

The scheduled program consisted of notes and exhibitions by the following six speakers:

Ashley B. Gurney, *Population and Distribution Studies of Grasshoppers:* a preliminary taxonomic study of *Melanoplus mexicanus* and its relatives (is) currently under way, in cooperation with A. R. Brooks of Saskatoon, Canada, who independently has found that the aedeagus of *M. spretus* is distinctive from that of *M. mexicanus* (as commonly identified in the United States and Canada). The true identity of *mexicanus* has been clarified by an examination of Saussure's type specimens, loaned from Geneva, Switzerland, and it is restricted almost entirely to Mexico. The several other species and subspecies of the complex are recognizable by male genitalic characters, and their geographic distribution presents a very interesting situation, which, when correlated with biological information, may help to clarify some of the problems of applied entomology.—(Speaker's abstract.)

Reece I. Sailer, *Review of Literature on Hybridization of Insects:* The amount and nature of the literature on hybridization of insects and other animals was discussed. Of 165 references, 52 concerned Lepidoptera and 51 involved species of Diptera. (Speaker's abstract.)

K. V. Krombein, *Life Histories, Habits and Behavior of Solitary Wasps:* The solitary, wood-boring vespid wasp, *Symmorphus canadensis* (Sauss.), which provisions its nest with leaf-mining beetle larvae, was discussed. Kodachromes to illustrate some details of behavior and life history were shown. (Speaker's abstract.)

T. J. Spilman, *Some Difficulties in Determining the Khapra Beetle:* Field identification of larvae of *Trogoderma* is almost impossible because of microscopic characteristics. Individual variations, present in the adults as well, make comparisons with large series necessary. (Speaker's abstract.)

Alan Stone, *A World Catalog of Mosquitoes:* the scope and purpose of a world catalog of mosquitoes and the methods used in gathering the data were described. This is a project being carried out with Cmdr. K. L. Knight under an ONR grant to the Smithsonian Institution. (Speaker's abstract.)

J. F. Gates Clarke, *Western Insect Haunts:* These were illustrated in a series of colored slides, with descriptions by Dr. Clarke.

Among numerous visitors attending were *Mr. and Mrs. L. M. Chilson* of Hawaii; *C. B. Spencer, Daniel Sonenshine,* and *Robert Evans* from the University of Maryland; *Mitchell A. Byrd* and member *Edward L. Mockford* of Camp Detrick, Md.; *Fernando Lopez* of Mexico; *Mr. and Mrs. Castillo Graham; Max Day* from Australia; *John C. Lutz* of Philadelphia; *J. J. Murayama* from Japan; and *Stephen L. Wood* of Ottawa.

The meeting was adjourned at 9:50 PM.—KELLIE O'NEILL, *Recording Secretary.*

The Society held its 649th regular meeting jointly with the Biological Society of Washington on Tuesday, December 6, 1955, in Room 43 of the U. S. National Museum; it was attended by 59 Entomological Society members, and 18 visitors and Biological Society members. President T. L. Bissell called the meeting to order and the minutes of the preceding meeting were read and approved.

The following new members were elected: *C. B. Spencer,* 7403 Hopkins Ave., College Park, Md.; *Robert Evans,* 4509 Knox Rd., College Park, Md.; *W. G. Phillips, W. C. Harding* and *R. A. Bram,* Dept. of Entomology, University of Md., College Park; and *R. L. Pienkowski,* 489th Preventive Medicine Co., Ft. Meade, Md.

The annual report on the state of the Society was given by President Bissell. He appointed Howard B. Owens to represent the Society at the meeting of the Joint Board on Science Education for the greater Washington area. This board was set up by the Washington Academy of Sciences and the District of Columbia Council of Engineering and Architectural Societies in the interest of promoting science education.

Officers for 1956 were elected from the slate presented by the Nominating Committee. (Note: Officers for the year 1956 are presented on the inside front cover.—Ed.)

G. W. Wharton exhibited a slide showing a chigger in the act of biting a human. Roger Drummond exhibited a nest-funnel developed to give a continuous sample of Acarina living in nests. This apparatus is designed to allow for a continuous collection of nest-inhabiting arthropods. The top is a wooden nest box with a hardware cloth bottom. A funnel is attached to the bottom of the box. Collections are made in water which is contained in a bottle at the base of the funnel.

A mimeographed copy of the program of the Tenth International Congress of Entomology to be held at Montreal in 1956 was circulated by F. L. Campbell.

W. H. Anderson announced the death on November 11 of J. M. Swaine, formerly director of Science Service at Ottawa and an authority on bark beetles, a group on which he published fairly extensively.

J. S. Wade was appointed by President Bissell as chairman of the committee to prepare an obituary of A. F. Satterthwaite.

President G. C. Decker of the Entomological Society of America brought greetings in the name of that Society, and spoke of his confidence in its incoming president, B. A. Porter.

The principal paper of the evening was given by E. F. Knipling, Chief, Entomology Research Branch, on *Eradication of the Screw-worm by Releasing Gamma-Radiated Males and Potential Use of This Method to Control Other Pests.* The screw worm fly, an important parasite of livestock, was eradicated from the Island of Curaçao, Netherlands Antilles, by releasing reared flies made sexually sterile by exposure to gamma rays. Eradication was accomplished in a period of about 3 months by releasing about 400 sterile males per square mile per week. The ratio of sterile males released to those in the natural population was about 3-1 during the first generation. The mating of sterile males with the fertile females, which mate once only, caused a reduction in the subsequent generations, which in turn progressively increased the ratio of sterile to fertile insects to the extent that the natural population could not survive. The success of this experiment, which was undertaken after extensive laboratory studies and some field tests, indicates that this method may be practical for eradication from the southeastern states.

The possibilities of this approach for controlling other insects were discussed. For this procedure to be successful several requirements must be met: 1) the gamma ray treatment must not adversely affect the mating behavior of the insect; 2) a method of rearing the insect in large numbers must be available; 3) the insect to be controlled must occur in relatively small numbers, or some other control method must be employed to reduce the natural population; 4) the released male insects must disperse sufficiently to compete with the fertile males in the natural population.

The requirements that must be met make it apparent that the number of insects which can be controlled by utilizing sterile males will be few in number, but the method may be useful for controlling or aiding in the control of some of our more important insect species. (Speaker's abstract.)

Discussion by Mitlin, Reed, Woke, Barker, Heller, Davis, Sullivan, F. L. Campbell, Sabrosky, Phillip, Bissell, Stone, Gray, and others followed.

Norman Cannon from Illinois and *Cornelius B. Phillip,* visitors, and *John Belkin,* member from California, were introduced.

The meeting was adjourned at 9:35 PM.—KELLIE O'NEILL, *Recording Secretary.*

PROCEEDINGS

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THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings*.

MEMBERSHIP

Members shall be persons over 18 years of age who have an interest in the science of entomology. Annual dues for members are $4.00; initiation fee is $1.00 (U. S. currency).

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DR. ERNEST N. CORY TO BE HONORED

Dr. Ernest N. Cory, State Entomologist and Head of the Department of Entomology, University of Maryland is to be honored on Thursday, May 24, 1956, at the University of Maryland. For forty-seven years he has contributed unselfishly to the entomological profession, the University of Maryland, to agriculture, and to his fellow man. On numerous occasions his many friends have suggested that he be honored and given public recognition for his unselfish services. Recently a large group of these friends met and organized to consider the many suggestions. The group decided that a dinner be given in his honor, and at this dinner he be given an appropriate personal gift, along with a volume of personal letters from his friends, have his portrait unveiled, and a fund bearing his name established at the University to aid worthy students in Entomology.

The committee requested that all of Dr. Cory's many friends be invited to participate. The letter should be on $8\frac{1}{2}$"x11" paper, with a $1\frac{3}{4}$ inch margin on the left side, and sent preferably unfolded. Tickets for the dinner may be reserved now. Those desiring to make a contribution should make their check payable to the "Cory Fellowship Fund." Letters, contributions and orders for dinner tickets may be sent to George S. Langford, Department of Entomology, University of Maryland, College Park, Md. Price of dinner tickets \$3.00 each.

FOR FALL PUBLICATION

A CLASSIFICATION OF THE SIPHONAPTERA OF SOUTH AMERICA

WITH DESCRIPTIONS OF NEW SPECIES

by Phyllis Truth Johnson

Memoir 5
of the
Entomological Society of Washington

The study of South American fleas was begun in 1879 when Weyenburg published the first descriptions of species from that region, using specimens mounted on cardboard as was usual in that day. These fleas were restudied in balsam by Jordan and Rothschild in England shortly after the turn of the cenutry, and from that time to the present day a large number of siphonapterologists, both in England and the Americas, have contributed to this study. Dr. Johnson's work is the first comprehensive taxonomic treatment of the fleas of the region, which comprises Trinidad and all of the continent and its coastal islands. The contemplated 275 page volume will be indispensable to the serious student of this important order of insects.

Memoir 5 opens with two discussions of morphological characters, one devoted to the terms used in the taxonomic section and the other to their taxonomic validity and possible phylogenetic significance. All the families, tribes and genera known to occur in South America are completely described and illustrated, and the species within each genus have been listed with host and locality data. Descriptions of 17 new species and two new subspecies bring the total number to 170. Keys to families, tribes, genera, and species are included. The discussion of each genus is terminated by a section giving the synonymies of the hosts concerned. The 114 plates are said to contain among the best illustrations of fleas currently available, and are grouped according to family. A section alphabetically listing hosts, each with the fleas known to occur on it, recapitulates the host-flea information; sections dealing with references, systematic index and list of abbreviations close the volume.

The *Siphonaptera of South America* will be ready for distribution in the late Fall. Arrangements have been made to offer this Memoir at a *prepublication* price of $8.00 to members of the *Society* and $9.00 to non-members. Orders should be addressed to: *Mr. Herbert J. Conkle, Custodian, Plant Quarantine Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.*

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 58 APRIL 1956 NO. 2

A REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS HELLUOMORPHOIDES BALL, 1951[1]

(COLEOPTERA, CARABIDAE, HELLUONINI)

By GEORGE E. BALL, *Department of Entomology, University of Alberta, Edmonton.*

INTRODUCTION

This paper is intended to elucidate the taxonomic status of the named forms of North American *Helluomorphoides.* This is the first revision of this group since the publication of Le Conte's "Synoptic Tables" (1879). The only forms of this predominantly Neotropical genus included in this study are those which enter or are endemic in continental United States. A revision of the entire genus is precluded by the paucity of Neotropical material in collections.

I am indebted to the following entomologists for their cooperation in this study, particularly for the loan of material: Dr. Henry Dietrich, Cornell University; Dr. P. J. Darlington, Jr., Museum of Comparative Zoology; Dr. R. H. Beamer, University of Kansas; Dr. Howard E. Evans, formerly of Kansas State University; Dr. Mont A. Cazier, American Museum of Natural History; Dr. J. Manson Valentine, Alabama Museum of Natural History; Dr. A. B. Champlain, formerly of the Bureau of Plant Industry, Harrisburg, Pa.; Mr. Hugh B. Leech, California Academy of Sciences. In addition, I take this opportunity to thank Dr. V. S. L. Pate, formerly of Cornell University, Dr. Ralph L. Chermock, University of Alabama, and Mr. Barry D. Valentine, Cambridge, Massachusetts, for their numerous valuable criticisms and suggestions. Finally, I thank Drs. P. J. Darlington, Jr., Museum of Comparative Zoology, and Ross H. Arnett, Jr., formerly of the United States National Museum, for their cooperation and assistance during my two visits to each institution.

[1]This paper was submitted as a thesis to the Faculty of the College of Arts and Sciences, University of Alabama, in partial fulfillment of the requirements for the degree of Master of Science.

Taxonomic Treatment

As the material studied consisted of dead specimens, it was necessary to base taxonomic conclusions on morphological and distributional data, using the following criteria. Two similar forms were considered as distinct species if their geographical ranges overlapped, and if they exhibited no intergradation in at least one diagnostic morphological character in the area where they were sympatric. If such intergradation was found they were considered to be conspecific. If two forms were completely allopatric, as evidenced by available material, the criterion was the structure of the genitalia. If these were identical, the population samples were considered to be conspecific. If the genitalia were different the samples were considered to represent distinct species.

The material studied consisted of 792 specimens which were either borrowed from the museums noted in the acknowledgements, or collected by me. The range of variation of various structures was studied either by direct observation, or by actual measurement. Measurements were made with an ocular micrometer, in a binocular microscope. These were used to determine the following ratios:

1. Antennal segment 6-L/W: median length/median width;
2. W.pn/W.ant.seg.6: maximum width of pronotum/width of antennal segment 6;
3. L.pn/W.base: median length of pronotum/width of pronotum at base.

Total length is the sum of the lengths of the head, pronotum (along the median line), and elytra (along the suture). Width is the maximum width of both elytra taken together. In the species descriptions, each numerical character is presented as a series of three figures, the middle one representing the average value, and the other two the extremes (i.e. L.pn/W.base—1.22-1.24-1.30).

The shape of the pronotum varies somewhat intraspecifically, but when coupled with other characters it is quite useful in delimiting species and subspecies. The ratio of antennal segment 6 can be taken to represent the proportions of segments 5-10 for each of the forms studied, as these segments are essentially the same in relative proportions. The arrangement of the elytral punctures is clearest in the discal region of striae 1-6. Laterally and apically the punctation is usually more confused. The term "biseriate" as used in this paper

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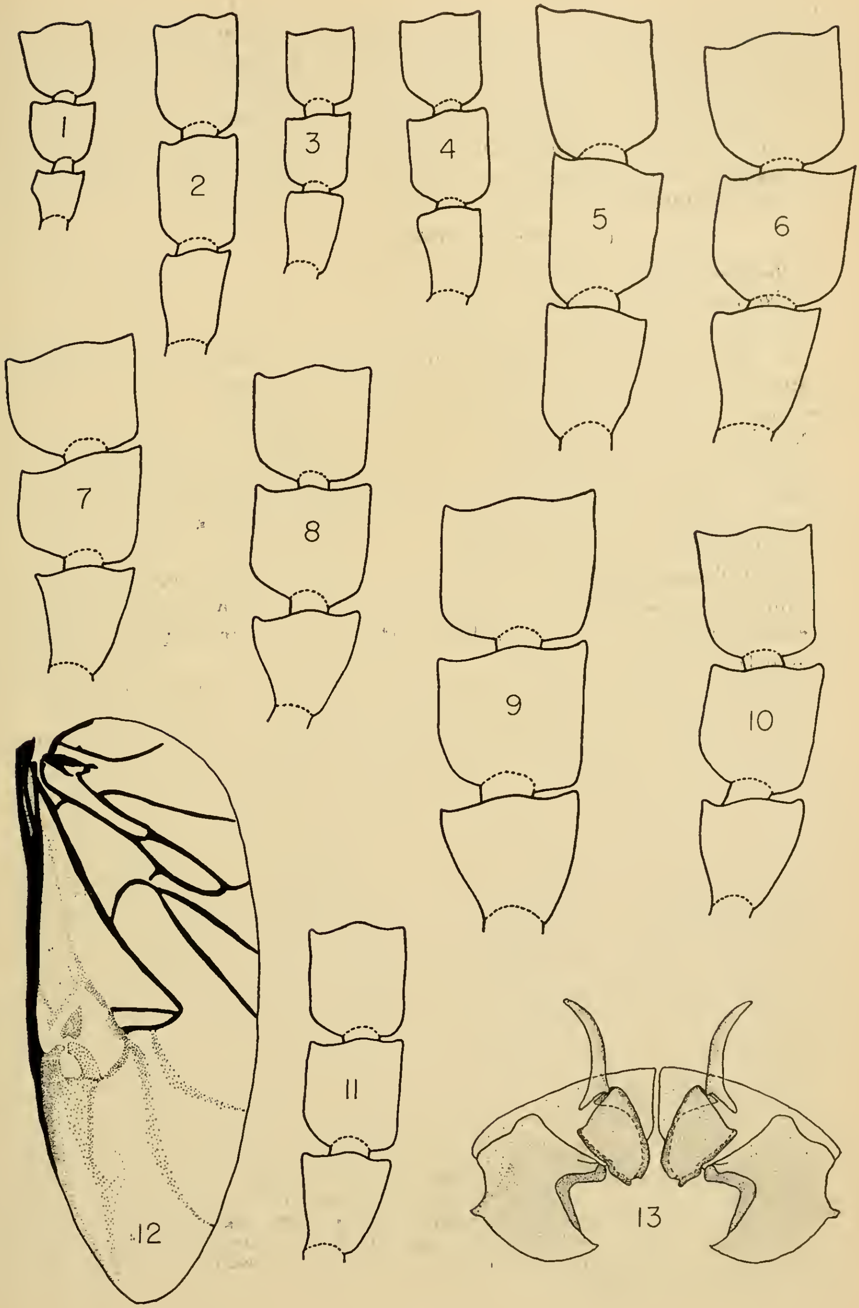
Fig. 1, right antenna, segments 4, 5, and 6, of *H. nigripennis*, Jamesburg, N. J.; Fig. 2, same of *H. ferrugineus*, Boerne, Tex.; fig. 3, same of *H. ferrugineus*, Brownsville, Tex.; fig. 4, same of *H. ferrugineus*, Stockton Pass, Pinaleno Mts., Ariz.; fig. 5, same of *H. praeustus floridanus*, "Fla."; fig. 6, same of *H. praeustus praeustus*, Grand Bay, Mobile Co., Ala.; fig. 7, same of *H. praeustus bicolor*, "Kansas"; fig. 8, same of *H. texanus*, Riviera Beach, Tex.; fig. 9, same of *H. clairvillei*, Ocala, Fla.; fig. 10, same of *H. latitarsis*, Parral, Chihuahua, Mex.; fig. 11, same of *H. papago*, Baboquivari Mts., Ariz.; fig. 12, left metathoracic wing of *H. ferrugineus*, Boerne, Tex.; fig. 13, female retractile plates, ventral aspect, of *H. ferrugineus*, Boerne, Tex.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means that the punctures are arranged approximately in two rows in striae 1-6; "triseriate" means that the punctures in these striae are approximately in three rows. It must be emphasized that these terms are not to be taken to be literally accurate but rather to express general impressions, because often the punctures are about but not quite bi- or triseriate in arrangement. For this reason it was finally deemed inadvisable to place much importance on intraspecific variation in elytral punctation.

Genus **Helluomorphoides** Ball, 1951

Helluomorpha Castelnau, 1834: 52, [in part].

Helluomorphoides Ball, 1951: 135-136.

Type of genus: *Helluomorpha texana* Le Conte, 1853: 374.

The name *Helluomorphoides* was proposed because the original name, *Helluomorpha* Castelnau, 1834, was apparently not available for this group of insects. See Ball (1951) for details.

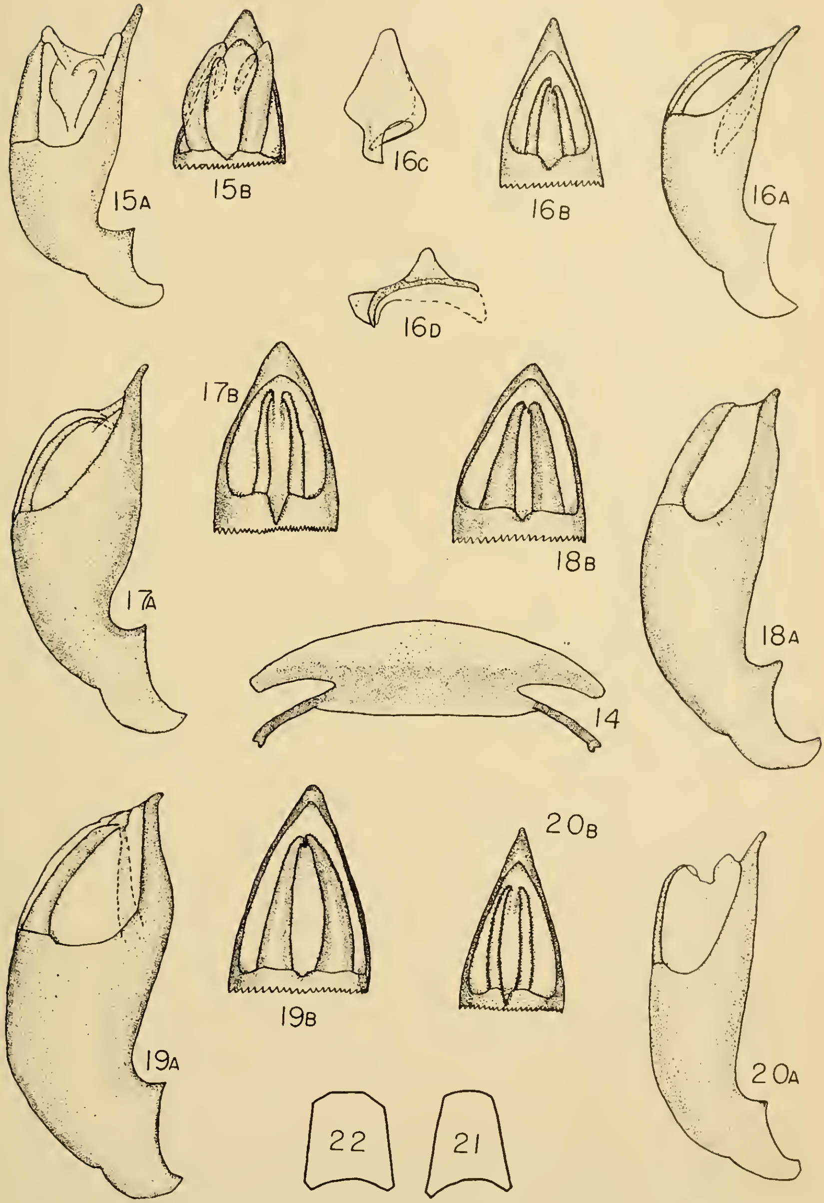
Diagnosis.—Head always with two supra-orbital setigerous punctures on each side; labrum evenly rounded, without an anterior median triangular prominence; ligula not fringed with setae, tooth of submentum triangular, not long and pointed; anterior femora without antebasal protuberances; wings fully developed; distribution North and South America.

The following generic description includes characters shared in common by those members of *Helluomorphoides* treated in this study. It seemed best to record them here, rather than repeating them in the description of each species.

Description.—Species of moderate size, depressed; punctate in varying degrees, punctures bearing short, pale yellow hairs.

Head approximately quadrate in outline, generally densely but finely punctate. Antennae clavate; segments 1-3 cylindrical, longer than wide, densely but finely punctate, punctures in approximately longitudinal rows on scape, in circular rows on pedicel, and scattered on segment 3, surface not granulate; scape as long as pedicel plus segment 3; segment 4 more or less compressed, generally widening somewhat from base to apex, surface not granulate, finely and irregularly punctate; segments 5-10 compressed (see Figs. 1-11), basal angles of each segment rounded, apical angles sharp, apical margin undulant, surface granulate-pubescent with exception of a glabrous triangular area in center of broad surface of each segment, base of this triangle at base of segment, apex not quite reaching apex of segment, impunctate except as noted under species descriptions, a series of long slender setae along apical margin of each segment; segment 11 distinctly longer

Fig. 14, tenth tergite, female, of *H. ferrugineus*, Boerne, Tex. Figs. 15, a & b, median lobe of *H. nigripennis*, So. Car.; a, left lateral aspect; b, apical portion, dorsal aspect. Figs. 16, a to d, male genitalia of *H. ferrugineus*, Stockton Pass, Pinaleno Mts., Ariz.; a, median lobe, left lateral aspect; b, median lobe, apical portion, dorsal aspect; c, left lateral lobe; d, right lateral lobe. Figs. 17, a & b, median lobe of *H. p. praeustus;* a, left lateral aspect; b, apical portion, dorsal aspect. Figs. 18, a & b, same of *H. texanus*, Concan, Tex.; figs. 19, a & b, same of *H. latitarsis*, Baboquivari Mts., Ariz.; figs. 20, a & b, same of *H. papago*, Fort Grant, Ariz.; fig. 21, hind tarsus, seg. 3, of *H. texanus*, Devera, Tex.; fig. 22, same of *H. latitarsis*, "Arizona."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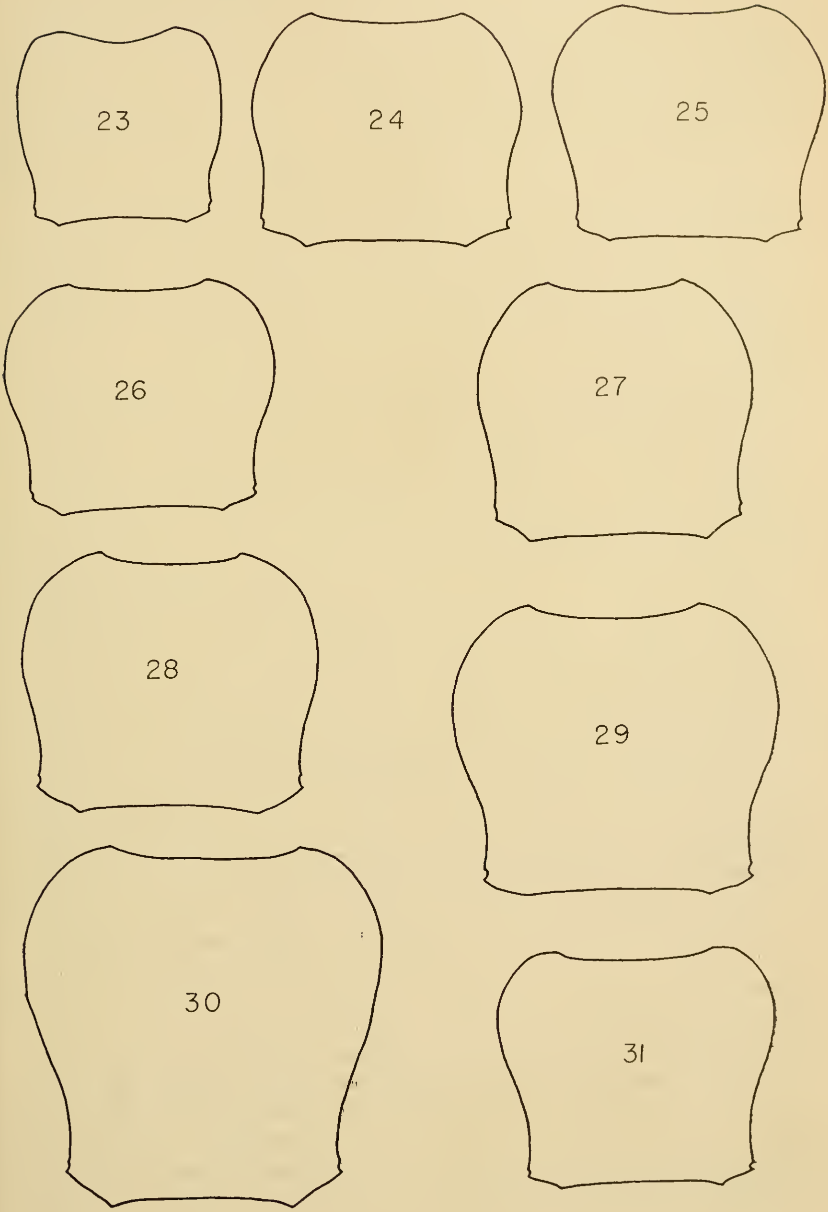
than wide and generally longer than any other segment, tapering to a blunt, rouned tip, triangular depression long and slender, extending for approximately ¾ the length of the segment, lateral areas as in segments 5-10, apical setae lacking. Eyes large and prominent, except as noted in species descriptions. Frontal grooves of head broad and shallow. Genae with a single row of punctures bordering ventral margin of eyes, and a cluster of punctures along inner margin bordering gula. Clypeus narrow, transverse, anterior margin slightly concave, and lateral margins slightly convex, densely punctate along anterior margin, very sparsely and finely so over rest of surface. Labrum large, completely concealing mandibles, a single row of punctures varying in number from 5 to 9, bordering the generally arcuate anterior margin. Mandibles stout, arcuate, acute at tip. Maxillary palpi stout, terminal segment more or less depressed and truncate at tip. Labial palpi shorter and not as broad as segments of maxillary palpi, terminal segment fusiform, and truncate at tip, penultimate segment bisetose. Ligula large, prominent; paraglossae reduced, adherent to sides of ligula. Submentum emarginate, with strong acute median tooth as long as lateral lobes. Gula impunctate.

Thorax. Pronotum as in Figs. 23-31; postero-lateral depressions broad and deep, generally densely punctate; propleurae sparsely and coarsely punctate; prosternum punctate at base, impunctate at apex; metasternum punctate along lateral margins, impunctate medially; metepisterna long and slender, coarsely and densely punctate. Legs of average length, femora and tibiae flattened, finely punctate; tarsal segment 4 emarginate, anterior tarsi the same in males as in females. Elytra widening somewhat from base to apex, apical margins truncate, humeri rounded, intervals in general only slightly elevated, the seventh generally obscure. Metathoracic wings fully developed (see Fig. 12), venation constant. Venter finely and densely punctate. Male genitalia with median lobe as in Figs. 15-20. Internal sac a large shapeless mass, devoid of spines or plates. Right lateral lobe as in Fig. 16d. Left lateral lobe as in Fig. 16c. Female retractile plates as in Fig. 13; tenth tergite as in Fig. 14.

Key to the Species and Subspecies

1. Elytra partly or wholly black or blue-black, at least darker than head and pronotum 2
   Elytra of same colour as head and pronotum, or lighter 4
2. Glabrous triangles of antennal segments 5-10 coarsely punctured, eyes relatively small, not prominent, elytra entirely blue-black, pronotum relatively large, elytral striae deep and narrow .... *nigripennis* Dejean
   Glabrous triangles of antennal segments 5-10 not coarsely punctured, almost smooth, eyes relatively prominent, pronotum average, colour of elytra varying from entirely black to apical ½ black, elytral striae variable 3

Fig. 23, pronotum, *H. nigripennis*, Clayton, Ga.; fig. 24, *H. ferrugineus*, Austin, Tex.; fig. 25, *H. p. praeustus*, Mt. Vernon, Ala.; fig. 26, *H. p. bicolor*, Wellesley, Mass.; fig. 27, *H. p. floridanus*, Type, Ormond, Fla.; fig. 28, *H. texanus*, Kingsville, Tex.; fig. 29, *H. latitarsis*, Huachuca Mts., Ariz.; fig. 30, *H. clairvillei*, "Florida"; fig. 31, *H. papago*, Huachuca Mts., Ariz.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3. Antennal segments 5-10 varying from slightly wider than long to slightly longer than wide (seg.6-L/W: 0.91-1.16); elytral striae relatively broad .... *praeustus praeustus* Dejean
   Antennal segments 5-10 distinctly wider than long, transverse, (seg.6-L/W: 0.57-0.91), elytral striae somewhat narrow .... *praeustus bicolor* Harris
4. Pronotum appearing long and slender (L/W.base 1.18-1.32), elytra lighter in colour than head and pronotum .... *clairvillei* Dejean
   Pronotum not appearing long and slender (L/W.base usually less than 1.18), elytra of same colour as head and pronotum 5
5. Elytral punctation very sparse, punctures tending to be arranged in discrete pairs, elytral striae very shallow, intervals broad, punctation of head and pronotum fine, terminal segment of maxillary palpus broad ..... *papago* Casey
   Elytral punctation variable, but always denser than above, punctures never tending to be arranged in discrete pairs, terminal segment of maxillary palpus variable 6
6. Antennal segments 5-10 relatively broad, longer than wide ,as long as wide, or distinctly wider than long (see Figs. 5-8 and 10), sclerotized strips of median lobe slender or broad at base 7
   Antennal segments 5-10 relatively slender, as long or distinctly longer than wide (see Figs. 2-5), median lobe slender, sclerotized strips slender at base 9
7. Sclerotized strips of median lobe narrow at base (see Fig. 17b), antennal segments 5-10 as long or distinctly longer than wide, punctation of elytral striae triseriate .... *praeustus floridanus,* new subspecies
   Sclerotized strips of median lobe broad at base (see Figs. 18b and 19b), antennal segments 5-10 as wide or wider than long, elytral punctation either distinctly biseriate, or tending to be triseriate 8
8. Basal angles of hind tarsal segments broad (see Fig. 22), sides of second and third segments parallel or almost parallel, terminal segment of maxillary palpus very broad, elytral punctation fine, tending to be triseriate, ventral surface of median lobe strongly sinuate in lateral aspect (see Fig. 19a) .... *latitarsis* Casey
   Basal angles of hind tarsal segments not broad, sides of second and third tarsal segments tapering from base to apex (see Fig. 21), terminal segment of maxillary palpus not as broad as in *latitarsis,* elytral punctation variable, biseriate in most individuals, but confused and triseriate in some, ventral surface of median lobe not as strongly sinuate as above (see Fig. 18a) .... *texanus* Le Conte
9. Apical portion of median lobe relatively broad in dorsal aspect (see Fig. 17b), apex not appearing long and slender in lateral aspect (see Fig. 17a), total length 15.4-18.4mm., antennal segments 5-10 longer than wide, elytral striae broad, densely and approximately triseriately punctured .... *praeustus floridanus* new subspecies
   Apex of median lobe relatively slender in dorsal aspect, long and slender in lateral aspect (see Figs. 16a and z); length 12.2-16.0mm., antennal segments 5-10 variable, but usually not wider than long *ferrugineus* Le Conte

Helluomorphoides nigripennis (Dejean)
(Figures 1, 15, 23)

Helluo nigripennis Dejean, 1831: 408
Helluomorpha nigripennis Castelnau, 1834: 52. Ibid, 1840: 47. Le Conte, 1879: 60.

The relatively small eyes, blue-black elytra with narrow, biseriately punctured striae, will serve readily to distinguish this species from all other known North American helluonines. The shape, and relatively large size of the pronotum, and the shape of the maxillary palpi are also of diagnostic value.

Description.—The measurements presented below are based on a series of 16 specimens. Length 9.0-11.1-14.0 mm., width 3.2-3.6-4.6 mm. Colour reddish-brown, except elytra which are blue-black, surfaces shining.

Head with vertex and front glabrous, shining, finely and somewhat sparsely punctate above eyes and along posterior margin. Terminal segment of maxillary palpus short, broadening distinctly from base almost to apex, then constricted very slightly, only slightly depressed. Antennae (Fig. 1): segment 4 slightly compressed, coarsely and densely punctate; segments 5-10 with glabrous areas coarsely and densely punctate, segment 6 L/W 0.71-0.87-1.00.

Pronotum as in Fig. 23, relatively large for genus, L/W.base 1.04-1.09-1.16, coarsely and sparsely punctate along margins and median longitudinal impression, irregular elongate areas on disc impunctate, shining; median longitudinal impression broad and deep. Hind tarsi slender, segments almost triangular, tapering strongly from apex to base.

Elytra with intervals high and rounded, striae narrow, biseriately punctate. Median lobe of male as in Figs. 15a-b.

Type and Distribution.—Lindroth (1955: 25) reports that no example of this species in the Oberthür Collection is marked as a Dejean type. No type locality other than "Amerique septentrionale" was indicated in the original description. The type specimen was sent to Dejean by Le Conte, and was therefore probably collected in southern Georgia, or southern New Jersey. This species appears to be confined to the Atlantic and Gulf coastal plain and piedmont, ranging eastward to Georgia from Texas, and northward as far as Massachusetts. It has not been reported from Florida. Life zones: Lower and Upper Austral. See Fig. 33.

25 specimens have been examined.

Helluomorphoides ferrugineus (Le Conte)
(Figures 2, 3, 4, 12, 13, 14, 16, 24, 32)

Helluomorpha ferruginea Le Conte, 1853: 373. Ibid, 1879: 60. Horn, 1881: t.9, fig. 103. Heyne-Taschenberg; 1908: 14.
Helluomorpha languida Casey, 1913: 90.

The slender antennae, slender terminal segment of the maxillary palpus and the relatively broad and shallow elytral striae serve to distinguish this species from the other members of the genus. *H. ferrugineus* can be most readily confused with *texanus,* but in the greater part of the area where the two are sympatric the discal elytral striae of the former are triseriately punctate, whereas those of the latter are biseriately punctate.

Geographical variation.—Specimens of this species which occur on the Atlantic Coast westward to the Edwards Plateau in Texas invariably have the elytral striae triseriately punctate. To the south and west, the elytral punctures are usually finer and less numerous, and in some specimens are arranged biserially. This persists across northern Mexico, and into southern Arizona and New Mexico. The type specimen of *Helluomorpha languida* (Brownsville, Texas) falls in the latter category. The western Texas sample (Fort Davis-Chisos Mountains-Alpine) seems to be intermediate between the two poorly defined conditions.

Specimens from southern Arizona seem to have relatively narrow pronota. To show this, the value of the width of the pronotum was divided by the value of the width of antennal segment 6 for each specimen. The results are presented in Fig. 32. Standard deviations and standard errors were calculated only for samples of 10 or more specimens. These data seem to indicate that while the central Texas (''Texas'' and Boerne) and southern Arizona samples are reasonably clearly differentiated, the difference is bridged by the geographically intermediate samples.

Three courses of action seem possible in the light of the data presented above. 1. The species *ferrugineus* may be divided into three subspecies: an eastern one (typical), to include specimens from the Edwards Plateau area, and eastward; characterized by larger elytral punctures, and greater average pronotal width; a southern Arizona race, smaller and fewer punctures on the elytral striae, and a narrower pronotum; and a central-southern race (*languidus* Casey), with average pronotal width intermediate between the other two races, and elytral punctation like that of the Arizona race. 2. *H. ferrugineus* could be divided into an eastern and western race, with specimens from Mexico and southern Texas being regarded as intergrades. 3. This species would not necessarily have to be divided. I prefer the third alternative because the punctation character is vague, and there is extensive overlap in relative width of the pronotum from sample to sample. Those wishing to apply a subspecific name to the southern Texas specimens may use *languidus* Casey. Then, specimens from the Edwards Plateau and eastward may be referred to *ferrugineus* (*s. str.*).

Description.—Measurements are based on a series of 132 specimens. Length 12.2-13.7-16.0 mm., width 4.4-4.9-9-5.8 mm. Colour uniformly reddish brown, some specimens slightly darker.

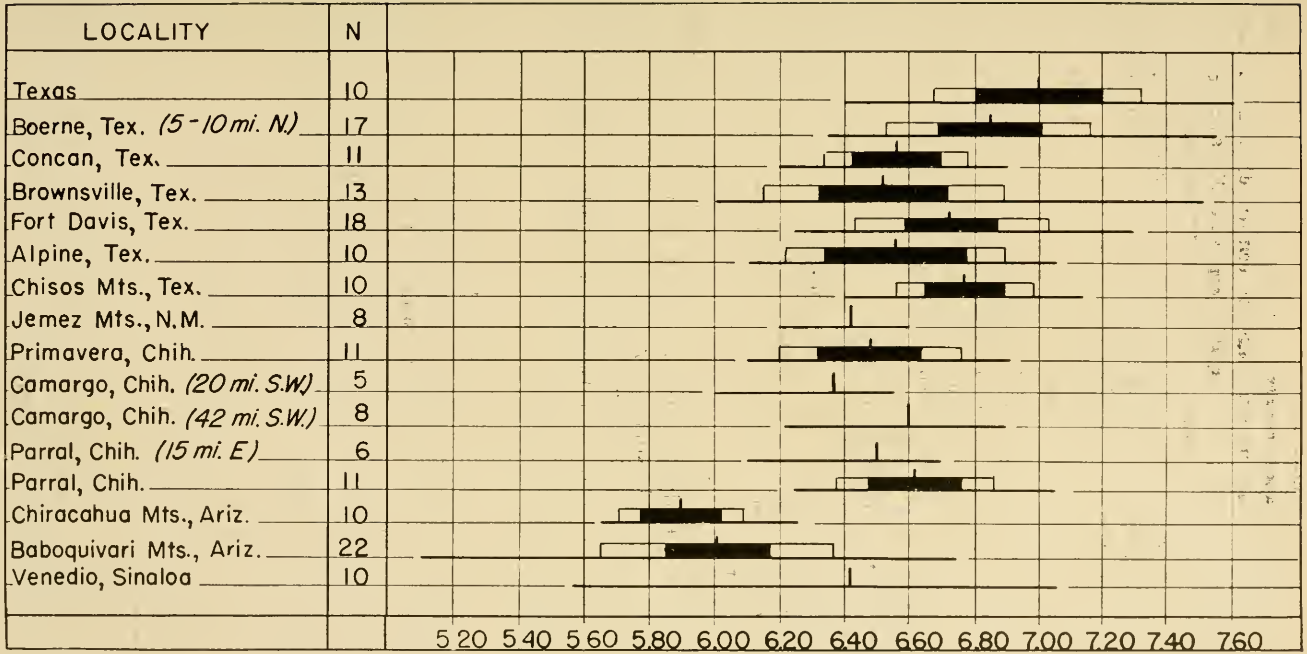

Fig. 32. Variation from east to west in the ratio W.pn./W.ant.seg.6 in samples of *H. ferrugineus*. Range of variation is represented by the heavy black horizontal line; mean by the short, heavy, vertical lines. The blackened part of each bar represents 2 standard errors of the mean on either side of M. One-half of each black bar plus the white bar at either end represent 1 standard deviation on either side of the mean.

Head finely and evenly punctate. Terminal segment of maxillary palpus slender, not widening from base to apex, depressed. Antennae (Figs. 2-4): segment 4 irregularly and somewhat finely punctate, slightly compressed, slender, widening only slightly from base to apex, not triangular; segments 5-10 as long or longer than wide, relatively slender, compressed; segment 6 L/W. 1.00-1.12-1.39.

Pronotum as in Fig. 24, L/W.base 0.93-1.01-1.11, coarsely and densely punctate excepting a narrow longitudinal area each side of median longitudinal impression. Median longitudinal impression broad, shallow, and punctate.

Elytra with striae broad, punctation variable, as noted in preceding section. Median lobe of male genitalia as in Figs. 16a-b.

Notes on types.—The type of *ferrugineus* Le Conte (sex undetermined) is in the Le Conte collection, MCZ No. 5838, and was collected in "Texas." The punctation of the elytal striae and proportions of the pronotum suggest that this specimen was taken in the eastern part of Texas. *H. languidus* Casey is represented in the Casey collection, USNM No. 47589 by the type and three paratypes, all of which were taken at Brownsville, Texas. As the external diagnostic characteristics of *languidus* grade into those of typical *ferrugineus,* and as the male genitalia of specimens referable to *languidus* are the same as those of typical *ferrugineus,* I feel certain that these two forms are conspecific.

Distribution.—This species ranges from Sinaloa, Mexico and southern Arizona, eastward along the Gulf Coast to the Atlantic Coast, and northward to central North Carolina, and possibly to southern New York; northward in the Great Plains to northeastern Kansas. Life Zones: Upper Sonoran to Lower, and possibly Upper Austral. See Fig. 34.

385 specimens have been examined.

Helluomorphoides praeustus (Dejean)

Helluomorphoides bicolor Harris is treated as a subspecies of *praeustus* because the geographical ranges of the two forms are complementary, and the diagnostic features form an almost continuous series of variation. The genitalia of the two forms are identical.

The diagnostic features lie in the shape of the median lobe of the male genitalia (Figs. 17a-b), and in the shape of the pronotum (Fig. 25).

Hellcomorphoides praeustus praeustus (Dejean)

(Figures 6, 17, 25)

Helluo praeustus Dejean, 1825: 289

Helluomorpha praeusta Castelnau, 1834: 52. Ibid, 1840: 47. Le Conte, 1879: 61.

The black elytra, prominent eyes, proportions of the antennal segments, and relatively broad elytral striae will separate this subspecies from other forms of the genus.

Description.—Measurements are based on a series of six specimens. Length 15.3-16.2-18.8 mm., width 5.0-5.6-7.0 mm. Colour: head, thorax, and basal ½-⅙ of elytra reddish-brown, rest of elytra black; abdomen blackish-brown, excepting lateral margins and apices of each segment, which are reddish-brown.

Head finely and sparsely punctate, vertex and front impunctate. Terminal segment of maxillary palpus widening slightly from base to apex, relatively broad. Antennae (Fig. 6): segment 4 slightly wider at apex than at base; segments 5-10 more or less quadrate, segment 6 L/W. 0.91-1.01-1.16.

Pronotum as in Fig. 25, coarsely and somewhat sparsely punctate excepting a narrow longitudinal strip each side of median longitudinal impression; this impression broad and deep, sparsely and coarsely punctate. Tarsi slightly darker than pronotum, segments of hind tarsus average in shape and proportions.

Elytra with striae broad, rather finely and densely punctate, the punctures more or less triseriate in arrangement. Median lobe of male genitalia as in Figs. 17a-b.

Type and distribution.—The type, which has not been examined in this study, is in the Dejean collection (Rene Oberthur Collection), and is said by Lindroth (1955: 25) to differ from *bicolor* in that the segments of the flagellum are narrower. It was collected in ''Amerique septentrionale,'' probably in southern Georgia or New Jersey, as it was sent to Dejean by LeConte.

The range of this subspecies is poorly known. Blatchley (1910: 155) notes that it is recorded from Concinnati, Ohio, but I have seen specimens only from Alabama and New Jersey. It would seem that this form is found on the Gulf and Atlantic coastal plain and piedmont and in the Mississippi basin, ranging northward on the Atlantic coast to southern New Jersey, and in the Mississippi basin to southwestern Ohio. This subspecies has been recorded from Sand Point and Tampa, Florida by Leng (1915: 589). Life Zones: Lower and Upper Austral. See Fig. 34.

Helluomorphoides praeustus bicolor (Harris)

(Figures 7, 26)

Zuphium bicolor Harris, 1828: 117.

Helluo laticornis Dejean, 1831: 407.

Helluomorpha pubescens Klug, 1834: 77.

Helluomorpha bicolor Le Conte, 1879: 61.

A combination of dark coloured elytra and transverse flagellar segments are sufficient to distinguish this subspecies from the other North American *Helluomorphoides.*

Description.—Measurements are based on a series of 33 specimens. Length 12.0-14.0-16.6 mm., width 3.4-4.9-6.0 mm. Colour: head, thorax, and basal ⅙ of elytra reddish brown, in most specimens, some, however, with elytra entirely black, teneral specimens with elytra entirely reddish brown, abdomen coloured as in the typical race.

Punctation of head as in typical subspecies. Terminal segment of maxillary palpus as in typical subspecies. Antennae (Fig. 7): segment 4 as in *p. praeustus;* segments 5-10 transverse, segment 6 L/W. 0.57-0.75-0.91.

Pronotum as in Fig. 26, L/W.base 1.00-1.04-1.19, punctation as in typical subspecies. Elytral striae narrower than in *p. praeustus*, densely and confusedly punctate. Median lobe of male genitalia as in typical subspecies.

Notes on synonymy.—The synonymy of *bicolor* was presented by Le Conte (1879). I have not seen the types of *laticornis* or *pubescens*, but their descriptions seem to fit *bicolor*.

Type and distribution.—The type is a male, in the T. W. Harris Collection at the Museum of Comparative Zoology, MCZ No. 28191. There is also one paratype, sex undetermined, in the same collection, MCZ No. 28192. They have been examined in this study. The type locality, as given in the original description, is the "Vicinity of Salem," Essex County, Massachusetts.

This is the northernmost race of *praeustus* ranging westward from the east coast to the western edge of the Great Plains, northward to southeastern South Dakota and southern Michigan, southward to central Kansas and Missouri (recorded from Vigo, Posey, and Crawford counties by Blatchley, 1910: 156); on the East Coast, northward to northeastern Massachusetts, southward at least to northern Virginia, and probably as far as Georgia (Fattig: 1949). Life Zones: Upper Austral and Upper Sonoran. See Fig. 34.

A total of 98 specimens representing this subspecies have been examined in this study.

Helluomorphoides praeustus floridanus, new subspecies
(Figures 5, 27)

This subspecies can be distinguished from the other two races of *praeustus* by the concolorous elytra, and from *ferrugineus* by its larger size, broader elytral striae, somewhat broader maxillary palpi, and by the structure of the male genitalia. Although the antennal segments resemble somewhat those of *texanus* in that they are relatively broad, these two forms can be distinguished by the punctation of the elytral striae: biseriate in *texanus*, and triseriate or dense and confused in *floridanus*. The tarsal segments are relatively longer than are those of *texanus* and the posterior sinuation of the pronotum is much less pronounced. *H.p. floridanus* can be distinguished from *clairvillei* by its broader, more densely punctate elytral striae, and relatively broader pronotum.

Description.—Type, male, length 16.6 mm., width 5.8 mm. Colour uniform reddish brown.

Head finely, rather densely punctate. Terminal segment of maxillary palpus rather broad. Antennae (Fig. 5): segment 4 moderately compressed, slightly wider at apex than at base; segments 5-10 longer than wide, segment 6 L/W 1.12, glabrous triangles faintly indicated.

Pronotum as in Fig. 27, L/W.base 1.07, coarsely and densely punctate, especially along lateral margins; median longitudinal impression punctate, a narrow medial area each side of this impunctate.

Elytral striae very broad, rather densely punctate, punctation approximately triseriate. Median lobe of male genitalia as in *p. praeustus*.

Allotype, female, length 17.8 mm., width 6.4 mm. Colour slightly darker than that of type. Terminal segment of maxillary palpus relatively slender, but broader than that of *ferrugineus*. Antennal segment 6 L/W 1.08. Pronotum relatively broader than that of type, posterior sinuation of lateral margins more pronounced, L/W.base 1.06. Elytral striae as in type, punctation dense, not as distinctly triseriate as in type.

Paratypes, 4 males and 2 sex undertermined, length 15.4-17.4-18.4 mm., width 5.0 6.0-6.4 mm. Colour same as type. Terminal segment of maxillary palpus with about same proportions as that of allotype. Antennal segment 6 L/W 1.08-1.10-1.15. Pronotum with posterior incurving of lateral margins variable, from relatively slight to as pronounced as in allotype, L/W.base 1.03-1.05-1.10. Elytra exhibiting slight variation in width of striae, these broad and generally densely punctate, the punctation approximately triseriate. Median lobe of male genitalia same as that of type.

Types and distribution.—All specimens are from the northeastern portion of peninsular Florida. They have been returned to the museums from which they were borrowed. The type locality is Ormond, Volusia County, Florida. Leng's Florida record of *ferruginea* (1915: 589) probably refers to this subspecies. Life Zone: Lower Austral. See Fig. 34.

Type, male—Volusia County, Ormond, Mch. 24, 1899, W.S.B. coll., Wickham Coll., 1933, [U.S. Nat'l. Museum]. Allotype, female, Volusia County, De Leon Springs, 7.5.29, John George Gehring coll., [Museum Comparative Zool.]. Paratypes—Volusia County: one male, De Leon Springs, [Museum Comparative Zool.]; Duval County: one male, Jacksonville, [Cornell Univ.]. St. Johns County: one sex undet., St. Augustine, [Calif. Acad. Sci.]. "Fla.": one, abdomen missing, [Museum Comparative Zool.]; one,male, [U.S. Nat'l. Museum].

Relationships of praeustus.—Le Conte (1853) noted in his description of *ferrugineus* that "except by the form of the antennae, this species almost exactly resembles *H. praeusta* and *laticornis;* the thorax is, however, less narrowed posteriorly." However, an inspection of the range of variability of antennal segment 6 shows that *bicolor* (*laticornis*) forms a continuous series with *praeustus* and *floridanus*, and *floridanus* and *ferrugineus* overlap 100 *per* cent with regard to this character. The shape of the pronotum is also sufficiently variable so that it does not constitute an absolute criterion for distinguishing between the two species, since the pronotum of *p. floridanus* resembles in shape the pronota of the Arizona specimens of *ferrugineus*. The partially black elytra will distinguish *p. praeustus* and *p. bicolor* from *ferrugineus*, but the elytra of *p. floridanus* have no black pigment, and therefore resemble those of *ferrugineus*. The elytral striae of *p. bicolor* are relatively narrow, while those of *p. praeustus* and *p. floridanus* are wider and densely punctate as in *ferrugineus*. There is also a slight difference in the shape of the median lobe which distinguishes all of the races of *praeustus* from *ferrugineus*. From these data it may be seen that *ferrugineus* and *praeustus* are really not very different, and that of the races of *praeustus floridanus* is the one that is most similar to *ferrugineus*.

To a certain extent, these species replace one another geographically. I have seen three specimns of *ferrugineus* from localities within the presumed range of *praeustus*. Of five specimens from Pottawattomie County, Kansas, four were typical *p. bicolor*, and the fifth typical *ferrugineus*. The specimens of *ferrugineus* from Southern Pines, North Carolina, were typical for that species. These data suggest that *ferrugineus* and *praeustus* do not interbreed, and thus may be considered to be specifically distinct.

Helluomorphoides texanus (Le Conte)
(Figures 8, 18, 31, 28)

Helluomorpha texana Le Conte, 1853: 374. Ibid, 1879: 61.

The following combination of characters separates this species from other members of the genus: colour uniformly reddish brown, antennal segments 5-10 usually slightly wider than long, pronotum wider than long, discal striae of elytra biseriately punctate.

Description.—Measurements are based on a series of 65 specimens chosen at random from localities throughout the range of the species. Length 13.8-15.6-17.3 mm., width 4.8-5.5-6.2 mm. Colour uniform reddish-brown, darker in some specimens.

Punctation of head fine and dense, especially in posterio-lateral areas, vertex impunctate with exception of line of punctures across middle. Terminal segment of maxillary palpus slightly but noticeably broader than that of *ferrugineus*, decidedly narrower than that of *latitarsis*. Antennae (Fig. 8): segment 4 somewhat compressed, approximately triangular in outline, somewhat coarsely and irregularly punctate; segments 5-10 relatively broad, averaging quadrate, segment 6 L/W 0.73-0.89-1.07.

Pronotum as in Fig. 28, L/Wbase 0.86-1.00-1.20, somewhat coarsely and densely punctate excepting narrow longitudinal area of disc each side of densely punctate median longitudinal impression; median longitudinal impression broad and shallow. Basal angles of hind tarsal segments narrow, sides not parallel, (see Fig. 21).

Discal elytral striae broad, punctation somewhat coarse, typically biseriate, but confused and triseriate in a few individuals. Median lobe of male genitalia as in Figs. 18a-b.

Type and Distribution.—The type specimen, which I examined, is a male. in the Le Conte Collection, MCZ No. 5837. The type locality is "Texas."

This species ranges from east of the Davis Mountains, Texas, and probably east of the Sierra Madre Occidentale in northern Mexico, northward in the Great Plains to southern Colorado and Kansas, and possibly Indiana (Blatchley, 1910: 156); on the Gulf Coast as far east as Alabama, and possibly Georgia (Fattig: 1949); not known from peninsular Florida. Life Zones: Upper Sonoran, and Lower and Upper Austral. See Fig. 33.

I have seen 150 specimens of this species.

Helluomorphoides latitarsis (Casey)

(Figures 10, 19, 22, 29)

Helluomorpha latitarsis Casey, 1913: 189.

The broad basal angles of the hind tarsal segments and the broad terminal segment of the maxillary palpus are the distinctive features of this species.

Description.—Measurements are based on a series of 39 specimens, except as noted below. Length 13.5-15.9-17.9 mm., width 4.6-5.8-6.4 mm. Colour uniform reddish-brown. Very similar in general proportions and appearance to *texanus* Le Conte.

Punctation generally finer than in *texanus,* head finely, densely, and evenly punctate. Terminal segment of maxillary palpus appearing very broad, lateral margins parallel. Antennae as in *texanus,* but averaging somewhat narrower (see discussion below, and Fig. 10).

Pronotum as in Fig. 29, L/W.base 0.94-1.05-1.13, posterior sinuation of lateral margins usually more pronounced than in *texanus.* Segments of hind tarsus with broad basal angles, sides parallel, and apical setae on each segment shorter than in *texanus* (see Fig. 22).

Elytral striae broad, punctures fine, typically confused, but biseriate in a few individuals. Median lobe of male genitalia generally as in *texanus* but with apex slightly longer and more slender, and ventral surface more strongly sinuate. See Figs. 192a-b.

Geographical Variation.—For purposes of this study, three samples are considered in some detail: one, from the Baboquivari Mountains of southern Arizona, is typical of specimens found in that state; a second is a composite sample from several localities in Chihuahua, Mexico; the third consists of specimens collected at Fort Davis, Texas. Mensural data for a sample of seven specimens from Alpine, Texas have been lost and therefore cannot be presented. However, this sample was very similar to the Fort Davis Sample in the characters noted below. See table I for data on variation in proportions of antennal segment 6.

These data were not analyzed statistically because their distributions did not seem to fit the normal curve of error (except the Baboquivari sample), and so a frequency distribution seemed the best way to present them. A trend in the flagellar segments from wider than long to longer than wide seems to be indicated, with the geographically extreme samples being morphologically extreme.

Table I. *Helluomorphoides latitarsis:* Frequency Distribution of Values for the Ratio Antennal Segment 6 L/W.

Values	Localities		
	Baboquivari Mts., Ariz.	Chihuahua, Mex.	Fort Davis, Tex.
0.75-0.79	2	1	
0.80-0.84	4	2	
0.85-0.89	5	2	1
0.90-0.94	3		1
0.95-0.99	1		2
1.00-1.04		6	3
1.05-1.09		2	1
1.10-1.14			6
1.15-1.19			1
N	15	13	15
Mean	0.87	0.97	1.04

The basal angles of the hind tarsal segments (especially segment 3) seem to be somewhat narrower and the segments appear to be slightly longer in the Fort Davis specimens than in the Mexican or Arizona samples. However, the angles are definitely broader than are those of *texanus.*

The elytral striae of the Fort Davis specimens are usually biseriately punctate, whereas the usual (but not universal) condition in the Mexican and Arizona samples is that the arrangement of punctures is more confused.

Thus it may be seen that the Fort Davis sample differs slightly from specimens occurring over the rest of the range of *latitarsis.* Further, the Fort Davis sample approaches *texanus* in elytral punctation and structure of the hind tarsal segments. (However, the male genitalia and terminal segment of the maxillary palpus are typical for *latitarsis* in this sample.). Originally, I interpreted this as evidence that the Fort Davis sample represented an intermediate population between *texanus* and *latitarsis,* but I now think that this view is incorrect, and that the two named forms though very similar morphologically, and apparently completely allopatric, are actually distinct species. However, the possibility that the Fort Davis, and presumably the West Texas population of *latitarsis* is of hybrid origin must be borne in mind, and deserves further investigation.

Type and Distribution.—The type is a male, in the Casey Collection, USNM No. 47590. "Arizona" is the only locality given in the original description, and so specimens collected in Arizona are typical from a nomenclatural point of view. I have seen and dissected the type.

This species ranges from western Texas to southern Arizona, as far north as Globe; southward on the Mexican Plateau at least to the state of Durango. See Fig. 33.

I have seen 74 specimens of this species.

Helluomorphoides clairvillei (Dejean)
(Figures 9, 30)

Helluo clairvillei Dejean, 1831: 406.

Helluomorpha clairvillei Castelnau, 1934: 52. Le Conte, 1879: 60.

A combination of large size, relatively broad flagellar segments, pronotum relatively elongate with narrow base, and head and prothorax darker in colour than elytra and abdomen, distinguishes this species from other North American helluonines.

Description.—Measurements are based on a series of 11 specimens. Length 16.0-18.4-21.0 mm., width 4.8-5.5-6.2 mm. Colour reddish-brown, head, prothorax and tarsi darker brown.

Head rather finely and densely punctate along lateral and basal margins, vertex impunctate. Terminal segment of maxillary palpus relatively narrow at base, broadening slightly to apex. Antennae (Fig. 9): segment 4 somewhat compressed, triangular in shape and densely punctate; segments 5-10 wider than long, compressed, segment 6 L/W 0.71-0.83-0.93.

Pronotum as in Fig. 30, L/W.base 1.18-1.25-1.32, coarsely and somewhat densely punctate along margins, and along the deep and broad median longitudinal impression; disc coarsely but less densely punctate than lateral areas. Hind tarsus, segment 3, widening only slightly from base to apex.

Elytra with intervals well defined, broad and rounded, striae each with two rows of punctures. Median lobe of the male genitalia as in *texanus*.

Type and Distribution.—Concerning the type, which is in the Dejean Collection Lindroth (1955:25) states: "*Helluo clairvillei* = *Helluomorpha clairvillei auct.* Compared with a male from Lucedale, Mississippi." I have seen the latter specimen. The type was collected by Escher in "Amerique septentrionale."

This species ranges on the Gulf and Atlantic coastal plains and piedmont from eastern Mississippi to central Florida, and northward to southern New Jersey. Life Zone: Lower Austral. See Fig. 33.

Notes.—This species seems to be closely related to *texanus* Le Conte, resembling that species in relative proportions of the antennal segments, shape of the median lobe of the male genitalia, and punctation of the elytral striae. Possibly *clairvillei* and *texanus* are subspecies, because the two forms to a large extent replace one another geographically. However, their ranges overlap in Mississippi, Alabama, and Georgia, and no intergrade specimens have been seen from this area. If the effects of the genetic factors determining shape and colour of the pronotum were essentially discontinuous, and if these were determined by a single pair of alleles, then morphological intergrades would not be expected, even though the two forms were capable of interbreeding. No genetic data are available, so it seems best to go on what is indicated by the morphological evidence.

A total of 18 specimens of this species have been examined.

Helluomorphoides papago (Casey)
(Figures 11, 20, 31)

Helluomorpha papago Casey, 1913: 190.

The outstanding characters of this species are the fineness and sparseness of the elytral punctation, the shallow elytral striae, and the broad terminal segment of the maxillary palpus. In most specimens the elytral punctures are arranged in discrete groups of two.

Description.—Measurements are based on a series of 10 specimens. Length 11.5-13.1-14.5 mm., width 4.0-4.5-5.2 mm. Colour uniformly reddish-brown.

Head shining, generally finely and somewhat sparsely punctate. Terminal segment of maxillary palpus broad, lateral margins parallel, as in *latitarsis*. Antennae (Fig. 11): segment 4 slightly broader at apex than at base; segments 5-10 varying from slightly wider than long to slightly longer than wide, relatively slender, as in *ferrugineus*, segment 6 L/W 0.93-1.03-1.27.

Pronotum as in Fig. 31, L/W.base 1.00-1.03-1.14, finely and sparsely punctate along margins, median longitudinal impression broad, shallow, punctation in general fine.

Elytra with intervals broad, shining, slightly elevated, striae each with a double row of a few fine punctures which are arranged more or less in discrete pairs. Median lobe of male genitalia as in Figs. 20a-b.

Type and Distribution.—The type, which has been examined in this study, is a male, in the Casey Collection, USNM No. 47588. The type locality is "southern Arizona." This species is found on the Mexican Placau, ranging northward from San Juan del Rio, Durango, Mexico, to the mountains of southern Arizona, and eastward to the Davis Mountains, Jeff Davis County, Texas. Life Zone: Upper Sonoran.

A total of 28 specimens have been examined in this study.

RELATIONSHIPS OF THE SPECIES

At this time it is impossible to consider more than the relationships of the North American species of *Helluomorphoides* to one another. These seven species can be arranged in four groups. 1. *H. nigripennis* is the most distinctive, and in some ways seems to be closer morphologically to the South American species than to the other forms which enter North America. 2. *H. ferrugineus* and *praeustus* seem to constitute a second group, as the two are closer to one another morphologically than either is to any other species. There seems to be a trend toward broadened flagellar segments within this group, and using this character as a criterion of degree of specialization, *ferrugineus* would be regarded as the more generalized of the two species and *p. bicolor* as the most specialized race of *praeustus*. 3. A third group includes *latitarsis*, *texanus* and *clairvillei*. Of these three species, *texanus* seems to be the least derivative, being average in proportions of the palpi, tarsal segments, and pronotum. *H. latitarsis* is derivative in proportions of the palpal and tarsal segments but is generalized in proportions of the flagellar segments, and of the pronotum, and *clairvillei* is derivative in colour pattern and proportions of the pronotum. 4. *H. papago*, like *nigripennis*, stands by itself. The data needed to asrrive at an understanding of the relationships of the groups to one another and to the other species of the genus are not available at present.

Geographical Distribution

(Figures 33, 34)

The Tribe Helluonini is discontinuously distributed. It is represented in the Australian Region, southeast Asia, Africa, the Nearctic Region and Central and South America. It is not known to occur in the Palaearctic, nor in the northern portion of the Nearctic Region. From such a pattern of distribution it may be deduced that this group is ancient, and that its dispersal predates the beginning of the Cenozoic Era (Dunn: 1931).

Of the three New World genera, two are restricted to South America. *Helluomorphoides* probably arose in South or Central America and spread northward from there. This seems likely because most of the species of the genus are tropical in distribution. Three of the four species groups which are treated here are found on the Mexican Plateau. Of these, two (*texanus* and *ferrugineus* groups) are represented also in the Great Plains, and in eastern United States. The third group (*papago*) is not known to occur east of the Davis Mountains, Texas. A fourth group (*nigripennis*) is restricted in its distribution to the Gulf and southern Atlantic coastal states.

The exact time and routes of invasion of these groups into North America cannot be known, but judging from the distribution pattern of the recent species it seems likely that the ancestral stocks of *nigripennis* and the *ferrugineus* and *texanus* groups entered the area under consideration in early glacial or late preglacial time. The *nigripennis* stock may have come *via* the coastal plain, if the present distribution of this species means anything in reconstructing its past history. As the remaining species occur in rather dry habitats, even in the basically humid southeast, they probably came northward by way of the Mexican Plateau: *ferrugineus* and *texanus* stocks along the eastern Sierras, and *papago* along the western. The limited distribution of *papago* in North America could mean either that this species is a relatively recent arrival or that it has not been able to move farther west for ecological reasons.

At the time of entry into North America, probably both the *texanus* and *ferrugineus* group stocks were, or became widespread, but probably only in the drier ecological zones (pine forests in the southeast and oak-pinõn pine woods in the southwest). The climatic changes of the Pleistocene glacial periods probably caused a fragmentation of the range of these two stocks, resulting in geographical isolation into several more or less southern refugia. The *texanus* stock was proba-

Fig. 33. Map showing the distribution of *H. ferrugineus* and *praeustus*; F, *ferrugineus*; V, *praeustus floridanus*; P, *praeustus praeustus*; B, *praeustus bicolor*.

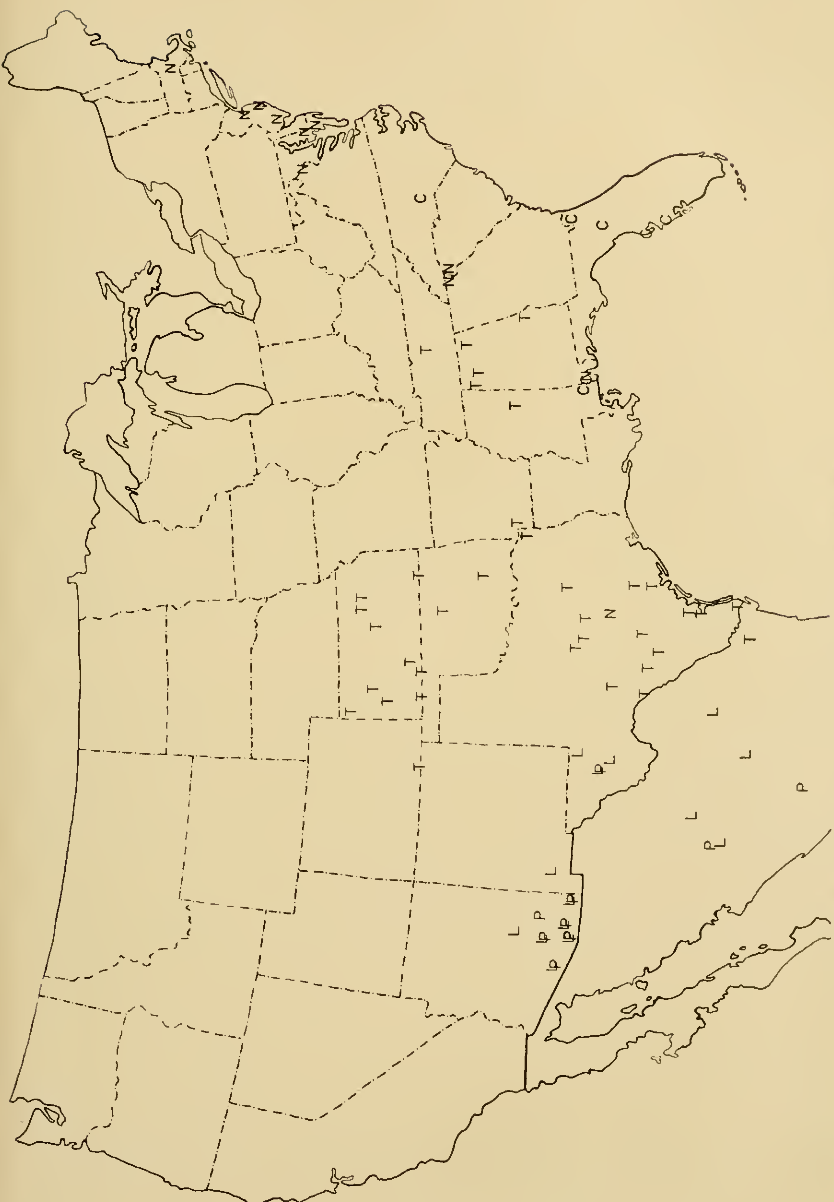

Fig. 34. Map showing the distribution of *H. nigripennis* (N), *clairvillei* (C), *texanus* (T), *latitarsis* (L), and *papago* (P). Note: The localities marked on Figs. 33 and 34 are based exclusively on material that I have examined. Records in the literature that I have not been able to verify are not considered.

bly divided into three parts: one in southeastern United States (possibly Florida), one in eastern Mexico, and one in western Mexico. The *ferrugineus* group stock survived in at least two, and possibly all three of the above areas. *H. nigripennis* may have survived the glaciations in either an eastern Mexican or the southeastern refugium, and the *papago* stock was probably restricted to the western Mexican refugium.

During the period or periods of isolation, the *texanus* stock differentiated into three species: *clairvillei* in the southeast, *texanus* in eastern Mexico, and *latitarsis* in western Mexico. The *ferrugineus* stock differentiated into two species: *praeustus* in the southeastern refugium (the least derivative race of this species is Floridian), and *ferrugineus* in Mexico. The slight differentiation of *ferrugineus* in the southwest may mean that this species survived in two Mexican refugia. On the other hand, the differentiation is of such a low level that it could very well have developed in post glacial time, and be correlated with the dispersal of a stock from a single area.

In post glacial time, the species of *Helluomorphoides* spread out from their refugia, eventually attaining their present ranges, and in the process of this dispersal, *praeustus* became differentiated into three geographical races. One peculiarity not accounted for is the distribution of *nigripennis*. This species is known only from United States, and does not seem to have Mexican "roots." This problem may be satisfactorily resolved when the Mexican-Central American species of the genus are worked out.

The hypothesis presented above rests on several assumptions. 1. Speciation in *Helluomorphoides* has come about as a result of fragmentation of once continuously distributed stocks. 2. Fragmentation and isolation of once continuously distributed stocks has occurred. 3. It is possible to predict approximately the location of the refugia postulated above. Assumption 1 rests on the further assumption that geographical isolation is necessary for speciation to occur. I think this may be true at least of terrestrial omnivores, such as most carabids are. The support for assumption 2 and for the existence of southeastern and eastern Mexican refugia is derived from the distribution patterns of other organisms (see Carr, 1940; Beecher, 1949; Hubbell, 1954). I am not aware of any data bearing on a western refugium, but postulate the existence of one on the basis of the present distribution of the *texanus* species group.

This hypothetical history is an outline and probably a gross oversimplification of events that may have led to the development of the recent North American helluonine fauna. It is a series of guesses that seem reasonable in the light of what data are available on the morphology and geographical distribution of the North American species of *Helluomorphoides*, and in the light of what is known about past climatic changes, and about the process of speciation.

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A NEW LIMNOCORIS FROM MEXICO
(HEMIPTERA, NAUCORIDAE)

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Subfamily *LIMNOCORINAE* (Stål), 1876

Division *Limnocoraria* Stål, 1876, Enum. Hemipt. Pt. 5: 142.

Subfamily *Limnocorinae* Montandon, 1897, Boll. Mus. Zool. Anat. Univ. Torino 12(297): 1; 1898, Verh. zool.-bot. Ges. Wien 48: 413; Usinger, 1941, Ann. Ent. Soc. Amer. 34(1): 8; La Rivers, 1950, *ibid.* 43(3): 368.

Genus **Limnocoris** Stål, 1860

Limnocoris Stål, 1860, Konig. Svenska Veten.-Acad. Handl. 2(7):83; Montandon, 1897, Boll. Mus. Zool. Anat. Univ. Torino 12(297): 1; 1898, Verh. zool.-bot. Ges. Wien 48: 413; 1909, Bull. Soc. Sci. Buc.-Roum. 18(1): 49; 1910, *ibid.* 19(3):440; 1911, *ibid.* 19(6):1268; Champion, 1900, Biol. Centr.-Amer. Insecta 2: 358; De Carlo, 1941, Rev. Soc. Ent. Argentina 11(1): 37; 1951, Mis. Estud. Patalog. Reg. Argentina 22:41; La Rivers, 1950, Ann. Ent. Soc. Amer. 43(3):373.

Limnocoris pygmaeus, species novum
(Fig. 1,b)

General appearance.—A small species, rivalling *L. insularis* Champion 1900 in size; 5.5-6.0 mm. long and 3.8-4.0 mm. wide; predominantly light colored dorsally, only eyes, scutellum and wing membranes showing as conspicuous darkened areas.

Head.—Light colored (yellowish) with suggestion of medial spotting particularly caudally; eyes convergent posteriorly; slightly but definitely elevated above the general head surface when viewed obliquely from behind; outer and posterior eye edges forming a blunt angle at their junctures; hind head margin weakly concave toward caudal end; external ridging of eyes distinctly thinned and flared out at anterior angle. Labrum as long as wide, parallel-sided for upper half and merging to a point at the tip; length-to-width ratio 23::25, pale yellow in color. Mouthparts darkening toward tip. Head ratios are: (1) Total length to width (including eyes) 78::140 (56%); (2) Anterior distance between eyes to posterior distance 87::70 (80%); (3) Anterior distance between eyes to inner eye length 87::56 (63%); (4) Posterior distance between eyes to greatest length of head posterior to this line 70::5 (7%).

Pronotum.—Lateral edges smoothly rounded, blunt-angulate anteriorly, rounded posteriorly; posterior margin rather wide, disc brownish, remainder of dorsum contrastingly yellowish; vague transverse rugosity behind head; percent of curvature of the pronotal sides, expressed as the ratio between the straightline distance between anterior and posterior lateral angles and the greatest vertical distance between this baseline and line of curvature, is 15% (102::15). Venter yellowish in lateral areas, darker in center; keel prominent, double-tipped anteriorly, the anterior tip lowest, blunt and rounded, the posterior tip higher, sharp, from which the keel is depressed abruptly down a sharp edge posteriorly, ending in an inverted "Y" fork. Prosternum-propleura fused, propleura gap-ing medially, separated by the prominent keel; interno-posterior angles of propleura moderately elongated into short, stubby processes, like *L. signoreti* Montandon 1897. Pronotal ratios are: (1) Width between anterior angles to width between posterior angles 47::80 (60%); (2) Median length to greatest width 48::80 (60%); (3) Distance between anterior and posterior angles on same side to perpendicular distance between anterior angle and baseline of pronotum 35::38 (92%).

Scutellum.—Dark centrally and anteriorly, lighter along postero-lateral margins; ratio of three sides, anterior and two laterals, 140::110::110.

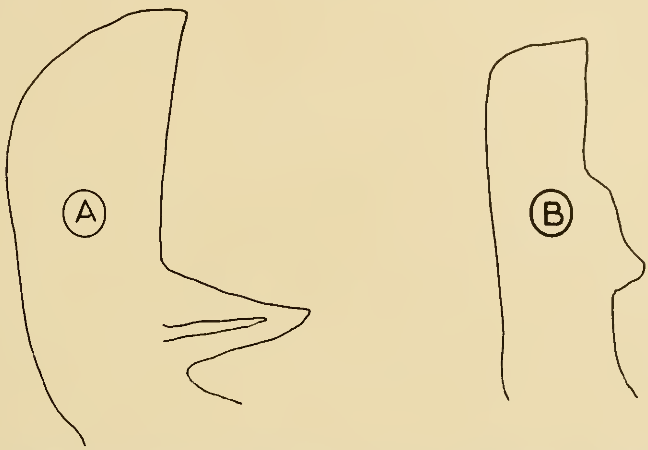


Fig. 1. Right lobe of the fifth male tergite, showing projecting tooth-like process: *a, Limnocoris signoreti* Montandon and *b, L. pygmaeus* La Rivers.

Hemelytra.—Yellowish in color over most of its area, wing membranes showing darker brown and weak spotting at postero internal emboliar margins and more internally. Embolium long and narrow, outwardly mildly inflated, this outer, curving surface constituting about 1/5th to 1/6th the total emboliar outline; length-to-width (latter measured at point of greatest inflation), 132::40 (30%). Inner emboliar crease prominent. Hemelytra fully attaining abdominal tip and moderately exposing the smooth, completely non-spinose lateral margins of the connexiva. Wings fully developed and functional, the hindwings as long as the hemelytra.

Venter.—The prothoracic venter has been discussed above. Meso- and metathoracic venter reddish brown, distinctly lighter than the dark brown abdomen. Connexival margins laterally striate-impressed, becoming very finely serrate posteriorly. Female subgenital plate undiagnostically similar in external tip outline to the larger *L. signoreti* (there is no indication, as yet, that this structure will be the valuable species indicator it is in *Ambrysus*). Thoracic foveae prominent, as in all limnocorines known to me, but specifically, undiagnostic; the meso- and meta-thoracic foveae well developed and functional; the former somewhat the larger and being preceded by a prominent, descending, sharp ridge terminating in a rather pointed tubercle. Mid-ventral keel on abdominal segments I-II conspicuous, the portion occupying segment I being typically thin, knife-like and nearly transparent. Male genital process on caudal margin of tergite V, to the right of the median line is a poorly developed but distinct projection occupying about the same position as in the genus *Ambrysus* but pointing dorsally in normal position rather than posteriorly and laterad. The shapes of these structures, with present material, do not seem to be taxonomically important, although that of *L. pygmaeus* is generally broader and less pointed than in *L. signoreti* (see fig. 1).

Legs.—Forelegs: Very typically those found in the genera *Ambrysus* and *Pelocoris,* among other naucorids, as well as in the remainder of *Limnocoris;* coxae yellowish, elongate; femora characteristically incrassate, flattened, ratio of length-to-width 100::53 (53%); tibiae long, slender, curving to fit against the inner edge of femora when closed; tarsi fused imperceptibly into tibiae, forming the end of the latter, one-segmented.

Midlegs: Coxae-trochanters yellow-to-red, former prominent and globular; femora long, whitish-yellow, flattened dorso-ventrally, rows of minute reddish spines along inner faces, ratio of length-to-width 100::18 (18%), length 1.4 mm.; tibiae long, narrow, more square in cross section, with conspicuous, but rather sparsely placed reddish spines particularly along front or leading edge—more plentifully equipped with long pilosity than are femora—spines more numerous at terminal apex, ratio of length-to-width 78::11 (14%), length 1.1 mm.; tarsi long, narrow, yellow-white, well-spined below and tipped with two rather weakly curved, amber claws—three segmented, the first segment small and basal.

Hindlegs: Larger facsimiles of the midlegs, femora more flattened, and tibiae proportionately more slender; femoral ratio of length-to-width 140::20 (14%), length 2.0 mm.; tibial ratio of length-to-width 132::15 (11%), length 2.0 mm.; tarsi similar to those of midlegs but longer.

Distribution.—See types.

Type locality data: MEXICO [438 kilometers south of Mexico City in the State of Guerrero, 1(xi)38, H. D. Thomas (UK)].

Location of types: Holotypic male, allotype and eight paratypes in the collection of the Snow Museum, University of Kansas at Lawrence; four paratypes in the collection of the writer, Reno, Nevada.

CULICOIDES GOETGHEBUERI, NOMEN NOVUM FOR CULICOIDES SETIGER GOETGHEBUER

In the preparation of a list of specific names employed in the genus *Culicoides*, which will be published soon, it was found that *Culicoides setiger* Goetghebuer, 1938, described from Belgium, is a primary homonym of *Culicoides setiger* Kieffer, 1910, described from India. The name *Culicoides goetghebueri* Arnaud, *nomen novum*, is proposed for *Culicoides setiger* Goetghebuer (1938, *Bull. Ann. Soc. Ent. Belgique*, *78*:379-380) *non Culicoides setiger* Kieffer (1910, *Mem. Indian Mus.*, *2*:190-191).—PAUL H. ARNAUD, *Natural History Museum, Stanford University, Calif.*

STUDIES ON SOME ORIENTAL XYSTODESMINE MILLIPEDS (POLYDESMIDA, CHELODESMIDAE).

By RICHARD L. HOFFMAN, *Box 749, Blacksburg, Va.*

Several years ago (1949) I published a short paper dealing with several Japanese milliped genera which were referred at that time to the family Xystodesmidae. Since then, it has been my good fortune to acquire material of exceptional interest from the Oriental region, and, in addition to treating the specimens at hand, I am taking this opportunity to present various data of systematic interest concerning some related forms.

Of perhaps greatest significance is that it is now possible to identify the genus *Xystodesmus* of O. F. Cook, and thereby to pave the way for a future consideration of the status of the family name based upon it. We have, in this instance, a case in which the characters of a family have been inferred from genera other than that designated type of the family. Although many of Cook's early milliped names were never adequately proposed, and subsequently gave rise to much confusion, as well as doubt about their status, probably none has been so vexatious as *Xystodesmus*.

Founded in 1895, the name was brought into the literature without any diagnosis, and with only the indication that *Polydesmus martensii* Peters, 1864, was the type species. The new family Xystodesmidae was created at the same time (and also without definition), including, in addition to the typical genus, *Fontaria* Gray, *Eurydesmus* Saussure, *Rhysodesmus* Cook, *Pachydesmus* Cook, and *Stenodesmus* Saussure.

Of the genera listed, *Eurydesmus* has since been transferred to another family (that which Cook knew as his Chelodesmidae). The others have been retained under the name Xystodesmidae by most American workers, and under the name Fontariidae by several of the European investigators. The original description of *P. martensii*[1] gives no characters of specific value, and no illustrations. Although Cook had seen the type specimen of *martensii* he never published what he knew about it.

Therefore, it became necessary to assume, as did Pocock in 1909, that Cook's systematic discernment was accurate enough to insure

[1] The original description, in a rather free translation, follows:

"Convex, the keels extending from about the middle of the segment and continuing the slope of the dorsum. The thickened margins of the keels are, as in other species, rounded in front and produced caudally. The pores open laterally. The first segment is almost as long as the following three combined, its caudal margin shallowly concave, and narrowed towards the ends; preanal scale rounded-triangular, with two lateral tubercules and a small terminal point. Light brownish, the keels yellow; antennae and legs white.

"Length, 24 mm; width across the metazonites, 4.3 mm; across prozonites, 3.0 mm.

"Yokuhama; Dr. von Martens, 2 males, No. 255."

that *Xystodesmus* was related within family limits to the other genera with which he associated it. Pocock wrote "The only character known to me by which the genera referred by Cook to the family Xystodesmidae can be distinguished from the genera constituting the Chelodesmidae of that author is the presence of a spine projecting from the distal end of the second segment of the legs." That character, supplemented by the compact body form, has remained until recently the main unifying feature characterizing the family.

Shortly after the recent death of Dr. Cook, a number of his effects were presented to Mr. H. F. Loomis, who discovered among them sketches of the male genitalia of the type specimen of *martensii*. Knowing of my interest in the group, Mr. Loomis very kindly sent me tracings of these drawings, and for the first time I learned the genital characteristics of the genus *Xystodesmus*. Unfortunately, the drawings were made of the gonopods *in situ*, and do not show a desirable amount of detail. Still more recently, however, Dr. Ralph Crabill sent me a milliped from Japan which is clearly a specimen of *martensii*, and the receipt of this individual makes it possible to bring the mystery of *Xystodesmus* to a satisfactory close. Although there is now considerable doubt that the family Xystodesmidae can be maintained on the basis of prefemoral spines alone, it is a matter of importance to present a generic description, based upon Peter's account of *martensii*, Cook's drawings of the type specimen, and the virtual topotype of the species which I have at hand. In 1952 I suggested the probable identity of the long-enigmatic *Fontaria*, and it is now a special pleasure to be able to dispose of the remaining *genus dubium* in this group of millipeds.

Genus **Xystodesmus** Cook

Xystodesmus Cook, 1895, Ann. N. Y. Acad. Sci. 9: 3.

Takakuwaia Verhoeff, 1936, Trans. Sapporo Nat. Hist. Soc. 14: 152 (type: *T. furculigera* Verhoeff).

Type species.—Polydesmus martensii Peters, 1864, by original designation.

Diagnosis.—A chelodesmoid genus with the following characteristics: composed of head and 20 segments; pore formula normal; sternites and coxae unarmed, prefemora with distal spines on legs posterior to gonopods, legs otherwise unmodified; pores lateral, in a definite peritreme; tergites smooth, moderately convex; telson triangular, its sides slightly concave; preanal scale with a conspicuous lobe on each side at the base, and with the lateral setiferous tubercules somewhat removed from the margin.

Male gonopods set in a broad, transversely oval aperture without raised margins; coxal joint of the usual form, bearing a conspicuous projecting process subtended distad by a single macroseta. Prefemoral portion straight, elongate, set with very long setae, and passing without differentiation into the femoral

[2] Verhoeff's illustration of the gonopod of his *furculigera* shows a suture setting off the femur, but his method of illustration does not inspire a great deal of confidence.

and tibiotarsal areas.[2] Femur with a thin projecting lamina on the mesial side and a slight shoulder on the lateral; tibiotarsus a simple arcuate distally tapering blade carrying the seminal groove and thus functionally a solenomerite. Prefemoral process long and slender, exceeding the tip of the tibiotarsus, unbranched but with a subterminal, mesially directed, laminate expansion.

Remarks.—Attems (1938, p. 151) observed ''Den Gattungen *Rhysodesmus, Pachydesmus,* und *Takakuwaia* sehr ähnlich'', and on the following page stated '' Eine sichere Trennung der Gattungen *Takakuwaia* und *Rhysodesmus* ist zur nicht moglich, weil die zahlreichen *Rhysodesmus*-Arten sehr ungenau beschrieben sind.'' Although Attems was correct in indicating a close relationship between the last two genera named, neither bears the slightest resemblance to the enormous and very singular *Pachydesmus* of eastern United States. Of American genera, *Xystodesmus* is apparently closest to the Mexican *Cruzodesmus,* species of which were included in *Rhysodesmus* by the conservative Attems. Further consideration of the position of this genus is deferred until such time as it is possible to attemble representatives of all of the groups involved for comparative study.

Xystodesmus martensii (Peters)

(Figs. 1, 2, 3, 4)

Polydesmus martensii Peters, 1864, Monatsb. Kais. Acad. Wiss. Berlin, p. 531.
Xystodesmus martensii Cook, 1895, Ann. New York Acad. Sci., 9: 3.
Takakuwaia furculigera Verhoeff, 1936, Trans. Nat. Hist. Soc. Sapporo 14: 153, figs. 6-8.

Diagnosis.—With the characters of the genus, specifically distinctive in the configuration of the male gonopods, as illustrated (fig. 1).

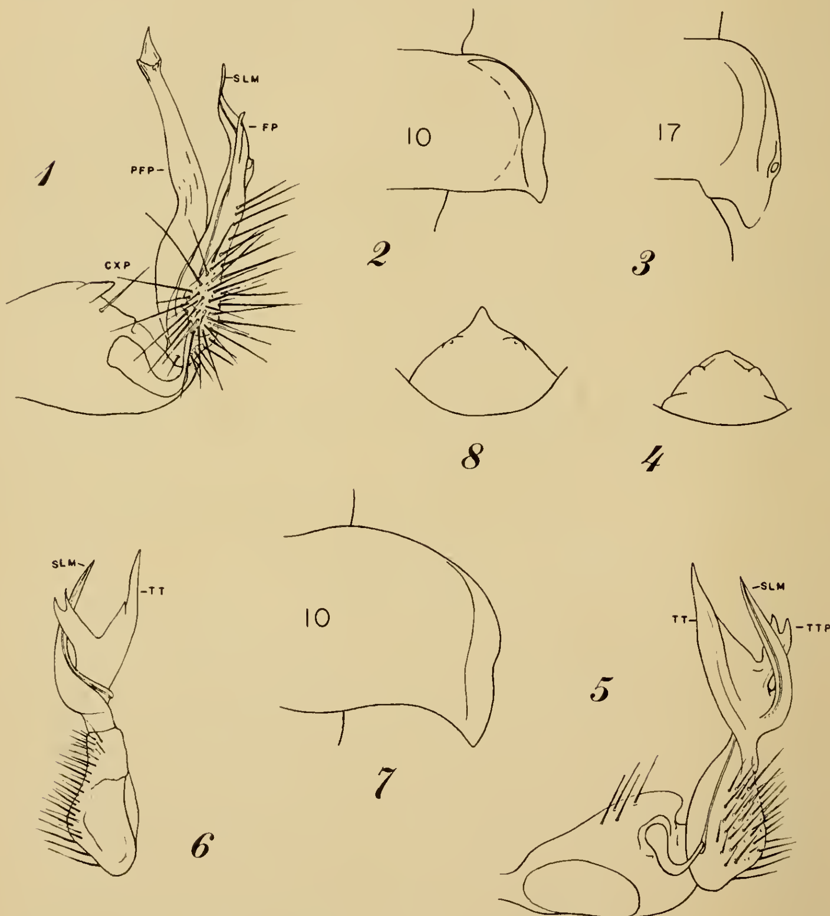
Type specimen.—Male, from Yokohama, Honshu, Japan, in the collection of the Berlin Museum. Present condition unknown.

Description of species.—The following descriptive notes are made from a specimen in my personal collection (no. 6324), collected at Myanoshita, Kanagawa Prefecture, Honshu, Japan, by Theodore J. Cohn, September 24, 1953.

Adult male, 22.5 mm. long and 4 mm. in greatest width. Dorsum chiefly dilute reddish-brown, with a large oval light spot on disk of each keel, each spot areolated with light brown. Legs, underparts, and antennae pale gray to white.

Head smooth, with a distinct median vertigial groove down to level of antennae. Labrum and frons broad, the subantennal projections each with a noticeable deep transverse groove.

Collum large, smooth, its disk flattened; anterior margin evenly curved, posterior border sinuate towards ends, latter rounded, their upper surface with a small depression near front margin on each side, causing outer part of front edge to appear set off by a slight ridge. Keels of segments 2-4 rectangular, swept forward, strongly margined in front; disk of 2nd keel convex. Caudolateral corner of 5th keel slightly produced. Pores lateral in position, in a large peritreme. Tergites smooth back to the 9th segment, where a row of faint tubercules appears on the metatergite. Most tergites caudad of 9th with a shallow transverse depression having one row of tubercules in front and two rows behind. Dorsal surface of keels swollen and rugose. Caudal corners of keels from 5th caudad increasingly produced, the caudal margin of keels straight or concave back to 16th, where a conspicuous "shoulder" appears at the base, to be repeated on the 17th segment (fig. 2) and lost again on the 18th. Peritreme of midbody segments much swollen, set off by a deep groove. Telson triangular, but with two larger-than-average terminal tubercules, and with the



Xystodesmus martensii (Peters). Fig. 1, mesial aspect of left gonopod; fig. 2, keel of 10th segment; fig. 3, keel of 17th segment, showing basal shoulder; fig. 4, preanal scale. *Kiulinga jeekeli*, n. sp., from holotype. Fig. 5, mesial aspect of left gonopod; fig. 6, sublateral aspect of telopodite of gonopod; fig. 7, keel of 10th segment; fig. 8, preanal scale. Abbreviations; *cxp*, coxal process; *fp*, femoral process; *pfp*, prefemoral process; *slm*, solenomerite; *tt*, tibiotarsus; *ttp*, tibiotarsal process.

usual two lateral tubercules on each side. Preanal scale unusual in having a definite lobe at its base on each side. Underparts smooth, glabrous; sternites wide, with a median tubercule between each legpair, a low blunt tubercule at the base of each leg, and one of similar size on each coxa. Legs short and stout. Each prefemur caudad to 9th legpair with a long sharp spine.

Aperture of gonopods broadly oval, flush with sternite (i.e., without raised marginal rim). Sternum between 4th legpair with two high conical processes; between 6th legpair with two lower triangular processes; between 7th legs deeply excavated to receive the tips of the gonopods.

Male genitalia as described for the genus and illustrated.

Remarks.—I believe that Verhoeff's species *furculigera*, the type of which also came from Yokohama, is a synonym of this milliped. The drawings illustrating the gonopod of his species do not preclude this liklihood, but rather confirm it. That showing the entire gonopod in mesial aspect is obviously made from the appendage in a tilted position with its distal end lower than the coxa, as the coxal projection is not shown, and more of the underside of the coxal joint is shown than in the accompanying drawing (fig. 1) of the gonopod of *martensii*. The tip of the prefemoral process as illustrated by Verhoeff is somewhat more complicated, apparently due to having been drawn from a cleared microscope preparation with an attempt to show the surface of the far as well as near side of the object. This practice was usually followed by Verhoeff, with the result of greatly complicating his drawings.

Genus **Profontaria** Verhoeff

Profontaria Verhoeff, 1941, Archiv Naturgesch., N.F. 10: 412.
Ezodesmus Takakuwa, 1942, Annot. Zool. Japonenses 21 (1): 42 (type: *E. lunatus* Takakuwa).

Type.—*Profontaria takakuwai* Verhoeff, by monotypy.

Diagnosis.—A xystodesmine genus apparently closely related to *Riukiaria*, from which it differs in lacking any trace of a prefemoral process on the male gonopod, and in the presence of a distinct subterminal branch from the tibiotarsus.

Profontaria takakuwai Verhoeff

Profontaria takakuwai Verhoeff, 1941, Arch. Naturg., N.F. 10: 412, fig. 2-4.
Ezodesmus lunatus Takakuwa, 1942, Annot. Zool. Japonenses 21: 43, fig. 7; Chamberlin and Wang, 1952, Amer. Mus. Nov. 1621: 7.

The figures given with the original descriptions by Verhoeff and Takakuwa leave no doubt that both names are based upon the same species. This is corroborated by the fact that both type specimens of both came from the same place—Sapporo, Hokkaido. Verhoeff's name is the older by about five months.

Genus **Japonaria** Verhoeff

Japonaria Verhoeff, 1936, Trans. Sapporo Nat. Hist. Soc. 15: 155 (as subgenus of *Fontaria*); Attems, 1938, Das Tierreich 69: 174; Takakuwa, 1942, Annot. Zool. Japonenses 21: 39; Hoffman, 1949, Chicago Acad. Sci. Nat. Hist. Misc., No. 45, p. 5.

Parafontaria Verhoeff, 1936, Zool. Anz. 115: 301 (type: *P. armigera* Verhoeff, by monotypy).

Grayaria Chamberlin, 1943, Bull. Univ. Utah, Biol. Ser., 8 (2): 16 (type: *G. attemsi* Chamberlin [= *Fontaria coarctata acutidens* Attems 1909 = *Japonaria circula acutidens* (Attems)]), by original designation.

Type.—*Japonaria falcifera* Verhoeff 1936, by subsequent designation of Attems, 1938.

Diagnosis.—Xystodesmines with both coxae and prefemora spined; sterna unarmed; pore formula normal, pores opening laterally; tergites smooth, moderately arched; posterior corners of keels rounded off except on the last 3 to 7 body segments where somewhat produced caudally. Male gonopods large, without any trace of coxal, prefemoral, or femoral processes; prefemur small and subglobose; femur nearly straight or slightly curved distad, set off from the tibiotarsus by a more or less perceptible joint; tibiotarsus forming somewhat more than a complete circle, distally enlarged and elaborated into a variable number of processes, of which one is a solenomerite.

Remarks.—The species of this genus have been the victims of some very careless work, chiefly at the hands of Verhoeff. When I expressed my belief (1949, *op. cit.*) that the subgenus *Parafontaria* was untenable, I was unaware that Takakuwa had previously published the same conclusion, based on first-hand experience with the animals involved.

In his very useful paper cited above, Takakuwa did a great deal to clear up the existing confusion. First, he pointed out that there is no real generic difference between *Japonaria* and *Parafontaria*. Second, he showed that, contrary to Verhoeff's original description, the gonopods of *J. attemsi* are *not* nearly straight[3] and provided a sketch of their true appearance. Third, he discussed inaccuracies in the descriptions of the genitalia of *J. acutidens* and *J. spiraligera*. Fourth, he came to the conclusion that *J. kuhlgatzi* is a strict synonym of *J. laminata*, and that *J. armigera* is only subspecifically distinct from it. With all of these observations I am in complete accord.

It is now necessary to see how these modifications affect the only existing complete account of the genus, that of Attems in Lief. 69 of *Das Tierreich*. Attems recognized two subgenera, *Japonaria* and *Parafontaria*, the latter now being consigned to synonymy and its type species regarded as subspecifically related to *Japonaria laminata*. Attems listed eight species in *Japonaria*, and provided a key, which

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[3] It is curious that Verhoeff apparently never realized that boiling of gonopods in caustic tended to straighten normally curved structures. Several of his species were founded upon material distorted in this manner.

must be entirely rewritten to correct the misconcepts based upon faulty descriptions and to accommodate new species recently described by Takakuwa and Verhoeff. Since the existing descriptions and illustrations leave much to be desired, the construction of such a key from information in the literature would be difficult and of dubious value. As I have but a few species represented by material, the best I can do at this time is to provide a list of the named forms which appear to be valid. These number 13, of which 8 are regarded as full species with 3 having several subspecies.

1. *J. coarctata coarctata* (Pocock) 1894, Ann. & Mag. Nat. Hist. (6) 15: 361, fig. 11.
2. *J. coarctata attemsi* Verhoeff 1938, Trans. Nat. Hist. Soc. Sapporo 14: 159, figs. 9, 10.
3. *J. circula circula* (Attems) 1901, Mitt. Mus. Hamburg 18: 97, pl. I, figs. 5-7.
4. *J. circula acutidens* (Attems) 1909, Ark. Zool. 5(3): 30, pl. I, fig. 13.
5. *J. circula marmorata* Verhoeff 1937, Zool. Anz. 117: 316, fig. 7.
6. *J. aculeata* Verhoeff 1941, Zool. Anz. 136: 68, figs. 3, 4.
7. *J. erythrosoma* Takakuwa 1942, Annot. Zool. Japon, 21: 40, fig. 3.
8. *J. terminalis* Takakuwa 1942, Annot. Zool. Japon. 21: 39, figs. 1, 2.
9. *J. spiraligera* Verhoeff 1937, Zool. Anz. 117: 315, figs. 3-6.
10. *J. falcifera* Verhoeff 1936, Trans. Nat. Hist. Soc. Sapporo 14: 157, pl. 3, fig. 11.
11. *J. laminata laminata* (Attems) 1909, Ark. Zool. 5 (3): 29, pl. I, figs. 14, 15.
12. *J. laminata armigera* Verhoeff 1936, Zool. Anz. 115: 301, figs. 4-6.
13. *J. laminata montana* Verhoeff, 1941, Zool. Anz. 136: 63, figs. 1, 2, 5, 6.

Kiulinga, new genus

Type.—K. *jeekeli,* n. sp., by present designation.

Diagnosis.—A genus of small xystodesmines with the following characteristics: composed of head and 20 segments, pore formula normal, pores opening lateral or ventrolateral; tergites completely smooth; caudal margins of keels from 4th segment caudad distinctly concave; preanal scale large, with a prominent terminal projection; sternites wide, smooth, not produced at bases of legs; coxae unarmed, prefemora with the usual acute distoventral spine.

Male gonopods set in a broad, transversely oval aperture the caudal edge of which is raised into a distinct flange; coxal joint without special modification; prefemoral portion enlarged, flattened, setose, without trace of prefemoral process; femur greatly reduced; tibiotarsus twisted about 180° around the main axis of the telopodite, the seminal groove thus nearly encircling the gonopod before proceeding upon the long slender solenomerite; tibiotarsus expanded into a broad lamellate blade, with an accessory projection near the base.

Range.—Central eastern China.

Species.—Two.

Kiulinga jeekeli,[4] new species
(Figs. 5, 6, 7, 8)

Diagnosis.—Separable from *K. lacustris* (Pocock) in lacking long setae on the sternites, and in that the basal tibiotarsal process is distally bifid.

Type specimen.—Adult male, U. S. Nat. Mus., from the Hangkow River Gorge, Kuling (near Kiukiang), Hupeh Province, China; collected by O. F. Cook and H. F. Loomis on October 18, 1919.

Description of type.—Adult male, 20 mm. long and 4.5 mm. wide. Completely bleached from long preservation.

Head smooth, shining, without special modification. Four long frontal setae. Clypeal groove distinct. Antennae long and slender, attaining 4th segment when laid back; articles increasing in length up to 6th, clothed from 3rd on with numerous long setae; 4 terminal sensory cones; antennae separated at base by a distance about equal to length of 6th article (ca. 0.70 mm.).

Collum rather large, longer than 2nd and 3rd tergites at midline; front margin continuously curved, posterior margin swept forward slightly, ends rounded; front margin with weakly defined submarginal grooves.

Tergites moderately arched, keels continuing slope of dorsum, smooth and shining; interzonal furrow very distinct. Caudal margins of keels of segments 2 and 3 swept forward, those of succeeding segments concave (fig. 7); the anterior corners of all keels broadly and evenly rounded and strongly margined; peritremata moderately broad in dorsal aspect and fairly well set off; pores lateral, becoming definitely sublateral on the caudalmost segments; pore distribution normal. Caudolateral corners of keels becoming increasingly produced back to 19th segment. Telson subtriangular, with several low transverse ridges. Caudal margin of 17th keel forming a very slight shoulder at base, similar to that figured for *martensii* but very much smaller.

Anal valves nearly flat and smooth, with very prominent compressed marginal ridges. Preanal scale relatively large, subtriangular with convex edges, terminal projection very prominent (fig. 8).

Pleural areas finely granular but without special tubercules or crests. Sternites wide, glabrous, the area between legs but slightly raised above level of prozonite, coxae of midbody legs about 1.0 mm. apart.

Legs short and robust, coxae with numerous long setae on the ventral side; prefemora much less hairy, with a sharp ventrodistal spine; femur and postfemur almost glabrous; tibia becoming setose distally; tarsus densely clothed with long bristle-like setae. Lengths of joints of midbody leg, from coxa distad: .34—.45—.90—.40—.38—.35 mm., total, about 2.80 mm. (exclusive of tarsal claw).

Sterna between 3rd and 4th legpairs each with two low transverse elevations. Anterior legs somewhat shorter and more setose than those farther back. Tarsal claws short, evenly curved.

Gonopod aperture large, oval, wider than intercoxal space of 7th segment, its caudal margin produced into a distinct thin flange. Gonopods as characterized for the genus and illustrated by figures 5 and 6.

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[4] Named for my friend and colleague, C. A. W. Jeekel, of the Zoologische Museum, Amsterdam, a specialist on Indo-australian diplopods.

Kiulinga lacustris (Pocock)

Fontaria lacustris Pocock, 1895, Ann. & Mag. Nat. Hist. 6, 15: 359; pl. 11, fig. 8.

Diagnosis.—Differing from *jeekeli* in that the sternites are setose, and the tibiotarsal process of the gonopod is unbranched and much more slender.

Type specimen.—Male, from Wo-Lee Lake, 25 miles south of Ningpo (now Ninghsien), Chekiang Province, China; in the collection of the British Museum (Natural History).

Description.—Pocock's original description is quoted in its entirety:

"*Colour* (?faded) pale yellowish white throughout.

Terga smooth, laterally above the keels lightly wrinkled or coriaceous; keels rather large, the anterior angle rounded, the posterior rectangualr or acute, but not dentiform; the anterior edge of the keel with a small basal shoulder, the posterior edge emarginate, with a larger basal shoulder.

Sterna and coxae of the legs studded with long hairs. Anal sternite furnished with a medianly backward projecting spinform process.

Copulatory feet diverging externally from the base, each terminating in two processes—the interior [solenomerite] simple, pointed, curved like an S, the superior [tibiotarsus] inwardly directed, bifid.

Length 20 millim.; width across keels 3.5, width across cylindrical part of segment 2.5."

Both the foregoing description and its accompanying figures agree so well with the type specimen of *jeekeli* that I have no doubt that the two are congeneric. The major points of difference between them are the presence of hairs on the sternites of *lacustris* and the bifurcate tibiotarsal process of the gonopod in *jeekeli.* The characters of the gonopods and the preanal scale are particularly indicative of close relationship.

The number of dubious Asiatic species of xystodesmines is now reduced to a very few, most of which were described in the last century from type specimens now lost or inaccessible. One genus remains enigmatic, *Cyphonaria* Verhoeff, the type species of which was based on a female specimen.

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A NEW PARASITE RECORD FOR THE LIMA BEAN POD BORER IN CALIFORNIA

(Lepidoptera, Pyralidae)

A sample of lima beans grown in Ventura County, California, in 1954 was sent to the author in November, 1955, for diagnosis of an insect infestation. From dead larval remains, frass and feeding damage it was determined that the lima bean pod borer, *Etiella zinckenella* (Treit.), had been responsible for the damage. Several hundred beans were split and examined carefully. Three female and one male bethylid parasites were discovered, with two of the females being still alive. All were found between the bean cotyledons in association with pod borer frass and damage. Several of the bethylid cocoons were found embedded in the pod borer frass. This evidence appears presumptive that the bethylids had parasitized the pod borer larvae. The parasites were determined by Howard Evans as *Cephalonomia gallicola* (Ashmead) (Hymenoptera, Bethylidae). Muesebeck and Walkley (1951, *In* Hymenoptera of America North of Mexico, U. S. Department of Agriculture, Agriculture Monograph No. 2, p. 727. list the known distribution as "probably almost cosmopolitan" with specific localities in the United States along the eastern seaboard and west to Nebraska. It is interesting to note that they record it from two species of Coleoptera, the drugstore beetle. *Stegobium paniceum* (L.), and the cigarette beetle, *Lasioderma serricorne* (F.), as well as from the gall of a cynipid, *Andricus foliatus* Ashm.

The females and one male have been placed in the California Insect Survey collection of the University of California, Berkeley.—Woodrow W. Middlekauff, *University of California, Berkeley.*

NOTES ON THE BIONOMICS OF ONYCHOBARIS SUBTONSA LECONTE ON MIRABILIS[1]

(*Coleoptera, Curculionidae*)

By CLIFFORD WESTER, *112 Park Ave., Stroudsburg, Pa.*

INTRODUCTION

In the February, 1956, number of these *Proceedings* (58(1):43-46), I presented the first of three proposed articles dealing with the bionomics of insects associated with the wild four-o'clock plant, *Mirabilis nyctaginea* (Michaux) MacMillan, in central Illinois. It treated two congeneric micromoths, *Heliodines nyctaginella* Gibson and *H. ionis* Clarke. The present, or second, article describes the life history of the snout beetle, *Onychobaris subtonsa* Leconte, whose larva is a borer in the stems of *M. nyctaginea*, and whose adult feeds on the foliage and stems of the plant. The eggs of the single yearly generation are deposited in the growing stems, and the pupae are formed within hibernacula in the dead stems, which remain standing after the plant crown dies.

Since *subtonsa* seems to feed only on the wild four-o'clock plant, I propse the common name "four-o'clock snout beetle" for this species.

THE ADULTS

The adult of *subtonsa* is black in color and about four millimeters in length. The pronotum is densely punctate, and the elytra are deeply striated, with single rows of punctures on the intervals.

The first beetles to emerge in the spring feed on the terminal parts of the young shoots of the plant before the leaves have developed. The minute feeding punctures made by the beetles in the miniature leaves at this time become holes in the fully developed leaves that sometimes measure up to ten millimeters in diameter. In cases where the beetle population is large, most of the leaves on the lower half of the plant may be riddled with holes, and the plants may be somewhat unsightly in appearance.

Bud-clusters begin to develop when the plant is about two weeks old, and the beetles migrate to them to feed. The punctures are made through the closed involucres in order to reach the succulent tissue of the developing buds inside. Some buds are probably destroyed by this feeding, but since they are produced in great numbers, and the involucres do not grow to any great extent, the effect is seldom noticed unless a careful examination is made. When the involucres open, some feeding is done on the exposed flower-buds.

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[1]This article is part of a thesis submitted to the Faculty of Graduate College of the University of Illinois in partial fulfillment of the requirements for the degree of Doctor of Philosophy, 1954.

As the flowers develop on the plant, there is an increasing migration to the stems to feed. By the latter half of June, all the flowers on the wild four-o'clock have produced fruit, and by this time, all the beetles feed wholly on the stems.

The eggs are always laid in the stems of the host plant, and only one egg is laid at a time. In its first phase, the act of ovipositing is the same as that of feeding, i.e., the female beetle chews a hole in the stem. Then she turns around and places the ovipositor over, or in, the feeding puncture, and deposits one egg. The female then turns around again and draws the snout across the place of oviposition a few times, probably to force the egg deeper into the puncture in the stem. The entire process takes about five minutes. The plant juices soon cover the egg, and in about one day congeal to form protective covering.

The Eggs

The eggs of *subtonsa* are oval in form, and about 0.35 millimeter in diameter and 0.52 millimeter in length. They are hyaline-white in color, and the chorion is glassy-smooth without any sculpturing. They hatch in about eight days.

The Larvae

The larvae of *subtonsa* are hyaline-white in color with light brown heads. They are apodous, robust, and curved. There are no significant changes in form or color during the larval life. The full-grown larvae have the same general appearance as the newly-hatched ones.

The larvae are borers in the stems of the wild four-o'clock plant, and feed on the succulent pithy centers of the stems. They may tunnel either upward or downward from the egg site in the stems, and may change the direction of their feeding many times, with the result that the tunnels they create by their feeding are often devious. The tunnels of the smaller larvae contain a small amount of brown, powder-like frass, which increases in quantity as the larvae become larger, to the extent that the tunnels of the full-grown larvae are completely filled with the material.

The newly-formed larvae always chew through the chorion at a point near the surface of the stem. The first feeding is just beneath the surface of the epidermis, and the tunneling is done in such manner that, for a distance of five to ten millimeters, the upper half of the initial tunnel is in the epidermis and the lower half is in the cortex of the stem. The larvae then bore into the center of the stems and begin to feed on the succulent tissue there, and they continue to feed there until they are full-grown.

Under crowded conditions, the larvae of *subtonsa* are sometimes cannibalistic. This usually occurs if one larva bores into the tunnel of another larva. In such cases, one larva is usually killed and devoured. Sometimes the larvae begin to feed on each other at the same time, and in such cases, both are usually killed.

Overwintering

Wood fibers begin to develop in the cortex of the stems of the wild four-o'clock early in July in central Illinois. By the middle of August, the cortex of the lower stems has become a woody tube.

When the larvae of *subtonsa* attain full growth, they begin to chew off splinters of the woody cortex, and mix them with frass from the tunnels. These two materials are then mixed with a glue-like substance excreted by the Malpighian tubes and formed into a hollow oval structure which becomes the hibernaculum inside which the larva overwinters. The interior of each hibernaculum is covered with the Malpighian excretion, which hardens to form a smooth, glass-like surface. When this operation has been completed, the larva chews a hole through the cortex to the epidermis. This is an exit hole and will be used by the adult in the spring to escape from the interior of the stem. The epidermis remains undisturbed and serves as a covering over the hole during the winter. The wood fibers removed in making the hole are packed rather loosely around the opening in the hibernaculum, which is always directed towards the hole in the stem.

Soon after the hibernacula are completed, the larvae change from a hyaline-white to a waxy-white color, and the posterior segments of the abdomen become somewhat flattened. *O. subtonsa* overwinters in the mature larval stage inside these hibernacula and pupates there in the spring.

Shelford (1929) proposed that the term "diapause" be used where insects enter a state of dormancy due to internal factors, and that the term "hibernation" be used for overwintering due to external factors, such as low temperatures or lack of food. If these terms be accepted in this sense, it may be that *subtonsa* enters the winter in a state of diapause, and completes its overwintering in a state of hibernation. Full-grown larvae begin to appear in the stems of the wild four-o'clock plant late in August and become dormant soon after. At this time of the year, the weather is still warm, and there is ample food available, which is indicated by the fact that later-maturing larvae continue to feed until late in September. This may indicate that the initial dormancy is due to internal factors, or diapause. In nature, the period of dormany continues until late in April, at which time pupation begins to occur. However, some larvae brought into the laboratory early in February, and kept indoors, pupated one week later. Other larvae brought into the laboratory during the winter pupated nine to twenty-seven days later. This may indicate that dormancy during the latter part of the winter is due to low temperatures, or hibernation.

It may be that *subtonsa* enters the winter in a state of diapause, but at some time during the winter, the factor, or factors, that induce diapause cease to function, and it completes its period of dormancy in a state of hibernation.

Seasonal History

The adults begin to emerge early in May in central Illinois, and emergence continues until near the end of the same month. The beetles are numerous on the host plant until near the end of June. During the month of July, there is a gradual decline in numbers, and by early August only an occasional one is found.

Mating seems to begin about the middle of May and continues until about the middle of June. Oviposition begins about the first of June and is a common activity until about the first of July. After that time, only an occasional egg is found in the stems.

The larvae appear in the stems as borers early in June and feed there during their larval life. Full-grown larvae begin to appear in the burrows in the stems late in August, and by late September all are full-grown. They construct the hibernacula in which they overwinter almost immediately after reaching full growth and become dormant about one week later. By early October, all larvae are dormant, and development remains suspended until late in April, at which time pupation begins to occur. By the middle of May, all larvae have pupated.

The duration of the pupal stage varies from nine to fifteen days. The average length of pupal life for 32 pupae which were formed in the laboratory was 11.12 days.

When the adult is fully formed, it pushes through the loosely packed fibers around the opening in the hibernaculum, chews through the dead epidermis, which remained during the winter as a covering over the exit hole, escapes from the interior of the dead stem of the previous year, and migrates to the new shoots of the plant, which appear above ground about the first of May.

Summary

Onychobaris subtonsa produces only one generation per year, and probably feeds only on the wild four-o'clock plant, *Mirabilis nyctaginea*. The adults feed externally on the plant, while the larvae are borers in the stems. The eggs are always deposited in feeding punctures in the stems. The species overwinters in the larval stage inside hibernacula constructed in the stems. Pupation follows in the spring of the next year.

Reference

Shelford, V. E., 1929. Laboratory and Field Ecology. Williams and Wilkins, Baltimore, 608 pp.

CORRECTION

The authorship of the obituary of Lawrence Peck Rockwood appearing on p. 55 of the February, 1956, issue of the *Proceedings* (Vol. 58, No. 1) should be corrected to read as follows:

T. R. Chamberlain, *Chairman*
J. S. Wade

SOME ASILIDAE BELONGING TO THE GENUS BATHYPOGON LOEW (DIPTERA)

BY FRANK MONTGOMERY HULL, *University of Mississippi, Oxford.*

The genus *Bathypogon* is an interesting component of the Australian and Chilean dipterous fauna. This paper describes several new species collected by the author in Australia during 1953-54. Cotypes will be deposited in the United States National Museum.

Bathypogon rubidapex, new species

A large species characterized by the wholly black antennae, the wholly black femora and the black ground color of humeri and mesonotum. The bristles of the face are entirely pale. Male terminalia dorsally reddish on the basal half, ventrally entirely reddish. The base of the seventh tergite is widely reddish. Length 21 mm.

Male:—Head entirely black in ground color, heavily obscured by pale brownish yellow pubescence. The face has numerous, long, stout bristles, which are entirely pale, concolorous with the pubescence and set in irregular, lengthening rows beginning below the antennae at a point which roughly corresponds to one-fourth of the face heighth; at this point the face is gently elevated; the epistomal row of bristles is longer than the proboscis. Proboscis and palpi black. Antennae wholly black, except for a little dark red color narrowly at the apex of the first and base of the third segment. Antennal pile pale. Bristles and pile of occiput pale.

Thorax everywhere black in ground color except for a small reddish spot posterolaterally on the humeri. Pollen of mesonotum dark brown when viewed from above, or anteriorly, except that the lateral margins, the humeri and the interior margins of the humeri tend to be paler in color and of a yellowish brown color. Pollen of mesopleura pale brownish yellow including coxae. Bristles of mesonotum long and stout and brownish yellow. The thoracic complement of bristles is as follows: one posthumeral and an oblique row of three to four notopleurals, one supra-alar, three to four postcalli, two pair of scutellars.

Anterior and middle trochanters shining reddish brown with a little yellow pollen posterodorsally. Hind pair blackish. All of the femora are uniformly black. The anterior tibiae are reddish brown dorsally, obscurely darker below; the middle tibiae are dark reddish brown, obscurely and diffusely lighter near the base; hind tibiae black throughout. Anterior and posterior tarsi nearly black dorsally, the middle tarsi very dark brown. Claws reddish brown on the basal third. All pile and bristles of legs pale brownish yellow.

Wings nearly hyaline with a faint brownish appearance, the veins a light orange brown. Venation typical, the lower end vein of the discal cell and the end vein of the fourth posterior cell almost exactly aligned.

Abdomen black with dense pale brownish yellow pollen, which appears dark brown except in an oblique light. The base of the sixth tergite is brownish on either side. The seventh tergite is widely reddish laterally, the reddish color almost meeting dorsally. Superior forceps light brownish red on the basal half, the whole of the lateral and ventral terminalia light shining brownish red. Ventral plate at apex and the superior forceps each with a long knobbed or flared process.

Female.—In the females the hind coxae, like the anterior four, are shining reddish brown; the bases of all the femora are very narrowly reddish; the anterior and middle femora are narrowly, diffusely and obscurely reddish brown ventroapically. The anterior and middle tibiae are still rather dark reddish brown but appear to be a little paler than in the male and their apices are dark brown but not black. The hind tibiae are approximately as in the male and the tarsi similar. The abdomen is similar to the male with the whole of the seventh and eighth tergites shining brownish red; spines of the acanthophorites shining sepia.

Type:—male and female, Canberra, Australia, 1.X.1953, F. M. Hull collector. Cotypes: males 18, females 20, same data.

Bathypogon fulvus, new species

A small species which like *rubellus* Hull and *rufitarsus* Hull has the first antennal segments pale and the face brownish orange with reddish yellow pollen. From *rubellus* it is distinguished by having pale frontal and supra occipital bristles and the pale scutellar bristles. From *rufitarsus* it is distinguished by the anterior, broad, black area of the mesonotum, the dark brown terminal tergites, the blackish scutellum. Length 14 mm.

Male: Head. Pollen of occiput and vertex yellowish brown, becoming a little bristles entirely brownish yellow;, the lower occipital pile is also light brownish lellow. The first segment of the antennae is pale brownish orange; second light reddish brown, very little darker than the first, and both with brownish yellow pile; the third segment is short, with rather long stout microsegments and black with the base narrowly light brown.

Thorax dark brownish black with the lateral margins and the humeri light reddish brown, and this light color is extended inward as a small adjacent triangle immediately behind the humeri. The medial margin of the humeri, however, is black. Pollen of mesonotum dark golden brown, or somewhat reddish brown. The reddish lateral areas have pale brownish yellow pollen. Viewed from above the submedial dark vittae are not very distinct and are indistinctly and narrowly separated. They are somewhat better defined from an anterior view. The thoracic complement of bristles is black except upon the scutellum and pleura, one post humeral, two notopleurals, one supra-alar, four to five post dorsocentrals and two pair of scutellar bristles. Pleura chiefly light reddish brown with a dark triangle of black in the upper anterior corner of the mesopleura and a larger one on the anterior ventral half of the stenopleura. Pleural pollen deep brownish yellow.

Legs almost entirely light brownish orange, the anterior surface of the anterior femora, the middle femora and the lateral surface of the hind femora black. There is only a narrow, dark brown stripe obscurely along the lateral surface of the hind tibiae and a still more obscure lighter streak on the posterior surface of the middle tibiae. Bristles and pile of legs everywhere reddish yellow. Basal third of claws light brown.

Wings nearly hyaline, but distinctly tinged with quite pale brown; apex of the wing distinctly darker. The lower end vein of the discal cell makes a rather strong angle with the end vein of the fourth posterior cell.

Abdomen dark brownish black dorsally on all of the tergites but becoming progressively more reddish brown in appearance, especially on the last three to four tergites, due to thick reddish brown pollen. Lateral margins widely light reddish brown, with yellowish brown pollen, which is paler on the sides of the basal tergites. All pile and bristles pale; distinct bristles are almost confined to the sides of the first tergite where there are five pair. Towards the middle of this segment and posteriorly on the remaining segments the bristly hairs are weak and only a little longer than the other pile. Terminalia entirely reddish brown, a little darker dorsally on the superior forceps; the basal plate has a short, dorsal, inwardly curved process and bears a very minute, low ventral tooth.

Female.—Similar to the male but with the tergites black, laterally margined with pinkish brown and similarly colored pollen. The pollen extending on the sixth segment for only half its length.

Type: male and female, Canberra, Australia, November 20-30, 1953, F. M. Hull collector. Cotypes: males 14, females 15, with the same data.

Bathypogon nigrachaetus, new species

A small species distinguished by the reddish first antennal segment, the black supraoccipital, vertical, frontal and mediofacial bristles; leg and mesonotal bristles likewise black. The femora and tibiae are black on the full length on a portion of their surfaces, elsewhere light brownish red. Closely related to *nigrinus* Ricardo, differing in the ventral needle-like process of the terminalia, which in *nigrinus* is relatively blunt and broader basally. Length 14-15 mm.

Male.—Head. Vertex, the front and the upper face narrowly black in ground color, with greyish white pollen, which is brown below the eye opposite the ocelli. The face and the first segment of the antennae are light pinkish brown; cheeks blackish only immediately beneath the eye. Palpi black; proboscis black, except the ventral base, which is brown. The apex of the first antennal segment and the second and third segments are blackish. Antennal pile white, bristles of the head black, except for a single submarginal row of white bristles on the upper and lateral occiput, and a vertical row of slender white bristles on the upper and lateral occiput, and a vertical row of slender white bristles sublaterally on the face which enclose the longer and stouter, medial black bristles. Pile of palpi and the lower occiput white.

Thorax black in ground color with a rather dark yellowish brown pollen and viewed dorsally there are two dark vittae narrowly divided in the middle. The lateral margins and the whole of the humeri are reddish brown, with pale brownish white pollen; the pleura have similar pollen. The pleural ground color is widely light reddish brown with a black spot dorsally on the pronotum, another medially on the pronotum, the anterior mesopleura, anterior sternopleura, anterior surface of the middle coxae and smaller, more obscure spots dorsally on the pteropleura and ventral hypopleura all blackish. There are two long, stout black metapleural bristles and numerous small slender white ones. The complement of mesonotal bristles consists of long black bristles as follows: one post humeral, two notopleural, one supra-alar, two post callars, two pair of scutellars and on each side two prescutellars. Scutellum blackish with the margin pale brown.

Legs. Anterior and dorsal surface of the anterior and middle femora, the dorsal and lateral surface of the hind femora and the whole lateral surface of the hind tibiae black; the remainders of these parts are light reddish brown. The posterior surface of the anterior and middle tibiae are pale reddish brown, their anterior surfaces dark brown but scarcely black. Tarsi dark brown dorsally.

Wings tinged with reddish brown villi, especially on the apical portion. Lower end vein of the discal cell and of the fourth posterior cell not quite in alignment. Veins dark brown, with the first three yellowish brown.

Abdomen. First three tergites brownish black dorsally, the next four dark reddish brown with narrow black posterior margin. The entire lateral, curled-over margins of the abdomen light reddish brown with paler pollen. All dorsal pollen is dark. The posterior margins of the tergites are black; pile chiefly white with a few black bristles intermixed dorsally, and posterior margins with a row of black bristles which are progressively shorter. The black bristle row of the first segment contains three or four white bristle elements laterally. The terminalia dorsally have a diffuse, reddish basal spot and a narrow, lateral, longitudinal, light colored streak. Basal plate with a pair of needle-tipped basally swollen processes.

Female.—Similar to the male. The black bristles of the face are rarely replaced entirely by white. The epistomal bristles are usually white. On the abdomen all of the tergites are quite black. The lateral margins, however, are reddish on the first five tergites and the pollen tends to be even paler in color.

Type: male and female, Canberra, Australia, November 20-30, 1953, F. M. Hull collector. Also cotypes: males 16 and females 13, with the same data.

BOOK REVIEW

CROP PROTECTION, by Rose, G. J. 223 + xxi pages, 113 figs. Philosophical Library, New York, 1955. $10.

Three interesting pages tell how man's long process of developing agriculture has upset the balance of nature and brought on troubles from insects, plant diseases and weeds. Man is constantly striving to restore the balance. The book attempts to "integrate the achievements of biologist, chemist, and engineer to make them intelligible to the practical agriculturist"—"it is not a textbook on crop protection." Subjects covered are cultural control; types and choice of chemical formulations; weed killers; insecticides; fungicides; rodenticides; dusting, spraying and other systems of application; choosing, operating and maintaining equipment; and protecting stored products. There is a summary of control measures by crops and pests with examples from around the world. The author says chemical control should be used only after the most benefit has been derived from cultural control, particularly in backward countries where natives accept a chemical as "ju-ju" or magic, and yet he devotes only two pages to cultural principles. The illustrations cover a rather large proportion of hand equipment. They are clear and instructive.—T. L. BISSELL, *University of Maryland, College Park.*

ZAPRIOTHRICA, A NEW GENUS BASED UPON SIGALOESSA DISPAR SCHINER, 1868
(Diptera, Drosophilidae)

By Marshall R. Wheeler, *Department of Zoology, University of Texas, Austin.*

I recently had the opportunity of studying the four "types" of *Sigaloessa dispar* Schiner, borrowed by Dr. Curtis Sabrosky from the Naturhistorischen Museum in Vienna. Dr. Sabrosky very courteously sent the specimens to the writer for examination upon noting that they belonged to the family Drosophilidae rather than to the Asteiidae as had been supposed.

Of the four types, two are males, two are females; all four bear identical labels as follows: (1) "Lindig; 1864; Venezuela"; (2) "dispar; Alte Sammlung"; (3) "Type" (on red paper). In addition, one specimen bears the handwritten label "*Sigaloessa dispar* Schin."

Since no holotype was designated for the species, I have selected one of the four syntypes as lectotype; the specimen so selected is a male to which I have affixed this label: "Lectotype; selected by M. R. Wheeler; April, 1955." All four specimens are being returned to the museum in Vienna.

Although the specimens are imperfect, among them one can see most of the external morphological features. They are clearly drosophilid but I have been unable to fit them into any of the established genera. The species show some features suggestive of *Zygothrica* while in other respects *Zaprionus* is indicated. However, *dispar* possesses certain unique traits which eliminate those genera from consideration, and I am describing for this species the new genus, *Zapriothrica.*

Zapriothrica, new genus[1]

(Fig. 1)

Type Species: *Sigaloessa dispar* Schiner, 1868.

Generic characters; many of the features of the head are shown in Figure 1. Arista short plumose, with 6-7 dorsal branches and 3-4 shorter lower branches, the main axis not forked apically; antennal foveae exceptionally deep for this family, separated by a high but very narrow carina; palpi exceptionally large, short-haired except for a single long hair near base; proboscis long, the labellum noticeably extended behind.

Scutellum elongate, truncate; thoracic bristling probably normal (damaged on all specimens and not described by Schiner) but the only sternopleurals seen were rather short and thin; all apical tarsal joints enlarged, with 4-6 strong bent hairs on the dorsal apex and the empodium and pulvilli remarkably enlarged (Schiner: die Klauen stark gebogen, die Pulvillen gefranst), the latter

[1] *Zapriothrica*—an artificial name formed by combining portions of the generic names *Zaprionus* and *Zygothrica;* the name is to be treated as feminine.

appearing quite plumose. Major bristles of front femora arising from small tubercles.

Female ovipositor long, protruding, the plates bearing very stout black teeth; in both males the penis (apparently) is extended, and is nearly as long as the abdomen. In both males two pairs of black accessory genitalial structures are protruding; I have seen nothing quite like them in other Drosophilidae.

Zapriothrica dispar (Schiner), new combination

Since Schiner's description is not generally accessible, a partial redescription of the species seems advisable.

Head.—Almost as broad as thorax; orbits subshining, reaching verticals; a frontal triangle fairly well indicated, large, subshining, but all of front appears dully micro-pubescent when viewed from an oblique angle. Ocellars arising from beside anterior ocellus; orbitals of about equal length (see Fig. 1); face tan, clypeus brown, shiny, narrow; cheeks pale tan becoming browner behind; palpi tan, large in both sexes; postverticals moderately large, convergent.

Fig. 1: *Zapriothrica dispar* (Schiner), head in profile, based mainly on the lectotype male.

Thorax.—Mesonotum subshining brownish-black, humeri tan; acrostichals probably 8-rowed but disturbed on all specimens; prescutellar bristles apparently absent; two thin humerals. Pleura brown becoming reddish below; halteres pale. Legs pale, apical tarsal joints darker, enlarged; apical and preapical tibial bristles not evident but tibia 2 has several black, stout, short bristles on lower apex. Tibia 3 mildly arcuate; front femora with the 4-6 larger bristles arising from small prominences.

Abdomen. The colors may not now be true to life, but on both males the tergites are mainly yellowish-tan while of the females, one has the tergites brown and the anal plates, ovipositor and circumanal tergite yellow, while on the second female the last two tergites are as yellow as are the anal plates and ovipositor. In both sexes several apical bristles on the last two tergites are noticeably enlarged.

Wings. Clear hyaline; 1st costal section with two rows of thin but moderately long hairs; costa reaching 4th vein; 3rd costal section with the small black setulae on the basal ½ or a bit more; anal vein rudimentary; 3rd and 4th veins weakly converging apically. Costal index 1.9-2.0; 4th vein index about 1.6; 5x index 1.1-1.2. Cilia of the calypters brown.

Addendum

Since the above was written, I have received about 60 additional specimens of *Zapriothrica dispar* from a locality near Bogota, Colombia, South America, from flowers of *Datura*.

Reference

Schiner, J. R., 1868. Reise der oesterreichischen Fregatte Novara um die Erde. Zoologischer Theil. Diptera. Wien, 1868, pp. vi and 388. (*Sigaloessa dispar*: p. 237).

ANNUAL REVIEW OF ENTOMOLOGY. Edited by Edward A. Steinhaus. Assoc. Ed., Ray F. Smith. Vol. 1. ix + 466 pp., 26 figs., 1956. Published by Annual Reviews, Inc., Stanford, Calif. Available from the Entomological Society of America, 1530 P St., N. W., Washington 5, D. C. Price $7.00 postpaid (USA), $7.50 postpaid elsewhere.

Annual Reviews, Inc., is a non-profit corporation which has devoted itself since 1931 to publishing, year by year, critical reviews of literature in certain major fields of science. To date these useful annual summaries of progress have included psychology, physiology, medicine, plant physiology, biochemistry, physical chemistry, microbiology, and nuclear science, and 1956 marks the entry of entomology to these ranks. The Entomological Society of America has been instrumental in initiating the present series by investigating ways and means by which adequate literature reviews might be published, and by cooperating in this very effective way with Annual Reviews, Inc.

Each of the 21 chapters included in Volume 1 is an authoritative and concise treatment of a definitive subject of current interest in entomology. It has been prepared by a leader or leaders in the field concerned, and is not only a critical analysis of recent literature but is also an appraisal of the present status of the subject. Although most of the cited literature has been published since 1950, many of the chapters contain historical information upon which recent developments are based, in order to give the reader an overall view of the subject. Those fields in which large amounts of active research are being conducted will be reviewed every year, while those of less activity will be summarized as developments require.

The literature cited at the end of each chapter is given in abbreviated form, which may prove disappointing to those who do not have access to the best library facilities. The entire volume, however, is indexed by both subject and author, a feature tending to offset this possible disadvantage.

Congratulations to ESA for this much needed addition to the entomological literature!

—RICHARD H. FOOTE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

MEGALOCERAEA RECTICORNIS (GEOFFR.), A MIRID NEW TO THE EASTERN UNITED STATES, WITH THE DESCRIPTION OF A NEW GENUS OF STENODEMINI

(HEMIPTERA, MIRIDAE)

By JAMES A. SLATER, *Dept. of Zoology and Entomology, University of Connecticut, Storrs.*

The Palearctic species *Megaloceraea recticornis* (Geoffr) was first reported from North America by Knight (1822), based upon specimens collected by Fracker in Wisconsin. Subsequently Knight (1927, 1941) reported the species from Iowa, British Columbia, Ontario and Idaho. Despite the considerable attention paid to the Miridae of the eastern United States by Knight, Blatchley, Parshley and McAtee among others, *recticornis* has not previously been reported from any of the eastern states.

During the 1954 and 1955 collecting seasons I have found this species to be one of the most abundant grass mirids present in the vicinity of Storrs, Connecticut. It is present in the spring in almost every field and roadside collecting spot. During a collecting trip to the White Mountains, New Hampshire, in 1954 *recticornis* was taken at every collecting station, both in the White Mountains and in southern New Hampshire, even near the summit of Mt. Washington at 6,000 ft.

The United States National Museum possesses specimens taken in New York and Maine from 1947 to 1953. The recent dates of these records, together with the fact that the species was not taken by Parshley in his extensive New England collecting and is not mentioned in the "Hemiptera of Connecticut" or Blatchley (1926), make it evident that *recticornis* has been spreading rapidly through the northeast in very recent years.

In addition to the literature records cited above, the following distributional data are available: CONNECTICUT: Storrs; NEW HAMPSHIRE: Crawford House, Gorham, North Conway, West Ossippee, West Hopkinton, Mt. Monadnock State Park, Mt. Washington at 2000, 3800, 6000 ft.; ILLINOIS: Belvidere (JAS); OREGON: McMinneville (JAS), Beaverton (USNM); WASHINGTON: Clarkston (JAS); MAINE: Monmouth (USNM); NEW YORK: Long Island, Northwest, Riverhead; Mechlenburg (on birdfoot trefoil) (USNM), Selkirk (JAS); IOWA: Ames (HHK, JAS); WISCONSIN: Madison (JAS).

BIOLOGY

Megaloceraea overwinters in the egg stage. In 1955 the first nymphs were taken on May 14th at Storrs and as several of these were in the second instar, the insects had apparently been present for several days. On May 22nd the majority of the nymphs were third instar. The first fifth instar nymph was taken on the 27th of May and the first adults were collected the evening of June 2nd. All adults taken at the above date were teneral and had obviously very recently emerged. A sample taken by sweeping *Agropyron repens* resulted in the collection of 44 specimens distributed as follows: adults, 1%; instar V, 36%; instar IV, 39%; instar III, 18%; instar II, 5%. On June 14th random sweeping at the same locality showed the following distribution: adults, 54%; instar V, 30%; instar IV, 16%. No adults were taken in mid-July, at which time I was able to collect at the same locality. It seems certain that, as in the case of so many of the Miridae, a single generation is passed through in a year. Butler (1923) reports a single generation in England.

Knight (1922) records the species as probably from green foxtail (*Setaria viridis* (L.) Beauv.), and Blatchley (1926) from foxtail (*Chamaeropsis glauca* L.). In 1927 Knight established breeding on *Panicum* sp. and doubted the earlier records from foxtail. In the Storrs area the species breeds abundantly on *Agropyron repens* (L.) Beauv. As noted above, the New York specimens were taken on birdsfoot trefoil. Butler (1923) reports *recticornis* in England from *Brachypodium sylvaticum, Lolium perenne* and on flowers of Umbelliferae. While the species appears to have definite host preferences, it seems very doubtful that it is host specific.

Immature Stages

Butler (1923) describes the egg and briefly compares the nymphs with *Stenodema laevigatus* (L.)

Second Instar.—General coloration as in succeeding instars, terminal half of fourth antennal segment reddish brown; wing pads absent, mesonotal area very slightly rounded in area of prospective pads. *Head,* length 0.50 mm., width across eyes 0.42 mm., interocular space 0.32 mm.; *pronotum,* length 0.25 mm., width 0.50 mm.; length of *abdomen* 1.52 mm.; *antennae,* length I, 0.25 mm.; II, 0.62 mm.; III, 0.90 mm.; IV, 0.72 mm.; *labium,* length I, 0.25 mm.; II, 0.28 mm.; III, 0.25 mm.; IV, 0.30 mm. Total length 2.57 mm.

Third Instar.—General coloration as in fourth and fifth instars, the legs nearly translucent grey. *Head,* length 0.55 mm., width across eyes 0.45 mm., interocular space 0.33 mm.; *pronotum* with anterior and posterior widths nearly equal, lateral margin moderately convex, length 0.28 mm., width 0.50 mm.; *wing pads* evident, strongly divergent, metathoracic pads reaching a very short distance onto the first abdominal tergite, length mesothoracic pads 0.25 mm.; *abdomen,* length 2.03 mm.; *antennae,* length I, 0.42 mm.; II, 1.00 mm.; III, 1.32 mm.; IV, 0.85 mm.; *labium,* length I 0.38 mm.; II, 0.35 mm.; III, 0.35 mm.; IV, 0.38 mm. Total length 2.88 mm.

Fourth Instar.—General coloration and markings as in fifth instar. *Head,* length 0.78 mm., width across eyes 0.58 mm., interocular space 0.40 mm.; *pronotum* less expanded from anterior to posterior margin than in succeeding instar, length 0.50 mm., width 0.73 mm.; *wing pads* strongly divergent, those of mesothorax not completely covering metathoracic pads, extending caudad onto antero-lateral portion of second abdominal tergite, length mesothoracic pads 0.88 mm.; *abdomen,* length 3.55 mm.; *antennae,* length I, 0.70 mm.; II, 1.60 mm.; III, 1.95 mm.; IV, 0.93 mm.; *labium*, length I, 0.53 mm.; II, 0.50 mm.; III, 0.45 mm.; IV, 0.50 mm. Total length 5.58 mm.

Fifth Instar.—General coloration grass green, marked with brownish-testaceous as follows: head adjacent to compound eyes, area of pronotal calli, mesothoracic wing pads, faint longitudinal stripe on thoracic pleura, narrow longitudinal stripes midway between meson and margin; lateral pronotal and wing pad margins, median stripe on pro- and mesothorax, eyes and basal segments of labium white; legs and antennae dull testaceous, apex of labium and terminal half of apical tarsal segment black. Body nearly glabrous, legs and antennae and two terminal abdominal tergites sparsely clothed with short, stiff black setae. *Head*, length 1.00 mm., width across eyes 0.75 mm., interocular space 0.48 mm.; nearly straight above, clypeus strongly declivent, bent at greater than a right angle to longitudinal axis of body; *pronotum* rectangular, lateral margins straight, narrowly carinate, length 0.78 mm., width 1.25 mm.; mesothoracic wing pads long and slender, mesal margin concave, extending caudad to or nearly to fourth abdominal tergite, length 2.10 mm.; *abdomen* elongate, narrowly tapering to apex, dorsal scent gland present between abdominal tergites three and four, tapering to apex, length 5.05 mm.; *antennae* filiform, first segment considerably thicker than succeeding segments, length I, 1.23 mm.; II, 2.55 mm.; III, 2.72 mm.; IV, 1.13 mm.; *labium* extending caudad onto first apparent abdominal sternite, first segment exceeding base of head, length labial segments I, 0.75 mm.; II, 0.63 mm.; III, 0.63 mm.; IV, 0.65 mm. Total length 8.08 mm.

The nymphs closely resemble the grass glumes and are very difficult to detect when motionless. Protective form and color is very evident.

Nomenclature

The question of the correct specific name to apply to this species is a thorny one involving primary homonymy. The species was first described as *Cimex linearis* by Fuessly (1775), but in the same year Fabricius (Syst. Ent., p. 710) described a Chinese alydid (now apparently in the genus *Riptortus*) by the same combination. Dr. J.C.M. Carvalho informs me that the Fabrician name has priority and I therefore adopt here the next available name to conform to Dr. Carvalho's use in his forthcoming Catologue.

The generic spelling *Megaloceroea* is apparently an unwarranted emendation of *Megaloceraea* (China, 1943).

Other Species

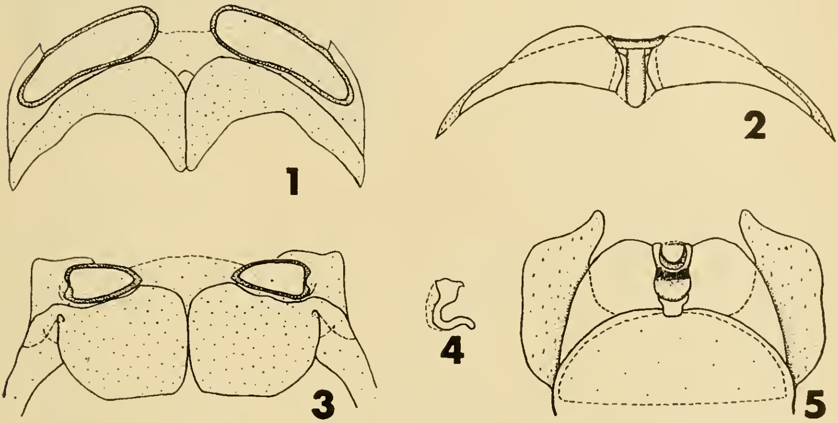
North American species from the western United States currently placed in *Megaloceraea* are not congeneric with *recticornis* (Geoff) (the type species), and as no name appears to be available in the literature, it is necessary to erect a new genus for certain of these forms.

Litomiris, new genus

Head straight, vertex with a longitudinal sulcus, compound eyes nearly touching anterior pronotal margin, antennae long and slender, basal segment bearing short, stiff setae and devoid of long hairs; pronotum strongly punctate, particularly on posterior lobe; scutellum, clavus, and areas on corium usually sparsely punctate; femora of same thickness throughout; labium extending caudad to metacoxae; body elongate, slender, nearly parallel-sided.

Type species.—Miris debilis Uhler, 1872.

Externally *Litomiris* differs from *Megaloceraea* primarily by the punctate pronotum and scutellum. Reuter (1909), in considering *debilis* a true *Megaloceraea,* noted the punctate pronotum, but mentioned the scutellum as completely glabrous and presumably impunctate, whereas it actually does possess scattered hairs and is sparsely and weakly punctate.



Litomiris debilis (Uhler): fig. 1, sclerotized rings of genital chamber; fig. 2, posterior wall of genital chamber. *Megaloceraea recticornis* (Geoff.): fig. 3, sclerotized rings of genital chamber; fig. 4, lateral view of sigmoid process of posterior wall; fig. 5, posterior wall of genital chamber.

In confirmation of the external differences, *Litomiris* and *Megaloceraea* have female genital structures of very different appearance.[1] The posterior wall of the genital chamber (bursa copulatrix) in *recticornis* (Fig. 5) has ''E'' structures (herein termed the *inter-ramal shelf*) that are very large and expanded flange-like beyond the arch of the inter-ramal sclerites (= A structures), the sigmoid process (B. structure) is complicated, strongly sinuate and concave, and a very large and elliptical ''C'' structure is present. In *debilis* the posterior wall area (Fig. 2) is very simple, with small inconspicuous inter-ramal shelves, no apparent ''C'' structure development, and a simple bar-like sigmoid process with a ventral flange. The sclerotized rings of the two are also very different in appearance (Figs. 1 and 3) although this may be a lesser value as a generic criterion.

Litomiris is suggestive of *Porpomiris* Berg (* = *Mesomiris* Reuter). from which it may easily be separated by the much more elongate shape, lack of punctures on the posterior margin of the

[1]I have in this paper adopted the terminology of Davis (1955) and have used the letter terminology of Slater (1950) only where other names are not available.

vertex and by the labial length, which reaches caudad only to the mesocoxae in *Porpomiris*.

Of the eight native North American species that have been assigned to *Megaloceraea*, the following are considered at present to belong to *Litomiris: debilis* Uhler, *curta* Knight, *rubicunda* Uhler, *punctata* Knight and *gracilis* Van Duzee. *Megaloceraea hirsuta* Knight with an impunctate pronotum, long hairs on the first antennal segment and short labium certainly is not congeneric with either *Litomiris* or *Megaloeraea;* it probably belongs near *Leptopterna*. *Megaloceraea letcheri* Knight has long hairs on the first antennal segment and is strongly punctate on the scutellum, clavus and pronotum. The species is suggestive of *Stenodema*. *Megaloceraea koebelei* Van Duzee is apparently very closely related to *letcheri* Knight.

ACKNOWLEDGEMENTS

I wish to sincerely thank the following persons for assistance on various aspects of the present paper: Dr. W. E. China of the British Museum of Natural History and Dr. J. C. M. Carvalho of the Museu Nacional, Rio de Janeiro, Brazil for nomenclatoral assistance; Dr. Norman Davis of the University of Connecticut and the late Dr. C. O. Esselbaugh for the gift of specimens from important localities; Dr. R. I. Sailer of the United States National Museum for making the national Museum records of *Megaloceraea recticornis* available.

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ZENO PAYNE METCALF
1885-1956

Dr. Zeno Payne Metcalf died at his home at Raleigh, N. C., January 5, 1956. Even though he had suffered poor health for many months, he died quite suddenly and unexpectedly while talking to his wife and daughter, Mrs. Micou Browne of Raleigh.

On March 11, 1955, Dr. Metcalf was presented the Oliver Max Gardner Award as "That member of the faculty of the Consolidated University of North Carolina who during the current scholastic year has made the greatest contribution to the human race."

Dr. Metcalf was the author of 9 books and an active member of 36 learned and professional societies, including the Entomological Society of Washington. He was a key speaker at the Interational Congress of Zoology which convened in Paris in July, 1948, and at the International Congress of Entomologists which met in Stockholm in August, 1948. In addition he was president of 3 major national scientific organizations, The Entomological Society of America, The Ecological Society of America and the American Microscopical Society—a distinction accorded few scientists in the United States.

Dr. Metcalf also served on the editorial Boards of 4 of the large national professional journals and was the author of 96 professional publications. At the time of his death he was engaged in preparing a 42-volume catalog of the homoptera of the world. Fifteen volumes had been or were in press at the time of his death, and several more volumes are nearly ready to go to press. An attempt is being made to provide means of completing the entire set of 42 volumes. Dr. Metcalf has spent much of the past 40 years collecting notes for the series. In an effort to obtain material he read and checked over 20,000 books and papers dealing with insects and visited all the principal libraries in the United States and England. The order Homoptera comprises about 4,000 described genera and 30,000 described species. The catalog now contains 512,000 references, probably the greatest catalog of any order of insects to be found anywhere in the world.

A native of Lakeville, Ohio, Dr. Metcalf was educated at Ohio State University where he received his A.B. degree in 1908 and at Harvard University where he earned his D.Sc. degree in 1924.

Prior to joining the State College Faculty in 1912 he was an Instructor in Entomology at Michigan State, 1907-1908, and was on the staff of the N. C. State Department of Agriculture from 1908 to 1912. He joined the N. C. State College Faculty as Entomologist with the Experiment Station and as Professor of Zoology and Entomology. He was Visiting Professor in the summer session of Ohio State in 1916 and 1918 and in the summer session of the University of Michigan in 1926. During the school year of 1935-36 he served as Visiting Professor of Zoology at Duke University. Dr. Metcalf was Head of the Department of Zoology and Entomology, N. C. State College, from 1912 to 1950. He was Director of Instruction in the School of Agriculture at N. C. State College during the years from 1923 to 1944; Director of Graduate Studies at the College, 1940-1943, and Associate Dean of the Graduate School of the Consolidated University, 1943-1950. He retired from administrative duties in 1950 and later devoted his full time to teaching, research and writing. In his later years of teaching he was the William Neal Reynolds Professor of Zoology and Entomology.

He was active in both civic and professional affairs and was a former President of the N. C. Academy of Science and a past-president of the Raleigh Kiwanis Club. He was also a Fellow of the American Association for the Advancement of Science and the Entomological Society of America.

Dr. Metcalf was married to Miss Mary Luella Correll of Wooster, Ohio, on October 20, 1909.

CLYDE F. SMITH, *N. C. State College, Raleigh*

SOCIETY MEETINGS

The 650th regular meeting of the Society was called to order by President R. A. St. George at 8 P.M. Thursday, January 5, 1956, in Room 43 of the U. S. National Museum, with 61 members and 35 visitors in attendance. The minutes of the previous meeting were read and approved.

Jalil S. Karam, Walter Reed Army Medical Center, Washington 12, D. C., was elected to membership.

Committee appointments for 1956 were announced. *Program:* (J. F. G. Clarke, elected Chairman), F. L. Campbell, R. Latta, T. L. Bissell, and E. R. McGovran. *Notes and Exhibition of Specimens:* C. F. Rainwater, Chairman, L. G. Davis, T. J. Spilman, and Elizabeth Haviland. *Membership:* Bernard App, Chairman, Howard B. Owens, T. E. Snyder, Engel Gilbert, M. P. Jones, P. A. Woke, and W. E. Bickley. *Memoirs:* A. B. Gurney, Chairman, R. I. Sailer, Louise M. Russell, C. F. W. Muesebeck, and R. H. Foote *ex officio*. *Reserve Stock:* (H. J. Conkle, elected Custodian), P. X. Peltier, and Helen Sollers. *Auditing:* J. S. Yuill, Chairman, Clarence Hoffmann, and L. B. Reed. *Advertising:* Price Piquett, Chairman, John Fales, A. H. Bender, and George Langford. *Joint Board on Science Education:* Howard B. Owens.

Keith Johnson, Advisor on Science Teaching for the District of Columbia Public Schools, delivered a report on the Joint Board on Science Education meeting December 9. So that as many students as possible may have the opportunity to enter exhibits, the Science Fair will be divided into 4 separate Fairs for the District, Montgomery, Prince Georges, and Arlington Counties, the last-named to be open to children from other greater Washington areas of Virginia. The number of prizes won by Washington exhibitors in the National Fair and the desirability of teachers' attending the National Fair were cited by Mr. Johnson. Member organizations are being asked to increase their contributions to provide for the expansion of the Fair.

President St. George announced the deaths of two local members, Royce B. Knapp on Dec. 9 and W. H. W. Komp on Dec. 7. B. A. App was appointed chairman of the obituary committee for Mr. Knapp, and P. A. Woke, with R. H. Foote and Alan Stone a committee for Mr. Komp. (Note: W. H. W. Komp's obituary appeared in Vol. 58, No. 1, of the *Proceedings*.—Ed.) Alan Stone spoke briefly on Komp and his work.

Recent contributions to the national collection of insects were described by J. F. Gates Clarke. The Bromley collection consists chiefly of Diptera, of which 28,000 specimens belong to the family Asilidae (robber flies). This is one of the world's outstanding collections in the group. 230,000 specimens of more than 1200 species of termites were transferred to the Smithsonian from the Forest Service. Dr. Frank Morton Jones, Wilmington, Delaware, has transferred his fine world collection of 4400 specimens of Psychidae (bagworms), 273 parasitic Hymenoptera, all associated with bagworm hosts, and 36 volumes pertaining to the Psychidae, numerous separata, many unpublished drawings and photographs. (Speaker's abstract.)

The first speaker of the evening was Allison R. Palmer, U. S. Geological Survey, whose subject was ''20,000,000-year-old Insects from the Mojave Desert, California.'' Fifteen species of insects replaced by silica, strontium sulfate, calcium carbonate or an undetermined organic substance have been recovered from calcareous nodules in lacustrine sediments of Middle Miocene age in the Calico Mountains, California. The fauna includes a dragonfly, four species of bugs, three species of beetles, three species of thrips, and four species of midges. This is the first known Tertiary insect fauna from a lacustrine environment that can be compared at the species level with Recent faunas. The quality of preservation of the specimens rivals and in some instances surpasses that of amber insects. Well preserved internal anatomical features have been observed for the first time in fossil insects: cephalic tracheae are present in dytiscid beetles; tracheae and internal genital structures are present in midges; and a dragonfly larva has its muscles, heart, Malpighian tubules, rectal gill system and tracheae preserved. The fauna shows no clear-cut relations to Recent faunas from a particular geographic region. (Speaker's abstract.)

Dr. Max Day, Australian Scientific Liaison Officer, told about the ''Mystery of Mt. Kosciusko.'' A field survey of the Australian grasshopper, *Kosciuscola tristis*, was made by the speaker near the top of Australia's highest mountain (about 7400 feet), Mt. Kosciusko. This jet black grasshopper was abundant at 5 A.M. at a temperature of 4 degrees C. The hoppers climbed on rocks and small shrubs to catch the rays of the rising sun, and within an hour all individuals had turned to a brilliant blue color. The speaker and others tested diurnal rhythm, effects of crowding, effects of colored backgrounds, light, and temperature (factors known to affect color changes in other animals) in the laboratory; they found that at 15 degrees C. and below the hoppers were maximally dark, at 25 degrees C. and above they were maximally blue, and that intermediate temperatures caused intermediate color changes. Black-bulb temperature measurements revealed the same relation between color and temperature in the field as was found in the laboratory. A number of color photographs of sections of the integument showed this color change to be caused by the migration of pigment within individual epidermal cells, each cell acting as an independent effector, and subsequent experiments showed there to be no nervous or hormonal cortrol over the process. One hypothesis advanced for the color change is that the black condition in the cold allows the insect to absorb heat faster, and the blue at higher temperatures tends to have the opposite effect. (Editor's abstract.)

Of numerous visitors present, the following were introduced: *Dr. and Mrs. A. C. Pipkin*, Rockville, Md.; *Dr. Kenneth D. Roeder*, Massachusetts; *Dr. E. F. Riek*, Australia; *Dr. O. Peck*, member from Ottawa; *Henry A. Dunn*, newly associated with the State Experiment Station Division of Agricultural Research Service; *Dr. W. J. Brown*, Ottawa; *Alberto W. Vasquez*, student at George Washington University, and *Dr. J. J. Murayama*, Yamaguchi University, Japan.

The meeting adjourned at 9:40—KELLIE O'NEILL, *Recording Secretary*

The 651st regular meeting of the Society was held in Room 43 of the National Museum on Thursday, February 2, 1956. It was attended by 42 members and 15 visitors. President R. A. St. George called the meeting to order at 8:00 PM and the minutes of the previous meeting were read and approved.

New members elected were *Dr. John H. Hughes*, Division of Foreign Quarantine, U. S. Public Health Service, Washington 25, D. C.; *James F. Schoen*, Apt. 16, 9002 Manchester Rd., Silver Spring, Md. and *Dr. Sarah B. Pipkin*, 1012 Paul Drive, Rockville, Md.

P. X. Peltier gave the report of the Treasurer and Louise M. Russell gave the report of the Corresponding Secretary for 1955. F. L. Campbell said he had been surprised to learn how much work was done by each of the officers and wished to thank all of them for what they had done.

President St. George presented the request of the Joint Board of the Washington Academy of Sciences and the D. C. Council of Engineering and Architectural Societies for scientists to substitute for local science teachers so that the teachers may attend the National Science Teachers Association meeting in Washington from March 14 through 17, 1956. A. B. Gurney briefly discussed the activities of the Washington Academy of Sciences, which is composed of established scientists primarily in the Washington, D. C., area. The Entomological Society of Washington is one of 23 affiliated groups. In the absence of Dr. F. W. Poos, representative of the Academy from the Society, Dr. Gurney explained that, in addition to the publication of the JOURNAL, the holding of meetings, and various other activities to promote science, the Academy now is doing a great deal to encourage the teaching of science in the secondary schools of the D. C. metropolitan area. The Annual Science Fair, for the metropolitan schools, is supported in large part by the Academy, which in turn gets some assistance from affiliates. The Executive Committee recently voted to contribute the sum of $15 to this worthy cause, and Dr. Gurney pointed out a box for any personal donations which members cared to contribute. (Speaker's abstract.)

The death on January 29 of L. M. Peairs, for many years the editor of the *Journal of Economic Entomology,* was announced by E. N. Cory.

Elizabeth Haviland exhibited an excellent collection made in the introductory course in entomology at the University of Maryland by G. S. W. Marvin. Mr. Marvin, whom Dr. Haviland introduced, had collected more than three hundred specimens during the fall of 1955.

R. I. Sailer read a letter applauding the decision by the Common Names Committee to adopt ''fig wasp'' for *Blastophaga psenes* (L.), as this name has been in use since the time of Aristotle.

The death of Z. P. Metcalf on January 7 was announced by Louise Russell. R. W. Harned spoke briefly on his early association with the well-known professor of entomology, who had been a member of the Society since 1942. (See p. 121—Ed.)

Professor Harned exhibited a program of the forthcoming meeting of the Cotton States Branch of the Entomological Society of America in Atlanta. J. S. Wade exhibited two new books, ''Kinships of Animals and Man,'' a zoology text by Ann H. Morgan, and ''Scientific Writing,'' by Meta Riley Emberger and Marian Ross Hall.

The address of retiring President T. L. Bissell was titled, ''The History of Entomology at the University of Maryland.'' The teaching of entomology at Maryland Agricultural College, forerunner of the University of Maryland at College Park, began with Townend Glover in 1860. From then until the 1890's teaching continued more or less regularly as a subject in the Natural History Department. C. V. Riley was the first entomologist employed by the Experiment Station, 1893 to 1895. Following the appearance of the San Jose Scale in Maryland, the State Horticultural Department was established to prevent the spread of harmful insects, to conduct investigations, and to disseminate information. There have been four State Entomologists: Willis G. Johnson, 1896-1901; A. L. Quaintance, 1901-1903; T. B. Symons, 1904-1914; and E. N. Cory, 1914 to date. Over this period of 96 years more than 80 persons have been employed in entomological work at the University of Maryland. Insects which have been the most significant in the history of entomology at the University are San Jose scale, codling moth, house fly, mosquitoes, Japanese beetle and the European corn borer. (Speaker's abstract.) The pictures of early entomologists, their equipment and their activities caused many chuckles, especially when respected senior members of the Society were recognized.

Visitors who were introduced included University of Maryland students *Linn B. Savage, A. F. Press, J. W. Press,* and *C. W. McComb,* recently returned from Okinawa; and *George R. Manglitz,* Cereal and Forage Insects Section, recently transferred to Beltsville from the Tifton, Ga., laboratory.

The meeting adjourned at 9:40.—Kellie O'Neill, *Recording Secretary*

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of the

ENTOMOLOGICAL SOCIETY of WASHINGTON

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CONTENTS

THE
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ORGANIZED MARCH 12, 1884

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THE MESOSTIGMATIC NASAL MITES OF BIRDS. IV. THE SPECIES AND HOSTS OF THE GENUS RHINONYSSUS
(ACARINA, RHINONYSSIDAE)

By R. W. STRANDTMANN, *Department of Biology, Texas Technological College, Lubbock.*

In this paper is presented a description of a new species, a redescription of an old species, and a key to the species thus far known.

Rhinonyssus novae-guinea Hirst, (1921:769) is removed from the genus. Hirst figured and described only the ventral side of the female and did not describe the chela. Hence, it is impossible to assign it definitely to its correct genus at present. At first glance, it strongly resembles a *Rhinonyssus* but the segmented portion of the palp is considerably longer than the basal portion and its host is not one of the water birds. These two factors are sufficient to exclude it from *Rhinonyssus*.

According to Trouessart (1894), bird nasal mites have been known since 1871, when Nitzsch found specimens in the goatsucker, *Caprimulgus europaea* (subsequently described by Giebel as *Dermanyssus nitzschi*). Trouessart pointed out that they were not related to the Dermanyssidae but seemed to be related to the pteroptids (=Spinturnicidae). But in 1895 he stated that they are as distinct from the pteroptids as from the dermanyssids and proposed a new subfamily, Rhinonyssinae (the genus *Rhinonyssus* he described in 1894). Trouessart further recognized that nasal mites were to be found in chickens, geese, cuckoos, and many other birds, but he described only a very few species. Among those described were *Rhinonyssus coniventris* and *Sternosstoma rhinolethrum*. The former is the genotype of *Rhinosyssus*, and the latter has been transferred to that genus.

Rhinonyssus Trouessart, 1894:723

Type.—Rhinonyssus coniventris Trouessart. Type by monotypy.

Synonym.—Somatericola Tragardh, 1904:28. Type *Sommatericola levinsini.*

Sternostomum Trouessart, 1895:393 (emendation of *Sternostoma* Berlese et Trouessart, 1889) is given as a synonym of *Rhinonyssus* by Vitzthum, 1935, and by Castro, 1948. However, the present writer is not at all in sympathy with considering *Sternostomum* an entity distinct from *Sternostoma*. Trouessart clearly stated that *Sternos-*

[1]This study was supported in part by a grant-in-aid from the Public Health Service, through Research Contract RG—4073(C2).

toma had the wrong ending according to Rules of Zoological Nomenclature and he was therefore correcting it to *Sternostomum*. He even mentioned the original species as genotype (*S. cryptorynchum*). But because Trouessart described *rhinolethrum* under this name, and which is obviously not a *Sternostoma,* Vitzthum (1935) stated that *Sternostomum* must be recognized as valid and distinct from *Sternostoma,* and that *rhinolethrum* is its genotype. But we are of the opinion that the names *Sternostoma* and *Sternostomum* should be considered as identical and that *rhinolethrum,* which is not a *Sternostoma,* should be removed to its proper genus, which is *Rhinonyssus,* as de Castro has done (1948).

The genus *Rhinonyssus* may be defined as mites of medium to large size; lacking a peritreme; having a single dorsal podosomal shield or a group of platelets in the podosomal region; the sternal plate lacking or greatly reduced; the anal plate also lacking or drastically reduced; the segmental portion of the gnathosomal palps shorter than the basal portion; the chelate portion of the chelicera at least 1/7 or more of the total length of the chelicera; lacking deutosternal teeth; lacking a modified forked seta on the palp tarsus and with no trace of a tritosternum.

They have been found in the Colymbiformes, Anseriformes, and in some of the Charadriiformes (Charadriidae, Scolopacidae, Recurvirostridae, and Alcidae; but not in the Laridae, which have their own peculiar mite of another genus).

Key to Species

1. Anal plate present though rarely fully developed; gnathosomal palps with stubby, short and thick, spine-like setae 2
   No trace of an anal plate. Palpal setae otherwise 3
2. Ventral setae attenuate; anal plate narrow and with a few lines, the anal setae rarely on the plate. Parasites of Anseriforme birds .... *rhinolethrum*
   Ventral setae blunt; anal plate broadly oval and bearing two setae. Parasites of Colymbiforme birds .... *alberti,* n. sp.
3. Anal pore dorsal; vestiges of a sternal plate. Sixteen or more ventral setae. Parasites of the Blacknecked Stilt (*Recurvirostridae*) .... *himantopus*
   Anal pore ventral; no traces of a sternal plate. Ventral setae 8 or less 4
4. Only four ventral setae on the hysterosoma; two anterior and two posterior to the anal pore. Parasites of the auks (Alcidae) .... *caledonicus*
   Eight ventral setae, six of which are anterior to the anal pore 5
5. Sternal setae all very short and not attenuated. (Examples of this species not seen by the writer). Parasites of auks—(Alcidae) .... *waterstoni*
   Sternal setae may be short and heavy but at least the third pair is appendiculate. Parasites of small wading birds (plovers and sandpipers) .... *coniventris*

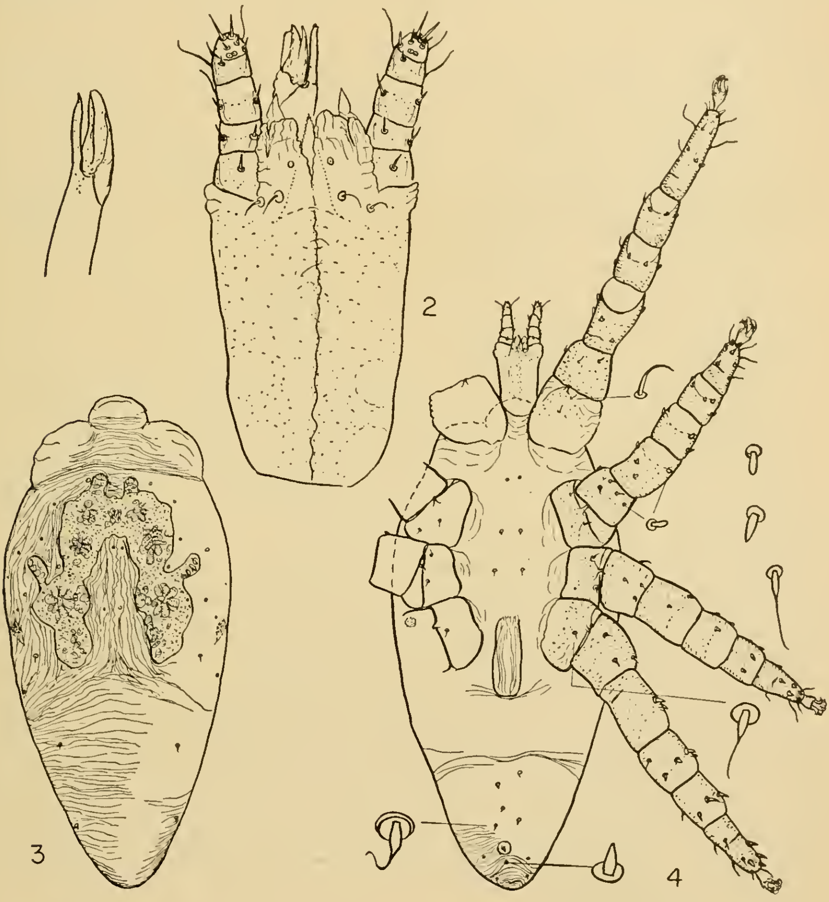
Rhinonyssus coniventris Trouessart

(Figs. 1, 2, 3, 4)

Rhinonyssus coniventris Trouessart, 1894:723; described but not illustrated. Hirst 1921:361; gives a very brief description and illustrates the ventral view of both male and female. Vitzthum, 1935. de Castro, 1948. Strandtmann, 1951: 130; illustrates dorsal and ventral views of both sexes and gives details of the gnathosoma.

Synonyms.—Rhinonyssus echinipes Hirst, 1921: 359; type host, *Charadrius hiaticula,* the ringed prover.

Rhinonyssus neglectus Hirst, 1921:359; type host, *Erolia maritima,* the purple sandpiper.



Rhinonyssus, coniventris Troussart: fig. 1, male chela; fig. 2, female gnathosoma, ventral view; fig. 3, dorsum of female; fig. 4, ventral view of female with sternal setae enlarged at right.

The mite varies in length from about 1400 μ to 2400 μ. It was redescribed by Strandtmann in 1951. Trouessart originally described it as being 2-3 mm. in total length and having stubby legs, the first pair being longest.

The type host was *Strepsilas interpres* (=*Arenaria interpres*), the turnstone.

Trouessart mentioned that a similar species, or a variety, was to be found in *Totanus calidris,* a yellow legs. Hirst's *neglectus* was found in *Erolia maritima,* the purple sandpiper; and his *echinipes* was found in *Charadris hiaticula,* the ringed plover.

We have found it in the following hosts:

Plovers: Arenaria interpres, the ruddy turnstone; Galveston, Texas; March 26, 1947; and May 29, 1948; 2 mites— a male and female.

Charadrius hiaticula, the ringed plover; Galveston, Texas; December 6, 1947; March 14, 1948; and March 20, 1948. About 20 mites, including males, females, nymphs, and larvae.

Charadrius alexandrinus, the snowy plover; Okaloosa County, Florida; April 8, 1951. Bob Elbel, collector. One female mite.

Sandpipers: Catophrophorus semipalmatus, the willet; Galveston, Texas; March 14, 1948; March 25, 1947; and April 3, 1948. About 15 mites, including all stages.

Totanus flavipes, the lesser yellow legs; Galveston, Texas; March 25, 1947. 4 mites.

Erolia alpina, Dunlin (=red-backed sandpiper). Galveston, Texas; March 20, 1948. I female mite.

Arquatella ptilocenemis, the Aleutian sandpiper. Eagle River, Alaska; October 29, 1949; R. B. Williams, collector. 1 female mite.

Crocethia alba, the sanderling, Galveston, Texas; November 30, 1947; March 14, 1948; and March 26, 1947. 3 mites, all female.

As is to be expected, there is some variation in the mites from these 8 hosts, but these variations are slight and intermediate conditions between extremes of variation exist.

Mites from the ringed plover have the dorsal sclerotized area well developed and meeting anteriorly, as depicted in the figure, and the ventral setae are apically attenuate. Mites from the dunlin (=red-backed sandpiper) and from the sanderling, have the dorsal sclerotizations more reduced and not meeting anteriorly, and the ventral setae have a very slender, subapical appendiculation. In mites from the snowy plover the dorsal sclerotizations are much reduced, as they also are in those from the turnstone. In both the latter the setae are not as prominently inflated as in the dunlin mites. Mites from the willet and yellow legs have rather well developed dorsal sclerotized areas and the ventral setae have apical attenuations. Variations in size, thickness of legs, and slenderness of the opisthosome are about the same for all hosts.

Rhinonyssus himantopus Strandtmann

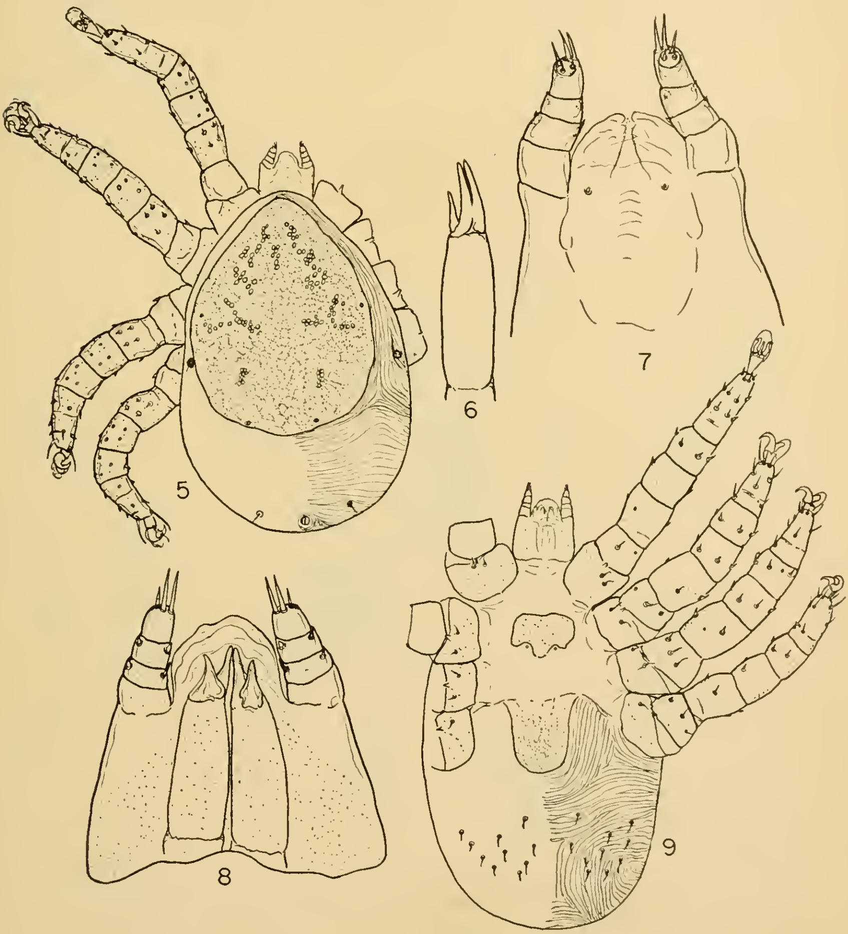
(Figs. 5, 6, 7, 8, 9)

Strandtman, 1951:136. Male, female and larva are described; male and female illustrated.

A fairly large, rather rounded mite. The female is about 800μ and the male about 700 μ long.

In addition to the characters in the key, the mite has the following distinguishing features: a large and prominent dorsal plate; a remnant of the sternal plate; apparent loss of sternal setae.

It has been recovered only from the type host, the black necked stilt, *Himantopus mexicanus*. Our records are: Kleberg County, Texas; September 11, 1949; Larry Cavazos, collector; 8 mites: Cocoa, Florida; June 9, 1954; R. O. Albert, collector; 4 female mites, one with larva.



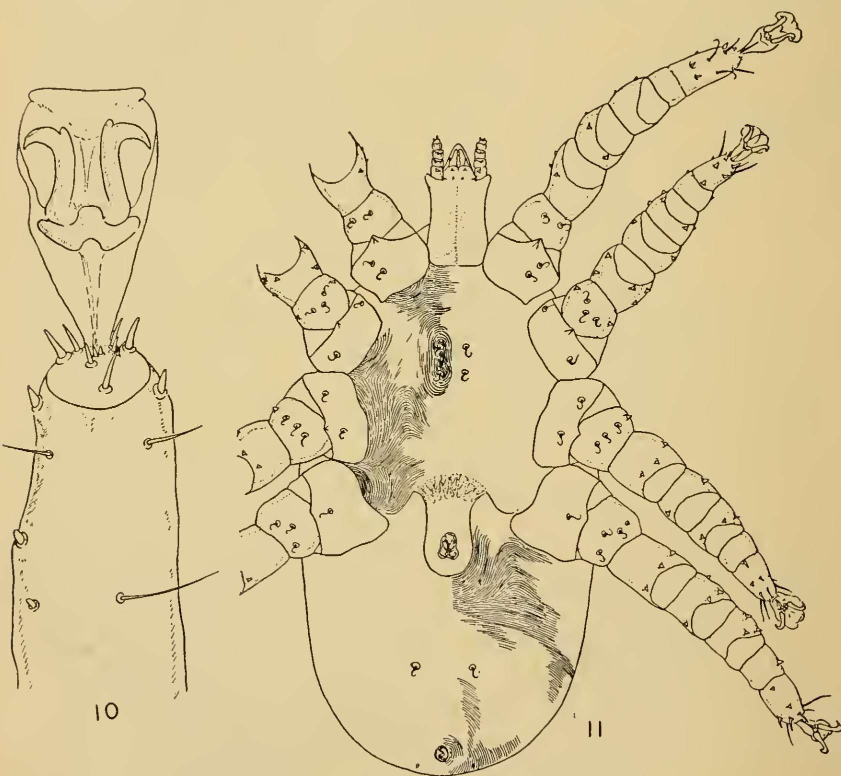
Rhinonyssus himantopus Strandtmann: fig. 5, dorsal view of female; fig. 6, male chelicera; fig. 7, ventral view of female gnathosoma; fig. 8, dorsal view of female gnathosoma with chelicerae; fig. 9, ventral view of female.

Rhinonyssus waterstoni Hirst

Hirst, 1921:359. Female briefly described and illustrated in ventral view. de Castro, 1948. Type host, the razor bill auk, *Alca torda.*
Synonym.—Sternostomum waterstoni, Vitzthum, 1935.

The present writer has not seen this species. Hirst's description is quoted below in its entirety.

"Female.—Abdomen not elongated. Very minute spinules are present on the venter in this species, instead of the hairs that are present in *R. caledonicus.* Capitulum short; segments of palp very short, being very much wider than long; tarsal segment very small, the conical tubercle on it well developed. Legs not



Rhinonyssus caledonicus Hirst: fig. 10, tarsus I of female, dorsal view; fig 11, ventral view of female.

very long, the first pair apparently slightly shorter than the fourth. Coxae with very short spinules or hairlets instead of the fairly long hairs present in *R. caledonicus.* Spines on legs much weaker than in *R. neglectus.* Claw of first leg apparently without any dorsal process.

Length.—0.96 mm.

Habitat.—Nasal cavities of the Razorbill (*Alca torda*), Ollaberry, North

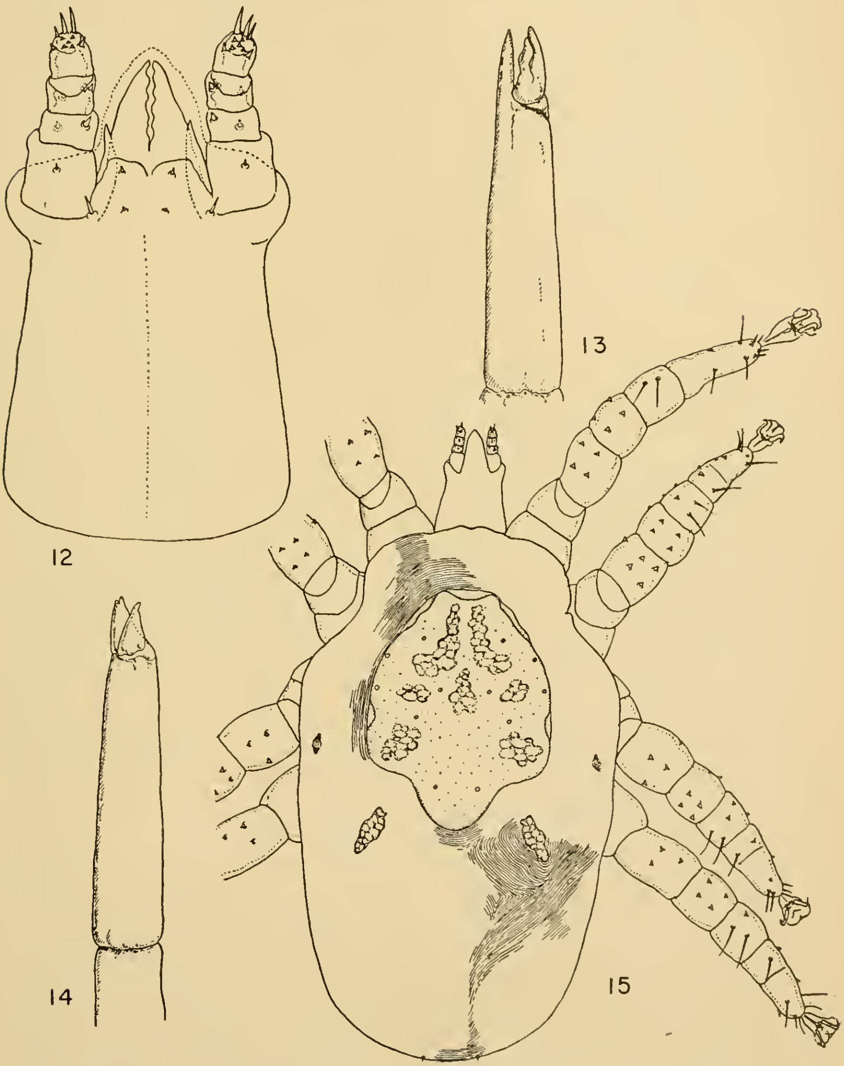
Mavine, Shetland Islands. Specimens collected by James Waterston (15. xii. 1913).''

Rhinonyssus caledonicus Hirst

(Figs. 10, 11, 12, 13, 14, 15)

Hirst, 1921:357. A brief description plus a ventral view of the female; (Type host: *Uria grylle,* (Black Guillemot). de Castro, 1948.

Synonym.—Sternostomum caledonicum, Vitzthum, 1935.



Rhinonyssus caledonicus Hirst: fig. 12, gnathosoma of female, ventral view; fig. 13, male chelicera; fig. 14, female chelicera; fig. 15, dorsal view of female.

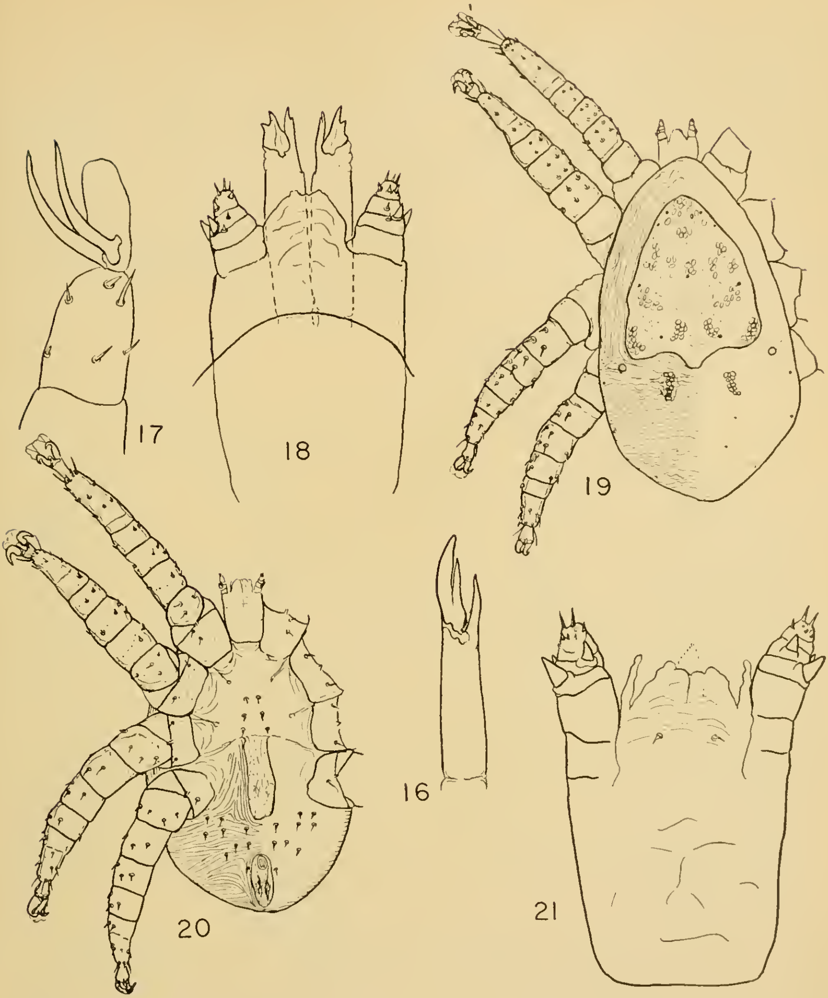
Several specimens from the Rhinocerus auklet were received through the kindness of Dr. R. O. Albert. They are apparently *R. caledonicus* although they have only two pairs of sternal setae instead of three.

Female.—Length; 1500 μ; dorsal plate 587 μ long, 450 μ wide. *Venter.* No sternal nor anal plates. Epigynial plate without setae but with a pair of small pores or setal bases posterior to it. One pair of rather prominent setae about midway between the epigynial plate and the anal pore, and one pair of smaller setae lateral and posterior to the anus. Only two pairs of sternal setae. *Dorsal.* One large podosomal shield, the posterior margin of which is strongly produced. Two small platelets lie posterior to the plate. There are six pairs of setal bases on the plate, but no setae. The dorsal surface otherwise is also devoid of setae. Stigma without platelet or peritreme. *Gnathosoma.* (The terminology as proposed by Gorirossi and Wharton (1953) is used.) Lacking are the deutosternal and gnathosomal setae. All three pairs of hypostomal setae are present; the anterior and inner basal are quite short, the outer basal longer. The palp trochanter has one small ventral seta; the femur has two setae, one dorsal, one ventral; the genu has three, two dorsal and one ventral; and the tibia has two, both ventral. The palp tarsus has a cluster of tiny setae and two to three long setae. The movable digit of the female chela is slightly reflexed at the tip; the immovable digit is apically bifid. The male chela has the spermatodactyl only slightly produced beyond the movable digit. The immovable digit is straight, simple, and as long as the spermatodactyl. The hypostomal processes appear as fleshy lobes. An epipharynx does not show. The tectum is smooth and nearly as long as the palps. One specimen shows a pair of rather short and heavy salivary stylets. *Legs.* The coxal setae and ventral setae of the trochanters are thin and flexible. The femora, genuae, and tibiae of all legs have short, thick setae but dorsally the tibiae also have a pair of long, slender setae. The tarsi also have short, thick setae but basally. Apically they are long and slender, especially on tarsus I.

Male.—Length. 1450 μ; dorsal plate 510 μ long, 390 μ wide. Differs from the female only in the chelae and in having a male gonopore. Plates and chaetotaxy as in the female.

Immature stages were not found.

Hirst's description was based on specimens taken from the black guillemot, collected on the Shetland Islands in February, March, and October, 1912 by James Waterston. Our description was based on three specimens, 1 male and 2 females, taken from *Cerorhincha monocerata,* the Rhinocerus auklet, collected in Puget Sound, Bremerton, Washington, North America, on March 1, 1952 by Dr. R. O. Albert.



Rhinonyssus rhinolethrum (Trouessart): fig. 16, male chelicera; fig. 17, tarsus I of larva; fig. 18, female gnathosoma, dorsal view, showing chelicerae; fig. 19, dorsal view of female; fig. 20, ventral view of female; fig. 21, female gnathosoma, ventral view.

Rhinonyssus rhinolethrum (Trouessart)

(Figs. 16, 17, 18, 19, 20, 21)

Sternostomum rhinolethrum Trouessart, 1895:393. Briefly described but not illustrated. (Type host, the domestic goose). Berlese, 1912:71, illustrated. Vitzthum, 1935. Vitzthum, 1941:656.

Rhinonyssus rhinolethrum (Trouessart), de Castro, 1948. Strandtmann, 1951: 132; redescribed, with illustrations of the male, female, and nymph as well as details of the gnathosoma.

Sommatericola levinsini Tragardh, 1904:29. Both sexes described and illustrated. Type host, eider duck, *Sommateria mollissima.*

Sternostomum levinsini, Vitzhum, 1935.

Rhinonyssus levinsini, Hirst, 1921, de Castro, 1948.

Rhinonyssus dartevellei Fain and Vercammen—Grandjean, 1953. Described and illustrated from eleven females, one nymph and three larvae. Type host, the spur-winged goose, *Plectropterus gambensis.*

This is a fairly large mite, up to 1.5 mm. long but the average length is slightly less than 1 mm. Distinguishing characters are the very heavy palpal setae, narrow anal plate, and seven to fourteen pairs of basally swollen but attenuated ventral setae.

This is a common mite in Anseriforme birds. Our records include the following:

Swans: *Cygnus columbianus*, the whistling swan. Norman, California; March 6, 1951; R. O. Albert, collector. Four specimens, 2 females and 2 nymphs, one of the females containing a larva.

Geese: *Branta canadensis*, the Canada goose. Muleshoe, Texas; February 11, 1950. One mite, a female.

Ducks: *Anas platyrhynchus*, the mallard. Coleman County, Texas; December 30, 1949; W. F. Cox, collector. Two mites.

Anas strepera, the gadwall. Matagorda County, Texas; January 18, 1948. Two heads yielded eight mites, one male, four females, three nymphs. Northwest Texas; November 13, 1951. Nineteen mites, of which 14 are females (one with larva, two with eggs) and 5 nymphs (two ready to molt). Earl Camp collector.

Mergansers: *Mergus merganser*, the American merganser. Several specimens, including 2 females with larvae. Collected in New England by Lawrence R. Penner.

Mergus sp. (probably *serrator*, the redbreasted merganser). Lubbock County, Texas; December 5, 1952; Anne McCaig, collector. Four mites, 2 of which had larvae.

From the literature may be added the domestic goose, the eider duck, and the spur-winged goose. We have also found one specimen, which may be an accidental record, in a head of a coot, *Fullica* sp. collected in Thailand and sent to us through the courtesy of Bob Elbel.

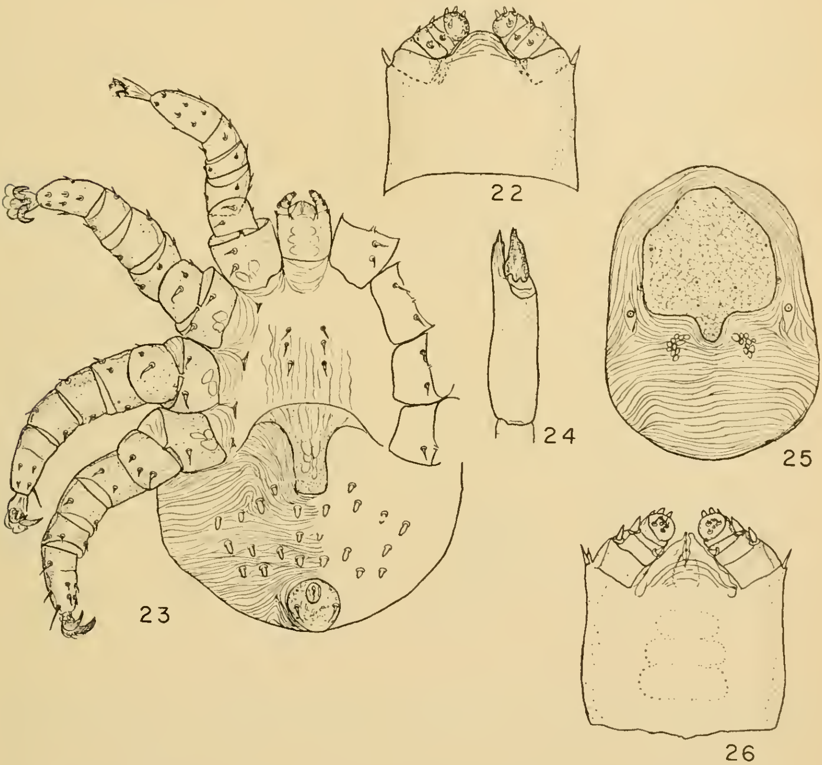
We have not seen specimens of *dartevellei* F. and V.-G. but the descriptions, illustrations and Anseriforme host argue powerfully for synonymy.

Mites from these hosts are strikingly similar, with the single exception of the swan. Mites from the swan have the posterior margin of the dorsal plate slightly eroded and the palpal setae are much reduced. A striking feature of the species is the exceptionally long tarsal claws of the larva. We have not seen any other related mite in which the claws are so well developed.

Anas acuta, the pintail. Muleshoe Wildfowl Reservation, Muleshoe, Texas; January 28, 1950. Four heads examined, 2 mites found in one of them.

Anas carolinensis, the greenwinged teal. Norman, California; January 14, 1951; R. O. Albert, collector. Three mites, 2 females and 1 nymph.

Mareca americana, the baldpate, or American wigeon. Muleshoe Wildfowl Refuge, Muleshoe, Texas; February 11, 1950. Examined 6 heads and found 2 mites, both females.

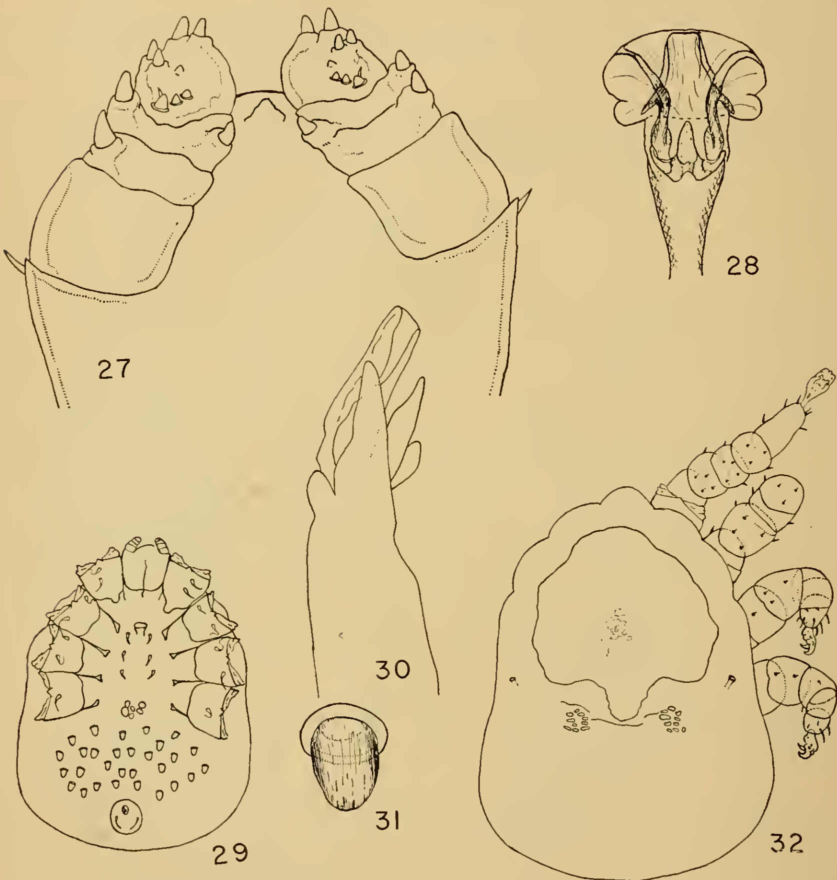


Rhinonyssus alberti, n. sp.; fig. 22, female gnathosoma, dorsal view; fig. 23, ventral view of female; fig. 24, female chelicera; fig. 25, dorsum of female; fig. 26, female gnathosoma, ventral view.

Spatula clypeata, the shoveler. Kleberg County, Texas; December 25, 1949; Larry Cavazos, collector. Four heads examined, two mites found, one female and one nymph.

Aythya affinis, the lesser scaup. Kleberg County, Texas; December 25, 1949. One mite, female.

Melanitta deglandi, the whitewinged scoter. Puget Sound, Bremerton, Washington; R. O. Albert, collector. One mite, a male.



Rhinosyssus alberti, n. sp.: fig. 27, gnathosomal palps, ventral view; fig. 28, claws and ambulacrum of tarsus I, female; fig. 29, ventral view of male; fig. 30, male chela; fig. 31, ventral seta, enlarged; fig. 32, dorsal view of female.

Rhinonyssus alberti, new species
(Figs. 22-32)

This new species from grebes is more closely related to *rhinolethrum* (from ducks, geese, etc.) than to any other *Rhinonyssus*. The female is about 800 μ long by 500 μ wide; the male is about 640 μ by 480 μ. The palps have blunt, heavy setae and the venter bears 10 to 15 pairs of very heavy, short, blunt setae. There is an anal plate but it bears only two setae and lacks a cribrum.

Female.—Varying in length from 720 μ to 890 μ, averaging just a little over 800 μ. *Venter.* No sternal plate. The six sternal setae are swollen basally and attenuate evenly into thin, flexible tips. The epigynial plate is about twice as long as wide and devoid of setae but it is sclerotized and pigmented. The venter bears from ten to fifteen pairs of prominent, broad, blunt setae. The anal plate is present but not sclerotized. It is rounded, bears two setae, and lacks a cribrum. The anal pore is near the anterior margin. *Dorsum.* A large, well sclerotized, lightly reticulated podosomal plate which is narrowly and bluntly produced on the posterior margin. Two small platelets lie posterior to the podosomal shield. There are no stigmal plates. The entire dorsal surface is devoid of setae. *Gnathosoma.* The pedipalps are short and stubby but bear prominent heavy setae. One rather slender seta is at the outer base of the palp trochanter (or at the apex of the coxa?). The palp femur has a short heavy seta on the outer margin and the palp genu has a seta on both the inner and outer margins, the palp tibia seems to have two or three heavy, blunt setae at the apex, and the small tarsus has several indistinct, knoblike setae. There are no hypostomal setae, no deutosternal setae and no gnathosomal setae. An epipharynx does not show. The tectum is a fairly short, rounded lobe. The chelae are about ¼ the total length of the chelicerae. Both arms are equally developed and are straight and thick and devoid of teeth. *Legs.* The coxal setae have slender tips which arise gradually from swollen bases. The trochanters have similar setae but smaller. The rest of the leg segments have short, rigid setae with the exception of the tarsi, which bear long, slender setae apically.

Male.—Average length, 640 μ; width, 480 μ. Gnathosoma, dorsal surface and chaetotaxy of legs as in the female. Anal plate as in the female. Ventral setae same morphologically as in female but numbering 26-28. *Genital pore* just anterior to the first pair of sternal setae. No sternal plate. A small, indistinct plate is located between coxae IV. The *chela* is difficult to delineate clearly. The immovable arm is slender, straight and edentate. The movable arm is a trifle longer, is quite broad, and seems to have an appressed appendage basally. The spermatodactyl is considerably longer, but is equally as broad as the movable arm. It seems to be either forked or broadly cupped apically.

Nymph.—Length 620 μ. Chaetotaxy quite similar to that of the female. The dorsal shield is extremely vague. The ventral side has only the anal shield. Number of ventral setae, 28-30.

Types.—Holotype female, and several paratypes, including a male and nymph are in the acarology collection of the U. S. National Museum, Washington D. C. Paratype females have been sent also to Dr. Jean Cooreman at the Brussels Natural history Museum, Belgium; Dr. A. Fain, Ruanda Urundi, Astrida; Dr. F. Zumpt at the Medical Institute, Johannesburg, South Africa; and Dr. Deane Furman, University of California. The balance are in the collection of the author.

Type host. Colymbus caspicus, the eared grebe.

Type locality. Longbeach, California, North America.

The above description is based on 18 females, 3 males and 2 nymphs. They were found in the nasal passages of a single bird which was collected on December 30, 1951 by Richard O. Albert, M.D., in whose honor this distinctive mite is named.

Summary

This paper includes the synonymy and description of the genus *Rhinonyssus*, a key to the known species, a brief description of the previously known forms, a detailed description of a new species, *R. alberti*, and illustrations of each species we have seen. The species *Rhinonyssus nova-guinea* is removed from the genus.

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ANNOUNCEMENT

Short scientific articles, not illustrated, two double-spaced typewritten pages or less in length, are welcome and will usually receive prompt publication. References to literature should be included in the text.

CONCERNING THE IDENTITY OF AMBLYOMMA MACULATUM, A. TIGRINUM, A. TRISTE, AND A. OVATUM OF KOCH, 1844

(Acarina, Ixodidae)

By Glen M. Kohls, *Rocky Mountain Laboratory, National Institutes of Health, Hamilton, Mont.*

In 1844 Koch described four South American species of *Amblyomma* which Neumann (1899) and subsequent authors regarded as synonyms of *A. maculatum* Koch, 1844 described from "Carolina," U.S.A. Recent studies of material in the Rocky Mountain Laboratory collection, plus several lots of presumed *A. maculatum* from South America kindly lent by Dr. H. de Beaurepaire Aragão of the Instituto Oswaldo Cruz in Brazil, supported my previous opinion that South American species other than *A. maculatum* had been and were continuing to be indentified as *A. maculatum.* It seemed likely that one or more of Koch's supposedly synonymic species were represented but since the descriptions of these are very inadequate the problem could be resolved only by examination of the types. These were made available to me by Prof. Dr. A. Kaestner of the Zoologisches Museum, Berlin, to whom I am deeply indebted for the favor.

The Koch species currently regarded as synonyms of *A. maculatum* are *A. tigrinum, A. ovatum, A.triste,* and *A. rubripes.* I have seen the types of all of these except the last. According to Prof. Kaestner, the types of *A. rubripes* cannot be found in the Zoologisches Museum collection.

It is evident from examination of the Koch material that, although similar in facies and details of the coxal armature, 3 distinct species are represented—*A. maculatum, A. triste,* and the single species represented by *A. ovatum* and *tigrinum.* These latter two are obviously one and the same species and *A. ovatum* (type, a male accompanied by labels reading "type," "ovatum Koch Montevid. Sello," "1048") is hereby reduced to a synonym of *A. tigrinum.*

Amblyomma maculatum Koch

Type.—A male with label reading "Carolina. Zimmermann." Accompanying this specimen but in another vial were 3 males and 3 labels each reading "Caracas. Gollmer." The two vials were contained within another vial in which was a label reading "type" and the number "1044." Since neither Koch nor subsequent authors have mentioned these 3 males from Caracas their status as types is questionable.

This species is readily distinguished from *A. tigrinum* and *A. triste* by the presence in both sexes of a pair of stout ventral spurs on the distal extremity of metatarsi II, III, and IV. Neumann (1899) saw the type but stated that one spur was present on metatarsi II, III, and IV and this error has been repeated in descriptions by most later authors. The presence of paired spurs was noted by Banks (1908), Robinson (1926), Senevet (1940), and Cooley and Kohls (1944). The numerous specimens of *A. maculatum* that I have examined all come from no farther south than Colombia and Venezuela, and I therefore suspect that Robinson's male from Paraguay (his figure 12) is probably *A. tigrinum*. Boero (1944) records *A. maculatum* from several hosts and localities in Argentina but the broad bands of scutal ornamentation shown in his figure of the male (here reproduced, Fig. 1) suggest that the species actually concerned is *A. tigrinum*. Furthermore, the description modified from Neumann (1899) states that one metatarsal spur is present on legs II, III, and

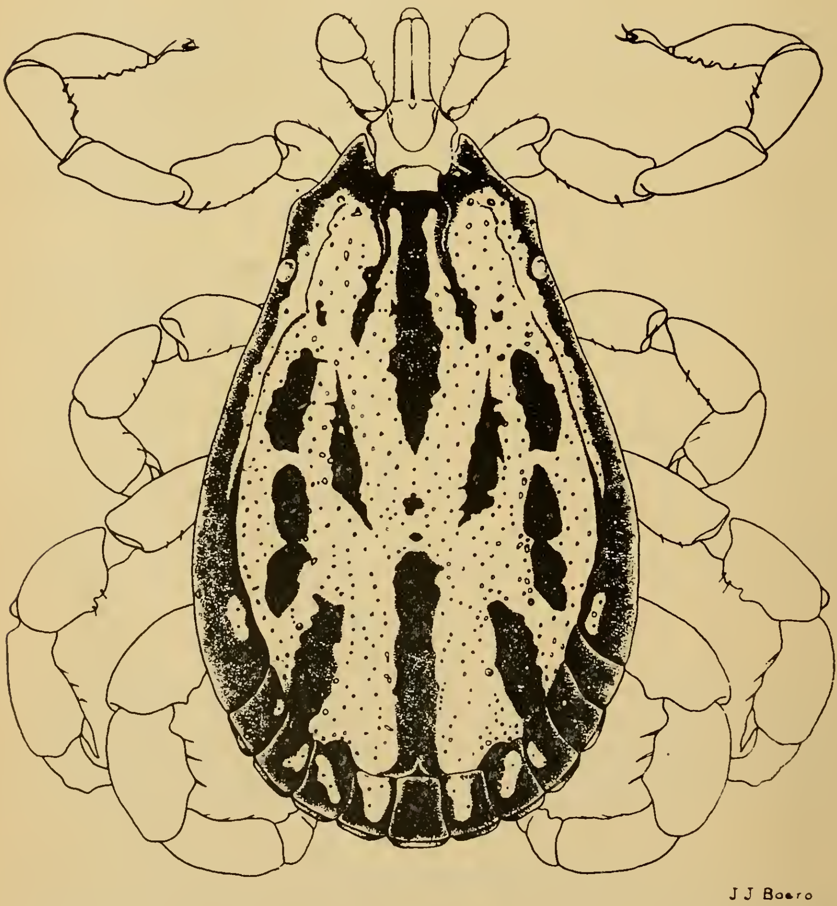

Fig. 1. Male of *Amblyomma maculatum* Koch according to Boero (1944). The broad stripes of ornamentation on the scutum suggest that the species concerned is *A. tigrinum* Koch rather than *A. maculatum*. N. J. Kramis, phot.

IV. The few specimens from Argentina that I have seen are *A. tigrinum,* and it appears likely that Ringuelet's (1948) records, as well as those of earlier authors, of *A. maculatum* in Argentina apply instead to *A. tigrinum.*

Amblyomma tigrinum Koch

Types.—Three males with labels reading "type," "tigrinum Koch. Brasil. Freyr" "1047."

This species is separable an once from *A. maculatum* by the presence of only 1 metatarsal spur on legs II, III, and IV of both sexes. The palpi are somewhat shorter and the bands of scutal ornamentation of the male are usually broader than in *A. maculatum. A. tigrinum* is best distinguished from *A. triste* by the absence of tubercles on the festoons. *A. boutheiri* Senevet 1940, known only from a male and 2 females off dog near Cayenne, French Guiana, appears to be closely related to *A. tigrinum* and is perhaps a synonym. From the description alone I am uncertain of its validity and I have been unable to obtain the types.

Besides the types, I have seen the following specimens, all from Brazil, sent to me by Dr. Aragão:

1 male, ex *Pseudalopex,* State of Rio Grande do Sul. Dr. Cesar Pinto, collector.

3 females, ex dog, S. Borja, State of Rio Grande do Sul, January 13, 1941, Dr. Cesar Pinto, collector.

2 males, ex dog, Belém, State of Pará, February 1955, Dr. Hugo Laemmert, collector.

1 male, ex dog, "Tamandua," State of Mato Grosso, January 23, 1955, Dr. R. Barth, collector.

5 males, 2 females, ex *Chrysocyon,* Anápolis, State of Goiás, December 17, 1936, Dr. R. M. Gilmore, collector.

Through the courtesy of Dr. Aragão, I have also seen a male and female of *A. tigrinum* from French Guiana determined by Dr. H. Floch as *A. maculatum* (Instituto Oswaldo Cruz No. 129).

Two lots totalling 1 male and 4 females in the collection of the Rocky Mountain Laboratory off dogs from unspecified localities in Argentina are clearly *A. tigrinum.*

The presence of the species in Peru is suggested by a collection at hand consisting of 7 males and 4 females from *Dusicyon culpaeus andinus* Thomas at Hacienda Capana, 3500 to 4000 meters elevation, Ocongate, Cusco, August 20, 1949, C. Kalinowski of the Chicago Natural History Museum, collector. These specimens differ from *A. tigrinum* only in being a little larger and more brightly ornamented and may be merely a local variant of that species.

Amblyomma triste Koch

Types.—Two females labeled "triste Koch Montevid. Sello," "type," and "1046."

A. triste agrees with *A. tigrinum* in having but one spur on the metatarsi of legs II, III, and IV, but differs from this species and from *A. maculatum* by the presence ventrally in both sexes of a small tubercle at the postero-internal angle of all festoons except the middle one. The pattern of ornamentation of the female scutum appears to be distinctive (Fig. 2).

The types and the following Brazilian specimens loaned to me by Dr. Aragão from the Instituto Oswaldo Cruz Collection constitute the only known records of this species:

I.O.C. No. 204, 1 male, 2 females, ex vegetation, at Jacaré, near mouth of the Culuene River, a tributary of the Xingu River in

Fig. 2. Female of *Amblyomma triste* Koch. Specimen from lot No. 204 of the Instituto Oswaldo Cruz Collection. N. J. Kramis, phot.

the northeastern part of the State of Mato Grosso, 1948, Dr. J. C. de Mello Carvalho, collector.

I.O.C. No. 215, 1 female, ex *Tapirus*, locality as above, July 10, 1947, Dr. H. Sick, collector.

I.O.C. No. 696, 1 female, host unspecified, area of the Cuminá River, a tributary of the Trombetas River, which joins the Amazon near Obidos, State of Pará, 1928, Dr. Gastão Cruls, collector.

The following key is modified from Robinson (1926) and is presented to aid in the diagnosis of *maculatum*, *tigrinum*, and *triste*:

Marginal groove continuous, coxa I with the external spur long and acute, the internal very short and insignificant. Coxae II and III each with a short spur not so broad as long, or barely broader than long; spur on coxa IV long and slender in males, short and triangular in females. . .

1. A pair of spurs on metatarsi of legs II, III, and IV .... *A. maculatum*
   A single spur on these metatarsi 2
2. Festoons ventrally with a tubercle at the postero-internal angle .... *A. triste*
   Festoons without tubercles .... *A. tigrinum*

Summary

Amblyomma tigrinum Koch, 1844, and *A. triste* Koch, 1844, long regarded as synonyms of *A. maculatum* Koch, 1844, are re-established as valid species. *A. ovatum* Koch, 1844, also long synonymized under *A. maculatum*, is found to be the same as *A. tigrinum* and is reduced to a synonym of the latter species. Koch's types of these species were examined and compared with additional material now available.

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A BRACONID PARASITE OF A PSOCID
(Hymenoptera)

By C. F. W. Muesebeck, *U. S. National Museum, Washington, D. C.*

To my knowledge there is no authentic published record of the rearing of a species of Braconidae from any species of Psocoptera. Accordingly, I was extremely interested to examine a nice series of specimens of a braconid recently reared from a psocid by Dr. Kathryn M. Sommerman under conditions that left no room for doubt as to the host association. The parasite proved to be an undescribed species of the little known euphorine genus *Euphoriella* Ashmead. Only two Nearctic species of this genus have been described, and no host is known for either of these. The only published host record for any species of *Euphoriella* concerns *E. marica* Nixon, an African form which is reported to have been reared from nymphs of a species of the mirid genus *Sthenarus*. I am happy to name the new species described here for its discoverer.[1]

Euphoriella sommermanae, new species
Figure 1

Very similar to *incerta* (Ashmead), but the head is relatively smaller, with the temples not so broad, and is deep black rather than reddish brown; the mesoscutum is more uniformly, though sparsely, covered with setigerous punctures; the propodeum is more regularly areolated, and the abdominal petiole is less strongly sculptured.

Female.—Length about 1.3 mm. Head much wider than thorax but barely twice as wide as long; frons, vertex and temples smooth and shining; face with closely placed, very shallow punctures; malar space about one-half as long as basal width of mandible; clypeus smooth; eyes very large, wider than temples or face, situated low, their upper margins barely attaining level of median ocellus; antenna 14-segmented, about as long as head and thorax combined, the flagellum thickening a little toward apex; pedicel large, about as long as first flagellar segment.

Mesoscutum smooth and shining, evenly covered with widely spaced, small, setigerous punctures; sulcus before scutellum broad and deep, divided into two large pits by a low median longitudinal septum; scutellum convex, polished, propodeum completely areolated, but the carinae weak and sometimes difficult to follow clearly owing to irregular rugosity within the areas; legs rather short and moderately stout; last tarsal segment of anterior leg stout and longer than third and fourth tarsal segments combined.

Abdomen small, slender, petiolate; petiole very slender, longer than propodeum, a little arched, about as wide as apex as at base and very slightly the widest at the middle where the spiracles are situated, its surface weakly longitudinally aciculate from spiracles to apex; remainder of abdomen smooth and polished.

Black; clypeus and mandibles brown; scape, pedicel and basal flagellar segments yellowish; wings hyaline, stigma brown with a small pale spot at base; legs

[1]See this number of the *Proceedings*, p. 149.—Ed.

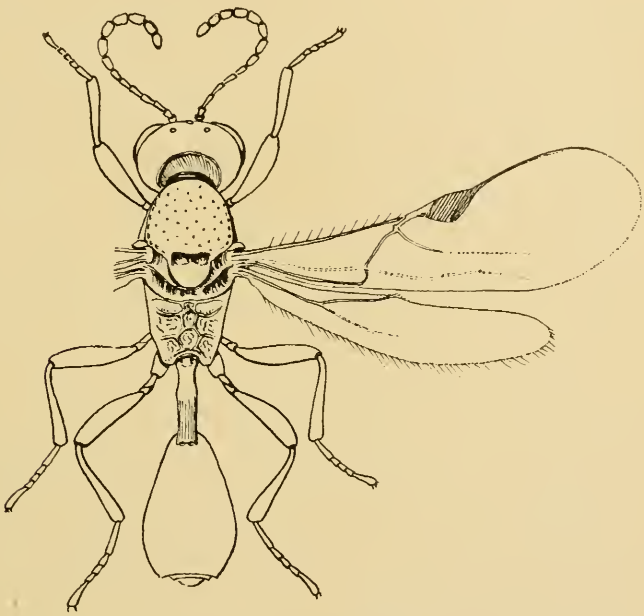
brownish yellow, the hind femora and tibiae, sometimes also the hind coxae and the anterior and middle femora, more or less infuscated.

Male.—Like the female except for its slightly wider face, longer malar space and more slender antennae.

Type.—United States National Museum No. 62982.

Type locality.—Mt. Carmel, Connecticut.

Described from 34 females and 10 males reared by Kathryn M. Sommerman from nymphs of the psocid *Anomopsocus amabilis* (Walsh).



Drawn by Arthur D. Cushman

Fig. 1: *Euphoriella sommermanae*, new species, female.

PARASITIZATION OF NYMPHAL AND ADULT PSOCIDS
(PSOCOPTERA)

By KATHRYN M. SOMMERMAN, *U. S. Public Health Service, Anchorage, Alaska.*

Occasionally I have collected parasitized psocids, but until recently my attempts to rear the parasites to the adult stage, for identification, have been unsuccessful. Adults of a braconid, described earlier in this number of the *Proceedings* (p. 148) by C. F. W. Muesebeck as *Euphoriella sommermanae*, have been reared from *Anomopsocus amabilis* (Walsh); and some parasitic larvae, emerging from nymphs of *Mesopsocus laticeps* (Kolbe) and *Teliapsocus conterminus* (Walsh), have spun cocoons from which adults may emerge eventually.

With the aid of a hand lens a parasitized psocid nymph or adult may be easily recognized, especially when the parasitic larva is nearly mature. The abdomen of the psocid is usually glossy and distended; in the case of the nymphs it is distended to a size normal for a last or fifth instar although the wing pads indicate the individuals to be an instar or two younger. In addition, the coil of the gut is often pushed over to one side or the abdomen is definitely asymmetrical. Sometimes the mature parasite larvae extends into the thorax.

It is difficult to estimate the percentage of a psocid population that is parasitized, because the non-parasitized nymphs tend to complete their development slightly earlier, and the adults could fly away leaving a nymphal population with a high percentage parasitized. Also, the psocid nymphs die within a day or two after the parasites emerge from them. Observations made during June and July, 1955, indicate that parasitization may be extremely localized. The population of *T. conterminus* in one brush pile was parasitized while a less densely populated brush pile about 500 feet away apparently contained no parasitized psocids. The same was true of populations of *A. amabilis* in three brush piles ten to thirty feet apart; only the psocids in the most densely populated pile were parasitized.

The collecting and rearing equipment and procedure are simple and rather satisfactory. The metal caps and rubber plugs were removed from dental tubes, the tubes washed, and a small amount of cotton tamped inside up by the neck of each. A cork was inserted in the larger opening at the opposite end. When psocids are being collected the cork is removed and the neck of the dental tube inserted in a piece of rubber tubing. The psocid is sucked into the dental tube, the cork replaced and the occupied tubes put in a plastic box containing a piece of moist paper. Later a piece of leaf or bark is slipped into the tube to serve a food for the psocid, moist cotton plugs are substituted for the corks and the tubes are placed upright in racks. When a psocid becomes sluggish, indicating that the parasite is about ready to emerge, a few tiny pieces of crushed dried leaf or a little fine sand are inserted for debris.

Collection data for the parasitized psocid nymphs (fourth, fifth and sixth instars) and adults that have come to my attention follow. In all cases the parasitic larvae were Hymenoptera and probably all were Braconidae.

Caeciliidae

Caecilius, n. sp. (description by Mockford in press): 3 nymphs, Apple River Canyon State Park, Ill., Aug. 25, 1949. *Teliapsocus conterminus* (Walsh): 7 nymphs, Mt. Carmel, Conn., July 20, 1955; 7 nymphs, same locality but July 21 (these parasitic larvae emerged and spun cocoons).

Polypsocidae

Polypsocus corruptus (Hagen): 1 nymph, Northeast of Wheaton, Md., June 16, 1950; 1 nymph, Rock Creek Park, Washington, D. C., Oct. 6, 1951, and another Oct. 20, 1951.

Lachesillidae

Lachesilla anna Sommerman: 3 nymphs, Mt. Carmel, Conn. ,July 20, 1955. *Lachesilla* (?) sp.: 1 nymph (3SA27F, Canadian National Collection.)

Peripsocidae

Peripsocus madidus (Hagen): 1 nymph, Leveret, Mass., Aug. 19, 1951; 2 nymphs, Army Medical Center, Washington, D. C., Oct. 7, 1951. *P. quadrifasciatus* (Harris): 1 nymph, Urbana, Ill., Aug. 26, 1949; 5 nymphs, Oakwood, Ill., Oct. 2, 1949; 1 nymph, Murphysboro, Ill., Sept. 20, 1949; 1 nymph, Monticello, Ill., Oct. 9, 1949; 1 nymph, Willimantic, Conn., July 22, 1951. *Ectopsocus californicus* (Banks): 1 female, Camp Picket, Va., July 20, 1953; 1 nymph, Dumfries, Va., Aug. 3, 1953. *Anomopsocus amabilis* (Walsh): About 50 nymphs, Mt. Carmel, Conn., June 18 and 19, 1955 (many parasites successfully reared to the adult stage).

Mesopsocidae

Mesopsocus laticeps (Kolbe): 3 nymphs, Mt. Carmel, Conn., June 29 and 30, 1955 (two parasites spun cocoons). *M. unipunctatus* (Mull.): 26 nymphs, Big Meadows Camp Ground, Skyline Drive, Va., June 19, 1952.

Psocidae

Blastopsocus variabilis (Aaron): 1 nymph, Northeast of Wheaton, Md., June 16, 1950; 1 nymph, Army Medical Center, Washington, D. C., Sept. 27, 1952. *Psocus leidyi* Aaron: 1 female, Northeast of Wheaton, Md., June 16, 1950; 1 nymph, Rock Creek Park, Washington, D. C., Sept. 23, 1951. *P. lithinus* Chap.: 2 nymphs, Mt. Carmel, Conn., Aug. 9, 1951; 2 nymphs and 4 females, Mt. Carmel, Conn., Aug. 13, 1951. *P. pollutus* Walsh: 2 females, Antioch, Ill., July 7, 1932; 1 nymph, Englewood, Fla., March 23, 1952. *Psocus* n. sp.: 1 nymph, Northeast of Wheaton, Md., June 16, 1950. *Psocus* sp.: 1 nymph, Englewood Cliffs, N. J., Sept. 19, 1925; 1 nymph, Mt. Carmel, Conn., Sept. 23, 1950. *Trichadenotecnum unum* Somm., 2 nymphs, Mt. Carmel, Conn., June 29, 1955. *Loensia moesta* (Hagen): 2 nymphs, Mt. Carmel, Conn., June 29, 1955. *Amphigerontia bifasciata* (Latr.): 1 nymph, Big. Meadows Camp Ground, Skyline Drive, Va., June 19, 1952.

Myopsocidae

Myopsocus sp.: 2 nymphs, Rock Creek Park, Washington, D. C., June 29, 1952.

The following information was obtained while three larvae of *Euphoriella sommermanae* were observed emerging from three nymphs of *A. amabilis*. The psocid nymphs were sluggish and walked only when disturbed by another psocid or when prodded. About two-and-a-half hours before actual rupture of the abdominal wall by the parasite larva, a patch of the pigmented layer under the integument had already been cleared away at the side of the abdomen in the vicinity of segments 3 to 5. The larva could be seen moving about inside. Spasmodically the head and abdomen of the psocid protruded simultaneously as the parasite "scraped" away the tissue. Actual emergence, from the time the abdominal wall was first ruptured until the larva was entirely free of the psocid, required about 5 or 6 minutes, but most of that time was occupied in making the rupture large enough to allow the large end (head?) of the parasite to pass through. As soon as the large end was free the larva popped out. Then it hitched nervously and actively about, small end (tail?) first, for about two hours before starting to spin its cocoon. It required about two hours of spinning before the silk was too dense to permit me to see inside the cocoon. Two of the parasites remained in the cocoon 13 days before emerging and the third died after cutting an emergence opening in the cocoon.

The parasitic larvae that emerged from *T. conterminus* and *M. laticeps* were not timed, but the process of emergence and spinning was the same as for those from *A. amabilis*.

BOOK NOTICE

TAXONOMIC APPRAISAL AND OCCURRENCE OF FLEAS AT THE HASTINGS RESERVATION IN CENTRAL CALIFORNIA, by Linsdale, J. M. and B. S. Davis. Univ. California Publ. Zool., 54(5):293-370, plates 11-22, 27 figs. in text. 1956. Univ. California Press, Berkeley. $1.50.

This paper discusses host relationships, seasonal distribution and taxonomy of flea species found on the Frances Simes Hastings Natural History Reservation, Monterey County, California. Continuing collection over a 17 year period yielded a total of 27 flea species taken from 34 species of mammals.

Each flea species is dealt with from the standpoint of its distribution by month of the year, host preference and overall male : female ratio. The taxonomic status of several species is changed, and discussions of individual variation within certain of the species is presented. Charts are included which show the seasonal distribution of all species of fleas found on each host.

—PHYLLIS T. JOHNSON, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

BIOLOGICAL AND TAXONOMIC NOTES ON THE WASPS OF LOST RIVER STATE PARK, WEST VIRGINIA, WITH ADDITIONS TO THE FAUNAL LIST

(HYMENOPTERA, ACULEATA)

By KARL V. KROMBEIN, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

The wasp fauna of Lost River State Park, Hardy County, West Virginia, has been discussed in two previous papers. The first paper (Krombein, Proc. Ent. Soc. Wash. 54: 175-184, 1952) presented an annotated list of 78 species collected June 18-25 and July 18, 1951. The second paper (Krombein, Bull. Brooklyn Ent. Soc. 49: 1-7, 1954) recorded 79 species collected June 29-July 5, 1953, of which 24 species had not been obtained in 1951.

In 1955 we were again able to spend part of our family vacation in the Park, from July 4 to 11. The collections made during this period included 81 species of wasps, of which 26 are new to the Lost River list, thus bringing the total known from the Park to 128 species. Collection data are presented below for the 26 species new to the list, and the opportunity is also taken to add a few biological notes, and descriptions of *Epyris deficiens*, n. sp., *Chalcogonatopus harpax*, n. sp., and of the putative male of *Ammoplanus unami* Pate.

ADDITIONS TO THE WASP FAUNA

Family BETHYLIDAE

Epyris deficiens, n. sp. 1 ♀; July 10; crawling on damp decaying tree stump in dense shade.

Family DRYINIDAE

Chalcogonatopus harpax, n. sp. 1 ♀; July 9; crawling on fence rail beneath oak.

Deinodryinus atriceps (Brues). 1 ♀; July 10; crawling on foliage of *Vaccinium* in sun along edge of trail.

Deinodryinus grandis (Brues). 1 ♀; July 7; crawling on foliage of *Vaccinium* in sun along edge of trail.

Family TIPHIIDAE

Tiphia affinis Malloch. 1 ♀; July 7; along trail on foliage.

Tiphia jaynesi Allen. 1 ♂; July 9; along trail on foliage.

Tiphia subcarinata Malloch. 1 ♂; July 10; along trail on foliage.

Family MUTILLIDAE

Timulla (Timulla) dubitatiformis Mickel. 1 ♀; July 6, crawling on ground along edge of trail in sun.

Family VESPIDAE

Eumenes fraternus Say. 1 ♀; July 10; flying along edge of trail; somewhat worn.

Ancistrocerus unifasciatus (Saussure). 1 ♀; July 7; hovering before log in cabin wall; unworn.

Family **POMPILIDAE**

Dipogon (Deuteragenia) papago anomalus Dreisbach. 1 ♀; July 10; on vegetation along trail; somewhat worn.

Ageniella (Ageniella) mintaka Brimley. 1 ♂; July 4; along trail in shade; fresh. Recorded as **Ageniella (Ageniella)** sp. in 1954.

Minagenia osoria (Banks). 1 ♂; July 10; along trail; fresh.

Evagetes hyacinthinus (Cresson). 1 ♀; July 10; along trail; worn.

Evagetes parvus (Cresson). 2 ♀♀; July 7 (worn) and 10 (fresh); along trail.

Agenioideus (Gymnochares) birkmanni (Banks). 1 ♀; July 10; around cabin; fresh.

Pompilus (Ammosphex) imbecillus imbecillus (Banks). 3 ♂♂; July 7, 8 and 9; along trail; fresh.

Pompilus (Anoplochares) similaris (Banks). 2 ♀♀; July 9 (worn) and 10 (fresh); along trail.

Family **SPHECIDAE**

Solierella nigrans Krombein. 1 ♂; July 4; along trail on fallen twig in sun; fresh.

Trypoxylon (Trypoxylon) adelphiae Sandhouse. 1 ♀; July 5; in open woods; fresh.

Trypoxylon (Trypoxylon) backi Sandhouse. 1 ♀; July 10; hovering before log in cabin wall; somewhat worn.

Trypoxylon (Trypargilum) clavatum Say. 2 ♀♀; July 10; along trail; fresh.

Mimesa (Mimumesa) johnsoni Viereck. 1 ♀; July 4; hovering in front of nest entrance in log in cabin wall; unworn.

Pemphredon (Pemphredon) nearcticus Kohl. 1 ♀; July 11; in woods; fresh.

Pemphredon (Cemonus) bipartior Fox. 1 ♀; July 10; along trail; fresh.

Ammoplanus (Ammoplanus) unami Pate. 1 ♂; July 10; hovering in front of logs in cabin wall in sun; fresh.

Chlorion (Isodontia) harrisi Fernald. 3 ♀♀, 6 ♂♂; July 7-10; along trail; somewhat worn.

Biological Notes

Family **TIPHIIDAE**

Myrmosa (Myrmosa) unicolor Say

A male (71055 B) was captured at 11 a.m. on July 10 while flying in copula with a female which was hanging from the tip of his abdomen. The male was a freshly emerged specimen 8.8 mm. long, and the wingless female was a freshly emerged specimen 4.1 mm. long. The male had a firm hold on the female and did not relax his grasp even after the pair was placed in a cyanide jar. However, the female had made an effort to free herself because the long axis of her body is at right angles to the long axis of the male with her venter upward. The male hypopygium is still in contact with that of the female, so it seems probable that the normal position during mating is for the female to be held beneath the male, venter to venter. Dr. H. K. Townes writes me that he has seen this species in copula several times, the male crawling, flying, and crawling again after flying with a female attached tail to tail and, as he recalls, venter to venter. He notes that the male abdomen is held somewhat elevated when the female is attached. His mating pairs separated quickly in a net.

Family VESPIDAE

Symmorphus canadensis (Saussure)

Females were nesting in moderate abundance in deserted beetle borings in logs in the cabin walls. One female (7855 A) was observed on July 8th bringing in paralyzed, leaf-mining chrysomelid larvae (*Chalepus*) to her nest in full shade on the cabin porch. She brought in one larva at 9:25 a.m., and successive larvae at 9:40 and 9:50. These observations on the provisioning cycle were then terminated. The wasp remained in her nest for a couple of minutes each time that she brought in a beetle larva. The wasp was captured on July 10th as she was constructing a clay plug to seal the boring entrance.

Family POMPILIDAE

Psorthaspis mariae (Cresson)

A newly emerged female was noted crawling in the sun on a gravelly slope along the edge of a trail at 3 p.m. on July 10th. A worn male was trailing excitedly a few inches behind her, and both were captured with one sweep of the net. This pairing confirms the tentative association of sexes in this species suggested by J. C. Bradley (Trans. American Ent. Soc. 70: 75, 1944), though the subgenital plate in the present male specimen shows some variation in being shallowly emarginate at the tip.

Family SPHECIDAE

Spilomena pusilla (Say)

An unworn female (71055 A), 2.6 mm. long, was captured at 4 p.m. on July 10th while she was hovering in the sun in front of her nest entrance in a log in the cabin wall 2.5 meters above the ground. She was carrying an adult winged thrips 1.25 mm. long. The prey record is rather unusual in that the wasp had captured an adult thrips. I have taken *pusilla* with its prey frequently in Arlington, Virginia, from May 28th to September 26th. In every case the prey was a larval thrips, 0.64-1.01 mm. long.

Trypoxylon (Trypargilum) striatum Provancher

An unworn female 16 mm. long nested in a wooden trap nest (E 14) having a boring 150 mm. long and 6.4 mm. in diameter. This trap had been placed horizontally 1.2 meters above the ground on a pile of logs cut for the fireplace. The entrance to the boring faced west and was shaded for most of the day. The trap had been set out on July 4th and an occupant was first noticed in it on July 8th. It was taken up the evening of July 10th at which time it contained the female wasp. Upon being split lengthwise that evening the nest was found to consist of three cells fully stocked with small paralyzed spiders and a single spider at the inner end of what would have become the fourth cell. There was a clay plug 3 mm. thick at the inner end of the boring. The cells, measured from the inner end of the boring, were 25, 28 and 23 mm. long The clay partitions closing each cell were about 2 mm. thick in the center, had the shape of a diverging meniscus, and were so oriented that the rather irregular convex surface was toward the inner end of the boring and the smooth concave surface toward the outer end.

The first (innermost) cell contained three spiders belonging to two species, and the wasp egg was laid on the abdominal dorsum of the last spider placed in the cell. Cell 2 contained six smaller spiders belonging to three species and the egg was laid on the side of the abdomen of the last spider brought in. The third cell contained 11 spiders, 3.8-4.6 mm. long, belonging to three species and the egg was laid on the abdominal dorsum of the fifth spider brought in. The wasp egg in cell 3 shriveled after several days, so the spiders were placed in alcohol and were identified as follows by B. J. Kaston: two females and one male of the araneid, *Neoscona minima* Camb. and what appear to be five juveniles of the same species; a juvenile araneid of another species; and a female anyphaenid, *Anyphaena pectorosa* Koch.

The wasp eggs in cells 1 and 2 had not hatched by the evening of July 11, but had done so by the morning of the 12th. These larvae had completely eaten all spiders stored in their cells by July 15th and began to spin cocoons.

The cocoons are made of a thin layer of tightly woven pale silk impregnated with a fluid, possibly of meconial origin, which dries to form a varnished, brittle, dark brown substance. Fragments of clay from the closing plug are incorporated in the outer end of the cocoon. The more solid part of the mecoinium is voided at the inner end of the cocoon and dries to form a solid black ring several millimeters wide near the end of the cocoon wall or a solid pellet at the inner end of the cocoon. There is a small black nipple on the inner surface of the outer end of the cocoon. The cocoon is circular in cross section with a rounded inner end and parallel sides which flare outward just before the outer end which is less strongly convex than the inner end. The cocoons in cells 1 and 2 were 15.5 and 13.5 mm. long and had been completed by July 18th. The cocoon in cell 2 was oriented with the head end toward the inner end of the boring, but that in cell 1 was properly oriented with the head end outward. Apparently there is only one generation a year, for the inhabitants of cells 1 and 2 were still prepupae at the end of fall.

Taxonomic Notes

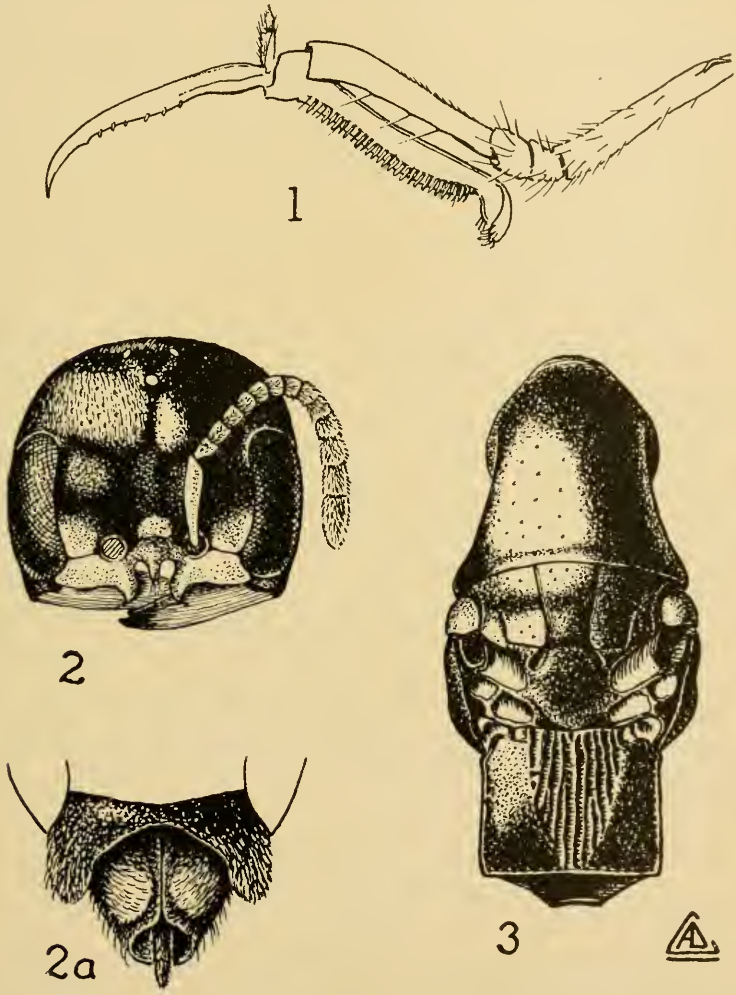
Family **BETHYLIDAE**

Epyris deficiens, new species
(Figure 3)

This is the first species of *Epyris* known from North America which is entirely wingless in the female. Although *E. texanus* (Ashmead) was described as being wingless, the type actually is brachypterous and the narrow wing pads extend backward to the anterior third of the propodeum. The present species may be distinguished from the other known Nearctic species by the following combination of characters: relative proportions of head; femora infuscated; scutellar pits elliptical; central U-shaped area of propodeal dorsum with strong regular rugae, lacking interspersed transverse or irregular rugulae; lateral areas of propodeal dorsum shining and very delicately and minutely alutaceous.

The unique type was walking on the surface of a damp, decaying tree stump in dense shade. It is presumed that the species may be parasitic on coleopterous larvae boring in decaying wood in such a habitat.

Type. ♀; Lost River State Park, Hardy Co., West Virginia; July 10, 1955 (K. V. Krombein) [donated to U. S. National Museum, Type No. 63039].



Drawings by A. D. Cushman.

Fig. 1, *Chalcogonatopus harpax*, fore tarsus of female, anterior view, X52; fig. 2, *Ammoplanus* (*Ammoplanus*) *unami*, frontal view of male head, X52; fig. 2a, the same, modified abdominal sterna, X105; fig. 3, *Epyris deficiens*, thoracic dorsum of female, X39.

Female.—Length about 5 mm. (head and thorax 2.4 mm., abdomen lost after some preliminary notes were made). Black including abdomen, the following reddish: mandible except narrowly at base, antenna except flagellum above which is brown, tegula, legs except femora which are brown. Head above, thorax above and mesopleuron with rather short, sparse, suberect grayish hairs.

Head broadly rounded posterolaterally, the greatest width 0.9 times the length; ocelli in a small, almost equilateral triangle, the posterior pair about twice their diameter from occipital carina; mandible at apex with a strong acute tooth below and a broad blunt lobe above, carina along lower edge of mandible present except on apical fifth; front with a very faint impressed line along midline from between antennae to about one-fourth the distance to anterior ocellus; front and vertex moderately shining, finely and distinctly alutaceous, with scattered, moderately large punctures separated from each other by from 1.5 to 3 times the diameter of a puncture; eyes oval, almost touching anterior mandibular condyle, the length 1.4 times the width, with scattered erect hairs a bit shorter than those on front; occipital carina complete beneath, separated from hypostomal carina on midline by half the distance between the posterior mandibular condyles.

Thoracic dorsum as figured (fig. 3); pronotum arched, somewhat foreshortened in fig. 3, the median length including collar 1.16 times the width at posterolateral lobes, sculptured similarly to front except punctures more remote and surface a little duller, the narrow apical margin smooth and polished; sculpture of scutum and scutellum similar to that of pronotum but surface more shining; tegulae fully developed; mesopleuron moderately shining, finely and distinctly alutaceous, impunctate; metapleuron shining; median U-shaped area on propodeal dorsum with about seven complete, rather straight rugae, the dorsal areas laterad of U-shaped area shining and very delicately and minutely alutaceous; lateral and posterior margins of propodeal dorsum with a strong carina; posterior surface of propodeum with a moderately strong keel along midline extending downward almost to abdominal insertion, the areas laterad of keel shining and alutaceous, the area below keel with a few, fine transverse striae; sculpture of lateral surface of propodeum as on mesopleuron.

Legs stout; mid femur about 1.85 times as long as greatest width; mid tibia with six weak spines in addition to pubescence; tarsal claws each with a tiny erect tooth in middle.

Abdomen shining, sparsely pubescent; apices of third to fifth sternites hyaline, narrowly notched on each side of midline.

Male. Unknown.

Family **DRYINIDAE**

Chalcogonatopus harpax, new species
(Figure 1)

The present species runs to *C. echo* Perkins from Nogales, Arizona, in that author's key (Div. Ent., Hawaiian Sugar Planters' Assn., Bull. 4: 16, 1907). It differs from *echo* in having the entire thorax and first abdominal segment reddish or brown, basal three segments of antenna not yellow, posterior slope of propodeum shining and with numerous transverse wrinkles, and fifth tarsal segment beneath with two rows of lamellate denticles, one row longer and composed of numerous close-set denticles, the other row shorter and composed of about six well-separated denticles. Of the described eastern species, *harpax* seems closest to *C. flavifrons* (Ashmead), n. comb. (*Gonatopus flavifrons* Ashmead, Bull. U. S. Nat. Mus. 45: 84, pl. 5, fig. 4, 1893.), but the thorax does not have a dull, alutaceous surface, the face lacks yellow, and the pronotum posterolaterally has several close, oblique wrinkles.

Type. ♀; Lost River State Park, Hardy Co., West Virginia; July 9, 1955 (K. V. Krombein; crawling on fence rail beneath oak [donated to U. S. National Museum, Type No. 63040].

Female.—Length 3.7 mm. Head, thorax, first abdominal segment and legs reddish brown, the head lighter beneath and infuscated above, pronotum posterolaterally and sides of propodeum darker, and hind tibia narrowly infuscated at apex; rest of abdomen black; clypeus and declivous part of front light stramineous; scape beneath creamy. Face with some dense slivery decumbent hairs along inner eye margins below; thorax with scattered, inconspicuous, erect light brown hair.

Head 1.5 times as broad as long, moderately concave above, the surface above glossy except minutely roughened areas narrowly along eyes and posteriorly in a transverse, arcuate band behind ocelli; antenna relatively slender at base, becoming somewhat broadened toward apex, comparative lengths of segments as 30:18:55:32:25:22:20:18:18:22.

Pronotum divided dorsally by a deep transverse groove into an anterior transverse area which is 0.3 times as long as narrower, posterior section; pronotum shining, impunctate and glabrous except posterolaterally where there is a patch of dense minute punctures just above the area of close oblique wrinkles on the side; mesonotal constriction twice as long as its median width, not carinate along midline but with a lateral sulcus above on anterior two-thirds; propodeum above smooth, posteriorly with moderately close, transverse wrinkles, on sides with these wrinkles oblique.

Fore trochanter with narrow basal stalk much shorter than enlarged apical part; fore tarsus as figured (fig. 1), the first and fourth segments subequal in length, the fifth beneath with a longer complete row of lamellate denticles reaching almost to articular cavity and a shorter row of about six separated denticles, claw with a few short, separated denticles beneath and a small blunt tooth three-fourths of distance to apex.

Abdomen shining, except bases of second and third tergites with a narrow transverse area composed of close, short aciculations.

Male.—Unknown.

Family **SPHECIDAE**

Ammoplanus (Ammoplanus) unami Pate

(Figures 2, 2a)

Ammoplanus ceanothae Viereck, 1904, Psyche 11: 72 (♀♀ in part, not ♂ lectotype designated by Pate).

Ammoplanus (*Ammoplanus*) *unami* Pate, 1937, Trans. Amer. Ent. Soc. 63: 101, figs. 2, 14 (♀; Lehigh Gap, Northampton Co., Pa.; Academy of Natural

Sciences, Philadelphia); Pate, 1942, Bull. So. Calif. Acad. Sci. 41: 154, fig. 9 (♀); Krombein, 1951, U. S. Dept. Agr., Agr. Monogr. 2: 969.

The male described below agrees in most details of the sculpture with the original description of the female of *unami*, and it seems quite probable that this association of sexes is correct. Both sexes were taken in the Appalachian Mountain system about 200 air miles apart. The conformation of the male clypeus (fig. 2) and of the fifth and sixth abdominal sterna (fig. 2a) distinguish it at once from males of all other North American forms. The type series of *unami* cannot be found in the Academy of Natural Sciences at Philadelphia, so it has not been possible to make a direct comparison.

Plesiotype. ♂; Lost River State Park, Hardy Co., West Virginia; July 10, 1955 (K. V. Krombein; hovering in front of logs in cabin wall in sun).

Male.—Length 2.3 mm. Black: the following ivory—mandible except apex, clypeus except median lobe, small semicircular spot on front above median lobe of clypeus, larger anterolateral subtriangular spot on front, scape, pedicel and first four flagellar segments beneath, apices narrowly beneath of remaining flagellar segments except the last; the following fulvous—apex of mandible, median lobe of clypeus, fore trochanter beneath, fore tibia externally and all tarsi. Wings as in female. Vestiture as in female except on modified sterna.

Head (fig. 2) shining, with greatest width subequal to length, broadly rounded posterolaterally; clypeus in middle quadrately excised almost to antennal sockets, the excision in middle with a slender linguiform lobe, lateral angles of excision produced into a rather stout, curved tooth; front without a median keel running upward from clypeus, in profile obtusely angled near top of eyes, the lower part more strongly alutaceous, the upper part and vertex delicately alutaceous and with a few scattered minute punctures; inner eye margins somewhat divergent above, the distance between eyes at frontal angulation 1.2 times the distance between them at base of clypeus; flagellar segments flat beneath.

Pronotum narrow, transverse, rounded and gradually declivous to neck, situated below level of mesonotum and about half as wide, the tubercle almost touching tegula, the surface finely alutaceous and moderately shining; mesonotum shining in middle, less so on sides, the middle smooth except for a few minute, dispersed punctures, the rest of mesonotum less shining and finely alutaceous, longitudinally so on sides, transversely so on apical part, notauli lacking; scutellum and post-scutellum shining, sculptured much as is middle of mesonotum; mesopleuron shining, longitudinally semi-aciculate; metapleuron with aciculations sloping downward and posteriorly; propodeum less shining than mesopleuron, the dorsal surface with a fine median keel laterad of which are weak, inconspicuous, fine, irregular reticulations arranged more or less in oblique lines, the lateral surface with close, oblique aciculations, and posterior surface smooth except for a median sulcus.

Abdomen fusiform, shining, not constricted between segments; first two terga glabrous, the remaining terga and first three sterna with scattered, sparse, decumbent aeneous setae; fourth sternum with these setae more closely grouped apically; modified sterna (fig. 2a) as follows: fifth sternum with apex deeply and broadly emarginate, the lateral lobes clothed with dense, long, light brown decumbent hair, the apices of the lobes visible from above as small, rounded projections adjacent to base of sixth tergum; sixth sternum strongly elevated along midline on apical half, a triangular area at base and a narrow strip along median ridge bare, the declivous areas laterad of median apical ridge clothed with very dense, short, erect silvery hair; seventh sternum completely retracted, very strongly raised along midline, apparently clothed as is the sixth; eighth sternum with exserted apical part very narrow, elongate linguiform, the sides minutely serrulate, apex bluntly rounded.

THREE NEW NORTH AMERICAN SPECIES OF TREE-HOLE CULICOIDES (Diptera, Heleidae)

By Willis W. Wirth[1] and Robert H. Jones[2]

Increased attention to the taxonomy and biology of biting midges of the genus *Culicoides* has resulted in the rapid addition of many new species to the already large list of North American members of this genus. The recognition of these additional species is due in part to the utilization of more minute structural characters, and in part to rearing work which enables the procurement of species not ordinarily attracted to light traps or not commonly collected in series long enough to give the taxonomist adequate material for comparison and placement.

This paper increases the number of known Nearctic tree-hole breeders to ten, the previously described species being *arboricola* Root and Hoffman, *borinqueni* Fox, *flukei* Jones, *guttipennis* (Coquillett), *nanus* Root and Hoffman, *ousairani* Khalaf, and *villosipennis* Root and Hoffman. A few other described species probably breed in tree holes, but their biology is still unknown.

Since two of the species described here as new, *snowi* and *cavaticus*, fall into the *unicolor* complex, it seems advisable to present keys to the species involved. The two previously known species in this complex, *unicolor* (Coquillett) and *piliferus* Root and Hoffman, are not tree-hole species.

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Culicoides footei, new species[3]
(Figure 1)

A small species; mesonotum with a moderately distinct pattern; wings with second radial cell included in a dark area, with central portion devoid of light spots except for two basally in cell M_2 between crossvien and mediocubital fork; halteres white.

Female.—Wing length 0.8 mm., width 0.4 mm. Eyes separated. Antennal ratio (combined lengths of last five segments divided by combined lengths of preceding eight) 1.2; segments slender, longer than broad, segments IX plus X, and XI to XV in ratio of 1.4, *1*, 1.0, 1.1, 1.2, 1.7; sensoria present on segments III to X (in one specimen from III to XII). Palpus with third segment (Fig. 1 c) distinctly swollen, 1.5 times as long as greatest breadth, with a small, very deep sensory pit; segments four and five small, subequal. Proboscis short, mandibular teeth minute, approximately 14 present.

Mesonotal disc (fig. 1 b) with a moderately distinct pattern of three longitudinal dark stripes, these defining two central light areas between them; the two wide lateral dark stripes joined with the lateral margins to enclose two light brown spots on each side anteriorly, a large rounded spot behind each humeral pit, pit, directed obliquely inwards, and a smaller one immediately posterior to each large spot; anterolateral corners light gray, prescutellar dark spots distinct. Scutellum unicolorous brown, with four large marginal bristles and about eight hairs. Legs brown; knees somewhat darkened, with narrow light bands distad and adjacent to them; hind tibial comb with four large yellow spines.

Wing (Fig. 1 a) with second radial cell included in a dark area; macrotrichia sparse; color brown with the following distinct light spots: a small round one on crossvein, not extending through vien M and indistinctly extending to costa; a large one at apex of second radial cell, extending posteriorly to fold above vein R_5 and indistinctly extending basally under second radial cell; a large spot distally in anal cell, indistinctly connected posteriorly along wing margin to basal angle of wing; a large one centrally in cell Cu_1, extending from vein M_1 to wing margin; one at apex of cell M_2; two light spots basally in cell M_2, the more distinct one occupying angle of mediocubital fork and the indistinct narrow one anterior to this extending from crossvein to base of cell M_1; cells M_1 and R_5 each with an indistinct light spot apically; cell M_1 with a linear light spot extending from base beyond end of radial cells; and cell M_2 basally with linear light spot extending along axis for basal three-fourths of cell's length; crossvein brown in contrast to the surrounding light spot, lighter at its midpoint. Halter white.

Abdomen brown, cerci paler brown. Spermathecae two (Fig. 1 f) oval, with distinct, parallel-sided, sclerotized portion of duct at junction with teach spermatheca; ring present, rudimentary spermatheca apparently absent.

Male.—Similar to the female with the usual sexual differences. Genitalia as illustrated (Fig. 1 d, e). Ninth sternum deeply excavated, membrane not spiculate; ninth tergum strongly tapered to apex, apicolateral processes well developed.

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[3]We take great pleasure in naming this species in honor of Dr. Richard H. Foote, Entomology Research Branch, in recognition of his long interest in and outstanding contribution to the taxonomy of the *Culicoides* of the eastern United States.

Basistyle normal; ventral root well developed, boat-hook shaped, posterior projection small and close to margin of basistyle; dorsal root well developed, stout. Aedagus with stem equal in length to height of basal portion, with subapical projections; basal arms with distinct pointed posterior projections from posterior margin. Parameres separate; each with base slightly divergent, with a distinct lobelike swelling on stem before the recurved tips which are flattened and expanded with inner edges barbed.

Types.—Holotype, ♀, allotype ♂: Alexandria, Virginia, 15 May 1955, W. W. Wirth and R. H. Jones, reared from oak tree hole (Type No. 62858, U.S.N.M.). Paratypes, 40 ♀♀, 71 ♂♂: 21 ♀♀, 56 ♂♂ same data as types; 1 ♀ same data but reared from maple tree hole; 2 ♀♀, 3 ♂♂, Alexandria, Virginia, 6 and 14 June 1951, W. W. Wirth, reared from tree hole; 10 ♂♂, Falls Church, Virginia, 23 June 1951 and 7 April 1954, W. W. Wirth, reared from tree hole debris; 6 ♀♀, Mount Solon, Augusta County, Virginia, 2 July 1955, W. W. Wirth and R. H. Jones, reared from tree hole; 5 ♀♀, 2 ♂♂, Camden, Tennessee, 17 May 1954, W. E. Snow; 1 ♀, same data except 22 September 1954; 4 ♀♀, Morgan Creek, Tennessee, 7 July 1954, W. E. Snow.

Larvae were collected, also last larval and pupal exuviae were associated with emerged adults. These will be described elsewhere by the junior author.

This species is closely related to *haematopotus* Malloch, with male genitalia very similar. The female resembles *nanus* Root and Hoffman in general color and wing markings and also in palpal structure, but is distinguished by the presence of two light spots basally in cell M_2 between the mediocubital fork and crossvein, *nanus* having this area completely devoid of light markings; in *nanus* moreover, the halteres are dusky.

Culicoides snowi, new species[4]

(Figure 2)

A medium-sized species; mesonotum with a moderately distinct pattern; wing yellowish without distinct markings, second radial cell in a dark area.

Female.—Wing length 1.0 mm., width 0.5 mm. Eyes moderately separated. Antennal ratio 1.1, segments IV to X longer than broad, segments IX plus X and XI to XV in ratio of 1.3, *1*, 1.0, 1.1, 1.1, 1.5; sensoria present on segments III, V, VII, IX, and XI to XV. Palpus (fig. 2 c) with third segment moderately swollen, 2.0 times as long as its greatest breadth, with a moderately broad and deep sensory pit; segment five slightly longer than segment four. Mandible with 15 teeth.

Thorax dull to slightly shining, light brown; mesonotal disc (Fig. 2 b) with a faintly indicated median line and a pair of elongate, sublateral bars darker

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[4]We are very happy to dedicate this species to Dr. Willis E. Snow, Tennessee Valley Authority, who has made an intensive study of the fauna of tree holes for the past decade and has contributed many records of North American *Culicoides*.

brown, these extending indistinctly to scutellum; disc with numerous short, fine, yellowish hairs; anterolateral corners whitish pollinose, prescutellar dark spots distinct. Scutellum dark brown with four large blackish marginal bristles and from 10 to 15 short hairs. Legs pale brown, tibiae with indistinct, sub-basal pale bands; hind tibial comb usually with four large spines.

Wing (Fig. 2 a) with second radial cell included in a slightly darker spot, yellowish macrotrichia numerous, fairly long and evenly distributed, giving the wing a distinct yellowish color. Only two distinct pale spots present, one over crossvein and the other at apex of second radial cell, remainder of wing without distinct pale spots but appearing more or less pale yellowish gray between veins. Some specimens with vein Cu_1 distinctly bordered by a darker area, veins M_1 and M_2 less distinctly so. Crossvein light in color, not distinct from surrounding light spot. Halter whitish.

Abdomen brown; spermathecae (Fig. 2 f) two, slightly unequal, oval, the ducts with a very short sclerotized portion at juncture with spermathecae; ring and rudimentary spermatheca present.

Male.—Similar to the female with the usual sexual differences. Genitalia as illustrated (Fig. 2 d, e). Ninth sternum with broad, deep caudomesal excavation, posterior membrane not spiculate; ninth tergum with apex slightly notched, apicolateral processes short and usually slender, sometimes broadened basally. Basistyle normal, slender; ventral root boat-hook shaped, the posterior projection short; dorsal root long, moderately stout and straight; dististyle slender with slender, in-curved apex. Aedeagus with basal arms well sclerotized, usually separated mesally by unsclerotized area; basal arms slender, widened posteriorly, slightly curved; anteromesal margin of basal arch at 0.7 of total length of aedeagus; distal stem short and tapering, typically indistinct, lightly sclerotized, with apex rounded. Parameres separate, basal portions divergent at about 45°; each with point of basal angulation and portion immediately posterior to it distinctly narrowed, anteriorly tapering evenly to the swollen end; stem sinuate, broader centrally than anteriorly, distal portion curved evenly ventrocephalad and bearing about four widely separated barbs.

Types.—Holotype ♀, allotype ♂: Falls Church, Virginia, 17 February 1954, W. W. Wirth, reared from debris in tree hole (Type No. 62859, U.S.N.M.). Paratypes, 17 ♀♀, 7 ♂♂: 3 ♀♀, 1 ♂, same data as types; 2 ♀♀ same data as types except 25 March 1951 and 29 April 1953; 4 ♀♀, 2 ♂♂, same data except April 1951; 4 ♀♀, 2 ♂♂, Alexandria, Virginia, 1 and 29 April 1951 and 12 April 1953, W. W. Wirth, reared from tree hole; 2 ♀♀, Alexandria, Virginia, 15 May 1955, W. W. Wirth and R. H. Jones, reared from oak tree hole; 1 ♀, Maryland near Plummers Island, 8 May 1915, J. C. Crawford; 2 ♂♂, Morgan Creek, Tennessee, 25 March 1954, W. E. Snow; 1 ♀,

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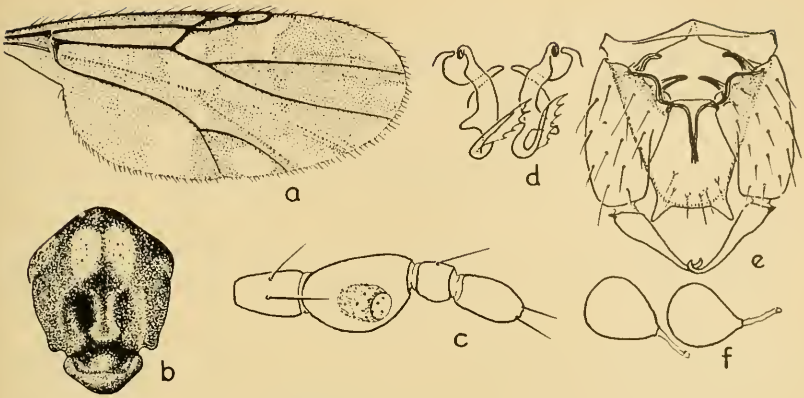
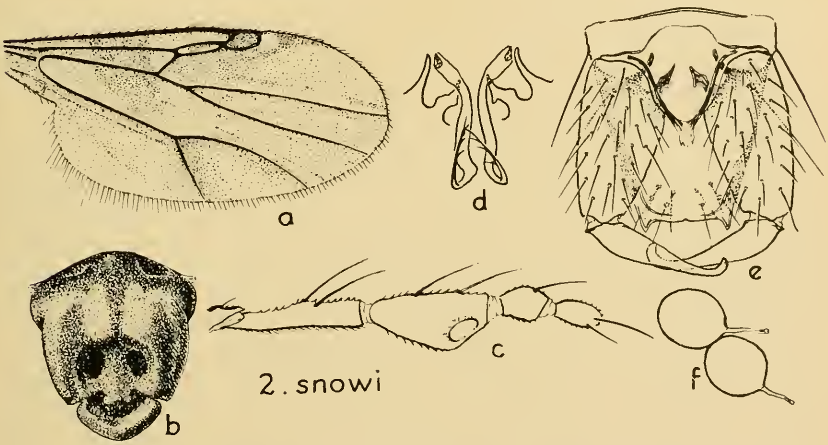
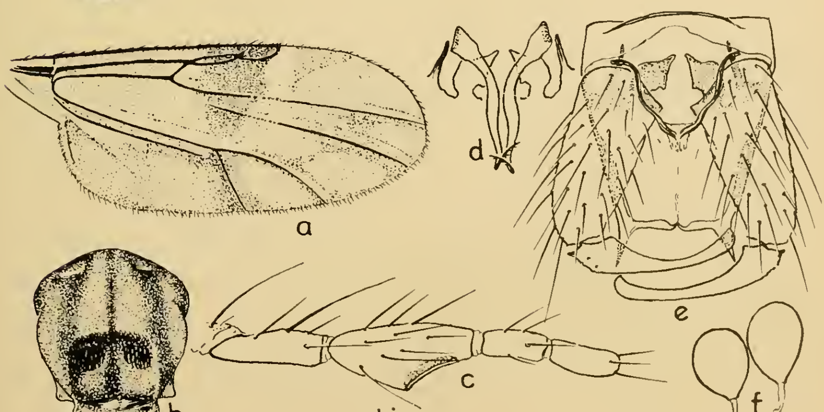
Fig. 1, *Culicoides footei*, n.sp.; Fig. 2, *Culicoides snowi*, n.sp.; Fig. 3, *Culicoides cavaticus*, n.sp. a, wing; b, mesonotal pattern; c, female palpus; d, male parameres; e, male genitalia, parameres removed; f, spermathecae.



1. footei



2. snowi



3. cavaticus

Drawings by Arthur D. Cushman

Grafton, Illinois, March 1950, W. E. Snow. No pupae, larvae or exuviae were collected.

This species is closely related to *unicolor* (Coquillett), *piliferus* Root and Hoffman and the new species from California, the description of which follows.

Culicoides cavaticus, new species
(Figure 3)

Culicoides unicolor Wirth, in part (misidentification, not Coquillett, 1905), 1952, Univ. Calif. Publ. Ent. 9: 185 (California; ''well-marked phase,'' tree hole records; fig. wing, palpus, male genitalia).

A large brown, very hairy species; mesonotal disc with three dark striae; wing with second radial cell included in a dark area, with moderately distinct light spots in addition to the two anterior distinct pale spots.

Female.—Wing length 1.6 mm., width 0.6 mm. Eyes separated by slightly more than the diameter of one facet. Antennal ratio 1.0; segments IX plus X, and XI to XV in ratio of 1.5, *1*, 1.0, 1.2, 1.2, 1.7; sensoria present on segments III to XV. Third palpal segment (Fig. 3 c) 2.2 times as long as its greatest breadth, distinctly swollen, with a large, shallow sensory pit; segment five subequal to or one-fourth longer than segment four. Mandible with 15 to 18 teeth.

Mesonotum (Fig. 3 b) usually with a distinct pattern of three longitudinal dark brown stripes, these extending posteriorly to prescutellar area; surface abundantly clothed with strong, dark hairs, their points of insertion on disc forming distinct small dark spots. Anterolateral corners light in color, prescutellar dark spots distinct. Scutellum unicolorous brown, with about 30 bristles and hairs, these varying from long to short. Legs brown; knees darkened, an indistinct light band distad and adjacent to them; hind tibial comb with four or five large spines.

Wing (Fig. 3 a) with second radial cell included in a dark area; macrotrichia dense; color brown, area of radial cells and area just beyond light spot at apex of second radia cell darker. Holotype with moderately distinct light spots as follows: a large one on crossvein, extending slightly through vein M posteriorly and to costa anteriorly; a medium sized light spot at apex of second radial cell, this forming the anterior end of an incomplete transverse light band across wing, ending posteriorly at wing margin in cell Cu_1; one light spot each on veins M_1 and M_2 caudal to the second radial cell, one on M_1 small, the large one on vein M_2 indistinctly connected to base of wing by linear light spot extending along axis of cell M_2 basally and indistinctly joined to light area occupying angle of mediocubital fork in cell M_2; this light spot in angle of mediocubital fork narrowly extending distally and basally along veing in cell M_2, and broadly joined with light spot in cell Cu_1; a large ight spot in cell Cu_1, occupying almost all of cell and broadly meeting wing margin posteriorly; one light spot each in apices of cells R_5, M_1 and M_2, from small to large respectively, the one in cell R_5 not meeting wing margin, whereas the latter two join margin of wing broadly; base of wing forming a distinct, narrow light area; and two light spots in anal cell, the one distad and anterior distinct, the one in basal angle indistinct. Paratypes usually have light areas smaller and less distinct, wings on slides not showing presence of distinct light spots. Crossvein light in color, indistinct from surrounding light spot. Halter yellow.

Abdomen brown; spermathecae (Fig. 3 f) two, saclike, ducts unsclerotized, ring and rudimentary spermatheca present, rudimentary spermatheca at least partially developed.

Male.—Similar to female with usual sexual differences. Genitalia (Fig. 3 d, e). Ninth sternum with broad, deep, caudomesal excavation, posterior membrane not spiculate; ninth tergum with apical margin notched, apicolateral processes well developed, slender. Basistyle normal; ventral root well developed, stout, boat-hook shaped, the posterior projection broad, blunt; dorsal root well developed, moderately stout, straight; dististyle slender with blunt, incurved apex. Aedeagus with basal arms well sclerotized, usually separated mesally by unsclerotized area, basal arms slender, posteriorly widened, then tapering evenly into distal stem; anteromesal margin of basal arch at 0.7 of total length of aedeagus; distal stem short, broad, nonsclerotized, apex rounded. Parameres separate, basal portions diverging at about 45°; each with basal end abruptly but slightly capitate, with margins and basal half heavily sclerotized; point of basal angulation not distinctly narrowed, stem sinuate, tapering evenly to the ventrocephally directed, pointed tip bearing four or five lateral barbs.

Types.—Holotype female: Davis, California, 22 March 1940, W. C. Reeves, reared from black walnut tree hole (Type No. 62860, U.S.N.M.). Allotype ♂, Woodland, California, 13 April 1940, W. C. Reeves, reared from walnut tree hole. Paratypes, 41 ♀♀, 66 ♂♂, reared from tree holes: 1 ♀ same data as allotype except 22 April 1940; 2 ♂♂, Davis, California, 21 February 1948, R. Bohart, walnut tree; 1 male, Alum Rock Park, Santa Clara County; California, 23 March 1949, W. W. Wirth; 21 ♀♀, 49 ♂♂, Sunol, California, 28 and 30 March and 1 April, W. C. Reeves, sycamore; 15 ♀♀, 5 ♂♂, same data except 14 March 1946, B. Brookman, cottonwood; 5 ♂♂, Sacramento, California, 21 March 1948, R. Bohart, cottonwood; 4 ♀♀, 4 ♂♂, Corvallis, Oregon, 8 April 1952, A. Roth.

Larvae, pupae, and pupal exuviae were also collected, but will be described elsewhere by the junior author.

This species is closely related to *snowi* new species, the points of difference being included in the following keys.

Key to Culicoides Females of the *unicolor* Complex

1. Mandible with 4 to 6 teeth distally; proboscis greatly tapered to narrow apex; eyes usually contiguous; wing typically well marked with moderately distinct, large light spots, but these frequently indistinct or absent .... *unicolor* (Coquillett)

   Mandible with 12 or more teeth distally; proboscis moderately tapered to broad apex; eyes separated 2

2. Wing with anal cell almost entirely or entirely a unicolorous light area, at most vein Cu_1 bordered by a darker area, wing without distinct light spots; third palpal segment moderately swollen, with a moderately broad, deep sensory pit .... *snowi* n. sp.

   Wing with anal cell predominanetly a dark area, with at least moderately distinct light spots present; wing with at least moderately distinct spots in addition to the anterior two; third palpal segment swollen or not, the sensory pit shallow 3

3. Third palpal segment distinctly swollen, the sensory pit large and shallow; antennal ratio 1.0; a light brown species .... *cavaticus* n. sp.

   Third palpal segment at most slightly swollen, the sensory pit small and shallow; antennal ratio 1.2; a dark species .... *piliferus* Root & Hoffman

Key to Culicoides Males of the *unicolor* Complex

1. Aedeagus with distal stem distinct, long and distinctly narrow, usually at least moderately sclerotized 2

   Aedeagus with distal stem usually indistinct, short and broadly rounded apically, lightly sclerotized 3

2. Apicolateral processes stout, triangular; aedeagus usually with distinct lateral flanges projecting from angle formed by juncture of distal stem with basal arms; distal stem relatively short, narrow, only slightly curved ventrad, with apex rounded; basal arms stout to very stout, usually only slightly arcuate, anteromesal area between basal arms relatively short and rapidly tapered posteriorly; ventral root with anterior projection long and usually stout, posterior projection usually short and blunt; membrane posterior to ninth sternum usually spiculate .... *unicolor* (Coquillett)

   Apicolateral processes slender, fingerlike; aedeagus without lateral flanges; distal stem long, distinctly turned ventrally, apex therefore poorly visible in ventral aspect, usually appearing broadened and flattened; basal arms of aedeagus slender and distinctly arcuate; ventral root of basistyle with anterior and posterior projections both long and narrow; membrane usually not spiculate .... *piliferus* Root & Hoffman

3. Paramere with the point of basal angulation and portion immediately distad distinctly narrowed, anteriorly tapering evenly to the swollen end; apicolateral processes short, narrow to moderately wide basally .... *snowi* n. sp.

   Paramere not distinctly narrowed at point of basal angulation, anteriorly abruptly, slightly capitate; apicolateral processes long, usually narrow, sometimes broadened basally .... *cavaticus* n. sp.

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1955

TREASURER

General Fund

Receipts and earnings during 1955	658.28	
Cash on hand January 1, 1955	$ 246.79	
Receipts from all sources during 1955	3571.32	
Total		$3818.11
Cash on hand December 31, 1955	$ 535.17	
Expenditures during 1955	3282.95	
Total		$3818.11

Memoir Publication Fund

Cash and securities on hand January 1, 1955	$5407.60	
Total		$6065.88
Cash and securities on hand December 31, 1955	$6044.28	
Expenditures during 1955	21.60	
Total		$6065.88

Copies of the complete Treasurer's report, approved by the Auditing Committee, are on file with the Corresponding Secretary and the Treasurer.

Respectfully submitted,
P. X. PELTIER, *Treasurer*

CUSTODIAN

The office of the Custodian during 1955 disposed of 70 copies of the Memoirs, 46 complete volumes and 38 miscellaneous numbers of the *Proceedings,* and other miscellaneous reports and sets of papers for a total income of $554.35.

The only expenses of the office amounted to $22.82 for postage, of which $8.38 was for foreign orders and recoverable with invoices, leaving actually $14.44 spent.

Contributions amounted to 49 entire volumes and 133 miscellaneous numbers of the *Proceedings* including 35 volumes from Mr. H. Y. Gouldman, who retired recently from the Plant Quarantine Branch, U. S. Department of Agriculture.

Copies of the complete report of the Custodian's office are on file with the Corresponding Secretary, the Treasurer and the Custodian.

Respectfully submitted,
H. J. CONKLE, *Custodian*

CORRESPONDING SECRETARY

Membership—January 1, 1955 (adjusted figure)			508
Reductions:			
Resigned	11		
Retired	1		
Dropped	21		
Deceased	6		
Total		39	
Additions:			
Elected to membership		33	
Loss in membership, 1955			6
Total membership, December 31, 1955			502

Classes of membership:

Dues paying	480
Life	5
Retired	13
Honorary	4
Total	502

The membership is distributed among 43 states, the District of Columbia, 5 territories, and 22 foreign countries.

Circulation of the *Proceedings* (December 1955 issue):

Unstamped, poundage rate:		
States	385	
District of Columbia	37	
U. S. Possessions	18	
Total		440
Stamped, foreign countries		153
Chain mail		114
Total		707

Distribution:

To members	465
To subscribers	242
Total	707

The *Proceedings* go to members and subscribers in 47 states, the District of Columbia, 5 territories, and 46 foreign countries.

Respectfully submitted,
LOUISE M. RUSSELL, *Corresponding Secretary*

EDITOR

Six numbers of Volume 57 of the *Proceedings*, a total of 304 pages, have been published in 1955. Ten pages have been devoted to advertising (exclusive of back covers) and 294 pages to scientific papers, notes, book reviews, obituaries and minutes of meetings. During 1955, 8½ published pages were paid for by their authors. Volume 57 contains 50 original contributions (excluding book reviews, obituaries and minutes of meetings) which average 5⅔ pages in length.

Changes were made in the format of the *Proceedings*. Beginning with No. 1, Vol. 57, a newly designed front cover in bright yellow and containing the table of contents was substituted for that of preceding years. Advertisements were admitted to the outside back cover. Beginning with No. 2, Vol. 57, the type width was increased from 23 to 26 picas and the type length from 38 to 41½ picas. Overall page size of the *Proceedings* remains the same.

Respectfully submitted,
RICHARD H. FOOTE, *Editor*

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
652nd REGULAR MEETING, THURSDAY, MARCH 1, 1956

The 652nd regular meeting of the Entomological Society of Washington, held in Room 43 of the U.S. National Museum on Thursday, March 1, 1956, was opened by President R. A. St. George at 8:00 P.M. with 46 members and 26 visitors in attendance. The minutes of the preceding meeting were read and approved.

B. A. App nominated the following persons and the *Society* voted to accept them as new members: *Charles W. McComb*, Apt. 204, 2213 University Lane, Hyattsville, Md.; *Andrew Barnum*, 2507 Orchard Ave., Grand Junction, Colo.; *George F. Townes*, 209-11 Masonic Building, Greenville, S. Car.; and *George R. Manglitz*, 4401 Selman Road, Beltsville, Md.

Officers reports for 1955 were given by R. H. Foote, Editor, and J. S. Yuill for H. J. Conkle, Custodian. Mr. Yuill, Chairman of the Auditing Committee, reported that the committee had found the report and accounts of the Treasurer and Custodian correct and in good order, adding that it had been a pleasure to make the audit because the books were in such good condition. His motion to tend a vote of thanks to Mr. Peltier, the Treasurer, was seconded and carried. The *Society* then voted to accept the reports.

L.J. Lipovsky, introduced by P. A. Woke, exhibited a mass culture of the common American chigger, *Trombicula* (*Eutrombicula*) *splendens* Ewing. The collenbolan, *Sinella curviseta* Brook, is maintained to provide their eggs for the predacious post-larval stages of the chiggers. The minute parasitic larval stage could be seen on black plates in the mass culture and free-living post-larval stages were exhibited in a small dish culture (Speaker's abstract).

T. J. Spilman reviewed ''The natural classification of the families of Coleoptera,'' by R. A. Crowson.

A recent discovery in the field of virus-vector relationships was described by Karl Maramorosch, who was introduced by F. F. Smith. Virginia C. Liffau, working at the Rockefeller Institute and at Columbia University and using an azure B stain at pH 4 after fixtion in Carnoy's fluid, has recently demonstrated cytological changes in fat body cells of *Macrosteles fascifrons* after this leafhopper had fed on plants infected with aster yellows virus. These changes suggest that the virus causes a disease in its insect vector, although viruliferous leafhoppers live as long and breed as freely as non-viruliferous individuals. The cause of these cytological changes has not yet been definitely established. (Speaker's abstract.)

Two notes were given by C. F. Rainwater. The first, on the khapra beetle, was prepared by L. G. Davis and others in the Cooperative Economic Insect Survey Section. Following the discovery of the khapra beetle, a serious pest of stored grain, in California in late 1953, surveys were immediately established. Early in 1954, California and New Mexico and the Federal Government, through the Plant Pest Control Branch, instituted a cooperative khapra beetle control program. More than 40,000 inspections have revealed 17 in Mexico and 345 infestations in Arizona, California and New Mexico, the vast majority of these being in California. The infestations have involved 91 million cu. ft. of bin space, of which 158 properties involving 64 million cu. ft. had been fumigated with methyl bromide and released from quarantine by February 10, 1956, at a cost of over 1 million dollars. Fumigation has involved a complete wrap-up, in plastic tarps, of nearly all infested properties fumigated, one in excess of 4 million cu. ft. The program has been the largest fumigation effort ever undertaken and has met with outstanding success.

Mr. Rainwater then reported on the record number of boll weevils in hibernation in the fall of 1956. Surface-woods-trash examinations during November and December in southern and eastern states showed high populations of boll weevils in hibernation. In Madison Parish, La., the number of live weevils per acre was 5.7 times the average found in fall surveys during the last 19 years, 2.6 times the number during the previous high record year of 1953, and 5 times the number found in 1954. In 7 Delta counties of Mississippi, hibernating weevils were found to average 5,054 per acre. Florence Co., S. Car., showed 2.3 times the average for the past 13-year period and 4.9 times the number found in 1954. Examinations in 12 counties in North Carolina showed an average of almost 3 times as many weevils as were present in 9 counties in 1954. Four southeastern counties of Virginia revealed fewer hibernating weevils than in 1954. (Speaker's abstract).

J. S. Wade exhibited the first Annual Review of Entomology, edited by E. A. Steinhaus and R. F. Smith.

T. L. Bissell announced that exhibits commemorating the centennial of the Maryland Agricultural College, which became the present University of Maryland, are being prepared by the Entomology and other Departments and will be shown in the Student Activities Building. A second important event at the University announced by Mr. Bissell is the dinner to be held May 24 in honor of E. N. Cory, who will retire in August.

D. R. Johnson called the attention of the Society to the seventh anniversary of the founding of the World Health Organization to be celebrated on WHO Day, April 7. The theme chosen for World Health Day, 1956, ''Destroy Disease-Carrying Insects,'' is of particular interest to entomologists everywhere and is being publicized in many countries of the world, including the United States.

President St. George announced the schedules of the Science Fairs to be held in the Washington metropolitan area and urged all who could to take the opportunity to see the exhibits.

The principal paper of the evening was, ''Humeral control of regeneration in insects,'' by Dr. Dietrich Bodenstein, Entomology Branch, Chemical Corps Medical Laboratories. Regeneration is the organized replacement of body parts that have been lost. The ability to regenerate is widely spread in insects and follows certain rules; these rules and the causal factors underlying the regenerative processes were emphasized in this lecture. The speaker discussed the roles of the organ stump, the regenrative field, nerves, the blastema and the time factor in the process of regeneration. The power of regeneration usually declines with age, and adult insects have lost their ability to regenerate, but regeneration can be induced experimentally by an appropriate humeral stimulus. However, an organ can be made to regenerate repeatedly in the larval stage. It was shown that the prothoracic gland plays an important part in regeneration; although this gland can initiate regeneration, its removal cannot suppress the process. Several possible explanations of this paradoxical situation were considered. Finally the role of wound hormones in regeneration and the suppression of regeneration by other than humeral means were discussed. (Speaker's abstract.)

Visitors introduced were *T. L. Aamodt,* Minnesota State Entomologist; University of Maryland students *Neville Rajapaksa* of Ceylon and *Leon Greenbaun;* and *Richard Connin,* Cereal and Forage Insects Section, Lincoln, Nebraska. George Washington University was represented by *Dr. Ira Hansen,* Head of the Zoology Department, and *Mary Weitzman* and *Alberto Velazquez,* students.

The meeting was adjourned at 9:45 P.M.—KELLIE O'NEILL, Recording Secretary.

Date of publication, Vol. 58, No. 2, was May 17, 1956

Insects

AUGUST 1956 VOL. 58, NO. 4

PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

U. S. NATIONAL MUSEUM
WASHINGTON 25, D. C.

PUBLISHED BIMONTHLY

CONTENTS

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings*.

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Members shall be persons over 18 years of age who have an interest in the science of entomology. Annual dues for members are $4.00; initiation fee is $1.00 (U. S. currency).

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

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 58 AUGUST 1956 NO. 4

A SYNOPSIS OF THE NEARCTIC CHRYSOPIDAE WITH A KEY TO THE GENERA

(NEUROPTERA)[1]

By WILLIAM E. BICKLEY and ELLIS G. MACLEOD[2]

The chrysopid fauna of North America has not been treated in a comprehensive way since the revision of Banks (1903). During the ensuing 47 years he published numerous papers in which he described 47 new species and erected two new genera. Smith (1922) made important contributions to knowledge of the biology of these insects and also added valuable information concerning the morphology and taxonomy of the larvae. Further studies by Smith adequately treated the species known to occur in Kansas (1925 and 1934) and in Canada (1932), while Froeschner (1947) dealt with the species of Missouri. Although these papers contain valuable keys to the genera and species of their respective regions, they are quite inadequate if one is dealing with forms from areas other than those for which the keys are intended. This is particularly true for specimens from the western United States which can be identified only by reference to many scattered publications.

Dr. Frank M. Carpenter and Mr. Phillip A. Adams (personal communication) propose to make the thorough revision of the family which is badly needed. Such a study requires analysis of the taxonomic characters now in use as well as basic morphological work to select new characters so that generic relationships will be clarified and species evaluated.

A revisionary study is greatly complicated, especially on the generic level, by the work of Longinos Navas, who failed to integrate newly described forms with previously established groups. To evaluate most genera which occur in North America it will be necessary to have a thorough knowledge of the numerous neotropical species which Navas has referred to these genera. Dr. Roger C. Smith studied many of these Navasian types in European museums and made notes on these specimens. He concluded that the evaluation and consolidation of the Navasian species from the New World is an overwhelming task involving "thankless and uninteresting . . . drudgery."

This paper is in the nature of an interim review of the family as it occurs in the Nearctic region north of Mexico. It is intended to facilitate determinations until such time as a thorough revision is

[1]Scientific Art. No. A524, Contribution No. 2655, of the Maryland Agricultural Experiment Station, Department of Entomology.

[2]University of Maryland, College Park.

available It is hoped that the present work will provide a means for recognition of genera and major species groups since, as pointed out previously, existing keys are inadequate. For specific determinations reference is made to the appropriate sources.

The synonymy of included species is believed to be comprehensive in the sense that all of the contributions which have affected the names of Nearctic species are listed.

Information on geographical distribution is not intended to be complete and is usually stated in general terms. For the sake of brevity distributional records obtained from the literature are not always credited to individual sources. In addition to the numerous papers by Banks (See Carpenter and Darlington, 1954), most records have been taken from the following: Bickley (1941), Brimley (1938), Froeschner (1947), Leonard (1926), Montgomery and Trippel (1933), Parfin (1952), and Smith (1922, 1932, and 1934). New records are based on material seen by one or both of the authors. It is hoped that the inclusion of these distributional records will serve as an aid in the determination of certain species.

The history of the family Chrysopidae begins with Leach who in 1815 established the genus *Chrysopa* for those lacewings in which the antennae are filiform, as contrasted to members of the restricted Linnaean genus *Hemerobius* in which the antennae are moniliform. For these two genera Leach erected the family Hemerobida. Schneider (1851) in his monograph of the species of the world designated the green lacewings as the division Chrysopina of his family Hemerobidae, and Hagen (1866) raised the group to the rank of subfamily with *Chrysopa* as the type genus. The present status as a family was the result of McLachlan's revision of 1868.

For many years it was assumed that the type species of *Chrysopa* had been subsequently designated as *Hemerobius perla* Linné by either Westwood in 1840 (Morse, 1931) or by Banks in 1903 (Smith, 1932). Unfortunately *Hemerobius perla* Linné had been selected by Latreille in 1810 to serve as the type species of the genus *Hemerobius* and this selection was upheld by the International Commission in 1910 (Opinion 11). A strict adherence to the International Rules in this case would have transferred the name *Hemerobius* to the genus *Chrysopa* and would have necessitated a new name for the genus formerly known as *Hemerobius*. In addition, since both of these genera are now the types of their respective families, this shift of names could have resulted in the renaming of the families. Indeed Banks (1945, 1948) began to use the name Nothochrysidae in place of Chrysopidae. A recent decision of the International Commission (Opinion 211, 1954) has prevented this confusion by a suspension of the rules. All previous designations of type species for these two genera were set aside, and *Hemerobius perla* Linné, 1758, was designated as the type of *Chrysopa* Leach, 1815.

Prior to the middle of the nineteenth century, all Nearctic species were referred to the genus *Chrysopa*. Fitch (1856) erected the genus

Meleoma and described *M. signoretti*—a species in which the males have a tubercle between the bases of the antennae—*signoretti* becoming the type species by monotypy. McLachlan (1868) described the genera *Nothochrysa* and *Leucochrysa* with *C. fulviceps* Stephens and *C. varia* Schneider respectively as the type species. Although these genera were based on Palaearctic and Neotropical forms several Nearctic species have subsequently been assigned to these genera. In the same paper McLachlan also called attention to certain features of the wing venation which have since been rather extensively used by numerous other workers. Banks (1903) in his revision of the family recognized the four existing genera and added *Allochrysa* and *Eremochysa*, designating *C. virginica* Fitch and *C. punctinervis* McLachlan respectively as the type species. In addition to keys to the existing genera and species, numerous forms were placed in synonymy. Subsequently Banks (1911) erected the genus *Chrysopiella* with *Chrysopa sabulosa* Banks as the type and (1938a) the genus *Abachrysa* with *Chrysopa eureka* Banks as the type.

Considerable confusion regarding the limits and validity of three genera has arisen as a result of the publications of Navas (1916, 1917 et seq.). *Nodita ramosi* and *Nodita melanocera* (both from Brazil) were described by Navas (1916), yet a description of the genus *Nodita* was not published until the following year. *Chrysopa intermedia* Schneider was designated by Navas (1917) as the type species of the genus *Nodita*, and two Nearctic species which had formerly been placed in *Leucochrysa* were referred to this genus. Navas (1917) also synonymized the genus *Allochrysa* Banks with *Leucochrysa* McLachlan, but this synonymy has not been recognized by any American worker. Banks (1939) placed the rest of our species of *Leucochrysa* in *Nodita*, so that *Leucochrysa* as it is now conceived is restricted to tropical America but is not necessarily congeneric with *Nodita* as was implied by Smith (1934).

Explanation of Taxonomic Characters

Descriptions of Nearctic species have relied heavily on the pigmentation of the body. To a lesser extent, the shape of the wings, degree of blackening of the wing veins and overall size have been used. Recent work has begun to stress the importance of more fundamental characters. Smith (1932) reported on preliminary genitalic studies, and Killington (1937) figured the male genitalia of many of the British species. Principi (1949) made a valuable study of the male and female reproductive systems of the Palaearctic species, *Chrysopa septempunctata* Wesm. and *C. formosa* Brauer, and assembled much pertinent information. Bickley (1952) studied the genetic basis of the pigmentation of the head of *Chrysopa oculata* Say. Future taxonomic studies of the Nearctic species will require a re-evaluation of specific relationships from the standpoint of internal anatomy as well as a consideration of the patterns of geographic distribution, ecology, and cytogenetics.

The generic classification has employed such characters as the relative length of the antennae, the presence or absence of an interantennal tubercle, darkening of the pterostigma, and the venation of the wings, particularly the basal course of the branches of the media. Venation in the family Chrysopidae is extremely specialized because of the extensive coalescence of many of the veins, and interpretations of the condition found in the adult wing have been possible only after a study of the tracheation of the developing pupal wings. McClendon (1906) interpreted the important veins correctly, and a more intensive analysis was undertaken by Tillyard (1916), Comstock (1918), and Smith (1922). Morse (1931) summarized previous work. It has recently become apparent that the venation of the Neuroptera is more complex than had been supposed. The primitive, four-branched structure of the media which is given by Comstock (1918) has been shown by recent work to be a more specialized condition, and the truly primitive wing had an anterior bifurcate vein attached to the medial stem. This vein has been termed the Anterior Media (MA) by Lameere (1922), while the remainder of the media (the entire media of Comstock's terminology) is referred to as the Posterior Media (MP). Although absent in many of the higher orders, Carpenter (1936, 1940, 1951) has concluded that the Anterior Media is still present in the lower neuropteroid groups, and Bradley (1939) has applied this terminology to the Chrysopidae.

The forewing of *Chrysopa oculata* Say is shown in fig. 1, and subsequent references are to this figure. If the proximal portion of the media (m) is examined, the typical anterior (MA) and posterior (MP 1+2) branches can be seen. MP 1+2, however, travels only a short distance before coalescing again with MA. This course of MP 1+2 (Tillyard's median loop) results in the formation of a small cell between the free portions of MA and MP 1+2 (which Tillyard termed the first intramedian cell (im_1). After extending longitudinally for a short distance, M again branches with MA continuing longitudinally while MP 1+2 turns sharply posteriorly. This section of MP 1+2 and the first branch of the cubitus (cu_1) form the distal and posterior margins of a cell directly behind im_1, the proximal margin being formed by a vein from MP 1+2 to Cu_1. This cell is designated as the third median cell (3M). The relationship of the shape and relative area between cells im and 3M is quite important in delimiting several of the genera. It should be mentioned that Banks in his very extensive series of publications followed the terminology of McLachlan (1868) and referred to these two cells collectively as the "third *cubital cell*" which he considered to be divided by the "divisory veinlet" (MP 1+2), and that Smith (1922, 1932) and Killington (1937) have employed the nomenclature of Comstock.

A second feature of the wings is the presence of one or two prominent series of cross veins in the distal portions. These cross veins were apparently called "gradates" for the first time by Schneider (1851).

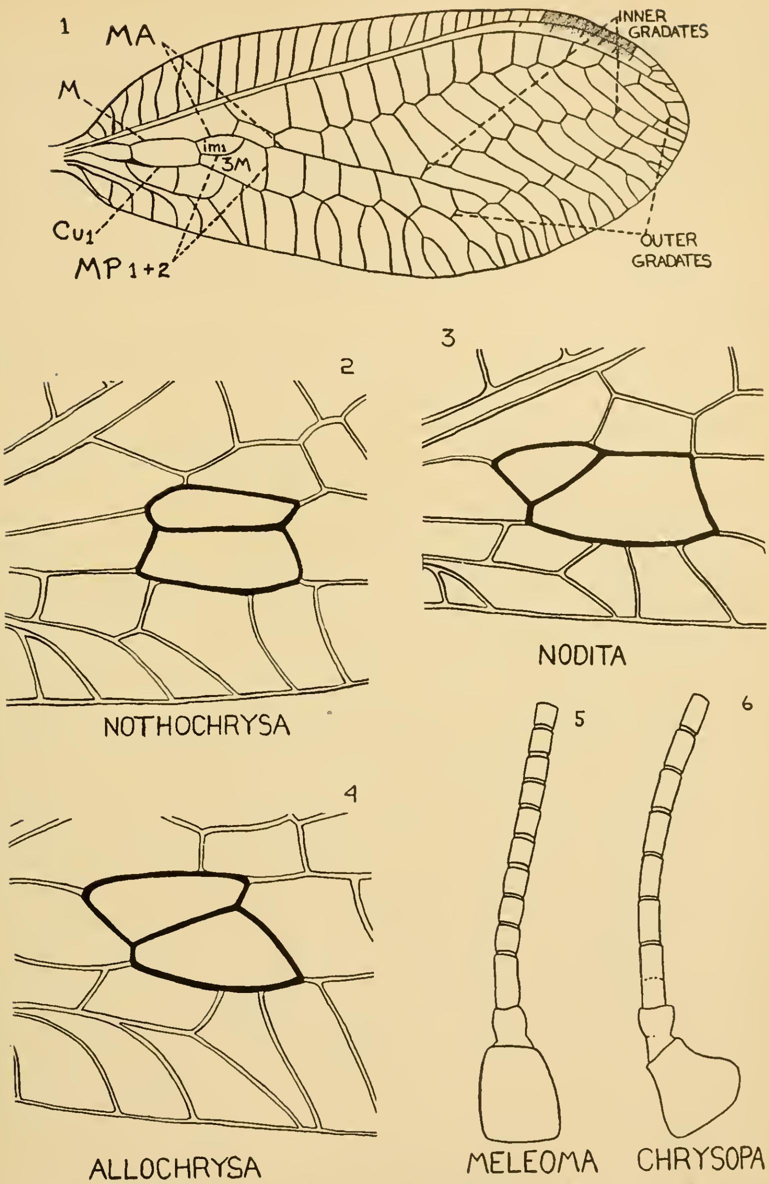

Fig. 1, *Chrysopa oculata* Say, right forewing (x7). M, media; MA, anterior branch of media; Cu 1, first branch of cubitus; MP 1+2, posterior branch of media; im 1, first intramedian cell; 3M, third median cell. Fig. 2, *Nothochrysa californica* Banks, medial branches in right forewing (x15). Fig. 3, *Nodita americana* (Banks), medial branches in right forewing (x15). Fig. 4, *Allochrysa virginica* (Fitch), medial branches in right forewing (x15). Fig. 5, *Meleoma verticalis* Banks, basal segments of antenna of a female (x30). Fig. 6, *Chrysopa rufilabris* Burmeister, basal segments of antenna (x30).

Many taxonomic papers have referred to the gradates without a clear explanation of the fact that they are the cross veins between the branches of the radial sector.

Key to the Genera of Nearctic Chrysopidae

1. Median loop (MP 1+2) in forewing following an oblique or longitudinal course and not meeting MA so that cell im_1 is closed by a cross vein and is subequal to cell 3M (figs. 2, 4) 2

   Median loop in forewing following a more sharply oblique course and meeting MA so that cells im_1 and 3M are unequal in shape and area (fig. 1) 3

2. Median loop following a longitudinal course so that cells im_1 and 3M are rectangular in shape (fig. 2); veinlets of outer and posterior margins of wings mostly simple; color dark brown or black .... *Nothochrysa*, p. 182

   Median loop following an oblique course so that cells im_1 and 3M are trapezoidal in shape (fig. 4); veinlets of outer and posterior margins of wings mostly forked; color yellow or greenish yellow .... *Allochrysa*, p. 183

3. Hind wings with two series of gradates 4

   Hind wings with one series of gradates, the inner series absent 7

4. Males with a prominent tubercle between the antennae (females without such a tubercle); proximal half of flagellum with most segments nearly as broad as long (fig. 5); bases of antennae usually widely separated, the distance often equal to or greater than the width of the basal segment .... *Meleoma*, p. 185

   An interantennal tubercle never present; proximal half of the flagellum with most segments plainly longer than broad (fig. 6); bases of antennae close together, usually separated by a distance which is less than the width of the basal segment 5

5. Antennae much longer than the wings; pterostigma of fore and hind wings dark, usually marked with dark brownish or purplish spots; first cross vein from radial sector meeting MA at a point more basal than the origin of the radial sector .... *Nodita*, p. 186

   Antennae at most equal to or usually shorter than the wings; pterostigma at most only slightly darkened, never spotted; first cross vein from radial sector meeting MA at a point which is even with or more distal than the origin of the radial sector 6

6. Prothorax longer or at least nearly as long as broad; usually slender insects; color ranging from yellow to dark green .... *Chrysopa*, p. 188

   Prothorax much broader than long; robust species, predominantly brown .... *Abachrysa*, p. 197

7. Fore wings with one seriees of gradates .... *Chrysopiella*, p. 198

   Fore wings with two series of gradates .... *Eremochrysa*, p. 198

Genus **Nothochrysa** McLachlan

McLachlan, R., 1868, Trans. Ent. Soc. Lond. (for 1868), p. 195 (type species by original designation, *Chrysopa fulviceps* Stevens).

This genus is quite distinct, being well-characterized by the longitudinal course of vein MP 1+2 which results in cells im_1 and 3M having the same shape and area (fig. 2). The veinlets reaching the outer and posterior margins of the wings are for the most part unforked, although this is subject to some variation. The uniformly dark coloration of all of the wing veins is another valuable taxonomic character which will aid in distinguishing this genus from the occasional aberrant forms of other genera in which vein MP 1+2 is longitudinal. Only one species is known to occur in the Nearctic region.

Nothochrysa californica Banks

Nothochrysa californica Banks, 1892, Trans. Amer. Ent. Soc. 19:373.

Distribution.—Described from southern California. Recorded from Washington and British Columbia.

Genus **Allochrysa** Banks

Banks, N., 1903, Trans. Amer. Ent. Soc. 29:143 (type species by original designation, *Chrysopa virginica* Fitch

As previously indicated, the exact status of this genus is somewhat in doubt at the present time. Banks (1903) characterized this genus as follows: ". . . the third cubital cell is nearly equally divided, the divisory veinlet running into the end-veinlet of the cell instead of into the upper margin. The antennae are quite long. . . ." Navas (1917) pointed out that these characters are also found in *Leucochrysa* McLachlan, and therefore synonymized these two genera. Subsequent American workers have failed to recognize this action of Navas, although no explanation of this viewpoint has appeared in the literature. The authors feel that such discussion is definitely warranted by the nature of the objections which Navas raised.

Banks (1903) separated his genus *Allochrysa* from *Leucochrysa* McLachlan on the basis of the course of veins MA and MP 1+2. In *Allochrysa* the median loop was described and figured as following a slightly oblique course and not reaching vein MA so that cells im_1 and 3M are quadrangular and subequal (fig. 4). In contrast, *Leucochrysa* was shown with the median loop more sharply oblique and meeting vein MA so that the cell im_1 is smaller and triangular and cell 3M is larger and polygonal as in Fig. 3. This characterization of *Leucochrysa* was quite correct for the Nearctic species of *Leucochrysa* with which Banks was dealing in 1903 (subsequently placed in the genus *Nodita* Navas); however, the Neotropical *Leucochrysa varia* (Schneider), which was designated as the type species of *Leucochrysa* by McLachlan (1868), does not conform to this description. A figure of the wing in Schneider's description of *L. varia* (1851), as well as a series of this species in the U. S. National Museum (det. Henry K. Townes) examined by the authors, show the same venational characteristics as *Allochrysa* Banks.

It is admitted that in the Chrysopidae venational differences alone are probably poor characters on which to separate genera, and it is hoped that future morphological studies will result in the discovery of more satisfactory characters. Work of this sort may very well show that these two genera are, after all, distinct. For these reasons the authors have continued to recognize *Allochrysa* Banks as a valid, though at present poorly characterized, genus, which is but slightly distinct from *Leucochrysa* McLachlan. Since *Leucochrysa* McLachlan in this sense probably occurs only rarely north of Mexico, the problem of separating these two genera in identification work in minimized.

Allochrysa longicornis (Walker)

Osmylus longicornis Walker, 1853, Cat. Neurop. Ins. Coll. British Mus., p. 235.
Meleoma longicornis, Hagen, 1861, Smiths. Misc. Coll., pp. 210-211.
Leucochrysa longicornis, Banks, 1907, Catalogue of the Neuropteroid Insects (except Odonata) of the U. S. Amer. Ent. Soc., p. 26.
Allochrysa longicornis, Banks, 1920, Bull. Mus. Comp. Zool. 64:339.

Walker (1853) described this species from Georgia (Abbott's Collection). Aside from the original description, the authors can find no additional Nearctic records for this species.

Allochrysa virginica (Fitch)

Chrysopa virginica Fitch, 1856, First Rpt. Ins. N. Y., p. 91.
Nothochrysa phantasma MacGillivray, 1894, Can. Ent. 26:170-171; Banks, 1895, Trans. Amer. Ent. Soc. 22:315.[3]
Nothochrysa virginica, Banks, 1895, Trans. Amer. Ent. Soc. 22:315.
Allochrysa virginica, Banks, 1903, Trans. Amer. Ent. Soc. 29:143.
Leucochrysa virginica, Navas, 1917, Ent. Mit. 6:279.
Leucochrysa californica Navas, 1928, Revista R. Acad. Cien. Nat. (Madrid) 25:36; Banks, 1938, Can. Ent. 70:122 (as *Allochrysa californica* Navas).

A color variety was described by Banks (1938) under the name *ocala.*

Distribution.—Type locality, Cartersville, Virginia. Recorded from Washington, D. C., New York, Massachusetts, North Carolina, Tennessee, and Florida.

Allochrysa parvula Banks

Allochrysa parvula Banks, 1903, Trans. Amer. Ent. Soc. 29:143-144.
Leucochrysa parvula, Navas, 1917, Ent. Mit. 6:279.

Distribution.—Type locality, Runneymede, Florida.

Allochrysa arizonica Banks

Allochrysa arizonica Banks, 1906, Psyche 13:98.

Distribution.—Type locality, Palmerlee, Arizona.

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[3]In the case of subjective synonymy the second entry indicates the first worker to regard that name as a synonym.

Genus **Meleoma** Fitch

Fitch, A., 1856, First Rpt. Ins. N. Y., pp. 81-82 (type species by monotypy, *Meleoma signoretti* Fitch).

In wing venation and many other characters this genus is similar to *Chrysopa* Leach, however the presence of a prominent tubercle between the bases of the antennae in the males is quite distinctive. Females are separated from *Chrysopa* females by the characters given in the key. In both sexes of several species the basal segment of the antennae is slightly concave on its medial surface.

This genus is essentially northern and western in its distribution, although in the East several scattered records have been obtained from as far south as North Carolina and Tennessee.

Meleoma signoretti Fitch

Meleoma signoretti Fitch, 1856, First Rpt. Ins. N. Y., p. 82.

Distribution.—Described from Vermont. Recorded from Ontario, Quebec, New Hampshire, New York, Maryland, Virginia, District of Columbia, North Carolina, Tennessee, Minnesota, and British Columbia.

Meleoma innovata (Hagen)

Chrysopa innovata Hagen, 1861, Smiths. Misc. Coll. 4:222-223.

Meleoma innovata, Banks, 1903, Trans. Amer. Ent. Soc. 29:158.

Distribution.—Type locality Mexico City, Mexico. Recorded from New Mexico. A specimen from Colorado Springs, Colorado (D. G. Denning) is in the collections of the University of Wyoming.

Meleoma mexicana Banks

Meleoma mexicana Banks, 1898, Trans. Amer. Ent. Soc. 25:201.

Meleoma innovata, Banks, 1903, Trans. Amer. Ent. Soc. 29:158.

Meleoma mexicana Banks, 1904, Trans. Amer. Ent. Soc. 30:104.

Banks (1948) states that he incorrectly synonymized *mexicana* with *innovata.*

Distribution.—Type locality, Amecameca, Mexico. Recorded from New Mexico.

Meleoma emuncta (Fitch)

Chrysopa emuncta Fitch, 1856, First Rpt. Ins. N. Y., p. 88.

Meleoma slossonae Banks, 1896, Ent. News 7:95; Banks, 1924, Bull. Mus. Comp. Zool. 69:432.

Meleoma emuncta, Banks, 1924. Bull. Mus. Comp. Zool. 69:432.

Distribution.—Described from New York. Recorded from Ontario, Quebec, British Columbia, Maine, New Hampshire. We have a male with all green venation collected at Mountain Lake, Virginia, June 25, 1953.

Meleoma verticalis Banks

Meleoma verticalis Banks, 1908, Trans. Amer. Ent. Soc. 34:259.

In this species the third antennal segment is about five times as long as the second (Smith 1932).

Distribution.—Described from Colorado. Recorded from New Mexico, British Columbia, and Ontario. We have seen specimens from Arizona and California.

Meleoma pallida Banks

Meleoma pallida Banks, 1908, Trans. Amer. Ent. Soc. 34:260.

Distribution.—Described from Huachuca Mountains, Arizona. We have seen specimens from Arizona and California.

Meleoma comata Banks

Meleoma comata Banks, 1950, Psyche 57:45-46.

Distribution.—Described from San Bernardino County, California.

Meleoma cavifrons Banks

Meleoma cavifrons Banks, 1950, Psyche 57:46-47.

Distribution.—Type locality, Pinecrest, Tuolumne County, California.

Meleoma delicata Banks

Meleoma delicata Banks, 1950, Psyche 57:48.

Distribution—Type locality, Fort Wingate, New Mexico. Recorded from Santa Cruz County, Arizona.

Genus **Nodita** Navas

Navas, L., 1916, Broteria (Braga) 14:21-22. (Type species by subsequent designation, *Chrysopa intermedia* Schneider.)

This genus has been regarded as having been erected in 1917 by Navas, and is so recorded by Neave (1940) and in the Zoological Record for 1917 (XII, p. 186); however, the previous year (1916) Navas described *ramosi* and *melanocera* from Brazil under the generic name *Nodita.* Although a formal description of the genus was not contained in that publication, the authors feel that the description of these species was sufficient to comply with Article 25 of the International Rules of Zoological Nomenclature, and that the generic name *Nodita* was validated in 1916. The following year Navas (1917) published a full description of the genus *Nodita*, and selected *Chrysopa intermedia* Schneider as the type species. A list of the species which were referred to *Nodita*, however, failed to include the two species which had been described the previous year.[4]

This confused situation has a very important consequence. The subsequent designation of *Chrysopa intermedia* Schneider as the type species was incorrect because the type should have been selected from the two species which were included in the genus at the time of its validation in 1916. A strict interpretation of Article 30 of the *Regles* would require that the designation of *C. intermedia* Schneider as the

[4]The fact that Navas in 1917 described *Nodita ramosa* (note spelling) from Guatemala (Mem. Pont. Acc. Romano 3:16) is irrelevant to the present discussion.

type species be rejected, and that either *Nodita ramosi* Navas, 1916, or *N. melanocera* Navas, 1916, be selected as the type species.

Such a course of action is clearly not advisable in this case. In view of the questionable status of many of the Navasian species, the retention of the old species *Chrysopa intermedia* Schneider as the type is more likely to promote "stability and universality" than would be the case if one of the 1916 species were selected. Furthermore, the authors feel that it is more desirable to have a type species designated by the author of the genus than by a subsequent worker. Navas apparently considered that the species which he discussed in 1916 and in 1917 belonged to the same genus, which he felt was typified by the *C. intermedia* of Schneider. In addition to these considerations, it should be pointed out that the 1917 paper was published in wartime Germany, while the 1916 paper was published in Navas's native Spain which was neutral. It is, therefore, entirely possible that the 1917 paper describing *Nodita* Navas was actually intended to have been published prior to the publication of the descriptions of *N. ramosi* Navas and *N. melanocera* Navas in 1916. For these reasons the authors have accepted Navas' designation of *C. intermedia* Schneider as the type species of *Nodita* Navas, 1916.

Navas (1917) characterized *Nodita* as having the antennae longer than the wings and the pterostigma darkened within. The crux of his description is contained in the following statement (transl.):

> In the middle section of the anterior wing a third small cell is divided into two very unequal parts by a small, slanting, nearly straight vein which begins near the cubitus and extends to the media in front of the apex of the small cell; therefore, the anterior cell, or rather the "divisoria" is somewhat triangular and smaller, the posterior (cell) is polygonal and larger.

This characterization (fig. 3) of the basal branches of the media is in agreement with the venation of the type species as figured by Schneider (1851). The Nearctic species of the genus for the most part share this arrangement of the basal branches of the media with the type species and are, therefore, easily separated from the closely related *Allochrysa* Banks and *Leucochrysa* McLachlan. In the Neotropical region, however, a confusing array of species seems to form a completely intergrading series from the type species of *Leuochrysa* McLachlan to the type species of *Nodita* Navas. The distinctness of *Nodita* Navas is therefore open to some doubt. Banks (1945) recognized this problem, and although he continued to recognize the validity of *Nodita* Navas, he sought characters other than the course of the basal branches of the media to separate it from closely related genera. Pending a thorough study of the affinities of these genera the authors have continued to recognize *Nodita* Navas.

In North America this genus is southern and southwestern in its distribution.

Nodita floridana (Banks)

Leucochrysa floridana Banks, 1897, Ent. News 8:184.
Nodita floridana, Navas, 1917, Ent. Mit. 6:280.

Distribution.—Type locality, Lake Worth, Florida. Also recorded from Mississippi.

Nodita americana (Banks)

Leucochrysa americana Banks, 1897, Proc. Ent. Soc. Wash. 4:175.
Nodita americana, Navas, 1917, Ent. Mit. 6:280.

Distribution.—Type locality, Auburn, Alabama. Recorded from Texas and Kansas.

Nodita nigrinervis Banks

Nodita nigrinervis Banks, 1939, Notulae Naturae Acad. Nat. Sci. Phil. 32:1.

Distribution.—Type locality, Satan Pass, McKinley County, New Mexico. We have seen specimens from Texas.

Nodita texana Banks

Nodita texana Banks, 1939, Notulae Naturae Acad. Nat. Sci. Phil. 32:3.

Distribution.—Type locality, Trevis County, Texas. Recorded from Austin, Texas.

Nodita callota (Banks)

Leucochrysa callota Banks, 1914, Proc. Acad. Nat. Sci. Phil. 66:626.
Nodita callota, Banks, 1939, Notulae Naturae Acad. Nat. Sci. Phil. 32:2.

Distribution.—Type locality, Austin, Texas.

Nodita pavida (Hagen)

Chrysopa pavida Hagen, 1861, Smiths. Misc. Coll. 4:216.
Chrysopa lateralis, Banks (not Guerin), 1903, Trans. Amer. Ent. Soc. 29:150, 161; Banks (1938) corrects this misidentification.
Nodita pavida, Banks, 1939, Notulae Naturae Acad. Nat. Sci. Phil. 32:2.

Distribution.—Described from Mexico and South Carolina. The authors have a specimen from Kitty Hawk, North Carolina, and have seen one from Florida.

Nodita antennata (Banks)

Leucochrysa antennata Banks, 1906, Trans. Amer. Ent. Soc. 33:5-6.
Nodita antennata, Banks, 1939, Notulae Naturae Acad. Nat. Sci. Phil. 32:2.

Distribution.—Type locality, Tuxpan, Mexico. In the U. S. National Museum there are specimens from Texas.

Genus **Chrysopa** Leach

Leach, 1815, Brewster's Edinburgh Encyclopedia 9(1):138. (Type species by subsequent designation *Hemerobius perla* Linné.)

This large cosmopolitan genus is represented in our fauna by 47 named species. Although the authors feel that some of these species are poorly characterized and are of doubtful validity, we have included in our list all species whose validity has not been seriously questioned up to this time.

Banks (1950) has proposed a division of this genus into two subgenera, based primarily on the shape of the costal cells. These groups are distinguished as follows:

Forewing with costal cells at the widest part of the wing lengthened so that at least one of them is as long as high .... *Chrysopa* (*Yumachrysa*)

Forewing with costal cells at the widest part of the wing higher than long .... *Chrysopa* (*Chrysopa*)

Subgenus **Yumachrysa** Banks

Banks, 1950, Psyche 57:51 (type species by original designation *Chrysopa* (*Yumachrysa*) *apache* Banks).

This section of the genus is confined to our southwest where it is represented by three species.

Chrysopa (Yumachrysa) apache Banks

Chrysopa apache Banks, 1938, Can. Ent. 70:121.

Distribution.—Type locality, Globe, Arizona; additional records from Davis Mts., Texas, Palmerlee, Arizona, and from near Sells, Arizona.

Chrysopa (Yumachrysa) yuma Banks

Chrysopa yuma Banks, 1950, Psyche 57:49-50.

Distribution.—Type locality, Fort Yuma, California.

Chrysopa (Yumachrysa) clarivena Banks

Chrysopa clarivena Banks, 1950, Psyche 57:50-51.

Distribution.—Type locality, Ehrenberg, Arizona.

Subgenus **Chrysopa** Leach

Five species groups occur within this subgenus, and although they probably do not represent phyletic units, they facilitate specific identifications within this section of the genus. These groups may be separated by the following key (modified from Smith, 1932):

1. Antennae except the basal segment black, or with at least the basal forth blackish 2
   Antennae either completely unmarked or at most with a black or brown ring on the second segment 3
2. Basal segment of the antennae unmarked .... *nigricornis* group
   Basal segment of the antennae with a dark red or black line on the lateral surface .... *lineaticornis* group
3. Antennae with a black or brown ring on the second segment .... *oculata* group
   Antennae entirely pale 4
4. All veins entirely pale, or at most with only an occasional dark cross vein .... *plorabunda* group
   Gradates and some other veins marked with black or brown ... *rufilabris* group

NIGRICORNIS GROUP

Chrysopa nigricornis Burmeister

Chrysopa nigricornis Burmeister, 1839, Handbuch der Entomologie 2:980.

Chrysopa colon Fitch, 1856, First Rpt. Ins. N. Y., p. 88; Hagen, 1861, Smiths. Misc. Coll. 4:214.

Distribution.—Described from North America. This species is widely distributed in the Nearctic region.

Chrysopa explorata Hagen

Chrysopa explorata Hagan, 1861, Smiths. Misc. Coll. 4:217.

Distribution.—Described from Mexico. Recorded from Arizona.

Chrysopa coloradensis Banks

Chrysopa coloradensis Banks, 1895, Trans. Amer. Ent. Soc. 22:314-315.

Distribution.—Type locality, Fort Collins, Colorado. Smith (1932) states that the range of this species appears to extend from Colorado northwesterly. The authors have seen specimens from Utah, California, and Oregon.

Chrysopa columbiana Banks

Chrysopa columbiana Banks, 1903, Trans. Amer. Ent. Soc. 29:150.

Distribution.—Type locality, Washington, D. C. Recorded from British Columbia, Iowa, and North Carolina. We have a specimen from Mt. Lake, Virginia.

Chrysopa excepta Banks

Chrysopa excepta Banks, 1911, Trans. Amer. Ent. Soc. 37:340.

Distribution.—Type locality, Fort Wingate, New Mexico. We have seen specimens from Utah and Wyoming.

Chrysopa nanina Banks

Chrysopa nanina Banks, 1911, Trans. Amer. Ent. Soc. 37:340.

Distribution.—Type locality, Palmerlee, Arizona.

LINEATICORNIS GROUP

Chrysopa lineaticornis Fitch

Chrysopa lineaticornis Fitch, 1856, First Rpt. Ins. N. Y., pp. 91-92.

Chrysopa puncticornis Fitch, 1856, First Rpt. Ins. N. Y., p. 92; Hagen, 1861, Smiths. Misc. Coll., p. 214.

?*Chrysopa ampla* Walker, 1853, Cat. Neuropt. Coll. British Mus. 2:268; Banks, 1903, Trans. Amer. Ent. Soc. 29:151.

Chrysopa stichoptera Navas, 1914, Bull. Brook. Ent. Soc. 9:61-62. NEW SYNONYMY.

The description by Navas of *C. stichoptera* contains no characters which can be used to separate it from *C. lineaticornis*. and therefore *stichoptera* is here considered a synonym.

Distribution.—Described from Central New York. Recorded from Quebec, New England, Maryland, Tennessee, North Carolina and Michigan. We have a specimen from Richmond, Virginia.

Chrysopa cubana Hagen

Chrysopa cubana Hagen, 1861, Smiths. Misc. Coll. 4:215.

Chrysopa lateralis, Banks (not Guerin), 1903, Trans. Amer. Ent. Soc. 29:150, 161; Banks, 1938, Can. Ent. 70:122.

Chrysopa sanchezi Navas, 1924, Bol. Soc. Ent. Espana Saragossa (Cuba) 7:52; Banks, 1938, Can. Ent. 70:122.

Banks (1938) discussed the similarity between *C. sanchezi* Navas and *C. cubana* Hagen, and retained *sanchezi* as a varietal name of *cubana.*

Distribution.—Described from Cuba and Virginia. Recorded from North Carolina and Florida. (We have seen a specimen from Tepio, Mexico.)

OCULATA Group

Chrysopa oculata Say

Chrysopa oculata Say, 1839, Jour. Acad. Nat. Sci. Phil. 8:45.

Chrysopa chlorophana Burmeister, 1839, Handbuch der Entomologie, p. 979; Smith, 1922, Cornell Univ. Agr. Expt. Sta. Memoir 58:1345.

Chrysopa euryptera Burmeister, 1839, Handbuch der Entomologie, p. 980; Banks, 1903, Trans. Amer. Ent. Soc. 29:161.

Chrysopa latipennis Schneider, 1851, Mon. Chrysopae, p. 118; Banks, 1903, Trans. Amer. Ent. Soc. 29:161.

Chrysopa albicornis Fitch, 1856, First Rpt. Ins. N. Y., p. 84; Smith, 1922, Cornell Univ. Agr. Expt. Sta. Memoir 58:1343.

Chrysopa illepida Fitch, 1856, First Rpt. Ins. N. Y., pp. 84-85; Banks, 1892, Trans. Amer. Ent. Soc. 19:373.

Chrysopa omikron Fitch, 1856, First Rpt. Ins. N. Y., p. 85; Hagen, 1861, Smiths. Misc. Coll., p. 211.

Chrysopa xanthocephala Fitch, 1856, First Rpt. Ins. N. Y., pp. 85-86; Smith, 1932, Ann. Ent. Soc. Amer. 25:589.

Chrysopa fulvibucca Fitch, 1856, First Rpt. Ins. N. Y., p. 86; Banks, 1892, Trans. Amer. Ent. Soc. 19:373.

Chrysopa mississippiensis Fitch, 1856, First Rpt. Ins. N. Y., p. 86; Banks, 1892, Trans. Amer. Ent. Soc. 19:373.

Chrysopa bipunctata Fitch, 1856, First Rpt. Ins. N. Y., pp. 87-88; Hagen, 1861, Smiths. Misc. Coll., p. 214.

Chrysopa transmarina Hagen, 1861, Smiths. Misc. Coll., p. 213; Banks, 1903, Trans. Amer. Ent. Soc. 29:161.

?*Nothochrysa annulata* MacGillivray, 1894, Can. Ent. 26:169-170; Banks, 1903, Trans. Amer. Ent. Soc. 29:143.

Chrysopa separata Banks, 1911, Trans. Amer. Ent. Ent. Soc. 37:341; Smith, 1932, Ann. Ent. Soc. Amer. 25:590-591.

Chrysopa rubicunda Navas, 1913, Ent. Zeitsch. 27:20; Smith, 1932, Ann. Ent. Soc. Amer. 25:587.

Smith (1932) described a color variety under the name of *carei*.

This species is extremely variable, and there are sixteen names which may be applied to identify individuals which differ primarily in color markings on the head and wings. There are many inconsistencies and intergradations in the varietal patterns. Smith (1932) reported that *albicornis* and *chlorophana* cross readily with other varieties, and Bickley (1952) after crossing and inbreeding the varieties *oculata* and *illepida* attempted to explain the genetic basis for the inheritance of the characters which caused the naming of these two forms. It is concluded that the varietal names have little value because a variety is not a taxonomic category. All of the species names except *annulata* have been clearly placed in synonymy by Banks (1903) and Smith (1922 and 1932). In the case of *annulata*, Banks (1903) suspected that the specimen in question was a sport of *oculata*.

Distribution.—Described from "U. S." This species occurs throughout the Nearctic region and is the most common lacewing in most areas.

Chrysopa chi Fitch

Chrysopa chi Fitch, 1856, First Rpt. Ins. N. Y., p. 87.

Chrysopa oculata, Banks (not Say), 1892, Trans. Amer. Ent. Soc. 19:373; Smith, 1922, Cornell Univ. Agr. Expt. Sta. Mem. 58:1352.

Chrysopa upsilon Fitch, 1856, First Rpt. Ins. N. Y., p. 87; Banks, 1903, Trans. Amer. Ent. Soc. 29:148-149.

Chrysopa hypsilon var. *haematica* Navas, 1918, Mem. de la Real Acad. y Artes de Barcelona 14:354-355; Smith, 1932, Ann. Ent. Soc. Amer. 25:592.

Smith (1922 and 1932) recognizes *upsilon* as a colorational variety of *chi*.

Distribution.—Described from New York. Recorded from New York, New Hampshire, New Jersey, Washington, D. C., Tennessee, and Minnesota, and from seven Canadian provinces, New Brunswick west to British Columbia. We have two specimens from Mountain Lake, Virginia, and have seen specimens from California.

Chrysopa assimilis Banks

Chrysopa assimilis Banks, 1899, Trans. Amer. Ent. Soc. 25:202.

Distribution.—Described from Ashland, Oregon and Hood River, Oregon.

Chrysopa pleuralis Banks

Chrysopa pleuralis Banks, 1911, Trans. Amer. Ent. Soc. 37:341-342.

Distribution.—Described from North Boulder Creek, Boulder County, Colorado and Steamboat Springs, Colorado. Recorded from Alberta and British Columbia.

PLORABUNDA Group

Chrysopa plorabunda Fitch

Chrysopa plorabunda Fitch, 1856, First Rpt. Ins. N. Y., p. 88.

Chrysopa robertsonii Fitch, 1856, First Rpt. Ins. N. Y., p. 88; Banks, 1903, Trans. Amer. Ent. Soc. 29:162.

Chrysopa pseudographa Fitch, 1856, First Rpt. Ins. N. Y., p. 89; Banks, 1903, Trans. Amer. Ent. Soc. 29:162.

Chrysopa illinoiensis Shimer, 1865, Proc. Ent. Soc. Phil. 4:208; Riley, 1870, Second Rpt. Ins. Missouri, pp. 25-26.

Chrysopa californica Coquillet, 1890, Rpt. Calif. State Board Hort., p. 288; Smith, 1932, Ann. Ent. Soc. Amer. 25:594.

Distribution.—Described from New York and Illinois. There are records from many states and Canadian provinces. This species is undoubtedly one of the most common and widely distributed of any in the nearctic region. Dr. R. I. Sailer collected specimens at Fort Yukon and Kotzebue, Alaska in July, 1951.

Chrysopa harrisii Fitch

Chrysopa harrisii Fitch, 1856, First Rpt. Ins. N. Y., p. 90.

Chrysopa externa Hagen, 1861, Smiths. Misc. Coll. 4:221; Smith, 1932, Ann. Ent. Soc. Amer. 25:596.

Chrysopa stenostigma Navas, 1914, Bull. Brook. Ent. Soc. 9:61 NEW SYNONYMY.

The description by Navas of *C. stenostigma* contains no characters which can be used to separate it from *C. harrisii,* and therefore *stenostigma* is here considered a synonym.

Distribution.—Described from New York. This species, which is often difficult to separate from *plorabunda,* is widely distributed throughout the Nearctic region, having been recorded from many states and provinces. A specimen was collected at Fort Yukon, Alaska by R. I. Sailer in July 1951.

Chrysopa signatalis Banks

Chrysopa signatalis Banks, 1911, Trans. Amer. Ent. Soc. 37:342-343.

Distribution.—Type locality, Brownsville, Texas. We have seen specimens from Texas and Lower California.

Chrysopa vegata Navas

Chrysopa vegata Navas, 1917, Mem. Pont. Acc. Romana Series 11, 3:6.

The description mentions two dark spots on each gena in addition to the longitudinal stripe. This species seems to be practically indistinguishable from *C. plorabunda.*

Distribution.—Type locality, Jemez Springs, New Mexico.

Chrysopa downesi Smith

Chrysopa downesi Smith, 1932, Ann. Ent. Soc. Amer. 25:594-595.

Distribution.—Type locality, Kelowna, British Columbia. Recorded from other localities in British Columbia and Saskatchewan. Introduced into New Zealand from Canada.

Chrysopa comanche Banks

Chrysopa comanche Banks, 1938, Can. Ent. 70:119-120.

Distribution.—Type locality, Laredo, Texas. Recorded from New Mexico, Arizona, and California. We have seen specimens from Colorado.

Chrysopa sperryae Banks

Chrysopa sperryae Banks, 1943, Psyche 50:74-75.

Distribution.—Type locality, Riverside, California. We have seen specimens from California, Arizona, Colorado, and British Columbia.

Rufilabris Group

Chrysopa rufilabris Burmeister

Chrysopa rufilabris Burmeister, 1839, Handbuch der Entomologie 2:979.

Chrysopa repleta Walker, 1853, Cat. Neuropt. Coll. British Mus. 2:244; Banks, 1903, Trans. Amer. Ent. Soc. 29:161.

Chrysopa novaeboracensis Fitch, 1856, First Rpt. Ins. N. Y., p. 90; Hagen, 1861, Smiths. Misc. Coll. 4:219.

Chrysopa citri Ashmead, 1880, Orange Insects, (Jacksonville, Fla.) p. 13; Banks, 1907, Catalogue ofthe Neuropteroid Insects (except Odonata) of the U. S., Amer. Ent. Soc., p. 28.

Distribution.—Described from "Mittel Amerika and Mexiko." this species has been recorded from many localities in eastern North America, Ontario to Florida and as far west as Minnesota and Kansas. According to Brimley (1938) it is second to *C. oculata* in abundance in North Carolina. In collections of the California Academy of Sciences are specimens from California, Arizona, Texas, Nevada, Oregon and Montana.

Chrysopa quadripunctata Burmeister

Chrysopa quadripunctata Burmeister, 1839, Handbuch der Entomologie 2:980.

Chrysopa sulphurea Fitch, 1856, First Rpt. Ins. N. Y., p. 89; Banks, 1903, Trans. Amer. Ent. Soc. 29:162.

Chrysopa sicheli Fitch, 1856, First Rpt. Ins. N. Y., pp. 89-90; Hagen, 1861, Smiths. Misc. Coll. 4:218.

Distribution.—Described from North America. This species has been recorded from seven eastern states, New York to Tennessee; from six central states, Minnesota to Texas; and from Vancouver Island.

Chrysopa interrupta Schneider

Chrysopa interrupta Schneider, 1851, Mon. Chrysopae, p. 76.

Chrysopa attenuata Walker, 1853, Cat. Neuropt. Coll. British Mus. 2:242; Kimmins, 1940, Ann. Mag. Nat. Hist. 11(5):447.

Chrysopa rufilabris, Banks (not Burmeister), 1903, Trans. Amer. Ent. Soc. 29:161; Kimmins, 1940, Ann. Mag. Nat. Hist. 11(5):447.

Banks (1903) synonymized *attenuata* Walker with *rufilabris* Burm. Kimmins (1940) pointed out that *attenuata* Walker is actually a synonym of *interrupta* Schneider. This species is very close to *C. rufilabris.*

Distribution.—Described from Pennsylvania. Recorded from seven eastern states, New York to Alabama and from Illinois, Kansas, and Missouri. We have collected a few specimens in Maryland and Virginia. A specimen from La Grange, California is in the collections of the University of Wyoming. We have seen specimens from California and Arizona.

Chrysopa thoracica Walker

Chrysopa thoracica Walker, 1853, Cat. Neuropt. Coll. British Mus. 2:243.

Distribution.—Described from St. Domingo. Banks (1938b) records this species from Coconut Grove, Florida.

Chrysopa bimaculata McClendon

Chrysopa bimaculata McClendon, 1901, Psyche 9:215.

Distribution.—Type locality, Laredo, Texas. Recorded also from San Antonio and Austin and from Florida.

Chrysopa schwarzi Banks

Chrysopa schwarzi Banks, 1903, Trans. Amer. Ent. Soc. 29:146.

Distribution.—Type locality, Las Vegas, Hot Springs, New Mexico. Recorded from Arizona.

Chrysopa medialis Banks

Chrysopa medialis Banks, 1903, Trans. Amer. Ent. Soc. 29:154.

Distribution.—Type locality, High Island (Md.) near the District of Columbia.

This species appears in the literature subsequent to the original description only in Banks' (1907) catalogue. It is very near *rufilabris* and *quadripunctata*. We have a specimen which fits the description; but it was collected January 29, 1954, and it is probably an overwintering *rufilabris* in which colorational changes have been brought about by cold weather. The type specimens were collected in late September so that they may have been affected by cold. The validity of this species is questionable.

Chrysopa cockerelli Banks

Chrysopa cockerelli Banks, 1903, Trans. Amer. Ent. Soc. 29:154-155.

Distribution.—Type locality, East Las Vegas, New Mexico. Recorded from Kansas and British Columbia. We have seen specimens from Arizona and California.

Chrysopa arizonensis Banks

Chrysopa arizonensis Banks, 1903, Trans. Amer. Ent. Soc. 29:155.

Distribution.—Type locality, Yuma, Arizona. We have seen a specimen from California.

Chrysopa majuscula Banks

Chrysopa erythrocephala Banks, 1898, Trans. Amer. Ent. Soc. 25:201-202 (not *C. erythrocephala* Leach, an old Palaearctic species).

Chrysopa majuscula Banks, 1906, Psyche 13:98.

Distribution.—Type locality, San Bernardino, California. Recorded from New Mexico, Minnesota and Departure Bay (B. C.), Canada.

Chrysopa injusta Banks

Chrysopa marginalis Banks, 1906, Trans. Amer. Ent. Soc. 32:5 (not *Chrysopa marginalis* Navas, 1905).

Chrysopa injusta Banks, 1906, Psyche 13:98-99.

Distribution.—Described from "the mountains near Claremont, California."

Chrysopa robusta Banks

Chrysopa robusta Banks, 1906, Trans. Amer. Ent. Soc. 32:5.

Distribution.—Type locality, Tyron (probably Tryon), North Carolina.

Chrysopa placita Banks

Chrysopa placita Banks, 1908, Trans. Amer. Ent. Soc. 34:259.

Distribution.—Described from Clear Creek and Chimney Gulch, Golden, Canada.

Chrysopa incompleta Banks

Chrysopa incompleta Banks, 1911, Trans. Amer. Ent. Soc. 37:340-341.

Distribution.—Described from Beaufort and Raleigh, North Carolina.

Chrysopa furcata Banks

Chrysopa furcata Banks, 1911, Trans. Amer. Ent. Soc. 37:342.

Distribution.—Type locality, Ft. Wingate, New Mexico. Recorded from Stanford University, California.

Chrysopa luctuosa Banks

Chrysopa luctuosa Banks, 1911, Trans. Amer. Ent. Soc. 37:343.

Distribution.—Type locality, Ft. Wingate, Colorado. We have seen a specimen from Oregon.

Chrysopa gravida Banks

Chrysopa gravida Banks, 1911, Trans. Amer. Ent. Soc. 37:343.

Distribution.—Type locality, Yosemite, California.

Chrysopa intacta Navas

Chrysopa intacta Navas, 1912, Broteria (Braga) 10:199 (translation of description is given by Smith (1932)).

Distribution.—Type locality, Toronto, Canada. Recorded from Quebec and Missouri.

Chrysopa bicarnea Banks

Chrysopa bicarnea Banks, 1920, Bull. Mus. Comp. Zool. 64:338-339.

Distribution.—Type locality, Miami, Florida. We have seen specimens from Texas.

Chrysopa sierra Banks

Chrysopa sierra Banks, 1924, Bull. Mus. Comp. Zool. 65:431.

Distribution.—Type locality, San Gabriel Mts., Sister Elsie Peak, California.

Chrysopa seminole Banks

Chrysopa seminole Banks, 1924, Bull. Mus. Comp. Zool. 65:432.

Distribution.—Type locality, Marco, Florida. We have seen a specimen from Arizona.

Chrysopa slossonae Banks

Chrysopa emuncta, Banks (not Fitch), 1903, Trans. Amer. Ent. Soc. 29:154.

Chrysopa slossonae Banks, 1924, Bull. Mus. Comp. Zool. 65:432.

One of the syntypes of this species is a specimen from Franconia, New Hampshire that Banks (1903) incorrectly identified as *Chrysopa emuncta* Fitch, a species which he subsequently (1924) transferred to the genus *Meleoma*. Simultaneously *M. slossonae* Banks, 1896, was synonymized with *M. emuncta* (Fitch 1856).

Distribution.—Described from Hendersonville, North Carolina; Franconia, New Hampshire; and Great Falls, Virginia.

Chrysopa antillana Navas

The authors have been unable to locate any formal description of this species. Smith (1931) quotes Banks as believing that the name appeared in a synoptic table of Navas's in 1924, which would validate the name. Banks (1938) records this species from Florida.

Chrysopa mohave Banks

Chrysopa mohave Banks, 1938, Can. Ent. 70:120.

Distribution.—Described from Claremont and Stanford University, California, and Chiricahua Mts., Arizona.

Chrysopa crotchi Banks

Chrysopa crotchi Banks, 1938, Psyche 45:76.

Distribution.—Type locality, Victoria, Vancouver Island (British Columbia).

Chrysopa pinalena Banks

Chrysopa pinalena Banks, 1950, Psyche 57:49.

Distribution.—Type locality, the Pinals, Globe, Arizona.

Genus **Abachrysa** Banks

Banks, N., 1938, Psyche 45:75 (type species by original designation, *Chrysopa eureka* Banks).

In this genus the pronotum is about twice as broad as long, and the second median cell is no longer than the first.

Abachrysa eureka (Banks)

Chrysopa eureka Banks, 1931, Psyche 38:174.

Abachrysa eureka, Banks, 1938, Psyche 45:75.

This species is robust, predominantly brown, with eight prominent black spots on the pronotum; there are many dark cross veins. A specimen in the U. S. National Museum from Georgia has curved ridges under each antennal socket.

Distribution.—Type locality, Hope, Arkansas. Known to occur in Mississippi and Georgia.

Genus **Chrysopiella** Banks

Banks, N., 1911, Trans. Amer. Ent. Soc. 37:34 (type species by original designation, *Chrysopa sabulosa* Banks).

This genus is characterized almost entirely by the absence of the inner series of gradate veins in both fore and hind wings. The three described species are greenish yellow with wholly pale venation, although occasionally a specimen will have a few of the veins marked with dark brown or black.

Representatives of this genus have so far been reported only in the Western United States and Mexico.

Chrysopiella sabulosa (Banks)

Chrysopa sabulosa Banks, 1897, Proc. Ent. Soc. Wash. 4:174.

Chrysopiella sabulosa, Banks, 1911, Ann. Ent. Soc. Amer. 37:344.

Distribution.—Type locality, Colorado. Reported from New Mexico and Texas by Banks (1903 and 1948) and from Arizona and Kansas by Smith (1934). The authors have seen specimens from Utah and Wyoming.

Chrysopiella pallida Banks

Chrysopiella pallida Banks, 1911, Ann. Ent. Soc. Amer. 37:345.

This species is separated with great difficulty from *C. sabulosa* by the presence of a median triangular spot below the antennae.

Distribution.—Type locality, Rincon, New Mexico. The authors have seen specimens from Utah, Oregon and Arizona.

Chrysopiella minora Banks

Chrysopiella minora Banks, 1935, Psyche 42:55.

This species is separated with great difficulty from *C. sabulosa* by the presence of dark lines on the vertex.

Distribution.—Type locality, Umatilla, Oregon.

Genus **Eremochrysa** Banks

Banks, N., 1903, Trans. Amer. Ent. Soc. 29:158 (type species by original designation *Chrysopa punctinervis* McLachlan).

To this genus are referred species which have two series of gradate veins in the forewings and only one (the outer) series in the hind wings. The veins are marked with dark areas or small spots to a varying degree. Aberrations in the number and location of gradates are not uncommon. In general *Eremochrysa* species are brownish, not green.

Banks (1950) provided keys to the species and figures illustrating significant characters. Except for *E. (Lolochrysa) canadensis* (Banks) and *E. (Eremochrysa) punctinervis* (McLachlan) members of this genus appear to be confined to Western North America, particularly the southwestern U. S.

Banks (1950) grouped six species into the subgenus *Lolochrysa* which was distinguished from the nominal subgenus primarily on the basis of having the lower terminal process of the male abdomen upcurved with simple hairs. In the subgenus *Eremochrysa*, the male terminal "process is straight and provided with reclinate hairs or bristles." *E.* (*Lolochrysa*) is a poorly defined group partly because one of the included species (*spilota*) was described without reference to male specimens. In using Banks' paper to determine species of the genus *Eremochrysa* it is necessary to refer to both of his "tables" and make careful reference to his specific descriptions. This is particularly important in the case of females. In *E.* (*Lolochrysa*) all species except *spilota* lack "dotting of the veins." In *E.* (*Eremochrysa*) four of the seven species have dotting on the veins.

Subgenus **Eremochrysa** Banks

Eremochrysa (Eremochrysa) punctinervis (McLachlan)

Chrysopa punctinervis McLachlan, 1869, Ent. Mo. Mag. 6:24.

Eremochrysa punctinervis, Banks, 1903, Trans. Amer. Ent. Soc. 29:159.

Distribution.—Described from Bosque County, Texas. According to Banks (1950) this species is widely distributed in the western states, most common in the southern ones; eastward it extends to Florida.

Eremochrysa (Eremochrysa) fraterna (Banks)

Chrysopa fraterna Banks, 1897, Proc. Ent. Soc. Wash. 4:174-175.

Eremochrysa fraterna, Banks, 1903, Trans. Amer. Ent. Soc. 29:159.

Distribution.—Described from Colorado. Banks (1950) reported this species as occurring over most of the western states. We have seen many specimens in which all the wing veins are dark. The dark band on the femora is variable.

Eremochrysa (Eremochrysa) rufina Banks

Eremochrysa rufina Banks, 1950, Psyche 57:54-55.

Distribution.—Type locality, Grand Canyon, Arizona.

Eremochrysa (Eremochrysa) tibialis Banks

Eremochrysa tibialis Banks, 1950, Psyche 57:55-56.

Distribution.—Type locality, Florence Junction, Arizona. Recorded from Utah and California. We have seen specimens from Nevada.

Eremochrysa (Eremochrysa) altilis Banks

Eremochrysa altilis Banks, 1950, Psyche 57:56-57.

Distribution.—Type locality, Stockton Pass, Graham County, Arizona.

Eremochrysa (Eremochrysa) rufifrons Banks

Eremochrysa rufifrons Banks, 1950, Psyche 57:57-58.

Distribution.—Type locality, Globe, Arizona.

Eremochrysa (Eremochrysa) pumilis Banks

Eremochrysa pumilis Banks, 1950, Psyche 57:58.

Distribution.—Type locality, Garland, Colorado. Recorded from Utah and Texas. We have seen specimens from California.

Subgenus **Lolochrysa** Banks

Banks, 1950, Psyche 57:59 (type species by original designation, *Eremochrysa* (*Lolochrysa*) *hageni* Banks).

Eremochrysa (Lolochrysa) hageni Banks

Eremochrysa hageni Banks, 1903, Trans. Amer. Ent. Soc. 29:158-159.

Distribution.—Type locality, Austin, Texas. Recorded from Utah, New Mexico, and Arizona.

Eremochrysa (Lolochrysa) californica Banks

Eremochrysa californica Banks, 1906, Trans. Amer. Ent. Soc. 32:6.

Distribution.—Type locality, Santa Clara County, California. Recorded from Arizona.

Eremochrysa (Lolochrysa) canadensis (Banks)

Chrysopa canadensis Banks, 1911, Trans. Amer. Ent. Soc. 37:339-340.

Eremochrusa canadensis, Banks, 1950, Psyche 57:64,66.

Distribution.—Type locality, Go Home Bay, Lake Huron, Canada. Recorded from Maine, New Hampshire, and Massachusetts.

Eremochrysa (Lolochrysa) spilota Banks

Eremochrysa spilota Banks, 1950, Psyche 57:61.

Distribution.—Type locality, Yuma, California.

Eremochrysa (Lolochrysa) pima Banks

Eremochrysa pima Banks, 1950, Psyche 57:61-62.

Distribution.—Type locality, S. Fork Camp, White Mts., Arizona. Recorded from New Mexico.

Eremochrysa (Lolochrysa) yosemite Banks

Eremochrysa yosemite Banks, 1950, Psyche 57:63-64.

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TAXONOMIC NOTES ON KIMMINSIA
(*Neuroptera; Hemerobiidae*)

By SOPHY PARFIN, *Division of Insects, U.S. National Museum, Washington, D. C.*

Ten species of *Kimminsia* have been included in Carpenter's revision of the Nearctic species of *Kimminsia* (1940, Proc. Amer. Acad. Arts & Sci., vol. 74, pp. 214-225). In this paper, two more species are added to the Nearctic fauna, including *constricta*, a new species, and *subnelbulosa* (Stephens), a Palaearctic species. Additional records for certain species of *Kimminsia* are also given.

Kimminsia constricta, new species

(Figures 1-6, 15)

Male (holotype).—Face dark brown; vertex dark brown anteriorly, yellow posteriorly, with narrow blackish-brown central longitudinal line in yellow portion; antennae with basal two segments light brown, following segments banded with fuscous, and terminal segments fuscous; palpi brown; thorax with broad dorsal median longitudinal yellowish stripe bordered by dark brown, pronotum slightly brownish anteriorly and with narrow median longitudinal dark line in central stripe, mesonotum dark brown anteriorly with spotting posteriorly in stripe; pleura yellowish to light brown; legs principally yellowish, prothoracic femora with dark longitudinal line, pro- and mesothoracic tibiae with dark spot at each end. Forewing, length 7.4 mm., width 2.8 mm., apex rounded; costal area moderately wide; longitudinal veins spotted with brown; membrane hyaline with fuscous sagittate markings, heavier spotting along inner and outer gradates on sectoral, radio-medial, medial, distal medio-cubital and cubital cross-veins, along inner margin of wing particularly in cubital area. Hindwing, length 6.2 mm., width 2.5 mm.; membrane hyaline, no maculations; venation yellowish brown. Abdomen brown; anal plates of male moderately long, each terminating in a short distal inwardly turned blackish-brown process bordered by several small tooth-like processes, and with eleven to thirteen trichobothria; tenth sternite large with a pair of broad lateral "wings," each having a posterior thin process; aedeagus long with the appearance of a very narrow neck-line portion near base, then expanding considerably, narrowing, curving and terminating acutely; parameres with narrow short arms and considerably broader long arms.

Holotype.—Alaska, 10-15 miles below Gulkana Lake along Gulkana River (145° 34′ N, 62° 50′ W), June 27-July 20, 1955, G. O. Schumann, collector; in United States National Museum, Type No. 63187.

The female is unknown.

This species resembles *schwarzi* closely. However, in *constricta* the long arms of the parameres are broader than in *schwarzi* and the notum is covered by a pale median stripe bordered by dark brown. The short distal process of the anal plate is similar to those of both *schwarzi* and *fumata*. The holotype of *fumata* was kindly compared with the holotype of *constricta* by Dr. E. S. Ross[1], who noted that in the male of *fumata*, the aedeagus in lateral view is more flattened, the distal tooth less inwardly curved, the processes from the lateral "wings" much more arcuate, and the parameres considerably more flattened in profile. The neck-like portion at the base of the aedeagus of the male separates *constricta* from other species of *Kimminsia*. Whether the pronounced dark spot on the medio-cubital cross-vein below the forking of MP in *constricta* is constant is not known.

Kimminsia subnebulosa (Stephens)
(Figures 7-11, 13, 14)

Hemerobius subnebulosus Stephens, 1836, Illus. Brit. Ent., Mand. 6:107.
Hemerobius fuscus Stephens, 1836, *ibid.*
Memerobius nebulosus Stephens (*part.*), 1836, *ibid.*
Hemerobius nervosus Hagen (*part.*), 1858, Ent. Ann. :28.
Boriomyia subnebulosus Banks, 1905, Trans. Amer. Ent. Soc.. 32:29; Killington, 1937, Monogr. Brit. Neur., 2:89 (*subnebulosa*).
Kimminsia subnebulosa Killington, 1937, *ibid.* :255.

Face dark brown to brownish-black with clypeus and labrum sometimes slightly paler; vertex yellowish, frequently mottled with dark brown around setal pits, with a blackish spot behind each antenna, and a narrow longitudinal median dark streak; antennae yellowish; palpi yellowish-brown; thorax with broad dorsal median longitudinal stripe over entire length, widest on mesonotum, narrowest on metanotum, bordered by blackish to reddish-brown laterally; pronotum with median dark line of variable form, meso- and metanotum usually with more or less extensive dark brown streaking or mottling in median stripe; pleura brown with some yellowish; legs pale yellow with pro- and mesothoracic tibiae usually marked with dark brown near both ends; tarsi yellowish with last segment of each usually dark. Wings similar to *disjuncta*. Forewing, length 7 to 9 mm., width 2.8 to 3 mm., membrane covered with sagittate markings; apex oval; costal area moderately wide; gradates sometimes slightly bordered; longitudinal veins intermittently spotted brown and hyaline, pronounced dark spots on gradate

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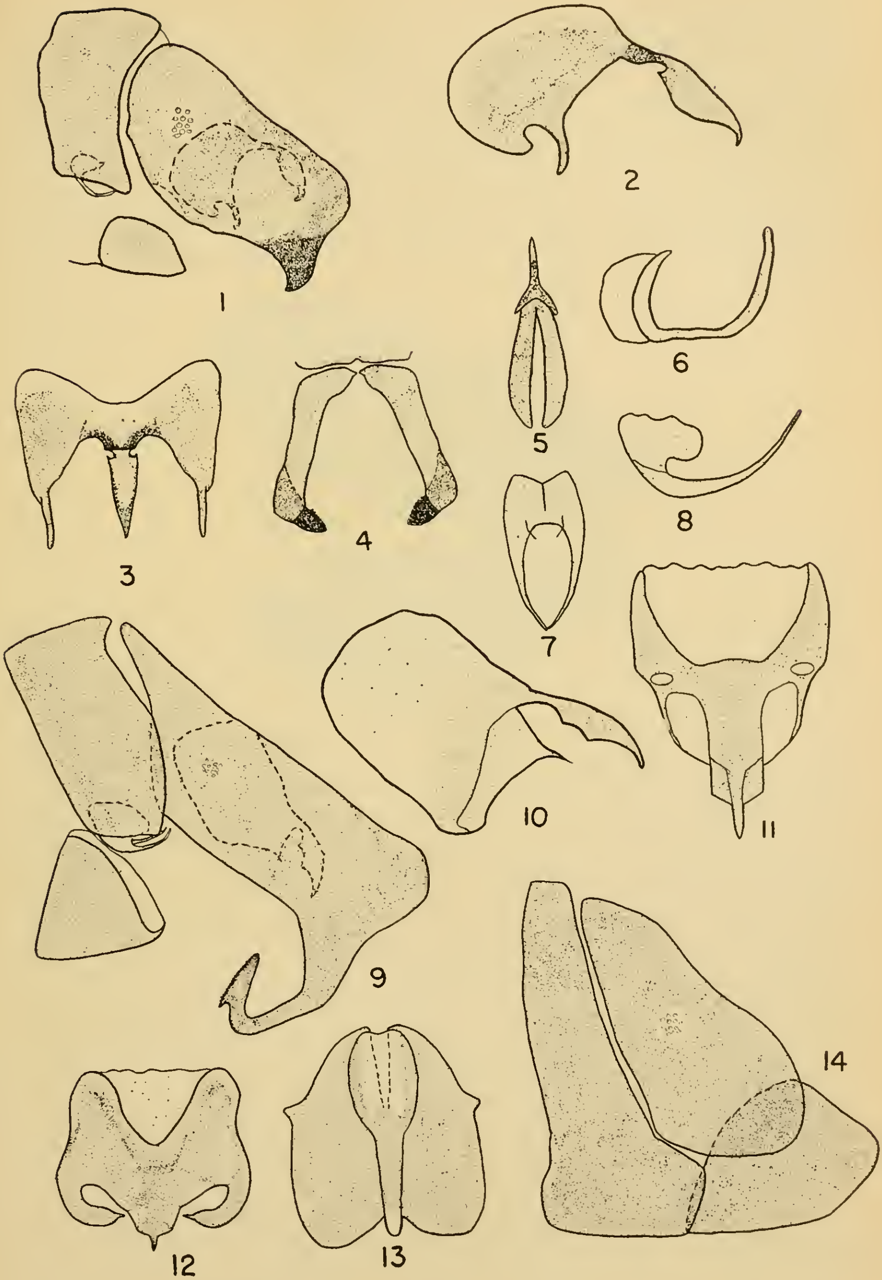
[1]The writer is indebted to Dr. Ross of the California Academy of Sciences and Mr. D. E. Kimmins of the British Museum (Natural History) for comparing specimens. Appreciation is also expressed to Dr. A. B. Gurney of the U.S. Department of Agriculture, Dr. J. B. Kring of the Connecticut Agricultural Experiment Station, Mr. G. O. Schumann of the State University of New York (Syracuse), and to Dr. J. F. G. Clarke of the Smithsonian Institution for other help.

Kimminsia constricta, n. sp. (holotype): fig. 1, terminal abdominal segments of male, lateral view; fig. 2, tenth sternite and aedeagus of same, lateral view; fig. 3, same, dorsal view; fig. 4, anal plates of male, dorsal view; fig. 5, parameres, dorsal view; fig. 6, same, lateral view. *Kimminsia subnebulosa* (Stephens): fig. 7, parameres of male, dorsal view; fig. 8, same, lateral view; fig. 9, terminal abdominal segments of male, lateral view; fig. 10, tenth sternite and aedeagus of same, lateral view; fig. 11, same, dorsal view; fig. 13, eighth abdominal sternite of female, ventral view; fig. 14, terminal abdominal segments of same, lateral view. *Kimminsia disjuncta* (Banks): fig. 12, tenth sternite and aedeagus of male, dorsal view.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between MP3+4 and Cu1 at forking, and from 3rd A to margin. Hindwing, length approximately 7 mm., width 3 mm.; membrane hyaline, venation in general light brown. Abdomen brown; anal plates of male long, with distal portion of each produced into a long slender process bent downwards and inwards, and ending in a slight expansion, the latter bordered with dark tooth-like processes, and with fifteen to seventeen trichobothria; tenth sternite with very short, acute, narrow, curved lateral processes; aedeagus long; parameres with a pair of ventral arms only; anal plates of female broader latero-ventrally than medially, eighth sternite of female about as broad as long, with ventral, median, elongate, flap-like portion attached anteriorly and slightly variable in outline.

Fig. 15. Right wings of *Kimminsia constricta*, n. sp. Holotype.

This Palaearctic hemerobiid, heretofore recorded from all over Europe, and also from Madeira, Siberia and Turkestan (see Killington, 1937, Monogr. Brit. Neur., vol. 2, p. 96), has recently been found in the United States. Distribution records include: CONNECTICUT (Hamden, May 18, 1947, NM, one female; Meriden, July 29, 1954, S. Parfin, one female), and NEW YORK (Long Island, Sag Harbor, May 1949, four females and one male; Greenport, May 1949 and September 1953, one male and one female respectively, R. Latham).

Dr. Gurney had previously identified a male from Greenport, Long Island, in the USNM collection as this species, but because the distinctive plate of the eighth abdominal sternite of the female has never been figured, it was not possible to identify isolated females until a vial containing four females and a male from Sag Harbor, Long Island, came into the hands of the writer. Identification was kindly confirmed by Mr. Kimmins, who compared a male and female from the United States with European specimens of *subnebulosa*.

Accordingly, a drawing of the genital plate of the female is given in this paper (fig. 13). Although Killington (*loc. cit.*, figs. 87 and 88) has illustrated the terminal abdominal segments of the male and female, and the genitalia of the male of *subnebulosa*, drawings of these parts, together with a redescription of *subnebulosa*, are included in order to supplement Carpenter's revision of the Nearctic species of *Kimminsia*, and to facilitate the work of those who do not have easy access to Killington's book.

Superficially, *subnebulosa* resembles *disjuncta*, but can easily be separated by the genitalia. In addition to the characters pointed out in the key, in the male of *subnebulosa*, the parameres have a pair of ventral arms only, whereas in *disjuncta*, the parameres have both ventral and dorsal arms. In the specimens of *subnebulosa* examined, the pale median stripe on the mesonotum was streaked with brownish-black, whereas in those of *disjuncta* examined, the stripe on the mesonotum on eastern specimens tended to be free of streaking, although that on western and Alaskan specimens usually showed some streaking (very pronounced on Utah specimens).

Because of uncertainty concerning the distinction between the genitalia of the Nearctic *disjuncta* (see Carpenter, *loc. cit.*, fig. 15) and the European *betulina* (Strøm) (see Killington, 1936, *loc. cit.*, vol. 1, fig. 13, and 1937, *op. cit.*, vol. 2, fig. 85), Mr. Kimmins kindly compared a Nearctic male and female of *disjuncta* with British specimens of *betulina* and, *in litt.*, stated the following: "In the ♂ the anal plates in side view are relatively broader, the outer apical angle is more prounced, the upper margin just before the angle being very slightly concave. The lateral processes of the tenth sternite in side view are broader and less acute, their general direction being more or less parallel to the aedeagus (divergent in *betulina*), from beneath broader and more abruptly tapered apically. Apices of the parameres more widely divergent. In the ♀ the anal plates are broader. There also appear to be differences in the subgenital plate (x of Killington, fig. 13), but examination of a longer series would be necessary to determine the range of variation." A flat dorsal view of the tenth sternite and aedeagus of a male of *disjuncta* is shown in fig. 12, since that figured by Carpenter is somewhat at an angle and the resemblance to *betulina* can not so clearly be seen.

The two species, *constricta* and *subnebulosa*, will fit into a modification of couplets 1-5 in Carpenter's key to the Nearctic species of *Kimminsia* (*loc. cit.*, p. 215) as follows:

1. Pronotum with a conspicuous longitudinal yellowish stripe, bordered laterally with dark brown 2
   Pronotum without such a median stripe .... to 6 of Carpenter's key
2. Face with upper part of frons adjacent to antennae very dark brown, the lower part of face yellowish or light brown and the transition very abrupt .... *coloradensis* Banks
   Face more uniformly dark brown, or if the upper part is darker than the lower, the transition is very gradual 3
3. Forewing with blackish-brown spots at distal medio-cubital cross-vein between MP3+4 and Cu1, and from Cu1 to anal border, particularly prominent, few maculations elsewhere other than at apex .... *posticata* Banks
   Forewing with maculations more evenly distributed 4

4. Anal plate of male with a very long dorsal process, posteriorly directed; eighth abdominal sternite of female consisting of a small median plate without gonapophyses; maculation of forewing at the gradudate cross-vein between MP3+4 and Cu1 strongly developed .... *furcata* Banks
   Anal plate of male without such a dorsal process; eighth abdominal sternite of female with or without a pair of gonapophyses 5
5. Anal plate of male with very long slender distal process bent downwards and inwards, terminating in expanded portion bordered by teeth; eighth abdominal sternite of female as broad as long, with ventral median elongate flap .... *subnebulosa* (Stephens)
   Anal plate of male with shorter distal process; eighth abdominal sternite of female about twice as long as broad or unknown 6
6. Anal plate of male with distal process short and bent inwards, aedeagus with narrow neck-like portion basally; forewing length about 7.5 mm.; eighth abdominal sternite of female unknown .... *constricta*, n. sp.
   Anal plate of male with distal process moderately long, and not bent inwards, aedeagus without basal ''neck;'' forewing length usually more than 7.5 mm.; eighth abdominal sternite of female about twice as long as broad 7
7. Forewing length averaging 11 mm., costal area broad; aedeagus of male long and narrow; posterior margin of eighth sternite of female about ¼ width of anterior margin .... *involuta* Carpenter
   Forewing length shorter, averaging 9 mm., costal area of moderate breadth; aedeagus of male much shorter; posterior margin of eighth sternite of female about ½ width of anterior margin .... *disjuncta* (Banks)

(See Carpenter, *loc cit.*, for rest of key.)

Additional Records of Nearctic Species of Kimminsia

The following species of *Kimminsia*, not mentioned in Carpenter's revision, have been examined:

1. *brunnea* (Banks): Utah (Logan Canyon, July 30, G. S. Stains and D. G. Hall); ALASKA (10-15 miles below Gulkana Lake, along Gulkana River (145° 34′ N, 62° 50′ W), June 27-July 20, 1955, G. O. Schumann).

2. *coloradensis* (Banks): California (Mono County, Leevining Creek, August 14, elevation 6500 feet, H. P. Chandler); Nevada (Baker, April 14, T. O. Thatcher); Oregon (Harney County, Frenchglen, June 26, B. Malkin); Utah (Heber, July 23, G. F. Knowlton and F. C. Harmston; Logan, September 1 and 17, G. F. Knowlton, and September 9, G. F. Knowlton and G. S. Stains); Washington (Godman Spring, Blue Mts., 5800 feet, July 17, J. F. G. Clarke).

3. *disjuncta* (Banks): Maine (Acadia National Park, August 31, E. L. Kessel); Michigan (Cheboygan, August 15, J. Leonard); New York (Orient, June 8, R. Latham); Oregon (Corvallis, June 5, E. C. Van Dyke; Salem, March 21, E. J. Newcomer); Utah (Logan, August 4, G. F. Knowlton and G. S. Stains, and August 24 and September 1, 17 and 21, G. F. Knowlton); British Columbia (Kaslo,

August 20, A. N. Caudell; Wellington, July 5, 23 and November 4, Richard Guppy); ALASKA (Eagle Summit, 3800 feet, June 25, R. I. Sailer; Matanuska, June 5, August 12 and 30, J. C. Chamberlin; Nulato, July 26, B. P. Clark).

4. *furcata* (Banks): CALIFORNIA (Mono County, Leevining Creek, August 11, H. P. Chandler); ALASKA (Teller, June 25, R. I. Sailer).

5. *involuta* Carpenter: UTAH (Logan, July 31, G. F. Knowlton and S. L. Wood); BRITISH COLUMBIA (Terrace, Mrs. Hippisley); ALASKA (Fairbanks, July 25, C. O. Esselbaugh).

6. *posticata* (Banks): UTAH (Logan, September 14, G. F. Knowlton and G. S. Stains).

7. *pretiosa* Banks): UTAH (Vinta Canyon, August 26, G. F. Knowlton and W. P. Nye).

THE FRANKLINIELLA OCCIDENTALIS (PERGANDE) COMPLEX IN CALIFORNIA, by Douglas E. Bryan and Ray F. Smith, University of California Publications in Entomology, Vol. 10, No. 6, pgs. 359-410, figs. 1-10, tables 1-10, University of California Press, Berkeley and Los Angeles, 1956. $0.75.

A material contribution to the taxonomy of Thysanoptera has been made in this study of the relationship between the taxa of the *occidentalis* complex of *Frankliniella.* Although the taxa discussed show intergradation in color and morphology, they have usually been regarded as species. As the complex is exceeded in economic importance by few species of thrips in the United States, and perhaps by none in the West, clarification of the identity of the components will be welcome to many, and to none more so than the reviewer.

In seeking an explanation for the coexistence of pale, intermediate, and dark forms, supposedly different species, the authors examine genetic, morphologic, and distributional evidence. Following a short section dealing with the life history, there are sections dealing with each of these factors, giving methods, results, and discussions of authors' investigations. Interest in this report will not be limited to thysanopterists. The technics employed will be useful to others concerned with the handling of minute thigmotropic winged insects, and the results and analyses will have far wider value, as the taxonomist in any group of organisms is confronted by this problem in some guise. The discussion of the breeding experiments and their genetic implications is particularly lucid and informative. An appendix gives synonymic bibliographies of the genus *Frankliniella* and the nominal species involved, recounting the nomenclatural history of the genus and assessing the status of each species in the light of the information obtained in the study.—KELLIE O'NEILL, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

FOR FALL PUBLICATION

A CLASSIFICATION OF THE SIPHONAPTERA OF SOUTH AMERICA

WITH DESCRIPTIONS OF NEW SPECIES

by Phyllis Truth Johnson

Memoir 5
of the
Entomological Society of Washington

The study of South American fleas was begun in 1879 when Weyenbergh published the first descriptions of species from that region, using specimens mounted on cardboard as was usual in that day. These fleas were restudied in balsam by Jordan and Rothschild in England shortly after the turn of the century, and from that time to the present day a large number of siphonapterologists, both in England and the Americas, have contributed to this study. Dr. Johnson's work is the first comprehensive taxonomic treatment of the fleas of the region, which comprises Trinidad and all of the continent and its coastal islands. The contemplated 275 page volume will be indispensable to the serious student of this important order of insects.

Memoir 5 opens with two discussions of morphological characters, one devoted to the terms used in the taxonomic section and the other to their taxonomic validity and possible phylogenetic significance. All the families, tribes and genera known to occur in South America are completely described and illustrated, and the species within each genus have been listed with host and locality data. Descriptions of 17 new species and two new subspecies bring the total number to 170. Keys to families, tribes, genera, and species are included. The discussion of each genus is terminated by a section giving the synonymies of the hosts concerned. The 114 plates are said to contain among the best illustrations of fleas currently available, and are grouped according to family. A section listing hosts, each with the fleas known to occur on it, recapitulates the host-flea information; sections dealing with references, systematic index and list of abbreviations close the volume.

The *Siphonaptera of South America* will be ready for distribution in the late Fall. Arrangements have been made to offer this Memoir at a *prepublication* price of $8.00 to members of the *Society* and $9.00 to non-members. Orders should be addressed to: *Mr. Herbert J. Conkle, Custodian, Plant Quarantine Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.*

STUDIES IN PANAMA CULICOIDES
VII. THE SPECIES OF THE PULICARIS AND COVA-GARCIAI GROUPS
(DIPTERA, HELEIDAE)

By WILLIS W. WIRTH[1] and FRANKLIN S. BLANTON[2]

This paper is based primarily, unless otherwise stated, on material collected by the junior author in Panama by means of light traps. Our methods and terminology are explained briefly in Part I of this series (1953, Jour. Wash. Acad. Sci., 43: 69-77).

We use the Tillyard modification of the Comstock-Needham system of wing venation; wing length is measured from the basal arculus, and the antennal ratio is the value obtained by dividing the combined lengths of the last five antennal segments by the combined lengths of the preceding eight. Measurements are of single specimens unless they are followed by values in parentheses, in which case the values are "mean (minimum-maximum, n = number of measurements)." The types of the six new species described here, and the bulk of the material studied are deposited in the collection of the U. S. National Museum, Washington, D. C.

We are very grateful to Paul Freeman and Alan Stone for their kindness in making the comparisons between our species and the type of *Ceratopogon decor* Williston in the British Museum (Natural History).

There are two subgenera of Neotropical *Culicoides* which have the second radial cell ending in a pale area.

1. Subgenus *Hoffmania* Fox. Species with the base of cell M_4 pale where it borders the veins at the base of the mediocubital fork or with apices of veins M_1 and M_2, and usually of M_{3+4} and Cu_1 pale; r-m crossvein often more or less darkened; male genitalia with the apicolateral processes small or absent, aedeagus with a proximal barlike sclerotization or marginal band and usually a distal peg with a ball-like tip; parameres usually fused at base. Numerous Neotropical species.

2. Subgenus *Culicoides* Latreille. Species with the base of cell M_4 dark at the base of the mediocubital fork and the apices of veins M_1, M_2, M_{3+4} and Cu_1 always dark; r-m crossvein always pale.

a. *obsoletus* Group. Very small species with bluish-black mesonotum and pale legs; male genitalia with ninth tergum rounded, apicolateral processes absent, aedeagus without basal barlike sclerotization or ball-like tip, but with distal peg; parameres separate and short with simple tips. Two Neotropical species: *pusillus* Lutz and *pusilloides* Wirth and Blanton.

b. *pulicaris Group*. Large species with black legs, at most with small pale knee spots; mesonotum blackish, entirely dull gray pruinose or with gray pruinose pattern; male genitalia with ninth tergum rounded caudally and bearing a low

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median lobe, the apicolateral processes small; basistyle with mesal surface more or less spinose; aedeagus without basal sclerotized band or distal peg or ball-like tip; parameres separate, with bent bases and slender, pubescent tips.

Two Neotropical species: *elutus* Macfie and *luteovenus* Root and Hoffman.

c. *cova-garciai* Group. Large to medium-sized species with legs yellow or with knees broadly yellow-banded or black-spotted; mesonotum yellowish to brown, subshining; male genitalia like those of *pulicaris* Group, with basistyles mesally spinose, but with tendency for the development of long apicolateral processes and a caudo-median cleft on the ninth tergum, a basal sclerotized band and distal peg and ball-like tip on the aedeagus, together with fusion of the parameres, all characters resembling those of species of the subgenus *Hoffmania*. Nine Neotropical species: *cova-garciai* Ortiz, *decor* (Williston), *efferus* Fox, and six new species described below.

In this paper we treat the Neotropical species of two of the groups of the subgenus *Culicoides*, the *pulicaris* Group and the *cova-garciai* Group.

Pulicaris Group

Culicoides elutus Macfie
(Figure 1)

Culicoides elutus Macfie, 1948, Ann. Trop. Med. & Parasit. 42:75 (female; El Carrizal, Chiapas, Mexico; fig. wing).

Culicoides cockerelli tristriatulus Hoffman, Vargas, 1945, Rev. Inst. Salub. Enf. Trop. 6:45, 48 (Camotlán, Oaxaca, Mexico; fig. male genitalia). Misdetermination.

Female.—Length about 1.4 mm. wing 1.14 (1.02-1.25, n = 14) mm. Eyes bare, contiguous. Antenna with flagellar segments in proportion of 20:15:15:15:15:15:15:15:20:20:22:25:35, antennal ratio 0.93 (0.91-0.96, n =2), distal sensory tufts on segments II, XI-XIV. Palpal segments (fig. 1b) in proportion of 5:15:15:6:5, third segment strongly swollen, 2.5 times as long as broad, abruptly narrowed beyond the large sensory pit. Mandible with 16 (14-17, n = 14) teeth. Mesonotum and scutellum uniformly dark pruinose brown. Legs dark brown, small knee spots and narrow bands on base and apex of hind tibia yellowish; six spines on comb of hind tibia, the second from the spur the largest. Wing (fig. 1a) with pattern as figured, costa extending 0.65 of distance from basal arculus to wing tip; macrotrichia abundant, extending nearly to base of wing and abundant in anal cell; second radial cell nearly all included in a pale area; first and second dark bands of wing nearly transverse, each broken into separate dark spots centering on the veins; third dark band zig-zag, produced to wing margin along tips of veins M_1, M_2, and M_{3+4}: distal pale spot in cell R_5 occupying entire apex of cell to wing margin; distal pale spots in cells M_1 and M_2 broadly meeting wing margin. Halter yellowish white. Abdomen blackish; spermathecae (fig. 1c) two, subequal, suboval, each measuring 0.083 (0.072-0.096, n = 6) by 0.053 (0.050-0.058, n = 4) mm.

Fig. 1, *Culicoides elutus* Macfie; fig. 2, *Culicoides luteovenus* R. & H.; fig. 3, *Culicoides cova-garciai* Ortiz. a, female wing; b, female palpus; c, female spermathecae; d, male parameres; e, male genitalia, parameres omitted; f, mesontal pattern.

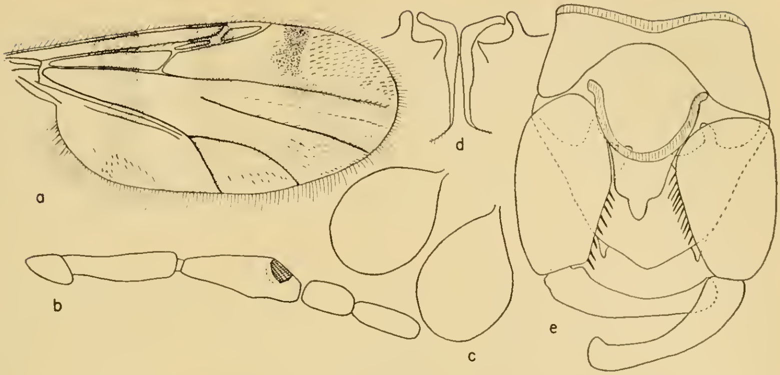

Fig. 1 ELUTUS

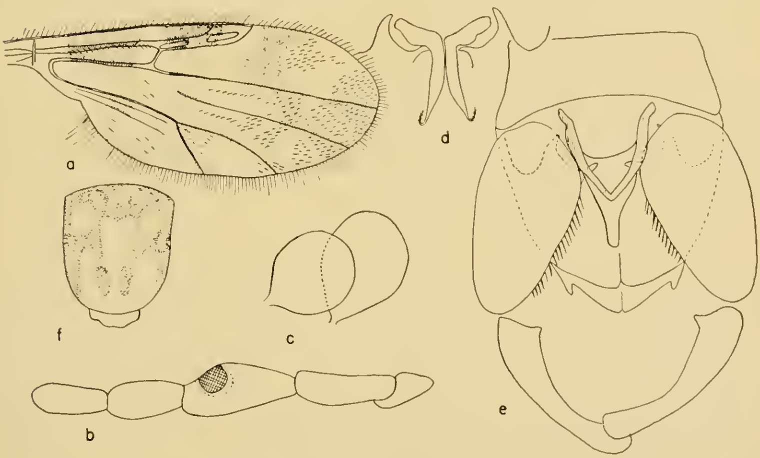

Fig. 2 LUTEOVENUS

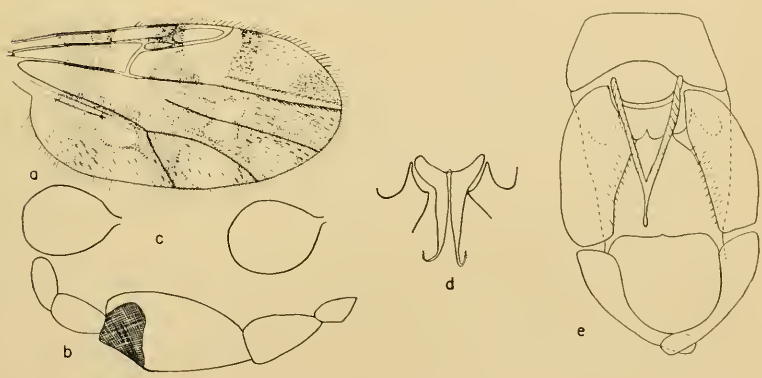

Fig. 3 COVA-GARCIAI

Male genitalia (fig. 1d, e).—Ninth sternum broad with a deep caudomedian excavation, the ventral membrane bare; ninth tergum rounded caudally with moderately developed apicolateral processes and a well-developed, hyaline, uncleft caudomedian lobe. Aedeagus massive, with a heavily sclerotized basal arch extending to slightly more than half of total length; distal portion stout, with broad shoulders and a short, rounded mesal, lobelike tip. Parameres entirely separate, slender, each with base abruptly bent laterad, nearly straight stem and pubescent, ventrally bent apex. Basistyle stout with dense dark spinose setae on mesal face, dorsal and ventral roots small, subequal; dististyle curved with bluntly rounded, bent apex.

Redescribed from a series of about 100 males and females from Almirante, Bocas del Toro Province, Panama, October, November 1952 and January 1953. Other material examined: *Panama*,—5 males, 20 females, Boquete, Chiriqui Province, 15 December 1952; 12 males, 8 females, El Volcan, Chiriqui Province, March, April, 1954; 5 females, Pacora, Panama Province, 4 June 1951; 3 females, Cerro Azul, Panama Province, 3 October 1952.

The male of *elutus* was described and figured by Vargas (op. cit.) under the name *cockerellii tristriatulus* Hoffman from a specimen from Camotlán, Oaxaca, Mexico. The association of sexes in the Panama material described above proves the true identity of Vargas' specimens.

Culicoides luteovenus Root and Hoffman
(Figure 2)

Culicoides luteovenus Root and Hoffman, 1937, Amer. Jour. Hyg. 25: 156 (male, female, San Jacinto, D. F., Mexico; fig. wing, male genitalia); Macfie, 1948, Ann. Trop. Med. and Parasit. 42:76 (Chiapas, Mexico); Wirth, 1952, Univ. Calif. Pub. Ent. 9:175 (Calif., Wash., Utah; male, female redescr.; fig. wing, mesonotum, palpus).

Female.—Length about 1.5 mm., wing 1.35 (1.29-1.42, n = 4) mm. long. Head dark brown, including antenna and palpus. Eyes contiguous a short distance; bare. Antenna with flagellar segments in proportion of 25:20:20:20:20:20:20:20:28:28:30:34:45, antennal ratio 0.99 (0.95-1.03, n = 5); distal sensory tufts on segments III, XI-XV. Palpal segments (fig. 2b) in proportion of 10:30:40:16:18, third segment slightly swollen, 2.45 (2.3-2.6, n = 2) times as long as broad, with a broad, shallow sensory pit. Mandible with 14 (13-17, n = 7) teeth. Mesonotum (fig. 2f) pruinose gray, with a prominent pattern of interconnected, subshining, dark brown areas as figured. Scutellum gray pruinose, postscutellum and pleuron subshining brownish black. Legs dark brown, knees narrowly yellowish; base and apex of hind tibia with narrow pale rings; six spines in comb of hind tibia, the second from the spur longest. Wing (fig. 2a) with pattern as figured, the pale areas milky white to yellowish hyaline; costa extending to 0.60 of wing length; macrotrichia numerous on distal half of wing, sparse in cell M_4 and anal cell. Distal pale spot in R_5 gradually evanescent towards wing tip. Abdomen blackish; spermathecae (fig. 2c) two, subequal, pyriform, each measuring 0.061 (0.058-0.065, n = 5) by 0.045 (0.043-0.048, n = 5) mm.

Male genitalia (fig. 2d, e).—Ninth sternum narrow, without caudomedian excavation; ninth tergum rounded caudally, with small apicolateral processes and a well-developed, undivided caudomedian lobe with a distinct thickening on the midline. Basistyle with well-developed dorsal and ventral roots, mesal margin with heavy spinose setae; dististyle slightly curved, with rounded apex. Aedeagus narrow, width at base 0.7 times total length, basal arch with a faintly sclerotized membrane across distal half; distal peglike sclerotization absent, the tip not ball-like but slender and roundly pointed. Parameres separate, each with stout, abruptly bent base, stout and nearly straight stem and slender, bent and pubescent tip.

Redescribed from a long series of males and females from El Volcan, Chiriqui Province, Panama, December 1952. Other material: 2 females, Cerro Punta, Chiriqui Province, 10 December 1952.

C. luteovenus is the only Neotropical species of the subgenus *Culicoides* having a well marked, extensive, mesonotal pattern, in this respect indicating its close relationship to the numerous Palaearctic and Nearctic species of the subgenus.

Cova-garciai Group

Key to the Neotropical Species of the Cova-garciai Group of Culicoides

1. Proboscis longer than height of head; third palpal segment long and slender, or if swollen, with open sensory area 2
   Proboscis shorter than height of head; third palpal segment more or less swollen, with a distinct sensory pit 4
2. Legs brown with knees and apex of hind tibia broadly yellow; third palpal segment long and slender with a small pit; mandible with 27 teeth .... *marshi*, n. sp.
   Legs pale including knees; mandible with 20-24 teeth 3
3. Third palpal segment long and slender with small pit .... *efferus* Fox
   Third palpal segment swollen with open sensory area .... *rostratus*, n. sp.
4. Knees pale; legs brownish with broad pale bands including knees on apices of fore and mid femora, bases of all tibiae and apex of hind tibia .... *cova-garciai* Ortiz
   Knees with a black spot, at least on hind pair; legs otherwise mostly yellowish 5
5. All knees with black spots; third palpal segment with a small sensory pit; femora more or less brownish with subapical pale bands; basal antennal segments moniliform or short oval, the eleventh segment two or three times as long as tenth 6
   Legs yellow, only hind knee with black spot; third palpal segment without sensory pit; eleventh antennal segment not markedly longer then tenth .... *metagonatus*, n. sp.
6. Distal pale spot in cell M_1 not attaining wing margin; pale spot straddling vein M_1 separate from the pale spot in cell R_5 at end of second radial cell; pale spot straddling vein M_2 in form of a double, more or less quadrate spot; femora blackish from near base to past middle; third palpal segment slightly swollen; wing 1.6 mm. long .... *chrysonotus*, n. sp.

Distal pale spot in cell M_1 broadly meeting wing margin; pale spot straddling vein M_1 continuous anteriorly with the pale spot in cell R_5 at end of second radial cell; third palpal segment greatly swollen 7

7. All femora dark brown from near base to past middle; tibiae brownish with narrow sub-basal pale band; wing yellow with greatly reduced blackish spots, 1.5 mm. long .... *lutealaris*, n. sp.

Fore and mid femora pale brown on basal portions, hind femur with a broad median darker brown band; wing 1.1 mm long 8

8. Abdomen yellowish white dorsally; wing yellow with greatly reduced blackish spots .... *nigrigenus*, n. sp.

Abdomen black with yellowish incisures; wing dark with rounded pale spots .... *decor* (Williston)

Culicoides cova-garciai Ortiz

(Figure 3)

Culicoides cova-garciai Ortiz, 1950, Rev. Sanid. y Asist. Soc. 15: 457 (male, female; Caracas, Venezuela; fig. wing, mesonotum, spermathecae, palpus, antenna).

Culicoides beebei Fox. 1952, Ann. Ent. Soc. Amer. 45:360 (female; Rancho Grande, Maracay, Venezuela; fig. wing, palpus, spermathecae, tibial comb). NEW SYNONYMY.

Female.—Length about 1.1 mm., wing 1.10 (1.06-1.28, n = 10) mm. long. Head brown; eyes contiguous for a distance equal to width of three corneal facets; bare. Antenna with flagellar segments in proportion of 20:18:18:18:18:18:18:18:25:25:28:30:44, antennal ratio 1.09; distal sensory tufts on segments III, XI-XV. Proboscis from base of palpi to its tip 0.8 as long as height of an eye. Palpal segments (fig. 3b) in proportion of 10:25:40:12:15; third segment swollen, 2.4 (2.1-2.7, n = 9) times as long as broad, with a broad, shallow sensory pit. Mandible with 15 (15-16, n = 10) teeth. Mesonotum uniformly yellowish brown, varying somewhat from golden yellow to darker brown, with vestiture of yellowish hairs; scutellum somewhat darker. Legs brown, bases of femora, apices of fore and mid femora, bases of all tibiae and apex of hind tibia broadly yellowish; hind tibial comb with six spines. Wing (fig. 3a) with costa extending 0.67 of distance from arculus to wing tip; radial cells broad, all of second radial cell except extreme base included in a yellow area; wing predominantly pale-marked; base broadly pale; a broad pale area over crossvein. Narrow, transverse, dark bands across wing; one before level of r-m crossvein; one at level of vein R_{2+3} to mediocubital fork and a sinuate band from just past apex of costa to tip of vein M_{3+4}; large rounded pale spots at margin of wing before apex of cell R_5, before margin of wing in cell M_1, at margin of wing in cell M_2, over middle of vein M_2 filling the cells before and behind this vein; rounded light spot in cell M_4 at wing margin but veins of mediocubital fork entirely dark-bordered, apex of anal cell with two, rounded, more or less connected pale spots. Halter pale. Abdomen dark brown; spermathecae (fig. 3c) two, subspherical, subequal, measuring 0.050 by 0.043 mm.

Male genitalia (fig. 3d, e).—Ninth sternum about twice as broad as long, with a caudomedian excavation to about half of length; ninth tergum not tapering caudally, the caudal margin truncated, with long, slender, apicolateral processes. Basistyle with heavy spinose setae on mesal margin, ventral root short and blunt, dorsal root longer and slender; dististyle curved, with slightly enlarged, rounded tip. Aedeagus long and narrow at base, twice as long as basal width, a sclerotized marginal band (transverse bar) near base of arch, a distinct peglike internal sclerotization present; apex very long and slender with ball-like tip. Parameres connected at their bases by a very narrow sclerotized band, each with abruptly bent stout basal portion, straight, tapering stem and pointed, slender, pubescent tip.

Redescribed from a long series of males and females from Cerro Campana, Panama Province, Panama. Other material studied: *Panama*,—Almirante, Bocas del Toro Province; Cerro Punta, Volcan and Boquete, all in Chiriqui Province; El Valle, Coclé Province. *Venezuela*,—Caracas (6 paratypes of *cova-garciai*), Los Chorros and Guamita, all from collection of I. Ortiz.

This species is easily recognized by its dark wings with well isolated pale areas, its dark brown legs with broadly pale knees, the short proboscis and swollen third palpal segment with the broad sensory pit. The long apicolateral processes, truncated ninth tergum, narrowly connected parameres and *Hoffmania*-like aedeagus are the most important characters of the male genitalia.

Through the courtesy of Dr. Fox we have studied the holotype female of *beebei* Fox and find that it agrees in all particulars with our series of *cova-garciai*. The only character by which *beebei* might be recognized is the divided palpal pit, but we have found specimens from each of the Panama localities with divided or undivided pits, and in one specimen from Cerro Punta the pit was divided on one palpus and undivided on the other one.

Culicoides efferus Fox

(Figure 4)

Culicoides efferus Fox, 1952, Ann. Ent. Soc. Amer. 45: 365 (female; Rio Charape, Peru; fig. wing, palpus, tibial comb, spermathecae, antenna).

Through the courtesy of Dr. Fox we have been privileged to study the holotype of *efferus* and to ascertain that the following material in the U. S. National Museum collection is conspecific: *Peru*,—6 females, Rio Charape, 14 September 1911, C. H. T. Townsend (apparently Fox's type came from this series through the W. H. Hoffman collection at the University of Puerto Rico). *Panama*,—4 males, 5 females, Cerro Punta, Chiriqui Province, 10 December 1952, 9 April 1954; 1 male, 4 females, El Volcan, Chiriqui Province, March, April, 1954; 1 male, 2 females, El Valle, Coclé Province, February, 1953. *Nicaragua*,—1 male, Villa Somoza, 14 July 1953, P. Galindo. *Honduras*,—1 female, Lancetillo, 20 January 1954, P. Galindo.

The female is recognized by its large size (wing 1.49 (1.35-1.62, n = 6) mm. long); long proboscis (1.42 times as long as height of eye); antenna with flagellar segments in proportion of 25:22:24:24:24:24:24:24:25:26:28:38:52, antennal ratio 0.93, distal sensory tufts on segments III, XI-XV; palpal segments in proportion of 10:50:50:26:24 (fig. 4b), third segment slender, 3.9 (3.5-4.4, n = 6) times as long as broad, with a small, shallow sensory pit at distal third, mandible with 24 (22-26, n = 8) teeth; hind tibial comb with six spines, the second from the spur the longest; spermathecae (fig. 4c) two, subequal, pyriform, each measuring 0.053 by 0.041 mm.; color of mesonotum subshining bright yellow, as in *rostratus*, n. sp.; and wing pattern practically identical with that figured for *rostratus* (fig. 5a).

The male of *efferus* has not been described. The following description is given of the genitalia (fig. 4d,e) of the males from Cerro Punta:

Ninth sternum transverse, without posterior excavation, the ventral membrane bare; ninth tergum long and tapering, rounded caudad with only faint vestiges of apicolateral processes, deeply cleft mesad at apex with a pair of pointed, contiguous, bare, submedian lobes corresponding to the broadly rounded ones of *metagonatus* n. sp. Basistyle slender, mesal spinose setae dense but hyaline in color and hence inconspicuous, ventral and dorsal roots undeveloped; diststyle curved with slender, blunt apex. Aedeagus narrow, the basal arms scarcely divergent, the anterior membrane covering slightly more than distal half of basal arch, distal peg and apical ball-like tip very slender. Parameres fused more than halfway to apices, the free portions very slender, pointed and pubescent, the common basal portion not greatly expanded laterad.

The caudally rounded ninth tergum of the male genitalia, even though slightly cleft caudomesad and therefore bilobate, is probably indicative of the close relation of *efferus* to the species of the *pulicaris* Group. The long proboscis, brilliant yellow coloration, *Hoffmania*-like aedeagus and fused parameres are indicative, however, of great specialization.

Culicoides rostratus Wirth and Blanton, new species

(Figure 5)

Female.—Length about 1.2 mm., wing 1.13 (1.06-1.19, n = 9) mm. long. Head dark brown including antenna and palpus, flagellum yellowish at base. Eyes contiguous a short distance, bare. Antenna with flagellar segments in proportion of 25:17:17:19:19:19:19:19:24:24:26:32:45, antennal ratio 0.98, distal sensory tufts present on segments III, XI-XV. Proboscis very elongate as in *efferus* Fox. Palpal segments (fig. 5b) in proportion of 8:32:43:17:17, second segment long and fairly stout, third segment moderately swollen on proximal two-thirds, 2.6 2.3-3.1, n = 8) times as long as broad, with a hollowed, open, sensory area on the tapering portion past middle of segment; fourth and fifth segments very slender. Mandible with 20 (19-21, n = 8) teeth. Mesonotum yellowish brown, becoming blackish at anterior margin, scutellum concolorous with mesonotum. Postscutellum and pleuron brown. Legs yellow, black knee spots absent, broad base of fore femur and apex of fore tibia brownish; six spines in distal comb of

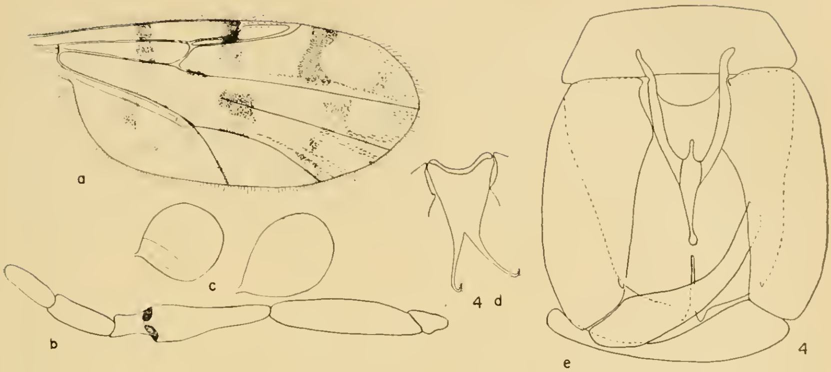

Fig. 4 EFFERUS

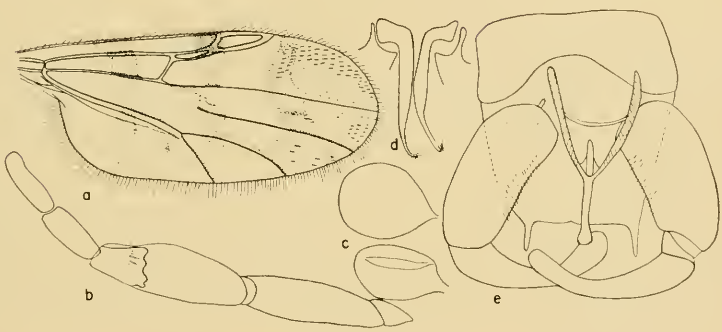

Fig. 5 ROSTRATUS

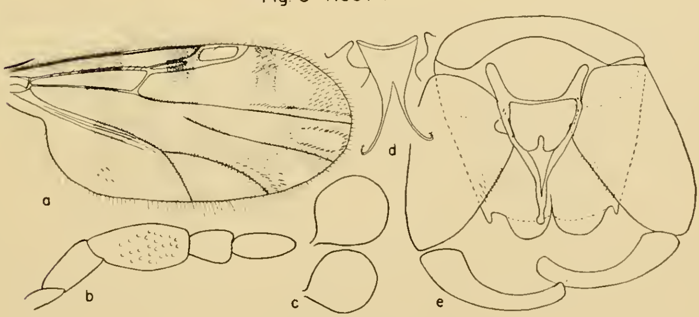

Fig. 6 METAGONATUS

Fig. 4, *Culicoides efferus* Fox; fig. 5, *Culicoides rostratus*, n. sp.; fig. 6, *Culicoides metagonatus*, n. sp. a, female wing; b, female palpus; c, female spermathecae; d, male parameres; e, male genitalia, parameres omitted.

hind tibia, the two nearest the spur longest and subequal. Wing (fig. 5a) with costa extending to 0.68 of wing length, macrotrichia confined to a few in apices of cells R_5, M_1 and M_2. Wing appearing pale yellowish, with restricted dark spots and areas as shown in figure, practically all of second radial cell in a pale area; dark spot over stem of M_1 and M_2 separate from the second dark band of wing which covers apex of first radial cell and extends narrowly but fairly regularly to hind wing-margin of apex of vein Cu_1. Third dark band of wing not interrupted, undulating in its course from front to hind wing-margin, the dark area continued to wing tip along veins, delimiting more or less rounded pale spots in cells R_5, M_1 and M_2; extreme apex of wing dark in cells R_5 and M_1 beyond these pale spots. Halter yellowish white. Abdomen dark brown. Spermathecae (fig. 5c) two, subequal, pyriform, each measuring 0.058 by 0.043 mm.

Male genitalia (fig. 5d, e).—Ninth sternum fairly broad, with a broad caudomedian excavation extending about half of breadth, the ventral membrane bare; ninth tergum short and tapering, the apex broad and truncated with long, slender apicolateral processes. Basistyle slender, the mesal margin with spinose setae, ventral roots short and blunt, the dorsal ones longer and slenderer; dististyle curved, with rather stout, rounded tip. Aedeagus twice as long as basal breadth, the membrane between basal arms extending about halfway to base, without marked anterior marginal band, apex with long, slender, internal peg and very slender, ball-like tip. Parameres entirely separate, each with abruptly bent, thickened base, slender, straight stem and gradually ventrally-curved, pointed, pubescent tip.

Holotype female, allotype, Cerro Campana, Panama Province, Panama, 19 September 1951, F. S. Blanton (light trap). (Type No. 62822, U. S. N. M.). Paratypes: 2 males, 17 females, same data as type except dates 3 July 1951, 19 September 1951, and 24 January 1952.

This species closely resembles *efferus* Fox in its pale legs without paler or darker knees, its wing pattern of very restricted dark markings and its long proboscis. However, it is a smaller species and differs in having the third palpal segment stouter and with an open sensory area. The male genitalia have the parameres entirely separate, the aedeagus without another sclerotized band and the ninth tergum is truncated with long apicolateral processes.

Culicoides marshi Wirth and Blanton, new species

Female.—Length about 1.1 mm., wing 1.18 (1.06-1.12, n = 5) mm. long. Head dark brown including antennae and palpi. Eyes bare, broadly contiguous. Antenna with flagellar segments in proportion of 30:21:22:22:22:22:22:22:25:25:31:33:50, antennal ratio 1.18; distal sensory tufts present on segments III, XI-XV. Palpal segments in proportion of 10:31:40:16:13, third segment very slender, 3.5 (3.1-3.9, n = 2) times as long as greatest breadth, with small, irregular, shallow sensory pit. Mandible with 27 (26-28, n = 5) teeth. Proboscis long, 1.2 times as long as height of eye. Mesonotum dark brown with a pruinose median area golden brown, anterior and lateral margins blackish; scutellum, postscutellum and pleuron blackish brown. Legs dark brown, broad bands at knees on all femora and tibiae, and apex of hind tibia, yellowish. Hind tibial comb with 5 (4-5, n = 4) spines, the second from the spur longest. Wing with costa extending to 0.68 of distance from basal arculus to wing tip; macrotrichia fairly abundant on distal half of wing. Wing pattern nearly as in *cova-garciai*, the distal pale spot in cell R_5 may or may not reach wing margin, distal pale spot in cell M_1 always separate from wing margin, the dark transverse bands of the pattern on distal half of wing irregular but connected, the pale spots rarely extensive enough to fuse in paler specimens. Halter yellow. Abdomen blackish, cerci yellowish. Spermathecae two, subequal, slightly pyriform, each measuring 0.050 by 0.039 mm.

Male unknown.

Holotype female, Almirante, Bocas del Toro Province, Panama, December 1952, F. S. Blanton, light trap (Type no. 62957, U. S. N. M.). Paratypes: 15 females, same data except dates October 1952 to March 1953.

This species resembles *cova-garciai* in leg markings but the length of proboscis allies it more closely with *rostratus*, while the palpi resemble those of *efferus*. The mandibles have more teeth and the antennal ratio is higher than in any of these three species.

We take pleasure in naming this species after Mr. Gordon A. Marsh of the University of California who as an Army Medical Department technician assisted us a great deal in our studies of Panama *Culicoides*.

Culicoides metagonatus Wirth and Blanton, new species

(Figure 6)

Female.—Length about 1.1 mm., wing 1.02 (0.89-1.19, n = 12) mm. long, Head dark brown including antenna and palpus, proximal flagellar segments yellow-annulated proximad. Eyes bare, broadly contiguous above. Antenna with flagellar segments in proportion of 25:20:20:20:20:20:20:20:25:25:28:30:48, antennal ratio 0.95; distal sensory tufts on segments III, XI-XV. Palpal segments (fig. 6b) in proportion of 8:17:26:11:15, third segment swollen, 2.1 (1.9-2.5, n = 9) times as long as broad, without sensory pit, sensoria scattered over mesal surface of segment. Mandible with 15 (14-16, n = 8) teeth. Mesonotum subshining yellowish brown, darker brown to blackish on anterior margin, humeri and sensory pits whitish pruinose, a small blackish spot mesad just anterior to scutellum; with sparse vestiture of yellow hairs. Scutellum, postscutellum and pleura yellowish brown. Legs yellow, hind knee with a black spot; hind tibial comb with six spines, the second spine from the spur the longest. Wing (fig. 6a) with costa extending to 0.63 of wing length, macrotrichia sparse in apices of cells M_3, M_1 and M_2. Wing pattern as figured, similar to that of *cova-garciai* Ortiz. Halter yellowish white. Abdomen brownish black, tergites with narrow, whitish, apical bands. Spermathecae (fig. 6c) two, subequal, pyriform, each measuring 0.048 by 0.039 mm.

Male genitalia (fig. 6d, e).—Ninth sternum very narrow, with a broad, scarcely discernible, caudomedian excavation; ninth tergum short and tapering, apicolateral processes very small but distinct, the caudal margin between them medially cleft and bilobate, with a submedian pair of hyaline, bare, rounded lobes produced caudad. Basistyle stout, mesal margin with fine spinose setae, ventral and dorsal roots poorly developed. Aedeagus well sclerotized, with stout basal arms, a more or less sclerotized anterior band at one-fourth of distance to apex, the apex slender, with a ball-like tip and internal peg characteristic of *Hoffmania* genitalia. Parameres fused for a third of total length, the fused bases without winglike or lateral extensions, the anterior margin concave, the free portions very slender and tapering to fine, minutely pubescent tips.

Holotype female, allotype, Cerro Campana, 19 September 1951, F. S. Blanton (light trap) (Type no. 62823, U. S. N. M.). Paratypes: *Panama*,—15 males, 38 females, same data as type, except dates 3 July 1951, 19 September 1951, 24 January 1952 and 24 April 1952; 11 males, 9 females, Almirante, Bocas del Toro Province, November, December 1952; 1 female, Cerro Punta, Chiriqui Province, 10 December 1952; 1 male, 3 females, El Volcan, Chiriqui Province, December 1952, March 1953; 2 females, El Retiro, Coclé Province, 10 November 1952; 1 female, Penonome, Coclé Province, 23 November 1952; 1 male, El Valle, Coclé Province, February 1953; 1 female, Jaque, Darien Province, July 1952. *Nicaragua*,—1 female, Villa Somoza, 14 July 1953, P. Galindo.

This species occupies an intermediate position in the group, with *cova-garciai*-like wing and mesonotum, short proboscis, and unmodified antenna. However, the swollen third palpal segment without sensory pit, the medially cleft, biolobate male ninth tergum and fused parameres are distinctive.

Culicoides nigrigenus Wirth and Blanton, new species

(Figure 7)

Female.—Length about 1.1 mm., wing 1.11 (1.02-1.25, n = 8) mm. long. Head dark brown, including palpus and five distal antennal segments; proximal flagellar segments yellowish. Eyes bare, contiguous along a line as long as five corneal facets. Antenna with flagellar segments in proportion of 20:15:15:15:15:15:15:15:47:50:50:50:55, antennal ratio 2.0; distal sensory tufts on segments III-XV. Palpal segments (fig. 7b) in proportion of 10:20:30:10:10; third segment greatly swollen, 1.9 (1.7-2.1, n = 6) times as long as broad, with a broad, deep sensory pit. Mandible with 13 10-15, n = 10) teeth. Mesonotum yellowish brown, with grayish pruinosity becoming very prominent in some specimens, anterior margin narrowly dark brown; with a dense vestiture of yellowish hairs. Scutellum concolorous with mesonotum; a small, dark brown spot on mesonotum just anterior to middle of scutellum; postscutellum and pleuron dark brown. Legs yellow; fore and mid femora pale brown on basal halves, broad median band on hind femur and on distal two-thirds of fore tibia brownish; prominent knee spots on all legs and the narrow apex of hind tibia blackish; comb of hind tibia with

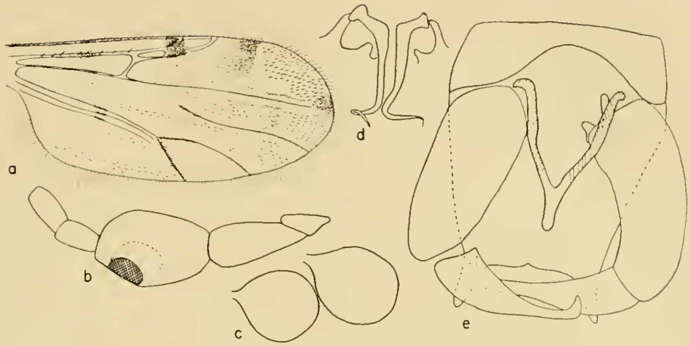

Fig. 7 NIGRIGENUS

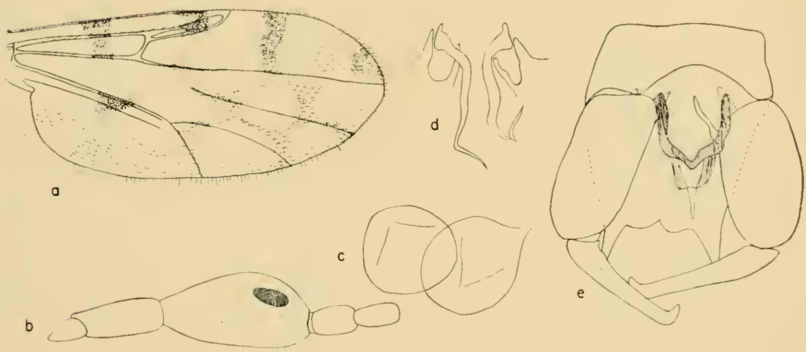

Fig. 8 LUTEALARIS

Fig. 9 CHRYSONOTUS

Fig. 7, *Culicoides nigrigenus*, n. sp.; fig. 8, *Culicoides lutealaris*, n. sp.; fig. 9, *Culicoides chrysonotus*, n. sp. a, female wing; b, female palpus; c, female spermathecae; d, male parameres; e, male genitalia, parameres omitted.

four spines, the one nearest the spur longest. Wing (fig. 7a) with costa extending to 0.64 (0.61-0.67, n = 8) of wing length; macrotrichia long and abundant, extending proximad almost to base of anal cell. Wing appearing pale yellowish, with dark spots very restricted as figured. Three very narrow, transverse dark spots on anterior wing margin; one well proximad of level of r-m crossvein extending caudad over base of media; second dark spot covering the distal end of first radial cell and the proximal end of second radial cell, about as wide as the length of the pale portion of second radial cell, continued as a narrow zig-zag line posteriorly across wing to mediocubital fork and along vein Cu_1 to wing margin; the third dark spot extending as a narrow transverse band slightly constricted in middle across cell R_5 just beyond midlength of cell; pattern of third dark mark continued as broken spots toward wing apex, a small spot at extreme apex of vein M_1, another across cell M_1 at distal third of its length and continued along vein M_2 to its apex, and an irregular spot at apex of vein M_{3+4}. A small, isolated dark spot across cubito-anal veins at half the length of anal cell. Halter yellowish white. Abdomen yellowish white dorsally and at base ventrally, pleuron and distal part of venter blackish. Spermathecae (fig. 7c) two, subequal, pyriform, each measuring 0.057 (0.055-0.060, n = 5) by 0.044 (0.043-0.048, n = 5) mm.

Male genitalia (fig. 7d, e).—Ninth sternum narrow, with a broad, shallow, caudomedian excavation, the ventral membrane bare; ninth tergum with large, triangular, apicolateral processes, the caudal margin between them truncated, with a slight mesal notch. Basistyle without spinose setae on mesal margin, ventral and dorsal roots small and simple, dististyle with slender, pointed, slightly hooked apex. Aedeagus V-shaped, without the anterior transverse marginal band or distal peg-like thickening, the apex slender and rounded but not ball-like. Parameres entirely separate, each with abruptly bent, knobbed base, nearly straight slender stem and slender, pointed, simple apex abruptly bent laterad, thence ventromesad.

Holotype female, allotype, Almirante, Bocas del Toro Province, Panama, November 1952, F. S. Blanton (light trap) (Type no. 62824, U. S. N. M.). Paratypes: *Panama*,—1 male, 43 females, same data as type except dates October 1952 to January 1953; 4 males, 2 females, Cerro Campana, Panama Province, 17 August 1954. *Nicaragua*,—2 females, Villa Somoza. September 1953, P. Galindo. *Honduras*,—2 females, Lancetillo, 23 December 1954, P. Galindo.

This species appears to be the most morphologically specialized of the entire *cova-garciai* Group. The very short, almost moniliform proximal antennal segments, each with a sensory tuft, the greatly swollen third palpal segment, the small number of mandibular teeth, the hairy, very pale mesonotum and wings, the great restriction of the dark wing markings, the conspicuous black knees, the small number of spines on the tibial comb, and in the male genitalia, the large apicolateral processes, the non-setose basistyles, the V-shaped aedeagus and the abruptly bent, non-pubescent tipped parameres are very distinctive characters. They might lead one to put *nigrigenus* in a separate group if these characters did not occur, one or a few in combination, usually in not such a highly developed condition, in the other species of the *cova-garciai* Group which we here describe.

Culicoides lutealaris Wirth and Blanton, new species
(Figure 8)

Female.—Length about 1.4 mm., wing 1.56 (1.49-1.62, n = 7) mm. long. Head dark brown, including palpus and five distal antennal segments; proximal flagellar segments yellowish. Eyes bare, broadly contiguous. Antenna with flagellar segments in proportion of 20:18:18:18:18:18:18:19:38:38:38:42:60, antennal ratio 1.3; distal sensory tufts present on segments III-XV. Palpal segments in proportion of 10:30:55:16:14, third segment (fig. 8b) greatly swollen, only 1.9 (1.7-2.1, n = 7) times as long as broad, with an extremely large sensory cavity opening through a large, sub-distal pore. Mandible with 14 teeth. Mesonotum dark brown, with dense, rather dark, yellowish gray pollen; area around humeral pits and narrow lateral lines blackish; scutellum pollinose dark brown; pleuron brown, paler above. Legs yellowish, narrow knee spots black; femora with broad blackish bands extending from near extreme bases two-thirds of distance to apices, fore tibia brownish except at extreme base, mid and hind tibiae with fainter infuscation on distal halves, narrow apex of hind tibia blackish. Hind tibial comb with four spines, the one nearest the spur longest. Wing (fig. 8a) with costa extending to 0.58 of wing length; macrotrichia abundant, extending nearly to base of anal cell. Wing appearing yellowish with narrow, sometimes broken, transverse dark bands and spots as figured; dark transverse band across middle of cell R_5 about a third as broad as yellow bands on each side, distal pale spot in cell M_1 broadly attaining wing margin; basal transverse dark band of wing may or may not be interrupted in base of cell M_2. Halter yellowish. Abdomen dark brown, terga with indistinct sublateral blackish areas, distal apical integumental bands and faint pollen on entire dorsum whitish; cerci yellowish. Spermathecae (fig. 8c) two, subequal, pyriform, each measuring 0.060 by 0.058 mm.

Male genitalia (fig. 8d, e).—Ninth sternum narrow, with a broad, shallow, caudomedian excavation, the ventral membrane bare; ninth tergum with long pointed apicolateral processes, the caudal margin between them distinctly notched mesally. Basistyle without spinose setae on mesal margin, ventral and dorsal roots each long and slender; dististyle slender with pointed, hooked apex. Aedeagus with heavily sclerotized basal arms forming a narrow basal arch, no anterior sclerotized membrane present; distal stem tapering to a very slender, pointed apex. Parameres entirely separate, each with bent, knobbed base, slightly sinuate, slender stem and very slender, recurved, simple pointed apex.

Holotype female, El Volcan, Chiriqui Province, Panama, 9 April 1954, F. S. Blanton, light trap (Type no. 62921, U. S. N. M.). Allotype male, same data except 8 April. Paratypes; 3 males, 20 females, same data except dates 8, 9, 21 April and 28 May 1954.

This species is closely related to *chrysonotus* n. sp. from which it can be distinguished by its swollen third palpal segment, the reduced dark markings of the wing and the very slender aedeagal tip and long apicolateral processes of the male genitalia. *Culicoides decor* (Williston) and *nigrigenus* n. sp. have much paler leg markings.

Culicoides chrysonotus Wirth and Blanton, new species
(Figure 9)

Female.—Length about 1.6 mm., wing 1.66 (1.58-1.75, n = 7) mm. long. Head dark brown, including palpus and five distal antennal segments; proximal flagellar segments yellowish. Eyes bare, broadly contiguous. Antenna with flagellar segments in proportion of 20:15:15:15:15:16:16:17:48:48:50:50:72, antennal ratio 1.91; distal sensory tufts present on segments III, VIII-XV. Papal segments in proportion of 15:35:50:20:20, third segment (fig. 9b) 2.4 (2.3-2.6, n = 6) times as long as greatest breadth, sensory pit deep with broad opening located near apex of segment. Mandible with 14 (13-14, n = 6) teeth. Mesonotum dark brown with dense golden brown pollen, anterolateral corners blackish broadly; scutellum dark brown; pleuron blackish. Legs yellowish, narrow knee spots black; femora with broad blackish bands extending from near extreme bases two-thirds of distance to apices, fore tibia brownish except at extreme base, mid and hind tibiae with fainter infuscation on distal halves, narrow apex of hind tibia blackish. Hind tibial comb with four spines, the one nearest the spur longest. Wing (fig. 9a) with costa extending to 0.60 of wing length; macrotrichia abundant, extending nearly to base of anal cell. Wing appearing dark with large, more or less isolated, rounded yellow spots as figured; the pale spot straddling base of vein M_1 separated from the pale spot at end of second radial cell by a narrow dark area, the dark band across middle of cell R_5 about as broad as the pale spots on each side, distal pale spot in cell M_1 not attaining wing margin, pale spot straddling vein M_2 small and appearing double. Halter pale yellowish.. Abdomen blackish, cerci yellowish. Spermathecae (fig. 9c) two, subequal, pyriform, each measuring 0.072 by 0.048 mm.

Male genitalia (fig. 9d, e).—Ninth sternum narrow, with a broad shallow, caudomedian excavation, the ventral membrane bare; ninth tergum with short, bluntly pointed apicolateral processes, the caudal margin between them slightly notched mesally. Basistyle without spinose setae on mesal margin, ventral and dorsal roots each long and slender; dististyle slender with pointed, slightly hooked apex. Aedeagus with heavily sclerotized basal arms, a faintly sclerotized anterior membrane forming a rounded basal arch, distal stem stout and tapering slightly to a bluntly rounded apex. Parameres entirely separate, each with bent, knobbed base, nearly straight slender stem and slender, recurved, simple pointed apex.

Holotype female, El Volcan, Chiriqui Province, Panama, 21 April 1954, F. S. Blanton, light trap (Type no. 62922, U.S.N.M.). Allotype male, same data except 22 April. Paratypes; 1 male, 25 females, same data except dates 9-22 April 1954.

This species is most closely related to *lutealaris* n. sp., from which it can readily be distinguished by its darker color with discrete rounded pale wing spots, the one in cell M_1 not attaining the wing margin, the blackish abdomen, slender third palpal segment and in the male genitalia the short apicolateral processes of the ninth tergite and stout aedeagus.

Culicoides decor (Williston)

Ceratopogon decor Williston, 1896, Trans. Ent. Soc. London 1896: 281 (female; St. Vincent; fig. wing).

Culicoides decor, Macfie, 1948, Ann. Trop. Med. Parasit. 42: 68 (generic transfer).

Macfie (op. cit.) referred to notes by Paul Freeman on the type of *decor* in the British Museum (Natural History) which led him to place the species in *Culicoides* near *guttatus* (Coquillett). Williston's original description, "legs yellow; all the femora at the tip, and a median ring on the hind pair, black," together with his crude figure of the wing, serves to place the species near *nigrigenus* n. sp. from Panama. Williston's description "abdomen black, with yellowish incisures," however, separates *decor* from *nigrigenus*. Paul Freeman and Alan Stone have made further comparisons between the type of *decor* and our Panama species which indicate that *nigrigenus* and *decor* are exceedingly close, but can be differentiated by the characters given in our key.

OHIO ZORAPTERA

Ohio is now added to the list of states where *Zorotypus hubbardi* Caudell is known to occur. On June 10, 1956, a collecting party from the Dayton Museum of Natural History visited the Pike Lake State Park area, Pike County, Ohio, and found this zorapteran in an old sawdust pile in Tobacco Barn Hollow. Fifteen wingless males, three wingless females, seventeen nymphs, and one egg were taken by Riegel, Koestner, and Kleeman. One of the adults shows vestiges of compound eyes. Most of the nymphs and some of the adults have the digestive tract packed with fungus spores. These spores were plentiful in the moist sawdust.

Undoubtedly this zorapteran eventually will be reported from West Virginia, South Carolina, southern Indiana, and southern Illinois. The range will then extend from Missouri (Riegel, in press, *Ent. News*) and Texas in the west to Maryland and Florida in the east.—GARLAND T. RIEGEL, *Visiting Entomologist, Dayton Museum of Natural History, Dayton, Ohio.*

ANNOUNCEMENT

Short scientific acticles, not illustrated, two double-spaced typewritten pages or less in length, are welcome and will usually receive prompt publication. References to literature should be included in the text.

DESCRIPTIONS OF TWO NEW SUBSPECIES OF HAEMAGOGUS MESODENTATUS KOMP AND KUMM 1938, FROM MIDDLE AMERICA

(DIPTERA, CULICIDAE)

BY PEDRO GALINDO *and* HAROLD TRAPIDO,[1] *Gorgas Memorial Laboratory, Panama, R. de P.*

Detailed comparative studies of the morphology, ecology, biology and zoogeography of a series of populations of *Haemagogus mesodentatus* Komp and Kumm from Middle America, have led the authors to conclude that these populations consist of a single polytypic species with three distinct biological entities or races recognizable in the complex.

The typical form, originally described from San Jose, Costa Rica, is reported by the authors (Trapido and Galindo, 1956) as extending from the mountain slopes of Bocas del Toro Province in western Panama through the Atlantic side forest of Central America and Mexico to southeastern San Luis Potosi.

Of the other two, one is described by the authors in this paper as *Haemagogus mesodentatus gorgasi*, n. ssp., and is said to extend (Trapido and Galindo, *loc. cit.*) from El Salvador through the Pacific versant of Guatemala and Mexico at least as far north as southern Sinaloa near Mazatlan.

The third member of the complex is reported by Trapido and Galindo (*loc. cit.*) from the highlands of Guatemala and southern Mexico at least as far north as Cuernavaca, Morelos. This form is described in this paper as *Haemagogus mesodentatus alticola*, n. ssp., by the authors in association with Dr. Jorge Boshell, who participated with them in the field work which first revealed the race near Tuxtla Gutierrez, Chiapas, Mexico.

A full discussion of this group is included by the authors in a forthcoming monograph on the *Haemagogus* of Middle America. However, it has been deemed advisable to describe these two forms separately, in order to make the names available for use in a series of publications which are in preparation dealing with the role of some Middle American species of mosquitoes in the transmission of yellow fever virus.

Haemagogus mesodentatus gorgasi Galindo and Trapido, n. ssp.

Female.—Head. Proboscis longer than fore femur, dark-blue to violet in color. Antennae almost as long as the proboscis, dark; tori nude, dark. Palpi half again as long as the clypeus, clothed with dark blue scales. Vertex with a very narrow line of silvery scales bordering the eyes. Occiput clothed with flat, broad, metallic blue scales. White scaled.

Thorax. Anterior pronotal lobe with five stout setae on its anterior border and entirely covered with flat metallic blue scales. Mesonotum almost completely devoid of setae except for a few on its anterior border and a cluster above the roots of the wings. Pleura largely white-scaled, except for the posterior pronotum

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which has a vestiture of blue scales; pleural chaetotaxy as follows: two propleurals, two or three posterior pronotals, one strong sternopleural inserted at a level slightly above the intersegmental suture between the meron and mesepimeron, two prealars and two or three upper mesepimerals; paratergite white-scaled; meron naked, dorsal surface almost in a line with the upper border of the coxa. Postnotum bare. Wings reaching slightly beyond the union of the seventh and eighth segments; R_2 cell about as long as its petiole, scales of cell outstanding, not closely appressed to the veins. Halteres dark, base lighter, knob clothed with dark scales except at apex where they are silvery. Legs with the coxae and trochanters dark, bearing a patch of snowy white scales on the outer surfaces; fore-leg entirely clothed with blue and violet scales except for a short line of silvery scales on the undersurface of the femur; mid femur and tibia with blue and violet scales except for a short line of silvery scales on the inner surface of femur; mid tarsus with blue or violet scales on its inner surface and with abundant greyish to white scales on the outer side of the segment; hind femur with blue or violet scales, a patch of white scales on its inner surface extending over the basal half of the segment and another and longer patch of white scales on the outer surface reaching almost to the tip of the femur; hind tibia and tarsus with blue and violet scales; tarsal claw formula: 1.1—1.1—0.0.

Abdomen. Greenish-blue scaled. Tergites with a small basal patch of snowy white scales on segments III-VII and with large lateral basal patches of silvery scales on segments I-VII, becoming progressively smaller on the posterior segments. Sternites blue-scaled with basal bands of silvery scales on segments II to VII.

Male.—As the female except for the antennae, which are densely plumose.

Terminalia.—Eighth tergite bearing posteriorly a large median patch of lanceolate scales flanked by several flat, broad scales truncated distally, and with six or seven setae. Basistyle conical with a dense tuft of narrowly ovate, striated, pointed scales inserted on distal third of inner margin; outer margin bearing on its proximal two-thirds several rows of striated scales truncated at tip; basal lobe small, bearing a tuft of unequaled hairs; apical lobe absent. Dististyle slightly less than one-half the length of the basistyle, somewhat constricted beyond the middle and bearing near the apex a long, curved, blunt spine about one-third as long as the dististyle. Stem of claspette sinuate, moderately to sharply bent on outer third, densely setose for three-fourths of its length and carrying two outstanding setae, one on the inner aspect near the base and a lateral one at the angle; filament flat, striated, broad at base, sharply pointed at tip. Phallosome large, heavily sclerotized; in lateral outline it narrows and bends dorsally beyond the shoulders to end in a capitate tip bearing on its dorsal aspect a serrated carina which reaches down to a level with the shoulders. Tenth sternites broadly hood-like at tip with seven to nine short setae subapically. Ninth tergites marked by the insertions of one to three strong short setae.

Larva.—Head. Rounded, antennae cylindrical with nearly straight sides; antennal hair single, approximately one-half as long as the antenna and inserted medially on its inner aspect. Head hairs as follows: Nos. 5 and 6 single, located well forward on the head; No. 4 a small multiple tuft; No. 7 two or three-branched; Nos. 8 and 9 single and inconspicuous; No. 10 moderate, double or triple; No. 11 a strong multiple tuft; No. 12 single, about as long as No. 10; No. 13 double, shorter; No. 14 five to six-branched; No. 15 double.

Thorax. Integument unpigmented, densely pilose. Prothoracic hairs as follows: No. 1 two to four-branched and very long; No. 2 single, one-half as long as No. 1; No. 3 five to six-branched; about as long as No. 2, all three inserted in a single sclerotized plate; No. 4 six or seven-branched; Nos. 5 and 6 single, strong and very long, basal tubercles broadly fused together; No. 7 long, two to four-branched; basal tubercle narrowly joined to No. 6 by a thin sclerotized bridge; No. 8 six-branched; No. 9 with three branches; No. 10 single, slightly longer than No. 9; No. 11 single, half-again as long as No. 10; No. 12 two to four-branched, small. Mesothoracic hairs as follows: Nos. 1 to 4 all single, short to moderate in length, No. 5 single, long and strong; No. 6 a long multiple tuft; No. 7 single, shorter and weaker than No. 5, inserted in the same sclerotized plate as No. 6; No. 8 a long multiple tuft similar to No. 6; No. 9 a multiple tuft, long and strong; No. 10 single, as long as No. 9; No. 11 single, somewhat shorter and weaker than No. 10; No. 12 single or double, very short. Metathoracic hairs Nos. 1 to 6 moderate, single or double; No. 7 long and strong, with four branches; No. 8 a multiple tuft; No. 9 three-branched; Nos. 10 and 11 single, long; No. 12 double, about one-third the length of No. 11.

Abdomen. Integument densely covered with short pile. Abdominal hair No. 6 double or triple on segments I and II; double on segments III to VI, single or double on segment VII. Eight to ten comb-scales aligned in a single row; the individual scales in the form of pointed teeth. Siphon tube 2 x 1 with 13 or 14 pecten teeth extending over the basal half of the tube and followed by a two-haired tuft. Anal saddle not ringing the segment, dorso-apical border of saddle bearing a number of pronounced spines; anal gills broadly pointed, as long as the segment; hair No. 1 double, twice as long as the saddle, No. 2 triple, No. 3 single.

Pupa.—Trumpets short, dark obliquely truncated; pinna almost half as long as length of trumpet, tracheoid rudimentary. Abdominal chaetotaxy reduced as usual in the genus; all abdominal hairs single (or occasionally double) and inconspicuous with the exception of the following: No. 2 on segment I the usual dendritic tuft; No. 4 single but very prominent and as long or longer that the segment on segments I, II and III; No. 5 quite prominent and long on segments IV, V, VI and VII; No. 8 strong, three-branched and with fringes and barbs on segment VII, similar but longer and multiple on segment VIII. Paddles ovoid, fringed with scattered fine spicules; midrib deeply pigmented, pronounced to apex, terminal hair single, short.

Type Material.—Holotype. Female with associated larval and pupal skins mounted on a slide. Reared from eggs laid by a female taken biting man in the vicinity of Tapachula, Chiapas, Mexico on 4 August 1953. G.M.L. collection No. 01591.

Allotype. Male with terminalia mounted on a slide; same data as holotype. G.M.L. collection No. 01758.

Paratypes. Seventeen males same data as holotype; G.M.L. collection numbers: 01590, 01592, 01742-49, 01940-42. One male and three females from Tuxtla Chico, Chiapas, Mexico, bred from larvae taken in bamboo-stumps on 4 August 1953; G.M.L. collection numbers: 01644, 01646-48.

Haemagogus mesodentatus alticola Galindo, Trapido and Boshell, n. ssp.

As in *H. mesodentatus gorgasi* Galindo and Trapido, except for the following differences:

Female.—Anterior pronotal lobe almost entirely silvery-scaled; scales of mesonotum metallic greenish in color instead of blue; posterior pronotal lobe with white scales on its posterior border, mid and hind legs with pronounced white knee-spots.

Type Material.—Holotype. Female, bred from eggs laid by a female taken biting man on 29 June 1953 at the summit of Sumidero, Canyon of the Rio Grijalva, elevation 4,000 feet, 24 kms. north of Tuxtla Gutierrez, Chiapas, Mexico; larval and pupal skins mounted on a slide. G.M.L. collection No. 01920.

Allotype. Male, same data as holotype; G.M.L. collection No. 01923.

Paratypes. Thirteen males same data as holotype; G.M.L. collection Nos. 01711-12, 01714, 01716, 01719, 01720, 01722-23, 01916-19. Three males from the type locality, 26 June 1953; G.M.L. collection Nos. 01527-28, 01573-74, 01631. One male from the type locality, 28 June 1953; G.M.L. collection No. 01715.

Fifteen females, same data as the holotype; G.M.L. collection Nos. 01567, 01695-98, 01708-13, 01724, 01921-23. Two females from the type locality, 26 June 1953; G.M.L. collection Nos. 01770-71. Eight females from the type locality, 27 June 1953; G.M.L. collection Nos. 01568-70, 01572, 01630, 01632-34. Three females from Cañon de Lobos, 5 miles east of Cuernavaca, Morelos, Mexico, elevation 4,400 feet, 30 September 1954; G.M.L. collection Nos. 01911-12, 01990.

Taxonomic Discussion

Female *gorgasi* may be separated from typical *mesodentatus* by the color of the scales on the apices of the mid and hind femora. These scales are dark in *gorgasi* and white in *mesodentatus*, forming conspicuous white 'knee-spots.' Female *alticola* differ from *mesodentatus* in two main characters: in *alticola* the anterior pronotal lobes are almost entirely white-scaled and the posterior pronotal lobes show abundant white scales on the posterior border, while in *mesodentatus* both the anterior and posterior pronotal lobes are entirely clothed with blue or greenish scales. Female *gorgasi* differ from *alticola* in the absence of white scales on the knees and on the anterior and posterior pronotal lobes.

Insofar as we are able to determine the males and larvae of these three races are indistinguishable.

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THE IDENTITY OF IXODES BOLIVIENSIS NEUMANN 1904 AND I. BICORNIS NEUMANN 1906

(Ixodidae)

By Glen M. Kohls, *Rocky Mountain Laboratory, National Institutes of Health, Hamilton, Montana.*

The study of several undetermined lots of Central and South American *Ixodes* in the collection of the Rocky Mountain Laboratory has necessitated examination of the types of *Ixodes boliviensis* Neumann, 1904 and *I. bicornis* Neumann, 1906, which were kindly made available to me by Professor A. Brizard, Ecole Nationale, Vétérinaire, Toulouse, France. Through the courtesy of Mr. E. Browning, several lots which had been determined by Nuttall and Warburton (1911) and Nuttall (1916) as these species were borrowed from the British Museum (Natural History).

I. boliviensis was described from a male, a mutilated female, and a nymph found on a wild dog, *Speothos venaticus,* Charuplaya, Bolivia. The species was redescribed by Neumann (1911) and by Nuttall and Warburton (1911) with no additional records. In 1916, Nuttall recorded two females from "pisote" and "mapatsching," foot of Mt. Turrialba, near Cartago, Costa Rica. As far as can be asceratined there have been no other records of the species. Cooley and Kohls (1945) recognized the similarity of *I. boliviensis* and *I. bicornis* but, not having authentic comparative materials, they regarded *I. boliviensis* as a doubtful species. However, they recognized that it would have priority over *I. bicornis* if the two were later found to be identical.

Neumann (1906) described *I. bicornis* from a female found on a child, and two females off jaguar, *Felis hernandesii* (syn. *Felis onca*), both lots from Atoyac, State of Guerrero, Mexico. He stated that the tick is called "Conchuda" at Atoyac and that it is considered to inflict a bite fatal to children. The species was redescribed by Neumann (1911), Nuttall and Warburton (1911), and by Cooley and Kohls (1945) who described and figured the male as well. Nuttall (1916) recorded 3 collections, all females, from *Nasua narica*, stag, and horse, from foot of Mt. Turrialba near Cartago, Costa Rica. It should be noted that this locality is the same as that given for ticks determined by Nuttall as *I. boliviensis.* Bequaert (1938) found the species on dog and *Crax globicera* in Guatemala, and Fairchild (1943) found it on a dog in Panama. Cooley and Kohls (*op. cit.*) added Honduras, gave new records for Mexico and Panama, and added deer and domestic cat as hosts. Since 1945, the Rocky Mountain Laboratory has received several lots from Guatemala which I believed to be this species.

Comparison of the cotype female (hypostome and legs missing) of *I. boliviensis* with the 3 cotype females of *I. bicornis* revealed that the former is slightly smaller and has somewhat shorter and broader palps. No other differences were detectable. Size alone is a notoriously unreliable character and no significance can be attached to it in the present instance. The palpi of the cotype *I. boliviensis* female are about 0.68 mm. in length compared to about 0.87 mm. for the *I. bicornis* cotype females. The specimens determined as *I. boliviensis* and as *I. bicornis* by Nuttall have palps similar to those of the *I. bicornis* types. The specimens in the Rocky Mountain Laboratory collection, heretofore regarded as *I. bicornis,* have the palpi longer than those of the *I. boliviensis* cotype, but this does not appear to be consequential since in our series some variation is apparent.

According to Neumann, palpal segments 2 and 3 are subequal in *I. boliviensis,* but in *I. bicornis* segment 2 is one and one-half times as long as segment 3. Actually there is less difference since the ratio in *I. boliviensis* is about 1.20 and in *I. bicornis* 1.33.

Differentiation between the females of *I. bicornis* and *I. boliviensis* is made in the key of Nuttall *et al.* on the basis of "a strong external spur" on coxa I for a group of species including *I. bicornis,* and "external spur short or absent" for *I. boliviensis* and some other species. Actually for the two species here concerned there is no difference in this respect. Neumann's (1906) fig. 1, reproduced by Nuttall and Warburton without comment, shows the external spur of coxa I much too long (*cf.* Cooley and Kohls, 1945, fig. 72B).

Several males, all from Central America, in the Rocky Mountain Laboratory collection which had been determined as *I. bicornis* have now been compared with the male cotype of *I. boliviensis.* They were found to agree with the cotype specimen in all particulars, including the characters of the hypostome.

From the foregoing observations, it is concluded that *I. bicornis* is a synonym of the earlier described *I. boliviensis.*

Summary

Study of the cotypes and other specimens reveals that *Ixodes bicornis* Neumann, 1906, is a synonym of *Ixodes boliviensis* Neumann, 1904.

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ALFRED FELLENBERG SATTERTHWAIT

1879-1954

After membership since 1914 and covering over forty years, our Society sustained the loss of one of our most valued and faithful workers in the death at St. Petersburg, Florida, on September 22nd, 1954, of Alfred Fellenberg Satterthwait. Born in Fairville, Chester County, Penna., April 9th, 1879, he was son of George T. and Sarah (Conrad) Satterthwait. Reared on a farm, he was educated in Pennsylvania public schools and in Westtown Friends' Boarding School, graduating in 1897. He also had a Jessup scholarship at the Academy of Natural Sciences, Philadelphia, 1898-1900. He was agriculturist in Pennsylvania, 1901-1904; served as assistant in zoology in the Division of Zoology, Pennsylvania State Department of Agriculture, 1905-1910; and was solicitor for Provident Life and Trust Company, Philadelphia, 1910-1913. He entered U. S. Government service on April 28, 1913, in the Department of Agriculture, Bureau of Entomology, and became the specialist in life history and control of cereal and forage insect pests under the leadership of the late Prof. Francis Marion Webster.

He served in Indiana from 1913-1916, in Charleston, Missouri, from 1916-1918, and was in charge of the Field Laboratory at Webster Groves, Kirkwood, Missouri, 1918-1936. Transferred to Urbana, Illinois, Field Laboratory on July 1st, 1936, he there served until retirement from public service on April 1st, 1948. He removed shortly thereafter to St. Petersburg, Florida. He is survived by his wife Elizabeth Allen Satterthwait (with whom he was united in marriage on June 22, 1911) and by a sister, Mrs. Helen Matteson, of Turtle Creek, Pennsylvania.

During his years of service, in addition to regular official assignments in cereal and forage insect investigations, he specialized in life history, ecology and control of the coleopterous genus *Calendra* and parasites, and likewise did extensive work on the lepidopterous genus *Heliothis*. Though comparatively few in number, his entomological publications rank in quality among the more important contributions in their respective subjects. Between 1916 and 1933, his economic papers pertained to various species of aphids and cutworms, and on true army worm and the chinch bug, while his ecological and systematic publications reported on results of studies of *Calendra pertinax* (Oliv.), and related species. A life-time student in the literature of science, he accumulated over the years an exceedingly useful working library that became particularly strong in rare periodical sets and separates in systematic Coleoptera. Likewise deeply interested in economic ornithology, his book collection also had numerous valuable standard works on bird study. It is of interest to note that much of his spare time between 1920 to 1954 was devoted to Governmental volunteer bird-banding in Missouri, Illinois and Florida, and in related activities, such as bird migrations, food habits, etc., in relation to agriculture.

He was a member of the Religious Society of Friends, and his memberships and fellowships in various scientific and other organizations included the following, in addition that in our own Society: Amer. Ass. Adv. of Science; American Nature Study Society; New York Entomological Society; Harrisburg (Penn.) Nature Study Society (past secretary); St. Louis (Mo.) Academy of Science (past president); Webster Groves (Mo.) Nature Study Society (past president); and St. Petersburg (Fla.) Audubon Society (past president).

One of the characteristics for which he doubtless will be longest and most gratefully remembered was his deep interest in the problems and welfare of younger workers in entomology, particularly those whose good fortune brought them for a time under his leadership. The aid thus given and the stimulus thus gained must have been invaluable to some of them who in later years went on to positions of leadership and responsibility. On the whole he lived a long, well-rounded life, filled with high ideals and useful service. Tireless in his efforts always to attain highest standards of excellence, such a career could not be otherwise than an exemplar and an inspiration to those who follow after. With a background of such attributes, accompanying a quiet, serene and kindly spirit, the memory of Alfred Fellenberg Satterthwait will long hold high place in the hearts of all those who knew him.

J. S. WADE

SOCIETY MEETING

The 653rd regular meeting of the Entomological Society of Washington was called to order in Room 43 of the National Museum at 8:05 P.M. on Thursday, April 5, 1956, by President R. A. St.George. Forty members and 12 visitors attended. The minutes of the previous meeting were read and approved.

Norman M. Dennis, 1609 Dayton Road, W. Hyattsville, Maryland, was elected to membership.

T. J. Spilman related some facts about his recent trip to the West to confer on the Khapra beetle.

A. B. Gurney reported seeing insects on snow in western Massachusetts. He also exhibited a photocopy of a letter in the handwriting of Charles DeGeer (1720-1778). The letter was written in 1742 and belongs to the Swedish Academy of Science. He also showed a copy of a 1778 signature of DeGeer's son, which has been presented by the Baroness Ebba-Hult DeGeer, of Stockholm, a member of this branch of the DeGeer Family. These signatures, together with other evidence which has been assembled, warrant the acceptance of DeGeer as the correct form of the famous entomologist's surname. (Speaker's abstract.)

Kellie O'Neill reviewed "The *Frankliniella occidentalis* (Pergande) complex in California," by D. E. Bryan and Ray F. Smith. (See p. 209, this issue.—ED.)

Helen Sollers discussed the research being conducted on the use of light traps by the Farm Electrification Section of The Agricultural Engineering Research Branch at Beltsville in cooperation with state and federal agencies in the southern and southeastern states. Various types of traps have been tested and many improvements have been incorporated in the design of traps now in use. The trend is toward the use of standard traps; the omni-directional black light trap is generally employed, although mercury vapor and other forms of light sources are used as well. The traps have been used only for survey purposes to obtain insect movement data for localized areas and to increase the available information on important migratory economic species for the information of states to the north of the overwintering areas. These data have aided materially in predicting possible developments outside the overwintering areas (Speakers' abstract.)

The first paper of the evening was given by L. E. Rozeboom, The Johns Hopkins School of Hygiene and Public Health, Baltimore, on "Filariasis in the Philippine Islands." This disease in the Philippines is endemic, especially in those areas where there are extensive abaca plantations. In these areas, high rainfall and humidity are favorable not only to abaca, but also to *Aedes* (*F.*) *poicilius*, which breeds in the leaf axils of these plants and appears to be the most important vector of the infection. There is a significantly higher rate of infection in adult men than in women, which suggests a higher rate of infection among males who cultivate, harvest and strip abaca. Throughout most of the islands, where abaca is absent, filariasis is also absent. However, high microfilaremia prevalence rates were found in two communities where epidemiologic factors were not associated with abaca. One of these is in the mountains of northern Luzon, the other in a forested area of Palawan. The vector in these localities is unknown. In urban areas, where *Culex quinquefasciatus* may become a severe pest, filariasis is rare. This species appears not to be involved in the transmission of *W. bancrofti* in the Philippines. (Speaker's abstract.) R. H. Nelson, P. A. Woke, D. L. Crawford, Alan Stone, and G. W. Wharton took part in the discussion of Dr. Rozeboom's paper.

Louis J. Lipovsky presented the second scheduled paper of the evening, entitled "The role of spermatophores in the reproduction of chiggers." The mode of inseminaion in chiggers has been unknown until the time of the present studies, which have established that adult females of several species, assigned to two subfamilies of Trombiculidae, are inseminated not by copulation but by means of spermatophores. The males erect fine, flexible stalks and at the tip of each stalk a sac of sperm is attached. The female acquires the sperm by rupturing the sperm sac so that its contents enter the genital opening. Males have not been observed to take part in introducing the sperm, and the process of fertilization can occur in the absence of the males. The contents of a single spermatophore may suffice for successful fertilization, as judged by the production of visible eggs by the females. Females reared and maintained in isolation for extended periods have never laid eggs, therefore fertilization appears to be essential for oviposition. (Speaker's abstract.) W. B. Hull, P. A. Woke, R. A. St. George, and others participated in the ensuing discussion. Mr. Lipovsky presented an exhibit of spermatophores.

Visitors introduced were *A. Rawhy,* Egypt; *Dr. A. W. Donaldson,* Communicable Disease Center, Atlanta, Ga.; *Dr. Karl Reinhard,* Arctic Health Research Center, Anchorage, Alaska; *Dr. Herbert C. Barnett,* Head, Department of Entomology, Walter Reed Army Institute of Research; and *Dr. Louis Hutchins,* Woods Hole Oceanographic Institute.

The meeting was adjourned at approximately 10:00 P.M.—KELLIE O'NEILL, *Recording Secretary.*

Date of publication, Vol. 58, No. 3, was June 29, 1956

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(Continued inside front cover)

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PROCEEDINGS OF THE
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VOL. 58 OCTOBER 1956 NO. 5

THE HELEID MIDGES INVOLVED IN THE POLLINATION OF RUBBER TREES IN AMERICA
(DIPTERA, HELEIDAE)

By WILLIS W. WIRTH, *Entomology Research Branch, U.S. Department of Agriculture, Washington 25, D. C.*

It has been my privilege to study an interesting collection of heleid midges captured by Dr. H. E. Warmke of the Federal Experiment Station, Mayaguez, Puerto Rico, in his studies on the pollination of the Para rubber tree, *Hevea brasiliensis* (Willd. ex. Adr. Juss.). Dr. Warmke stated in his reports (1951, 1952) on natural *Hevea* pollination that there was a close relation between the number of pollen grains and the presence of heleid body hairs on *Hevea* stigmas. Of a number of small insects captured in *Hevea* flowers, heleid midges of the genera *Atrichopogon*, *Dasyhelea*, and *Forcipomyia* were most frequently found bearing pollen grains among the hairs on their bodies. The purpose of this paper is to furnish identifications of the heleid species found to be associated with *Hevea* pollination, in order that the names may be used in Dr. Warmke's forthcoming publication.

Table I is a summary of the heleid collections[1] which form the basis of this taxonomic report.

TABLE I

Locality	Date	Number of Collections	Number of Specimens			
			Atrichopogon	*Forcipomyia*	*Dasyhelea*	*Other*
Puerto Rico, Mayaguez	1950	7	6	1	18	..
Puerto Rico, Mayaguez	1953	1	6	11	..	..
Brazil, Belém	1951	14	29	..	2	3
Costa Rica, Cairo	1953	1	1	..	1	..
Costa Rica, Los Diamentes	1953	2	12	11	..	1
Costa Rica, Turrialba	1953	3	21	4	..	..
Guatemala, Cuyotenango	1953	1	1	1	..	1
Mexico, Cozalapa	1953	3	5	7	..	2
Panama, Canal Zone	1953	1	..	1	5	..
Totals		33	81	36	26	7

[1]These collections were made possible through the cooperation of the Division of Rubber Plant Investigations, ARS, U. S. Department of Agriculture, which sponsored Dr. Warmke's trips to Brazil and to Central America.

Seventy of the 150 specimens could be definitely assigned to the eleven species whose names are given below. The remaining 80 specimens, which are discussed in the taxonomic section, could be assigned only to genus or species group. The number of undetermined and undescribed species is estimated to be 20 in *Atrichopogon,* two in *Forcipomyia,* six in *Dasyhelea* and two in *Stilobezzia.*

With very few exceptions the midges found in *Hevea* flowers are common species of genera in the subfamilies Forcipomyiinae and Dasyheleinae, in the primitive section of the family Heleidae. These midges are habitual flower-feeders as adults and only exceptional groups of species have developed the insectivorous or blood-sucking habits which characterize the more highly evolved lines of the family (Gad, 1951). The flower-feeders are usually very small species, more or less densely covered with soft hairs and inconspicuously colored in contrast with the large, strong bodied, often very spiny, and conspicuously marked species of the predaceous genera. It appears that the *Hevea* pollinating species form no highly adapted or specialized biota, but consist mainly of a cross section of the commoner flower-feeding species of the family in the vicinity of the rubber groves. The species of Heleidae reported by Macfie (1944) as pollinators of cacao in Trinidad (Posnette, 1944) are apparently taxonomically and biologically very similar to the rubber pollinators.

The terminology used in this paper is the same as that explained in detail in my Heleidae of California (1951). Wing length is measured from the basal arculus. The value AR (antennal ratio) is obtained by dividing the combined lengths of the last five antennal segments by the combined lengths of the preceding eight, and TR (tarsal ratio) is the length of the hind basitarsus divided by the length of the second tarsomere.

The material studied, including the types of the new species, is deposited in the U. S. National Museum in Washington. All specimens, unless otherwise specified, were collected by Dr. Warmke while they were actually pollinating *Hevea.*

Atrichopogon fusculus (Coquillett)

Ceratopogon fusculus Coquillett, 1901, Proc. U. S. Nat. Mus. 23: 605 (male; Riverton, New Jersey).

Atrichopogon fusculus, Ingram and Macfie, 1922, Ann. Trop. Med. & Parasit. 16: 244; Wirth, 1952, Univ. Calif. Pub. Ent. 9 :118 (synonymy, redescription figures).

COSTA RICA: Turrialba, W20,22, 20-27 March 1953, 2 males, 2 females; W13, 16 March 1953, 1 female; W14,15, Los Diamentes, 17 March 1953, 2 males. BRAZIL: Belém, 2704, August 1951, in flowers of *Hevea,* 3 males.

These specimens appear to be identical with our abundant material of this widespread North American species. The Palaearctic *rostratus* (Winnertz) is very close, but more extensive material will have to be examined to investigate the possible synonymy.

Distinguishing characters of *fusculus* females: size large (wing 1.5- 2mm. long); thorax dark brown; eye bare; proboscis long, 1.3 times as long as height of eye; mandible bearing extremely large, sharp teeth at the apex, the teeth gradually becoming smaller proximad on the mandible; palpus with third segment slender, 3.5 to 4.7 times as long as broad, with small, very deep pit near the apex; spermathecae two, unequal, pyriform, abdomen with no ventral armature. In the male the ninth sternum bears an irregular double row of hairs proximad of the caudomesal excavation.

Atrichopogon glaber Macfie

Atrichopogon glaber Macfie, 1935, Stylops 4: 50 (female; Tutoia, Brazil; fig. armature female abdomen); Macfie, 1938, Proc. R. Ent. Soc. London (B) 7: 162 (Trinidad; male, fig. genitalia); Macfie, 1953, Beitr. zur Ent. 3: 97 (Costa Rica).

BRAZIL: Belém, August 1951, No. 2700, in flowers of *Hevea*, 14 females; No. 2708, on stigmas of *Hevea*, 2 females; No. 2716, trapped in inflorescences of *Hevea*, 3 females; No. 2717, tanglefoot trap on petals of *Hevea*, 1 female; No. 2722, trapped in inflorescences of *Hevea*, 4 females.

COSTA RICA: Cairo, W18, 18 March 1953, 1 male. Los Diamentes, W14,15, 18 March 1953, 3 males. Turrialba, W20,22, 20-22 March 1953, 1 male.

The female of this species is characterized by its small size (wing 0.7-1.0 mm. long); uniform pale yellow color with only the antenna and palpus brown; third palpal segment short, slender, 2.3 times as long as broad with a small, deep, oblique pit, fourth palpal segment more swollen than third, the fifth segment short and pointed; antennal segments short, the proximal series subspherical to slightly transverse, AR 1.8, last segment with a long terminal stylet; eyes hairy; spermatheca single, subspherical to slightly oval with sclerotized neck; seventh sternum with ventral armature of a long pedunculated, three- to eight-branched process on the posterior margin and eighth sternum with a patch of long simple hyaline processes. The male genitalia possess a row of seven to nine hairs across the ninth sternum and the aedeagus has a distal complicated structure.

Atrichopogon warmkei Wirth, new species
(Figure 1)

Female.—Wing 0.90 mm. long by 0.38 mm. broad.

Head dark brown, including palpus and antenna. Eyes hairy, broadly contiguous above antennae. Antenna (fig. 1c) with flagellar segments in proportion of 10:8:8:8:8:8:8:8:21:22:24:24:33, segments IV to X each slightly broader than long, XV with a long terminal stylet, AR 1.9. Palpal segments (fig. 1a) in proportion of 12:12:19:12:15, third segment unusually short and swollen with a small deep sensory pit. Mandible with very slender, pointed apex (fig. 1b) bearing about 12 minute, blunt teeth.

Thorax dark brown, mesonotum subshining, with two, pale, translucent lines extending from humeral depressions to ends of scutellum where they end in a pair of prominent elongate pale spots. Scutellum with four strong brown bristles. Legs yellowish, TR 2.7, seven spines in hind tibial comb.

Wing (fig. 1c) with costa extending 0.73 of distance to wing tip; both radial cells complete, second 0.37 times the length of first; nearly bare, a few macrotrichia in apices of cells R_5 and M_1; veins yellowish, the membrane grayish hyaline. Halter whitish.

Abdomen whitish, dusky above, first tergum with a transverse, translucent, blister-like area, the ends of which are connected to a widely separated pair of similar areas on second tergum, succeeding terga each with less apparent, sublateral areas. Spermatheca (fig. 1e) single, pyriform, heavily sclerotized, measuring 0.05 by 0.08 mm. Genital region without special armature.

Male genitalia (fig. 1d) as figured; ninth sternum with four bristles in a transverse row across middle; dististyle very short with slender, rounded, peg-like apex.

Holotype female, allotype, Mayaguez, Puerto Rico, 1-9 April 1953, in *Hevea* flowers, W25, PR2620 (Type No. 62914, U.S.N.M.). Paratypes: 3 males, 13 females, 9 females same data as type. 1 female, Coconut Grove, Florida, 27 August 1952, H. F. Loomis, near *Hevea* flowers. 2 males, 1 female, Miami, Florida, 20 December 1912, on *Persea* flowers. 2 females, Biscayne Bay, Florida, Mrs. Slosson. 1 male (genitalia only), Miami, Florida, 21 February 1944, W. W. Wirth, light trap.

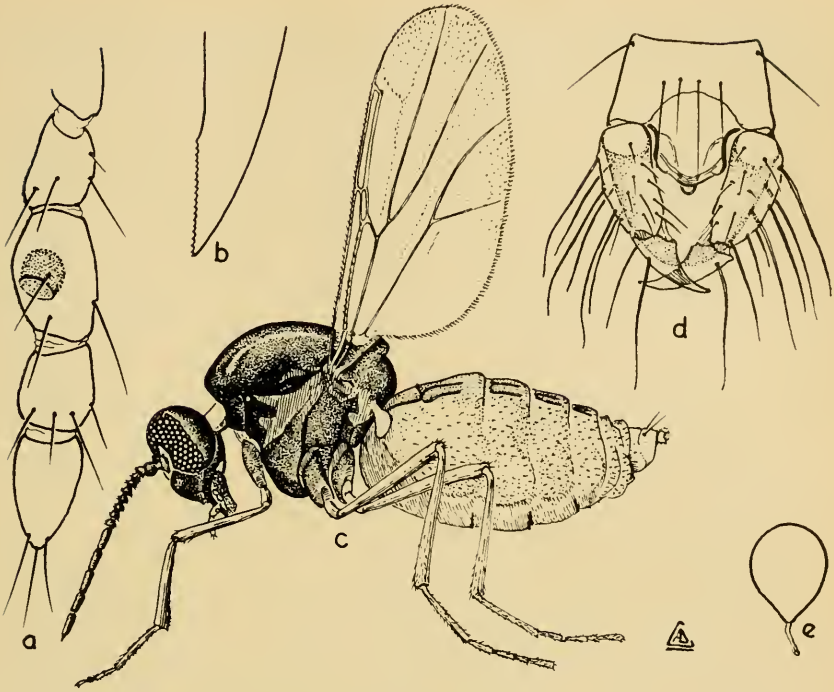
Atrichopogon websteri (Coquillett), a common and widespread Nearctic species, resembles *warmkei* in the possession of the pale mesonotal lines and the translucent areas on the basal abdominal terga, the pale halters, transverse proximal antennal segments, single pyriform spermatheca, hairy eyes and four bristles on the male ninth sternum, but differs in its larger size (wing 1.1 mm. long), darker, more blackish color, hairier wing, more slender third palpal segment, longer serrated area on mandible (approximately 25 teeth) and longer, more pointed, male dististyle. *Atrichopogon nanus* Macfie from British Guiana is also very similar, but has dark halters, TR over 3 and only five spines in the hind tibial comb.

I take great pleasure in dedicating this flower-visiting species to Dr. Warmke, who collected it in Puerto Rico.

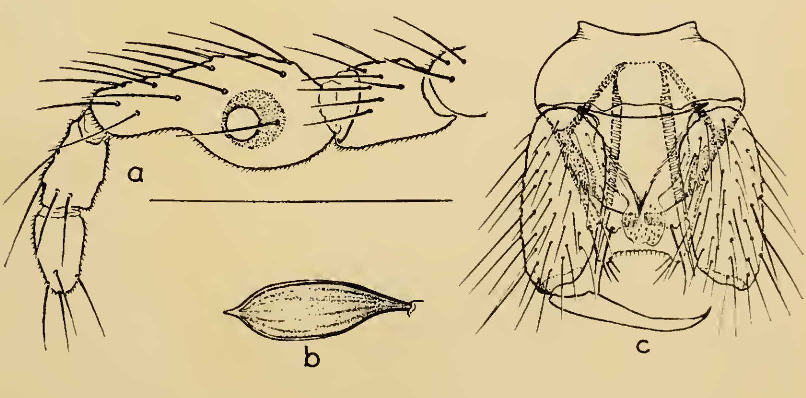
Atrichopogon spp.

The remaining specimens of *Atrichopogon* collected by Dr. Warmke superficially resemble *websteri* and *warmkei* in their small size, dark brown color, bare or nearly bare wings and single spermatheca, but nearly all differ among themselves in several important structural characters. There is a total of 16 males and 14 females representing at least 11 and 10 species respectively, and few of the males can definitely be associated by combinations of characters with any of the females. In the present state of our knowledge of this genus it would require a statistical study of long series to characterize each species.

Fig. 1, *Atrichopogon warmkei:* a, female palpus; b, apex of female mandible; c, female, side view; d, male genitalia; e, female spermatheca. Fig. 2, *Forcipomyia sexvittata*: a, female palpus; b, modified scale from female tibia; c, male genitalia.



1. warmkei



2. sexvittata

Drawings by Arthur D. Cashman

It is moreover very likely that even then, as Nielsen (1951) discovered in Denmark, species which could easily be recognized in the larval and pupal stages could scarcely be differentiated, if at all, as adults.

Variation occurs in different combinations of such characters as eye hairy (15 specimens) or bare (7), halter dark (16) or pale (5), wing of female bare (5) or hairy at apex (6), translucent mesonotal lines and abdominal patches present (10) or absent (6), female antennal ratio from 1.4 to 2.7, tarsal ratio from 2.6 to 3.2, palpal pit of female deep (4), moderate (4) or shallow (3), mandible usually with 20-30 minute teeth, though in two females the teeth were large, in one larger towards the base and in the other larger towards the apex of the mandible, and in the male genitalia there may be on the ninth sternum four median bristles, one, two, three or four pairs of laterals, or a dense row of bristles.

BRAZIL: Belém, 2700, 2701, August 1951, on stigmas of *Hevea*, 1 male 1 female.
COSTA RICA: Turrialba, W20,22, 20-22 March 1953, 6 males, 5 females; W13, 16 March 1953, 4 males; Los Diamentes, W14,15, 18 March 1953, 2 males, 5 females.
GUATEMALA: Entre Rios, Cuyotenango, W12, 6 March 1953, 1 female.
MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7, 27 February 1953, 1 male, 4 females.
PUERTO RICO: Mayaguez, PR 2620, 1 April 1950, on *Hevea*, 1 female; W25, 1-9 April 1953, in *Hevea* flowers, 2 males.

Lasiohelea stylifera (Lutz)

Centrorhynchus stylifer Lutz, 1913, Mem. Inst. Oswaldo Cruz 5: 63 (female; Minas Gerais, São Paulo, Brazil; habits; fig. wing, palpus).
Lasiohelea stylifer, Macfie, 1939, Rev. Ent. 10: 171 (Brazil); Macfie, 1940, Proc. R. Ent. Soc. London (B) 9: 181 (British Guiana); Lane, 1945, Rev. Ent. 16: 362 (female redescribed); Lane, 1947, Arq. Fac. Hig. S. Pub. Univ. São Paulo 1: 161 (larva, pupa; fig. larva; Brazil); Macfie, 1953, Beitr. zur Ent. 3: 97 (Costa Rica; male, fig. genitalia); Ortiz, 1952, Rev. Sanid. Assist. Social 17: 241 (Venezuela; female redescribed, figured).
COSTA RICA: Los Diamentes, W14,15, 18 March 1953, 1 female.

This species is a notorious biter of man and animals in the Neotropical region. Distinguishing characters of the female:

Wing 1.0 mm. long, radial cells long and narrow, extending to 0.6 of wing length; macrotrichia numerous with bare lines next to veins scarcely perceptible; halter dark; eyes bare, contiguous above antenna for distance equal to diameter of about six corneal facets; antennal ratio 1.8, segments IV to X subspherical; third palpal segment greatly swollen, about twice as long as greatest breadth, with a very large open pit; mandible with about 22 teeth, those in mid portion very large, those on ends minute; a distinct buccal armature of about nine sharp spines in a curved row; thorax shining brown with dense brown hairs; legs pale brown; tarsal ratio 2.5; hind tibial comb with seven spines; claws slender, bent in middle, with a small tooth-like projection on side at the bend; spermatheca single, large, oval; scales of wing and tarsi long and slender, striate, not fringed.

Forcipomyia (Thyridomyia) nana (Macfie), NEW COMBINATION

Lasiohelea nana Macfie, 1939, Rev. Ent. 10: 171 (female; Nova Teutonia, Brazil); Macfie, 1944, Bull. Ent. Res. 35: 297 (Trinidad; on Cacao flowers; male descr., genitalia fig.).

COSTA RICA: Los Diamentes, W14,15, 18 March 1953, 1 male, 2 females. Turrialba, W13, 17 March 1953, 1 female.

GUATEMALA: Entre Rios, Cuyotenango, W12, 6 March 1953, 1 female.

MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7, 27 February 1953, 2 females.

A very small (wing 0.6-0.7 mm. long), uniformly dull brown species; antenna very short, proximal segments slightly broader than long, AR 1.0-1.2; third palpal segment with open sensory area, pit absent; eyes bare; mandible with 30-35 minute subequal teeth; TR 2.8; spermatheca single, subspherical; with a short sclerotized neck. Male genitalia with parameres typical of subgenus *Thyridomyia*, consisting of a pair of triangular plates with sharp mesal points nearly meeting each other; ninth sternum with a comparatively shallow, very faint, mesal excavation; aedeagus with a pair of contiguous caudomesal lobes and more strongly sclerotized pair of arcuate, pointed lateral processes with apices crossed mesad.

Forcipomyia species complex near **calcarata** (Coquillett)

COSTA RICA: Los Diamentes, W14,15, 18 March 1953, 1 male, 1 female. Turrialba, W20,22, 20-22 March 1953, 2 males, 1 female.

MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7, 27 February 1953, 1 female.

PUERTO RICO: Mayaguez, No. 25, 1-9 April 1953, in *Hevea* flowers, 5 males, 5 females; No. 2618, 1 April 1950, 1 male.

These specimens belong to a difficult group of species which according to Dr. L. G. Saunders (personal communication) are fairly easy to distinguish in the immature stages but as adults show only slight differences, even in the male genitalia. Species in this group are unmarked, dull grayish brown; rather small (wing 0.8-1.3 mm.); TR of female 1.4-2.1, of male 0.9-1.9; spur of hind tibia distinctly enlarged, the hind basitarsus sometimes incrassate; third papal segment slender with a small round pit, third and fourth segments often fused; spermathecae two, subequal, pyriform. Male parameres consisting of a narrow, ribbon-like, U-shaped or V-shaped sclerotized band, sometimes with a pair of indistinct sclerotizations within the apex of the U or V; aedeagus simple with apex bilobed or caplike; ninth sternum not emarginate; dististyle often quite stout.

Forcipomyia fuliginosa (Meigen)

Ceratopogon fuliginosus Meigen, 1818, Syst. Beschr. Eur. Zweifl. Ins. 1: 86 (Germany).

Forcipomyia fuliginosa, Goetghebuer, 1933, Rev. Zool. Bot. Afr. 24: 130 (combination); Wirth, Ann. Ent. Soc. Amer., IN PRESS.

MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7, 27 February 1953, 1 female; W8, 28 February 1953, swept from *Hevea*, 3 females.

PANAMA: Summit Gardens, Canal Zone, W23, 24 March 1953, 1 male.

In a paper now in press I have given an extensive synonymy and host and locality records of this common parasite of caterpillars and sawfly larvae. Its distribution is world-wide and it has been most often referred to in the literature under the names of *inornatipennis* Austen and var. *ornaticrus* Ingram and *Macfie, kirtipes* (Meijere) and *flava* (Williston).

These midges are characterized by their large size (wing 1.5-2 mm. long); short basitarsus (TR 0.4-0.6); third palpal segment of female swollen to tip with a deep pit nearly the entire length of segment; body with numerous flattened scales.

Forcipomyia raleighi Macfie

Forcipomyia raleighi Macfie, 1938, Proc. Roy. Ent. Soc. London (B) 7: 160 (male, female; Trinidad; fig. male genitalia).

PUERTO RICO: Mayaguez, No. 25, 1-9 April 1953, in flowers of *Hevea*, 1 male.

Forcipomyia sexvittata Wirth, new species
(Figure 2)

Female.—Wing 0.93 mm. long by 0.40 mm. wide.

Head yellowish, palpus brown. Eye bare. Antenna with flagellar segments in continuous series, longer than broad, last six segments in proportion of 18:18:-18:19:21:32; AR 0.63. Palpus (fig. 2a) with third segment 2.4 times as long as basal breadth, greatly swollen at base with a large round sensory cavity opening by a narrow pore, distal half abruptly narrowed; fourth and fifth segments not fused. Mandible vestigial, without teeth.

Thorax dull brown; mesonotum with three pairs of shining, brownish-black vittae, the mesal pair attaining anterior margin and ending in front of prescutellar depression, the two lateral pairs failing by their combined breadths to reach anterior mesonotal margin and extending caudad all the way to ends of scutellum. Mesonotum with short, semi-appressed, whitish pile; scutellum, postscutellum and lower pleuron dark brown. Legs with femora and tibiae dark brown and comparatively stout; tarsi pale; fore, mid and hind tibiae each with a dorsal row of broadly expanded, flattened, striated scales (fig. 2b); TR 0.9.

Wing unadorned, without pale or dark spots. Halter whitish.

Abdomen dark brown. Two large, oval spermathecae.

Male.—Similar to the female with usual sexual differences. Tibiae without broad scales. Genitalia (fig. 2c) with dististyle very slender and nearly straight; aedeagus shield-shaped, with anterior arch very low and anterior arms very short, bearing a sharp caudomedian point; parameres with a pair of rather stout, straight, sharp-pointed rods with bases widely separated, the area between their bases poorly sclerotized.

Holotype female, allotype, Los Diamentes, Costa Rica, 18 March 1953, H. E. Warmke, W14,15 (Type No. 62915, U.S.N.M.). Paratypes: 1 male, 3 females, same data as type.

The banding of the mesonotum resembles that of the European *pulchrithorax* Edwards but in that species the bands are not divided and the legs are pale and lack the broad scales. *Forcipomyia elegantula* Malloch from Illinois has the mesonotal vittae and lanceolate scales on the tibiae, but the lateral vittae are not subdivided, the wing bears a large yellowish patch over the apex of the costa and the legs have only the apex of the hind femur dark. *Forcipomyia squamitibia* Lutz from Brazil to Mexico and *spatuligera* Macfie from Chiapas, Mexico have specialized tibial scales but otherwise bear little resemblance to the present species.

Dasyhelea spp.

No previously described species can be identified from the present material and the difficulty of the genus and the limited material available does not justify the description of any new species, although it is likely that all of the species are undescribed.

BRAZIL: Belém, No. 2711, August 1951, on *Hevea* stigma, 1 male (species 1); No. 2723, August 1951, trapped in *Hevea* tree, 1 female (possibly species 1).
COSTA RICA: Los Diamentes, W14,15, 18 March 1953, 1 female (yellow species 2). Cairo, W18, 18 March 1953, 1 female (small black, species 3).
PANAMA: Canal Zone, Summit Gardens, W23, 24 March 1953, 3 males, 2 females (species 4, near *grisea* (Coquillett).
PUERTO RICO: Mayaguez, Nos. 2611, 2617, 29-31 March 1950, on *Hevea*, 6 males (species 5). Mayaguez, No. 2612, 3 April 1950, on *Hevea*, 9 females (possibly species 5). Mayaguez, No. 2618, 1 April 1950, on *Hevea*, 1 male (species 6). Mayaguez, No. 2619, 1 April 1950, on *Hevea*, 2 females (possibly species 6).

Culicoides diabolicus Hoffman

Culicoides diabolicus Hoffman, 1925, Amer. Jour. Hyg. 5: 294 (female; Panama).
BRAZIL:: Belém 2709, August 1951, on stigmas of *Hevea*, 1 female.

Culicoides jamaicensis Edwards

Culicoides loughnani var. *jamaicensis* Edwards, 1922, Bull. Ent. Res. 13: 165 (female; Jamaica).
Culicoides jamaicensis, Wirth, 1955, Proc. Ent. Soc. Washington 57: 112 (status; Guatemala; fig. male genitalia).
GUATEMALA: Entre Rios, Cuyotenango, W12, 6 March 1953, 1 female.

Stilobezzia spp.

BRAZIL: Belém, Nos. 2703, 2710, August 1951, on *Hevea*, 2 males.
MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7 27 February 1953, 1 female.

The numerous Neotropical species of this genus are currently being revised by Dr. John Lane of the University of Sao Paulo, Brazil. The present specimens from Brazil are related to but distinct from *bulla* Thomsen and *thomseni* Wirth from North America, and the Mexican specimen is most closely related among the described North American species to *sybleae* Wirth.

Echinohelea ornatipennis Macfie

Echinohelea ornatipennis Macfie, 1940, Proc. R. Ent. Soc. London (B) 9: 188 (male, female; British Guiana; fig. male genitalia).
MEXICO: El Palmar, Cozalapa, Vera Cruz, W6,7, 27 February, 1953, 1 male.

This Mexican specimen is the first record of the species since it was described from British Guiana. It is easily distinguished from the two other British Guiana species, *richardsi* Macfie and *smarti* Macfie, and the North American *lanei* Wirth, by presence of two dark spots on the anterior wing margin. In other details, particularly the distinctive male genitalia, the Mexico specimen agrees closely with the original description given by Macfie.

Summary

Identifications are given of the heleid midges which were found by H. E. Warmke to be associated with the pollination of the *Hevea* rubber tree in America. Thirty three collections of midges from *Hevea* flowers at eight locations in Puerto Rico, Central America and Brazil in 1950, 1951, and 1953 yielded 150 midges of which all but seven belonged to the genera *Atrichopogon, Forcipomyia* and *Dasyhelea*. Eleven species, including two new ones here described, could be definitely named, while 80 specimens comprising an estimated 30 species could be assigned only to genus or species group.

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BOOK NOTICE

CLASSICS OF BIOLOGY, by August Pi Suñer. Authorized English translation by Charles M. Stern. The Philosophical Library, Inc., New York. x + 337 pp. 1955.

Dr. Pi Suñer's work is a testimonial to his high standing in the world of human physiology, and Mr. Stern's translation is a faithful reflection of his writing style. The book is a review, necessarily brief because of the complexity of the subject, of the important physiological principles governing all living things. Appropriate quotations from the classical writings on each phase of the subject are included.—Richard H. Foote, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

TWO NEW SPECIES OF THE DROSOPHILA SUBGENUS PHOLADORIS AND A REDESCRIPTION OF DROSOPHILA HYPOCAUSTA OSTEN SACKEN

(DIPTERA, DROSOPHILIDAE)

By SARAH BEDICHEK PIPKIN, *801 E. 23rd St., Austin, Tex.*

In the course of a study of seasonal fluctuations of *Drosophila* species in the Lebanon (Pipkin, 1952),[1] three new species belonging to the *victoria* group of the subgenus *Pholadoris* (*Drosophila*) were found. The first, *D. lebanonensis,* a geographical replacement of *D. victoria*, was described by Wheeler (1949). The purpose of the present paper is to describe the remaining two species, *D. pattersoni,* sp. nov., and *D. stonei,* sp. nov. A redescription of *D. hypocausta* Osten Sacken, of the *immigrans* group, subgenus *Drosophila* Fallén (*Drosophila*), from the Truk atoll, Eastern Caroline Islands, is also presented.

DESCRIPTION OF THE NEW SPECIES

Drosophila pattersoni, sp. nov.

(subgenus *Pholadoris*)

(Figs. 2, 6, 8, 10, 11, 12)

Male.—Arista with about 7 branches, two below in addition to the terminal fork. Antennae brown, the second and third joints being the same color. Face and front yellowish brown; ocellar triangle and orbits, brown. Frontal hairs in a rough V, the point lying anteriorly and hairs pointing medially; the bristle bearing area not shiny. A single prominent oral bristle, the slender second oral bristle about half as long as the first. Middle orbital about one-fourth the length of the other two; posterior orbital a little longer than the anterior orbital. Carina small, expanded below, not sulcate, bulbous. Palpi light tan with 3-4 prominent hairs. Checks yellowish, their width about one-sixth the greatest diameter of the eye, with about 4 prominent bristles at the lower angle of the cheek. Eyes reddish on emergence (Pl. 6-L 5),[2] darkening with age; pile short and dark.

Acrostichal hairs often in 6 rows, with an additional row on each side just anterior to the level of the anterior dorsocentral bristles; sometimes acrostichal hairs irregular and present in 7 or 8 rows. Four bristles in the prescutellar row, the median pair being enlarged to form prescutellar bristles extending one-third the greatest length of the scutellum. Anterior scutellars divergent. Three well developed sternopleurals, the middle one thin, about half the length of the posterior; sterno-index about .8. Halteres pale yellow. Mesonotum yellowish brown with a narrow pale gray medial stripe; pleurae dark grayish brown.

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[1]Collections made while the author was the recipient of a Rockefeller Foundation Grant, Division of Natural Sciences, from 1947-1950.

[2]Color determinations from *A Dictionary of Color* by Maerz and Paul (1950) were made for eye color on newly hatched flies and for testes color on flies 3 days old.

Legs yellowish brown, all parts of uniform shade. Apical bristles on 1st and 2nd tibiae; preapicals on all three.

Abdominal tergites shining black, the basal one somewhat less so and paler medially. Sternites pale gray, the yellow testes being faintly visible through the ventral body wall. Hypopygium retracted into abdomen, possessing the general characteristics of the *victoria* group described by Hsu (1949). Lobe-like process on the heel of the clasper prominent; primary teeth of clasper about 11. Four bristles on the upper part of the genital arch; numerous bristles on the lower part of the genital arch and on the anal plate; these bristles closely approximating in position and size those of *D. stonei*, sp. nov. (fig. 3).

Female.—Same as above except for genitalia differences and slight differences in abdominal coloration. First abdominal tergite yellowish medially, dark brown laterally. Broad shining black bands across the 2nd, 3rd, 4th, and 5th tergites, the black area narrowing laterally. Anterior, lateral, and very narrow posterior margins of all tergites yellowish. Circum-anal tergite yellow medially with black spots laterally, its anterior, posterior, and lateral margins being yellowish. Anal plates yellowish; ovipositor yellowish tan. Sternites pale gray.

Wings clear. Costal index about 2.3; 4th vein index, 2.4; 4c index, 1.3; 5x index, 2. Two bristles at the apex of the first costal section. Heavy hairs on the basal three-fifths of the third costal section.

Length, male body, 2.7 mm. (in live specimen); wings, 2.3 mm.

Length, female body, 2.8 mm.; wings, 2.5 mm.

Testes elliptical, bright yellow (Pl. 10-K 5). Ventral receptacle short, finger-like, bent once. Spermathecae with chitinized centers (fig. 10). Posterior malpighian tubes approximately two-thirds as long as anterior malpighian tubes, the common stalks of each about one-tenth their total length. Tips of anterior tubes free; those of posterior tubes apposed without the formation of a continuous lumen.

Physiological characters.—Recovers rapidly from anaesthetization with ether. Will breed in the dark.

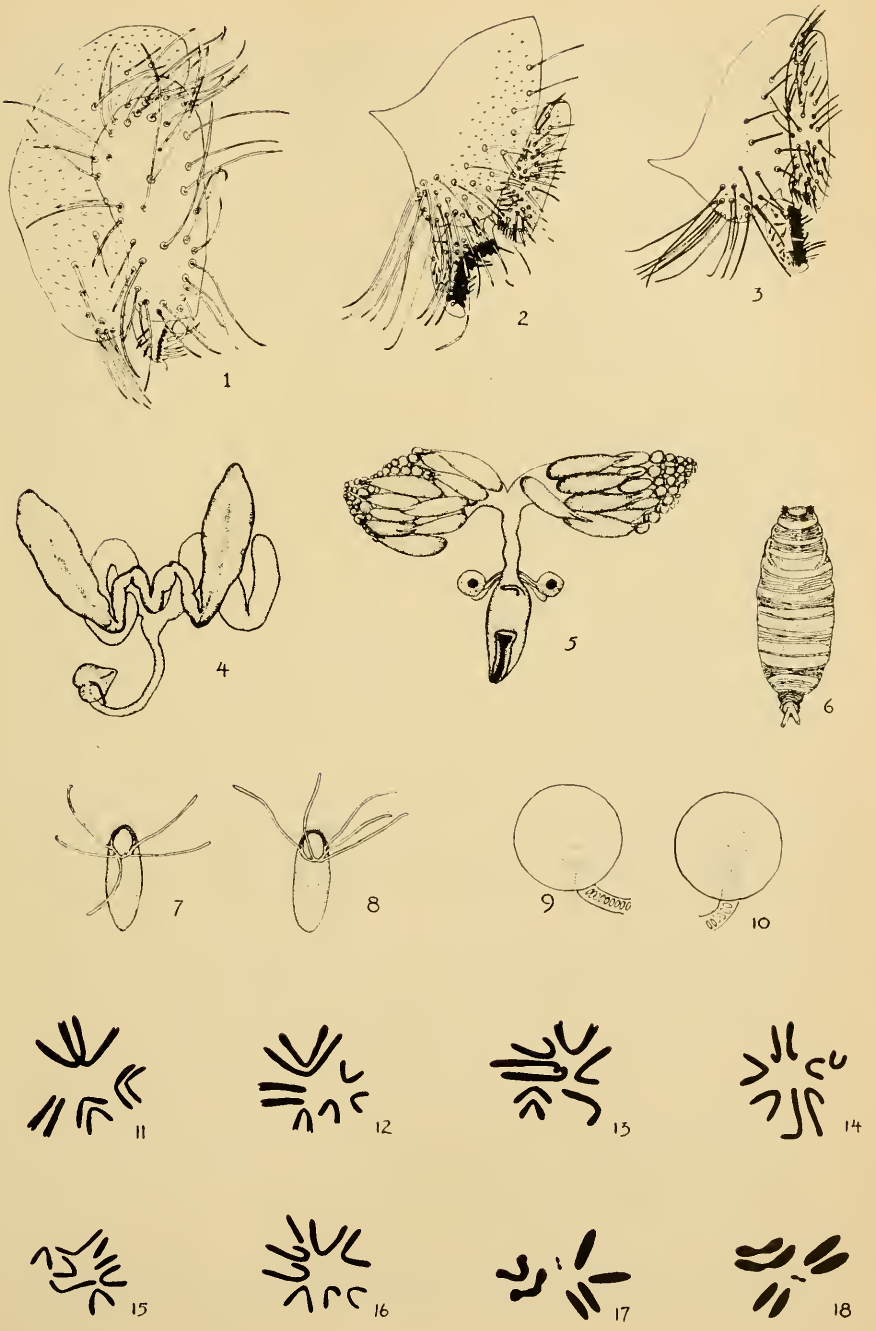
Eggs.—With from 3 to 8 filaments; 26% with 4; 48% with 5; and 15% with 6 filaments. Tips of filaments curly (fig. 8).

Larvae.—White in color; skip; very active; often escape plugged bottles unless these are capped with gauze.

Puparia.—Dull gold (Pl. 12-J 10). Each anterior spiracle with 6-9 branches, 52% having 8 branches. Stalk of anterior spiracle very short. Posterior spiracles closely apposed (fig. 6). Pupation usually in the paper in laboratory bottles, sometimes near the cotton plugs.

Chromosomes.—Larval brain preparations show males and females with one pair of large V's, 2 pairs medium-sized V's, and one pair rods (figs. 11 and 12). Salivary chromosomes with 3 long arms, 2 medium arms, 2 short arms, a pronounced chromocenter; one salivary gland smaller than the other.

Drosophila pattersoni, n. sp.: fig. 2, hypopygium; fig. 6, puparium; fig. 8, egg; fig. 10, spermatheca; fig. 11, chromosomes of larval brain of male; fig. 12, same, of female. *D. stonei*, n. sp.: fig. 3, hypopygium; fig. 4, internal reproductive tract of male; fig. 5, same, of female; fig. 7, egg; fig. 9, spermatheca; figs. 13-16, chromosomes of larval brain of male, female, female, and male, respectively. *D. hypocausta* O. S.; fig. 1, hypopygium; fig. 17, chromosomes of larval brain of male; fig. 18, chromosomes of oocyte of female.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Relationship.—Belongs to the *victoria* group of the subgenus *Pholadoris* with *D. victoria* Sturtevant, 1942, *D. nitens* Buzzati-Traverso, 1943; *D. lebanonensis* Wheeler, 1949, and *D. stonei,* sp. nov. *D. pattersoni* is the only yellowish member of this species group. Females of *D. pattersoni* crossed with males of *D. lebanonensis* produce slowly developing larvae and pupae which die at various stages of development, only rarely giving rise to a hybrid imago. The results of this cross are similar when males are chosen from *lebanonensis* strains of different regions; i.e., Beirut, Sofar, Ksara, or Ain Anub. The rare hybrids are of both sexes, small, squat, with minute bristles, wings frequently not fully expanded, posterior ocelli fused, ommatidia slightly disarranged; eye color dark as in *lebanonensis;* body color dark as in *lebanonensis* but with light area on posterior thorax and scutellum. *D. pattersoni* females crossed with *D. victoria* (Arizona strain) males less readily produce slowly developing larvae and pupae, more of the hybrids dying in the earlier larval stages, giving rise to a hybrid imago in only two instances. The two hybrid females were small and squat, with minute bristles, one wing crumpled, ommatidia not rough but splotched with dark red and lighter red; body dark with two light spots on the posterior thorax separated by a dark bridge reaching the scutellum.

D. pattersoni females and *D. stonei* males are poorly fertile, giving F_1 hybrids which are sterile *inter se,* but the F_1 *pattersoni/stonei* female hybrids are fertile with *D. pattersoni* males. Progeny from this back cross are fertile *inter se.* The F_1 *pattersoni/stonei* hybrids are slightly lighter than *D. stonei* in color, but they are much darker than their *pattersoni* parent.

Corresponding reciprocal crosses; i.e., females of *D. lebanonensis* with males of *D. pattersoni;* females of *D. stonei* with males of *D. pattersoni;* and females of *D. victoria* with males of D. pattersoni do not yield hybrid larvae. However, *pattersoni/stonei* hybrid females, proven sterile with their brothers, when recrossed with *D. lebanonensis* males, yielded larvae which died in the first and second stages.

Distribution.—Of 835 collections from six regions within 35 miles of Beirut, Lebanon, *D. pattersoni* was trapped only 3 times: 2 females were taken at Beirut on Sept. 5 and 6, 1948 and a single female was taken at Ksara in the Bekaa Valley on Sept. 12, 1948.

Types.—Holotype male and a series of paratype males and females, no. 2093.3, from the Beirut stock. These specimens as well as the type of the other species described in this article have bee placed in the *Drosophila* Type and Reference Collection of The University of Texas, Austin, Texas.

Drosophila stonei, sp. nov.

(subgenus *Pholadoris*)

(Figs. 3, 4, 5, 7, 9, 13-16)

Male.—Arista with about 7 branches, 2 below in addition to the terminal fork. Antennae black; face and front dark brown; ocellar triangle and orbits black.

Each orbit shows 3 prionose areas appearing whitish when viewed from certain angles: one anterior to the proclinate orbital, one between the proclinate orbital and the posterior reclinate orbital, and one anterior and medial to the inner vertical. Similar prionose areas present in related species of the *victoria* group but not prominent. Frontal hairs pointing anteriorly in a rough V. A single prominent oral bristle, the second oral bristle slender and about half the length of the first. Middle orbital about one-fourth the length of the anterior and posterior orbitals. Carina small, widely expanded below, bulbous, not sulcate. Palpi light tan, darker on distal ends, with 4 prominent hairs. Cheeks dark brown, their width about 1/6 the greatest diameter of the eyes. Four prominent bristles at the lower angle of the cheek. Eyes dark red on hatching (Pl. 7-L7), becoming wine color with age; short dark pile.

Acrostichal hairs in 6 obvious rows but usually an additional row on each side ending just anterior to the level of the anterior dorsocentrals. Four hairs in the prescutellar row, the median pair enlarged to form prescutellar bristles extending one-third the greatest length of the scutellum. Anterior scutellars divergent. Three well developed sternopleurals, the middle one thin and ¾ the length of the posterior; sterno-index about 0.8. Halteres yellow, browish at the base. Mesonotum and scutellum shining black without a pattern. Legs dark brown to yellow brown, darkest on femora. Apical bristles on 1st and 2nd tibiae; preapicals on all three.

Abdominal tergites black and shining; the first one being dark brown medially. Sternites dark gray. Hypopygium retracted into abdomen resulting in a blunt tip when viewed from above. Lobe-like process on the heel of the clasper prominent; clasper with about 13 primary teeth; 4 bristles on the upper part of the genital arch; numerous bristles on the lower part of the genital arch and on the anal plate (fig. 3).

Female.—Same as above except for genitalia differences and slight differences in abdominal coloration. Abdomen with shining dark brown bands, the medial region of the first tergite lighter brown. The lateral anterior edges of the 2nd, 3rd, 4th, and 5th tergites slightly but progressively yellowed. The circum-anal tergite yellow medially with black spots laterally, and yellow anterior and posterior margins. Sternites pale gray. Ovipositor light yellowish brown.

Wings clear. Costal index about 2.4; 4th vein index, 2.7; 4c index, 1.3; 5x index, 2. Two bristles at the apex of the first costal section; heavy hairs on the basal three-fifths of the third costal section.

Length, male body 2.6 mm. (in live specimen); wing, 2.4 mm.

Length, female, 2.8 mm.; wing, 2.6 mm.

Testes elliptical; burnt orange in color (Pl. 10-K 8) (fig. 4). Ventral receptacle short, finger-like, bent once in the middle (fig. 5); centers of spermathecae chitinized (fig. 9). Anterior malpighian tubes about twice as long as posterior tubes; the common stalks of each about 1/10 their total length; tips of anterior tubes free; those of posterior tubes apposed but without the formation of a continuous lumen.

Physiological characters.—Recovers rapidly from anaesthetization with ether. Requires light for breeding.

Eggs.—With from 2 to 8 filaments; 40% with 5 filaments; 23% with 6 filaments; 20% with 4 filaments. Tips of filaments curly (fig. 7).

Larvae.—White in color; skip. Very active; often escape laboratory bottles unless these are capped with gauze.

Puparia.—Dull gold in color (Pl. 12-J 10). Each spiracle with from 5 to 8 branches, with 70% having 6 branches; stalk of anterior spiracle very short; posterior spiracles closely apposed. Pupation usually in the paper inserted in food medium in laboratory bottles but sometimes near the cotton plug.

Chromosomes.—Larval brain preparations show males with 1 pair large V's; 1 pair large long-armed J's; 1 pair small V's; and a large V-shaped Y chromosome plus either a rod-shaped X or an X chromosome with the shape of a short-armed J (fig. 16). Some slides show a pericentric inversion in the first pair of large V's, resulting in 1 pair large short-armed J's; 1 pair large long-armed J's; 1 pair small V's, and a large V plus either a rod or a short-armed J-shaped X chromosome (fig. 13). Observed preparations of females show 1 pair large V's; 1 pair large long-armed J's, 1 pair small V's; and either 2 rod-shaped X chromosomes or 2 X-chromosomes with the shape of short-armed J's (figs. 15, 14). Some salivary female preparations show 3 long arms, 4 medium arms, and a very short arm; chromocenter pronounced; 2 salivary glands not noticeably different in size.

Relationship.—Belongs to the subgenus *Pholadoris,* closely related to *D. victoria, D. nitens, D. lebanonensis,* and *D. pattersoni,* sp. nov. Females of *D stonei* and males of *D. lebanonensis* are usually sterile, rarely give 1st and 2nd stage larvae which die at one of these stages. Females of *D. stonei* give no hybrid larvae with *D. victoria* or *D. pattersoni* males. Males of *D. stonei* are sterile with females of *D. lebanonensis* and *D. victoria,* but they yield hybrids with females of *D. pattersoni* (see *D. pattersoni* for discussion of these hybrids).

Distribution.—Of 835 collections from 6 regions within 35 miles of Beirut, Lebanon, *D. stonei* was trapped on six occasions at Sofar (from 1 to 3 individuals being taken each time) during July, August, and September, 1948; and twice at Ain Anub during July and August, 1948, respectively, 2 individuals being taken on each occasion.

Types.—Holotype male and a series of paratype males and females, No. 2093.2, have been placed in the *Drosophila* Type and Reference Collection of the University of Texas, Austin, Texas.

Drosophila hypocausta Osten Sacken
(subgenus Drosophila)

Osten Sacken, 1882; De Meijere, 1911.

Male.—Arista with about 10 branches, 4 below, in addition to the terminal fork. First and second points of the antennae browish-yellow; third joint sooty-brown laterally, yellowish-brown medially. Front yellowish tan, paler anteriorly; ocellar triangle, black. Small furrow from anterior ocellus to anterior boundary of front with 6-8 tiny hairs on each side this furrow, just posterior to the bases of the antennae. Middle orbital a third as long as posterior orbital; half as long as anterior orbital. Second oral bristle more than half as long as first. Orbits yellowish and pollinose. Palpi sooty, with 2 prominent bristles. Carina broad, flattened on top, not sulcate; face yellowish brown above, shading into sooty brown on lower carina. Cheeks dark brown, their greatest width scarcely 1/7 the greatest diameter of the eyes. Eyes bright red; short light pile.

Acrostichal bristles in 8 rows; no prescutellars. Anterior scutellars convergent. Sterno-index .5. Mesonotum yellowish brown dorsally with narrow paler longitudinal stripes on each side along the dorsocentral bristles extending the length of the mesonotum; also a pale central line, incomplete medially. Scutellum yellowish brown; pleurae sooty brown to shining black, the darkened area extending dorsally on the mesonotum to the level of the notopleural and humeral bristles and posteriorly to the transverse suture; darkest areas along the sutures. Coxae and femora shining dark brown to black; tibiae dark brown medially, yellowish brown at the extremities; tarsae yellowish brown. Preapical bristles on all three tibiae; apical bristles on the first and second tibiae, that of the second tibia, very large. Nine short black bristles in a row on the lower apical part of the forefemora, more conspicuous in the female than in the male owing to the pale color of the femora in the former. Halteres yellow.

Abdominal tergites with black shining bands posteriorly, their anterior margins yellowish brown, the light area occupying about three-quarters the width of the 1st tergite and diminishing with successive tergites. The dark abdominal bands extend to the lateral margins of the tergites. Sternites sooty, becoming progressively darkened posteriorly. A darkening with age of all body parts occurs. Hypopygium consists of a horse-shoe shaped genital arch with about 9 bristles on the lower part, 3 bristles on the upper part; primary clasper with 9 short stout primary teeth; marginal bristles about 6 (fig. 1).

Female.—As above, aside from genital differences and the following important exceptions in body color: palpi yellowish brown; pleurae yellowish, darkened to brownish along the sutures. Coxae of first two pairs of legs dirty yellow; otherwise, legs yellowish. Brown replaces black of male in first 4 abdominal tergites, their anterior margins being yellow. Fifth tergite brown on posterior lateral border; yellow medially; circum-anal tergite yellow. Ovipositor golden.

Wings yellowish with slight clouding on the posterior cross vein; veins slightly darkened. Costal index about 3.6; fourth vein index about 1.1; 5x index, 1; and 4c index, .63. Apex of first costal section with 2 bristles, the dorsal one being stout and slightly longer than the thin ventral bristle. Third costal section with heavy hairs on its basal half.

Length, male body, 2.8 mm. (live specimen); wings 2.6 mm.

Length, female body, 3 mm.; wings, 2.8 mm.

Testes with 3 pale yellow proximal gyres and 4 and ½ burnt-orange mottled with yellow distal gyres; ejaculatory sac with 2 diverticulae, each about one half the length of the sac. Spermathecae large, spherical, pale, not strongly chitinized; about 15 coils to the ventral receptacle; ventral receptacle not coiled at base.

Eggs. With 2 filaments, each filament being split into about 3 curly branches, beginning at at point approximately 2/3 the length of the filament.

Puparia.—Transparent brownish orange. Each anterior spiracle with from 13 to 19 branches; horn index about 2.4.

Chromosomes.—Larval brain of males and females and oocytes with one pair large V's, 2 pairs rods, and a pair of dots (figs. 17 and 18). Salivary chromosomes with 3 arms of medium length, 1 long arm, and 1 very short arm.

Relationship.—Belongs to the *immigrans* group of the subgenus *Drosophila* Fallén. Reciprocal crosses with *D. spinofemora* Patterson and Wheeler, 1942, were sterile.

Distribution.—The type described from male specimens by Osten-Sacken (1882) was collected in the Phillipine Islands by Dr. Carl Semper. The sexual color dimorphism was described from specimens collected in Java by DeMeijere (1911). The present description is based upon a stock brought by the author from the Truk atoll, Eastern Caroline Islands (Pipkin, 1953). The species was searched for in daily collections at Koror, The Palau Islands during July and August, 1952, without success.

The author is indebted to Dr. Leonie Kellen Piternick, of The University of California, for her courtesy in extending certain laboratory facilities for a part of this work, and to Dr. Marshall R. Wheeler, of The University of Texas, for identifying *D. hypocausta*, for helpful suggestions, and for reading the manuscript.

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SPECIES OF PHYLLOBROTICA OCCURRING IN THE PACIFIC COAST STATES

(COLEPTERA, CHRYSOMELIDAE)

By DORIS H. BLAKE, *Division of Insects, U.S. National Museum, Washington, D.C.*

The type of the genus *Phyllobrotica, P. quadrimaculata* (L.), found in northern Europe and Siberia, is a pale yellow beetle with elytral markings, as indicated by its name, consisting of four bluish spots. This color pattern with variation in the size and number of the spots is repeated in many of the other central European, Asia Minor, and Siberian species of the genus. In North America we have *P. decorata* (Say) which is also 4-spotted, but in this case the spots are brownish. Most North American species have the spots united in a long median vitta. Along the Pacific coast, both in America and Asia (China and Japan), occur species of *Phyllobrotica* that have entirely blue or bluish black elytra. In the Pacific United States there have been recognized up to now three species of this sort: *P. nigripes* Horn, an entirely dark beetle; *P. viridipennis* Lec., a pale yellow beetle with bluish green elytra; and *P. luperina* Lec., a bluish or greenish black beetle with pale yellow legs and antennae. In the collection of *P. viridipennis* from the California Academy of Sciences is a series of beetles of similar coloration but smaller, paler, and with dense fine pubescence on the upper surface. Also among the California Academy of Sciences specimens is what appears to be a race of *viridipennis* from Mokelumne Hill, Calaveras Co., that I cannot differentiate except by the shape of the aedeagus, which is consistently different in the several males that I have dissected. Among the specimens of *luperina* are some that are more lustrous and from a more northern range than *luperina*, having been collected in northern California, Oregon and Washington. In their case, too, the aedeagus is quite different from that of *luperina*.

I have examined specimens loaned by the California Academy of Sciences and the Los Angeles County Museum, as well as material in the U. S. National Museum. I have brought together the localities of these specimens showing the distribution of *Phyllobrotica* species in the Pacific Coast states and have made a key to them.

KEY TO SPECIES OF PHYLLOBROTICA OCCURRING IN THE PACIFIC COAST STATES

1. Legs and antennae black .... *P. nigripes* Horn
   Legs and antennae pale 2
2. Prothorax dark 3
   Prothorax pale 4
3. Elytra very shiny, not alutaceous. N. Calif., Oregon, Washington .... *P. leechi*, n. sp.
   Elytra not so shiny, distinctly alutaceous. Calif. .... *P. luperina* Lec.

4. Elytra covered with short fine pubescence; a small roundish dark spot on occiput. Sequoia Nat. Forest and vicinity .... *P. sequoiensis*, n. sp.
   Elytra very inconspicuously and sparsely pubescent; spot on occiput usually large, frequently covering back of head 5
5. Aedeagus widest before tip .... *P. viridipennis* Lec.
   Aedeagus widest near tip, Mokelumne Hill, Calaveras Co., Calif. .... *P. viridipennis mokelensis*, n. ssp.

Phyllobrotica leechi, new species
(Figure 5)

About 6 mm. in length, elongate oblong-oval, lustrous, elytra distinctly and densely punctate in basal half, upper part of head and thorax black, elytra deep blue or green, antennae and legs reddish brown, body beneath dark.

Head with the upper part smooth, shining black down to the swollen frontal tubercles, a few punctures about eyes, lower front reddish brown. Antennae stout, pale, extending about half length of beetle, 4th joint nearly twice as long as 3rd. Prothorax subquadrate, approximately a fourth wider than long, with nearly straight sides, a semicircular depression in basal half, surface very shiny with a few scattered punctures, entirely black, Scutellum black. Elytra very shiny dark blue or green, distinctly and densely punctate in basal half, the punctures becoming finer and fading out in apical half. Body beneath dark piceous with sparse fine pubescence, a large shallow roundish excavation in male at tip of abdomen; legs reddish brown with a darker brown area near base of femora usually. Length 5.3 to 6.5 mm.; width 2.4 to 2.8 mm.

Type.—Holotype male, U.S.N.M. Type No. 63173, from Scotia, Humboldt Co., Calif., collected by H. S. Barber on June 20.

Other localities.—CALIFORNIA: Eureka, H. S. Barber; Green Point, F. E. Blaisdell; Mad River Mts., Van Dyke; Orick, Van Dyke, all in Humboldt Co.; Walker, Siskiyou Co., C. L. Fox. OREGON: Cascade Head Exper. Forest, on alder; Corvallis, Van Dyke; Mary's Peak, G. F. Moznette. WASHINGTON: Crescent, Bruce Martin; Forks, Clallam Co., E. P. Van Duzee; Olympic Mts., C.V. Piper.

Remarks.—The more lustrous appearance of these beetles is the chief character to distinguish them from *luperina*. The aedeagus is also different. So far I have not seen any specimens of this species from south of Humboldt Co., or any specimens of *luperina* from north of there. This species is dedicated to Hugh Leech, who has generously picked out specimens for my study on many an occasion.

Phyllobrotica sequoiensis, new species
(Figure 3)

About 5 mm. in length, elongate oblong, faintly shining under the fine, short golden pubescence, pale yellow (reddish in life) with a small brown or piceous

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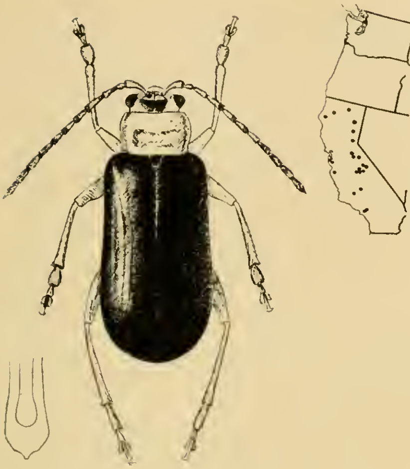
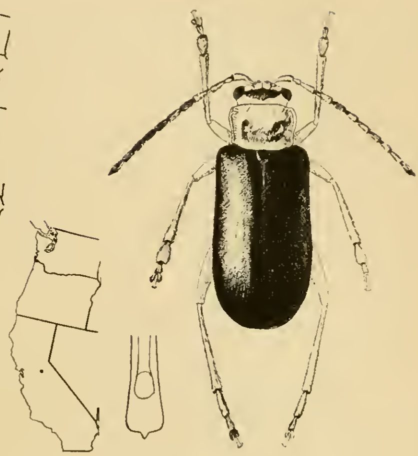
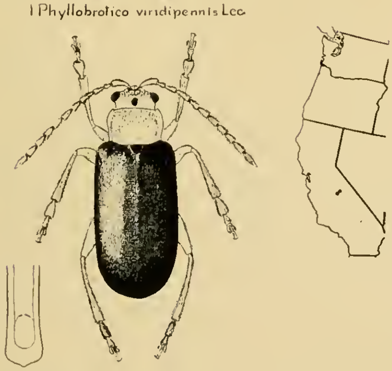
Figs. 1-6. Species of *Phyllobrotica* and their distribution in the Pacific Coast states.



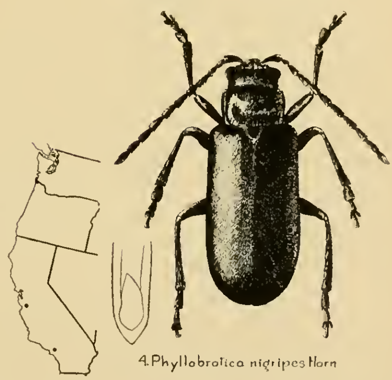
1 Phyllobrotica viridipennis Lec.



2 Phyllobrotica viridipennis mokelensis

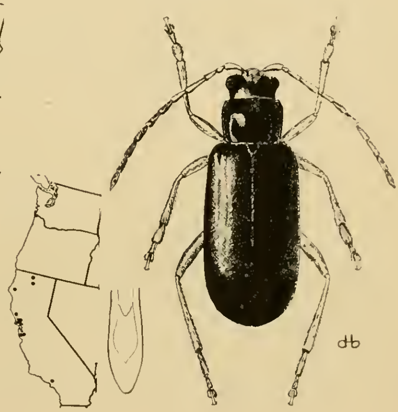


3. Phyllobrotica sequoiensis



4. Phyllobrotica nigripes Horn

5 Phyllobrotica leechi



6. Phyllobrotica luperina Lec.

spot on the occiput of head and deep blue, purple or greenish elytra, body beneath, except the pale prosternum, piceous, legs and antennae pale.

Head pale yellowish brown with a small dark spot on the occiput and the mandibles brown edged, shining, smoothly rounded over the top, with fine pubescence, and fine punctures; frontal tubercles well developed. Antennae stout, nearly half as long as beetle, 3rd joint shorter than 4th, pale yellow brown sometimes deepening in color in distal joints. Prothorax subquadrate, a little wider than long, shining, pale yellow brown, moderately densely and coarsely punctate and with long, not very dense yellow pubescence, a semicircular depression in basal half. Scutellum shining piceous. Elytra metallic blue, purple, or even greenish, faintly shining under the short, moderately dense (in unrubbed specimens), fine, golden pubescence; finely and moderately densely punctate. Body beneath in male with a large shallow rounded excavation near tip of abdomen; prosternum pale, breast and abdomen piceous; legs entirely pale; densely pubescent. Length 4.8 to 5.8 mm.; width 2 to 2.6 mm.

Type.—Male and 10 paratypes, California Academy of Sciences, holotype. Two paratypes, U.S.N.M. Type No. 63174, from Potwisha, alt. 2—5000 ft., Sequoia National Park, California, collected June 20, 1929, Van Dyke collection.

Other localities.— CALIFORNIA: Wolverton, Sequoia National Park, June 24, 1929, Van Dyke; Sequoia National Park, alt. 2—3000 ft. A. T. McClay; Kaweah, Tulare Co., April 19, 1907, R. Hopping.

Remarks.—In general this is a smaller, paler beetle than *P. viridipennis* Lec., with a smaller, rounder, piceous or dark brown spot on the occiput. In its thick pubescence it resembles *P. nigripes* Horn. *P. viridipennis* is very inconspicuously and sparsely pubescent above. So far, *P. sequoiensis* has been collected only in a small area in or near Sequoia National Park.

Phyllobrotica viridipennis mokelensis, new subspecies

(Figure 2)

About 6 mm. in length, elongate oblong oval, alutaceous, faintly shining, elytra and prothorax rather obsoletely punctate, the former more densely in basal half; head pale yellow brown with a broad piceous occipital spot or band, thorax yellow brown, elytra deep blue or green, body beneath with piceous breast and abdomen; antennae pale, the distal joints sometimes darker, legs pale.

Head pale with a broad piceous spot, often triangular in shape and extending from occiput to frontal tubercles, this area being lightly punctate and sparsely pubescent. Antennae about half length of beetle, stout, the 4th joint twice as long as 3rd, pale yellow brown, often deepening to dark brown in distal joints. Prothorax subquadrate with nearly straight sides, about a third wider than long, surface more or less densely punctate and with sparse golden brown pubescence; alutaceous, only faintly shining, a deep semicircular depression in basal half. Scutellum shining piceous. Elytra deep blue or bluish green, alutaceous, densely but obsoletely punctate in basal half, the punctures becoming finer and inconspicous after the middle. Body beneath with breast and abdomen piceous, prosternum and legs pale, lightly pubescent, a large shallow roundish excavation near tip of abdomen in the male. Length 5.5 to 7 mm.; width 2.1 to 2.6 mm.

Type.—Male, and 15 paratypes, California Academy of Sciences, Two paratypes, U.S.N.M. Type No. 63175, from Mokelumne Hill, Calaveras Co., California, collected in June by F. E. Blaisdell.

Other localities.—1 specimen in U.S.N.M. collection labelled "?Cal." from the M. L. Linell collection.

Remarks.—In its outward appearance this does not differ from the other specimens of *P. viridipennis*, but the males show a somewhat differently shaped aedeagus, with the orificial opening farther from the tip. Whether this is a distinct species or merely a race of *viridipennis* cannot be determined at present but I believe it merits a subspecific name.

Distribution of *Phyllobrotica luperina Lec.: California:* Blocksburg, Humboldt Co., H. J. Rayner; Comfort, Mendocino Co., F. Knab; Lagunitas, Marin Co., F. E. Blaisdell, Van Dyke; Los Angeles, Los Angeles Co.; Los Gatos, Santa Clara Co., Hubbard and Schwarz; McCloud, Siskiyou Co., Fenyes; Mill Valley, Marin Co., H. E. Leech; Muir Woods, Marin Co., F. E. Blaisdell, E. P. Van Duzee; Ross, Marin Co., E. P. Van Duzee; Santa Cruz Mts., Santa Cruz Co., Koebele; Siskiyou Co., A. Koebele; Sobrevista, Sonoma Co., Van Dyke; Sylvania, A. Fenyes.

Distribution of *Phyllobrotica nigripes Horn: California:* Paraiso Springs, Monterey Co., L. S. Slevin; Los Angeles Co., Coquillet.

Distribution of *Phyllobrotica viridipennis Lec.: California:* Alta Meadows, Mt. Alta, G. E. Bohart; Angels' Camp, Calaveras Co., E. P. Van Duzee; Bear Lake, J. O. Martin; Calaveras Co., Van Dyke; Camp Baldy, San Bernardino Co., L. L. Muchmore; Cisco, Placer Co.; Claremont, Los Angeles Co., Baker; Carrville, Trinity Co., Van Dyke; Forest Home, San Bernardino Co., Van Dyke; Huckleberry Meadows, 6500 ft. alt., R. Hopping; Kaweah, 10,000 ft. alt., Tulare Co., R. Hopping; Kern Lakes, 6500 ft. alt., Tulare Co., Kern River, 6000 ft. alt., Tulare Co.; King's River Canyon, Tulare Co.; Lassen National Park, Lassen Co., Van Dyke; McCloud, Siskiyou Co., A. Fenyes; Meadows Valley, 4-5000 ft., Plumas Co., Van Dyke; Plumas Co., J. C. Huguenin; Potwisha, Sequoia National Forest, Tulare Co., Van Dyke; San Bernardino Mts., San Bernardino Co., L. L. Muchmore; Santa Cruz Mts., Santa Cruz Co.; Shasta Co., Coquillet; Sylvania, A. Fenyes; Tassajara, Monterey Co., L. S. Slevin; Tehachapi, Kern Co., Wickham; Tuolumne Co., Coquillet; Visalia, Tulare Co., Culbertson; Whitney Creek, Sierra Nevada Mts.; Yosemite, Tuolumne, Van Dyke.

BOOK NOTICE

POMP AND PESTILENCE, by Ronald Hare, M.D. The Philosophical Library, Inc., New York. 224 pp. 1955.

Written largely from the standpoint of disease organisms as parasites, this volume should be of considerable interest to the medical entomologist.—RICHARD H. FOOTE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

NEW SYNONYMY IN NORTH AMERICAN NANOPHYINAE
(COLEOPTERA, CURCULIONIDAE)

Nanophyes Schoenherr

Nanophyes Schoenherr, 1838, Gen. sp. Curc. 4: 780. Type, *Rhynchaenus lythri* Fabricius, by original designation.

Pseudotychius Blatchley, 1922, Jour. N. Y. Ent. Soc. 30: 102. Type, *Pseudotychius watsoni* Blatchley, by monotypy. NEW SYNONYMY.

Nanodactylus Blatchley, 1922, Jour. N. Y. Ent. Soc. 30: 103. Type, *Nanodactylus obesulus* Blatchley, by monotypy. NEW SYNONYMY.

Zeugonyx Notman, 1922, Jour. N. Y. Ent. Soc. 30: 128. Type, *Zeugonyx sabinae* Notman, by monotypy. NEW SYNONYMY, subordinated as subgenus.

Nanophyes watsoni (Blatchley, new combination)

Pseudotychius watsoni Blatchley, 1922, Jour. N. Y. Ent. Soc. 30: 103.

Nanophyes pallidulus Leconte (*not* Gravenhorst, 1807), 1876, Rhynch. Amer., p. 220. NEW SYNONYMY.

Nanophyes confusor Sleeper, 1955, Ohio Jour. Sci. 55: 56, figs. 2, 3, 4, and 8. NEW SYNONYMY.

I am indebted to Mr. Elbert Sleeper for two paratypes of *Nanophyes confusor* Sleeper. I am also greatly indebted to Dr. N. M. Downie who recently compared a male paratype of *N. confusor* Sleeper with the types of Blatchley's two species. There is no question regarding the generic synonymy. *Nanophyes obesulus* (Blatch., n. comb.) is evidently a distinct species judging by the shorter, more robust form and the sparser, finer pubescence.

Zeugonyx Notman was established for a Texas species reared from "oval swellings on *Sabina sabinoides.*" This subgenus is evidently intermediate between the European subgenus *Nanodiscus* Kiesenwetter, 1864, and *Nanophyes* sens. str. *Nanodiscus* is distinguished by the single tarsal claw. In *Nanophyes* sens. str. the two claws are closely connate. The claws of *Zeugonyx* are unequal, the inner one is greatly reduced in size. The femora of *Nanodiscus* are armed with three spines. The meso and meta-femora of *Zeugonyx* have three spines, the profemora two. In some European *Nanophyes* sens. str. the femora are armed with a single spine. The larvae of *Nanodiscus transversus* Aubé develop in the berries of *Juniperus* spp., which is in the same family as *Sabina sabinoides,* thus indicating a possible host plant relationship between the subgenera.—D. G. KISSINGER, *University of Maryland, College Park.*

ANNOUNCEMENT

Short scientific articles, not illustrated, two double-spaced typewritten pages or less in length, are welcome and will usually receive prompt publication. References to literature should be included in the text, and the author's name should appear at the end of the article.

NOTES ON THE BIOLOGY OF FOUR SPECIES OF GROUND-NESTING VESPIDAE
(HYMENOPTERA)

BY HOWARD E. EVANS, *Cornell University, Ithaca, N.Y.*

The following notes were gathered somewhat incidentally in the course of studies on the comparative ethology of fossorial wasps of the families Pompilidae and Sphecidae, a research project supported by the National Science Foundation under grant number G-248. While the notes are rather fragmentary, they do concern several species which have not been previously studied.

Three of the species were found nesting on the grounds of the University of Florida Conservation Reserve at Welaka, Florida, where the author and his wife were privileged to spend four weeks in the spring of 1955. Since the three nested under virtually identical ecological conditions, an opportunity was presented for studying the differences between the species with regard to type of nest and species of prey utilized. The author would like to express his appreciation to the Department of Biology at the University of Florida for making available to him the facilities at Welaka.

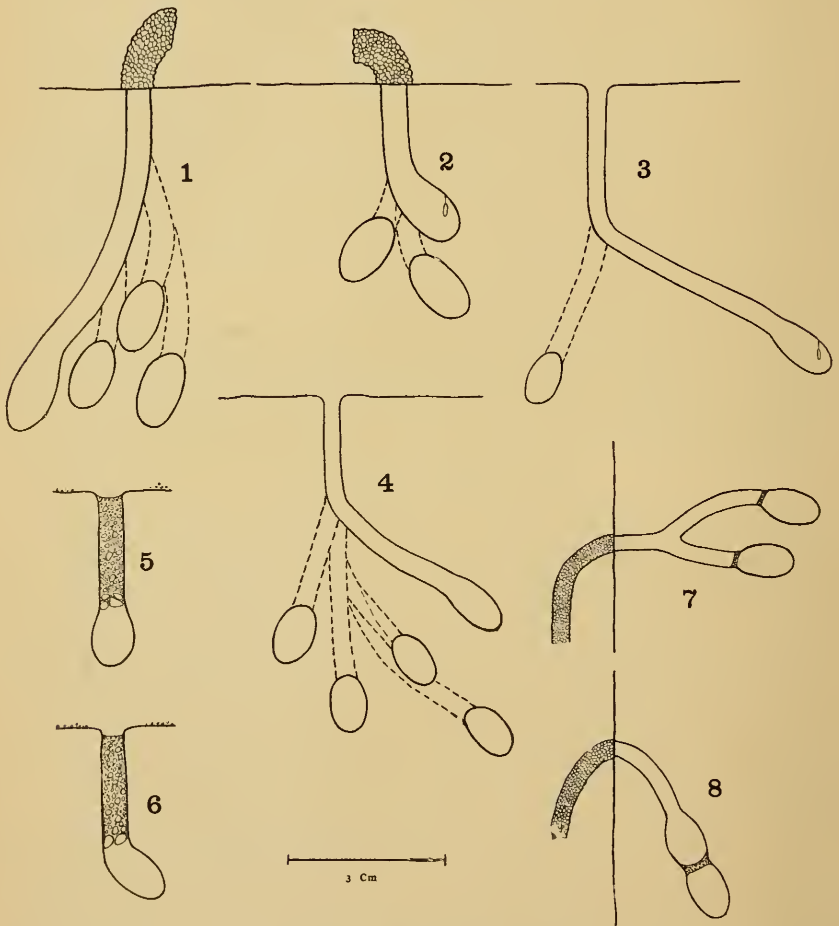
The note numbers in the descriptions which follow refer to field notes and associated specimens now on file at Cornell University. Thanks are expressed to two specialists of the Entomology Research Branch, U.S. Department of Agriculture, K. V. Krombein and H. W. Capps, for identifying the wasps and their lepidopterous larval prey, respectively.

Pterocheilus texanus Cresson

This species was found nesting in a bare spot in the lawn of the Conservation Reserve at Welaka. The bare spot was about half a meter in diameter and was situated near the edge of the lawn, only a few meters from a wooded area. The soil here was a dry, somewhat crumbly clay-sand, with a very hard crust on the surface. A female (No. 1016) was seen closing her nest here at 1430 on April 20, 1955. She was scraping and kicking sand from the periphery and backing toward the hole. Eventually her activities described a circle around the hole with a diameter of about three centimeters. The hole was not completely filled, but a slight depression was left. When she appeared to have completed filling and was cleaning herself on the earth nearby, she was captured for identification and the nest dug out.

The burrow was vertical and penetrated the soil only 23 mm., when it broadened into a vertical cell 11 mm. long (fig. 5). The burrow was about 5 mm. in diameter and was filled with loose sand which fell away upon excavation; the cell was about 9 mm. in diameter, oval in shape. In the cell were eight small, transversely striped caterpillars (*Heliophana mitis* Grote, Noctuidae) closely packed together. The cell may have contained an egg, but if so it was not found.

While this nest was being excavated, another nest was noted only 14 cm. away; it was recognized by the slight depression in the sand, leading to a vertical tunnel full of loose sand, with a little loose sand around the entrance in a circle about 2 cm. in diameter. This nest was also dug out and found to have exactly the same dimensions as the first; the cell was, however, bent slightly to one side (fig. 6). In the cell were six caterpillars of the same species as above; all were rather lively and there were numerous fecal pellets in the cell. At the bottom of the cell was a wasp larva 2.5 mm. long feeding on one of the caterpillars. The contents of this cell were placed in a rearing tin; four days later the larva was 15 mm. long and had eaten three caterpillars; in two more days it had eaten all the prey and was preserved in an apparently full-grown condition.



Figs. 1 and 2: nests of *Rygchium annulatum arvense* (Saussure). Figs. 3 and 4: nests of *Stenodynerus fundatiformis* (Robertson). Figs. 5 and 6: nests of *Pterocheilus texanus* Cresson. Figs. 7 and 8: nests of *Stenodynerus microstictus* (Viereck). Burrows indicated with broken lines were filled and not traced in detail; they are therefore somewhat hypothetical.

While no adult was collected in association with the second nest, there is no question that it was a nest of *Pterocheilus texanus*. In fact, it was probably made by the same individual two or three days earlier. Neither nest showed any evidence that this species moistens the soil during nest preparation or carries in mud. *P. texanus* has long fringed palpi like other members of its genus; these are supposedly used to form a basket for carrying earth from the nest during excavation.

The nesting behavior of *P. texanus* appears to differ somewhat from that of *P. quinquefasciatus* Say as described by Isely (1914). The latter species prepares several cells per nest, the nests being horizontal and in series, separated by partitions of glued-together sand grains. Each cell contains two or three noctuid caterpillars. The manner of closure seems to be the same in both species.

Rygchium annulatum arvense (Saussure)

Rygchium annulatum and its subspecies *arvense* are both widely distributed and not uncommon. The nesting habits have been described by Hartman (1905), Hungerford and Williams (1912), Isely (1914), and the Raus (1918). Subspecies *arvense* nested in the lawn at Welaka in close proximity to *Pterocheilus texanus;* however, it seemed invariably to select places where the soil was much harder, almost rock-like, although appearing the same on the surface.

The first *arvense* (No. 1017) was seen on April 20 at 1415 going in and out of a small, curved tube of dried mud pellets which projected above the surface of a large bare area. Each time the wasp landed on top of the tube and entered the nest upside-down, remaining in the nest about 30 seconds before backing out with a pellet of soil in its mandibles; the wasp would then fly off about 3 meters, about a meter high, and drop the soil on the ground. This nest was revisited at 1645; the wasp was away but came back shortly and was captured. The nest was then dug out (fig.1). It contained three completed cells, closed off with earth, plus a newly completed cell which was empty and open to the outside. The oldest cell was directly beneath the entrance and contained five rather active caterpillars (*Elasmopalpus furfurellus* Hst., Pyralididae), which had passed several fecal pellets, and a very small wasp larva. The cell next to it contained four caterpillars of the same species and an egg, about 2 mm. long, suspended from the wall of the cell by a short petiole. The third cell contained five caterpillars of the same species and an egg. The cells varied in depth from 50 to 65 mm.; each was about 8 mm. wide and 15 mm. high and slanted slightly from the vertical. The open burrow leading to the fourth and newest cell was curved, 75 mm. long, and capped by a curved mud tube 15 mm. high. Two larvae were reared successfully from this nest, reaching maturity in about six days, when they were preserved.

While this nest was being dug, another (No. 1018) was noticed about 15 cm. away. The entrance tube of this nest had been broken off near the base. The nest was found to have two cells, each containing 11 caterpillars, all *Elasmopalpus furfurellus,* but smaller specimens than those in the preceding nest. The first cell was directly beneath the entrance at a depth of 45 mm.; it contained a wasp larva about 6 mm. long. The second cell was slightly off to one side and at a depth of 65 mm.; this cell contained an egg. The burrow leading to the first cell was filled, but that leading to the second was only partially filled.

Probably part of the entrance tube had been used for filling, as has been reported by other workers for this species. Still a third nest (No. 1019) was found in another part of the lawn at Welaka on the same date. This nest was very similar in structure to No. 1017, also having four cells, varying in depth from 4 to 6 cm. The number of caterpillars in the cells varied from three to five; all appeared to be the same species as above. Three of the cells contained larvae and the fourth an egg. A fourth *arvense* nest (No. 1039; fig. 2) was found on May 1 on a hard sandy road about half a mile away. The three cells in this nest were very close together, between 3 and 4 cm. deep. The oldest cell contained five caterpillars and a medium-sized wasp larva; the next cell contained five caterpillars but no egg or larva; and the newest cell contained an egg and six caterpillars. Again, all the caterpillars were *Elasmopalpus furfurellus,* and all were quite active and voiding fecal pellets freely.

These notes agree well with the more detailed observations the Raus (1918) made in Missouri; the nests figured by the Raus are very similar to those found at Welaka. All of the nests studied by the Raus were stocked with *Loxostege similalis* (Pyralididae). Hungerford and Williams (1912) reported the same species as prey in Kansas; they found as many as eight cells per nest. The present observations agree less well with those of Hartman (1905), who reported *arvense* nesting in crevices in brick walls and fence posts and closing the nest with mud. Isely (1914) found nests of typical *annulatum* with up to 22 cells, and nests of *arvense* with up to six cells. In both cases he found the cells arranged in series and separated by mud partitions.

Stenodynerus fundatiformis (Robertson)

A nest of this species (No. 1038; fig. 3) was discovered on April 30 along a roadside a few miles south of Welaka. The wasp was seen entering a hole in a rather moist strip of sand near a stream. The wasp was captured and the nest dug out. The burrow went down vertically for 3 cm., then went off at about a 45° angle for another 5 cm., so that the terminal cell was about 5 cm. beneath the surface. The cell was about 8 x 10 mm. in size; the egg was suspended by a short pedicel from the sloping roof. On the floor of the cell was a single very small larva of the subfamily Chlamisinae (Coleoptera, Chrysomelidae). These larvae are case-bearers, but this one had apparently been neatly removed from its case. On further digging, another cell was located directly beneath the entrance at a depth of 6 cm.; the burrow leading to this cell had been closed off, and the cell contained an apparently full-grown larva which had consumed all its provisions.

A second nest of this species (No. 1043; fig. 4) was located on May 4 on a hard sandy road passing through a pine woods. The soil here was much harder and drier than in the previous locality. The adult was flying in and out of the nest in the process of digging. As in the previous nest, there was no entrance tube. The burrow had a diameter of 3.5 mm. and led to a cell about 6 mm. wide and 15 mm. long; this cell was empty and probably not quite finished. Four additional cells varied in depth from 5 to 7 cm. Three of these contained cocoons and the other a larva 5 mm. long and about ten extremely small caterpillars (at least two species of Pyralididae) and one coleopterous larva belonging to the Chlamisinae. This larva reached maturity in five days and was preserved.

Stenodynerus microstictus (Viereck)

This species was found nesting at Blackjack Creek, Pottawatomie Co., Kansas, on June 17, 1952. At least six individuals were nesting in a vertical clay bank on the edge of a dry wash; two nests were dug out (Nos. 71 & 72) and observations were made on a third (No. 73). The earth here was extremely hard, almost rock-like. Each nest possessed an entrance tube about 3 cm. long, curved so that the opening faced downward. These very fragile tubes were built of sand grains cemented together in such a way that there were open spaces between the grains.

One wasp which was expanding its nest was seen to fly off for about two minutes, presumably to obtain water. She returned and re-entered the nest, then in a few moments backed out of the nest to the end of the tube, carrying a pellet of moist clay. As she held onto the outside of the end of the tube, she passed the pellet from the front to the middle and finally to the hind legs, whereupon it was dropped to the ground. The wasp then re-entered and repeated the performance. A small mound of pellets could be seen beneath each of the nests.

One of the nests which was dug out (fig. 7) went straight into the bank for about 1 cm., then forked into two burrows, at the end of each of which was a cell about 12 mm. long; the cells were from 3 to 4 cm. from the surface of the bank. Each cell was closed off with a mud wall, suggesting that additional cells might be built along the burrows. One cell contained 14 caterpillars and an egg, the other 18 caterpillars and a small larva. All the caterpillars were very small and quite active. Most of them were a single species of Phaloniidae, with a few individuals of a species of Gelechiidae and a species of Cosmopterygidae. The wasp larva reached maturity in four days and spun its cocoon, from which an adult emerged 24 days later. The second nest (fig. 8) had a single burrow terminating in two cells in series, separated by a mud partition; the burrow was about 4 cm. long but curved downward rather than going straight into the bank. Each cell contained about 15 small caterpillars and an egg which was suspended from the top of the cell.

These observations agree well with Isely's (1914) on the related species *Stenodynerus papagorum* (Viereck). Isely's wasps prepared up to 14 cells per nest, most of them arranged in series, and provisioned them with small noctuid caterpillars. He noted that the entrance tubes were made up of longitudinal strands of earth particles held together by cross-bands.

The close similarity between the nesting habits of *papagorum* and *microstictus* is particularly striking when we consider the great diversity of nesting habits within the genus *Stenodynerus*. *S. fundatiformis* nests on flat ground, makes no entrance tube, and does not prepare its cells in series. Several species nest in hollow twigs and will accept trap-nests, while others nest in abandoned bee burrows or *Sceliphron* nests. The following very brief notes on two other species of *Stenodynerus* may be of interest as further evidence of the great diversity within the genus.

Stenodynerus vagus vagus (Saussure)

On June 14, 1952, in a meadow between two series of sand dunes at Medora, Reno Co., Kansas, a small mud nest (No. 57), nearly spherical and about 2.5 cm. in diameter, was found on a willow branch about a meter high. The nest was definitely not that of a *Sceliphron*, and furthermore showed no evidence of having been modified or patched over. The nest was collected, and in the next six weeks six adult *S. vagus vagus* and one cuckoo-wasp, *Chrysis* (*Chrysis*) sp., emerged.

Stenodynerus fulvipes rufovestis Bohart

Several of these wasps accepted wooden trap nests having a bore of 5 mm., put out near Mud Springs, Welaka, Florida, in May 1955 (Nos. 1066, 1067, 1068). The cells were separated by mud partitions 1.5 mm. thick, and the last cell was closed off with a partition of about 7 mm. thickness. The cells were provisioned with small caterpillars belonging to a species of Olethreutidae or Phaloniidae.

Discussion

The three species of Vespidae which nested at Welaka under very similar ecological conditions showed striking differences in nest type and prey preference. *Pterocheilus texanus* utilized a single species of Noctuidae and *Rygchium annulatum arvense* a single species of Pyralididae, while *Stenodynerus fundatiformis* used at least two species of Pyralididae as well as a case-bearing coleopterous larva. *Rygchium annulatum arvense* constructed mud entrance tubes to its nests while the other two did not; the nests of *Pterocheilus texanus* were unicellular while those of the other two were multicellular. Each of these differences implies fundamental differences in behavior patterns. *Rygchium annulatum* in other areas uses other caterpillars, but always employs Pyralididae and apparently always a single, readily available species. This implies a specific type of hunting behavior. On the other hand, most species of *Stenodynerus* seem to hunt rather widely and take a considerable variety of small larvae.

All of the differences noted between these three species cannot, however, be considered generic differences. *Stenodynerus microstictus* constructs curved entrance tubes to its nests, while some other species of *Rygchium* do not. Although *Pterocheilus texanus* and *Stenodynerus fundatiformis* do not appear to make their cells in series, other species of both genera are known to do so. Within the genus *Stenodynerus* species are known which construct almost every type of nest known in the Eumeninae. It is possible that when the eumenine wasps are more thoroughly studied, important concordances will be discovered between morphological and ethological characters, but at the present state of our knowledge one is more often impressed by the lack of such concordance.

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A FURTHER CONTRIBUTION TO THE TAXONOMY AND BIOLOGY OF THE INQUILINE ANT, LEPTOTHORAX DIVERSIPILOSUS SMITH
(HYMENOPTERA, FORMICIDAE)

By MARION R. SMITH, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

In 1939 (Proc. Ent. Soc. Wash. 41: 179) I described a new ant, *Leptothorax* (*Mychothorax*) *diversipilosus*, from two workers and an ergatoid female collected by Falconer Smith at Fort Lewis, Wash., from a nest of the western thatching ant (*Formica obscuripes* Forel). The nest was found in the humid Transition Zone at approximately sea level, in an area dominated by Douglas-fir trees and low grass of the genus *Poa*. The soil in the immediate vicinity bore a layer of moss, *Eurynchium oregonum*. After the description was published I studied specimens of *diversipilosus* further and noted the general similarity in habitus, and later in biology, to the well-known inquiline species *Formicoxenus nitidulus* (Nyl.) of Europe and Asia.

Formicoxenus nitidulus has been collected on numerous occasions from the nests of *Formica rufa* L. and *Formica pratensis* Retz. and less frequently from those of *Formica exsecta* Nyl. and *Formica truncorum* F. A. colony of *nitidulus* may be composed of workers, females, forms intermediate between workers and females, and worker-like, wingless males. It is usually small and found fairly deep within the nest of the host ants. The nests of the two species, although distinct from each other, have free intercommunication. Host and guest ant are friendly or tolerant of each other. They do not feed on the other's brood or food, nor do they attempt to feed each other. When the host ants move their nest to a new location, the guest ants trail along in the file with the hosts. On a number of occasions mating between the wingless males and winged females of *nitidulus* has been observed on the exterior of the nest. For a more detailed account of *nitidulus* the reader is referred to Wheeler (Amer. Nat. 35: 535, 1901, and his book "Ants," Columbia Univ. Press, 1910 and 1926 editions, p. 431).

Wishing to secure more specimens of *diversipilosus* and also notes on the biology of this ant, I wrote W. W. Baker of Puyallup, Wash., who found two colonies at Spanaway, Wash., on August 3, 1940. One was within a nest of *Formica obscuripes*, the other in an independent nest in some rotten wood near a colony of *obscuripes*. Concerning colonies found in nests of the host ant, he remarked that he failed to obtain these ants on his first visit to the prairie, because he did not look for their nests in the rotten or punky wood rather deep within the nests of *obscuripes*. It appeared to him as though burrows of other insects were sometimes utilized for nest chambers. He also found small amounts of lichens and dried fungi in the nests apart from the brood chambers, but was not able to ascertain whether or not they were used for food. Among the approximately 150 individuals received from Mr. Baker were numerous workers, females, intermediate forms between workers and females, and a few wingless, workerlike males. Since the female and male of *diversipilosus* have not been previously described, a description of each is given below, as is a figure of the male.

L. diversipilosus has also been collected at Tenino, Wash., by E. A. Schwarz. Should the species be as widely distributed as its host, one may expect to find it in the western provinces of Canada and in the United States from at least the Dakotas to Oregon and Washington and south to Colorado.

A comparison of *diversipilosus* with *nitidulus* shows many striking similarities. Both species have the same castes and intermediate forms, live within the nests of their host ants (various species of *Formica*), and have almost identical habits and a habitus that is so similar as to be more than just superficial. However, the worker of *nitidulus* is distinct from that of *diversipilosus* in color, sculpture, and pilosity. The former is a darker, reddish color and has a rather smooth and polished body and a few simple hairs. The latter, lighter in color, has most of the body (excluding the gaster) punctulate and bearing both simple and clavate hairs. Unlike *diversipilosus, nitidulus* has a lamellate process beneath the petiole and a very long and prominent spine beneath the postpetiole . I believe that *nitidulus* is the more highly specialized of the two. It is entirely possible that future studies based on additional material may prove these species congeneric because of intermediate or annectant forms.

The tribe Leptothoracini (to which both ants belong), as outlined by Emery, 1921 (Wytsman Genera Insect., fasc. 174a, p. 244), is composed of such a large number of species of heterogeneous habits and anatomy that it does not seem wise at this time to attempt to evaluate the taxonomic status or relationship of any of them, especially of *nitidulus* and *diversipilosus*. Only a complete revision of the tribe could possibly accomplish this.

Another North American ant that will probably be found to have habits similar to those of *diversipilosus* is *Leptothorax hirticornis* Emery. This ant was originally described from specimens from Hill City, S. Dak., without reference to host. At the time I described *diversipilosus* I gave characters for distinguishing the worker from that of *hirticornis* as did Creighton, 1950 (Ants of North America, Harv. Univ., Bul. Mus. Compar. Zool. 114: 258). Neither the male nor the typical female of *hirticornis* has yet been described.

It is hoped that some student of ants who has easy access to colonies of *diversipilosus* will undertake a thorough study of the biology of this species and answer for us such questions as to what comprises their food, their method of establishing colonies, and how this habit of becoming a guest originated.

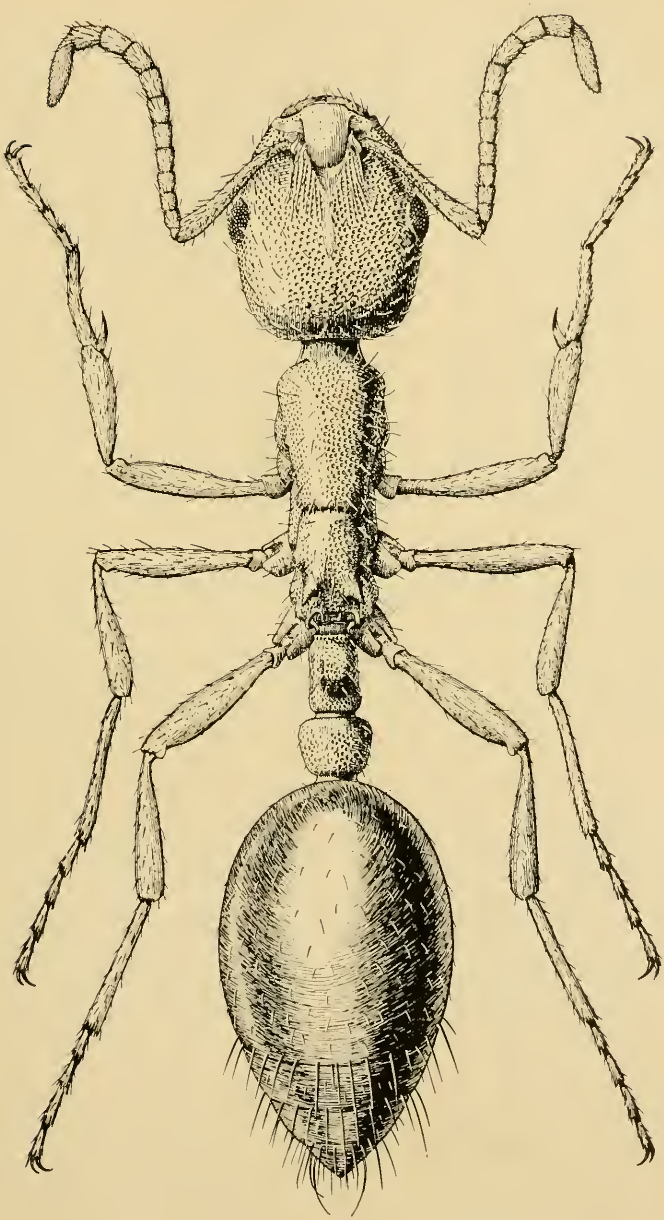


Fig. 1. *Leptothorax diversipilosus* Smith, ergatoid male.

Leptothorax diversipilosus M. R. Smith

Ergatoid male (fig. 1).—Length 2.5-2.75 mm.

Head, excluding mandibles, approximately one-sixth longer than broad, with straight or feebly rounded posterior border, rounded posterior corners and convex sides behind the eyes; sides anterior to eyes converging anteriorly, thus giving the area in the vicinity of the mandibles a narrow, reduced appearance. Eye larger and more convex than that of the worker. Antenna 12-segmented; scape noticeably enlarged toward the apex, not attaining the posterior border of the head; funiculus more slender than that of the worker, the segments progressively enlarged apically but without forming a clearly differentiated club, the three segments preceding the last subequal in length. Clypeus prominent, strongly convex, protruding above and beyond the mandible and partly concealing them; the anterior and posterior borders rounded, the posterior border more rounded than the anterior and extending well between the frontal carinae. Mandible greatly reduced; masticatory margin with a long apical and several small, indistinct teeth. Vertex of head with small, indistinct ocelli. Frontal area poorly defined. Thorax, petiole, and postpetiole similar to that of the worker but more slender. Promesonotal suture obsolete. Postpetiole more convex dorsally than that of the worker. Gaster similar to that of worker, when viewed from above, with the first segment occupying almost all of the dorsal surface; genitalia concealed.

Hairs moderately abundant, simple, grayish, short, suberect to erect; some of the hairs on the head and appendages appear to be a little thicker than those on the remainder of the body and to assume a slightly clavate form, especially a small number on the vertex of the head. Hairs at apex of gaster the longest.

Head, thorax, petiole and postpetiole punctate, subopaque; scape, femur and tibia more finely punctate, almost shining in certain lights. Most of the clypeus, frontal area, a median line or spot on front of the head, and gaster, smooth and shining.

Color dirty ferruginous, lighter than that of the worker; gaster dark brown, almost black.

Described from eight males collected at Spanaway, Wash., on August 3, 1940, by W. W. Baker and one male collected at Tenino, Wash., by E. A. Schwarz.

The male closely resembles the worker, but can be distinguished from that caste by an additional segment to its antenna, and also by its more slender funiculus; the greatly narrowed head in the vicity of the mandibles; the reduction in the size of the mandible and in the number of well-developed teeth; the presence of ocelli; the less stout petiole and postpetiole; the presence of male genitalia, although these are usually concealed at the apex of the gaster; the absence of distinctly clavate or capitate hairs on the tips of the femur, tibia, and metatarsus; the weaker sculpturing of the body, and the lighter color.

Dealate Female.—Length 3-3.5 mm.

Similar to the worker except for the following: Larger, stouter and more deeply colored. Eye larger and more convex. Thorax with the usual sclerites typical of a female (queen); viewed from above, with prominent but rounded humeral angles and a distinct constriction or concavity on each side of the body anterior to the insertions of the front pair of wings.

Described from four females collected at Spanaway, Wash., and two females from Tenino, Wash. The females from Tenino are similar to those from Spanaway except that they are lighter in color.

CHRYSIS FUSCIPENNIS BR., A RECENT ADVENTIVE WASP IN WASHINGTON, D. C., FROM THE OLD WORLD

(HYMENOPTERA, CHRYSIDIDAE)

Recent captures of *Chrysis* (*Chrysis*) *fuscipennis* Brullé in Washington, D. C., indicate that it is now an established member of the Nearctic fauna. The first specimen, a female, was caught alive by T. P. Cassidy in an office of the South Building of the Department of Agriculture in downtown Washington on July 28, 1953. A pair was taken by Miss Hazel Wharton in an office of the same building on June 8 and 27, 1956. I captured another female when it flew into an office in the U. S. National Museum on June 26, 1956. This species has a wide distribution in the Old World, where it occurs in the eastern half of the Palaearctic Region, and in the Oriental and Australian Regions. Several years ago it became established in Hawaii (Pemberton, 1952, Proc. Hawaii. Ent. Soc. 14: 360).

C. fuscipennis has been recorded as a parasite of *Eumenes conica* (F.) in India (Bingham, 1899. Jour. Bombay Nat. Hist. Soc. 12: 586). No adventive eumenine wasps have been captured in Washington, and the host species of the chrysidid in this area are unknown. However, the chrysidid presumably could effect its development on any of our native mud-daubers such as the species of *Eumenes, Sceliphron, Chalybion,* or *Trypoxylon politum* Say.

C. fuscipennis may be distinguished readily from any of our native species by the following combination of characters: very dark wings; malar space 0.4 times as long as first segment of antennal flagellum; facial concavity punctate, the punctures confluent in transverse rows; anterior ocellus enclosed by a semicircular ridge arising from the straight transverse facial ridge; dorsal length of head a little greater than pronotal length; lateral margin of third abdominal tergum slightly concave or sinuate; and apical teeth of third tergum short and obtuse, the median teeth closer to each other than to the lateral teeth.—KARL V. KROMBEIN, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

BOOK REVIEW

DIE WANDERAMEISEN DER NEOTROPISCHEN REGION, by Thomas Borgmeier. Studia Entomologica Nr. 3, 716 pp., 87 plates, 1955. Editora Vozes Limitada, Petropolis, R. J., Brazil. Price $15.00.

It is fortunate that so difficult a group of ants as this should have been revised by one who is not only an accomplished myrmecologist but a scholar and editor as well. Legionary ants differ from most ants in that the worker, female and male of a species bear little or no resemblance to each other. The female is wingless and somewhat termitiform in appearance, the male wasplike. Since it is impossible to associate the various castes of a species without collecting them from the same colony, the describing of species from a single caste alone has resulted in numerous errors of synonymy. In addition to such difficulties, previous American workers have been greatly handicapped by the fact that most of the types of our legionary ants are in European Museums. In revising the group Dr. Borgmeier has very conscientiously and patiently attempted to see the type of every described form. Fortunately he was able to examine approximately 80 percent of the types; those that he did not see were either dstroyed, lost or misplaced. Even with the great amount of synonymy that he was able to accomplish, there are at present 140 forms recognized as valid, the names of many of which rest on a single caste alone! When all the castes of these 140 forms are known it would not be surprising if the total number of valid forms is not reduced to 100.

Dr. Borgmeier's revision is one of the largest and most comprehensive that has ever appeared on ants and will remain forever as a monument to his endeavours. Examination will show that he has carefully considered every aspect that an excellent revision should include. There are keys for the known castes of all forms from subspecies to tribes. A large number of the forms are fortunately figured once or more. The known castes of every form are adequately described and the repository of the type stated. Under each form there is a statement concerning material studied and the general distribution of that form. There are also remarks on variation and biology. Bibliographical references are arranged chronologically in order to cover all important changes in the taxonomic status of a form such as synonymy, new combinations, etc. The reader will be especially pleased to note that Dr. Borgmeier has quoted not only the original description of each form but the original description of every synonymized form as well! The revision is carefully indexed. I would have preferred, however, to list the page number of the text treatment of each form at the proper place in the key rather than in the index at the back of the publication. A statement concerning the general distribution of a form might be helpful in an appropriate place in the key. In addition to the subjects mentioned, the revision contains in the general introduction such subjects as methods and techniques, sources of material for the study, acknowledgements, relationships and limits of various taxonomic categories, status of subspecies and varieties, and a general discussion of systematics. Any publication, regardless of its excellence, must necessarily contain a certain number of errors. I have especially noted these in reference to names of localities and individuals.

What Borgmeier has accomplished for the taxonomy of the legionary ants, Dr. T. C. Schneirla has done for their biology, so that either aspect of the group is now well known. Their work will form dependable corner stones on which future contributions can easily be added.

The publications of both men should not only be in the libraries of all myrmecologists but in every department of biology and also in general libraries that give consideration to biological subjects.—MARION R. SMITH, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

ON THE GENUS STRONGYLOCORIS BLANCHARD, 1840
(Hemiptera, Heteroptera, Miridae)

By Eduard Wagner, *Hamburg, Germany*

The genus *Strongylocoris* Blanchard hitherto has been regarded as Holarctic. There have been recorded 10 species from the Old World and about 12 from America. The American species, however, are not congeneric with the Palaearctic ones. The first to point out this fact was Slater (1950). After having examined the female genitalia of *S. stygicus* (Say) and *S. leucocephalus* (L.), he wrote: "It is interesting to discover that the type species of the genus, *leucocephalus*, is apparently not congeneric with the North American *stygicus*." He concluded from this fact that it seemed to be necessary to ascertain the actual generic limits. The following paper is an essay to show these limits.

Female Genitalia

In his excellent work Slater (1950) showed the differences between *S. leucocephalus* (L.) and *stygicus* (Say) in the structure of the bursa copulatrix. The sclerotized rings of *S. stygicus* were found to have the typical Orthotylinae infolding of the lateral margin and were very similar to those of *Orthotylus modestus* Van Duzee. The posterior wall is composed of an L- and two J- structures, shows a very distinct K-structure and is suggestive of *O. ornatus* Van Duzee. *S. leucocephalus* has a very complicated form of the sclerotized rings. The posterior wall could not be studied by Slater.

The author has examined the female genitalia of several Nearctic and Palaearctic species. The American species proved to be very similar to *S. stygicus* and showed the Orthotylinae type. The European species, however, were quite different from them. The bursa copulatrix in any case was much smaller. The sclerotized rings showed the same complicated form as those of *S. leucocephalus*. The posterior wall was scarcely half as wide in the European species and showed distinct structures that seemed to be A-structures, E-structures and a B-structure. As Slater states, they appear to approach the Capsinae type.

The examination of some species of *Heterocordylus* Latr. showed a great resemblance to the American species of *Strongylocoris*. These facts seem to be a very good reason to separate the American species from those of Europe.

Male Genitalia

The genital segment is conical in the Palaearctic species. It is very broad at its base and the sides converge strongly (figs. 1 and 2). The genital opening is small. With the Nearctic species the genital segment is trapezoidal, broad at its apex and the sides converge slightly (fig. 3). The genital opening is very wide and bears on its left side a blunt process.

The right paramere is of a very unique type in all Palaearctic species (figs. 5 and 6). It is spoon-shaped, its basal part very long and straight. In the Nearctic species (figs. 7 and 8) the right paramere is of different shape. It is toothed and branched, the basal part being quite small.

The left paramere (figs. 10-15) does not show great differences between the American and European species.

The aedeagus, however, is very different. In the Palaearctic species (fig. 16) it is thick and short, suddenly narrowed in its middle. The vesica has only membranous appendages and lacks any chitinized parts. In the Nearctic species (fig. 17) the aedeagus is more slender and pointed at its apex. The vesica has no membranous appendages, but consists of two chitinized bands, which are toothed and somewhat branched. *Heterocordylus* (fig. 18) shows the same shape of aedeagus as the American species.

Much stress is here placed on the structure of the vesica. The differences shown above are sufficient reason to separate Nearctic and Palaearctic species and to constitute a new genus for those of the Nearctic.

Head

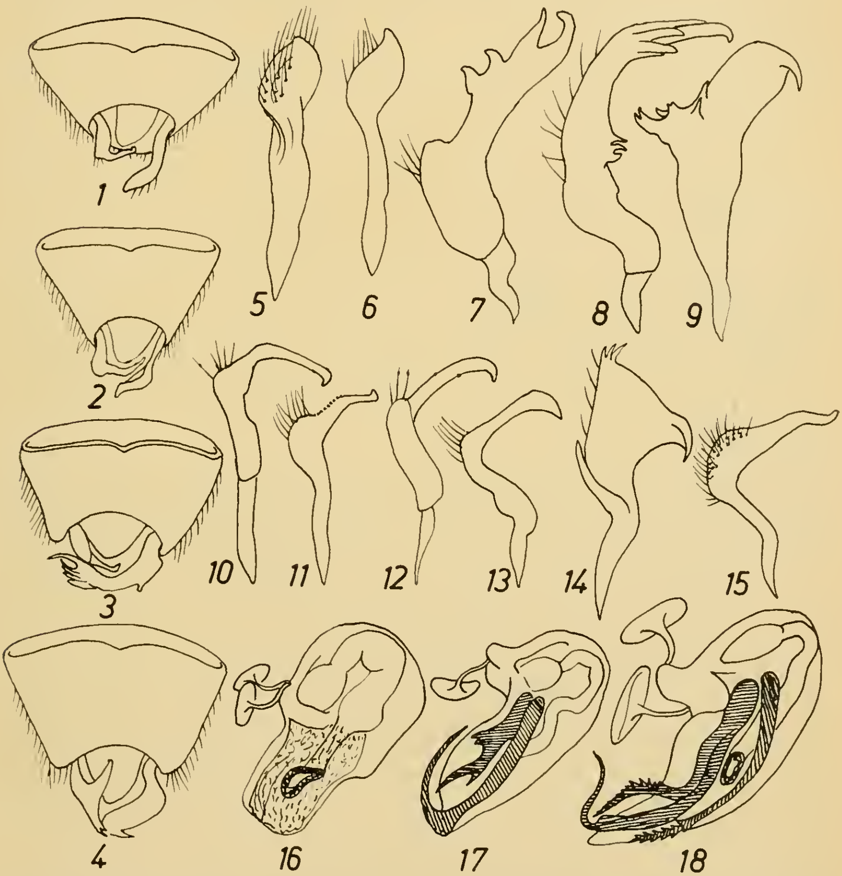
The head of the Palaearctic species (figs. 19 and 20) is, when seen from above, very short and broad. The antennal fossa is well separated from the margin of the eye, the minimal space between the two is greater than the diameter of the antennal fossa. Seen from the side (figs. 23 and 24), the vertex is almost adpressed to the pronotum and somewhat covering its anterior margin. The space between the eye and the apex of the clypeus is at least as great as the height of the eye. The first segment of the rostrum is nearly as thick as the eye is broad. In the Nearctic species (fig. 21) the antennal fossa almost touches the eye. The front has two ocellus-like spots. The vertex is well separated from the pronotum (fig. 25). The distance between the eye and the apex of clypeus is less than the height of eye. The first segment of rostrum is much narrower than the breadth of eye.

Claws

In the Nearctic species (fig. 29) the arolia as well as the pseudarolia are well developed and membranous; in the Palaearctic species (fig. 27 and 28) the arolia are also well developed and membranous; the pseudarolia, however, are replaced by a pair of straight bristles.

Conclusions

The differences shown above make it evident that the Nearctic species of *Strongylocoris* are not congeneric with the Palaearctic ones. The differences in the form of the female genitalia and those of the aedeagus of the male without any doubt are of generic value. But as there are also external differences, the genera are easily separated without reference to genitalic characters. Therefore it is necessary to make two genera of the genus hitherto treated as *Strongylocoris* Blanchard. The genotype of this genus, *S. leucocephalus* (L.), belongs to the Palaearctic genus. Therefore the name *Strongylocoris* Blanchard must remain with this genus. The Nearctic genus, on the other hand, must have a new name. As there is no name available for it, I propose to name the genus in honor of Dr. James A. Slater who first called attention to the difference between the females of the Nearctic and Palaearctic species.



Figs. 1-18, male genitalia. Figs. 1-4, genital segment from above (22.5X); figs. 5-9, right paramere (47.5X); figs. 10-15, left paramere (47.5X); figs. 16-18, aedeagus (47.5X). Figs. 1, 5, 10, 16, *Strongylocoris leucocephalus* (L.); fig. 2, *S. atrocoeruleus* (Fieb.); figs. 3, 8, *Slaterocoris stygicus* (Say); figs. 4, 14, *Heterocordylus erythrocephalus* (Hhn.); figs. 6, 11, *Strongylocoris niger* (H.-S.); figs. 7, 12, 17, *Slaterocoris pallipes* (Kn.); fig. 13, *Slaterocoris atritibialis* (Kn.); fig. 9, *Heterocordylus flavipes* E. Wgn.; fig. 15, *Pseudoloxops coccinea* (M. D.); fig. 18, *Heterocordylus tibialis* (Hhn.).

Slaterocoris, novum genus
(Type species: *Capsus stygicus* Say)

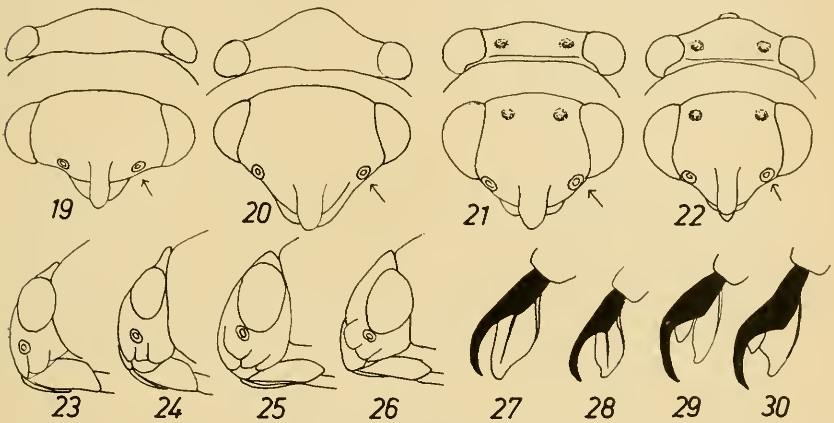
Generic description.—Body almost glabrous, sometimes covered with a fine semierect pubescence, but without scale-like hairs. Form oval. Always macropterous. Head strongly inclined. Posterior margin of vertex not adpressed to the pronotum and not having a ridge from eye to eye.

Pronotum and hemelytra shining, densely punctured. Antennae slender, with a very fine pubescence, the second joint as a rule shorter than the two apical joints taken together. Rostrum very short, the second and third joint being thicker at their connection. Legs slender. Tibiae with fine spines. Arolia and pseudarolia of the claws well developed and membranous. Genital segment of male very short and broad, trapezoidal. Genital opening very wide. Right paramere toothed and branched, of different shapes. Left paramere slender, falciform. Aedeagus without membranous parts, with two chitinized bands, which are toothed and branched.

I have examined four species of this new genus (*pallipes* Knight, *stygicus* Say, *atritibialis* Knight, *atratus* Knight). The excellent figures provided by Knight (1941) show that *S. hirtus* Knight, *ambrosiae* Knight and *breviatus* Knight also belong to this genus. It will be necessary to examine the rest of the Nearctic species in order to find out whether they belong to this genus or not. I leave this question to be solved by my American colleagues, who may have access to the material. Of the Palaearctic genus *Strongylocoris* Blanch. I have examined seven species (*niger* H.-S., *atrocoeruleus* Fieb., *leucocephalus* L., *erythroleptus* Costa *luridus* Fall., *obscurus* Rmb., *cicadifrons* Costa).

The genus *Slaterocoris*, nov. gen., does not belong to the tribe Halticini Kirk. It is quite different from this tribe since its aedeagus lacks membranous parts, but has two chitinized bands in the vesica. The female genitalia also differ by having distinct K-structures in the posterior wall of the bursa copulatrix. In addition, the pseudarolia are well developed and membranous. All these facts show that it must be removed to the tribe Orthotylini Van Duzee. Within this tribe it comes very near to the genus *Heterocordylus* Fieber, 1858, and especially its subgenus *Bothrocranum* Reuter, 1876. It agrees with this genus in having ocellus-like spots on the front, the antennal fossa nearly touching the eye, the large eye, the slender first segment of rostrum (figs. 25 and 26), the claws having well-developed pseudarolia (figs. 29 and 30), the posterior wall of the female bursa copulatrix having distinct K-structures and the chitinized bands of the male aedeagus being very similar (figs. 17 and 18), as well as by the form of the genital segment (figs. 3 and 4). It differs, however, from this genus by the rostrum which is very slender in *Heterocordylus,* the second joint of antennae which is longer than the two apical joints taken together, and the absence of scale-like pubescence on the body.

In the case of the genus *Strongylocoris* Blanch., the tribes Orthotylini and Halticini seemed to intergrade. The examination of the genus, however, showed that there was a mistake in the systematic position of a part of the genus. The correetion of this mistake has made both tribes more homogenous. The opinion of Carvalho (1952), p. 34) : "the genitalia alone have been found to be misleading in many respects" may have been based upon similar mistakes in the systematic position of genera and groups. It will be necessary to check all those cases. I suggest that the result will be that the genitalia are a very good criterion, as I could state already with all Palaearctic genera.



Figs. 19-30, Head and claws. Figs. 19-22, head seen from above and from the front (18X) ; figs. 23-26, head seen from the side (18X) ; figs. 27-30, claws (135X). Figs. 19, 23, 28, *Strongylocoris niger* (H.-S.) ; fig. 20, *S. luridus* (Fall.) ; figs. 21, 25, *Slaterocoris pallipes* (Kn.) ; figs. 22, 26, 30, *Heterocordylus erythrophthalmus* (Hhn.) ; figs. 24, 27, *Strongylocoris leucocephalus* (L.) ; fig. 29, *Slaterocoris atritibialis* (Kn.).

Ackowledgments

My best thanks are due to Professor Remington Kellogg and Dr. Reece I. Sailer of the U. S. National Museum, Washington, who sent me the material of the American species. I wish to extend thanks also to Professor H. H. Knight, Iowa State College, Ames, and Dr. José C. M. Carvalho, Rio de Janeiro, for literature which they have kindly sent to me.

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A NEW ARRANGEMENT IN THE SUBFAMILY CYMINAE

(Hemiptera, Lygaeidae)

By Harry G. Barber, *Collaborator, Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

Stål, 1874, separated the Cyminae into two divisions, Cymaria and Ischnorhynchinaria. Since that time systematists have followed Stål and included the *Ninus* group of species in the tribe Ischnorhynchini. As this group of species have very distinctive characteristics readily separable from the Ischnorhychini, it should be raised to equal tribal rank and called Ninini.

Key to Tribes of the Subfamily Cyminae

1. Hemelytra coriacous, densely punctate; costal margins gently convex, not contracted towards base; claval margins not parallel, commissure longer than scutellum (*Cymus*) .... Cymini

   Hemelytra most commonly hyaline or subhyaline, sparsely punctate; costal margins either strongly convex or contracted towards base; claval margins parallel, in which case commissure shorter than scutellum, or clavus more or less expanded apically, in which case commissure subequal to length of scutellum 2

2. Head more or less porrect, much narrower than baasl margin of pronotum; eyes mediocre, neither projected nor stylate, most commonly in contact with anterior angles of pronotum; ocelli set much farther apart than each is removed from eye. Hemelytra expanded, costal margins convex; claval margins parallel; commissure commonly shorter than scutellum. Body glabrous (*Kleidocerys*) .... Ischnorhynchini

   Head more or less deflexed anteriorly nearly or quite as wide as basal margin of pronotum; eyes either projected or stylate, remote from anterior angles of pronotum; ocelli set nearly as far apart as each is removed from eye. Costal margins of corium strongly contracted towards base; clavus more or less expanded apically; commissure subequal to length of scutellum. Body pilose (*Ninus*) .... Ninini

List of the genera under the respective tribes:

Cymini: *Cymus* Hahn; *Cymodema* Spin.; *Arphnus* Stål; *Cyrtohamphus* Stål; *Gonystus* Stål; *Karamania* Korm; *Ontiscus* Stål; *Sephora* Kirk. for *C. criniger* White; *Nesocymus* Kirk. for *C. calvus* White; *Neocymus* Van D.; *Pseudocymus* Van D.

Ischnorhynchini: *Kleidocerys* Steph.; *Polychisme* Kirk. for *Imbrius* Stål; *Crompus* Stål; *Neocrompus* China; *Rhiobia* Bergr. (= *Domiduca* Dist.); *Rhiophila* Bergr.; *Pylorgus* Stål; *Mesostates* Reut.; *Hovania* Horv.; *Syzgitis* Bergr.

Ninini: *Ninus* Stål (= *Ossipaga* Dist.); *Cymoninus* Bred.; *Neoninus* Dist.; *Ninomimus* Lundb.; *Nesomartis* Kirk.

NOTES ON THE BIONOMICS OF THE NATURAL ENEMIES OF THE INSECTS ON MIRABILIS[1]

Clifford Wester, *911 No. Ninth St., Stroudsburg, Pa.*

Introduction

In two previous numbers of these *Proceedings,* I presented articles dealing with the bionomics of insects associated with the wild four-o'clock plant, *Mirabilis nyctaginea* (Michaux) MacMillan, in central Illinois. The first of these articles treated two micromoths, *Heliodines nyctaginella* Gibson, whose larva feeds on the leaves of *M. nyctaginea*, and *H. ionis* Clarke, which develops as a borer in the stems of *M. nyctaginea.* The second article described the life history of the snout beetle, *Onychobaris subtonsa* Leconte, whose larva is also a borer in the stems of *M. nyctaginea.*

During my investigation of the life histories of the insects named above, I found that these three species were subject to attack by certain insect enemies. The present article concerns the bionomics of these natural enemies, which include two braconid and four chalcid parasites, and one hemipterous predator. Reared specimens of all six species of parasites were sent to the United States National Museum, Washington, D. C., for identification.

Parasites

Bracon caulicola (Gahan)
(Hymenoptera, Braconidae)

Hosts.—Heliodines ionis Clarke (Lepidoptera, Heliodinidae). *Onychobaris subtonsa* Leconte (Coleoptera, Curculionidae).

Bracon caulicola is a solitary external parasite on the boring larvae of both *Heliodines ionis* and *Onychobaris subtonsa.* The number of parasitic larvae found feeding on each of the two hosts were approximately equal, and there seemed to be no preference for either host. Parasitized larvae of the two hosts were most common from early July to late August.

Oviposition is probably accomplished by thrusting the ovipositor through the stem into the larval burrows of the host. The host is permanently paralyzed, and one parasitic egg is deposted on its body.

The duration of the larval feeding period is about three days, in which time the larvae of *caulicola* become full-grown and reach a length of about five millimeters. Then they leave the remains of the host and begin to spin their cocoons nearby almost immediately. The cocoons are at first translucent but in about three days become light brown and opaque.

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[1]This article is part of a thesis submitted to the Faculty of the Graduate College of the University of Illinois in partial fulfillment of the requirements for the degree of Doctor of Philosophy, 1954.

Pupation occurs about two days after the completion of the cocoon, and the duration of the pupal period varies from six to nine days. Upon emerging, each adult chews an exit hole through the stem to escape from the burrow of the host.

B. caulicola probably overwinters as a full-grown larva inside its cocoon in the larval burrows of its host. Overwintering larvae of the parasite were found inside the hibernacula of *Onychobaris subtonsa* during the months of November and January, and were brought into the laboratory, where they emerged as adults from late in January to late in February.

Muesebeck, Krombein, and Townes (1951) list only lepidopterous hosts for this species.

Bracon gelechiae Ashmead
(Hymenoptera, Braconidae)

Host.—Heliodines nyctaginella Gibson (Lepidoptera, Heliodinidae).

Bracon gelechiae is a solitary external parasite on the leaf-eating larvae of *Heliodines nyctaginella*, and according to my observations, attacks only the fifth instars of the host. Parasitized larvae of the host were most common from late July to late August.

Oviposition is probably accomplished by thrusting the ovipositor through the web under which the host feeds, since in every case the permanently paralyzed larva of *nyctaginella* was lying under a web when found. Only one parasitic egg is laid on each host.

The parasite begins to feed at the point where the egg is attached to the host, but does not remain there during the entire larval stage. It soon begins to move about over the body of the host and attaches its mouth parts at various points to feed. It becomes full-grown in about two days, and in that time reaches a length of about three millimeters.

The parasite begins to spin its cocoon near the remains of the host almost immediately after becoming full-grown. Pupation takes place about one day after the cocoon is completed. The pupal period varies from five to seven days.

Tetrastichus coerulescens Ashmead
(Hymenoptera, Eulophidae)

Host.—Heliodines ionis Clarke.

Tetrastichus coerulescens is an internal gregarious parasite of the pupae of *Heliodines ionis* in the stems of the wild four-o'clock plant. In one instance, I counted 40 adult *coerulescens* that emerged from one pupa of the host. In this case, the pupal shell of *ionis* burst before the parasitic larvae pupated. The smallest number that I observed to emerge from a single pupa of the host was 10, and the average number of parasites in each host was about 22.

By way of clarifying the probable oviposition of *T. coerulescens* in *H. ionis*, I restate that the full-grown borer hollows out a cavity in the stem, chews a hole in the stem for the escape of the adult, then spins a silken septum across the cell just behind this exit hole. Behind the septum, *ionis* pupates. I believe that the female *T. coerulescens* probably enters the cavity by way of the exit hole before the septum is made and oviposits in the mature *ionis*. It does not seem likely that she can penetrate the septum to oviposit directly into the pupa, and the ovipositor of the adult a bare milimeter long probably can not reach the host larva or pupa by boring through the stem wall of the plant.

Although the eggs are inserted into the full-grown larva of the host, larval development of the parasite does not take place until the host has pupated. The parasite pupates within the pupal shell of *ionis*, and the adults upon emerging chew one or two exit holes in the pupal case of the host to escape from it.

T. coerulescens probably overwinters as a full-grown larva inside the pupal shell of *ionis*. It probably enters diapause during the pupation period of the second generation of *ionis*, which extends from late in July to the middle of August. Dormant full-grown larvae of *coerulescens* were found during the month of November inside pupal shells of *ionis* that evidently had been formed while the plant was still growing, since the exit holes which are made in the stems by *ionis* just prior to pupation were almost closed by the growth of the plant.

Since the third generation of *ionis* overwinters in the larval stage and does not chew the exit holes in the stems until just prior to pupation in the spring following the summer in which the larvae developed, it does not seem likely that *coerulescens* could overwinter in this generation of the host.

The dormant larvae of the parasite found during November, and brought indoors, emerged in the laboratory as adults during December.

Eupelmus allynii (French)

(Hymenoptera, Eupelmidae)

Host.—*Heliodines ionis* Clarke.

Eupelmus allynii is a solitary external parasite on the larvae of *H. ionis*. Oviposition is probably accomplished by thrusting the ovipositor through the stem into the larval burrows of the host. The parasite permanently paralyzes the host and deposits one egg on its body.

The full-grown parasitic larva is about 3.5 millimeters in length, and it eliminates the meconium about two days after it ceases to feed. Pupation follows in another two days. The pupal stage varies from six to eleven days, and the emerging adult chews an exit hole through the stem to escape from the larval burrow of the host.

Parasitized larvae of the host were most common from early July to early August.

Only one dormant parasitic larva of this species was found in the dead stems of the wild four-o'clock plant. It was found inside the silk-lined overwintering cell of *ionis* on January 19, 1953, and it emerged as an adult in the laboratory on February 11 of the same year.

Eupelmus cyaniceps Ashmead
(Hymenoptera, Eupelmidae)

Host.—Heliodines ionis Clarks.

Eupelmus cyaniceps is a solitary external parasite on the larvae of *H. ionis.* Oviposition is probably accomplished by thrusting the ovipositor through the stem into the larval burrows of the host. The host is permanetly paralyzed, and one egg is laid on its body.

E. cyaniceps overwinters as a full-grown larva inside the silk-lined cells of the host in the dead stems of *M. nyctaginea.* Dormant larvae of the parasite found during January and early February emerged in the laboratory as adults late in February.

Neocatolaccus tylodermae (Ashmead)
(Hymenoptera, Pteromalidae)

Host.—Onychobaris subtonsa Leconte.

Neocatolaccus tylodermae is a solitary parasite of the larvae of *O. subtonsa.* Its pupal period is about ten days. Only one overwintering larva of this species was found in the dead stems of the wild four-o'clock. It was found inside a hibernaculum of *subtonsa* on January 19, 1953, and it emerged in the laboratory as an adult on February 10 of the same year.

Muesebeck, Krombein, and Townes (1951) list only curculionid hosts for this parasite.

PREDATOR

Orius insidiosus (Say)
(Hemiptera, Anthocoridae)

Prey.—Heliodines nyctaginella Gibson.

The insidious flower bug, *Orius insidiosus*, preys on the smaller larvae, principally first and second instars, of *H. nyctaginella* as they feed among the flower-clusters of the wild four-o'clock plant. The first instars of *nyctaginella* are particularly vulnerable, since they do not feed under webs in the manner of the other instars and thus are open to attack at any time. The second instars are attacked when they leave the protective web under which they feed. In no case did I observe *insidiosus* attacking a larva that was under a web.

The method of attack by this bug is somewhat striking. It circles slowly around a particular larva of *nyctaginella* several times, and at a distance of about five millimeters. Then it stops, extends its proboscis, races towards its prey, and rams it. As soon as the proboscis penetrates the larva, the predator backs up to its starting point, dragging its prey with it, and begins to feed.

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REDESCRIPTION OF TUMIDALVUS AMERICANA EWING AND HYPOCHTHONIUS CROSBYI EWING

(ACARINA: ORIBATEI, HYPOCHTHONIIDAE)[1]

By TYLER A. WOOLLEY, *Zoology Department, Colorado A & M College, Ft. Collins.*

A new genus and species of oribatid mite, *Tumidalvus americana,* was described by Ewing (1908) in the family Oribatidae. Initially he suggested a generic relationship with *Lohmannia* and in a subsequent publication (1917) listed *Tumidalvus, Lohmannia* and *Trhypochthonius* in the subfamily Lohmanninae, family Nothridae. In 1909 Ewing described *Hypochthonius crosbyi* as a new species in the same family. Both *Tumidalvus americana* and *Hypochthonius crosbyi,* however, demonstrate the familial characteristics of *Hypochthoniidae* Berlese, 1910, and should be included in this family. The generic features of *Tumidalvus* are characteristic of *Trhypochthonius* as described by Willmann (1931). This also agrees with Baker and Wharton (1952), who synonomized *Tumidalvus* with *Trhypochthonius.*

Consideration of descriptions and drawings of *Tumidalvus americana* Ewing, 1908, clearly indicates that the generic features are those of *Trhypochthonius* Berlese, 1905. The specific characters, however, appear to be distinctly different from others of the genus. The principal differences are the median posterior projection of the hysterosoma and the barbed dorsal hairs. These characteristics, in the opinion of the writer, constitute evidence for the validity of the species, but change the generic designation to *Trhypochthonius.* This alteration also necessitates the revision of the specific name to *americanus* to agree with the generic noun.

Since *Hypochthonius crosbyi* Ewing, 1909, has two hysterosomal sutures, it resembles *Hypochthoniella* Berlese, 1910, and would fall in *Hypochthoninae* Jacot, 1936, on the basis of "an abdomen with one or more transverse divisions." Baker and Wharton (1952), however, make *Hypochthoniella* a synonym of *Hypochthonius.* The writer is of the opinion that the name *Hypochthonius crosbyi* Ewing, 1909, should be retained. This species resembles H. *rufulus* Koch and H. *pallidula* (Koch) in body form, setation and arrangement of pseudostigmatic organ. The main differences lie in the simple pseudostigmatic organ and in hysterosomal sutures. While all of the specific relationships are not obvious, further investigations of North American species may disclose additional generic and specific affinities.

Ewing's original accounts have been followed generally in this writing, but the author has employed more recent terminology and has clarified certain aspects of the descriptions.

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[1]Research supported by a grant from the National Science Foundation. Pencil drawings of these species were provided by Dr. E. W. Baker of the U. S. Department of Agriculture.

Trhypochthonius americanus (Ewing)
(Figures 1, 2)

Type: *Tumidalvus americana* Ewing, 1908, Ent. News 19:244. From moss, Arcola, Illinois, by H. E. Ewing.

Diagnosis.—Hysterosoma with a prominent median tubercle at posterior end; propodosomal and hysterosomal bristles barbed; surfaces of propodosoma and hysterosoma with small rounded tubercles of almost uniform size.

Description.—Color light yellowish brown. Propodosoma nearly as broad as long, somewhat triangular, with rounded anterior end; without lamellae; bearing three pairs of barbed hairs. Rostral bristles about half as long as propodosoma, inserted slightly less than half their lengths from anterior margin, straight, directed anteriorly. Lamellar hairs approximately same length as rostral hairs, somewhat stouter, slightly curved, inserted about a third their lengths posterior and slightly laterad of insertions of rostral hairs. Interlamellar hairs nearly a third longer than lamellar hairs, inserted between pseudostigmata, directed laterad. Pseudostigmata short and cylindrical, in latero-posterior angle of propodosoma, about their widths laterad of insertions of interlamellar hairs. Pseudostigmatic organs about two-thirds as long as interlamellar hairs, with a narrow pedicle and a barbed, elongate, clavate tip.

Hysterosoma about three-fifths as broad as long, surface covered with small rounded uniform tubercles; with a prominent median swelling as posterior end. Dorsal hysterosomal setae barbed, in two main rows (fig. 1). Dorsal plate extended ventrally and continuous with ventral plate (fig. 2).

Camerostome oval, palps prominent; mandibles chelate, with two pairs of setae; other ventral bristles as shown in Figure 2.

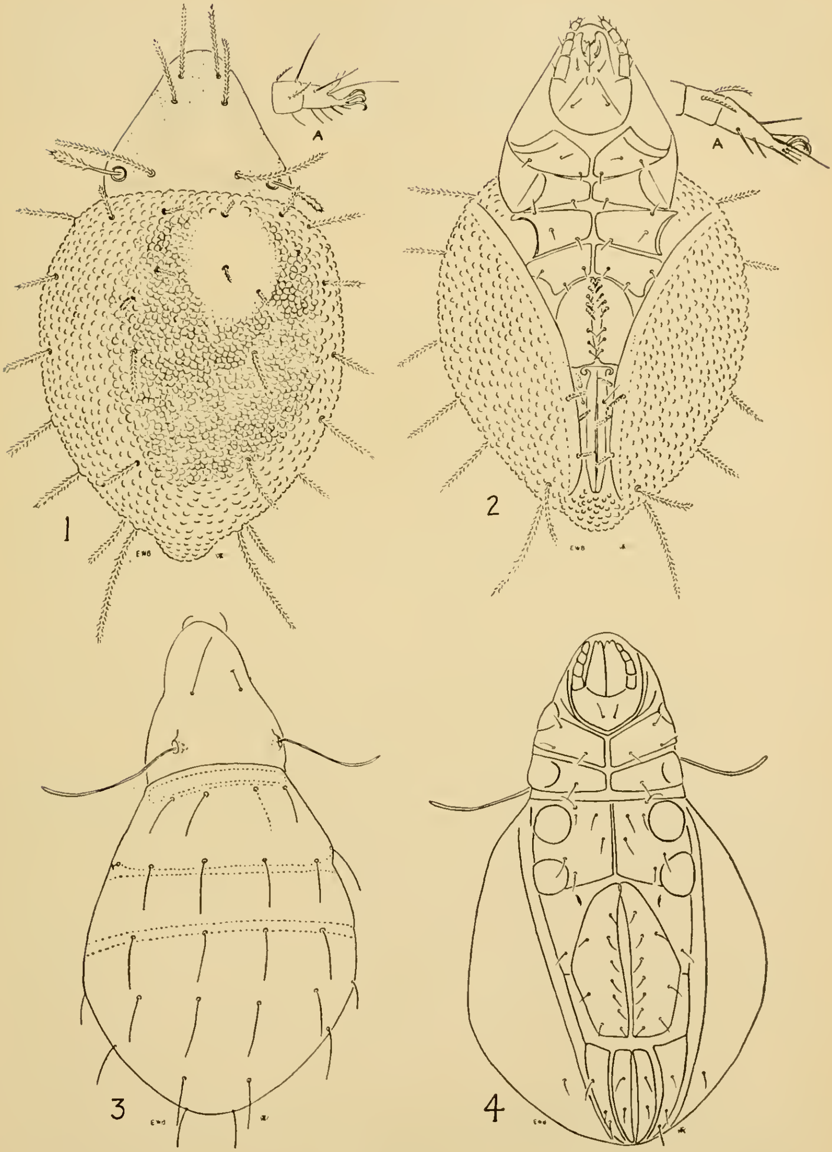
Genital covers contiguous with anal covers, longer than broad and somewhat crescent-shaped, blunt posteriorly, about two-thirds as long as anal covers. Eight genital setae on each cover, anterior five setae serrate, posterior three simple.

Anal covers long and narrow, slightly wider at anterior end, posterior ends narrowed into blunt, projecting points; each cover with three setae (fig. 2). Two pairs of prominent serrate adanal setae in margin of ventral plate.

Legs short and stout, anterior pair about as long as propodosoma; tarsus I as in fig. 1A; tibia IV about as broad as long, tarsus IV nearly twice as long as tibia (fig. 2A). Legs with pectinate setae on segments other than tarsi; tarsi with simple bristles, tridactyle.

Length 533 μ, hysterosoma 380 μ; width 320 μ.

Discussion. —*T. americanus* (Ewing) differs from other North American species of *Trhypochthonius* in the prominent posterior hysterosomal projection and in the prominent barbed hysterosomal hairs. Hammer (1952) lists two European species of this genus from Northern Canada, *T. tectorum* (Berl.) and *T. barius* (Berl.). Neither of these species exhibits the hysterosomal protuberance so distinctive for *T. americanus. T. tectorum* (Berl.) does have barbed hysterosomal hairs, some of which are less conspicuous than others; the hysterosomal surface also resembles the dorsum of *T. americanus. T. americanus* (Ewing) differs most noticeably from *T. badius.*



Trhypochthonius americanus (Ewing): fig. 1, dorsal aspect; fig. 1a, tarsus I from dorso-lateral aspect; fig. 2, ventral aspect; fig. 2a, tarsus IV from lateral aspect (after Ewing). *Hypochthonius crosbyi* Ewing: fig. 3, dorsal aspect; fig. 4, ventral aspect.

Seven specimens of *Trhypochthonius americanus* (Ewing) were collected by the writer at Fish Creek Camp Ground, Roosevelt National Forest, Colorado, October 3, 1953. These specimens are larger than Ewing's with a total length of 571 μ and a hysterosomal length of 428 μ. The posterior hysterosomal tubercle was also slightly smaller than the described species.

Hypochthonius crosbyi Ewing

(Figures 3, 4)

Hypochthonius crosbyi Ewing, 1949, Jour. N. Y. Ent. Soc. 17:132. In trash at Columbia, Mo., by C. R. Crosby.

Diagnosis.—Simple, flagelliform pseudostigmatic organs and two transverse hysterosomal sutures.

Description.—Color light yellowish brown. Propodosoma triangular in shape with shallow lateral indentations midway posterior, nearly one and one-half times as long as broad, less than twice the length of hysterosoma. Rostral bristles simple, curved, short; inserted nearly twice their lengths from each other on antero-lateral edges of rostrum. Lamellar hairs simple, inserted slightly more than their lengths from anterior margin of rostrum and about three-fourths their lengths from each other. Interlamellar hairs absent. Pseudostigmata low, bowl-shaped, conical beneath surface of propodosoma (fig. 3). Pseudostigmatic organ long, flagelliform, as long as propodosoma, curved outward and upward.

Hysterosoma oval in outline, overlapping propodosoma at anterior margin; with two transverse sutures, the anterior suture about one-fourth length of hysterosoma from anterior margin, posterior suture longer, nearly in middle of hysterosoma. Hysterosomal bristles in five transverse rows as indicated in fig. 3.

Camerostome oval, mandibles and palpi prominent. Insertions of legs I lateral to posterior margin of camerostome; legs II inserted at latero-posterior margin of propodosoma at level of pseudostigmatic organs; apodemata I, II relatively narrow bands. Insertions of legs III, IV more medial in position, at edge of ventral plate, without separating apodemata. Ventral bristles as in Figure 4.

Genital covers truncate, twice as long as broad; nearly twice as long as anal covers. Seven genital setae along median edge of each cover; g:1 inserted at level of anterior fifth of medial margin, other genital setae subequally spaced posteriorly; three lateral setae on each cover, one anterior to lateral angle of cover, one posterior to same angle, the third seta in latero-posterior corner of cover.

Anal covers truncate, reaching from posterior margin of genital covers to posterior margin of hysterosoma. Two setae on each cover. Three setae in adanal plates, a single seta in ventral plate laterad of anal opening (fig. 4).

Anterior legs slightly longer than propodosoma, tarsus I nearly twice as long as tibia I, tibia I and genu I equal; tibia I with a long, tactile bristle about as long as leg I itself; claws monodactyle.

Length 400 μ, hysterosoma 273 μ; width 106 μ at propodosomal-hysterosomal suture, hysterosoma 226 μ.

Discussion.—*Hypochthonius crosbyi* Ewing resembles *Hypochthoniella pallidula* (C. L. Koch) as illustrated by Hammer (1952), but differs in the two distinct hysterosomal sutures and the simple pseudostigmatic organ. *H. crosbyi* differs from *H. rufulus* Koch, *H. rufulus paucipectinatus* Jacot and *H. rufulus carolinicus* Jacot, in the simple pseudostigmatic organ and the simple hysterosomal setae.

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KIEFFERIELLA ACMAEODERA, NEW SPECIES

(Hymenoptera, Cynipoidea)

Female.—Differs from *Kiefferiella rugosa* Ashmead in being bicolored instead of black, the head and thorax being amber. It lacks the distinct carina from the middle ocellus to between the antennae. The clypeus is not striate. Mesopleuron has a smooth and polished area below as well as above the longitudinal groove. The abdomen is not longer than head plus thorax, its length to height to width as 39: 25: 15. Length 3.75 mm. Length of wing 2.9 mm.

Holotype.—U.S.N.M. No. 63269.

K. rugosa was described in 1903 from a unique female from the Santa Cruz Mts. in California. On July 15, 1950, E. D. Algert reared three females, determined as *rugosa*, from Borego, San Diego Co., Calif. "They make their own emergence hole which leads to a fresh *Acmaeodera* tunnel."

In June, 1956, W. F. Barr reared the above new species from 16 miles west of Mt. Home, Idaho, from *Eurotia lanata* Moq. ("White Sage") infested with *Acmaeodera pulchella* Herbst., a brupestid beetle. These two records afford the first clue to the possible habit of the subfamily Mesocynipinae, whose members are mostly exotic and habits hitherto unknown.—

Lewis H. Weld, *Arlington, Virginia.*

A NEW PREDATORY MITE FROM INSECT CULTURE[1]

(Acarina, Phytoseiidae)

By Ralph A. Bram, *University of Maryland, College Park*

An infestation of mites in a laboratory culture of the Angoumois grain moth, *Sitotroga cerealella* Oliv., at the Department of Entomology, University of Maryland, was found to consist of an undescribed species of *Garmania.* Ears of corn were taken from the storage bin of the Plant Research Farm near College Park, Maryland, on October 13, 1955, and placed in large jars at room temperature. On October 20, 1955, great numbers of mites were found associated with the eggs of the Angoumois grain moth. Hughes, (1948), has reported *Blattisocius tineivorus* (Oudemans) infesting stored food products; *Blattisocius tineivorus* and *B. keegani* Fox collected from stored food products and laboratory cultures are also in the U. S. National Museum collection.

The author expresses his appreciation to Dr. Edward W. Baker for help in writing the description.

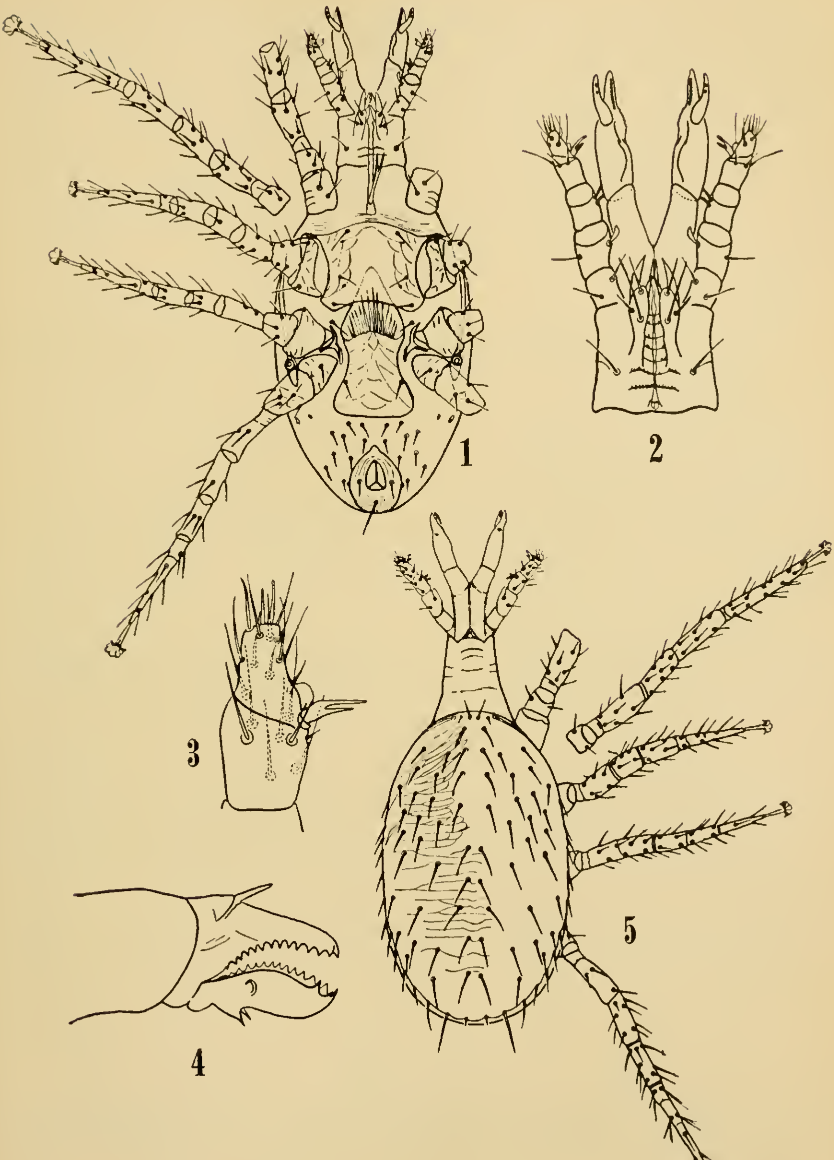
Garmania bickleyi, new species

(Figures 1, 2, 3, 4, 5)

Garmania bickleyi is related to those species having a small anal plate with only the single pair of paraanal setae (Nesbitt, 1951). It is distinctive in having all ventral hypostomal setae of equal strength, in having many cheliceral teeth, and a triangular serrated epistome. Its nearest relative, *G. bulbicola* (Oudemans), has the anterior pair of ventral hypostomal setae very strong, several times thicker than the others, and has few cheliceral teeth. *G. bickleyi* also differs from *bulbicola* in that the anal plate is knobbed anteriorly. *G. novae-guineae* (Oudemans) has very short dorsal body setae and possesses only one long seta on the dorsum of the fourth tarsus, while *bickleyi* has all tarsal setae of equal length; the anal plate of *novae-guineae* does not possess an anterior knob. *G bickleyi* differs from *G. domestica* (Oudemans) in that the latter has short dorsal setae which do not reach half way to the next row. The anterior margin of the genital plate of *bickleyi* is pointed rather than rounded. *G. bickleyi* differs from *G. pomorum* (Oudemans) in having anterior lateral wings on the sternal plate and also in having a pointed genital plate.

Female.—The epistome is triangular and with a slightly serrate margin. There is a membrane between the base of the forked seta and the last palpal segment. A small spine is on the base of the forked seta. The fixed chela possesses 14 teeth; the movable chela possesses a forked distal tooth and a larger proximal tooth. The lateral membrane of the chelicerae is strongly serrated. The ventral

[1]Scientific Art. No. A530, Contribution No. 2665 of the Maryland Agricultural Experiment Station, Department of Entomology.



Garmania bickleyi, n. sp.: fig. 1, ventral view of female; fig. 2, ventral view of gnathosoma; fig. 3, details of distal segments of palps; fig. 4, chelicera showing teeth on fixed chela and membranous teeth on movable chela; fig. 5, dorsal view of female.

hypostomal setae are equal in strength. The dorsal setae are strong and reach to the base of the next row; the marginal setae are somewhat shorter. The dorsal sculpture pattern is faint. The sternal plate has three pairs of setae; it is rounded in front, concave on the lateral and posterior margins, and has anterior lateral extensions. The genital plate is pointed anteriorly and slightly rounded posteriorly. The anal plate is rounded with a small anterior knob and has a single pair of paraanal setae and a longer single median posterior seta. There are 9 pairs of setae lateral and anterior to the anal plate. The peritreme reaches anteriorly past coxa I. All tarsal setae are of equal strength. The body, exclusive of the gnathosoma, is 425 μ long and 253 μ wide.

Male.—Unknown.

Nymph.—Unknown.

Type Habitat. On laboratory cultures of *Sitotroga cerealella* Oliv., at the Department of Entomology, University of Maryland, College Park, Maryland.

Holotype. U. S. National Museum No. 2223, found in the above habitat on October 20, 1955.

Paratypes. 28 specimens with the above data deposited in the U. S. National Museum. This species has also been studied from the National Museum Collection which were collected at Quarantine on plant material from Jamaica, Holland, Tahiti, Haiti, Lebanon, Liberia, France, Mexico, Cuba, Brazil, and Peru. Others are from Illinois, Minnesota, and New York.

This species is named for Dr. W. E. Bickley of the Staff of the Department of Entomology at the University of Maryland in appreciation for the help and encouragement he has given his students.

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Nesbitt, H. H. J., 1951. A taxonomic study of the phytoseiinae (Family Laelaptidae) predaceous upon Tetranychidae of economic importance. Zool. Verhandel. 12:1-64, 32 pls.

BOOK NOTICE

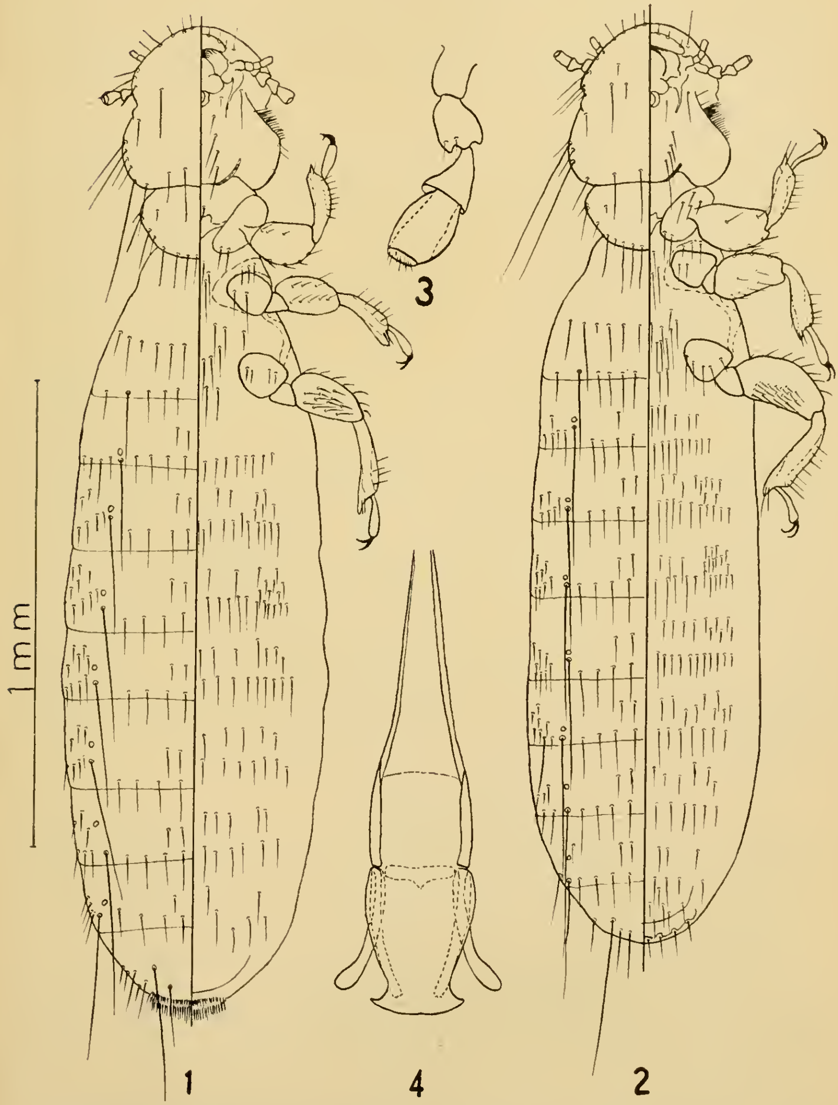
BIRD AND BUTTERFLY MYSTERIES, by Bernard Ackworth. Introduction by Brian Vesey-Fitzgerald. The Philosophical Library, Inc., New York. 303 pp., 11 text figures, 3 colored plates. 1956. Price $7.50.

The present volume is a revision of two popular early works, *The Cuckoo and Other Bird Mysteries and Butterfly Miracles and Mysteries,* both of which were written by this very perceptive layman.—RICHARD H. FOOTE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

A NOTE ON THE IDENTITY OF LONGIMENOPON PEDICULOIDES (MJöBERG)

(MALLOPHAGA, MENOPONIDAE)

By K. C. EMERSON, *Stillwater, Oklahoma*



Longimenopon pediculoides (Mjöberg): fig. 1, dorsal-ventral view of female; fig. 2, dorsal-ventral view of male; fig. 3, antenna of male; fig. 4, male genitalia.

Longimenopon pediculoides (Mjöberg)

Colpocephalum pediculoides Mjöberg, 1910, Arkiv för Zoologi, 6, 13): 44, pl. 2, fig. 6.

Rediella pediculoides (Mjöberg), Hopkins and Clay, 1952, A check list of the genera and species of Mallophaga: 322.

Longimenopon pediculoides (Mjöberg) was originally described from a series supposedly collected from *Strepsilas interpres* = *Arenaria interpres* and *Falco tinnunculus.* While these two hosts are quite common, other collections of the form were not accomplished until quite recently.

Through the courtesy of Dr. Henry S. Dybas, Chicago Natural History Museum, the author examined a series of ten males and twenty-five females of this species collected by Dr. Harry Hoogstraal from *Arenaria interpres interpres* (Linnaeus) on Ramesamey Island, Puerto Princesa, Palawan, Philippines. Since this series represents the first known collection of this form since the original record, opportunity is here taken to present illustrations and notes concerning this rare species.

The Ramesamey Island specimens agree completely with the original description and illustration, so due to the size of the series, it is believed that the turnstone is the correct host. The shape of the head and thorax, and the general chaetotaxy preclude the inclusion of the species in the genus *Rediella* as presently defined. Hopkins and Clay qualified their action with a note, ''referred here with much doubt,'' which was probably accomplished by an examination of Mjöberg's description and rather poor illustration. The species has a slight ''brush'' in each posterior lateral angle of abdominal sternite IV, and only a single median prothoracic seta, which are characteristic of some members of the genus *Actornithophilus.* Even though the species is somewhat intermediate to the typical forms of *Actornithophilus* and *Longimenopon,* it has been referred to the latter genus because the sparse chaetotaxy and external morphological characters of the head indicate a closer affinity to that genus.

BOOK NOTICE

GALL MIDGES OF ECONOMIC IMPORTANCE; VOL. VII, CEREAL CROPS, by H. F. Barnes, Rothamsted Experimental Station, Harpenden, Herts., England. Crosby Lockwood & Son, Ltd., London. 261 pp., 7 text figures, 15 plates. 1956. Price $3.15.

Dr. Barnes has added another volume to his extremely valuable series on the economically important gall midges. Part VII deals with ''. . . some of the oldest described, most widely distributed and most injurious species of gall midges'' (the Hessian fly, the wheat blossom midges, and the sorghum midge), as well as many others. The book is divided into four sections: Section 1 deals with midges injurious to wheat, barley, oats and rye; Section 2 with sorghum; Section 3 with the panicum millets and Section 4 with paddy or rice.—Richard H. Foote, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

AN ADDITIONAL RECORD FOR PANORPA LUGUBRIS (SWEDERUS)
(MECOPTERA, PANORPIDAE)

During the summer of 1954 a specimen of *Panorpa lugubris* (Swederus) was collected by the author at Holland, Virginia. This is the first known record of this species in the state of Virginia and also the most northerly recorded specimen. Prior to this date this species had been recorded in the following states: Alabama, Florida, Georgia, North Carolina, South Carolina, and New Mexico. The most recent collection dates in the adjoining state of North Carolina are September, October, and November, 1904, and September, 1915, all of Raleigh. Mr. G. M. Bently collected in 1904 and Franklin Sherman in 1915. With the new record of its presence in Virginia, a definitive geographic range is shown along the southern and middle Atlantic seaboard from Florida northward into Virginia, with an isolated group in New Mexico.

At the time of collection the specimen was feeding on rotting apples found under several apple trees about 100 yards from a slow-flowing stream. Holland is located in the southeastern part of Virginia within ten air miles of the North Carolina state line, 40 air miles from the Atlantic Ocean, and eight air miles from the border of the Dismal Swamp.

With Holland, Virginia, only 120 miles northeast of Raleigh, it is not surprising that a natural migration has taken this insect into the southeastern section of Virginia.—

AVERETT S. TOMBES, *Virginia Polytechnic Institute, Blacksburg, Virginia.*

CORRECTION

The following corrections are to be made in the paper entitled "Taxonomic Notes on Kimminsia," by Sophy Parfin. This paper appeared in Vol. 58, No. 4, pp. 203-209, of the Proceedings of the Entomological Society of Washington.

Cover—line 8 . . . . Parfin, Sophy, not "Parfin, Sophie"
Page 203—line 8 . . . . *subnebulosa*, not "*subnelbulosa*"
Page 204—line 13 . . . . *Hemerobius*, not "*Memerobius*"
Page 207—line 22 . . . . pronounced, not "prounced"
—line 6 of key . . . *coloradensis* (Banks), not "*coloradensis* Banks"
—line 11 of key . . . *posticata* (Banks), not "*posticata* Banks"
Page 208—line 3 . . . . gradate, not "gradudate"
—line 4 . . . . *furcata* (Banks), not "*furcata* Banks"
—line 28 . . . . specimens, not "species
Page 209—line 12 . . . . *pretiosa* (Banks), not "*pretiosa* Banks"

—EDITOR

BOOK NOTICE

A MANUAL OF PARASITIC MITES, by E. W. Baker, T. M. Evans, D. J. Gould, W. B. Hull, and H. L. Keegan. 170 pp., 59 text figs. National Pest Control Assn., Inc., 30 Church St., New York 7, N. Y. Price $4.25.

The present manual promises to be an answer to the prayer of many a medical and veterinary worker harassed by the task of keeping up with a forbidding volume of current literature. It is the first succinct and useful summary of the biology, taxonomy and control of parasitic mites ever to be offered the public under a single set of covers.

The authors have included all species of direct medical and veterinary importance, and have added those parasitic on animals in which man is economically interested. Sections on morphology and techniques of mounting and examining mites are followed by a key to the included species. The principal features discussed for each species are medical importance, morphology, life cycle, and control, and a list of references enables the user to refer to the original literature for more detailed information. The illustrations are abundant and clear, and the literary style suits the volume for good use by any interested non-specialist. The authors and the National Pest Control Association are to be congratulated for filling an ever-increasing demand in one of the most rapidly growing fields of biology.—Richard H. Foote, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

ROYCE BURTON KNAPP, 1924-1955

Royce Burton Knapp, 31, entomologist with the Cereal and Forage Insects Section, Entomology Research Branch, ARS, USDA, at Beltsville, Md., died at Washington, D. C., on December 9, 1955.

Born at Binford, North Dakota, on June 1, 1924, Royce was the son of Olaf and Susan (Shaw) Knapp. He attended grammer and high school at Binford, North Dakota, and the North Dakota Agricultural College, graduating with a B.S. degree in 1946. From 1946 to 1948 he attended graduate school at North Dakota and also assisted in teaching entomology. While at the College he conducted research and was author or joint author of several papers dealing with livestock pests, wireworms, and the wheat stem sawfly. In 1948 he accepted an appointment in the Cereal and Forage Insects Section of the Entomology Research Branch and conducted research on the wheat stem sawfly at Minot, North Dakota, the European corn borer at Ankeny, Iowa, and on legume insects at Beltsville, Md.

On June 14, 1946, he was married to Betty Jean Getman, who survives. While he had no children, Mr. Knapp was affectionately called Uncle Louis by many children in his home neighborhood. He had a great fondness for the outdoors and was an enthusiastic hunter and fisherman. He was also an expert square dancer.

Mr. Knapp was a member of Sigma Alpha Epsilon social fraternity and Phi Kappa Phi honorary society. He was also a member of the Moose and Elk Lodges.

Mr. Knapp was at Beltsville only a few months but had made a wide circle of friends. His associates held him in high regard and will long remember his cheerful and friendly disposition.—

B. A. App

SOCIETY MEETING

The 654th regular meeting of the Entomological Society of Washington was held in Room 43 of the U.S. National Museum on Thursday, May 3, 1956, and was attended by 41 members and 17 visitors. President R. A. St. George called the meeting to order at 8:00 P.M. and the minutes of the previous meeting were read and approved.

Herbert A. Dean, Box 942, Weslaco, Tex.; *Frank J. Burke*, 3 Brightside Ave., Pikesville 8, Md.; and *Dr. Jerome G. Rozen, Jr.*, U. S. National Museum, Washington 25, D. C., were elected to membership.

President St. George announced the appointment of Louise M. Russell to represent the *Society* at the Tenth International Congress of Entomology. Helen Sollers, Edgar A. Taylor, and William N. Sullivan will represent the *Society* on a committee for the picnic to be held jointly with the Insecticide Society of Washington at the Log Lodge June 2. The President also reminded friends of Dr. Cory that letters for the commemorative volume to be prepared for him were due.

The death of L. F. Byars was announced by the President, who called on P. N. Peltier for a few remarks about his late coworker. George G. Becker at Hoboken will be asked to assist with the preparation of Dr. Byars' obituary.

President St. George announced that two grand-prize winners in the Prince Georges County Science Fair are students of member Howard Owens at Northwestern High School. The students will be sent to Oklahoma to enter their exhibits in the National Fair. The winner of the Fifteenth Annual Westinghouse Science Talent Search contest is a student of nearby Langley Park, Md.

R. H. Nelson, called on for observations on the Science Fairs, told about the regularity with which Mr. Owens' students have won prizes in various categories year after year. Mr. Owens has played a large part in initiating the Fairs, both locally and in other parts of the country. Mr. Nelson introduced another of Mr. Owens' students, Francis ''Bud'' Cole, who presented the exhibit with which he won a first prize in the Zoology Section of the local Fair. Mr. Cole explained the exhibit, a comparison of the life cycles of *Curculio auriger* (Casey) and *C. proboscideus* F.

W. E. Bickley reviewed the fifth edition of L. M. Peairs' ''Insect Pests of Farm, Garden and Orchard,'' prepared by R. H. Davidson. He also called attention to the fifth edition of ''Applied Entomology'' by Fernald and Shepard.

Alan Stone noted that the Mediterranean fruit fly had been found in two counties of Florida. Richard H. Foote is in Florida for consultation on the fly.

A letter of greeting from James Zetek in Panama, a member since 1930, was read by President St. George. The President gave a note on the eastern tent caterpillar, *Malacosoma americanum* (F.), which he said was more prevalent in the metropolitan Washington area than it has been for about 5 years.

The principal speaker of the evening, Dr. Vincent G. Dethier, The Johns Hopkins University, told about "Insect Physiology in Great Britain and the Netherlands." During the Fall and Winter of 1954-1955, visits were made to seven of the 12 English universities, one Scottish and one Irish, and four experiment stations. Visits were also made to two Dutch universities (Leiden and Gröningen), the agricultural research center at Wageningen, and the T.N.C. laboratory for research on biocides at Utrecht. At each of these institutions there is an active program of insect physiology study in progress. In general, the European physiologists tend to lay greater emphasis on behavior aspects of physiology and the relation between physiology and ecology. The extensive use of teaching museums, demonstrations, and collections of living invertebrates was noted. The status of technical assistants, space, equipment, and library facilities was also discussed. (Speaker's abstract.) Dr. Dethier's slides added much to an already excellent talk.

Visitors introduced were *Roy Elliott*, Nigeria Malaria Service, Lagos; and Dr. *James Gates*, Army Chemical Center, Md. Also introduced were *J. F. Schoen*, new member with the Plant Quarantine Branch, ARS; and *R. A. Boettcher*, now with the Japanese beetle control office in Baltimore.

The meeting was adjourned at 9:50 P.M.—KELLIE O'NEILL, *Recording Secretary.*

Date of publication, Vol. 58, No. 4, was August 30, 1956.

Insects

DECEMBER 1956 VOL. 58, NO. 6

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of the

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THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

ORGANIZED MARCH 12, 1884

Regular meetings of the Society are held in Room 43 of the U. S. National Museum on the first Thursday of each month from October to June, inclusive, at 8 P.M. Minutes of meetings are published regularly in the *Proceedings.*

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 58 DECEMBER, 1956 NO. 6

STUDIES IN PANAMA CULICOIDES. VIII. THE NEOTROPICAL SPECIES OF THE GUTTATUS GROUP OF THE SUBGENUS HOFFMANIA (DIPTERA, HELEIDAE)

by WILLIS W. WIRTH[1] and FRANKLIN S. BLANTON[2]

In 1948 Fox erected the subgenus *Hoffmania* for twelve American species of *Culicoides* with the following characters:

"Female with eyes contiguous in the median line and with the second radial cell of the wing included in a light spot. Male hypopygium as follows: ninth tergite rounded with the apico-lateral processes small or absent; inner process of sidepiece absent; aedeagus more or less triangular basally with a ventral marginal band and distally with a dorsal 'peg' having a ball-like tip; harpes approximate or even fused basally. Type.—*Culicoides inamollae* Fox and Hoffman."

In addition to *inamollae*, Fox assigned the following species of *Culicoides* to the subgenus *Hoffmania: diabolicus* Hoffman, *flavivenula* Costa Lima, *guttatus* (Coquillett), *heliconiae* Fox and Hoffman, *insignis* Lutz, *lutzi* Costa Lima, *maruim* Lutz, *oliveri* Fox and Hoffman, *painteri* Fox, *trinidadensis* Hoffman and *venustus* Hoffman.

In 1950 Ortiz reviewed all the known species of the subgenus *Hoffmania* and to the twelve species included by Fox, added *coutinhoi* Barretto, *cova-garciai* Ortiz, *decor* (Williston), *ocumarensis* Ortiz, *palpalis* Macfie, *recifei* Barbosa, *rozeboomi* Barbosa and *verecundus* Macfie. Ortiz synonymized three additional nominal species, *filariferus* Hoffman, *bimaculatus* Floch and Abonnenc and *pseudodiabolicus* Fox, although it is not clear in his paper to what species these synonyms should be referred.

Ortiz (1950) pointed out that *cova-garciai* had many affinities with the *pulicaris* group of the subgenus *Culicoides* and we have recently (Proc. Ent. Soc. Washington, 58(4):211-227, 1956) given a separate group rank to a number of Neotropical species of *Culicoides* s. str.

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[1] Entomologist, Entomology Research Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington, D. C.

[2] Lieutenant Colonel, MSC, Department of Entomology, Walter Reed Army Institute of Research, Washington, D. C. Present address: Department of Entomology, University of Florida, Gainesville.

related to *cova-garciai* which are intermediate in characters between the *pulicaris* group and *Hoffmania*. In our opinion *decor* (Williston) would fall in this *cova-garciai* group. Otherwise our concept of *Hoffmania* remains the same as that of Fox and of Ortiz. We have revised the three species of the *hylas* group of *Hoffmania* in a separate paper (Jour. Washington Acad. Sci. 46:95-99, 1956), but for completeness they are included in the key which follows in this paper. For the present, therefore, we are primarily concerned with the remaining species of *Hoffmania* which for convenience we will refer to as the *guttatus* group.

In order to identify the Panama species of the *guttatus* group it has been necessary to undertake a review of all of the Neotropical species of the subgenus *Hoffmania*. Since the key published by Fox (1948) is no longer adequate, we have designed a new key utilizing different combinations of characters. In past years many species of this subgenus have been described without comparison with types of existing species, resulting in numerous problems of synonymy. Ortiz (1950) indicated a number of suspected synonyms but probably because he had not seen types he did not definitely dispose of them. We hope that our fairly extensive study of type material will contribute materially to a more accurate appraisal of valid species and their synonyms in this group.

We have examined the types of six species (*diabolicus* Hoffman, *diminutus* Barbosa, *filariferus* Hoffman, *guttatus* (Coquillett), *recifei* Barbosa and *trinidadensis* Hoffman) in the U. S. National Museum collection; the types of four species (*inamollae* Fox and Hoffman, *oliveri* Fox and Hoffman, *painteri* Fox and *pseudodiabolicus* Fox) from the University of Puerto Rico collection; syntype specimens of *insignis* Lutz from the Instituto Oswaldo Cruz collection; and have seen paratypes of three species (*foxi* Ortiz, *ocumarensis* Ortiz and *ruizi* Forattini). We have examined topotypic specimens, but not type material, of three species (*flavivenula* Costa Lima, *lutzi* Costa Lima and *maruim* Lutz), leaving only two species (*bimaculatus* Floch and Abonnenc and *coutinhoi* Barretto) which we have had to characterize on the basis of descriptions and advice from others. Apparently our species concepts rest about midway between the very narrow ones of Fox (1948, 1949) and Ortiz (1950) on one hand and the very broad ones of Lane (1950) and Macfie (1948) on the other.

In this paper we offer brief descriptions of all the species for which we have been able to secure specimens, basing our diagnoses and figures whenever possible on type or topotypic material. Wing length is measured from the basal arculus. In our references to the wing venation we follow the Tillyard modification of the Comstock-Needham system whereby veins Cu_1 and Cu_2 of previous workers become M_{3+4} and Cu_1 respectively and cell Cu_1 becomes cell M_4. Antennal ratio is the value obtained by dividing the sum of the lengths of the last five segments by the sum of the lengths of the preceding eight. Measurements are of single specimens unless they are followed by values in parentheses, in which case the values are "mean (minimum-maximum, n = number of measurements)." A comparison of the mean values of certain characters is given in Table I. Unless otherwise specified all our Panama material was collected by the junior author by means of light traps and is in the collection of the U. S. National Museum in Washington.

TABLE I. Mean Values of Certain Quantitative Characters of Neotropical Species of Subgenus *Hoffmania*

	Wing Length	Costal Ratio	Antennal Ratio	Sensoria	Palpal Ratio	Mandible Teeth	Tibial Spines
hylas Group							
heliconiae	1.46	0.68	1.06	3,11-15	3.3	23	6
hylas	1.19	0.68	1.12	3,11-15	3.1	19	6
verecundus	1.31	0.70	1.10	3,11-15	4.2	23	6
guttatus Group							
foxi	1.21	0.68	1.10	3,11-15	3.2	16	6
ruizi	1.29	0.69	1.21	3,11-15	1.8	14	5
guttatus	1.46	0.67	--	--	--	--	--
coutinhoi	1.09	0.69	1.15	3,11-15	2.0	15-17	5
diabolicus	1.03	0.67	1.14	3,11-15	3.0	15	5
lutzi	1.22	0.70	1.18	3,11-15	1.9	16-17	6
flavivenula	1.10	0.68	1.17	3,11-15	3.7	21	5
insignis	1.11	0.65	1.32	3,5,7,9, 11-15	2.8	21	6
maruim	1.12	0.68	1.11	3,11-15	3.6	16	5
trinidadensis	1.12	0.66	1.22	3,5,7,9, 11-15	3.4	17	5

We wish to express our deepest appreciation to our coworkers on Neotropical *Culicoides* for their generous assistance and free discussion on points of taxonomy and problems of synonymy; more specifically to Irving Fox of the University of Puerto Rico School of Public Health and Tropical Medicine at San Juan for the loan of the holotypes in that collection, to A. da Costa Lima of the Instituto Oswaldo Cruz in Rio de Janeiro for the loan of syntypes from the Lutz Collection, and to Ignacio Ortiz of the Ministerio de Sanidad y Asistencia Social at Caracas, Venezuela and to Oswaldo P. Forattini of the Faculdade de Higiene e Saude Publica of the University of São Paulo, Brazil, for the generous donation of paratypes and determined material. Their generous exchange of specimens and of notes and keys has aided us immeasurably in studying this problem on the broadest possible basis.

Key to the Neotropical Species of the Subgenus Hoffmania

1. Second radial cell included in a pale spot at apex; base of cell M_4 pale bordering bases of veins M_{3+4} and Cu_1, or apices of veins M_1 and M_2 pale (subgenus *Hoffmania*) 2
   Second radial cell dark, or if pale at apex, base of cell M_4 dark bordering veins M_{3+4} and Cu_1 and apices of veins M_1 and M_2 dark .... (other subgenera)
2. Cell R_5 with a separate pale spot present anterior to base of vein M_1 (*hylas* group) 3
   Cell R_5 without a separate pale spot present anterior to base of vein M_1 (*guttatus* group) 5
3. Hind femur dark to apex; apex of vein M_{3+4} and of vein Cu_1 pale 4
   Hind femur with subapical yellow band; apex of vein M_{3+4} and of vein Cu_1 dark; third palpal segment slender without pit; mesonotum yellow in middle with dark brown sublateral vittae; wing 1.2 mm. long .... *verecundus* Macfie
4. Mid knee broadly yellow on femur and tibia; third palpal segment of female slender, without pit; mesonotum dark gray in middle; wing 1.4-1.7 mm. long .... *heliconiae* Fox & Hoffman
   Mid knee black with adjacent narrow pale rings on femur and tibia; third palpal segment swollen, with a shallow, subdivided pit; mesonotum yellow in middle with dark brown sublateral vittae; wing 1.2 mm. long .... *hylas* Macfie
5. Cell M_1 with two pale spots distal to the double spot straddling vein M_2; female palpal pit always present 6
   Cell M_1 with only one pale spot distal to the double spot straddling vein M_2; female palpal pit present or absent 10
6. Small black spot present on vein R_{4+5} near the end of second radial cell; mesonotum with prominent pattern; halter knob dark .... *foxi* Ortiz
   No small black spot on vein R_{4+5} near end of second radial cell 7
7. Cell R_5 with two pale spots distal to the one lying at the apex of second radial cell; halter knob dark .... *ruizi* Forattini
   Cell R_5 with only one pale spot distal to the one lying at the apex of second radial cell, no pale spot at extreme apex of cell R_5; halter knob pale (occasionally dark in *diabolicus*) 8
8. Mesonotum with a prominent pair of tapering sublateral blackish bands; small to medium size species (wing 0.9-1.2 mm. long) 9
   Mesonotum without prominent pattern; larger species (wing 1.46 mm. long) .... *guttatus* (Coquillett)
9. Third palpal segment of female short and swollen, 1.6-2.4 times as long as broad .... *coutinhoi* Barretto
   Third palpal segment of female slender, 2.8-3.2 times as long as broad .... *diabolicus* Hoffman
10. Halter knob pale; r-m crossvein not infuscated 11
    Halter knob brown; r-m crossvein infuscated, at least on anterior end 12
11. Distal pale spot in cell R_5 meeting anterior wing margin; female palpal pit irregular .... *lutzi* Costa Lima

Distal pale spot in cell R_5 smaller, not attaining anterior wing margin; female palpal pit circular .... *flavivenula* Costa Lima

12. Wing with very prominent pattern; vein R_{4+5} darkened in the pale area over second radial cell to the point where it turns abruptly forward to meet costa; female third palpal segment with definite, irregular sensory pit .... *insignis* Lutz

Wing with pale markings recessive, appearing grayish; vein R_{4+5} not darkened in the pale area over second radial cell; third palpal segment without pit but with sensoria scattered over distal half 14

13. Female with sensoria on antennal segments III, XI-XV; male aedeagus with simple swollen apex .... *maruim* Lutz

Female with sensoria on antennal segments III, V, VII, IX, XI-XV; male aedeagus with apex shaped like a fleur-de-lis .... *trinidadensis* Hoffman

Culicoides (Hoffmania) foxi Ortiz
(Figure 1)

Culicoides foxi Ortiz, 1951, Nov. Cient. Mus. Hist. Nat. La Salle, ser. Zool. no. 5, p. 4 (male, female; Caracas, Venezuela; fig. wing, mesonotum, palpus, spermathecae, male genitalia); Fox, 1953, Jour. Econ. Ent. 45:888 (Puerto Rico).

Culicoides diabolicus Macfie (not Hoffman, misident.), 1935, Stylops 4: 54 (Tutoia, Piauhi, Brazil); Macfie, 1937, Ann. Mag. Nat. Hist. (10) 20: 7 (Trinidad); Floch and Abonnenc, 1942, Inst. Pasteur Guyane Publ. 37: 2 (French Guiana; fig. female wing, palpus).

Culicoides guttatus Fox (not Coquillett, misident.), 1948, Proc. Biol. Soc. Washington 61: 23 (Brasil, Venezuela; fig. female palpus); Fox, 1949, Bull. Brooklyn Ent. Soc. 44: 31 (Puerto Rico; female, male genitalia; fig. female wing, spermathecae, male aedeagus, parameres); Fox and Kohler, 1950, Puerto Rico Jour. Pub. Health Trop. Med. 25: 342 (Puerto Rico).

Diagnosis.—The small, isolated dark spot near the tip of vein R_{4+5} will readily identify this species. Other characters of the female are: large size, wing 1.21 (1.01-1.33, n = 15) long; antennal ratio 1.10, sensoria present on antennal segments III, XI-XV; palpus (fig. 1b) with third segment 3.2 (2.5-3.6, n = 9) times as long as broad with a broad shallow sensory pit; mandible with 16 (14-17, n = 16) teeth; mesonotum with prominent pattern; legs brown with distinct pale bands at midlength and narrow blackish rings before apex on fore and mid femora, fore and mid knees narrowly pale, hind tibia with basal and apical pale bands; hind tibial comb with 6 spines; wing (fig. 1 a) with sparse macrotrichia near distal margin, dark spot on crossvein r-m, two pale spots in cell M_1 beyond the double spot on vein M_2; halter knob blackish; spermathecae (fig. 1 c) measuring 0.063 by 0.049 and 0.053 by 0.043 mm., pyriform, unequal, with bases of the ducts sclerotized a short distance. Male genitalia (fig. 1 d, e) with very small apicolateral processes on ninth tergum; aedeagus elongate, sides convexly swollen, apex truncate rather than spherical; parameres fused on basal fourth.

Discussion.—Fox's (1948, 1949) descriptions and figures of *guttatus* were apparently based on Brazil, Puerto Rico and Venezuela specimens compared with Brazilian material in the University of Puerto Rico collection determined by Hoffman as *guttatus*. By examination of the female specimens from Km. 47, Estrado Rio—São Paulo, and Porto das Caxias, Brazil, kindly loaned to us by Dr. Fox, we are able to establish that these specimens are not conspecific with the type of *guttatus* in the U. S. National Museum collection. Ortiz correctly pointed out Fox's misidentification when he described *foxi*.

Specimens examined.—

BRAZIL: Ilhéus, Bahia, July 1930, Davis and Shannon,—3 females. Piraua, Bahia, 16 April 1929, Davis and Shannon, animal bait—48 females. Porto das Caxias (from Univ. Puerto Rico coll.),—1 female. Km. 47, Estrado Rio—São Paulo, 22 June, P. Wygodzinsky (from Univ. Puerto Rico coll.),—1 female.

HONDURAS: Lago Yojoa, 2 June 1953, P. Galindo, light trap,—1 male. Lancetilla, December 1953, P. Galindo, light trap,—1 female.

NICARAGUA: Villa Somoza, 20 July 1953, P. Galindo,—1 female.

PANAMA: Barro Colorado Island, C. Z., Jan.-March 1944, J. Zetek, —2 females; July 1923, R. C. Shannon,—1 male. Cabima, 19 May 1911, A. Busck,—5 females. Many males and females collected in light traps by F. S. Blanton from: Canal Zone—Fort Clayton, Fort Sherman, Loma Boracho, Madden Dam, Mandinga River, Mindi Dairy, Mojinga Swamp; Chiriquí Prov.—El Volcán, Pedregal; Coclé Prov. — Aguadulce; Darien Prov. — El Real, Punta Patiño; Herrera Prov.—Chitré; Panamá Prov.—Arraiján.

PUERTO RICO: Mayaguez, 2 July 1952, F. S. Blanton, light trap—1 male, 7 females.

VENEZUELA: Caracas, 3 May 1950, I. Ortiz,—5 females (paratypes). Caripito, Monogas, P. Anduze,—3 females. Los Chorros, 29 August 1951, I. Ortiz,—1 male, 6 females.

Culicoides (Hoffmania) ruizi Forattini
(Figure 10)

Culicoides ruizi Forattini, 1954, Arq. Fac. Hig. Saude Pub. Univ. São Paulo 8:189 (male, female; Brazil; fig. wing, palpus, mesonotum, aedeagus, parameres).

Diagnosis.—Wing 1.29 mm. long; antennal ratio 1.21; sensoria present on segments III, XI-XV; palpus (fig. 10b) with third segment 1.8 times as long as broad, with broad, shallow pit; mandible with approximately 14 teeth; thorax dark brown, mesonotum densely whitish pruinose with two small, faintly indicated, sublateral brown vittae; legs dark brown, fore and mid knees and base of hind tibia very narrowly yellowish; wing nearly bare, only a few macrotrichia near apex, pale spots extensive (fig. 10a), two pale spots in cell M_1 past the pale spot straddling vein M_2, r-m crossvein and vein R_{4+5} not infuscated, a small round pale spot

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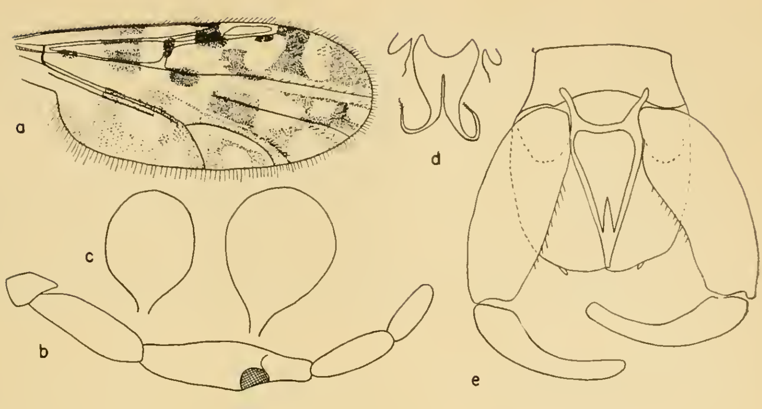
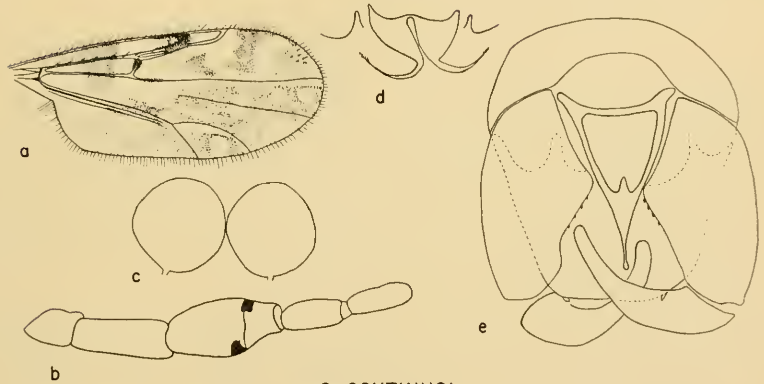
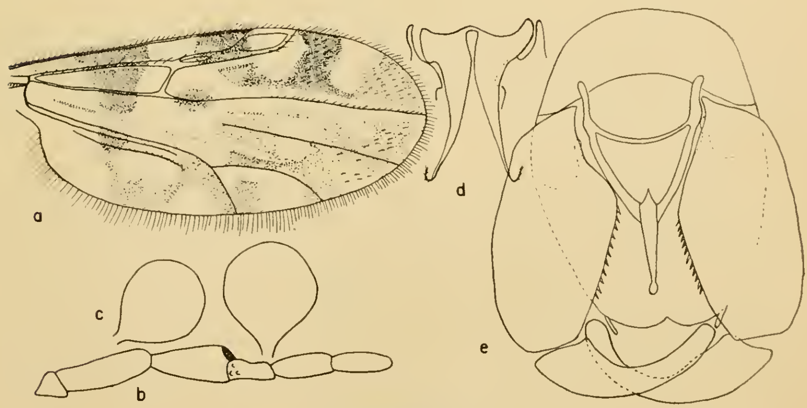
Fig. 1: *Culicoides foxi* (Loma Boracho, Canal Zone); fig. 2: *Culicoides coutinhoi* (Macrouria, French Guiana); fig. 3: *Culicoides diabolicus* (Tela, Honduras). a, wing; b, female palpus; c, spermathecae; d, male parameres; e, male genitalia, parameres removed. (Drawings by the junior author.)



1. FOXI



2. COUTINHOI



3. DIABOLICUS

in cell R_5 distal to the usual large pale spot near apex of cell; halter knob dark; spermathecae (fig. 10 c) slightly unequal, pyriform. Male genitalia: Aedeagus without spherical tip, the basal arms proximad of the transverse bar short; parameres fused at the base for a distance of about an eighth of the total length, the filiform apices without branches.

Discussion.—Through the kindness of Dr. O. P. Forattini we have received paratypes of this very distinctive species from which the female diagnosis and figures were made. This species is apparently closely related to *foxi* Ortiz, as evidenced by the presence of two spots in cell M_1 distal to the pale spot straddling vein M_2, the darker halters, the absence of a spherical tip on the aedeagus and the basal fusion of the parameres.

Specimens examined.—
BRAZIL: Aruana, Goiás, September 1948, Ruiz,—3 females (paratypes).

Culicoides (Hoffmania) guttatus (Coquillett)
(Figure 7)

Ceratopogon guttatus Coquillett, 1904, Jour. New York Ent. Soc. 12: 35 (female; São Paulo, Brazil).

Culicoides guttatus, Lutz (in part), 1913, Mem. Inst. Oswaldo Cruz 5: 58 (São Paulo, Brazil; notes). Costa Lima, 1937, Mem. Inst. Oswaldo Cruz 32: 416 (fig. female wing; notes); Barretto, 1944, An. Fac. Med. Univ. São Paulo 20: 91 (male; fig. male palpus, wing, genitalia); Barbosa, 1947 (in part), An. Soc. Biol. Pernambuco 7: 17 (discussion; Brazil records); Lane, 1949, Bol. Ent. Venezolana 8: 115 (extensive synonymy).

Notes on the type (pinned).—Wing 1.46 mm. by 0.65 mm. Third palpal segment slender, spindle shaped, superficially resembling that of *diabolicus.* Mesonotum and scutellum uniform tawny brown, anterior and lateral margins of mesonotum blackish, prescutellar depression whitish pollinose. Wing pattern as in fig. 7; pale areas extensive and well defined, r-m crossvein infuscated on anterior half, vein R_{4+5} not darkened distal to dark spot over base of second radial cell, two large pale spots in cell M_1 distal to the pale spot straddling vein M_2. Halter whitish, small area at base of knob dark. Legs brown, fore and mid knees and base and apex of hind tibia yellowish.

Discussion.—There has been much confusion regarding the application of the name *guttatus* (Coquillett), since it was the first species of Neotropical *Hoffmania* to be described and was but superficially characterized. Coquillett described *guttatus* from three females, only one

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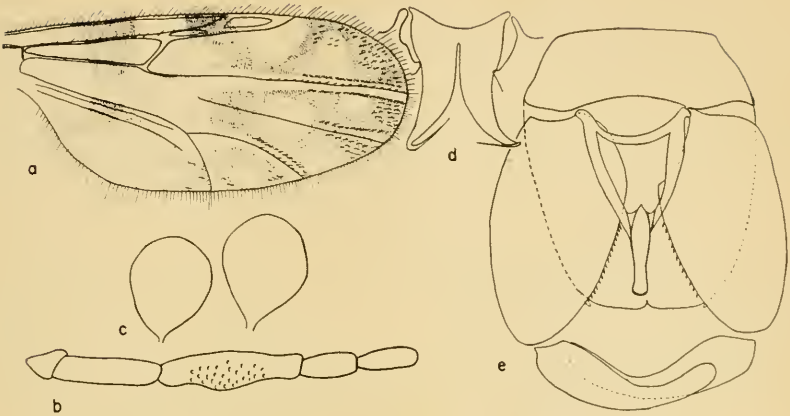
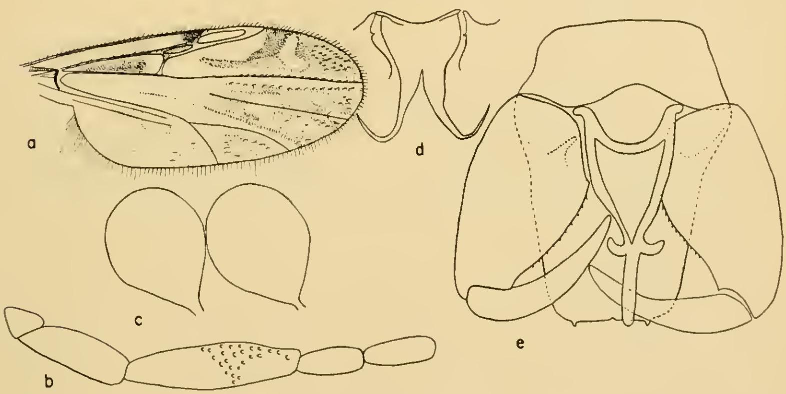
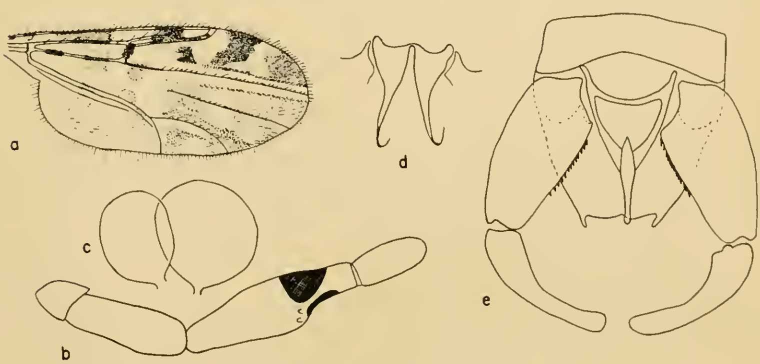
Fig. 4: *Culicoides maruim* (Recife, Brazil); fig. 5: *Culicoides trinidadensis* (Garachine, Panamá); fig. 6: *Culicoides insignis* (Jaqué, Panamá). a, wing; b, female palpus; c, spermathecae; d, male parameres; e, male genitalia, parameres removed. (Drawings by the junior author.)



4. MARUIM



5. TRINIDADENSIS



6. INSIGNIS

of which remains in the U. S. National Museum collection. This female is here designated as lectotype. The type series was collected from Serra da Cantareira, Sáo Paulo, Brazil, by Lutz to whom, according to Costa Lima (1937), Coquillett returned a labeled cotype. The wing of this specimen was figured by Costa Lima, who established the fact that the specimen upon which Lutz (1913) based his figure of the wing of *guttatus* was actually a misidentified specimen of *insignis* Lutz. Barretto (1944) restudied Lutz' collection and verified Costa Lima's conclusions; moreover he collected males and females of *guttatus* at the type locality, as well as in other parts of the state of Sáo Paulo, on which he based his excellent figures and description of the male of *guttatus*.

The larger size and the absence of a prominent mesonotal pattern, and the more numerous distal branches of the male parameres will readily separate *guttatus* from *diabolicus* Hoffman. From *coutinhoi* Barretto, *guttatus* differs in its slender third palpal segment and longer apicolateral process on the male genitalia.

Material examined:

BRAZIL: Sáo Paulo, Dr. A. Lutz,—1 female (lectotype).

Culicoides (Hoffmania) coutinhoi Barretto
(Figure 2)

Culicoides coutinhoi Barretto, 1944, An. Fac. Med. São Paulo 20: 96 (male, São Paulo, Brazil; fig. antenna, palpus, wing, genitalia); Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 13 (Est. São Paulo, Brazil; female; fig. palpus, mesonotum, wing).

Diagnosis.—Wing 1.09 mm. long; antennal ratio 1.15, sensoria present on segments III, XI-XV; palpus (fig. 2 b) with third segment 1.6-2.4 times as long as greatest breadth, short and greatly swollen, with a broad, shallow sensory pit; mandible with 15-17 teeth; legs dark brown, fore and mid knees broadly yellow on femora and tibiae, hind tibia with broad basal and apical yellowish bands, hind tibial comb with 5 spines; wings (fig. 2 a) well marked with *diabolicus*-type pattern, two pale spots in cell M_1 distal to the pale spot straddling middle of vein M_2, r-m crossvein darkened, vein R_{4+5} not darkened distal to the dark spot over basal half of second radial cell; halter knob pale; spermathecae (fig. 2 c) subspherical, subequal, measuring 0.050 by 0.041 mm. Male genitalia (fig. 2 d, e) with apicolateral processes very small, aedeagus with anterior transverse sclerotization very near extreme base, with very slender, spherical tip and distinct internal sclerotized peg; parameres connected basally by a short sclerotized loop, the main bodies short and the slender apices with a few fine hairs.

Discussion.—The above diagnosis is based entirely on slide-mounted specimens from French Guiana. Barbosa's (1947) description of the female of *coutinhoi* indicates that it can be separated from *guttatus* by the swollen third palpal segment and by the prominent pattern of the mesonotum ("yellowish in the center showing a characteristic marking reminiscent of a shield of dark coloring. Another dark chestnut area involving this yellowish zone.''). Although Barretto's description states that the r-m crossvein is not darkened on the anterior half, his photograph of the wing shows the crossvein to be distinctly infuscated.

Specimens examined.—
FRENCH GUIANA: Macrouria, May 1953, E. Abonnenc,—1 male, 12 females.

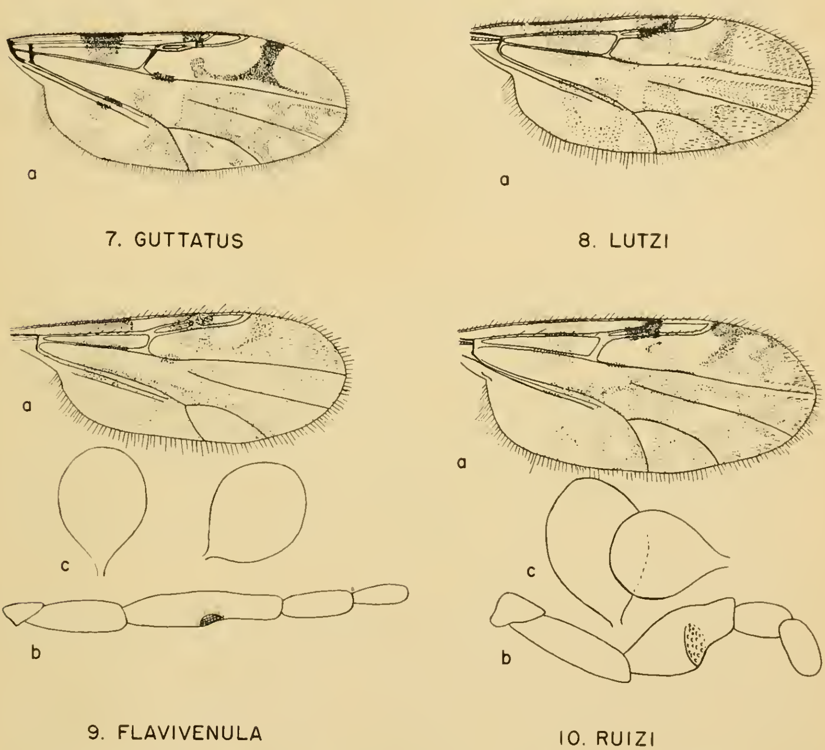


Fig. 7: *Culicoides guttatus* (São Paulo, Brazil); fig. 8: *Culicoides lutzi* (Pará, Brazil); fig. 9: *Culicoides flavivenula* (Espirito Santo, Brazil); fig. 10: *Culicoides ruizi* (Goiás, Brazil). a, wing; b, female palpus; c, spermathecae; d, male parameres; e, male genitalia, parameres removed. (Drawings by the junior author.)

Culicoides (Hoffmania) diabolicus Hoffman
(Figure 3)

Culicoides diabolicus Hoffman, 1925, Amer. Jour. Hyg. 5: 294 (female; Cabima, Panama; fig. wing); Macfie, 1932, Ann. Mag. Nat. Hist. (10) 9: 487 (Colombia); Macfie, 1937, (in part), Ann. Mag. Nat. Hist. (10) 20: 7 (male, female redescribed; Trinidad); Costa Lima, 1937, Mem. Inst. Oswaldo Cruz 32: 416 (fig. female palpus; Brazil [Amazonas], Colombia); Adamson, 1939, Trop. Agr. 16: 81 (Trinidad); Kumm, Komp and Ruiz, 1940, Amer. Jour. Trop. Med. 20: 420 (Costa Rica); Vargas, 1944, Rev. Inst. Salub. Enf. Trop. 5: 163 (Mexico; fig. palpus, antenna, legs, male genitalia); Vargas, 1945, *idem.* 6: 44 (Mexico records; syn.: *filariferus* Hoffman; Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 17 (Nicaragua, Guatemala, Panama, Trinidad and Brazil); Fox, 1948, Proc. Biol. Soc. Washington 61: 24 (Panama; notes; fig. palpus, male aedeagus, parameres; syn.: *filariferus, pseudodiabolicus*); Wirth, 1955, Proc. Ent. Soc. Washington 57: 109 (Guatemala).

Culicoides filariferus Hoffman, 1939, Puerto Rico Jour. Pub. Health Trop. Med. 15: 172 (female; Chiapas, Mexico; fig. mesonotum, wing, palpus).

Culicoides bimaculatus Floch and Abonnenc, 1942, Inst. Pasteur Guyane Publ. 49: 3 (female; Cayenne, French Guiana; fig. wing, palpus). NEW SYNONYMY.

Culicoides pseudodiabolicus Fox, 1946, Ann. Ent. Soc. Amer. 39: 256 (female; Cumuto Village, Trinidad; fig. wing).

Culicoides ocumarensis Ortiz, 1950, Rev. Sanid. Asist. Soc. 15: 455 (male, female; Ocumare del Tuy, Venezuela; fig. wing, mesonotum, antenna, palpus, spermathecae, male genitalia); Ortiz & Leon, 1955, Bol. Inf. Cient. Nac., no. 67: 571 (Ecuador; notes; fig. wing, palpus, male genitalia). NEW SYNONYMY.

Culicoides guttatus of authors (misident., not Coquillett); Macfie, 1940, Ent. Mo. Mag. 76: 25 (British Guiana); Macfie, 1948, Ann. Trop. Med. & Parasit. 42: 74 (Chiapas, Mexico); Barbosa, 1952, Novos Subs. Conhec. Culicoides Neotropicos, p. 15 (Ecuador; discussion); Gibson and Ascoli, 1952, Jour. Parasit., 38: 315 (Guatemala).

Diagnosis.—Wing 1.03 (0.92-1.22, n = 35) mm. long; antennal ratio 1.14 (1.09-1.17, n = 4), sensoria present on segments III, XI-XV; palpus (fig. 3 b) with third segment 3.0 (2.4-3.7, n = 29) times as long as broad, with a broad shallow sensory pit; mandible with 15 (14-18, n = 34) teeth; mesonotum with a prominent pattern, yellowish in center with a pair of prominent blackish sublateral vittae; legs brown, fore and mid knees broadly yellow on femora and tibiae, hind femur dark to apex, hind tibia with broad basal and apical yellowish bands; hind tibial comb with 5 spines; wing (fig. 3 a) with well-marked pattern of yellowish spots as figured, crossvein r-m pale (variety *filariferus* Hoffman) or dark on anterior end (typical form), vein R_{4+5} not infuscated in the pale area over apex of second radial cell, cell M_1 with two pale spots distal to the pale spot straddling vein M_2; halter knob pale (typical form) or infuscated (variety *filariferus* Hoffman); spermathecae (fig. 3 c) pyriform, unequal, measuring 0.062 by 0.046 and 0.053 by 0.039 mm. Male genitalia (fig. 3 d, e) with small apicolateral processes; aedeagus with spherical, slender tip; parameres connected by a short loop at extreme bases, the apices at most with one or two microscopic branches.

Discussion.—The synonymy of *filariferus* Hoffman and *pseudodiabolicus* Fox is confirmed by a comparison of their types with the type of *diabolicus* Hoffman; the synonymy of *ocumarensis* Ortiz is based on the study of male and female paratypes. A study of the figures and description of *bimaculatus* given by Floch and Abonnenc convinces us that they were dealing with *diabolicus;* moreover they erroneously gave the name *diabolicus* to specimens of *foxi* Ortiz.

The absence of infuscation on the r-m crossvein and the infuscation of the halteres, the principal distinctions of *filariferus* Hoffman and *ocumarensis* Ortiz, occur with varying frequency in many localities in our material and are not apparently associated with any structural differences from typical *diabolicus.* For convenience, specimens with these characters may be referred to as the variety *filariferus* Hoffman. The proportion of this variety in the population is apparently quite high in Venezuela (where it was described as *ocumarensis* by Ortiz) and in the Central American highlands; elsewhere it seems to be relatively rare.

Specimens examined.—

BRAZIL: Pará, Belém, August 1951, H. E. Warmke, on stigma of *Hevea brasiliensis*,—1 female. Pará, São Caetano de Odivelas, February 1948, L. Deane,—4 females (from O. P. Forattini, det. as *trinidadensis* Hoffman).

GUATEMALA: Acatenango and San Pedro Yepocapa, 1950 and 1951, C. L. Gibson and W. F. Ascoli,—1 male, 211 females. El Zapote, 11 July 1945, E. J. Hambleton,—3 females.

HONDURAS: Lago Yojoa, 4 June 1953, P. Galindo, light trap,—3 males, 8 females. Tela, Valle Lancetilla, 10 June 1953, P. Galindo, light trap—7 males, 22 females.

MEXICO: Tapachula, Chiapas, 20 September 1944, B. Brookman, light trap,—11 females. Vergel, Chiapas, July 1935, A. Dampf, 28 females (type and 27 paratypes of *filariferus* Hoffman).

NICARAGUA: Rama, Zelaya, 18, 20 August 1943, P. A. Woke,—9 females. Villa Somoza, 20 July 1953, P. Galindo, light trap,—5 males, 10 females.

PANAMA: Cabima, 19 May 1911, A. Busck,—50 females (including type and 7 paratypes of *diabolicus* Hoffman). Cano Saddle, Gatun Lake, C. Z., May 1923, R. C. Shannon,—1 female. Barro Colorado Island, C. Z., 20 June 1941, October 1942, January to March 1944, J. Zetek,—100 males, females. Fort Kobbe, C. Z., 30 August 1950, S. J. Carpenter, 1 female. Balboa, C. Z., 23 June, 3 July 1942, P. A. Woke,—11 females. Many males and females collected in light traps by F. S. Blanton from: Canal Zone—Fort Clayton, Fort Kobbe, Fort Sherman, Loma Boracho, Madden Dam, Mindi Dairy, Mojinga Swamp; Darien Prov.—El Real, Garachiné, Jaqué, Punta Patiño; Herrera Prov.—Chitré; Panamá Prov.—Arraiján, Cerro Campana, La Jolla, Las Tablas, Pacora, Isla Taboga, Tocumen; Veraguas Prov.—

El Maria; Chiriquí Prov.—El Volcán, Gualaca, Pedregal; Colón Prov.—Piña; Coclé Prov.—El Valle, Rio Hato.

SURINAM: Moengo, August, September 1946, H. H. Stage,—3 females.

TRINIDAD: Cumuto Village, 7 August 1941, wall of stable,—1 female (holotype of *pseudodiabolicus* Fox, from Univ. Puerto Rico coll.). Arena Forest, 19 July 1954, T. Aitken,—1 female. Port of Spain, June 1953, 25th Med. Detachment, U. S. Army,—1 female. St. Pats, Arima, 1953 and 1954, W. G. Downs and T. Aitken,—26 females, mostly biting man in tree station. Sangre Grande, 5 October 1954, T. Aitken,—4 females. Tabaquite, 17 September 1954, T. Aitken,—3 females.

VENEZUELA: Ocumare del Tuy, 5 May 1950, I. Ortiz,—3 males, 2 females (paratypes of *ocumarensis* Ortiz).

Culicoides (Hoffmania) lutzi Costa Lima
(Figure 8)

Culicoides lutzi Costa Lima, 1937, Mem. Inst. Oswaldo Cruz 32: 419 (female; Pará, Brazil; fig. palpus).

Diagnosis:—Wing 1.22 mm. long; antennal ratio 1.18, sensoria present on segments III, XI to XV; third palpal segment 1.9 times as long as greatest breadth, with a shallow, irregular sensory pit; mandible with approximately 16 -17 teeth; mesonotum and scutellum as in *diabolicus*, with a prominent pair of blackish sublateral vittae on mesonotum; legs dark brown, apex of mid femur, bases of all tibiae and apex of hind tibia narrowly yellowish; hind tibial comb with six spines; wing (fig. 8 a) with sparse macrotrichia in apices of cells R_5, M_1 and M_2, with pattern as figured; one pale spot in cell M_1 past the pale spot straddling vein M_2, crossvein r-m pale, vein R_{4+5} infuscated only a short way past the dark area over base of second radial cell; halter knob pale; spermathecae subspherical to pyriform with distinct sclerotized necks, subequal, measuring 0.053 by 0.043 mm. Male unknown.

Discussion:—This species is nearly identical with *flavivenula* Costa Lima, from which it can be distinguished by the stouter third palpal segment with irregular sensory pit.

Specimens examined.—

BRAZIL: Pará, April 1930, N. C. Davis,—9 females. Pôrto Velho, Guaporé, Rio Madeira, May 1931, R. C. Shannon,—2 females.

BRITISH GUIANA: Oko River, 20 June 1936, N. A. Weber,—1 female.

Culicoides (Hoffmania) flavivenula Costa Lima
(Figure 9)

Culicoides flavivenula Costa Lima, 1937, Mem. Inst. Oswaldo Cruz 32: 418 (Brazil: Japuiba, Angra dos Reis, Est. Rio; Manguinhos, Bahia; female; fig. palpus); Floch and Abonnenc, 1942, Inst. Pasteur Guyane Publ. 37: 3 (French Guiana); Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 15 (Santa

Cruz, Est. Esp. Santo, Brazil; fig. female palpus); Forattini, 1954, Rev. Brasil. Ent. 1: 135 (redescr. female; descr. male; fig. female wing, palpus; male genitalia; states of Rio & São Paulo, Brazil; Panama [sic]; Ortiz and Leon, 1955, Bol. Inf. Cient. Nac. No. 67, p. 572 (notes).

Diagnosis:—Wing 1.10 (1.06—1.15, n = 3) mm. long; antennal ratio 1.17, sensoria present on segments III and XI to XV; palpus (fig. 9 b) with third segment 3.7 (3.6–3.8, n = 3) times as long as greatest breadth, with small, round, shallow, sensory pit; mandible with approximately 21 very fine teeth; mesonotum and scutellum brown, the former with median area indistinctly paler; legs brown, apex of mid femur, bases of mid and hind tibiae and apex of hind tibia, indistinctly paler yellowish; hind tibial comb with 5 spines; wing (fig. 9a) with very sparse macrotrichia on distal half and in anal cell, pattern of diffuse pale spots as figured, r-m crossvein pale, vein R_{4+5} infuscated a short distance distal to the dark area over base of second radial cell, only one pale spot in cell M_1 distal to the pale spot straddling vein M_2; halter knob pale; spermathecae (fig. 9c) subspherical to pyriform, subequal, measuring 0.053 by 0.043 mm.

According to Forattini (1954), the male genitalia are characterized by the presence of distinct apicolateral processes on the ninth tergum, aedeagus with convex sides as in *foxi* but with slender, spherical tip and parameres fused mesally for about half the total length.

Specimens examined.—

BRAZIL: Japuiba, Angra dos Reis, Est. Rio, March 1946, Lopez and Lane,—female (topotypic, received through O. P. Forattini). Espiritu Santo, Piragueassia,—13 females.

Discussion.—The pale halter, absence of infuscation on vein r-m and vein R_{4+5} darkened only a short way distal to the dark area over base of second radial cell of *flavivenula* will distinguish it from *insignis* Lutz, and the slender third palpal segment with a small round sensory pit will separate it from *lutzi* Costa Lima. Forattini l.c.) gives a Panama record of *flavivenula* (Chelpillo, C. Z., Fairchild, collector), but we have been unable to find any specimens assignable to this species in our Panama collections. Aberrant specimens of *diabolicus* in which the crossvein is pale and the distal pale spot in cell M_1 is lacking might be mistaken for *flavivenula*.

Culicoides (Hoffmania) insignis Lutz
(Figure 6)

Culicoides insignis Lutz, 1913, Mem. Inst. Oswaldo Cruz 5: 50 (male, female, pupa; Rio de Janeiro and Bahia, Brazil; (fig. female wing); Costa Lima, 1937, Mem. Inst. Oswaldo Cruz 32: 415 (fig. female palpus); Floch and Abonnenc, 1942, Inst. Pasteur Guyane publ. 49: 1 (French Guiana; fig. wing, palpus); Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 20 (notes on genitalia of male in Lutz' collection; fig. male genitalia from Rio de Janeiro); Macfie, 1948 Ann. Trop Med. Parasit. 42: 75 (Chiapas, Mexico); Fox, 1948, Proc. Biol. Soc. Washington 61: 25 (notes on female characters); Barbosa, 1952, Novos Subs. Conhec. *Culicoides* Neotropicos, p. 16 (Ceara, Brazil; notes on Lutz' collection).

Culicoides guttatus Lutz (misident., not Coquillett), 1913, Mem. Inst. Oswaldo Cruz 5: 58 (fig. wing); Beck, 1952, Florida Ent. 35: 102 (Florida records).
Culicoides inamollae Fox and Hoffman, 1944, Puerto Rico Jour. Pub. Health Trop. Med. 20: 110 (male, female; Puerto Rico; fig. wing); Fox, 1948, Proc. Biol. Soc. Washington 61: 25 (Florida; fig. male aedeagus, parameres, female palpus); Fox, 1950, Puerto Rico Jour. Pub. Health Trop. Med. 25: 342; Foote and Pratt, 1954, Pub. Health Monogr. 18:25 (U. S. records; fig. wing, mesonotum, palpus, male genitalia); Fox, 1955, Jour. Agr. Univ. Puerto Rico 39: 242 (syn.: *painteri* Fox, *oliveri* Fox & Hoffman [sic]).
Culicoides painteri Fox, 1946, Ann. Ent. Soc. Amer. 39: 257 (female; Honduras; fig. wing); Fox, 1948, Proc. Biol. Soc. Washington 61: 26 (fig. male parameres, aedeagus, female palpus). NEW SYNONYMY.

Diagnosis.—Wing 1.11 (0.89–1.25, n = 24) mm. long; antennal ratio 1.32, sensoria present on segments III, V, VII, IX, XI-XV; palpus (fig. 6 b) with third segment 2.8 (2.5–3.5, n = 19) times as long as greatest breadth, sensory pit varying from a broad shallow pit to subdivided, pitted areas; mandible with 21 (20–23, n = 20) teeth; mesonotum with pattern of a yellowish center and two prominent dark sublateral vittae; legs dark brown with pale spots on fore and mid knees and at base and apex of hind tibia; hind tibial comb with 6 spines; wing (fig. 6 a) with sparse macrotrichia on distal half and in anal cell; pattern of very distinct spots as figured, one pale spot in cell M_1 distal to the pale spot straddling vein M_2, crossvein r-m dark; vein R_{4+5} dark up to the point where it turns abruptly forward to meet the costa; halter knob dark; spermathecae (fig. 6 c) subspherical to pyriform, slightly unequal, measuring 0.063 by 0.049 and 0.052 by 0.041 mm. Male genitalia with very small apicolateral processes; aedeagus A-shaped, with a slender, spherical tip; parameres with main bodies joined at bases by a short loop, the tips bare (West Indies and South America) or with very fine branches (Central America).

Specimens examined.—

BRAZIL: 1 male, 1 female from type series of *insignis* in the Lutz collection in the Instituto Oswaldo Cruz, locality not given on slide. Guajara-Mirim, Rio Madeira, May 1931, R. C. Shannon,—1 female. Pelotas, Rio Grande do Sul, 5 April 1954, C. Biezanko, —2 males, 4 females. Recife, Pernambuco, F. Barbosa, reared from tidal mangrove marsh,—2 males, 2 females.
COLOMBIA: Opogoda, Emilio J. Pampana coll.,—3 females.
FLORIDA: Alachua Co., 28 November 1953, F. W. Mead,—4 females; Bradenton, Manatee Co., 1 September 1948, Parnu, light trap. —1 female; Charlotte Harbor, 6 June 1949, Bennett, light trap. —1 male, 7 females; Coogler Island, Hernando Co., 28 November 1949, Smith, light trap,—6 females; Crystal River, Citrus Co., 7 June 1949, Hudson, light trap,—2 males, 4 females; Fort Myers, 2 February 1949, Brechtel, light trap,—1 male, 1 female; Immokalee, 1 November 1946, M. J. Whisnaut,—1 female; Jacksonville, 16 September 1952, K. L. Knight, light trap,—female; Matecumbe Key, Monroe Co., 14 June 1949, Martin, light trap.

—1 female; Miami, 14 December 1943, W. Wirth, light trap,—1 male, 2 females; Morrison Field, Palm Beach Co., 20 November, 10 December, 1942, D. E. Hardy, light trap,—13 females; Titusville, Brevard Co., 2 February 1949, light trap.—1 female.

FRENCH GUIANA: Macrouria, May 1953, E. Abonnenc,—1 male, 5 females.

HONDURAS: Lago Yojoa, 4 June 1953, P. Galindo,—4 males, 5 females. Puerta Castilla, 29 April 1926, R. H. Painter,—1 female (holotype of *painteri* Fox, from Univ. Puerto Rico collection).

JAMAICA: Bath St. Thomas, Halfway Tree, Santa Cruz, Spa Town, Troy, 26 females, males, all collected in February 1937 by Chapin and Blackwelder.

MEXICO: Ciudad Monte, Tamaulipas, 13 November 1943, B. Brookman, light trap,—5 females. Tapachula, Chiapas, 20 September 1944, B. Brookman, light trap,—1 female.

NICARAGUA: Villa Somoza, 20 July 1953, P. Galindo, light trap,—4 males, 4 females.

PANAMA: Balboa, Canal Zone, 3 July 1942, P. A. Woke,—1 female. Many (51) specimens collected in light traps by F. S. Blanton from: Canal Zone—Loma Boracho, Mojinga Swamp; Chiriquí Prov.—El Volcán, Gualaca; Coclé Prov.—Aguadulce, El Valle, Rio Hato; Darien Prov.—El Real, Jaqué, Punta Patiño; Herrera Prov.—Chitré; Los Santos Prov.—Guarare, Las Tablas; Panamá Prov.—Arraiján, Cerro Campana, Pacora, San Carlos, Isla Taboga, Tocumen.

PUERTO RICO: Caroline, 20 July 1948, H. D. Pratt, light trap,—4 males, 7 females. Camp Tortuguero, 24 June 1952, F. S. Blanton, light trap,—3 males, 7 females. Fajardo, 1 July 1952, F. S. Blanton, light trap,—1 male, 1 female. Fort Buchanan, 26 June 1952, F. S. Blanton, light trap,—1 female. Guajalaca, 3 July 1952, F. S. Blanton, light trap,—2 females. Henry Barracks, 21 June 1952, F. S. Blanton, light trap,—3 males, 1 female. Mayaguez, 7 October 1935, Tulloch, light trap,—1 female (holotype of *inamollae* Fox and Hoffman).

SURINAM: Moengo, 25 March 1946, H. H. Stage,—1 female.

TRINIDAD: La Paille Village, 19 June 1954, Aitken & Downs, Shannon trap,—1 female. Port of Spain, 18 December 1953, W. G. Downs, light trap,—1 female. St. Pats, Arima, 19 November 1953, W. G. Downs,—1 male.

VENEZUELA: Ocumare del Tuy, 28 May 1951, I. Ortiz.—5 females. San Felipe, 23 May 1951, I. Ortiz.—2 males, 5 females.

Discussion.—The synonymy of *painteri* and *inamollae* with *insignis* is based upon examination of the types of *painteri* and *inanmollae* kindly loaned to us by Dr. Fox for this study.

The females of *insignis* are quite easily recognized by the wing markings, only one pale spot in cell M_1 past the pale spot straddling vein M_2, r-m is dark and vein R_{4+5} is dark extending well into the pale area over the second radial cell and usually dark to the point where it bends forward abruptly toward the costa.

Barbosa (1947) described and figured as *insignis* the genitalia of a male which he mounted from a vial of alcoholic specimens from the Lutz collection (in 1952 he stated, "infelizmente o único macho que montamos no Instituto Oswaldo Cruz nao foi encontrado") which differ from those of our material in showing the parameres entirely separate at the base and bearing distinct branches on the apex. In 1952 Barbosa quoted a letter from Costa Lima which confirmed his 1947 observation by Costa Lima's examination of other males from the type series of *insignis* in the Instituto Oswaldo Cruz (We believe, however, that there was a confusion as to which parts Costa Lima meant his remarks to apply). Ortiz (1950) on the other hand believed that Barbosa's description of the male genitalia of *insignis* could equally well apply to those of *guttatus* which had been figured by Barretto (1944), a species which Lutz had confused in his collection with *insignis*.

Dr. A. da Costa Lima has kindly loaned us for study a slide from the Instituto Oswaldo Cruz collection on which are mounted a male and a female from Lutz' type series of *insignis*. Examination of these syntypes of *insignis* reveals no differences from our extensive material which we have characterized above. We are thus led inescapably to the conclusion that *inamollae* is a synonym of *insignis*. Since the genitalia of the male specimen from the Lutz collection have the parameres joined at the base with the apices bare exactly as in *inamollae*, it seems best to resolve the problem on this positive evidence and therefore we here designate this male as the lectotype of *insignis*. We are also forced to agree with the opinion expressed by Ortiz (1950) that Barbosa's (1947) figure of the male genitalia of the alcoholic specimen from Lutz' collection probably represented the genitalia of *guttatus* (Coquillett) or some other species, a male of which may well have been mixed in the vial of specimens from which Barbosa made his slide. The possibility of *guttatus* being mixed up in Lutz' collection, or that a third, unnamed salt marsh species was also present, can be resolved only by a comprehensive study of Lutz' complete collection in line with the rapidly advancing knowledge of the Brazilian *Culicoides* fauna.

Lutz (1913) reported that *insignis* (in part) would feed on man and was taken in emergence traps on the seacoast at low tide. On the other hand, what little has since been reported on the habits and distribution of this species in the Caribbean area would indicate that it is abundant far from seacoasts near muddy cowpastures and does not feed on man. Barbosa (in litt.) has recently sent us for determination male and female specimens identical with our characterization of *insignis* which he reared from tidal mangrove marshes at Recife, Brazil. Barbosa states that this species bites man at Recife.

We believe that our designation of the male which we have studied as the lectotype of *insignis* will preserve the concept of this species consistent with Lutz' original description and figures of the female and Costa Lima's (1937) subsequent notes on that sex, all of which definitely indicate a species with the female characters of *inamollae* and not at all like *guttatus*. We do not consider Barbosa's actions as constituting those of a true reviser, since in his 1947 paper he nowhere indicates that he was aware of a confusion of species or was choosing a male by critical comparison with other species of this complex, and by 1952, the specimen which he had figured earlier had apparently been lost.

Culicoides (Hoffmania) maruim Lutz
(Figure 4)

Culicoides maruim Lutz, 1913, Mem. Inst. Oswaldo Cruz 5: 48 (female: Rio, São Paulo, Bahia, Brazil; mangrove swamps); Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 22 (fig. female palpus, male genitalia from Rio de Janeiro, Brazil); Fox, 1948, Proc. Biol. Soc. Washington 61: 22 (male, female; Itapagipe, Bahia, Brazil; fig. male genitalia).

Culicoides lutzi Floch and Abonnenc (not Costa Lima, misident.), 1942, Inst. Pasteur Guyane publ. 37: 2 (female; French Guiana; fig. wing, palpus); Floch and Abonnenc, 1942, idem. 49: 2 (male; fig. genitalia).

Culicoides insignis Barbosa (not Lutz, misident.), 1944, Rev. Brasil. Biol. 4: 259 (Recife, Brasil; male, female; fig. female palpus, wing, male genitalia).

Culicoides recifei Barbosa, 1947, An. Soc. Biol. Pernambuco 7: 25 (nom. nov. for *insignis* Barbosa 1944, not Lutz, misident.). NEW SYNONYMY.

Diagnosis.—Wing 1.12 (n = 4) mm. long; antennal ratio 1.11 (1.05–1.19, n = 4), sensoria present on segments III, XI-XV; palpus (fig. 4 b) with third segment 3.65 (3.5–4.1, n = 4) times as long as broad, without pit, sensoria scattered on surface; mandible with 16 (15–17, n = 5) teeth; mesonotum uniformly pruinose gray, without pattern; scutellum yellowish brown; legs brown, fore and mid knees with paler spots, hind tibia with faint basal and apical pale bands; hind tibial comb with five spines; wing (fig. 4 a) with macrotrichia present on distal third, wing yellowish with a poorly defined gray pattern as figured, r-m crossvein dark on anterior end, vein R_{4+5} not darkened distal to the dark area over base of second radial cell, one small round pale spot in cell M_1 distal to the pale spot straddling vein M_2; halter dark; spermathecae (fig. 4 c) pyriform, slightly unequal, measuring 0.055 by 0.043 and 0.051 by 0.038 mm. Male genitalia (fig. 4 d, e) with small apicolateral processes; aedeagus heavily sclerotized, internal peg-like sclerotization absent, apex stout with ball-like tip; parameres fused a short distance at extreme bases, main bodies stout and gradually tapering to relatively stout, bare, pointed tips.

Discussion.—Barbosa (1944) and other workers have confused *maruim* Lutz with *insignis* Lutz, and this resulted finally in Barbosa describing *maruim* again in 1947, as *recifei*. We have examined a series of 2 males and 29 females in the U.S.N.M. collected by Barbosa in Recife, Brazil, and labelled by him as *insignis* Lutz. These specimens cannot be distinguished from those from Itupagipe reported by Fox as *maruim*, of which Dr. Fox has kindly deposited a male and a female in the U.S.N.M. collection. There should be no problem in determining females of Lutz's two species. Lutz (1913) showed an excellent figure of the wing and palpus of *maruim*, the palpus being very distinctive. Lutz' figure of the wing of *insignis* clearly shows the dark extension formed by vein R_{4+5} into the pale spot over the second radial cell, characteristic only of this species. Moreover, Costa Lima (1937) as first reviser, pointed out this character of the wing and figured the characteristic irregular sensory pit of the palpus of *insignis*. The separation of *maruim* and *trinidadensis* is much more difficult, but *maruim* is a much paler species with a more yellowish wing on which the macrotrichia are very scanty and, in our material, lacks the sensoria on antennal segments V, VII and IX which are characteristic of *trinidadensis*.

Floch and Abonnenc's figures of French Guiana males and females which they reported as *lutzi* Costa Lima leave little doubt that the species was *maruim*.

According to Lutz (1913), *maruim* is periodically a great pest in the mangrove zone of the coasts of Brazil, where it is known by the common name of "maruim," attacking man and other animals indiscriminately and in hordes. Barbosa (1944) also stated that this species (as *insignis*) was very abundant at Recife near the mangrove zone.

Specimens examined.—

BRAZIL: Recife, F. Barbosa collector,—2 males, 29 females (determined by Barbosa as *insignis* Lutz). Itupagipe, Salvador, Bahia, 16-18 August 1932, N. C. Davis,—1 male, 1 female.

Culicoides (Hoffmania) trinidadensis Hoffman
(Figure 5)

Culicoides trinidadensis Hoffman, 1925, Amer. Jour. Hyg. 5: 286 (female; Trinidad; fig. wing); Fox, 1946, Ann. Ent. Soc. Amer. 39: 256 (Stubals Bay, Trinidad); Fox, 1948, Proc. Biol. Soc. Washington 61: 23 (fig. female palpus).

Culicoides oliveri Fox and Hoffman, 1944, Puerto Rico Jour. Pub. Health Trop. Med. 20: 108 (Haiti; male, female; fig. male aedeagus, parameres); Fox, 1948, Proc. Biol. Soc. Washington 61: 23 (discussion). NEW SYNONYMY.

Culicoides wokei Barbosa (in part, not Fox, June 1947), November 1947, An. Soc. Biol. Pernambuco 7: 28 (male, female; Balboa, Panama; fig. male genitalia, female palpus).

Culicoides diminutus Barbosa, 1951, Proc. Ent. Soc. Washington 53: 163 (new name for *wokei* Barbosa not Fox). NEW SYNONYMY.

Diagnosis.—Wing 1.12 (1.06–1.19, n = 14) mm. long; antennal ratio 1.22 (1.15–1.30, n = 5), sensoria present on segments III, V. VII, IX, XI-XV; palpus (fig. 5 b) with third segment 3.4 (2.8–3.9, n = 15) times as long as greatest breadth, without sensory pit, sensoria scattered on surface; mandible with 17 (16–20, n = 17) teeth; mesonotum and scutellum uniformly dull dark brown; legs dark brown, trace of pale spots on fore and mid knees and at base and apex of hind tibia; hind tibial comb with 5 (n = 17) spines; wing (fig. 5 a) with macrotrichia sparse but present in all marginal cells of wing; wing grayish brown with pattern of small, dull grayish white spots as figured, r-m crossvein dark on anterior end, vein R_{4+5} not darkened past the dark area over base of second radial cell, cell M_1 with only one pale spot distal to the pale double spot straddling vein M_2; halter dark; spermathecae (fig. 5 c) subspherical to pyriform, subequal, measuring 0.058 by 0.046 mm. Male genitalia (fig. 5 d, e) with apicolateral processes small; aedeagus stout, with a pair of peculiar subapical projections extending ventrolaterad, the shape of the apex resembling a fleur-de-lis; parameres with main bodies fused on basal half, apices filiform and bare.

Discussion.—We are forced to synonymize *oliveri* Fox and Hoffman with *trinidadensis* after a comparison of the types, that of *oliveri* having been loaned by Dr. Fox. As Fox (1948) later pointed out, his male allotype of *oliveri* was probably not correctly associated with the female and is probably *insignis* Lutz, a species which undoubtedly also occurs in Haiti.

We have studied the type series of *wokei* Barbosa (not Fox) = *diminutus* Barbosa in the U.S.N.M. and have selected as lectotype a male mounted on a slide from Balboa, Panama Canal Zone, 2-9 July 1942, P. A. Woke no. 1027. The lectoparatypes of *wokei* Barbosa are indicated below in the list of specimens examined.

The material which Forattini (1953) redescribed as *trinidadensis* was surely misidentified. Of a short series kindly sent to us by Forattini, the females are close to *diabolicus* var. *filariferus*, while the male genitalia are unlike those of any described species, although the parameres resemble those of *flavivenula* Costa Lima.

Specimens examined.—

BAHAMAS, B. W. I.: Andros Island, Driggs Hill near South Bight, 27 April 1953, Van Voast—A.M.N.H. Exp., Hayden and Giovannoli,—4 females.

HAITI: Mariana, 7 December 1925, "biting viciously in sun,"—1 female (holotype of *oliveri*).

NICARAGUA: Corinto, 20 December 1942, 3 April 1943, P. A. Woke, —16 males, 18 females (paratypes of *wokei*).

PANAMA: Balboa, Canal Zone, 2, 9, 11 July 1942, P. A. Woke,—2 males, 4 females (paratypes of *wokei*). Many males and females collected in light traps by F. S. Blanton from: Canal Zone—Fort Kobbe, Mojinga Swamp; Bocas del Toro Prov.—Almirante; Chiriquí Prov.—Rio Tabasará; Coclé Prov.—Puerto Farallón, Rio Hato; Darien Prov.—Garachiné, Jaqué, Punta Patiño; Herrera Prov.—Puerto Chitré; Los Santos Prov.—Bayano, Las Tablas; Panamá Prov.—Arraiján, Chame, Pedregal, Puerto Chorrera, Tocumen, Vique Cove; Perlas Islands—Isla del Rey.

TRINIDAD: Port of Spain, Caronia River, 14 June 1906, F. W. Urich,—1 female (holotype of *trinidadensis*). Port of Spain, June 1953, (light trap),—3 females. Stubal's Bay, 4 July 1941 (light trap),—2 females.

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A COLOR VARIETY OF THE MEADOW SPITTLEBUG NEW FOR OHIO
(Homoptera, Cercopidae)

Doering (1930, Jour. Kan. Ent. Soc. 3:53-64, 81-108) described eight color varieties of the meadow spittlebug, *Philaenus leucophthalmus* (L.), which occur in North America. Six of these have been previously reported from Ohio by Weaver and King (1954, Ohio Agric. Expt. Sta. Res. Bul. 741). A single female specimen of *P. leucophthalmus* color variety *leucocephalus* (L.) was taken in sweeps from alfalfa at Wooster, Ohio, on June 25, 1956. This is the first record of this color variety in Ohio and increases the state list to seven varieties.

The specimen has been deposited in the Ohio State University Collection, Columbus, Ohio.—K. P. Pruess, *Ohio Agricultural Experiment Station, Wooster.*

TWO NEW SPECIES OF ALLUAUDOMYIA FROM CHEBOYGAN COUNTY MICHIGAN, WITH A NOTE ON THE SYNONYMY OF PARA AND DOWNESI[1]

(Diptera, Heleidae)

BY ROGER W. WILLIAMS,[2] *School of Public Health and Administrative Medicine, Columbia University, New York, N. Y.*

During the summer of 1954 studies were initiated on the Heleidae of the Douglas Lake region of Cheboygan County, Michigan. Two male specimens, representing two previously undescribed species, of the biting midges of the genus *Alluaudomyia* were taken in recovery cages. The genitalia were so markedly different from any of those discussed by Wirth (1952) in his paper on this genus in North America, and from any species mentioned by Goetghebuer (1933), Kieffer (1925 a, b), de Meillon (1939), de Meillon and Hardy (1953), Okada (1942), Tokunaga (1940 a, b), and Vaillant (1954), that describing these species from single male specimens was felt to be justified.

Although male wings are not as a rule described it seemed advisable to include illustrations and descriptions of these wings since no females were recovered and since the aedeagus of one was somewhat distorted due to folding. The terminology of wing venation follows that of Tillyard's modification of the Comstock-Needham system, a system which has been used by various students of this family in recent years, thus Cu_1 and Cu_2 of some workers become M_{3+4} and Cu_1 respectively, and cell Cu_1 becomes cell M_4. Much of the study was done with 18X eyepieces and a 43X objective.

Alluaudomyia megaparamera, new species

(Figures 1 and 2)

Male.—Length 1.34 mm; wing 1.05 mm; by 0.37 mm. *Wing* (Fig. 1) with costa to 0.495 of wing length. Subcosta not distinct but present, first radial cell closed, second but slightly open. Only two large black spots, one just proximad to the r-m cross vein on and between the radial and medial sectors, darkest on the sectors, the other near the tip of the second radial cell. Nine other somewhat faint darkened areas on veins as follows: veins M_1, M_2, and M_{3+4} each with a darker area on the proximal half and another on the distal half; vein Cu_1 with a central marking; an elongate marking on the medial-cubital sector; a slight marking at the tip of the anal vein. Macrotrichia few along distal anterior border. *Genitalia* (Fig. 2) about as broad as long; ninth sternite more than

[1] Contribution from the University of Michigan Biological Station.

[2] I wish to thank Dr. W. W. Wirth of the Entomology Research Branch, Agricultural Research Service, U.S. Department of Agriculture, for his aid in determining that these specimens represented undescribed species and for references pertaining to this genus in other countries.

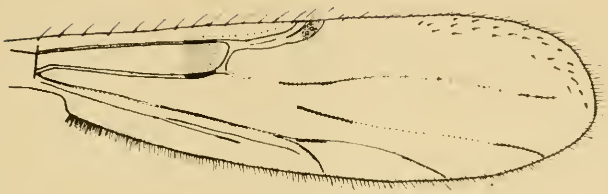
twice as broad as long, depth of mesal excavation less than ½ length of ninth sternite, the posterior membrane spiculate; ninth tergite short and narrow, apicolateral processes appearing as fleshy lobes, broader at base than long, tips at about ⅔ length of basistyles, membrane of ventral face of tergite rather evenly rounded and extending well beyond apicolateral processes. Basistyles somewhat broader at base with prominent, sharply recurved, pointed ventral roots, inner margins slightly concave; dististyles spiculate throughout, strong, subequal to tip, slightly curved, apex with small tooth. Aedeagus a long, slender, tapering arch reaching beyond base of apicolateral processes, basal arms forming about 60° angle with main arch, the ventral surface of the tip is bluntly rounded whereas the dorsal surface terminates in a square-cut end, a highly sclerotized arch crosses the main arch a short distance from the tip, a center strip of this arch appears more highly sclerotized than the borders. Lateral basal apodemes of the parameres rather deeply notched at outer end, a second pair of apodemes, with lateral ends broad and flaired narrow abruptly and pass under the base of the parameres. Parameres exceedingly long, about 2⅓ times as long as the basistyles, divided by a joint into two portions, the basal portion, or stem, as long as the basistyles, broadened laterally at the distal end to form a ledge for the attachment of the distal portion; the distal portion of the parameres directed anteriorly but recurving abruptly at about ¼ their length, gradually tapering and extending well beyond the distal end of the basistyles, terminating in sharp points.

Type.—Holotype ♂, Reese's Bog (just north of Burt Lake), Cheboygan County, Michigan, June 30, 1954, R. W. Williams (recovery cage). Type in U.S.N.M.

Of the species found in North America *megaparamera* appears to be more closely related to *parva* than to any other. In both, the genitalia are broader than long, the posterior membrane is spiculate and the ninth tergite is relatively small. However, in *megaparamera* the arch of the aedeagus possesses prominent basal arms and is much longer and more narrow with a sclerotized arch near the tip, two pairs of apodemes are present near the base of the parameres and the parameres themselves are unique in that they are composed of two semiequal regions or segments the total length of which is about 2⅓ times the length of the basistyles.

Alluaudomyia wirthi, new species
(Figues 3 and 4)

Male.—Length 1.40 mm; wing 1.08 mm. by 0.38 mm. *Wing* (Fig. 4) with costa to 0.518 of wing length. Subcosta barely visible under proper lighting, first radial cell closed, second fairly widely open. Five dark spots on the wing; of the two larger spots one lies proximad to the r-m cross vein on and between the radial and medial sectors and the other at the tip of the second radial cell (this spot may appear as two separate spots, one at the tip of vein R_{4+5}, the other lying just below, barely touching it); vein M_2 with a prominent spot on the proximal half and cell M_2 with a somewhat smaller lighter spot which lies below and slightly behind the large dark spot proximal to the r-m cross vein; the anal vein has a darkened area at the tip. Macrotrichia very sparse, a few



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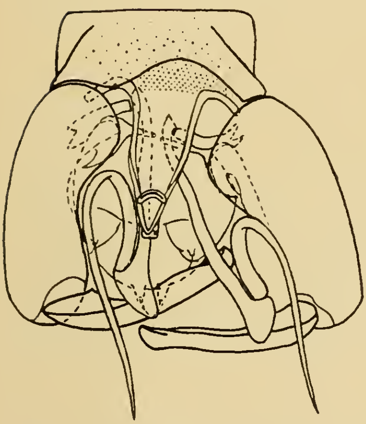

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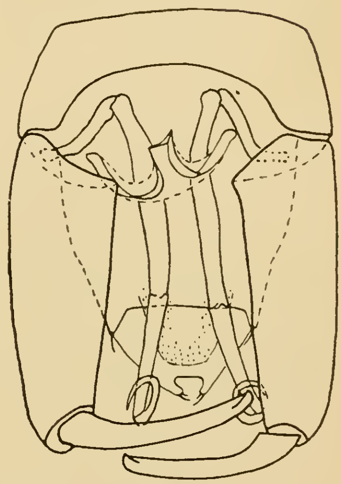

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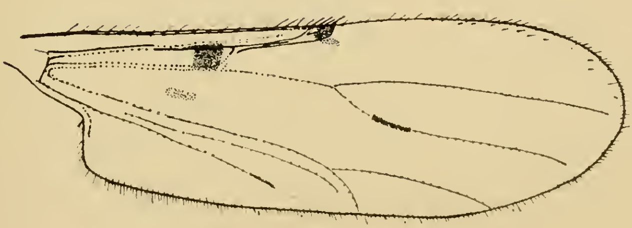

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Alluaudomyia megaparamera n. sp.: fig. 1, male wing; fig. 2, male genitalia. *A. wirthi* n. sp.: fig. 3, male genitalia; fig. 4, male wing.

on distal anterior border. *Genitalia* (Fig .3) about ¼ longer than broad. Ninth sternite more than twice as broad as long, the posterior excavation is apparently rounded (somewhat difficult to see in this single specimen) going halfway to base, the membrane not spiculate; ninth tergite with distal third subparallel, the apicolateral processes about ¼ as long as the distance between their bases, membrane on ventral face of tergite ends well beyond the apicolateral processes and has a mesal spiculate area. Basistyles subparallel, about 2.8 times as long as broad; distyles slender, slightly incurved, the proximal half somewhat more densely pilose. Aedeagus (artificially folded in this specimen as indicated in Fig. 3) with basal arch about one-half of total length, tip square-cut, ventral surface slightly concave. Parameres with lateral basal apodemes originating within base of basistyles, bent at 40-60° angle at proximal third to fourth, spiculate stems with the somewhat bulbous base extending well below base of basistyles and extending distad nearly to the tip of the basistyles where there is an apparent joint terminated by a second segment or filament which is short, recurved and sharply pointed.

Type.—Holotype ♂, Smith's Bog, Cheboygan County, Michigan, July 27, 1954, R. W. Williams (recovery cage). Type in U.S.N.M.

The genitalia of *wirthi* displays some resemblance to *bella* and some to *needhami*. It can, however, readily be separated from either of these species by its distinctive aedeagus and parameres, absence of spicules on the ninth sternite and rather long membrane on the ventral face of the ninth tergite which has a spiculated mesal area. I am pleased to name this species after Dr. Willis W. Wirth who has been so extremely helpful to me in many ways during my study of heleids from various parts of North America.

Note on the Synonymy of **Alluaudomyia parva** and **A. downesi**

Wirth (1952) described *Alluaudomyia downesi* from a single female specimen and stated that it was closely allied to *parva*. Since the male of *megaparamera* appeared to be more closely related to *parva* than to any other North American species the possibility existed that it might be the male of *downesi*. Communication with Dr. Wirth concerning this possibility disclosed that he had later collected a male of *parva* from the type locality of *downesi* and that he now feels that the female he described as *downesi* actually represented a variation within the species *parva*. After studying specimens from all available localities I concur with Dr. Wirth that this is probably the case and at his suggestion am including this brief paragraph on this synonymy.

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BOOK NOTICE

AQUATIC INSECTS OF CALIFORNIA, With Keys to North American Genera and California Species, Edited by Robert L. Usinger. University of California Press, Berkeley. 1956. 576 pp., index, many illustrations. Price $10.00.

This field manual and text provides a general introduction to aquatic entomology and detailed treatments of the biology and classification of each group of aquatic insects. The volume offers the first opportunity for students of entomology and related fields to become easily acquainted with contemporary work in this area.

The introduction, written from the ecological point of view, presents the basic concepts of limnology as applied to insects. The various aquatic habitats of California are described, and the applied aspects of aquatic entomology are discussed. Techniques of collecting, mounting and rearing aquatic insects are explained, and standard limnological methods are brought to the attention of entomologists.

The greater part of the book is written from the taxonomic point of view and presents detailed keys for the identification of aquatic insects, including all the genera for North America north of Mexico and the species for California. Important taxonomic characters are well illustrated, and wherever possible, keys are given for both adults and immature stages. Each of the chapters on classification has been prepared by a leading authority on the group covered. Much original work is included, and references to the literature include the latest monographic treatments. Information is given on life histories, habitats, distribution, feeding habits and taxonomic characters.

A special feature that will facilitate the use of the systematic chapters is a glossary of technical terms.—RICHARD H. FOOTE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

FOR WINTER PUBLICATION

A CLASSIFICATION OF THE SIPHONAPTERA OF SOUTH AMERICA

WITH DESCRIPTIONS OF NEW SPECIES

by Phyllis Truth Johnson

Memoir 5 of the Entomological Society of Washington

The study of South American fleas was begun in 1879 when Weyenbergh published the first descriptions of species from that region, using specimens mounted on cardboard as was usual in that day. These fleas were restudied in balsam by Jordan and Rothschild in England shortly after the turn of the century, and from that time to the present day a large number of siphonapterologists, both in England and the Americas, have contributed to this study. Dr. Johnson's work is the first comprehensive taxonomic treatment of the fleas of the region, which comprises Trinidad and all of the continent and its coastal islands. The contemplated 275 page volume will be indispensable to the serious student of this important order of insects.

Memoir 5 opens with two discussions of morphological characters, one devoted to the terms used in the taxonomic section and the other to their taxonomic validity and possible phylogenetic significance. All the families, tribes and genera known to occur in South America are completely described and illustrated, and the species within each genus have been listed with host and locality data. Descriptions of 17 new species and two new subspecies bring the total number to 170. Keys to families, tribes, genera, and species are included. The discussion of each genus is terminated by a section giving the synonymics of the hosts concerned. The 114 plates are said to contain among the best illustrations of fleas currently available, and are grouped according to family. A section listing hosts, each with the fleas known to occur on it, recapitulates the host-flea information; sections dealing with references, systematic index and list of abbreviations close the volume.

Prepublication orders at the price of $8.00 to members and $9.00 to nonmembers may still be placed with the *Society* for Memoir No. 5. Orders should be addressed to *Mr. Herbert J. Conkle, Custodian, Plant Quarantine Branch, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.*

CORRECTIONS IN THE TAXONOMY AND NOMENCLATURE OF MOSQUITOES (DIPTERA, CULICIDAE)

by ALAN STONE, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

Recent work on the mosquitoes of the world, particularly in connection with a forthcoming synoptic catalogue of the Culicidae, has revealed the need for certain corrections, and I make them at this time so that they can be incorporated in the catalogue. Much of the information on which this paper is based was obtained during a visit to the British Museum (Natural History), and I am indebted to the authorities of that institution, particularly to P. F. Mattingly, for the many courtesies extended during that visit.

THE FAMILY CULICIDAE

For many years this family included three subfamilies, the Dixinae, Chaoborinae, and Culicinae, but recently there has been a strong tendency to raise the Dixinae to family rank, a procedure with which I have been in full agreement. Some authors have accorded the same treatment to the Chaoborinae, and while this has not been widely accepted, it seems to me to be a logical and useful step and I have adopted it. Certainly there are sufficient characters on which to base the family Chaoboridae, and it is of great practical value since it leaves in the family Culicidae only the true mosquitoes, all of which have an elongate labium and nearly all of which are bloodsucking.

Within the Culicidae, after the exclusion of the Dixidae and the Chaoboridae, we can recognize three subfamilies—the Anophelinae, Culicinae, and Toxorhynchitinae. The Culicinae can in turn be separated into several tribes. These will include the Culicini, Aedini, Culisetini, Uranotaenini, and Sabethini.

Anopheles ludlowae (Theobald)

Myzomyia ludlowii Theobald, 1903, Mon. Cul. 3: 43.

Since the original description of this species states, "Habitat.—Luzon, Philippine Islands (Miss Ludlow)," it is evident that Theobald intended to dedicate the species to Miss C. S. Ludlow (see also p. 347, accession 141a), and since it is obvious that Theobald was using the genitive case when he proposed the name *ludlowii*, it is necessary to correct the spelling of this name. The International Rules of Zoological Nomenclature demand that a species name based on the modern patronymic of a woman, if in the genitive case, should be formed by adding *ae* to the complete name.

Orthopodomyia albicosta (Lutz)

Bancroftia albicosta Lutz, 1904, in Bourroul, Mosq. Brasil, pp. 40, 59.

Lane (1955, p. 624) considers that this is a *nomen nudem* in Bourroul, but since only a single species is included in the newly named genus on p. 40, and since characters are given for the genus on p. 59, one must consider that these characters apply to the species also, and validate the name. Lane has marked two specimens in the British Museum as types of the species. The male bears the label, ''Cochocirinha 22.11.04 Bainha,'' and the female, ''Cantareira 11.4.05.'' Lane gives Cantareira as the type locality. Since the Cantareira specimen was collected after the publication of the description, and the male was collected late in 1904, it does not seem likely that either of these specimens was before Lutz when he described the species. For this reason the validity of these as syntypes is questionable.

Mansonia arribalzagai (Theobald)

Taeniorhynchus arribálzagae Theobald, 1903, Mon. Cul. 3: 261.

In accordance with the International Rules of Zoological Nomenclature and supported with a slight modification not affecting this case by the Copenhagen Decisions on Zoological Nomenclature, a specific name based on a modern patronymic of a man is, if in the genitive case, to be formed by adding *i* to the portion of the name used. Since it is certain that this species was named after Felix Lynch Arribálzaga, the name of this species should be emended from *arribálzagae* to *arribalzagai*.

Theobald consistently referred to Dr. Lynch Arribálzaga as Dr. Arribálzaga, an error which has persisted to this day. As is customary in Spanish names, Lynch and Arribálzaga are the family names of his father, Felix F. Lynch, and his mother, Trinidad Arribálzaga. Species described by him should be credited to Lynch Arribálzaga, which might be abbreviated to Lynch, Lynch A., or L. A., but not to Arribálzaga or Arrib. Comparable names are Gil Collado, Osorno Mesa, Diaz Najera, Martinez Palacios, Nunez Tovar, Campos R., etc. It should be noted that Portuguese names do not follow the same plan, so that Costa Lima is alphabetized under Lima, Ayrosa Galvão under Galvão, Oliveiro Castro under Castro, etc.

Mansonia bonneae Edwards

(Figures 1 and 2)

Mansonia bonneae Edwards, 1930, Bul. Ent. Res. 21: 542.

When Edwards described this species, he considered it to be the taxon that Bonne-Wepster (1930, p. 209) described as *Taeniorhynchus annulipes* var. A. An examination of the terminalia of the holotype male of *bonneae* in the British Museum shows certain differences from Bonne-Wepster's figure. The dististyle (Fig. 1) is somewhat similar to the upper figure of Bonne-Wepster, but there is no evidence of the hairs along the concave margin of the dististyle, as shown in the whole

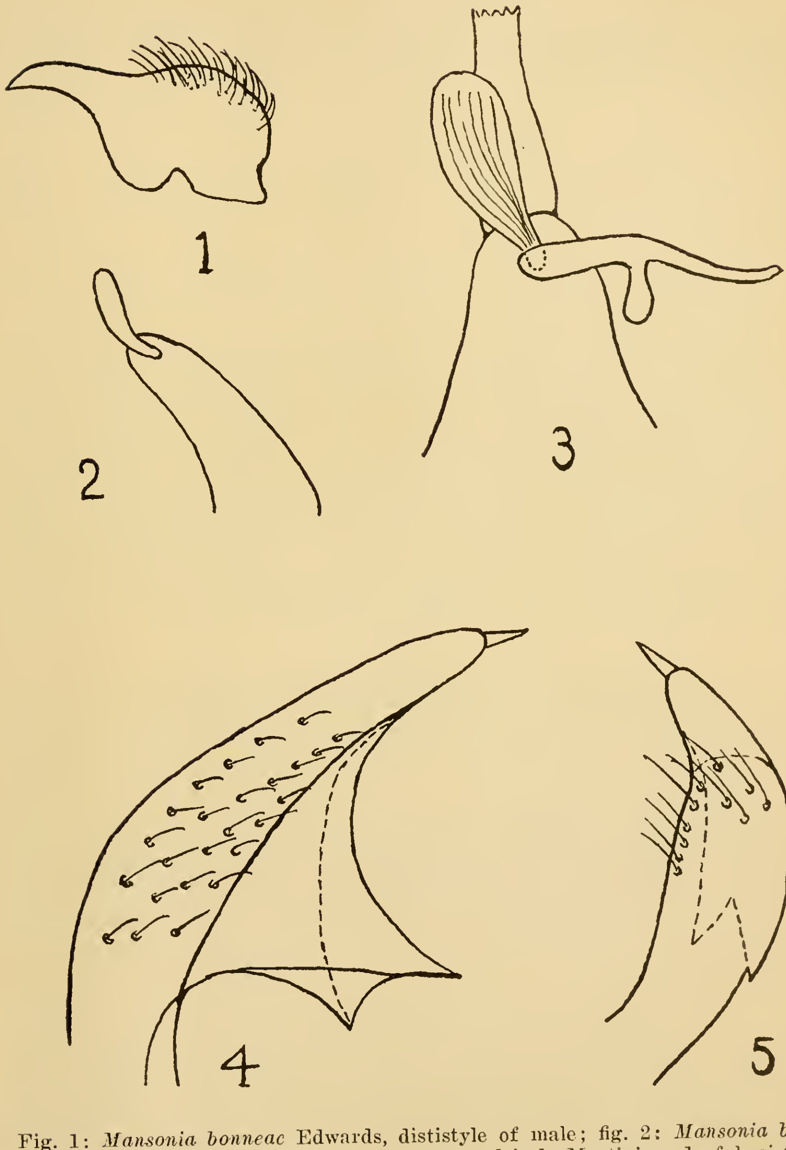

Fig. 1: *Mansonia bonneac* Edwards, dististyle of male; fig. 2: *Mansonia bonneae* Edwards, claspette of male; fig. 3: *Culex alticola* Martini, end of basistyle and base of dististyle of male, showing leaflet and subapical process; figs. 4 and 5: *Psorophora pallescens* Edwards, tip of dististyle of male.

figure of the terminalia. The claspette shows only one blunt appendage at the tip (Fig. 2) rather than two acutely pointed ones as in the figure. There are also many more, longer, heavier, spines on the inner margin of the basistyle than shown in the figure. These differences seem to make the identity of *bonneae* with *annulipes* var. A very doubtful.

Mansonia dives (Schiner)

Culex annulipes Walker, 1857, Jour. Proc. Linn. Soc. London 1: 6 (not Meigen, 1830).

Culex dives Schiner, 1868, Reise der Novara, Diptera, p. 31.

Culex longipalpis van der Wulp, 1881, Bijd. Faun.-Midden-Sumatra, Dipt., p. 9.

The name *Culex dives* was completely overlooked by Edwards (1932), although Giles referred to it in both editions of his "Handbook of Gnats or Mosquitoes." Schiner proposed this name as a substitute for the preoccupied *Culex annulipes* Walker. It is possible that Schiner misidentified Walker's species, but nomenclatorially *dives* is a substitute name for *annulipes* Walker and must be applied to Walker's species, which is accepted as being the same as *Culex longipalpis* Wulp. Paragraph 142, p. 75, of the Copenhagen Decisions on Zoological Nomenclature (Hemming 1953) is very clear on this nomenclatorial principle. For this reason the name *dives* Schiner replaces the currently used *longipalpis* Wulp.

Psorophora (Grabhamia) cingulata (Fabricius)

Culex cingulatus Fabricius, 1805, Syst. Antliat., p. 36.

Aedes (Lanesia) garciai Levi-Castillo, 1953, Rev. Ecuat. de Ent. and Parasit. 1(3): 102 (New synonymy).

The description and figures of the single male of *Aedes* (*Lanesia*) *garciai* Levi-Castillo, type of the subgenus *Lanesia*, are quite evidently of a *Psorophora* of the subgenus *Grabhamia*. Dr. Levi-Castillo wrote to me that the type specimen was destroyed by, "time, humidity and fungi" but the terminalia were preserved on a slide which he very kindly loaned to me for examination. The terminalia are dissected and agree well with the original figures except that both dististyles are cut or broken off a short distance beyond the base, at the same level, and the distal two-thirds of these structures are missing from the slide. These terminalia are certainly of a *Psorophora* (*Grabhamia*) and the figure of the adult agrees well with *cingulata*. Levi-Castillo describes the wing as, "Recubiertas de escamitas negras y algunas más claras." In *cingulata* the scales are usually all dark, as figured for *garciai*, but a few paler scales may be present. I consider *garciai* to be a synonym of *cingulata* and *Aedes* (*Lanesia*) Levi-Castillo, 1953, to be a synonym of *Psorophora* (*Grabhamia*) Theobold, 1903.

Psorophora (Janthinosoma) albipes (Theobald)

Janthinosoma albipes Theobald, 1907, Mon. Cul. 4: 157.

This name was proposed for the species that Theobald (1903, p. 126) had determined as *Janthinosoma discrucians* (Walker). In 1903 Theobald gave as localities "South America (Walker): Trinidad, at Agua Santa (F. W. Urich)." In 1907 Theobald gave the additional locality "Fort Logan H. Roots, Arkansas (Miss Ludlow)." The locality, "South America (Walker)" would be that of the true *discrucians* and would not be eligible for lectotype selection for *albipes*. The other two localities are therefore the only ones available, and since *albipes*, as now recognized, does not occur in the United States it seems best to restrict the name to the Trinidad locality. There are two specimens in the British Museum labeled "Agua Santa, Trinidad," and I have labeled the one bearing the date 22.XII.1900 as lectotype and the one dated 25.XII.1900 as paralectotype.

Lane and Cerqueira (in Lane, 1955, p. 758) give the type locality as U. S. A. and the type in the British Museum. No U. S. A. type was found there, but there is a specimen from Red Hills, Kingston, Jamaica, on which Lane put a type label. Since this is not an original locality and the lectotype designation was not published, it has no standing as a lectotype.

Posorophora (P.) pallescens Edwards
(Figures 4 and 5)

Psorophora (P.) pallescens Edwards, 1922, Bul. Ent. Res. 13: 76.

This distinctive species is based on a pair of syntypes in the British Museum and presumably others in Budapest. An examination of the terminalia of the male syntype in the British Museum shows certain structures to be somewhat different than as figured by Lane and Cerqueira (in Lane, 1955, p. 737). One difference is in the hairs at the tip of the claspette, these being considerably longer and bent. A more striking difference is in the shape of the tip of the dististyle. On the slide one of these is in the lateral view, and the other with the convex surface toward the observer. These two aspects are shown in figures 4 and 5, respectively.

Psorophora perterrens (Walker)

Culex perterrens Walker, 1856, Insecta Saundersiana, Dipt. 1: 431.

A specimen in the British Museum bears the following labels: "Saunders 68-4/Type/perterrens Wlk/identified as type by E. A. Waterhouse ♀ perterrens Walk. N. Amer." This specimen belongs to the subgenus *Janthinosoma* and, although it lacks all legs, the head and thoracic coloration show it to be, with little doubt, *Psorophora ferox* (Humb.). If this specimen is considered as the type of *perterrens*, then the name should be transferred from synonymy under *P.*

ciliata (F.) to synonymy under *P. ferox.* There are, however, serious objections to accepting this specimen as the type. The original description of *perterrens* gives the locality as South America, whereas this specimen is labeled "North America"; the dimensions given, "Length of body 4 lines; of the wings 6 lines," are considerably greater than in this "type" specimen; the abdominal coloration as described is "purplish with a testaceous band on the fore border of each segment," while in *ferox* the testaceous bands are on the hind borders of the segments, if present. For these reasons I do not think that this specimen can be considered the type, and since no other type was found, the original specimen is presumably lost.

The synonymizing of *perterrens* with *P. ciliata* (F.), as done by Theobald and accepted ever since, is also open to question. While the size is in agreement, one would hardly expect Walker to overlook the banding of the tarsi, and the described abdominal coloration agrees no better with *ciliata* than it does with *ferox.* For this reason we must consider *perterrens* as an unknown species of mosquito, presumably of the genus *Psorophora,* with no type in existence.

Aedes, subgenus **Neomelaniconion** Newstead

Neomelaniconion Newstead, 1907 (Feb. 1), in Newstead, Dutton and Todd, Ann. Trop. Med. and Parasit. 1: 31.

Banksinella Theobald, 1907 (Feb. 23), Mon. Cul. 4: 469.

It has apparently been overlooked that the name *Neomelaniconion,* based upon the single included species, *palpale* Newstead, antedates both *Banksinella* Theobald and the differently spelled *Neomelanoconion* Theobald, published 22 days later. Since *Culex luteolateralis* Theobald, the type of *Banksinella,* and *N. palpale* belong to the same subgenus of *Aedes,* as has long been recognized, it is evident that *Neomelaniconion* must replace *Banksinella.*

Aedes (Finlaya) mjoebergi (Edwards)

Armigeres mjöbergi Edwards, 1926, Sarawak Mus. Jour. 3: 248.

The British Museum collection contains three rather badly rubbed female syntypes of this species. An examination shows them to belong to the genus *Aedes,* subgenus *Finlaya,* of the *geniculatus* group and *niveus* subgroup. The specimens are not in good enough condition for identification as any species previously placed in the subgroup, and it is probable that they represent a valid species. Discovery of the male would be most helpful in settling the relationship of the species. The best of the syntypes has been labeled and is here designated as lectotype of the species.

Aedes (Ochlerotatus) vigilax ludlowae (Blanchard)

Culex annulifera Ludlow, 1903, N. Y. Ent. Soc. Jour. 11: 141 (not Blanchard, 1852).

Culex ludlowi Blanchard, 1906, Les Moustiques, p. 630.

Since this was a new name for *Culex annuliferus* Ludlow, not Blanchard, it is obvious that it was named for Miss Ludlow and should therefore take the feminine ending.

Aedes (Aedimorphus) stenoscutus (Edwards)

Stenoscutus africanus Theobald, 1910, Mon. Cul. 5: 263 (not *Duttonia africana* Newstead, 1907).

Ochlerotatus minutus var. *stenoscutus* Edwards, 1912, Bul. Ent. Res. 3: 22.

Edwards proposed the name *stenoscutus* to replace *africanus* of *Stenoscutus africanus* Theobald 1910, which was preoccupied by *Duttonia africana* Newstead 1907, when Edwards placed both in the genus *Ochlerotatus*. Since these two and *Stegomyia africana* Theobald 1901 are all in the genus *Aedes* as now understood the substitute name is necessary. The fact that Edwards sank Theobald's 1910 taxon to varietal status in proposing the name does not alter the fact that one name replaces the other. Therefore, if *Stenoscutus africanus* Theobald is a synonym of *Aedes congolensis* Edwards 1927, as suggested by Edwards (1941, p. 178), then *stenoscutus* must replace *congolensis* as the valid name for the species. It is to be hoped that males will be found in the Gold Coast that will fix the identity of *stenoscutus*.

Aedes (A.) seculatus Menon

Aedes (A.) seculatus Menon, 1950, Roy. Ent. Soc. London, Proc. (B.) 19: 139.

Aedes (A.) carteri Wijesundara, 1951, Ceylon Jour. Sci. (B) Zool. 24: 176. (not *Aedes palpalis carteri* Edwards, 1936; New synonymy.)

The pinned specimens of *Aedes carteri* were destroyed in transit to the British Museum, but there are slides of the terminalia of a male labeled as type and of a female labeled as paratype in the collection. A comparison of the male terminalia with those of the type male of *seculatus* shows very close agreement, and I have no doubt that the two are synonymous. This is fortunate, since it avoids the necessity of proposing a new name for *Aedes carteri* Wijesundara, preoccupied by *A.* (*Banksinella*) *palpalis* var. *carteri* Edwards 1936, which was treated as a subspecies by Edwards in 1941.

Haemagogus anastasionis Dyar

Haemagogus anastasionis Dyar, 1921, Ins. Insc. Mens. 9: 155.

Haemagogus uriartei var. *obscurescens* Martini, 1931, Rev. Ent., Sao Paulo 1: 212. (New synonymy.)

Mattingly (1955, p. 28) selected a female from Peru as hololectotype of *H. uriartei* var. *obscurescens*. An examination of this specimen in the British Museum shows the foré and mid-tarsi toothed and the sternopleuron without setae. I am unable to discover any reason why this should not be synonymized with *anastasionis*, nor why it should be considered a variety of *uriartei*. The other specimen in the British Museum, from Bolivia, was labeled as paratype by Mattingly. This has two sternopleural setae and I consider this to be *spegazzinii* Brethes.

Culex (C.) alticola Martini
(Figure 3)

Culex alticola Martini, 1931, Rev. Ent., Sao Paulo 1: 216.

The lectotype male in the British Museum shows terminalia so different from those figured by Lane (1955, p. 342) for *Culex apicinus* Philippi, and from the syntype males of *Culex debilis* (Dyar and Knab) in the U. S. National Museum, that the synonymizing of *alticola* with these two species appears unwarranted. Lane's figure does not show the large leaflet with serrate margin that arises between the base of the subapical process and the base of the dististyle in *apicinus*, as it is represented by its generally accepted synonym *debilis*. It also does not show the distinct, acute, somewhat retrorse process at the apex of the dististyle opposite the dististyle claw. In other respects Lane's figure agrees rather well with the terminalia of *debilis*. The principal differences between *apicinus* (= *debilis*) and *alticola* is in the subapical appendages of the basistyle. In *alticola* (Fig. 3) the leaflet is not as large and curved and no serrations are visible on its margin, and the subapical process has a slender distal process beyond an inwardly directed lobe. The basal lobe of the basistyle and the two spine-like setae between the basal and subapical lobes are exactly as in *apicinus*. Because of the differences pointed out, it seems necessary to resurrect *alticola* as a valid species.

Culex flavipes, var. biocellatus Theobald

Culex flavipes var. *biocellatus* Theobald, 1903, Mon. Cul. 3: 224.

This is a name that the catalogues of Edwards (1932) and Lane (1939) failed to include. The type is a female in the British Museum collected by C. H. Hewitt in Trinidad. It stands in the collection as *Culex nigripalpus* Theobald, and is probably that species although this is not certain. The specimen was stated ''probably'' to form a distinct variety, and described as a ''colour variation'' of what Theobald determined as *Culex flavipes* Macquart. The name was based upon a single female from among other Trinidad specimens. It seems rather evident that Theobald considered this as no more than a variant in the Trinidad population of what he called *flavipes* Macquart, and I feel that the name can be treated as ''infra-subspecific'' as defined by the Copenhagen Decisions on Zoological Nomenclature (Hemming 1955,

p. 84, par. 165). By treating it in this manner one avoids the necessity for proposing a new name for the well-established *Aedes* (*Finlaya*) *biocellatus* (Taylor), originally described in the genus *Culex*.

Culex tarsalis Coquillett

Culex tarsalis Coquillett, 1896, Canad. Ent. 28: 43.
Culex kelloggii Theobald, 1903, Canad. Ent. 35: 211.

Eight syntypes of *C. kelloggii* were found in the collection of the British Museum, a female and a male being marked as type. All of these are conspecific with *Culex tarsalis* Coq., except the female "type," which is a specimen of *C. stigmatosoma* Dyar. In order to forestall a possible name change, I here designate the male "Stanford Univ. Cal., Oct. 8, 1901" as lectotype.

Culex (C.) nigripalpus Theobald

Culex nigripalpus Theobald, 1901, Mon. Cul. 2: 322.

Culex nigripalpus was "Described from a single ♂ in perfect condition," collected at St. Lucia by Dr. Low. A thorough search of the British Museum collection failed to reveal this specimen, although Lane (1955, p. 351) said, "Type in B.M." All the Low material under the name *nigripalpus* came from St. Vincent and Barbados, and none from St. Lucia. The only old specimen bearing the name *nigripalpus* is one without a type label and with the name written on the under side of the circular cardboard mount. It is from St. Vincent with no date. A slide that probably came from this is labeled by Edwards in ink "Culex similis Theo.," and in pencil "(factor D. & K.) = nigripalpus." Another from Barbados bearing a type label has no name label. The type of *nigripalpus* is probably lost. However, since it is a well established name for a common and well-known species, there is no reason for not maintaining the present usage.

Culex (C.) virgultus Theobald

Culex virgultus Theobald, 1901, Mon. Cul. 2: 123.

Lane studied what he considered to be the type of this species and found it to be same as *C. declarator* Dyar and Knab. *Culex virgultus* was described from two males from Rio de Janeiro, but I found only one in the British Museum and this is presumably the one examined by Lane. The terminalia mounted on a piece of celluloid attached below the specimen are, however, not those of *C. declarator*, but they agree well with those of *C. nigripalpus*. The mount was not particularly good, but I was convinced of this determination. Mr. Mattingly remounted the terminalia and an examination after this remounting confirmed my opinion.

There are several possible explanations of this confusion. One is that Lane examined the other male, which I was unable to find.

Another is that by mistake the wrong terminalia were returned to this specimen of *virgultus*, following examination. One of the disadvantages of this method of preparing mosquito terminalia for study and preservation is that in order to examine the preparation under high enough magnification to see essential details it must be removed from the pin. If one is very careful he can do this without snapping the drop of hardened mountant off the celluloid. Once removed from the pin one must make sure that the mount gets back to the right pin again, since there is no label on the celluloid mount associating it with the specimen from which it came. One should not, of course, remove more than one mount at a time, although there is a temptation to do so when comparing closely related species. Since Rio de Janeiro is out of the expected range of *nigripalpus*, there is some reason for believing that a misassociation of parts has occurred here, but it would be difficult to prove. It seems best, under the circumstances, to consider *virgultus* as an unrecognized species and resurrect the name *declarator* for *virgultus* Theobald of Lane.

Culex quinquefasciatus Say

Culex quinquefasciatus Say, 1823, Jour. Acad. Nat. Sci. Philadelphia 3: 10.
Culex fatigans Wiedemann, 1828, Aussereuropaische zweiflugeligen Insekten 1: 10.

For many years these two names have been used for the same taxon, and it seems imperative that some agreement should be reached to bring about the rejection of one of the names and the uniform acceptance of the other. It is my belief that the name *quinquefasciatus* should be used for this taxon, and support this view as follows:

1. Reasons for rejecting *Culex fatigans* Wiedemann except as a synonym of *Culex quinquefasciatus* Say:

a. The name *fatigans* has almost universally been considered to apply to the same taxon as that to which the name *quinquefasciatus* has been applied, and it was proposed five years after *quinquefasciatus*, so that by the rules of priority it must fall if the synonymy is accepted. The two names have been synonymized for forty years without serious challenge.

b. Edwards (1932, p. 208) and (1941, p. 316) questioned the identity of *fatigans* but accepted the name. If both names are questionable, then either both should be rejected or the senior one accepted.

c. The original description of *fatigans* gives no biological information, and Wiedemann's description is not adequate for specific recognition among "Ostindien" species. Wiedemann's statement, "Untergeschicht schneeweiss" hardly seems to fit *fatigans* as currently understood.

d. The type of *fatigans* is lost, as is that of *quinquefasciatus*, so that one cannot go to original specimens to settle the problem.

2. Reasons for accepting *Culex quinquefasciatus* Say as the valid name for the taxon:

a. Specimens determined by Say as *Culex quinquefasciatus* were sent to Wiedemann, who described them as *Anopheles ferruginosus.* Howard examined Wiedemann's specimens of *ferruginosus* in Vienna and said that they belonged to the genus *Culex.* Wiedemann also noted that the legs of *ferruginosus* were shorter than those of *Anopheles crucians.*

b. Say gives certain characters in his description that seem to definitely rule out its identity with any North American species of *Anopheles.* One is the statement that the legs are, "much shorter" than in *Anopheles punctipennis.* The second is the statement that the abdomen is banded, the character to which the specific name *quinquefasciatus* refers. He also mentioned the dehiscence of the hairs [scales] and the dark integumental pattern that shows in denuded specimens. This seems to me to be more characteristic of *Culex* than *Anopheles,* the latter not altering much in appearance by a moderate amount of rubbing.

c. It has been suggested that the biological data given by Say for *quinquefasciatus* do not agree with the biology of the species referred to in parts of the world as *fatigans.* These data are: "This is an extremely numerous and troublesome species. We found them in great numbers in the Mississippi in May and June." I can see nothing in this statement to rule out the southern house mosquito. One would expect a boat tied up at any of the towns along the lower Mississippi in the early 19th century to be invaded by swarms of locally breeding *Culex quinquefasciatus* (= *fatigans* of authors and perhaps Wiedemann). It is true that May is somewhat early for great numbers of *quinquefasciatus* except in the Far South, and it is possible that more than one species was involved in Say's biological observations, but this did not prevent him from basing his description on what we call *quinquefasciatus,* which would undoubtedly have been present.

d. The name *quinquefasciatus* has not been applied to any species other than the one that has also gone under the name of *fatigans,* so that in accepting the name *quinquefasciatus* no change in the concept of the name is involved.

Since this problem is zoological rather than nomenclatorial depending upon the interpretation of the descriptions of Say and Wiedemann, it cannot be referred to the International Commission of Zoological Nomenclature for a decision. It is hoped that an agreement can be reached on the proper name for this extremely important species or subspecies of mosquito.

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AEDES SIERRENSIS (LUDLOW, 1905), A CHANGE IN NAME FOR THE WESTERN TREE-HOLE MOSQUITO OF THE PACIFIC SLOPE
(DIPTERA, CULICIDAE)

The Western Tree-hole Mosquito is a pest of considerable importance in some sections of California and other Pacific Slope states. It has long been known as *Aedes varipalpus* on the assumption that it is conspecific with the form described by Coquillett (Canad. Ent. 34: 292-293, 1902) from a single female collected in Williams, Arizona. No additional topotypic material of *varipalpus* had been collected until we were fortunate in obtaining all stages and making individual rearings of 20 males and 22 females in August, 1956. We find that *varipalpus* Coquillett is a species distinct from that found in the Pacific Slope states not only in the male genitalia, which are characterized particularly by a single differentiated bristle instead of a clump of many stout bristles on the basal lobe of the sidepiece, but in all stages as well (Belkin & McDonald, in preparation). For the economically important Western Tree-hole Mosquito of the Pacific Slope the name *sierrensis* Ludlow is available. Ludlow (Canad. Ent. 37: 231-232, 1905) described *Taeniorhynchus sierrensis* from several males and females collected in Three Rivers, Tulare Co., Calif. Dr. Alan Stone and the senior author have examined the type material of *sierrensis* and find that it agrees well with other populations from the Pacific Slope. Therefore the scientific name of the Western Tree-hole Mosquito becomes *Aedes sierrensis* (Ludlow, 1905). Apparently all the populations of the Pacific Slope from British Columbia to southern California are referable to *sierrensis* but there are indications that subspecifically distinct populations exist in this area. We have described elsewhere (Ann. Ent. Soc. Amer., *in press*) a new species closely related to true *varipalpus* from the mountains of southern Arizona and the Cape Region of Baja California. It is very likely that additional undescribed forms of this complex exist in the Great Basin area and elsewhere in the western states as indicated by the presence of a population of "*varipalpus*" near Hamilton, Montana (D. W. Jenkins, 1956, *in lit.*).—JOHN N. BELKIN and WILLIAM A. MCDONALD, *Department of Entomology, University of California, Los Angeles.*

A SYSTEMATIC NOTE ON HAEMAGOGUS SPEGAZZINII BRETHES, 1912 (Diptera, Culicidae)

by Roberto Levi-Castillo, *Ecuadorian Center for Entomological Research, Guayaquil, Ecuador.*

Cerqueira (1943), in a paper on the *Haemagogus* of Bolivia, validated the species *Haemagogus spegazzinii* Brethés, 1912, and placed *H. janthinomys* as a synonym. Cerqueira and Boshell-Manrique (1946) published a note on *H. spegazzinii* Brethés, 1912, wrote a complete redescription, and retained *H. janthinomys* Dyar, 1921, as a synonymous species. Kumm, Osorno-Mesa and Boshell-Manrique, in a paper (1946) on the *Haemagogus* of Colombia, described a new subspecies, *Haemagogus spegazzinii falco*, based on differences in the tip of the mesosome of the male terminalia. Levi-Castillo (1951) published a book on the *Haemagogus* of South America, giving the distribution of *H. spegazzinii spegazzinii* as Argentina, the country from which it was originally described (La Mendieta, Jujuy), Brazil, Bolivia and Paraguay. The distribution of *H. spegazzinii falco* was given as Brazil, Colombia, Guianas, Venezuela, Bolivia, Ecuador and Peru. This geographical distribution has proven correct to date. Kumm and Cerqueira (1952) studied the *H. spegazzinii* complex in Brazil, and although this complex forms, according to these authors, intermediary forms of transition between the two known subspecies, their adult and larval structure hold characters that render them unrecognisable but for the dissection of the male terminalia and observation of the tip of the mesosome. The geographical extension of the subspecies *H. spegazzinii spegazzinii* in Brazil extends only to the state of Amazonas, while subspecies *falco* covers all the north and northeast and extends in a westerly direction toward the eastern slope of the Andes. Komp (1955) studied the types and paratypes of the adults and larvae of *Haemagogus janthinomys* Dyar, 1921, and after a long discussion reached the conclusion that this species was the same as *H. spegazzinii*, but he did not explain which subspecies, giving only a very wide distribution for the complex and placing *H. janthinomys* as a synonym of both subspecies. Stone and Knight (1955) published a list of the type material of the genus *Haemagogus* in the U.S. National Museum, giving as lectotype of *Haemagogus janthinomys* Dyar, 1921, the slide No. 219 from Trinidad with the labels "St. Ann, Trinidad, W. I./F. W. Urich 17/1/219. Lane (1953), referring to *H. spegazzinii spegazzinii* Brethés, 1912, gives the geographical distribution of this subspecies as Argentina, Brazil, Bolivia, Venezuela? and Trinidad? The subspecies *H. spegazzinii falco* is described as occurring only in Colombia and the Amazon Basin of Brazil. In both species, the types have been misplaced, according to Lane, and his drawings and descriptions are in accordance with the publications by Cerqueira (1943) and Kumm, *et al.* (1946).

During a recent visit by the author to the U. S. National Museum, Dr. Alan Stone extended him the courtesy of studying the slides of the *H. spegazzinii* complex, including Dyar's lectotype slide No. 219 and other slides from Matto Grosso and northern Argentina in the U. S. National Museum collection. The author's experience with *falco* in particular enabled him to recognize it immediately in the slides of male terminalia examined, and to his surprise, slide No. 219 of Dyar's collection had the male mesosome tip of *H. spegazzinii falco*. Since this is the lectotype of *H. janthinomys* Dyar, 1921, there is no doubt that both species are the same, while *H. janthinomys* would not agree on tip comparison with specimens from Matto Grosso and northern Argentina.

In accordance with the Law of Priority (Article 25 of the *Regles*, Paris, 1948), the name *falco* becomes a synonym of the name *janthinomys*, holding no relationship to the subspecies *H. spegazzinii spegazzinii*. The new name for the subspecies *Haemagogus spegazzinii falco* is therefore *Haemagogus spegazzinii janthinomys* Dyar, 1921, and the type is slide No. 219, the valid lectotype of *H. janthinomys* Dyar. The type locality of the new subspecies is St. Ann, Trinidad, B.W.I. The geographical distribution of *H. spegazzinii janthinomys* Dyar is Trinidad, Venezuela, northern Brazil, Guianas, Peru, Ecuador, Bolivia, Colombia, Panama and Central America.

The author acknowledges his gratitude to Dr. Alan Stone of the Entomology Research Branch, U. S. Department of Agriculture, for the facilities extended him during his short visit to the National Museum and for making the material available, including the lectotype slide of *H. janthinomys*.

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MUSCA AUTUMNALIS IN UPSTATE NEW YORK
(DIPTERA, MUSCIDAE)

A second species of *Musca* for North America, *M. autumnalis* DeGeer, was found in Nova Scotia in 1952 (McNay, 1953, Ent. Soc. Ontario, Ann. Rept. for 1952, p. 69) and at Riverhead, Long Island, N. Y., by H. C. Huckett in 1953 (Vockeroth, 1953, Canad. Ent. 85: 422-3). Vockeroth has given a key to distinguish it from the common *domestica*. Although the species has possibly been overlooked for many years, the present pattern suggests relatively recent introduction. In any event it is noteworthy to record a westward extension of known distribution.

Two females of *autumnalis* were found at Granby Center, Oswego County, New York, Sept. 4, 1956, in nests of *Bembix pruinosa* (Fox) collected by Dr. Howard E. Evans of Cornell University, to whom I am indebted for this interesting record. The specimens came from two different nests, and in each case *domestica* had also been taken as prey.—CURTIS W. SABROSKY, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

NEW SYNONYMY OF A NEW GUINEA ANT
(HYMENOPTERA, FORMICIDAE)

In 1946 (see reference below), Donisthorpe described a new species of ant, *Prenolepis discoidalis* from a single male collected March 18, 1944, by K. V. Krombein at Milne Bay, New Guinea. I have carefully examined this holotype specimen which is in the United States National Museum, Washington, D. C., and find it to be the male of *Iridomyrmex anceps papuana* Emery. Synonymy is as follows:

Iridomyrmex anceps papuana Emery, 1897, Ann. Mus. Stor. Nat. Genova 38: 572. ☿. Type locality, Kapa Kapa, New Guinea. Type in Museo Civico di Storia Naturale, Genoa, Italy.

Prenolepis discoidalis Donisthorpe, 1946, Ann. and Mag. Nat. Hist. 13 (105): 594. ♂. Type locality, K. B. Mission, Milne Bay, New Guinea. Holotype in U. S. National Museum, Washington, D. C. *New Synonymy.*—MARION R. SMITH, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

NEW SPECIFIC SYNONYMY IN THE FAMILY GELASTOCORIDAE (HEMIPTERA)

by E. L. TODD, *Falls Church, Virginia*

In a recent paper (Beiträge zur Fauna Perus, 1954, vol. 4) Poisson has described on pages 69-74, four new species and one new form from gelastocorid material collected in 1936 by the Hamburg Zoologisches Museum expedition to Peru. This paper was in press for approximately ten years and Doctor H. Weidner, Zoologisches Museum, Hamburg, Germany, has informed me in correspondence that after completion of the manuscript, the specimens upon which the descriptions were based were destroyed during the second World War. In this instance, the absence of type specimens does not eliminate the proper assignment of Poisson's names because the descriptions and/or illustrations are adequate to identify accurately Poisson's species as follows.

Gelastocoris incasiana Poisson (*loc. cit.*, p. 69) is a synonym of *G. peruensis* Melin (Zoologiska Bidrag Fran Uppsala (prepub. 1929) 1930, Bd. 12, p. 160). The structures illustrated in fig. 11, A., a dorsal view of the keel hood and pan of the male genitalia (Poisson believed it to be the extremity of the aedeagus), are those of *G. peruensis* Melin. Inasmuch as Poisson neglected to indicate a type specimen, and since the specimens have been destroyed, I restrict the name *Gelastocoris incasiana* Poisson to the species illustrated by fig. 11, A.

Gelastocoris problematicus Poisson (*loc. cit.*, p. 71) is a synonym of *G. fuscus* Martin (University of Kansas Science Bulletin, 1929, vol. 18, no. 4, p. 364). The size, coloration, shape of the lateral margin of the pronotum, especially the presence of a small angular projection on the anterior third and the obtuse distal angle of the lateral expansion of the embolium, are characteristic of *G. fuscus* Martin.

Mononyx titschacki Poisson (*loc cit.*, p. 72) is a synonym of *Nerthra terrestris* (Kevan) (Annals and Magazine of Natural History, 1948, 11th series, vol. 14, no. 119, p. 813). Poisson states that this species differs from *Mononyx bipunctatus* Melin (a homonym of *Mononyx bipunctatus* Stål and renamed *Mononyx terrestris* by Kevan) in that the margins of the pronotum are not crenulated. The lateral margin of the pronotum of *Nerthra terrestris* (Kevan) is not always crenulated. I have indicated this variation in the nature of the lateral margin in the University of Kansas Science Bulletin (1955, vol. 37, no. 11, p. 374). The abdominal sternites illustrated by fig. 14, D., are those of *N. terrestris* (Kevan).

Mononyx melini Poisson (*loc. cit.*, p. 72) is a synonym of *Nerthra ranina* (Herrich-Schäffer) Die Wanzenartigen Insecten, 1853, vol. 9, p. 28). I restrict the name *Mononyx melini* Poisson to the species illustrated by fig. 16, C., the female abdominal sternites. The curved groove extending from the triangular emargination of the last visible abdominal sternite toward the caudo-lateral margin of the right side is characteristic of females of *N. ranina* (H.-S.). The female described by Poisson as *Mononyx melini* forma *siviae* nov. falls within the range of variation of size and coloration of this extremely variable species and I, therefore, consider it also to be a synonym of *Nerthra ranina* (H.-S.).

COPULATION IN CRAB-HOLE MOSQUITOES
(Diptera, Culicidae)

by William H. W. Komp,[1] *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Md.*

In the first volume of the monograph by Howard, Dyar and Knab (1912), page 128, F. Knab is quoted as follows: "It seems remarkable that the attitude taken by *Anopheles* in copulation, end to end and facing in opposite directions, is identical with that of *Culex pipiens*. . . . . Dr. H. G. Dyar has found that *Culiseta consobrinus* [=*inornata* Will.] another form with simple claws and quite a distinct generic type, takes the same position in copulation. It is fair to assume that this is the mode of copulation in all the forms in which the female has simple claws. . . . ." On page 275 of the same volume, the following statement appears: ". . . . . in a report to one of the writers (Howard) . . . . . shows that with this species [*Aedes aegypti L.*] mating begins when on the wing. It may, and usually is completed while still flying, but the female frequently alights during the act and before its completion." Quoting observations made by Goeldi, Howard further states: "When a female approaches one of these groups of males [of *A. aegypti*] she is pounced upon, the male clasping the female from beneath." On page 276, Howard says "The copulation of *Aedes calopus* [= *aegypti*] has been observed by a number of other investigators. Nearly all agree that it takes place in the daytime, during flight, face to face, and that it is of very short duration."

The observations made by the writer on the mode of copulation of *Deinocerites cancer* Theobald, are presented to show that (1) little is known of the method of copulation in some uncommon mosquito species, and (2) that in *D. cancer*, structures are used in copulation that are not ordinarily used in other species.

Some little known neotropical *Culex* species, such as *C. alogistus*, *C. caudelli*, *C. egcymon*, and particularly *C. tecmarsis* (see figures of the male terminalia in Rozeboom and Komp, 1950), have the lobes of the ninth tergites peculiarly modified, but whether these lobes have an unusual function in copulation is not known; so far as the writer is aware, copulation has not been observed in any of these species.

The only other *Culex* species whose larvae normally live in the water in crab-holes is *C. latisquama* (Coq.), known from Costa Rica and Panama. Dyar (1928) states that "This peculiar *Culex* shows all the essential structures of *Deinocerites* in an incipient form," but his figure (No. 291) of the male terminalia and his description (P. 336) do not bear out this statement. The lobes of the ninth tergite of *latisquama* are "small, transversely elliptical, remote, covered with rather stiff setae," quite different from the elongated, flattened lobes

[1] Deceased December 7, 1955.

present in *D. cancer* and in the known males of the other species of *Deinocerites*. These species have rather short, club-like claspers, and may utilize the ninth tergite lobes as grasping organs, as observed and reported here for *D. cancer*.

While collecting mosquitoes in the Mojinga Swamp, on the right bank of the lower Chagres River in the Panama Canal Zone, larvae and pupae of the crab-hole mosquito, *Deinocerites cancer* Theobald, were obtained from the crab-holes of a large land crab, probably *Cardiosoma guanhumi* Latreille,[2] common in the region. This crab makes holes in muddy soil, which sometimes become overflowed after heavy rains. The larvae and pupae were taken to the laboratory and placed in chinaware cups, over which bobbinet-covered lantern globes were set. Adult males and females emerged from the pupae during the night, and the next morning several pairs were observed in copulation. On closer examination it was noted that the males, head downwards, had clasped the terminal segments of the females with their elongated and flattened ninth tergites, instead of with the claspers (dististyles), as is normally the case in other Culicidae, so far as is known.

Carpenter and LaCasse (1955), in their figure 285, show the male terminalia of *D. cancer*, and state that the "ninth tergite [has] two long finger-like lobes." They also show the very short dististyle which lies in a groove at the apex of the side-piece (coxite). Dyar (1928) calls the clasping organs the parameres, "very large, flattened, broad, rounded at tip, reaching three-fourths the length of side-piece." He makes no mention of the ninth tergites, and these are not shown in his figure 211 of the male terminalia of *D. cancer*. In this species, and in the other members of this specialized genus, the dististyles are aborted, and do not function as clasping organs during copulation.

Apparently very little is known of the mechanism of the male organs during copulation, probably because relatively few species have been colonized, and in many that have, copulation takes place in flight. Russell and Mohan (1939) observed the mating in captivity of *Anopheles stephensi* Liston, 1901 (type form), and give a photomicrograph (fig. 3) of the terminal segments of a male and female of this species in copulation. They state, "Appendages of male claspers [terminal claws] inserted at base of 8th segment of female," and also ". . . . . it appeared that the coxites [side-pieces] of the male terminalia diverged, the extended claspers (styles) converging so that the appendages of the claspers were gripping and holding the female from the two sides of the base of the eighth segment."

Rees and Onichi (1951) give an extended account of the genital structures of the male and female of *Culiseta inornata* (Williston), and of the way in which these structures are used in copulation. They

[2] The probable identity of this crab was kindly given by Dr. F. A. Chace, Jr., curator of marine invertebrates at the U. S. National Museum.

state in part, "The males initiate copulation by hovering over the dorsum of the recently emerged female" and further ". . . . . the male . . . . . attaches the claws of the claspers on the membrane between the bases of the cerci near the tenth tergite of the female . . . . . copulation occurs end to end, with the male and female facing opposite directions. Other structures used by the male as a means of attachment to the female . . . . . are the spines on the lobe of the ninth tergite . . . . . and the teeth on the tenth sternite. . . . ."

A secondary purpose of this paper is to call attention to our relative lack of knowledge of the mechanism of copulation in mosquitoes. For instance, it has not been determined what purpose, if any, is served by the sometimes extremely enlarged and fantastically complicated claspers of many of the Sabethini, *e. g. Dendromyia mystes* Dyar; other species of the same tribe seem to get along very well with unmodified, rod-like claspers, such as are present in *Wycomyia incaudata* Root. For illustrations of these, see Dyar (1928), figs. 43 and 39, respectively.

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BOOK REVIEW

A REVISION OF THE GENUS MEGARTHROGLOSSUS JORDAN AND ROTHSCHILD, 1915, (SIPHONAPTERA: HYSTRICHOPSYLLIDAE), by Eustorgio Mendez. University of California Publications in Entomology. Vol. 11, No. 3, pp. 159-192, 14 figures in text. Published July 26, 1956 by University of California Press, Berkeley 4, California. Price: $0.85.

This paper is a thorough and carefully done study of the anomiopsylline genus *Megarthroglossus* Jordan and Rothschild, which occurs only in western United States and Canada. *Megarthroglossus* species are highly modified fleas adapted for existence in the nests of rodents. Mr. Mendez is to be congratulated on the quality of his illustrations, and the only improvement might have been addition of entire drawings of both male and female modified segments.

Flea workers will welcome this addition to the steadily growing list of generic revisions within the order Siphonaptera.—PHYLLIS T. JOHNSON, *Entomology Research Branch, U.S. Department of Agriculture, Washington, D. C.*

A NEW NEOTERMES FROM PANAMA
(ISOPTERA, KALOTERMITDAE)

by THOMAS E. SNYDER, *Washington, D. C.*

A new termite from western Panama near the Costa Rican border is herewith described.

Neotermes setifer, new species

Winged female adult.—Head light castaneous-brown, shining, longer than broad, slight depression and slope to front at epicranial suture, with scattered long and short hairs. Eye black, nearly round, separated from lateral margin of head by a distance equal to half its diameter and from posterior margin by a distance equal to twice its diameter. Ocellus large, hyaline, projecting, at angle but close to eye.

Labrum yellow-brown, pubescent.

Antenna pale yellow-brown, 18 segments, third and fourth short, ring-like, become elongate towards apex, pubescent.

Pronotum slightly lighter colored than head, wider, nearly twice as wide as long, roundedly emarginate anteriorly, very slightly posteriorly, sides rounded, with scattered long and short hairs.

Legs light yellow-brown, pulvillus between claws.

Wings yellowish, veins darker, pubescent. In forewing median vein close to subcosta, extends to apex; subcostal vein with 6 (mostly long) branches to costa, cubitus nearer to subcosta than to lower margin of wing, above center, with 17 branches to lower margin, extends to apex.

Abdominal tergites light castaneous brown, with scattered long and short hairs.

Measurements.—

Length of entire winged female adult	18.5 mm.
Length of entire dealated female adult	8.5
Length of head (to tip of labrum)	3.0
Length of pronotum (where longest)	1.5
Length of hind tibia	2.0
Length of anterior wing	15.0
Diameter of eye (long diameter)	0.65
Width of head (at eyes)	2.25
Width of pronotum	2.75
Width of anterior wing	4.75

This species is larger than any of the 16 other Neotropical *Neotermes* except the Venezuelan *araguaensis* Snyder, the pronotum and eyes are large and the antenna has 18 segments.

Type locality.—Almirante, Rep. Panama. Described from a series of winged adults collected at a trap light at the type locality 4/29/'53 by R. C. Morris; also collected at light at same locality in Jan., 1953.

Types.—*Holotype, winged female.* Cat. No. 63270, U.S. National Museum; paratypes at same institution.

A NEW SPECIES OF NEMATALYCUS STRENZKE WITH NOTES ON THE FAMILY[1]

(Acarina, Nematalycidae)

By F. Cunliffe, *Kansas Wesleyan University, Salinas*

In a recent paper Strenzke described *Nematalycus nematoides* and discussed its position in the Trombidiformes mites. His conclusion was that the mite, which was immature, represented a new family, Nematalycidae, related to the Endeostigmata (Pachygnathoidea). The finding of a second species and possibly a distinct genus in this family has indicated that these mites are more closely related to the Tydeoidea rather than the Pachygnathoidea. Strenzke apparently

Nematalycus strenzkei, new species. Fig. a, lateral view of female.

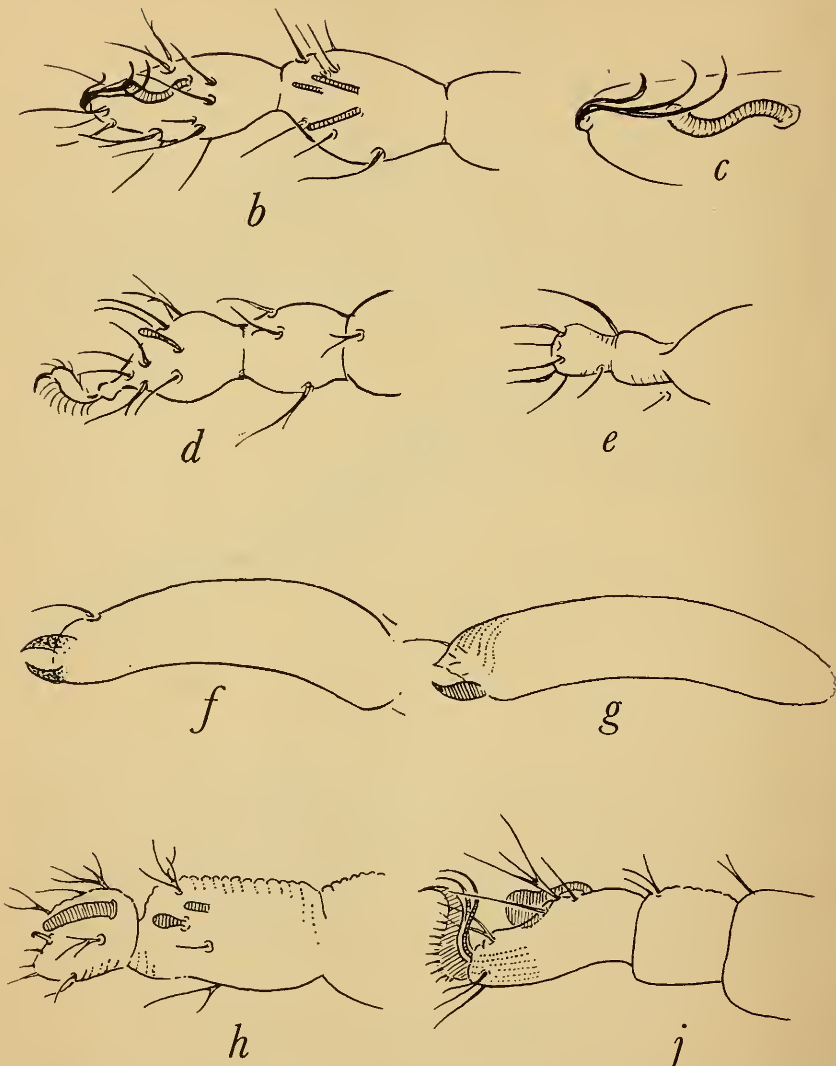
believed that he had a larva instead of a nymph and in so doing mistook the palps for the maxillae, and legs I (which in his species do not possess claws) for the palps. Consequently, the rodlike sensory setae of leg I were assumed to be analogous to those found on the palps in some of the pachygnathoid mites. A study of Strenzke's excellent figures, and of two females and one nymph of the species to be described, shows a relationship to the Tydeoidea, although perhaps somewhat isolated.

Nematalycus strenzkei, new species

(Figs. a, b, c, d, e, f)

This species is characterized by the presence of tiny opposed chelae, the sickle-like claws and empodium on tarsus I, the lack of claws and the presence of a broad, distally hooked, rayed empodia on the other tarsi. *N. nematoides* Strenzke (figs. g, h, and i) has a reduced membranous fixed chela, no claws or empodium on leg I, sickle-like claws and a hooked, rayed empodium on legs II-IV. The

[1] A contribution from the Pinellas Biological Laboratory, Inc.



Nematalycus strenzkei, new species. Fig. b, tarsus and tibia I; fig. c, detail of tarsus I; fig. d, tarsus and tibia II; fig. e, palpus; fig. f, chelicera. *Nematalycus nematoides* Strenzke. Fig. g, chelicera; fig. h, tarsus and tibia I; fig. i, tarsus and tibia II (after Strenzke).

difference in the tarsal claws and chelicerae may be of generic value, but until more species are discovered it is preferred to keep the genus broad.

Female.—Palpus (fig. e) tiny, two segmented, almost coalesced, with few, simple setae. Chelicerae (fig. f) small, with distal dorsal seta, and two small opposed chelae. Body (fig. a) very elongate, wormlike, with strongly tuberculate striae; anteriorly a small longitudinally striate tubercle bears a pair of short simple setae, and laterad of these are two pairs of bifurcate setae. Body setae arranged as figured and apparently all trifurcate. Genital opening of female with pairs of short simple setae and three pairs of genital suckers. Legs small and with few setae. Leg I (fig. b and c) with sickle-like claws and empodium; other legs (fig. d) without claws but with rayed, distally hooked, broad empodia. Tarsus I (figs. b and c) with S-like, rodlike sensory seta; tibia I with three straight, rodlike sensory setae. Tarsus II (fig. d) with a single clublike sensory seta; other leg setation as figured. Length, 390 μ.

Holotype.—One female taken from pasture soil, McClain County, Oklahoma, August 16, 1949, by Thomas E. Rogers. U. S. National Museum No. 2241.

Paratype.—One female with the above data.

A single nymph, similar to the female but lacking the genital opening, was also studied.

References

Cunliffe, F., 1955. A proposed classification of the trombidiforme mites (Acarina). Proc. Ent. Soc. Wash. 55(5):209-218.

Strenzke, K., 1954. *Nematalycus nematoides* n. gen. n. sp. (Acarina Trombidiformes) aus dem grundwasser der Algerischen Küste. Vie et Milieu 4(4): 638-647.

BOOK REVIEW

HISTOLOGY OF THE OVARY OF THE ADULT MEALWORM TENEBRIO MOLITOR L. (COLEOPTERA, TENEBRIONIDAE), by Loren L. Schlottman and Philip F. Bonhag, University of California Publications in Entomology, Vol. 11, No. 6, pp. 351-394, pls. 42-50, Sept. 14, 1956. Price $1.00.

The morphology and histochemistry of the ovarioles and the development of follicles are discussed. The telotrophic ovariole of *Tenebrio* is compared with the similar ovariole of the Heteropteran *Oncopeltus fasciatus.* Localizations of ribonucleic acid (RNA) and desoxyribonucleic acid (DNA) are given, along with evidence of the contribution of these acids by the apical trophocytes to the enlarging oocytes. It is interesting to note that the authors believe the follicular epithelium develops from the interstitial cells of the germarium via the prefollicular tissue. Protozoan parasites in the ovarioles were quite common. Good photomicrographs show cellular structure, protozoan parasites, and evidence of the acids mentioned.—T. J. SPILMAN, *Entomology Research Branch, U.S. Department of Agriculture, Washington, D. C.*

LOREN FREELAND BYARS

1908-1956

The death of L. Freeland Byars on April 14, 1956 came with unexpected suddenness. The shock of his passing at so young an age is shared by all who knew him, his teachers and friends, and his associates in the United States Department of Agriculture.

Dr. Byars was born in Valley, Nebraska, May 29, 1908. He moved to Shelbina, Missouri, at the age of nine, and completed secondary education there. He received his A.B. degree from Central College at Fayette, Missouri, in 1930, and both his M.A. in 1936 and Ph.D. degree in 1952 from the University of Colorado. He evidenced interest in natural history early, and this eventually led him to seek advanced training in the subject. For a time he taught high school in Missouri, but left an academic career in 1937 for one in government service. He progressed through various ranks in the United States Department of Agriculture, holding such positions as Assistant Range Classifier, Agent for several special projects, Junior Plant Quarantine Inspector, Assistant Plant Quarantine Inspector, and at the time of his death had achieved the title of Plant Quarantine Inspector at the Plant Inspection Station in Hoboken, New Jersey. Dr. Byars was engaged at different periods with such special investigations as the Mormon Cricket Project, the Grasshopper Control Project, and the Pear

Psylla Control Project, finally moving into Port Inspection work in the Bureau of Entomology and Plant Quarantine. These assignments carried him to numerous stations in the United States which included Montana, Utah, Colorado, Washington, New York, Arizona, and New Jersey. For a short time he was appointed to duties in Sonora, Mexico. During his tenure with the Department of Agriculture, he was granted leave and studied at Scripps Institution of Oceanography and the University of Colorado. In 1939 he was married to Frances K. Learned, who travelled with him and assisted him extensively in his research. He is survived by his wife, his daughter, Julie Anne, and a brother, A. Lynn Byars.

In addition to his professional activities as an economic entomologist, Dr. Byars had a keen interest in the ecology and taxonomy of ants, and contributed several papers on this subject before completing his thesis on the distribution of desert ants in southern Arizona. He possessed a first-hand field acquaintance with the species of these insects occurring along the Mexican border in Arizona, New Mexico, and California. The writer found Dr. Byars' discussions of his experiences in these areas interesting and stimulating, and he generously showed the location of some rich collecting sites in the vicinity of Nogales, Arizona. One of his outstanding characteristics was willing helpfulness combined with enthusiastic discourse.

Dr. Byars was a member of the Entomological Society of America and Sigma Xi. He was an active member of the Protestant Episcopal Church and was energetic in organizing Civilian Defense in his community of residence up to the very last.

—Robert E. Gregg

SOCIETY MEETING

The 656th regular meeting of the Entomological Society of Washington was called to order by President R. A. St. George at 8:00 P.M., Thursday, Oct. 4, 1956, in Room 43 of the U.S. National Museum. Fifty members and 25 visitors attended. The minutes of the previous meeting were read and approved, and the President commented on the June picnic meeting, thanking Entomological Society and Insecticide Society committee members for their work in making the meeting a success.

The following new members were elected: *Donald M. Weisman*, Division of Insects, U.S. National Museum, Washington, D. C.; *Dr. Henry A. Dunn*, State Experiment Stations Division, ARS, U.S. Department of Agriculture, Washington, D. C.; *John C. Keller*, Pesticide Chemicals Research Section, Entomology Bldg. A, Agricultural Research Center, Beltsville, Md.; *Robert Lee Soles*, 507 Quintana Place, N.W., Washington, D. C.; and *Howard L. Hunt, Jr.*, Insecticide Testing Laboratory, Agricultural Research Center, Beltsville, Md.

The death of Dr. Norman Eugene McIndoo was announced by the President. E. H. Siegler was called upon to tell the Society about Dr. McIndoo's life work.

The nominating committee appointed by President St. George to present candidates for offices in 1957 are W. H. Anderson, chairman; F. W. Poos; and W. D. Reed.

Proposed changes to the constitution for the purpose of clarifying references to publications of the Society, which had been approved by the Executive Committee, were circulated, and the President pointed out the changes and the purpose of each. (The changes will be published in a future issue of the Proceedings, after their adoption by the Society.—ED.)

A. C. Smith of the National Science Foundation was introduced to the Society by J. F. G. Clarke. Dr. Smith, who is Program Director for Systematic Biology, urged entomologists to take advantage of Foundation grants for basic research. Although there are many entomological projects receiving support, Dr. Smith thought that entomologists were far from having fully exploited the opportunities available to them and stated that the Foundation would be glad to receive applications in behalf of entomological projects. Federal projects, however, are ineligible for grants.

''American Moths of the Subfamily Phycitinae'', the life work of the late Carl Heinrich, was reviewed by J. F. G. Clarke. This is U.S. National Museum Bulletin No. 207, published in 1956.

''An Annotated Subject-Heading Bibliography of Termites, 1350 B.C.—A.D. 1954,'' published Sept. 25, 1956, as Volume 130, Publication 4258, of the Smithsonian Miscellaneous Collections, was just received by Dr. Snyder, who circulated the copy. It is supplementary to his ''Catalog of the Termites of the World,'' Smithsonian Miscellaneous Collections, Volume 112, Publication 2953, 1949.

The first scheduled speaker of the evening was Jerome G. Rozen, Jr., who gave ''An Evaluation of the Economic Importance of the Oedemerid Beetles.'' By use of labeled museum specimens and the literature, an attempt was made to evaluate the economic importance of both the larvae and the adults of the Oedemeridae. It was concluded that the larvae were of little significance to man at the present but may possibly be a potential threat, either as stem borers or as borers in structural wood. Since the adults are often found on flowers, they may be regarded as being of service as pollinators. (Speaker's abstract.)

''The Fruit-Piercing Moths of the Family Phalaenidae'' was the subject of E. L. Todd. The adults of several related genera of erebine moths have been reported to pierce the fruit of citrus and other tropical plants. This activity occasionally results in serious losses, either as a direct result of the injury or through the introduction of fungi. Losses have been reported from most tropical and subtropical areas of the world but appear to be greatest in humid coastal regions. Some of the species reported piercing fruit were presumably only feeding on exudate from punctures made by other species. The latter all have the apex of the proboscis greatly modified for piercing. The casual species may, however, play an important role in the introduction of fungi. (Speaker's abstract.) Dr Todd showed illustrations of simple probosces and those modified for fruit-piercing.

Paul H. Arnaud, Jr., told about ''Entomological Explorations in the Gulf of California.'' Mr. Arnaud was a member of an expedition to the Gulf during the month of March and the first week of April, 1953, aboard the research ship Orca, which was sponsored by Mr. Joseph Sefton, Jr., of San Diego. He showed slides of 12 of the Gulf islands that were visited; these included Isla Corralvo in the Lower Gulf to Isla San Esteban and Isla San Pedro Martir in the Upper Gulf. (Speaker's abstract.)

D. M. Weisman's subject was "Host Associations in Flea Beetles."

Phyllis T. Johnson told about a study of "Internal Symbionts of *Triatoma infestans.*" Species of *Triatoma* (blood-sucking reduviid bugs) apparently all have symbiotic bacteria which inhabit the anterior part of the midgut and supply some factor necessary to metabolic processes which is not present in blood. Various investigators have isolated several different bacterial species from Triatominae. As well as bacteria, a Rickettsia-like intracellular organism has been found in the blood cells, female gonads, salivary glands and eggs of *Triatoma infestans,* and also occurs free in the saliva. (Author's abstract.)

Visitors introduced were *Dr. Keizo Yasumatsu* and *Dr. Jose Murayama* of Japan, and *Dr. Elli Franz* of the Senckenberg Museum, Frankfurt-am-Main, Germany. Among numerous University of Maryland students, *John A. Davidson, John K. Clagett* and *Karl E. Lipinson* were first-time visitors. *William A. Downes* and *Paul Arnaud,* member of the Society, are new members of the Diptera Unit of the Insect Identification Section.

The meeting was adjourned at 9:55 P.M.—KELLIE O'NEILL, *Recording Secretary.*

ACTUAL DATES OF PUBLICATION, VOL. 58

No. 1, pp. 1-64 . . . March 6, 1956	No. 2, pp. 65-128 . . May 17, 1956
No. 3, pp. 129-176 . . June 29, 1956	No. 4, pp. 177-240 . . Aug. 30, 1956
No. 5, pp. 241-304 . . Nov. 23, 1956	No. 6, pp. 305-362 . . Jan. 31, 1957

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