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THE GENUS HALMATHRIPS HOOD

(THYSANOPTERA, THRIPIDAE)

BY LEWIS J. STANNARD, JR., *Illinois Natural History Survey, Urbana*

The first specimen of *Halmathrips* was collected in 1917, but no other specimens referable to this genus were found until the discovery of the specimens representing the three new species described herein. Even with the knowledge of three additional species, no information on the host plants of any of the species in the genus can be given. All four species were found after they had been attracted to lights. The genotype was taken from a window pane in Trinidad, and the three species described here were recovered from light traps in Honduras. Males of all are still unknown.

One of the new species, *beckeri*, is sufficiently distinct to be placed apart from the others. Instead of having an eight-segmented antenna and a transversely striate pronotum, as is true in the typical species of *Halmathrips*, *beckeri* has a nine-segmented antenna and nearly all traces of the pronotal striations have disappeared. To separately categorize *beckeri*, the subgenus *Phaosothrips* is proposed.

The specimens designated the types of these new thrips were donated to the Illinois Natural History Survey by Dr. Edward C. Becker. I am much indebted to him for these and many other thrips from Honduras.

Halmathrips Hood

Halmathrips Hood, July 1936, Rev. de Ent. 6(2):248-249. Monobasic; type species by original designation, *Halmathrips citricinctus* Hood. Tiny, somewhat stocky thrips with short heads, bulged eyes, long antennal styles, with a transverse apodeme across the middle of the pronotum, with but a single submarginal forewing vein. Known only from the American tropics.

Of the genera I have studied, the closest relatives of *Halmathrips* appear to be *Graphidothrips* Moulton (1930, Rev. Chile de Hist. Nat. 34:272-3) and *Dendrothrips* Uzel (1895, Monog. Thysanopt., p. 159). All three genera have similarly formed heads with protruding eyes, short occipital regions, and with the ocellar triangle located well back on the head.

Possibly the common feature of straight instead of wavy fringe setae of the wings indicates a common ancestor for these genera. Straight wing fringe setae is a primitive characteriestic, being found in the Aeolothripidae, Heterothripidae, and Phlaeothripidae. These stetae are wavy only in the higher groups, that is, the Merothripidae and most genera of the Thripidae.

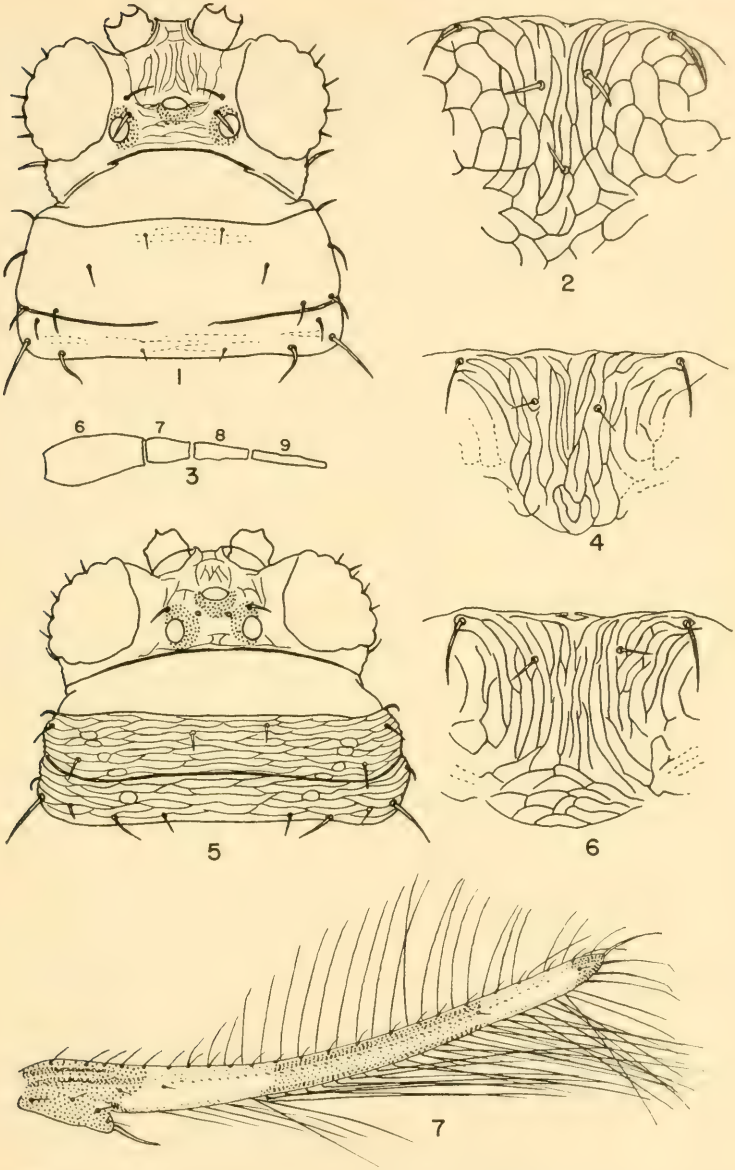
It is likely that *Graphidothrips* should be considered the nearest relative of *Halmathrips*. The form of the antenna of *Graphidothrips stuardoi* Moulton is similar, except for the length of the sense cones, to the type of antenna found in *Halmathrips* (*Phaosothrips*) *beckeri*, new species. Both species have the antenna nine-segmented with the terminal segments forming a long style. While not mentioned in Moulton's original description, *Graphidothrips* bears a faint mid-transverse apodeme on the pronotum much in the manner of the species of *Halmathrips*.

In other characters *Graphidothrips* is markedly distinct from *Halmathrips*. The hind tarsi of *Graphidothrips* are extremely long; in length each of these one-segmented tarsi is nearly as long as its respective tibia. In *Halmathrips*, the one-segmented hind tarsus is at the most much shorter than the hind tibia. *Graphidothrips stuardoi* Moulton, known from Chile, feeds on *Ficus*.

A more distant relative of *Halmathrips* is *Dendrothrips*. Like *Graphidothrips* and one species of *Halmathrips*, *Dendrothrips* has nine segments in the antenna. Unlike either of the former genera, *Dendrothrips* does not have the terminal antennal segments formed as a long style. Perhaps most importantly, *Dendrothrips* is set apart from *Halmathrips* and *Graphidothrips* by the lack of a mid-transverse apodeme across the pronotum. The widely distributed *Dendrothrips* contains several species that feed on the leaves of a variety of temperate, deciduous trees and shrubs.

Key to Halmathrips

1. Antenna 9-segmented; pronotal surface smooth with hardly any trace of transverse striations, fig. 1 .... *beckeri*, new species
   Antenna 8-segmented; pronotum distinctly transversely striate, fig. 5 2
2. All abdominal segments brown; forewing with three dark bands, fig. 7 .... *tricinctus*, new species
   Basal abdominal segments pale yellow to white; forewing with two dark bands 3
3. Forewing tip pale, distal dark band not continuous to the wing apex .... *citricinctus* Hood
   Forewing tip brown, distal dark band continuous to the wing apex .... *debilis*, new species



Halmathrips (*Phaosothrips*) *beckeri*. Fig. 1, dorsal aspect of head and prothorax; fig. 2, Metanotal striations; fig. 3, outline of terminal segments of right antenna.

Halmathrips (*Halmathrips*) *debilis*. Fig. 4, metanotal striations.

Halmathrips (*Halmathrips*) *tricinctus*. Fig. 5, dorsal aspect of head and prothorax; fig. 6, metanotal striations; fig. 7, right forewing.

Halmathrips Subgenus **Halmathrips** Hood

Head broad and short, mouthcone blunt when viewed from above, extending across the prosternum; posterior of head with a thickened, dorsal ridge. Eyes strongly protruding anteriorly and laterally, extended posteriorly more on the ventral surface than on the dorsal surface of the head. Antenna eight-segmented with forked sense cones on third and fourth segments. Maxillary palp two-segmented. Pronotum short and broad, closely, transversely striate, with but a single pair of major setae which are placed one on each of the posterior angles, with a complete, transverse apodeme across the middle. Mesosternellum fused to metasternum so that no suture is present between the meso- and metasternum. Tarsus with but one segment, each hind tarsus with a pair of stout spurs. Forewing with but one main submarginal vein on which there are few setae, fringing setae not wavy. Most abdominal tergites, at the sides, with transverse striae which are finely subdivided by minute, longitudinal ridges, median portions of abdominal terga, except tergum one, without sculpture. Part of the eighth abdominal tergum and all of the ninth and tenth tergites with microtrichiae, most abdominal sternites transversely striate like pronotum, tenth abdominal segment rectangular, not pointed, and undivided dorsally.

Halmathrips (Halmathrips) citricinctus Hood

Halmathrips citricinctus Hood, July 1936, Rev. de Ent. 6(2):249-252, fig. 1. Type locality: Verdant Vale, Trinidad, B.W.I.

This, the type species, is known only from a single female specimen. It is described as being bicolored brown and yellow, with reddish, subintegumental pigments. Judging from the illustrations, the wings of *citricinctus*, which have only two dark bands, are less out-curved than are the wings of the other species of the genus.

Halmathrips (Halmathrips) tricinctus, new species

Figs. 5, 6, 7

Female (macropterous).—Length, distended, exclusive of the antennae, about 0.75 mm. General color light brown and bright red. Light brown: head, prothorax, abdomen, basal segments of the antennae, the legs, except the tips of the tibiae and all the tarsi, three bands on each of the forewings, fig. 7, and the central portion of the trailing edges of the hindwings. Pale brown to colorless: terminal segments of the antennae, tips of tibiae, all of tarsi, two bands on the forewing, fig. 7, and most of the hindwing. Yellow: subintegumental pigments of the central portions of the head, thorax, and abdomen. Bright red: subintegumental pigments around the ocelli, on sides of thorax, sides of the abdomen, and a line along the veins of the forewings.

Head as in fig. 5; outer fork of sense cone of the fourth antennal segment long, extending beyond the fifth antennal segment. Prothorax as in fig. 5; metanotum sculptured as in fig. 6. Forewings as in fig. 7, slightly out-curved. Abdomen as for genus, medial portion of the first abdominal segment strongly marked with striae; comb on eighth abdominal segment complete, preceding segment combs incomplete, being reduced to small, medial combs on second to sixth segments.

Types.—Holotype ♀, La Ceiba, Honduras, June 12, 1949, in light trap (E. C. Becker); 2 ♀ paratypes, same data as for holotype, except May 22, 1949, and June 17, 1949.

Halmathrips (Halmathrips) debilis, new species

Fig. 4

Female (macropterous).—Length, distended, exclusive of the antennae, about 0.6 mm. Bicolored light yellowish brown and white. Light brown: head, thorax, sixth to tenth abdominal segments, basal segments of the antennae, basal segments of the legs, a band at the base of the forewing including the scale, and another band on the apical half of the forewing. Pale white to colorless: apical segments of the antennae, terminal segments of the legs, first to fifth abdominal segments, a submedian band on the forewing, and most of the hindwings. Bright red: sides of the thorax, sides of sixth to eighth abdominal segments, and the basal edges of the forewings.

Head similar to fig. 5. Outer fork of the sense cone of the fourth antennal segment about as in *citricinctus*, not extended much beyond the middle of the fifth antennal segment. Prothorax similar to fig. 5. Metanotum sculptured as in fig. 4. Forewings less out-curved than *tricinctus*, more as in *citricinctus*. Medial portion of first abdominal segment weakly marked. Comb on eighth abdominal segment complete.

Type.—Holotype ♀, La Ceiba, Honduras, June 7, 1949, in light trap (E. C. Becker).

Halmathrips Subgenus **Phaosothrips,** new subgenus

This subgenus differs from the typical subgenus by the following characteristics:

Head not so short nor so broad; dorsal surface of eye prolonged posteriorly slightly farther than that part of the eye that is ventral; antenna nine-segmented, fig. 3, instead of eight-segmented; striae of pronotum and abdominal sterna nearly lost; ocellar triangle spread out more on the head; transverse, pronotal apodeme interrupted in the middle.

Type species.—*Halmathrips* (*Phaosothrips*) *beckeri*, new species.

Halmathrips (Phaosothrips) beckeri, new species

Figs. 1, 2, 3

Female (macropterous): Length, distended, exclusive of the antennae, about 0.95 mm. Generally bicolored, brown and white. Brown: head, thorax, all of first to third and sixth and seventh antennal segments and basal three-fourths of fourth antennal segment, most of segments of the first two pair of legs, the forewings, a median spot on first to seventh abdominal terga which tends to widen until on eighth segment it nearly covers the entire tergum, and covers all of ninth and tenth segments. Pale yellow to white: tip of fourth antennal segment and all of fifth, eighth, and ninth, all tarsi, all of the hind legs and venter and portions of the sides of the terga of the abdomen except on segments nine and ten. Vivid red: subintegumental pigments of the first four antennal segments, ocellar pigments, extensive areas of the thorax, and traces in abdomen in the areas of the dark spots. This red often fades to orange in the thorax and in the abdomen.

Head as in fig. 1; outer fork of sense cone of fourth antennal segment extending only to a point midway of the fifth segment. Prothorax as in fig. 1. Metanotum sculptured as in fig. 2. Forewing with about 9 or 10 setae along the submarginal vein. Median portion of first abdominal segment weakly marked. Comb on eighth abdominal segment complete.

Types.—Holotype ♀, La Ceiba, Honduras, June 11, 1949, in light trap (E. C. Becker); 2 ♀ paratypes, same data as for holotype; 2 ♀ paratypes, same data as for holotype except May 21, 1949.

SOME INTERESTING CHINESE SPECIES OF GLOSSOSOMA

(Trichoptera, Rhyacophilidae)[1]

By Herbert H. Ross[2] and Chi-Ling Hwang[3]

Among some miscellaneous Chinese caddisfly material in the collections of the Chicago Natural History Museum and the United States National Museum were found specimens of three new species of *Glossosoma*, closely allied only to the Chinese species *minutum* Banks. All four are unusual in lacking specialized male characters which would place them in any of the known groups of the genus, and characterize the species as persistent forms of phyletic lines more primitive than any heretofore described. They may be related to the Tibetan subgenus *Lipoglossa* Martynov, but since we have not studied material of this genus no definite comparison with it can be made. We feel that until the relationship of these particular Chinese species to *Lipoglossa* can be made clear, it is better not to describe new subgenera to accommodate the Chinese forms, but rather simply to state that they represent the simplest known forms in the genus.

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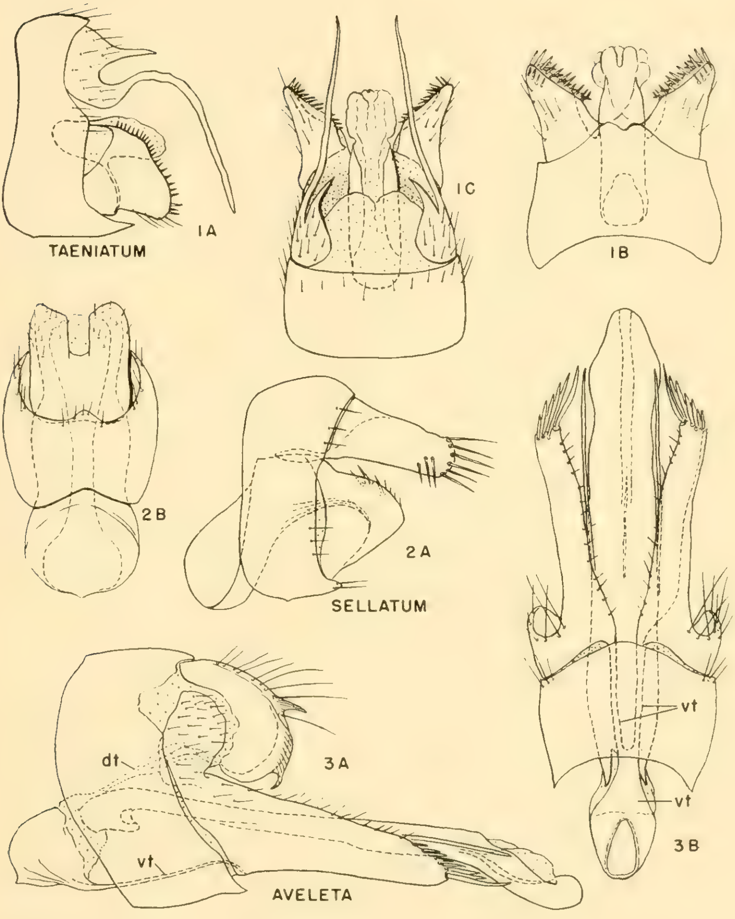
[1]This paper is a joint contribution from the Section of Faunistic Surveys and Insect Identification, Illinois Natural History Survey, and the Department of Entomology, University of Illinois.

[2]Illinois Natural History Survey, Urbana.
[3]Formerly, University of Illinois, Urbana.



Male genitalia of *Glossosoma*. *A*, lateral aspect; *B*, ventral aspect; *C*, dorsal aspect; *dt*, dorsal tendon of aedeagus, *vt*, ventral tendon of aedeagus.

Glossosoma taeniatum, new species

Fig. 1

This species differs from other known members of the genus in the short claspers and aedeagus, and the long, ribbon-like ventral process of the tenth tergite plates.

Male.—Length 7 mm. Color dark brown, almost black, the legs and venter slightly lighter than the dorsum. Front wing with anal callosity large and only slightly thickened. Hind tibia with both apical spurs sharp and straight. Genitalia, fig. 1, with ninth segment annular, produced into a point beneath bases of claspers; lobes of tenth tergite well separated on meson, each lobe divided into a fairly long, pointed dorsal spike and an exceedingly long, ribbon-like ventral whip; clasper short, its edge armed with short, stout spines; aedeagus consisting of dorsal membranous portion situated chiefly within a ventral sclerotized shell which continues as a ventral strap joining the ninth sternite at the base of the claspers.

Types.—Holotype ♂, Tu-pa-keo, Szechuan, China, Sept. 7, 1929, 7400 ft. elev., H. Stevens; 2 ♂ paratypes, same data as for holotype. The holotype is in the collection of the Chicago Natural History Museum, paratypes are in the Illinois Natural History Survey and the Museum of Comparative Zoology.

Glossosoma sellatum, new species

Fig. 2

Most closely related to the above species, *sellatum* differs in the simple lobes of the tenth tergite and the curious saddle-like structure bearing the membranous part of the aedeagus.

Male.—Size, color and general structure similar to *taeniatum*. Male genitalia, fig. 2, with ninth segment almost evenly circular; lobes of tenth tergite simple, undivided, and rounded at tip; claspers short, fused with each other at base and also with the ventral sclerotized part of the aedeagus, the whole forming a saddle-shaped structure on which rests the membranous portion of the aedeagus. Each clasper bears a row of stout setae just within the lateral margin, the posterior five setae large and peglike, the more anterior ones smaller and sharper. Membranous portion of adeagus with a large swollen basal portion, a constricted middle part, and an apical portion consisting of a series of membranous folds.

Type.—Holotype ♂, Tu-pa-keo, Szechuan, China, Sept. 4, 1929, 7400 ft. elev., H. Stevens. In the collection of the Chicago Natural History Museum.

Glossosoma aveleta, new species

Fig. 3

This species resembles *minutum* most closely, especially in regard to the long claspers and general shape of the tenth tergite. It differs from *minutum* in the division of the aedeagus into a basal cup and a freely-articulating, long, slender, sclerotized phalicata.

Male.—Size, color and general structure almost identical with *taeniatum.* Male genitalia, fig. 3, with ninth segment almost a perfect, regular ring; lobes of tenth tergite each with a short dorsal and ventral tooth on apical margin, otherwise rounded and simple; clasper elongate, with a high, basal shoulder fitting under the base of the tenth tergite lobe, and with the apex narrowed and armed with a row of long setae. Aedeagus with a cup-shaped base attached to base of claspers with a long, forked strap; apical portion and basal cup joined by a freely articulating area of membrane; phalicata elongate, sclerotized, enlarged slightly near apex, and bearing a pair of long, slender, lateral spines.

Type.—Holotype ♂, Szechuan, China, 13,000 ft. elev., July 9-12, D. C. Graham. In the collection of the U. S. National Museum.

NOTES ON AMERICAN MANSONIA MOSQUITOES

(Diptera, Culicidae)

By Harry D. Pratt, *Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.*

Species of *Mansonia* include some of the most vicious, day-and-night-biting mosquitoes in the New World tropics. At least one species (*M. titillans*) has some medical importance. Gilyard (1945) has shown that it can transmit the virus of the Venezuelan strain of equine encephalitis and may have been an important vector in the Trinidad epidemic of this disease in 1942-1943. Kumm and Frobisher (1932) have shown that *titillans* can retain the virus of yellow fever after having fed on an infected patient, but in the laboratory is unable to transmit the virus to a new patient by biting. This same species is also known to be a vector of filariasis, according to Belding (1942). It is not improbable that other Neotropical species of *Mansonia* will be found to play a role in the transmission of disease, especially of filariasis in such hyperendemic areas as the Guianas. There these mosquitoes are very common and often as much as one-third of the native population has microfilariae in the peripheral blood.

The males of *Mansonia* subgenus *Mansonia* have been carefully studied and figured recently by Barretto and Coutinho (1944). Females, however, make up the majority of the specimens found in biting, light trap, and animal bait trap collections. Often such specimens are so badly rubbed that the colorational characters used in classification are difficult to see. Hence, any structural characters which will aid in identifying the females are of interest and value to entomologists. The characters of the female terminalia of many African and Oriental species of *Mansonia* in the subgenus *Mansonioides* have been carefully figured and worked out by a number of students, including Bonne-Wepster (1930), Edwards (1932), and Barraud (1934). Working independently in the United States, Gerry (1932) found and figured the same type of hooks on the eighth tergite of the female *M. titillans*, in the Neotropical subgenus *Mansonia*. No further studies were made of the female terminalia of the New World *Mansonia* until Pratt (1945) showed that three species found in southern United States and the Caribbean (*flaveolus*, *indubitans*, and *titillans*) which had been "lumped" under the single species name "*titillans*," could be separated most easily and certainly on characters of the eighth tergite of the female. Following this study, Chamberlain and Duffey (1945) restudied the specimens in the U. S. Army Fourth Service Command Laboratory and in several private collections and published records of *indubitans* and *titillans* for Florida. Subsequently, Carpenter, Middlekauff, and Chamberlain (1946) figured and keyed the three North American species of *Mansonia* (*sensu latu*) and gave distributional data for these throughout the United States.

The present paper includes figures and a discussion of the female terminalia of seven species of mosquitoes in the subgenus *Mansonia*. It also includes figures, a key, and a discussion of important taxonomic characters of the pupae of four species of *Mansonia* mosquitoes, including the previously-unknown pupa of the genotype, *Mansonia titillans* (Walker).

Technique

It is not difficult to see the spines on the eigthth tergite in many undissected specimens of female *Mansonia* subgenus *Mansonia* mosquitoes. In Jamaica and Puerto Rico, in making routine determinations of fresh light trap specimens of *Mansonia*, G. A. Thompson and the writer commonly followed a technique used by June beetle specialists. The abdomen of these insects was squeezed gently with fine forceps thus forcing the eighth tergite into full view so that the spines could be seen quite easily under a dissecting microscope. Many of these specimens were pinned or mounted on points and the taxonomic characters are still visible in the undissected mosquitoes four and five years after preparation.

For critical study, the same techniques may be followed as are used in examining terminalia. The tip of the abdomen is cut off with fine scissors. Quick determinations may be made a few hours after mounting the undissected terminal segments in chloral gun or polyvinyl alcohol. For permanent mounts, however, the writer prefers to soak the terminal

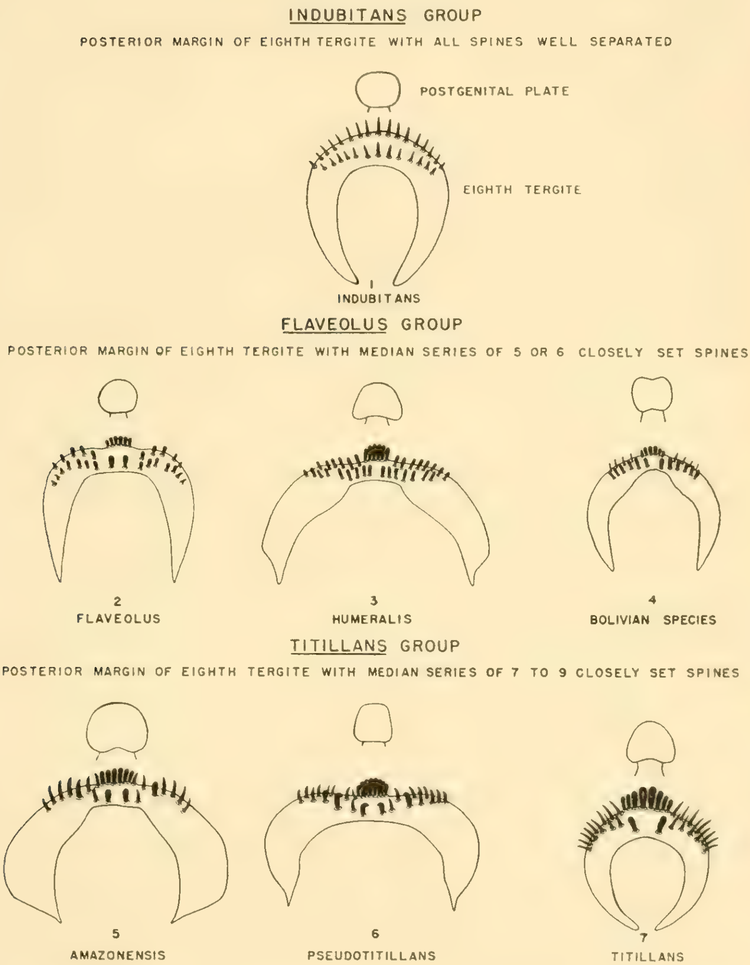


PLATE I. MANSONIA, FEMALE EIGHTH TERGITE AND POSTGENITAL PLATES

Fig. 1. *M. indubitans;* fig. 2, *M. flaveolus;* fig. 3, *M. humeralis;* fig. 4, *Mansonia* species from Bolivia; fig. 5, *M. amazonensis;* fig. 6, *M. pseudotitillans;* fig. 7, *M. titillans.*

segments of the abdomen in 10% potassium hydroxide solution until all the flesh has been removed, then wash in distilled water, stain in a dilute solution of acid fuchsin, run through the alcohol series into cellosolve and clove oil, and finally mount in Canada balsam or Euparal. Usually the eighth tergite and sternite should be dissected from the following segments and all the parts laid flat before the cover slip is placed on the final preparation.

Female Terminalia of Mansonia Subgenus Mansonia

The *indubitans* group (Pl. I, fig. 1) is especially characterized by the eighth tergite having all the spines well separated (frequently, though not always, by at least the diameter of the individual spines), never closely set in a median series of 5 to 9 contiguous spines in the middle of the posterior margin as in the following two groups. The group contains only *indubitans* Dyar and Shannon.

The *flaveolus* group is characterized especially by a median series of 6 (rarely 5 or 7) stout spines set closely together on the middle of the posterior margin of the eighth tergite. It contains three species at the present time; *flaveolus* (Coquillett), *humeralis* Dyar and Knab, and an undetermined Bolivian species (Pl. I, figs. 2, 3, 4). *Humeralis* and *flaveolus* have a post-genital plate distinctly broader at the base than at the apex, while the Bolivian species has the post-genital plate subcircular and slightly concave at the base.

The *titillans* group is characterized especially by a median series of 6 to 9, (usually 8) closely set, stout spines in the middle of the posterior margin of the eighth tergite. It contains three species at the present time: *titillans* (Walker), which is the genotype, *pseudotitillans* Theobald, and *amazonensis* Theobald (Pl. I, figs. 5, 6, 7). In this group *pseudotitillans* has the widest eighth tergite, much wider than in either of the other two species. *Amazonensis* has a subcircular post-genital plate which is slightly concave at the base and only a few spines (6-8) on the eighth tergite on either side of the median series. *Titillans* has a post-genital plate which is broader at base than at apex and has more spines on the eighth tergite on either side of the median series. In addition the apical margin of the seventh tergite has a row of short, stout spines (much smaller than those of the eighth tergite) not found in the other species.

During the course of the present study the writer has examined specimens of six described species of *Mansonia* subgenus *Mansonia*. Locality records and notes on these species are presented herein.

Mansonia indubitans Dyar and Shannon

Mansonia indubitans Dyar & Shannon, 1925. Jour. Wash. Acad. Sci., *15*: 41.

The writer has examined females with the eighth tergite as figured on Plate I from the following localities:

BRAZIL: Rio Branco, 1 paratype in U. S. National Museum. PANA-

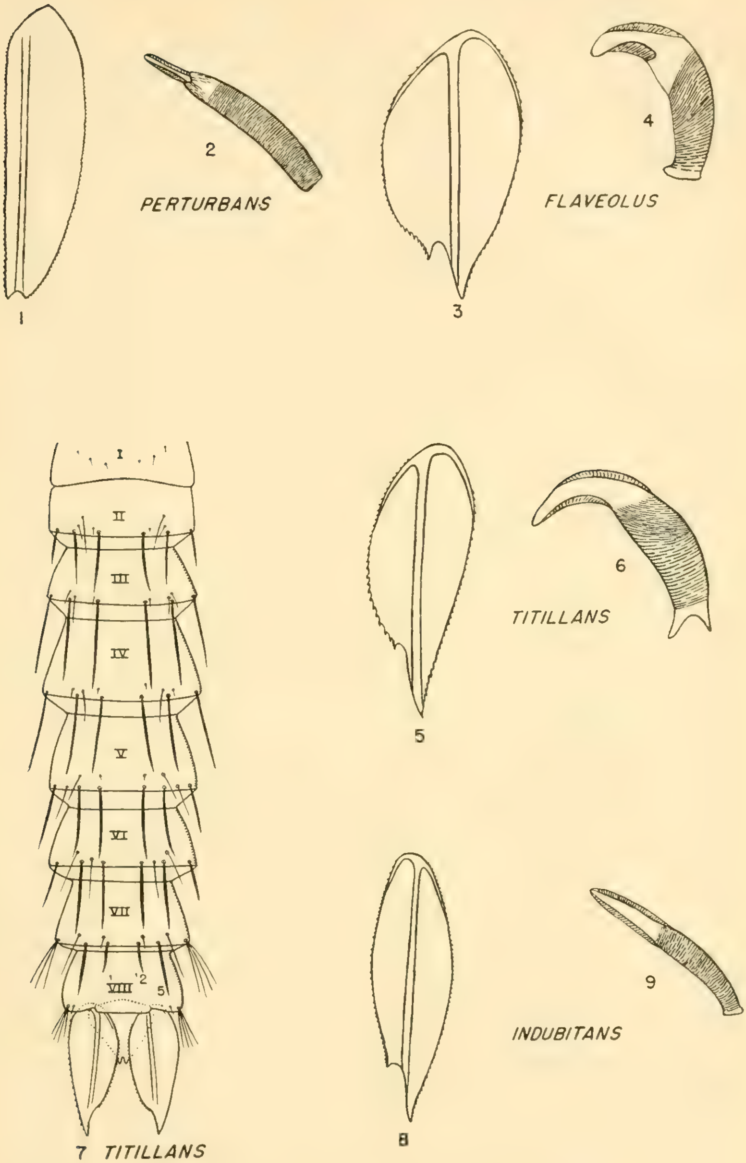


PLATE II. MANSONIA, DETAILS OF PUPAE

Fig. 1, *M. perturbans* paddle; fig. 2, *M. perturbans* trumpet; fig. 3, *M. flaveolus* paddle; fig. 4, *M. flaveolus* trumpet; fig. 5, *M. titillans* paddle; fig. 6, *M. titillans* trumpet; fig. 7, *M. titillans* abdomen; fig. 8, *M. indubitans* paddle; fig. 9, *M. indubitans* trumpet.

MA: Juan Mina, C. Z. Oct. 30, 1947, H. L. Trapido. JAMAICA: South Clarendon, January 17, 1945, reared from *Pistia stratiotes* L., H. D. Pratt and G. A. Thompson. Also numerous other specimens from light traps and donkey-baited traps on or near the U. S. Army Reservation of Fort Simonds taken in 1943, 1944, and 1945 by C. E. Peres, A. E. Pritchard, and G. A. Thompson, Jr. Some of these are mentioned by Pratt (1945), others by Thompson (1947). PUERTO RICO: Fort Buchanan, Lake Cartagena, and Camp Tortuguero. This includes some of the series recorded by Pritchard and Pratt (1944) from Fort Buchanan, also the material mentioned by Tulloch (1937), and Pratt (1945). UNITED STATES: Florida, Boca Raton, Aug. 18, 1944, reared from *Pistia stratiotes* L., W. W. Wirth and D. G. Denning; recorded by Pratt (1945). Subsequent material examined through the kindness of D. C. Thurman, Jr. and John A. Mulrennan of the Florida State Board of Health are from the following localities: Wabasso, Indian River Co.; Odessa, Pasco Co.; Lake Worth and West Palm Beach, Palm Beach Co.; and Okeechobee City, Okeechobee Co.

Mansonia flaveolus (Coquillett)

Taeniorhynchus flaveolus Coquillett, 1906. Proc. Ent. Soc. Wash., 7: 182.

The type of this species is a male from St. Thomas, Virgin Islands. The writer has seen no females from St. Thomas, but does have many females and males from Puerto Rico and Vieques Island 20 to 40 miles by sea from St. Thomas. These are almost certainly conspecific with Coquillett's type. *Flaveolus* is a larger, yellower species than the other species of *Mansonia*. The females of this species have the palpi more than half as long as the proboscis. This is the *M. titillans* of Tulloch (1937), Wolcott (1936), and Pritchard and Pratt (1944).

The writer has examined females from the following localities:

BRAZIL: Tonantins, Amazonas, March 1931, R. C. Shannon: see Shannon (1934). This specimen has seven spines in the median series on the eighth tergite but otherwise appears typical of this species, with such diagnostic characters as long palpi and yellowish color. PUERTO RICO: Several hundred females from light traps along the entire coastal plain, more abundantly on the north coast at such places as Loiza, Vega Baja, and Catano, and on the east coast at Humcao. The series includes two females from Vieques Island east of Puerto Rico.

Mansonia humeralis Dyar and Knab

Mansonia humeralis Dyar and Knab, 1916. Insect. Inscit. Mens., 4: 65.

Through the courtesy of the officials of the U. S. National Museum the writer was able to dissect the abdomen of the type female of *humeralis* and to make a slide mount of the terminal structures. The eighth tergite has a median series of six closely set, black spines on the posterior margin as in Plate I, fig. 3.

The writer has examined seven female specimens from the following localities:

BRAZIL: 2 from Manaos, Amazonas, June 1931, R. C. Shannon, part of the series recorded by Shannon (1934); 2 from Boa Vista, Tapajos, Para, C. H. T. Townsend, 23-VII; 2 from Manaos, Amazonas, 23-VII-24 and 29-VII-24, J. C. Bequaert, part of the series recorded by Bequaert (1926). BRITISH GUINEA: 1 from Georgetown, H. W. B. Moore.

Mansonia titillans (Walker)

Culex titillans Walker, 1848. Cat. British Mus. Dipt. I, p. 5.

The type specimen in the British Museum was dissected in August 1945 by Dr. John Smart who sent the present writer (through Dr. Alan Stone) a sketch of the mount showing the characteristic 8 closely set spines in the middle of the posterior margin of the eighth tergite. Fig. 7, Pl. I is redrawn from Dr. Smart's sketch. During the present study the writer has examined specimens from the following localities.

UNITED STATES: Florida, 10 ♀ from Delray and Boynton, Sept. 6, 1947, W. D. Sudia; Texas, 1 ♀ from Brownsville, Oct. 30, 1942, E. S. Ross; 1 ♀ from Austin, 10 larvae from Hidalgo Co. X-29, 1948, R. B. Eads. JAMAICA: A number of females, larvae, and pupae from G. A. Thompson in the vicinity of Fort Simonds, about 40 miles west of Kingston on the south coast. ST. LUCIA: A dozen females collected on window screens at Gros Islet, probably in November 1941, W. A. Hoffman. TRINIDAD: Several females from Fort Read, Oct. 16, 1943; T. K. Yolles. These include some of the 'titillans'' mentioned by Gilyard (1945). PANAMA: 1 female Juan Mina, C. Z. Sept. 24, 1947, H. Trapido; several females without specific locality or collection data from W. H. W. Kemp; 1 female from Port of La Chorrera, Dec. 1, 1944, H. Knutson. BRITISH GUIANA: Several females from U. S. Army A. P. O. Without specific localities or dates.

In addition to these records *titillans* probably occurs in Cuba since Gerry's drawing (1932) seems to represent this species.

Mansonia amazonensis (Theobald)

Panoplites amazonensis Theobald, 1901. Mon. Cul., 2: 182.

The writer has examined 5 female specimens from Brazil: 4 from Manaos, Amazonas, June 1931, R. C. Shannon, part of the series referred to by Shannon (1934) and Shannon (1931), and 1 from Belem, Para, 19-IX-24, J. C. Bequaert, one of the specimens referred to by Bequaert (1926).

Mansonia pseudotitillans (Theobald)

Panoplites pseudotitillans Theobald, 1901. Mon. Cul., 2: 178.

The writer has examined two specimens from the U. S. National Museum:

Tonantins, Amazonas, Brazil, March 1931. R. C. Shannon; part of the species recorded by Shannon (1934).

The Pupae of Mansonia

The pupae of *Mansonia*, pl. II, differ from those of most other mosquitoes in that the trumpets are pointed and narrowed apically. This adaptation allows the pupae to pierce the soft roots of aquatic plants with their trumpets so that they may obtain their air supply from the vascular system of the plant below the water surface. Since the pupae of *Mansonia* do not float at the water surface like those of other mosquito pupae, the "float hair," or dendritic tuft, on the first abdominal segment has become greatly reduced, often to a single hair.

Pupae of *Mansonia* (*Mansonia*) *flaveolus* (Coquillett) and *Mansonia* (*Mansonia*) *indubitans* Dyar and Shannon have been described by Pratt (1945). Bonne-Wepster and Bonne (1925) figured the trumpet of *Mansonia* (*Mansonia*) *titillans* (Walker) while Marshall (1938) figured and described the pupa of *Mansonia* (Coquillettidia) *perturbans* (Walker) as *Taeniorhynchus richardii*. In the present paper one paddle and the trumpet of each species are figured to show diagnostic differences in the pupal stage of the four species. The abdomen of *titillans* is figured here for the first time, pl. II, fig. 7.

All three species in the subgenus *Mansonia* figured in this paper have one characteristic in common which may be of subgeneric value: the inner margin of the paddle is somewhat curved with the outer portion of the paddle extending considerably further posteriorly than the inner portion. These three species show a definite gradation of characters: *flaveolus* having the broadest paddle and stoutest trumpet, *indubitans* with the narrowest paddle and longest and straightest trumpet, with *titillans* more or less intermediate between these two.

Mansonia perturbans belongs in the subgenus *Coquillettidia*. It is probable that the two characters of short, hair-like setae on the middle abdominal segments, and the paddle with the inner margin straight and the inner and outer portion of the paddle extending posteriorly about the same distance have subgeneric value.

The differences among the pupae of these four species may be summarized in key form as follows:

Key to Pupae of some American Species of Mansonia

1. All hairs on abdomen, weak and seta-like, never as long as an abdominal segment; inner margin of paddle straight, inner and outer portions of paddle extending posteriorly about the same same distance .... *M.* (*Coquillettidia*) *perturbans* (Walker)

   Some of the hairs on the abdomen long and strap-like, longer than an abdominal segment; inner margin of paddle curved, outer portion of paddle definitely extending posteriorly further than inner portion of paddle ...... *M.* (*Mansonia*) 2

2. Paddle very broad, about twice as wide as long ...... *M.* (*M.*) *flaveolus* (Coquillett)

   Paddle narrower, more than twice as long as broad 3

3. Seta VII-2[1] noticeably shorter than VII-5[1] .... *M.* (*M.*) *titillans* (Walker)

Seta VII-2 about as long as VII-5 .... *M.* (*M.*) *indubitans* Dyar and Shannon

The larvae and pupae of *M. titillans* are usually reported in the literature as occurring on water lettuce (*Pistia*). However, the writer has found only *M. indubitans* larvae and pupae among some 500 larvae and pupae from Florida and Jamaica collected in *Pistia*. It is probable that many of the records of *M. titillans* reported in the literature are based on incorrect determinations and are actually *M. indubitans*.

The pupae of *M. titillans* figured and discussed in this paper were collected by G. A. Thompson and H. D. Pratt from the roots of a *Pontederia*-like plant with purplish flowers at Clarendon, Jamaica, B. W. I., January 11, 1946. Data on the other pupae were published in the article by Pratt (1945).

Summary

The females of *Mansonia* subgenus *Mansonia* can be placed in three groups according to the arrangement of spines in the eighth tergite; an *indubitans* group containing only *indubitans*; a *flaveolus* group containing *flaveolus*, *humeralis*, and an undescribed Bolivian species; and a *titillans* group containing *titillans*, *pseudotitillans*, and *amazonensis*. This structural character should be a valuable aid in determining damaged female specimens from light trap, bait trap, or human biting collections.

Important taxonomic characters are figured and discussed for the pupae of *M. titillans*, *flaveolus*, *indubitans*, and *perturbans*. There is also a key to the pupae of these four species.

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Dr. John Smart of the British Museum, Natural History very kindly examined the type of *Mansonia titillans* (Walker) and made a sketch of the terminalia. The authorities of the U. S. National Museum permitted the writer to dissect and study the type of *Mansonia humeralis* and to study in the Museum on many occasions.

[1] Seta VII-2 of Knight and Chamberlain (1948) is seta VII-C of earlier authors; seta VII-5 of Knight and Chamberlain in seta VII-B of earlier authors.

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A SECOND REVISION OF THE GENUS PTOCHIOMERA SAY AND ITS ALLIES

(HEMIPTERA, LYGAEIDAE)

BY HARRY G. BARBER, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

As the former revision of the genus *Ptochiomera*, published by the author in 1928, (Jour. N. Y. Ent. Soc., 36: 175-177), contains several errors it is necessary to make certain corrections in it.

Plociomera puberula Stål was confused with *Sisamnes contractus* Distant and the true *puberula* was described as *Valonetus pilosus* in 1918, (Jour. N. Y. Ent. Soc., 26: 50). An examination of Stål's type of *Plociomera puberula* disclosed the fact that *Valonetus pilosus* was a synonym. But as Stål's species is not congeneric with the other species of the group. *Valonetus* is a valid generic name, and the species should be known as *Valonetus puberulus* as stated by the author in 1949. (Proc. Ent. Soc. Wash., 51: 275). The brachypterous form of this species presents such remarkable differences from the normal form that it is very apt to be considered distinct. Bueno, 1946, (Entom. Amer., 26: 86) also was in error in placing this in the genus *Sisamnes*.

Another error was made in following Van Duzee in the misidentification of *Lygaeus minima* Guérin. This misidentified species is described in this article as *Exptochiomera confusa*.

A third error was made in the identification of the Adirondack Mountain species of *Carpilis* as *ferruginea* Stål, described from Texas. As a result of a study of the type the author published a correction in 1949 (Proc. Ent. Soc. Wash., 51: 275), and described the misidentified species as *Carpilis consimilis.*

Key to Ptochiomera and Related Genera

1. Third and fourth segments of antenna filiform, much more slender than either basal or terminal segments 2
   Third and fourth segments of antenna strongly incrassate, often clavate 3
2. Body densely, long pilose. Anterior tibia of male with a postmedian spine. Macropterous and brachypterous. Type, *Plociomera puberula* Stål .... *Valonetus* Barber
   Body either glabrous or slightly sericeous or sparsely pilose as in *formosa.* Anterior tibia of male most often without a postmedian spine. Macropterous. Type, *Lygaeus minima* Guérin .... *Exptochiomera* Barber
3. Third segment of antenna more incrassate than terminal; second and third segments equal. Anterior tibia of male mutic. Costal margin of corium straight. Anterior lobe of pronotum black, smooth, often more or less inflated. Macropterous and brachypterous. Type, *Ptochiomera nodosa* Say .... *Ptochiomera* Say
   Third segment not more incrassate than fourth, commonly subequally wide; second and third segments clavate. Anterior tibia of male with small apical spine on the inner side 4
4. Costal margin of corium more or less convexly rounded from base. Glabrous, somewhat shining. Anterior tibia of male curved. Antennae with erect hairs. Macropterous and brachypterous. Type, *Carpilis ferruginea* Stål .... *Carpilis* Stål
   Costal margin of corium straight anteriorly. Either sparsely sericeous or with cerous-like hairs. Anterior tibia of male straight. Antennae without erect hairs. Macropterous and brachypterous. Type, *Sisamnes contractus* Distant .... *Sisamnes* Distant

Genus **Ptochiomera** Say

Ptochiomera Say 1832, Heterop. Hemip. No. Amer., p. 18; Le Conte, 1859, Comp. Writ., vol. I, p. 335; Van Duzee, 1917, Cat. Hemip. No. Amer., p. 185 (in part); Blatchley, 1926, Heterop. E. No. Amer., p. 406 (in part); Barber, 1928, Jour. N. Y. Ent. Soc., 36: 176; 1928, Bull. Bklyn. Ent. Soc., 23: 153; Bueno, 1946, Ent. Amer., 26: 153.

R. (*Plociomerus*) Stål, 1860, Rio Jan. Hemip., Vol. I, p. 40 (in part).

Plociomera Stål, Stett. Ent. Zeit., 23: 313 (in part); 1874, Enum. Hemip., vol 4, p. 152 (in part).

Ptochiomera nodosa Say

Ptochiomera nodosa Say, 1832, Heterop. Hemip. No. Amer., p. 18; Le Conte, 1859, Compl. Writ., vol. I, p. 335.

The only included species is *P. nodosa,* occurring in both the macropterous and brachypterous forms. It is distinguished by the nude body, contrasting black, anterior lobe of the pronotum, which is often inflated, and especially by the more incrassate third segment of the antenna.

It is a common, widely distributed species in the United States, ranging from Canada, New England states south through the coastal states to Florida and west across the country to Nebraska, Kansas and Texas.

Genus **Exptochiomera** Barber

Exptochiomera Barber, 1928, Jour. N. Y. Ent. Soc., 36: 175; Bueno, Ent. Amer., 26: 67, 86.

Chiefly because of the filiform character of the second and third segments of the antenna this assemblage of species was separated from its congeners as treated by Stål, Van Duzee, and others. Eight species have been described from the United States and two more are added herewith. So far as known all species are represented only in the macropterous form.

Exptochiomera confusa, new species

Ptochiomera minima, Van Duzee, 1917, Cat. Hemip. No. Amer., p. 186 (not Guérin); Blatchley, 1926, Heterop. E. No. Amer., p. 407, 408 (not Guérin); Barber, 1928, Jour. N. Y. Ent. Soc., 36; 176 (not Guérin); Bueno, 1946, Ent. Amer., 26: 87 (not Guérin).

Shining, sparsely sericeous. The following parts castaneous: head, anterior lobe of the pronotum and three rather vague fasciae on the posterior lobe, scutellum, postmedian and apical fascia and the punctations of the corium, basal and apical segments of antennae, femora except at apices, bases of tibiae and body beneath. The following parts stramineous: apex of scutellum, surface of the corium, for the most part, second and third segments of the antennae, apices of femora and tibiae.

Head a little shorter than anterior lobe of the pronotum, nearly one-third wider than long. Pronotum, viewed laterally, deeply constricted between the two lobes; anterior lobe nearly one-third longer and one-third narrower than the posterior lobe, very finely punctate; posterior lobe coarsely, closely punctate; humeral angles smooth, pale, with a fuscous spot on the margin. Scutellum a little longer than wide, basal disk depressed, a median carina on the apical half, coarsely puctate at base and laterally on either side of the carina; four rows of punctures along the scutellar margin, two on the clavus and two on the corium paralleling the claval suture. Posteriorly, between the median vein and costal margin, sparsely punctate. Costal margin of the corium slightly, concavely arcuate opposite apex of the scutellum. Membrane lightly infumed, veins pale, well extended beyond apex of abdomen, its outer margin about one-third shorter than the costal margin of corium; antennae noticeably longer than costal margin of corium; basal segment extended beyond apex of tylus by one-third of its length, second segment twice as long as basal which is equal to the terminal, third shorter than terminal; proportional lengths of segments: 15: 30: 20: 30. Anterior femora with three small spines on the apical half; anterior tibia of male with a postmedian spine. Length 3.75 mm.

This species is most closely related to *E. oblonga*, but is considerably larger and differently colored. The fore tibia of the male has a postmedian spine.

Distribution.—Texas, Florida, Mexico, Central America, Ecuador, and Cuba.

Types.—Holotype ♂, Brownsville, Tex., Nov. 29, 1929; U.S.N.M. no. 61726. Paratypes, males and females—TEXAS: Brownsville, 33, Apr. 30, 1904; 18, May 5, 1904; 26, June 1904, collected by H. S. Barber; 2, June and July (no other data); 5, from Bklyn. Mus. coll., without data; 2, June 23, 1918 (no other data); 3, June 19, 1921, at light, D. K. McMillan; 2, Oct. 20, 1921, Deputy; 1, Sept. 22, 1924 (no other data); 3, May 8, 1935, J. N. Knull; 3, May 11, 1938, Deputy; 1, June 11-16, 1938, Darlington; 3, Jan. 28, 1943, Schiller; 1, Jan. 24, 1944; Victoria, 5, J. D. Mitchell; 1, W. E. Hinds; Lolita, 5, July 6, 1916, J. D. Mitchell; San Diego, 2, May 23, E. A. Schwarz; Sabinal, 1, Sept. 7, 1910; Sinton, 1, P. R. Uhler collection; LOWER CALIFORNIA: 2, P. R. Uhler collection; FLORIDA: 1, Homestead, Mar. 1, 1918, A. Wetmore; MEXICO: 55; GUATEMALA: 1; PANAMA: 3; CUBA: 1; ECUADOR: 60, Guayaquil. All in the collection of the U. S. National Museum.

Exptochiomera dissimilis, new species

The following parts piceous: head, anterior lobe of the pronotum, except the narrow anterior margin, scutellum, except along the sides posteriorly, and body beneath; the following parts sordid straminous; anterior margin of pronotum and posterior lobe with exception of the three rather obscure, longitudinal casaneous fasciae, lateral area of scutellum, corium, for the most part, second and third segments of the antennae, apices and bases of the femora; basal and terminal segments of antennae and the femora, except at bases and apices, castaneous; apex of scutellum straminous.

Slightly shining and sparsely sericeous. Head much wider than long, preocular part equal to the length of an eye. Pronotum rather strongly constricted between the two lobes; anterior lobe, finely, sparsely punctate, nearly one-fourth longer than the more coarsely punctate posterior lobe and nearly one-fourth narrower. Scutellum noticeably longer than wide; basal disk depressed, surrounded by an elevated ridge from which extends posteriorly an elevated, median carina; closely, coarsely punctate on either side of the carina. Clavus with three regular rows of puctures, a fourth row on the corium parallels the claval suture, coarsely, closely puntate between the median vein and the costal margin; the latter lightly concavely arcuate opposite apex of the scutellum; maculations of the corium rather faint; the usual postmedian fascia ill-defined or absent entirely. Membrane fuliginous with the veins pale. Antenna about as long as costal margin of the corium, basal segment exceeds apex of the head by nearly one-half of its length, subequal to the third in length, terminal segment a little shorter than second; proportional lengths of the segments: 16:30:17:28. Incrassate fore femora with a few small, preapical spines. Length 3.50 mm.

Distribution.—So far as known, Florida and the West Indies.

Types.—Holotype ♂, Everglade, Fla., May 1912, Wm. T. Davis, no. 61727. Paratypes, males and females—FLORIDA: 4, same data as type; Ocean Beach, Miami, 1, Sept. 23, 1913, Wm. T. Davis; Homestead, 3, Feb. 28, Mar. 1, A. Wetmore; La Belle, 2, July 16, 1939, P. W. Oman; Paradise Key, 1, Feb. 28, 1919, H. S. Barber; Key West, 1, Mar. 8, 1912, E. A. Schwarz; PUERTO RICO: Aguirre, 1, June 28-29, 1931, M. D. Leonard; CUBA: Guantanamo, 4, intercepted at San Juan, P. R., Sept. 2, 1944; Baragua, 1, Nov. 10, 1926, at light. All in the collection of the U. S. National Museum.

This species is rather more closely related to *confusa* than to any other species of the genus. Besides being somewhat larger, the two lobes of the pronotum are more nearly equal, the scutellum is bicolored, and the general coloration is more piceous.

Key to Species of Exptochiomera

1. Lateral margin of pronotum very delicately carinate; constriction between the two lobes, viewed laterally, very shallow. Body nude. Anterior tibia of male mutic. Anterior costal margin of corium, straight 2

   Lateral margin of pronotum ecarinate; constriction between the two lobes sharply defined or more rarely, shallow. Body most often sericeous, more rarely pilose. Costal margin of corium most often, slightly, concavely arcuate, opposite apex of the scutellum 3

2. Basal segment of antenna short, scarcely exceeding apex of head; preocular part of head, viewed laterally, but little longer than an eye. Scutellum ecarinate. Fore femora of male with a single series of numerous, small, setigerous spines. Head, pronotum and scutellum yellow testaceous. Massachusetts. (1932, Jour. N. Y. Ent. Soc., 40: 361, fig. 3) .... *nana* Barber

   Basal segment of antenna surpasses apex of head by about one-third of its length. Preocular part of head, viewed laterally, much longer than an eye. Scutellum distinctly carinate. Fore femora of male with a single series of four short spines on the apical half. Pronotum and scutellum castaneous, humeral angles pale. Ariz., So. Calif. Mexico. (1932, Jour. N. Y. Ent. Soc., 40: 359, fig. 2) .... *arizonensis* Barber

3. Constriction between the two lobes of the pronotum, viewed dorsally, sharply defined. Anterior costal margin of corium concavely arcuate opposite apex of scutellum 4

   Constriction between the two lobes of the pronotum rather shallow, not sharply defined. Anterior costal margin of corium straight . 9

4. Anterior tibia of male with a postmedian spine 5

   Anterior tibia of male mutic 6

5. Body robust, pilose, with matted appressed hair. Eyes slightly removed from anterior angles of pronotum. Anterior lobe of pronotum often inflated. Scutellum sharply carinate, apically. Costal margin of corium strongly, concavely, arcuate opposite opposite apex of scutellum. Fore femoral spines in two series. Ariz., Mexico and Centr. Amer. ([*Plociomera*], 1882, Biol. Centr. Amer., Rynch. I, p. 210, pl. 19, fig. 25) ... *formosa* (Distant)

   Body less robust, most often sericeous and somewhat shining. Scutellum more lightly carinate apically. Fore femoral spines in a single series. Head imbedded to eyes. Fla., Texas, Lower Cal., Mexico, Centr. Amer., Ecuador and Cuba *confusa*, new species

6. Two lobes of pronotum very nearly equally long. Scutellum equilateral, equal to the length of pronotum. Claval commissure about one-fourth as long as scutellum. Basal segment of antenna longer, extended beyond apex of head by very nearly one-half its length. Larger species 7

   Anterior lobe of pronotum evidently longer than posterior lobe. Claval commissure one-third as long as scutellum. Basal segment of antenna scarcely extended beyond apex of head 8

7. Costal margin of corium straight. Pronotum, viewed laterally, scarcely at all constricted betwen the two lobes. Scutellum equilateral, bicolored. Interocular space about four times the width of an eye. Head, anterior lobe of pronotum and scutellum, castaneous. Mexico, Centr. Amer., Venezuela. ([*Plociomera*] 1893, Bioly. Centr. Amer., Rhynch. I, p. 400, pl.. 35, fig. 6) .... *albomaculatus* (Distant)

   Costal margin of corium plainly, concavely, arcuate. Pronotum, viewed laterally, evidently constricted between the two lobes. Scutellum longer than wide, unicolorous. Interocular space twice as wide as an eye. Head, pronotum and scutellum black. Fla. and West Indies .... *dissimilis*, new species

8. Eyes not quite in contact with anterior angles of pronotum. Antennae longer, longer than head and pronotum combined. Scutellum bicolored. Femora straminous, with basal and preapical castaneous bands. Ariz., Mexico, Cent. Amer., West Indies. ([*Plociomera*] 1862, Stett. Ent. Zeit., 23: 313) .... *oblonga* (Stål)

Eyes in contact with anterior angles of pronotum. Antennae shorter, scarcely as long as head and pronotum combined. Scutellum unicolorous. Femora straminous, unicolorous, Cuba. (*Lygaeus* (*Beosus*) *minima* Guérin, 1857, *in* La Sagra, Hist. de Cuba, Ins., p. 398) .... *minima* (Guérin)

9. Anterior tibia of male with a postmedian spine and a slight apical one on the inner side. Basal segment of antenna incrassate, somewhat longer than preocular part of head. Head, pronotum, scutellum and corium, in part, testaceous. Fla., Ark., and La. (1932, Jour. N. Y. Ent. Soc., 40: 357, fig. 1) .... *intercissa* Barber

Anterior tibia of male mutic. Basal segment of antenna moderately incrassate, much shorter than preocular part of head. Pronotum dark brown, devoid of pale maculations. Tex., Ark., Ariz., Mexico. ([*Plociomera*] 1874, Stål, Enum. Hemip. vol. 4, p. 152) .... *fuscicornis* (Stål)

Genus **Sisamnes** Distant

Sisamnes Distant, 1893, Biol. Centr. Amer., Rhynch. vol. I, supp., p. 402.

Ptochiomera Barber, 1914, Bull. Amer. Mus. Nat. Hist., 33: 402 (in part); Van Duzee, 1917, Cat. Hemip. No. Amer., p. 186 (in part); Barber, 1918, Psyche, 25: 77 (in part); Barber, 1923, Conn. Geol. and Nat. Hist. Hist. Surv., Bull. 34: 728 (in part); Blatchley, 1926, Heter. E. No. Amer., p. 408-409 (in part).

Sisamnes, Barber, 1929, Jour. N. Y. Ent. Soc., 36: 176-177 (not Distant); Bueno, 1946, Ent. Amer., 26: 67, 85 (in part).

Sisamnes clavigera (Uhler)

Ptochiomera clavigera Uhler, 1895, *in* Gillette and Baker, Prelim. List of Hemip. Colo., p. 24, 25; Blatchley, 1926, Heter. E. No. Amer., p. 408.

Sisamnes clavigera, Barber, 1928, Jour. N. Y. Ent. Soc., 36: 176-177; Bueno, 1946, Ent. Amer., 26: 85, 86.

Dull, fusco-cinerous, with short, decumbent, cereous-like hairs. Head much longer than anterior lobe of the pronotum. Third segment of antenna much more incrassate than basal segment. Membrane (Macropterous) fumose, with three conspicuous, pale veins. In the brachypterous form the corium is truncate with a very slight trace of a membrane at the inner and at the outer angles.

This species was described from Colorado and is fairly common in all of the western states. In the East it occurs at least on Long Island, in northern New Jersey and probably extends further south, but evidence is lacking as to its southern limits.

Sisamnes contractus Distant

Sisamnes contractus Distant, 1893, Biol. Cent. Amer., Rhynch., vol. I, supp., p. 402, Pl. 35, fig. 11.

Ptochiomera antennata Van Duzee, 1909, Bull. Buff. Soc. Nat. Sci., 9: 172; Blachley, 1926, Heter. E. No. Amer., p. 409. (New Synonymy.)

Slightly shining, very sparsely sericeous, devoid of cereous hairs. Head, anterior lobe of the pronotum and the scutellum, castaneous; corium, for the most part, straminous. Head and anterior lobe of the pronotum very nearly equally long, the latter somewhat longer than the posterior lobe. Second and third segments of the antenna clavate, terminal segment a little more incrasate than apical part of third segment which is not abruptly truncate as in *clavigera*. In the brachypterous form the apical margin of the corium is bluntly rounded, without trace of a membrane.

This species was described from Guatemala. From the evidence at hand it occurs in southern Texas, Arizona, Southern California, and throughout Mexico and Central America. The author has not been able to separate Van Duzee's *P. antennata* from Distant's species.

Key to Species of Sisamnes

Fusco-cinerous, with short, decumbent, cereous-like hairs. Clavus and corium closely, coarsely punctate. Third and fourth antennal segments almost equally incrassate. Brachypterous form: posterior margin of corium obliquely truncate with slight traces of membrane .... *clavigera* (Uhler)

Castaneous and straminous; very slightly, sparsely sericeous on head and pronotum. Clavus and corium finely punctate. Brachypterous form: posterior margin of corium bluntly rounded, without trace of membrane .... *contractus* Distant

Genus **Carpilis** Stål

Carpilis Stål, 1874, Enum. Hemip., vol. 4, p. 145, 153; Van Duzee, 1917, Cat. Hemip. No. Amer., p. 187; Bueno, Ent. Amer., 26: 67, 84.

Ptochiomera (*Carpilis*), Barber, 1918, Jour. N. Y. Ent. Soc., 26: 46.

Ptochiomera, Barber, 1928, Jour. N. Y. Ent. Soc., 36: 176 (not Say); Barber, 1918, Psyche, 25: 77 (not Say); Blatchley, 1926, Heter. No. Amer., p. 407, 409 (not Say).

Carpilis ferruginea Stål

Carpilis ferruginea Stål, 1874, Enum. Hemip., vol. 4: p. 153; Van Duzee, 1917, Cat. Hemip. No. Amer., p. 188 (in part); Barber, 1949, Proc. Ent. Soc. Wash., 51: 275.

Pronotum a little longer than wide; anterior lobe scarcely longer than wide; posterior lobe with three fuscous fascia. Scutellum longer than wide, basal angles and median, longitudinal fascia, pale, paler on either side. Membrane very short, truncate apically. Brachypterous. Described from Texas.

Carpilis barberi (Blatchley)

Ptochiomera barberi Blatchley, 1926, Heter. E. No. Amer., p. 410.

Carpilis barberi, Bueno, 1946, Ent. Amer., 26: 84.

Pronotum a little wider than long; anterior lobe wider than long; posterior lobe very short, with pale humeral angles, scarcely wider than anterior lobe. Scutellum equilateral, paler on either eside of a narrow, median, fuscous line. Membrane absent. Corium truncate apically. Described from Florida.

Carpilis consimilis Barber

Carpilis ferruginea, Van Duzee, 1917, Cat. Hemip. No. Amer., p. 188 (in part); Blatchley, 1926, Heter. No. Amer., p. 409 (not Stål); Bueno, 1946, Ent. Amer., 26: 85 (not Stål).

Ptochiomera (*Carpilis*) *ferruginea,* Barber, 1918, Jour. N. Y. Ent. Soc., 26: 46 (not Stål).

Carpilis consimilis Barber, 1949, Proc. Ent. Soc. Wash., 51: 275-276.

Pronotum a little wider than long; anterior lobe distinctly longer than wide, scarcely wider than the anterior lobe, coarsely punctate, immaculate. Scutellum equilateral, uniformly colored. Membrane very slightly developed. Corium with posterior margin gently rounded in the brachypterous form. Occurs both in the macropterous and brachypterous forms. Known from Adirondack Mts., N. Y., Long Island, N. Y., and northern New Jersey.

NOTES ON THE GENUS LEPTOTHORAX IN NEW MEXICO AND A DESCRIPTION OF A NEW SPECIES

(Hymenoptera, Formicidae)[1]

By A. C. Cole, *Department of Zoology and Entomology, University of Tennessee, Knoxville*

During my studies of ants of New Mexico in the summer of 1951[2] I was able to collect a number of colonies of *Leptothorax* and to learn something of the distribution of the genus in that state. I believe that the notes and description which follow may be of interest to myrmecologists.

Numerous collections of *L.* (*Leptothorax*) *crassipilis* Wheeler were made from beneath stones at Cimarron Canyon and in the area between Ute Park and Taos, New Mexico, at the following elevations: 7,050, 7,250, 7,400, 7,500, 7,750, 8,100, and 8,500 feet. The species was also found nesting under stones in a stand of spruce and pine in the Gila National Forest, Mogollon Mountain, in the extreme western part of the state, at an elevation of 8,350 feet. On the other hand, nests of *L.* (*L.*) *canadensis* were found beneath stones in the spruce, pine, and aspen communities of the Santa Fe National Forest. Hyde Park, near Santa Fe, at the following elevations: 7,900.

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[1]Contribution No. 62, Department of Zoology and Entomology, University of Tennessee, Knoxville.

[2]These studies were aided materially by a grant from the Penrose Fund of the American Philosophical Society.

8,000, 8,200, 8,400, 8,600, 9,000, 9,500, and 10,000 feet. At no place were the two species collected together. The ranges of the two populations in New Mexico seem to be discrete. Morphologically the two species are very closely related.

Colonies of *L.* (*Myrafant*) *rugatulus* Emery were observed nesting beneath stones on rather dry, open slopes at an elevation of 6,350 ft., at Bandelier National Monument. I was unable to find this species elsewhere in the state.

Collections of *L.* (*Myrafant*) *tricarinatus neomexicanus* Wheeler were taken in Cimarron Canyon, between Cimarron and Ute Park, at elevations of 6,500 and 6,700 feet. The nests were in moist soil beneath stones in open, grassy areas.

Leptothorax (Myrafant) obliquicanthus, new species

Holotype, worker (Cole coll. no. N-279).—Length, 2.6 mm. Head rather large, excluding the mandibles a little longer than broad, narrower in front than behind, the occipital corners broadly rounded, the sides feebly convex. Eyes very large, fig. 1, much elongated, subobovate and subreniform, convex, oblique, and directed anterio-ventrad, the dorsal portion broader than the ventral, the distance between the lower margin and the mandibular insertion equivalent to less than one-half greatest transverse diameter of the eye. Mandibles with 5 distinct teeth. Clypeus moderately convex, with broadly rounded anterior border. Frontal area indistinct. Antennae 12-segmented; scapes rather robust, not extending to the occipital margin; first funicular segment as long as the succeeding three segments taken together, the distal segment of the club of about the same length as the preceding two segments taken together.

Thorax rather robust; pronotum convex, with rounded humeral angles; dorsum of meso- and epinotum flat in profile, the mesoepinotal suture obsolete; sides of meso- and epinotum strongly compressed laterally; epinotal spines robust, broad at base, distinctly tapered from base to the rather blunt apex, about as long as the distance between their bases, very slightly curved, directed upward, backward, and outward. Petiole, when viewed in profile, fig. 2, with the anterior face flat and sloping sharply anateriorventrally, the apex of the node subtruncated, only feebly convex, and sloping steeply posterioventrally; when viewed from above the node is transversely subrectangular; peduncle very short, ventral surface with a prominent, triangular tooth. Postpetiole much broader than the petiole, but not twice as broad, its dorsal surface very convex, when viewed from above it is transversely subrectangular. Legs stout, femora incrassated.

Gaster ovoid, truncate basally, the basal angles sharp.

Thorax, petiole, and postpetiole opaque; head subopaque. Head finely and longitudinally rugulose—reticulate and finely punctate; mandibles longitudinally striated; clypeus coarsely and longitudinally rugulose. Thorax, petiole, and postpetiole more coarsely rugulose—reticulate and with abundant, larger, and more pronounced punctures; pleurae with rather coarse longitudinal rugae. Gaster and legs shining, very finely coriaceo-reticulate.

Hairs silvery; short, rather numerous, blunt, subclavate, and erect, as well as some which are short, slender, pointed, appressed and subappressed, on head; longer, slender, and sharper on clypeal border, gula, and mandibles; longer and more clavate on dorsum of thorax, petiole, and postpetiole; erect on thoracic dorsum, reclinate on petiole, postpetiole, and gaster.

Color of body black, appearing as very dark brown under high magnification; leg articulations and apical half of mandibles brown.

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Leptothorax (*Myrafant*) *obliquicanthus* worker. Fig. 1, head, showing compound eye; fig. 2, petiole in profile.

Type locality.—The holotype and a series of 61 paratype workers were collected by the writer on August 10, 1951, at a point 12 miles south of Santa Fe, New Mexico, along U. S. highway 85. The ants were ambling about on the soil of a dry, grassy area and were apparently foraging. The nest was not found.

Disposition of type material.—The holotype and a series of paratypes are in the collection of the writer. Paratypes have been deposited in the U. S. National Museum, the Museum of Comparative Zoology at Harvard, and the American Museum of Natural History.

Variation.—Body length of the paratypes varies from 2.2 to 3.0 mm. A few of the specimens have the postpetiole somewhat less opaque than do others. The eyes of some of the paratypes are more subreniform than those of others.

Affinities.—This new species is apparently a member of the *tricarinatus-texanus* complex. The most outstanding, distinctive feature of this ant is the shape, size, and position of the eyes. The eyes are evidently quite different from those of any other known North American *Leptothorax*. *L.* (*M.*) *obliquicanthus* bears some resemblance to *L. tricarinatus neomexicanus* Wheeler, which is known from northern New Mexico and Arizona, from which it differs chiefly in the shorter scapes, larger epinotal spines, differently shaped petiole, and the more compressed thorax, as well as in the shape, size, and position of the eyes.

The writer wishes to express his gratitude to Dr. M. R. Smith, of the U. S. National Museum. Dr. Smith examined specimens of this new species and compared them with cotypes of members of the *tricarinatus-texanus* complex. He substantiated my belief that the specimens might represent a new species and generously supplied me with some important diagnostic characteristics.

THE NYMPH OF MIATHYRIA MARCELLA (SELYS)

(Odonata, Libellulidae)

By George H. Bick, *Zoology Department, Tulane University, New Orleans, La.*

In 1932 Klots described, by supposition, nymphs from Puerto Rico and British Guiana as *Miathyria marcella* (Selys). The correctness of her identification has been questioned by Geijeskes (1934) and by Byers (1936). Geijeskes found that his *Brachymesia furcata* ran to *Miathyria* in Klots, and Byers stated that Klots's description closely resembled reared *Brachymesia gravida*. There is no description of *marcella* based on reared material.

Miathyria marcella was first recorded from continental United States by Needham (1933) who reported a single nymph from a roadside ditch between Fort Pierce and Okeechobee, Florida. Byers (1936a) repeated the Needham record and stated that Needham informed him in personal communication (Oct. 13, 1934) that he had also received the adult from another collector. Bick, Aycock and Orestano (1950) recorded 25 adults from Florida and Louisiana and concluded that *Miathyria marcella* is well established along the Gulf Coast.

On February 1, 1950, Mr. James Aycock collected a nymph from an irrigation canal four miles west of Dania, Broward County, Florida, and on February 23 a male *Miathyria marcella* emerged. The last instar exuvia and its associated adult are in my collection and are both labelled B56A.

Study of the reared exuvia showed that it differed substantially from the Klots description and that it could not be determined correctly in generic keys of Byers (1936), Needham and Fisher (1936), or Wright and Peterson (1944). Moreover, the nymph of *Miathyria simplex* (Rambur), the only other species in the genus, is undescribed. For these reasons it is advisable to describe the last instar exuvia of this one reared individual.

Miathyria marcella (Selys) Nymph

Measurements[1]—Total length, 16.8; length of abdomen, 10.2; of head, 2.4; of hind femur, 4.9; width of head, 5.1; of abdomen, 4.9.

Small; not hairy; head wider than abdomen; abdomen narrowly ovate; mostly amber colored.

Head—Posteriorly amber, largely black anterior to the frontal suture. Widest at rear margin of eyes; width at eyes 2.1 times the mid-dorsal length, fig. 1. Caudo-lateral margins rounded and hairy; the hairs extend almost to the posterior margins of the eyes. Posterior borders slightly concave and hairy. General dorsal surface without hairs.

Eyes rounded laterally. They project slightly posteriorly and are scarcely elevated. Their caudal margins extend well beyond the middle of the head.

Antennae 7-segmented; total length (2.3) is but slightly shorter than the mid-dorsal length of the head. The length of each segment from base outward is: 0.12, 0.22, 0.50, 0.35, 0.35, 0.41, 0.36. Segments 1, 2, and 6 black; 3, 4, and 5 black with a very narrow light colored apical ring on each; 7 strikingly lighter in color than all others. Segments 4, 5, 6, 7 with numerous fine long hairs.

Labium extends to basal ¼ of mesosternum. Lateral setae, fig. 2, 6 (left), 7, (right), with a basal group of 12-14 minute setae. Moveable hook long and slender, considerably longer than the most distal of the lateral setae. Distal border of lateral lobe, fig. 3, with 10 *very* shallow crenulations, each bearing 2-5 setae. The number of setae at each crenulation starting with the moveable hook is: 2, 3, 4, 5, 4, 3, 5, 4, 4, 3. Median border with about 28 setae extending almost to the basal notch. Lateral border without hairs or setae.

Mid-dorsal length of mentum, 4.3; basal width, 1.5; maximum width, 4.4 (measured with labium removed from head but unflattened). There are three short stout setae at either lateral margin at juncture with the lateral lobes. Mental setae 11, the outer 7 forming a longer series, fig. 4. There are two very minute setae on either side near the mid-line which are not included in the counts of the mental setae. The distal

[1] All observations and measurements were with a Spencer dissecting microscope with 9x oculars and 0.7x, 2x, and 4x objectives. It was equipped with an ocular net reticule ruled into 0.5mm. squares. All measurements are given in millimeters. Drawings were made with the aid of the reticule and cross-section paper.

margin of the mentum is pointed but there is no median projection (as in many *Libellula* species). The distance from the most anterior point to the most lateral point of insertion of the lateral lobe, measured along the mid line, is approximately ⅓ the total length of the mentum. There are about 14 setae on the distal margin at either side and the actual edge is without obvious crenulations or teeth.

Thorax—Uniformly dark amber except for a very narrow black line extending above leg bases from anterior margin of meso to posterior margin of metacoxae. Cervical processes[2] knob-like, regularly rounded and with long coarse hairs. Supracoxal processes minute. Prothoracic ridge prominent and with conspicuous long hairs. Wing buds extend to the middle of the 6th abdominal segment.

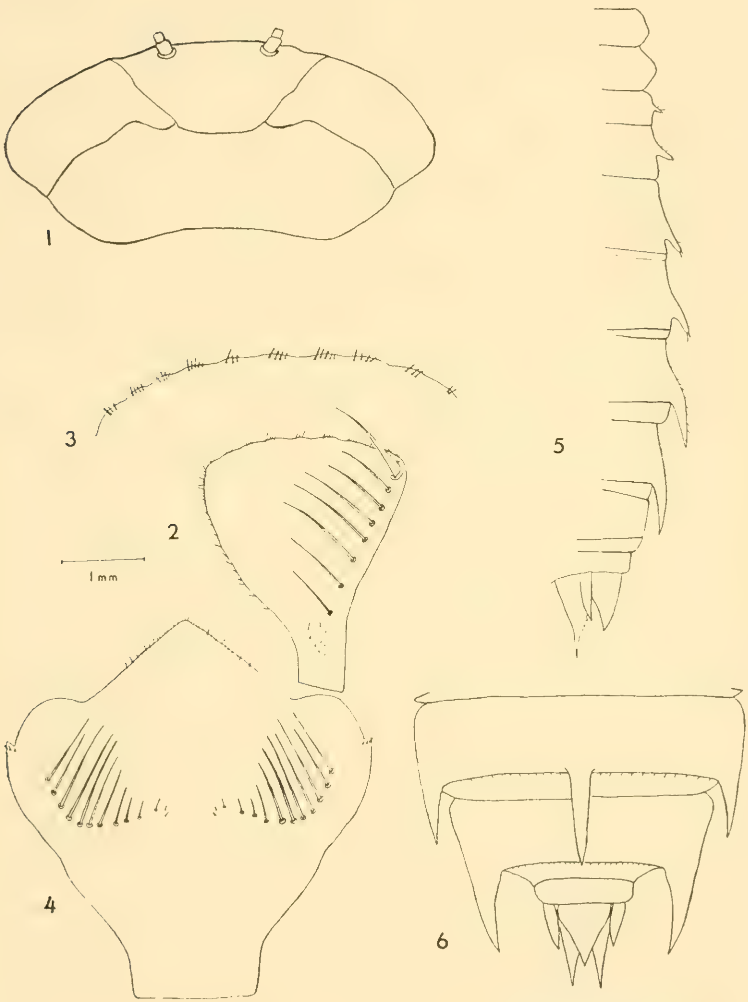
Hind femur is as long as the maximum width of the abdomen and extends to the middle of the 6th abdominal segment. Legs uniformly amber, with a few widely spaced long hairs on femora and tibiae. On pro and meso tarsus the proximal joint is considerably shorter than either of the other two joints but on the metatarsus the joints are subequal. Divided setae are present near the distal tips of all tibiae: about 5 on pro; approximately 18 in a short anterior and a longer posterior row on mesotibiae; approximately 7 widely spaced on metatibiae in a median row. Divided setae were noted only on the protarsi in an anterior row of 6 on the two basal joints.

Abdomen—Narrowly ovate, widest at juncture of segments VI and VII. Amber colored but IX and X darker; X with a narrow, black border at caudal margin. Dorsal surface with scattered long hairs at posterior lateral margins of VI through IX, increasing in number and length posteriorly. Lateral margins of VII, VIII, IX (including the lateral spines on VIII and IX) with conspicuous short stout spines. A dense mat of long hairs on the posterior ventral border of IX.

Dorsal abdominal spines are present on III through VIII and increase in size posteriorly, fig. 5. Rounded elevations present on I and II in the usual position of dorsal spines. On III and IV the spines are short, weak and blunt tipped with setae at their apices. They project dorsally and scarcely extend beyond the middle of their respective segments. On V and VI the spines point posteriorly and are blunt tipped with setae at their apices. They extend approximately to the anterior borders of the succeeding segments. The spines on VII and VIII point posteriorly, are very sharply pointed and are black and shiny. On VII the spine reaches to ⅓ the length of VIII and on VIII it extends to the posterior border of segment IX.

Lateral spines, fig. 6, are present on segments VIII and IX and bear both short spines and long hairs along their lateral borders. The spine on VIII (axial length, 0.70; basal width 0.29) is straight; it is 0.7 the

[2] "Laterally projecting lobes close behind the postocular lobes and before the antero-lateral lobes of the prothorax." Lieftinck, 1930, p. 321; Calvert, 1927. These processes have been called propleural by Bick (1951).



Nymph of *Miathyria marcella*. Fig. 1, head; fig. 2, lateral lobe; fig. 3, distal margin of lateral lobe; fig. 4, mentum; fig. 5, lateral view of abdomen; fig. 6, abdominal segments VIII, IX, X and abdominal appendages. (Fig. 3 is enlarged slightly more than indicated in the scale.)

mid-dorsal length of segment VIII and it extends to about ⅔ the length of segment IX. The spine of IX (axial length, 1.07; basal width, 0.37) is slightly incurved; it is 1.6 the mid-dorsal length of segment IX and it extends slightly beyond the tip of the lateral abdominal appendage.

Lengths of abdominal segments VIII, IX, X, fig. 6, along the mid-dorsal line are: 0.87, 0.64, 0.29 respectively and 0.79, 0.87, 0.13 respectively along the mid-ventral line. Lengths of abdominal appendages, fig. 6, are: inferior, 1.14; superior, 0.81; lateral, 0.69. All are mostly black and are sharply pointed. The superior is broad at the base and tapers to a sharp tip. It bears several long hairs on the dorsal surface near the base, setae at the margins, and 3 short spines in an irregular row at the mid line near the apex. The inferiors are distinctly longer than the superior; are almost straight and bear numerous spines and a few long hairs. The laterals are only 1/7 shorter than the superior and point slightly mesad. They are dark basally, with a very narrow sub-apical dark ring and are apparently without hairs or spines.

Triangular sclerites (*tr. scl.*, Schmidt, 1951) are present on abdominal segments III, IV, and V. They are small and somewhat ovate on III, triangular on IV and V and increase in size posteriorly.

Outstanding differences between the reared last instar exuvia and the Klots (1932) description follow:

	Klots, 1932	Reared nymph
Total length	21 mm.	16.8 mm.
Dorsal abdominal spines	II through IX	III through VIII
Dorsal spines on VIII	To middle of IX	To posterior margin of IX
Appendages plus X	Equal to VIII+IX	Shorter than VIII+IX
Distal margin, lateral lobe	Deeply crenulate, 2 setae per crenulation	*Very* shallowly crenulate, 2-5 setae per crenulation.
Lateral setae	8	6,7
Mental setae	9	11
Femora	Twice banded	Bands absent

The reared, ultimate exuvia runs to rubric 13 in Wright and Peterson (1944), which may be modified to include *Miathyria* as follows:

13. Lateral anal appendages nearly as long as the superior 13a
 Lateral anal appendages usually about half the length of the superior appendage. (*Macrodiplax*, *Sympetrum*, *Leucorrhinia*, *Celithemis*) 14

13a. Abdomen without dorsal hooks or only with small knob-like prominences; lateral spines on segment 9 one-third as long as that segment .... *Dorocordulia*
 Abdomen with conspicuous elevated and sharp pointed dorsal hooks; lateral spines on segment 9, 1.6 times as long as that segment .... *Miathyria*

In Byers (1936) the reared, ultimate exuvia runs to rubric 15, which may be modified to include *Miathyria* as follows:

15. Lateral abdominal appendages nearly as long as the inferiors; lateral setae 7 .... *Dorocordulia*
Lateral abdominal appendages about half the inferiors 15a
15a. Lateral setae 6, 7 .... *Miathyria*
Lateral setae 9-14 (*Leucorrhinia, Celithemis, Sympetrum*) 16

Additional characters given by Walker (1916, 1917), Garman (1927), Byers (1930, 1936), Broughton (1928), Needham and Fisher (1936), and Wright and Peterson (1944) will contrast *Miathyria* with *Celithemis, Macrodiplax, Leucorrhinia*, and *Sympetrum*.

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THE SCIENTIFIC NAME OF THE SCREW-WORM, WITH A NOTE ON PARALUCILIA FULVICRURA

(DIPTERA, CALLIPHORIDAE)

BY CURTIS W. SABROSKY, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

For many years uncertainty and difference of opinion have existed as to the correct generic and specific names for the screw-worm of the Western Hemisphere. For the generic name both *Callitroga* and its synonym *Cochliomyia* have been used, the still older name *Chrysomya* being now universally recognized as applying only to the Old World screw-worm flies. For the specific name both *americana* and *hominivorax* are used by modern authors, the former principally in North America. It is certainly desirable to reach sound and uniform conclusions in the use of these names as soon as possible, and the time seems appropriate for steps in that direction.

During a recent trip to Europe it was possible for me to examine, in the Muséum National d'Histoire Naturelle in Paris, the types of Calliphoridae described by Robineau-Desvoidy and Macquart. I paid particular attention to those that concerned the screw-worm flies, especially those left in questionable status in Hall's revision, "The Blowflies of North America" (1948). I am greatly indebted to Monsieur E. Séguy for information and many courtesies in expediting the work during my brief visit to Paris.

Types of the following species, labeled in the handwriting of their authors, were examined and found to be referable to the synonymy of *Callitroga macellaria* (F.). The data on the labels are given in quotation marks. The species of Robineau-Desvoidy were described in his "Essai sur les Myodaires" (1830) and those of Macquart in various parts of the "Diptères Exotiques"; the complete references are given in Hall (1948).

Chrysomya affiinis R. D.: Type female, ''Brésil, Delalande.''

C. alia R. D.: Type male, ''du nord de la Capit.—de St. Paul'' [Brazil].

C. caerulescens R. D.: Type male, ''Caroline, l'herminier.''

C. lepida R. D. (1830, p. 448): Type (headless), ''du nord de la Capit.—de St. Paul'' [Brazil]. Not listed in Hall (1948) and should be added to the synonymy under *macellaria*.

C. Lherminieri R. D.: Type male, ''Caroline, l'herminier.''

C. socia R. D. (1830, p. 447): Type female, ''du nord de la Capit.—de St. Paul'' [Brazil]. Not listed in Hall (1948) and should be added to the synonymy under *macellaria*.

C. viridula R. D.: Type female, ''du midi de la Capit.'' [Brazil], ''de Goyaz'' (? spelling).

Lucilia durvillei Macquart (1843): Type female, ''Paytou de Pérou, Durv.'' This specimen bears the label ''Lucilia peruviana,'' apparently a manuscript name that was supplanted by *durvillei* in publication.

L. vittata Macquart (1843): Type, ''Nouv. Holl., Durville.''

L. rubrifrons Macquart (1851): Type female.

Calliphora tibialis Macquart (1851): Type male, and female. Hall (1948, p. 157) listed *C. tibialis* in the synonymy of *Paralucilia fulvipes*, but if these specimens are the true types, as they seem to be, it must be referred to the synonymy of *macellaria*. Hall also included it there on page 139, but as *Lucilia tibialis*, possibly influenced by information that the pair in the Paris Museum are so labeled in Macquart's handwriting. In any case the name is of no consequence, because it is a homonym of *Calliphora tibialis* Macquart (1846), from Tasmania.

One other obscure name, *Chrysomya placi* Robineau-Desvoidy, is represented in the collection by a small male (''Plée 1826'') which is now headless and in poor condition. The rules of the Museum prohibit dissection of unique examples, so that its identity cannot be confirmed, but it appears to be *macellaria* and may conveniently rest in the synonymy of that species.

I also examined the types of several early Walker names—*Musca certima* (1849), *M. phauda* (1849) and *M. fasciata* (1856)—in the collection of the British Museum (Nat. Hist.), and confirmed their previously published synonymy with *macellaria*. I did not find the type of *Musca turbida* Walker (1856), but the name need not concern us: it is a homonym of *M. turbida* Wiedemann (1830).

The old Robineau-Desvoidy and Macquart names which were listed as possible synonyms of *americana* or *macellaria* by Hall (1948) have now been found to refer to *macellaria*, the secondary screw-worm.

The oldest remaining name that is accepted as applying to the screw-worm is *hominivorax* Coquerel (1858)[1], based on a

[1] It is unfortunate that the natural abbreviation for Coquerel, *viz* Coq., is also that long and widely used for Coquillett. Since the name Coquerel occurs relatively seldom, I suggest that it be written in full to avoid confusion. If an abbreviation is desired, Cqrl. would be distinctive.

fly reared from a case of human myiasis in Cayenne, French Guiana. This name was adopted by Aubertin and Buxton (1934, Annals Trop. Med. Parasitol. 28: 245-254, who recognized that it was the screw-worm, described as a new species (*americana*) in 1933 by Cushing and Patton. Many European and South American workers have been using the name *hominivorax*, while the North Americans in general have continued to use *americana*. Hall (1948) recognized that there were older available names than *americana*, but he wisely refrained from making any change until the status of names older than either *americana* or *hominivorax* could be clarified. Now that this has been done, it is clear that the oldest valid and available name for the species is *hominivorax* Coquerel.

Accordingly, the correct scientific name of the screw-worm of the New World, hitherto called *Cochliomyia americana* or more recently *Callitroga americana*, is *Callitroga hominivorax* (Coquerel).

Paralucilia fulvicrura (R. D.)

The species with white squamae recognized as *Paralucilia fulvipes* (Macq.) by Hall (1948) falls in synonymy under the older name *fulvicrura*, a name which was accidentally overlooked. The Paris Museum has two headless specimens, ''Montevideo, 7bre Obre 1820,'' one bearing Robineau-Desvoidy's handwritten label as *Chrysomya fulvicrura*.

The species was called *Paralucilia affinis* (R. D.) (synonym, *Chrysomya fulvicrura* R. D., from its type) by Shannon (1926, Proc. Ent. Soc. Wash. 28: 127), though apparently without seeing the type of *affinis*. Aubertin and Buxton (1934, Ann. Trop. Med. Parasitol. 28: 246) adopted *P. fulvicrura* on the authority of Aldrich, who had seen the types of both *affinis* and *fulvicrura*. However, Smart (1937, Diptera Patagonia & S. Chile, Pt. VII,(fasc. 3, p. 379) followed Shannon in using *affinis*. Hall (1948) correctly referred *affinis* to *Callitroga*, but missed *fulvicrura* (1830) in adopting *P. fulvipes* (Macquart, 1843).

Two other species listed by Hall as questionable synonyms of *fulvipes* may be mentioned for the record. The female labeled in Macquart's handwriting as *Calliphora rufipes* is *Paralucilia fulvicrura* but it bears a small disc of green paper said to mean ''Amerique,'' whereas the original description said ''Java.'' Similar confusion exists for *Calliphora violacea* Macq., for the original description said ''D'Afrique,'' but the female labeled as *violacea* in Macquart's handwriting is from ''Mr. Gay—Chile.'' This specimen is actually *Callitroga macellaria*. Fortunately for present purposes, both names are junior synonyms of their respective species, and we need not speculate on the confusion.

THE OCCURRENCE OF BLATTELLA VAGA HEBARD IN TEXAS

(ORTHOPTERA, BLATTIDAE)

BY PAUL T. RIHERD, *Texas Agricultural Experiment Station, Weslaco*

While I was searching for specimens of a species of *Compsodes* (Blattaria, Polyphagidae) I collected some specimens of wingless roaches from beneath duff under a row of athel trees (*Tamarix articulata*) growing on the grounds of the Agricultural Experiment Station, Substation 15, at Weslaco, Texas. Dr. A. B. Gurney identified these specimens as nymphs of a species of *Blattella*. He suggested rearing some of the nymphs to the adult stage in order to determine if the species were the common German cockroach, *Blattella germanica* (L.), living outside near buildings, or if another species of *Blattella* were established in the area. Such a species, if present, would be encountered occasionally and be confused with the common household species. Following this suggestion, I reared adults and sent them to Dr. Gurney, who identified them as *B. vaga* Hebard, and suggested publishing this note on the Texas record for this species.

Blattella vaga was described by Morgan Hebard, 1935 (Trans. Amer. Ent. Soc. 61: 112-114, pl. 4, figs. 1-4) from material collected in 1933 at Phoenix, Arizona, by E. D. Ball. Hebard stated that *vaga* was undoubtedly an introduction, and he believed that it was of Asiatic origin. He recorded the species in the United States from along the Gila and Colorado rivers in Arizona and California. Specimens of *vaga* in the U. S. National Museum are from Yuma and Sacaton, Arizona, and Indio and Patterson, California. Roaches superficially resembling *vaga* have been observed rather commonly in the Lower Rio Grande Valley of Texas, though Hebard, 1943 (Trans. Amer. Ent. Soc. 68: 2521276) reviewed the roaches of Texas, and at that time made no mention of *vaga*.

When *vaga* was originally described, Hebard related that Ball observed that it occurs in Arizona only in areas of rather extreme alkali conditions. This does not hold true in Texas. Flock, 1941 (Jour. Econ. Ent. 34: 121), who has discussed the distribution and ecology of *vaga*, did not indicate any restriction to alkaline areas. He found *vaga* typically an inhabitant of irrigated fields and yards, with some tendency to injure plant seedlings. Flock also reported that when field conditions are very dry this roach may enter houses in large numbers, usually temporarily.

On November 23, 1951, nymphs of *vaga* occurred at Weslaco to the extent that five or six would be seen when about a foot square of the duff was disturbed; no adults were observed on that occasion. In March 1952, the duff had dried and only after considerable search could a single specimen be found in this locality.

On April 28, 1952, two adults of *vaga* were collected near a sink in the Experiment Station office at Weslaco. Later, on May 27, *vaga* was found to be rather abundant in clumps of Rhodes grass between Weslaco and Donna, Tex. Both young and adults occurred there, and three or four could usually be found easily in a single clump. Many of the females were carrying oöthecae.

From observations made during the rearing of the nymphs to adults, there was no evidence that any food we offered the caged nymphs was eaten; they apparently existed entirely on decaying organic matter.

Blattella vaga is slightly smaller and of a more delicate appearance than *B. germanica*, and is best recognized in the field by its blackish face. This character was indicated by Doner and Thomssen, 1943 (Soap and San. Chem. 19 (9) : 94), who included *vaga* in a simple key to a few common roaches. Structurally, the male sexual organs provide the most reliable distinguishing characters for *vaga*.

REDESCRIPTION OF THE GENUS BURTINUS STAL AND DESCRIPTION OF A NEW SPECIES FROM PUERTO RICO

(Hemiptera, Coreidae)

By J. Maldonado Capriles, *Department of Biology, University of Puerto Rico, Mayaguez*

The genus *Burtinus* was described by Stål in "Till Kännedomen om Coreida." Öfvers. Svenska Vet.-Akad. Forh. 16: 459, Dec. 1859. He included only the species *notatipennis* Stål. In 1881, Distant described *Alydus femoralis* in Biologia Centrali-Americana, Rhynchota, Vol. 1, p. 158, pl. 15, fig. 9. Distant later decided that *femoralis* should also be placed in *Burtinus* (*loc. cit.*, p. 373). Barber (1914, Bul. Amer. Mus. Nat. Hist. 33:521), however, found *femoralis* to be a synonym of *notatipennis*. The genus has therefore remained monotypic. The purpose of the present paper is to add a second species and to recharacterize the genus. The author is much indebted to Dr. R. I. Sailer and to Prof. José A. Ramos for their assistance in writing this paper.

Genus **Burtinus** Stål

Burtinus Stål, 1859, Öfvers. Svenska Vet.-Akad. Forh. 16: 459.

Elongate, slender, depressed above, convex beneath; broadly rounded anteriorly and posteriorly. Slightly wider near base of wings. Pronotum and head declivous.

Head broader across eyes than long; as long as base of pronotum. Tylus slightly exceeding jugae. Antennal tubercle very short. First antennal segment surpassing apex of head. Second antennal segment slightly longer or longer than first; fourth segment the longest, cylindrical, stoutest. Rostrum slender, reaching mesocoxa; first segment the longest, fourth longer than third. Gula slightly wider than width of an eye. Pronotum wider than long, trapezoidal; edges carinate, smoothly wavy, with very shallow indentation at middle of hind margin. Apical angles acute, without spines, punctate.

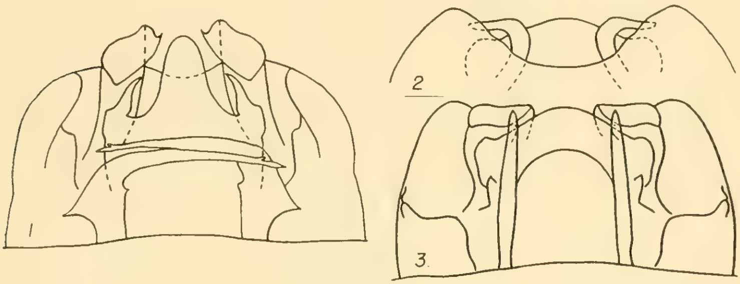

Fig. 1, *Burtinus notatipennis* Stål, dorsal aspect of male genitalia; fig. 2, *B. luteomarginatus*, new species, ventral aspect of male genitalia; fig. 3, *B. luteomarginatus*, dorsal aspect of male genitalia.

Scutellum longer than wide, punctate. Hemelytra with corium opaque, punctate, with apex extending to nearly three-fourths of membrane. Membrane slightly exceeding tip of abdomen.

Osteolar orifice slitlike, between meso and metacoxa, prolonged as a very short, curved canal. Legs slender, unarmed, except hind femur which has 3 or 4 moderately long, stout spines; these longer than widest portion of hind tibia; 1 or 2 short spines between last two. First segment of hind tarsus one and a fourth times the length of second and third together.

External genitalia of male as typified by *Burtinus notatipennis* Stål, fig. 1. Claspers projecting upward, with their apices broad, flattened, and curved forward. Median process of hypopygium much widened apically and with latero-apical angles opposed to apices of claspers. Dorsoposterior margin of hypopygium with two long, slender processes.

Genotype: *Burtinus notatipennis* Stål, 1859 (only included species).

Burtinus is very close to *Alydus* Fabricius and *Megalotomus* Fieber, sharing several characteristics with both genera. *Alydus* differs in having the pronotum longer than wide, the basal joint of hind tarsi twice the length of the other two united, and in the type of the genitalia. *Megalotomus* differs in having the pronotum longer than wide, the basal joint of hind tarsus more than twice the length of the other two united, the hind femora armed beneath with a row of stout spines, and in the type of the genitalia.

Burtinus luteomarginatus, new species

Figs. 2, 3, 4

Male (fig. 4).—Head dorsally, brown with an elevated lighter median longitudinal vitta. Covered with long yellowish hairs; short appressed golden hairs on vitta. Eyes dark brown, large. Ocelli brilliant, elevated. Antennal segment I stramineus; II and III with basal two-thirds to three-fourths, and IV with basal third stramineus; apical portions blackish brown; covered with moderately long hairs. Rostrum blackish. Pronotum dark brown, lateral margins yellowish; posterior margin with a small yellowish spot at middle; covered with scattered golden yellow hairs. Scutellum dark brown, with a small yellowish spot at tip. Hemelytra brown, costal area yellowish; except membrane, covered with scattered golden yellow hairs. Membrane fuscous. Body laterally, from base of beak to end of abdomen with a broad yellowish brown stripe, spotted with red. An elongated yellowish area ventral on first visible abdominal segment; rest of abdomen, meso and metasternal areas blackish. Margin of connexivium yellowish. All three pairs of legs similarly colored; coxa, trochanter and femur black; tibia yellowish with blackish brown apex; second and third segments and claws blackish brown.

Head across eyes wider than long; slightly shorter than pronotum. Lengths of antennal segments as follows: I, 20; II, 29; III, 29; IV, 45. First segment surpasses apex of head. Rostrum extending to middle coxa; lengths of segments as follows: I, 20; II, 17; III, 8; IV, 12. Pronotum wider than long; very narrow collar. Anterior calli not prominent, narrow, slightly elevated at middle, rough, not punctate. Posterior lobe deeply and closely punctate. Depressed lateral and hind margins. Posterior margin with a shallow broad indentation at middle. Scutellum longer than wide, punctate. Hemelytra with costal margin slightly concavely sinuate about one-half from base. Hind tibia terete, straight, without spur at apex. Basal joint of hind tarsi one and a fourth times the length of the second and third united. Osteolar opening distinct, slitlike, between meso and metacoxae. Hind femur with three medium sized spines at apex, two very short stout spinules before and after last spine. Overall length 11.0 mm.

Male genitalia.—Claspers with apical portions outwardly projected, apical margin rounded in outline, fig. 2. Median process of hypopygium with latero-apical angles unarmed, angulate; central lobe obtusely rounded. Dorsal processes reaching to claspers, straight, slender and tapering, fig. 3.

Female.—Slightly darker than male, coloration otherwise similar.

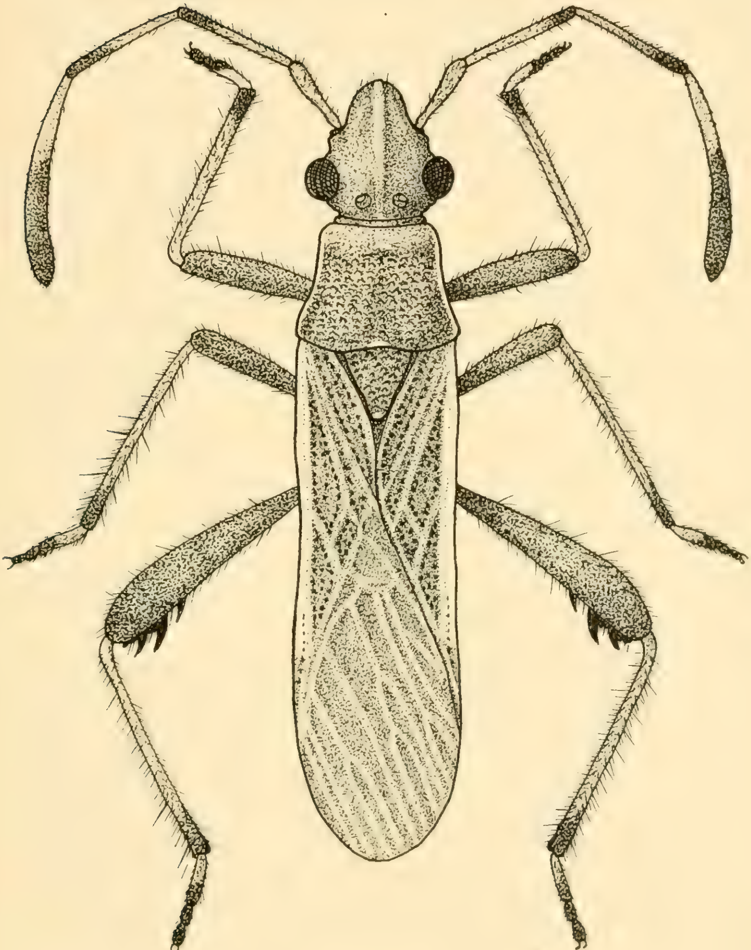

Fig. 4, *Burtinus luteomarginatus*, new species, male holotype.

This species was described from one male and one female collected in light traps and one male by sweeping vegetation near the beach at Ponce, Puerto Rico.

Types—Holotype ♂, Ponce, Puerto Rico, August 15, 1946. U. S. N. M. no. 61564. Allotype, ♀, same locality, July 10, 1947 (U. S. National Museum). Paratype, ♂, same locality, August 1947 (in the author's collection).

THE GENUS METACOLUS IN NORTH AMERICA

(HYMENOPTERA, CHALCIDOIDEA)

In the Hymenoptera of America North of Mexico—Synoptic Catalog (Muesebeck *et al.*, U. S. Dept. Agr. Monog. 2, p. 549), the pteromalid genus *Metacolus* Foerster is placed in the tribe Pteromalini. Actually it is almost impossible to characterize that tribe in such a way that *Metacolus* will be retained in it, while excluding the genus *Rhaphitelus* Walker. The latter is the only North American genus now placed in the tribe Rhaphitelini.

Restudy of the European genotype species, as well as the North American forms referred to *Rhaphitelus* and *Metacolus*, shows clearly that the two belong in the same tribe. Both have incomplete parapsidal furrows, sessile abdomen, each hind tibia with a single spur, and the marginal vein so greatly thickened that it is only two and one-half to three times as long as wide. Consequently *Metacolus* should be removed from the Pteromalini and be placed in the Rhaphitelini.

The above-cited catalog lists two North American species in *Metacolus*, *bifasciatus* and *fasciatus*, both described by Girault on page 14 of his privately-published paper, Descriptiones Stellarum Novarum, 1917. The second of the two species was described from specimens from New Mexico, the first from ones thought to have come from West Virginia. Actually the latter specimens came from the Black Hills, South Dakota, as is shown by the Hopkins U. S. records. Furthermore, study of the types of these two convinces me they are identical. Accordingly *M. bifasciatus* Grlt. should be placed as a synonym of *fasciatus* Grlt., the latter having line priority (new synonymy).—B. D. BURKS, *U. S. Bureau of Entomology and Plant Quarantine.*

A NEW BLACKFLY SPECIES FROM CALIFORNIA

(DIPTERA, SIMULIIDAE)

By R. W. COLEMAN, *San Francisco, Calif.*

The author made a detailed, state-wide survey of blackflies in California throughout 1947-1951. During this time he collected Simuliidae from nearly every county in the state. A new species is here described from pupae and from reared adult specimens collected from this survey.

Cnephia stewarti, new species

Adult female.—Frons dark brown with pruinosity; antennae brown; viewing mesoscutum anteriad from prescutellar area mesoscutum dark brown with pale golden hair; mesoscutum with three indistinct silvery lines in the form of one median line and two other lines on either side of the median line; pleura dark brown; wings with anterior veins dark brown; basal section of radius with macrotrichia above; radial sector forked terminally, figs. 1, 2, stem vein dark pilose; halteres and stalk of halteres pale; legs brown with golden yellow hairs; tarsal claws with basal tooth large, tooth over one-half length of tarsal claw, fig. 3, abdomen brownish black with slight vestiture of golden hairs. Genitalia: Genital rod expanded into widely divergent arms; apical parts of arms developed into plates.

Adult male.—Face and frons brownish-black; antennae brown; mesoscutum dark brown to brownish black with golden pilosity and with same mesonotal pattern noted in female; pleura dark brown to brownish black; wings with anterior veins dark brown; basal section of radius with macrotrichia above; radial sector forked terminally; stem vein dark pilose; halteres and stalk of halteres brown; coxae dark brown; legs brown with slight pilosity; tarsal claws bifid; abdomen brown to brownish-black. Genitalia: Diststyle shorter than basistyle; apex of diststyle with two spines; basistyle longer than wide; adminiculum slightly longer than wide; basal prongs of adminiculum strongly chitinized.

Pupa.—Cocoon of indefinite shape; respiratory filaments six in number, fig. 4, anterior pair of filaments fuse to a common base with one posterior pair; tergite four without series of small spines near its anterior margin; sternite five with four spines; tail hooks present.

Type locality.—Near Spring Garden, Plumas County, California. The type specimen has been deposited in the collections of the U. S. National Museum.

Distribution.—Near Spring Garden, Plumas County, California, May 19, 1948 (W. W. Wirth and R. W. Coleman); approximately 6 mi. n.w. of Bassett's Station, Sierra County, California, May 28, 1950 (M. B. and R. W. Coleman).

This species has been collected only in May in California, and from the surfaces of small rocks. It was collected from a temporary stream near Spring Garden and from a snow run-

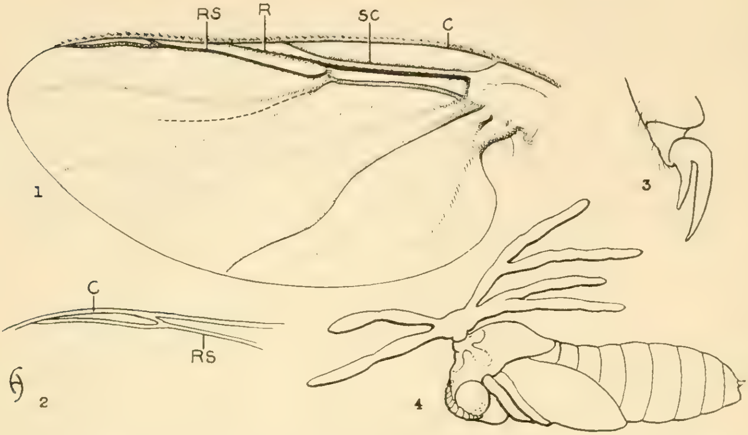

Fig. 1, wing; fig. 2, magnification of radial sector; fig. 3, tarsal claw; fig. 4, pupa. Drawings by F. Abernathy.

off near Bassett's Station. It has been taken in areas as high as about 6400 feet above sea level.

Cnephia stewarti differs from *Cnephia osborni* (Stains and Knowlton), a closely related species, in the adult stage in that, in the female of *C. stewarti*, the mesoscutum bears three silvery white lines and the basal tooth of the tarsal claw is over one-half the length of the tarsal claw itself, while, in the female of *C. osborni*, no silver markings are present on the mesoscutum and the basal tooth of the tarsal claw is less than one-half the length of the tarsal claw.

ENTOMOLOGICAL SOCIETY OF WASHINGTON
620TH REGULAR MEETING, OCTOBER 2, 1952

The 620th regular meeting of the Entomological Society of Washington was called to order at 8 P. M. Thursday, October 2, 1952, in Room 43 of the U. S. National Museum, by President W. D. Reed. Thirty-four members and nineteen visitors attended.

The picnic committee was complimented by President Reed on the success of the June picnic, enjoyed by all.

New members elected to the Society were:

Dr. David Russell Cook, U. S. National Museum, Washington 25, D. C.

M. E. Yount, U. S. Bureau of Entomology and Plant Quarantine, Washington 25, D. C.

Dr. Boynton H. Booth, 910 Hume Mansur Bldg., Indianapolis, Indiana

Major K. C. Emerson, 42nd A.I.B., A.P.O. 42, c/o Postmaster, New York, N. Y.

Professor Robert B. Kleinhans, 3535 Evanston Ave., Cincinnati 7, Ohio

Warren T. Johnson, Dept. of Entomology, Univ. of Maryland, College Park, Md.

Robert M. Lee, V.F.B.I., College Park, Maryland

Lt. John E. Scanlon, 8079 Army Unit, A.P.O. 613, Unit 3, c/o Postmaster, San Francisco, California

C. V. G. Morgan, Division of Entomology, Department of Agriculture, R. R. 1, Summerland, B. C., Canada

Joe C. Elkins, 2710 Grayson Drive, Dallas, Texas

Elbert B. Dixon, U. S. Bureau of Entomology and Plant Quarantine, P. O. Box 232, Christiansted, St. Croix Is., American Virgin Islands

B. V. Peterson, Division of Biology, The University of Utah, Salt Lake City 1, Utah

The Society voted to adopt a resolution to permit the program committee to spend up to $45 per year for transportation of speakers and other incidental expenses in connection with programs.

Arlo Vance reported that the Society had been invited to be represented at the First Inter-American Congress of Public Health at Havana, Cuba, from September 26 to October 1, 1952, and that Dr. Salvador Luis de la Torrey y Callejas had been appointed by President Reed to represent the Society. Mr. Vance read the letter from Dr. de la Torrey reporting that he had extended the greetings of the Society to the Congress.

Mr. Vance also gave the following obituary of Traber Norman Dobbins, 1896-1952: The sudden death from a heart attack of Mr. Dobbins at his home in Moorestown, N. J., on April 14, 1952, came as a shock to his friends and associates, ending almost 20 years of continuous service in the Bureau of Entomology and Plant Quarantine. He was born at Las Animas, Colorado, November 25, 1896. He received a medical certificate from the University of Mississippi in 1924, a B. S. degree from Mississippi State College in 1927, and a M. S. degree from Texas Agricultural and Mechanical College in 1932. In 1932 he was appointed field aid at the Japanese Beetle Laboratory, Mooretown, N. J., and in 1940 received his appointment as entomologist. He was transferred in 1946 to the Division of Cereal and Forage Insect Investigations at Beltsville, Md., where he assisted in investigations on the control of alfalfa, red clover, and peanut insects.

An exhibit of abnormal specimens of *Papilio turnus* L. was shown by Elizabeth Haviland, who noted that this species was the subject of the first insect drawing made in America.

T. L. Bissell gave a note on outbreaks of walking-sticks, *Diapheromera femorata* (Say), which he and E. N. Cory, A. B. Gurney, and O. L. Cartwright had observed at Polish Mountain and Fairview Mountain in Maryland. Examples of the insects were circulated, and their damage shown in slides of defoliated trees and specimens of oak branches from which the leaves had been stripped. Chestnut oak seemed to be a favorite food, although white oak, red oak, hackberry, hawthorn, hazelnut, shagbark hickory, huckleberry, black locust, shadbush and witchhazel were attacked. Grapevines and coniferous trees were not touched.

Kelvin Dorward gave the first scheduled speech of the evening, ''Development of the cooperative economic insect detection and reporting program.'' This program relies on information about economic insect conditions obtained from voluntary cooperators in the 48 states and three territories. Clearing houses in each state or territory are responsible for receiving, reviewing, and forwarding to the Bureau of Entomology and Plant Quarantine items on insect activity. These items are published weekly in the Cooperative Economic Insect Report. Permanent files are maintained on domestic and foreign economic insects. In case of necessity the program provides a skeleton structure, readily expandable, to combat any attempts at biological warfare. (Speaker's abstract)

E. F. Knipling then gave the second speech of the evening, on ''The possibilities of controlling screw-worms by releasing flies sterilized with gamma rays.'' It has been shown that male screw-worm flies can be made sterile by exposing the pupal stage to 5,000 roentgens of X-rays or gamma rays. Normal females mated with sterile males deposit infertile eggs. Experiments are now underway in Florida in which large numbers of sterile flies are being released each week in a 1,200 square mile area. Animals having wounds are exposed in various locations in the area. Records are kept on the percentage of fertile and infertile egg masses deposited by screw-worms on these animals. It may be possible to achieve control or eradication of screw-worms by releasing sufficient numbers of sterile males over a period of a year or two, provided the natural population is not too large and the released sterile males compete with the normal wild males. Many ecological problems are involved in this investigation, and the feasibility of the method will not be known until further studies are conducted. (Speaker's abstract)

Visitors introduced included Robert R. McIntire and Walter C. Atcheson, students at the University of Maryland, Warren T. Johnson, instructor, and Dr. Castillo Graham, a staff member; also N. A. Janjua of Pakistan and Col. and Mrs. Ralph W. Bunn. Adjournment 9:05 P.M.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
SPECIAL MEETING, OCTOBER 16, 1952

The Washington Academy of Sciences and the Entomological Society of Washington held a joint meeting in the New Cosmos Club on Thursday, October 16, 1952 at 8:15 P. M. President Walter Ramberg of the Academy introduced the speaker, Professor Carroll M. Williams of Harvard University, who spoke on his research on ''Morphogenesis and the metamorphosis of insects.'' Colored slides illustrated the ways in which the relationships of various organs affecting morphogenesis in insects and the effects on them of external factors were learned. After Professor Williams had answered a number of interested questioners, the meeting was adjourned by Acting President W. H. Anderson of the Society and informal discussions continued over refreshments.

KELLIE O'NEILL, *Recording Secretary*

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NOTICE

Memoir 4 of the Society has been printed on two kinds of paper—a relatively small number of copies on thin paper, and a much larger number of copies on eggshell book paper. All copies which were mailed prior to Jan. 9, 1953 were those printed on thin paper. Any purchasers who received these thin-paper copies, but who prefer to have copies produced on book paper, may return the volumes for exchange.

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PROCEEDINGS

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PROCEEDINGS
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PROCEEDINGS OF THE

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THE ANT LARVAE OF THE MYRMICINE TRIBE PHEIDOLINI

(HYMENOPTERA, FORMICIDAE)[1]

BY GEORGE C. WHEELER AND JEANETTE WHEELER,
Department of Biology, University of North Dakota, Grand Forks

The tribe Pheidolini comprises 18 genera: *Stenamma, Sifolinia, Aphaenogaster, Novomessor, Veromessor, Messor, Goniomma, Oxyopomyrmex, Machomyrma, Pheidole, Ceratopheidole, Ischnomyrmex, Epipheidole, Sympheidole, Parapheidole, Conothoracoides, Gallardomyrma* and *Ancyridris.* It includes harvesting ants (*Messor, Veromessor, Goniomma, Oxyopomyrmex, Pheidole*); species with a strongly polymorphic or dimorphic worker caste (the soldiers with enormous heads) (*Messor, Machomyra, Ischomyrmex, Ceratopheidole, Pheidole*); and permanent social parasites (*Sympheidole, Epipheidole, Sifolinia*). There are about 500 species in the tribe, most of which (391 according to the *Genera Insectorum*) are in *Pheidole,* which is, in fact, the second largest genus of ants. "One species, *Pheidole megacephala,* has been carried to all parts of the tropics and has become a great pest in and about dwellings and plantations as it assiduously cultivates coccids on many economic plants and ruthlessly destroys and replaces the native ant-faunas" (Wheeler, Bull. Amer. Mus. Nat. Hist. 45: 128. 1922).

In this article we have described the larvae of 22 species representing six genera. References from the literature are cited for 22 additional species, making a total of 44 species considered.

Our pheidoline larvae are a heterogeneous group which we have found difficult to characterize as a tribe. They differ little (as a group) from the Myrmicini but are perhaps somewhat more specialized as to body shape, mandibles, spinules on the mouth parts and body hairs. As with the adults, *Stenamma* is the most primitive genus and *Ischnomyrmex* the most specialized.

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[1] The research on which this article is based was aided by a grant-in-aid from the Sigma Xi Research Fund.

Tribe **PHEIDOLINI** Emery

Moderately stout or plump and chunky; neck short or wanting. Body hairs sparse to moderately numerous; mostly short; of 1-3 types; shapes diverse. Spiracles all small, the mesothoracic slightly larger. Antennae small, each with two or three sensilla, each of which bears a spinule. Head hairs few or moderately numerous; short to rather long; shapes diverse. Labrum typically bilobed; short (breadth 2-2½× length); ventral border bearing 4-10 sensilla and usually spinulose; posterior surface spinulose, the spinules minute and mostly in rows. Mandibles small to moderate-sized [ratio of head width to mandible length—2.2-3.3 (average 2.9)]; ratio of length to width (at base)—1.4-2.4 (average 2); moderately sclerotized; apical tooth slender, curved medially; two or three stout medial teeth (except in *Messor*); with some portion of the surface spinulose (except in *Novomessor*). Maxillary palp usually short and bearing 5 sensilla; galea longer and slender. Anterior surface of labium usually spinulose; palp a low elevation bearing five sensilla; opening of sericteries an inconspicuous transverse slit. Hypopharynx with minute spinules arranged in rows and usually also with sublongitudinal ridges.

Genus **Stenamma** Westwood

Moderately stout; constricted slightly at the first abdominal somite; thorax turgid; abdomen swollen; no neck. Submature larva shaped somewhat like a crook-neck squash; thorax and first abdominal somite forming a short stout neck, which is curved ventrally; remainder of abdomen subellipsoidal. Body hairs moderately numerous and rather short; bifid; the tip of each branch may be bifid or denticulate. Head moderately large. Head hairs moderately numerous, rather long, 2-4-branched, usually bifid, rarely denticulate. Posterior surface of labrum spinulose, the spinules minute and mostly in short arcuate rows which form a reticulate pattern, a few isolated near the lateral borders. Mandibles with the apex forming a moderately long slender tooth which is curved medially; two rather stout medial teeth; medial surface of basal half with several short coarse spinules. Maxillae with the apex spinulose; palp a short stout peg with two large contiguous apical sensilla, two small discoidal apical sensilla (each bearing a short spinule) and one lateral sensillum (bearing a very long spinule). Dorsal portion of hypopharynx with sublongitudinal ridges; ventral spinulose, the spinules minute and arranged in rows which form a reticulate pattern.

Stenamma diecki Emery

(Pl. I, figs. 1-13)

Body moderately stout; slightly constricted at the first abdominal somite; thorax turgid; abdomen swollen; diameter greatest at the fourth abdominal somite. No neck. Anus posteroventral. Leg, wing and gonopod vestiges present. Eight differentiated somites. Spiracles small, the first slightly larger. Integument of ventral surface of thorax and first abdominal somite with a few minute spinules in short to moderately long subtransverse rows. Body hairs moderately numerous and rather short (0.036-0.11 mm). All body hairs bifid; branches very short to more than half the total length of the hair; each branch may also be bifid at the tip and may be furnished with denticles. Head moderately large. Cranium subhexagonal in anterior view; slightly broader than long. Antennae small; with three sensilla each. Head hairs moderately numerous, rather long (0.054-0.09 mm), 2-4-branched, usually bifid, rarely denticulate. Labrum short (breadth nearly 2½× length), bilobed, narrowed dorsally; anterior surface of each lobe with five sensilla (each bearing a spinule); ventral border of each lobe with two contiguous sensilla and several spinules; posterior surface of each lobe with about five isolated and a cluster of 2-3 contiguous sensilla; posterior surface spinulose, the spinules minute and mostly in short arcuate rows which form a reticulate pattern, a few isolated near the lateral borders. Mandibles moderately sclerotized; subtriangular in anterior veiw; apex forming a moderately long slender tooth which is curved medially; two rather stout medial teeth; medial surface of basal half with several short coarse spinules. Maxillae with the apex paraboloidal and spinulose, the spinules minute and in short arcuate rows; palp a short stout peg with two large contiguous convex apical sensilla, two small discoidal apical sensilla (each bearing a short spinule) and one lateral sensillum (bearing a very long spinule); galea digitiform, with two apical sensilla. Labium with the anterior surface spinulose, the spinules minute and in short transverse rows; palp a low elevation with two large contiguous convex sensilla, two small discoidal sensilla (bearing each a short spinule) and one small discoidal sensillum (bearing a long spinule); opening of sericteries a short transverse slit on the anterior surface. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinulose minute and arranged in rows which form a reticulate pattern.

Submature.—Shaped somewhat like a crookneck squash, the thorax and first abdominal somite forming a short stout neck which is curved ventrally; remainder of abdomen subellipsoidal. Anus ventral. Otherwise as in the mature larva.

Young.—Length 1.6 mm. Thorax and first abdominal somite forming a short stout neck which is strongly arched ventrally; rest of abdomen somewhat swollen. Anus ventral, with a posterior lip. Body hairs similar in shape to those of adult; moderately numerous on thorax and abdominal somite I, very few on II and III and none elsewhere. Head hairs few, short and simple. Otherwise as in the mature larva.

Material studied: Numerous larvae from Michigan and North Dakota.

Stenamma sp.

Apparently similar to *diecki* except that the body hairs are shorter (0.027-0.081 mm long), less numerous and with shorter branches; head hairs also shorter (0.036-0.063 mm long), less numerous and with shorter branches; mandibles with the teeth stouter and blunter. (Material studied: numerous damaged larvae labeled "Cloudcroft, New Mexico, 9000 ft., July 7, 1917".)

Stenamma westwoodi Westwood

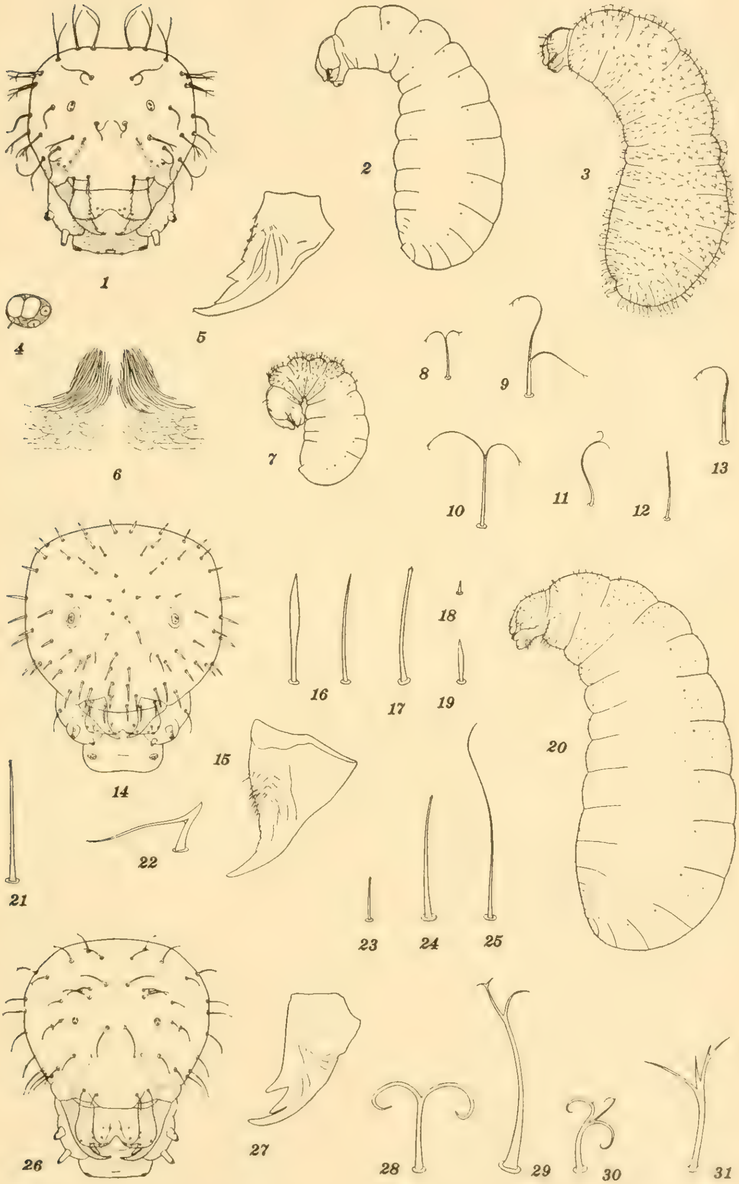
Donisthorpe, 1922, p. 2: The workers in an artificial nest "have a curious habit, when . . . the colony [is] disturbed by being exposed to light, of rushing at a larva, seizing it, and apparently giving it a good shaking up! I have found when touched that a larva will exude a drop of thick white fluid; it is probable that this is a means of defense, and possible that the worker shakes up a larva to induce it to discharge this fluid. These ants devour flies and other insects readily, with bits of which they feed the larvae, as also with crumbs of cake and biscuits. . . .

"*Larvae.*—Grayish white, head pale yellow, mandibles reddish; covered *all over* with short anchor-tipped golden hairs. Plainly segmented to within a third of the posterior end; the head and 3 thoracic somites bent over posteriorly towards the ventral surface. Head flat, rounded, with short very pointed mandibles; abdomen pyriform. [This paragraph repeated 1927, p. 153.]

"The larva is semi-transparent under the microscope, part of the alimentary canal, breathing apparatus, and nervous system being visible through the skin from the dorsal and ventral aspects; but not nearly so plainly through the sides. At the ventral posterior end of the body, a white opaque mass can be seen through the skin, which is evidently of a liquid consistency, as when the larva is touched with a paint brush, a thick white drop of fluid is exuded from the anus, which either evaporates very quickly, or is partly received back into the body, leaving a thick white coating of the consistency of 'Chinese White' on the anal surface of the larva."

Plate I. Larvae of Pheidolini

Stenamma diecki Emery, figs. 1-13—1, head in anterior view, ×76; 2, submature larva in side view (hairs omitted), ×20; 3, mature larva in side view, ×20; 4, right labial palp in anterior view, ×433; 5, left mandible in anterior view, ×185; 6, hypopharynx in anterior view, ×185; 7, young larva in side view, ×20; 8-13, six body hairs, ×185. *Messor barbarus* (Linnaeus), figs. 14-20—14, head in anterior view, ×67; 15, left mandiple in anterior view, ×170; 16, two views of a lanceolate hair from the ventral surface of the prothorax, ×185; 17, a hair from the ventral surface of the prothorax, with frayed tip, ×185; 18, a hair from the dorsal surface of the abdomen, ×185; 19, a hair from the dorsal surface of the prothorax, ×185; 20, larva in side view, ×16; *Messor barbarus striaticeps* Ern. André, Figs. 21-25—21, typical head hair, ×185; 22, atypical head hair, ×185; 23-25, three body hairs, ×185. *Novomessor albisetosus* (Mayr), Figs. 26-31—26, head in anterior view, ×57; 27, left mandible in anterior view, ×118; 28-31, four body hairs, ×185.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Genus **Aphaenogaster** Mayr

Bernard, 1948: The abdomen has 6-8 visible sutures (p. 179). "*Aphaenogaster*, et tous les Myrmicinés primitifs, paraissent avoir des larves sans poils crochus ni poils en pinceau" (p. 180).

Gantes, 1949: "Très agiles" (pp. 84 and 88). Growth p. 85. "Chez les larves très agiles comme *Aphaenogaster* les mandibules sont grandes, bien formées et servent à mastiquer. J'ai vu ces larves mordre seules de la viande fraîche que les ouvrières avaient posée près d'elles. Ces larves sont primitives" (p. 88).

Wheeler, 1928*a*, p. 202: "The larvae may be given crude pieces of insects" (=1926, p. 243).

Subgenus **Attomyrma** Emery

Moderately stout; constricted slightly at the first abdominal somite; thorax turgid; abdomen swollen; no neck. Submature larva with its diameter greatest at abdominal somites IV and V, diminishing anteriorly; anterior end bent ventrally; no neck; posterior and broadly rounded. Body hairs moderately numerous and rather short. Of two types: (1) with long stout base and short dichotomizing tip, on the thorax and abdominal somites I, IX, and X; (2) with short base and long flexible dichotomizing branches, on abdominal somites I-VIII; intergrades rare. Head hairs moderately numerous and rather long. Of two types (1) simple and (2) with bifid tip. Posterior surface of labrum densely spinulose, the spinules minute and in short arcuate rows which tend to form a reticulate pattern. Apex of mandible forming a rather slender tooth which is slightly curved medially; two stout round-pointed medial teeth; medial surface of basal half with several short to very long

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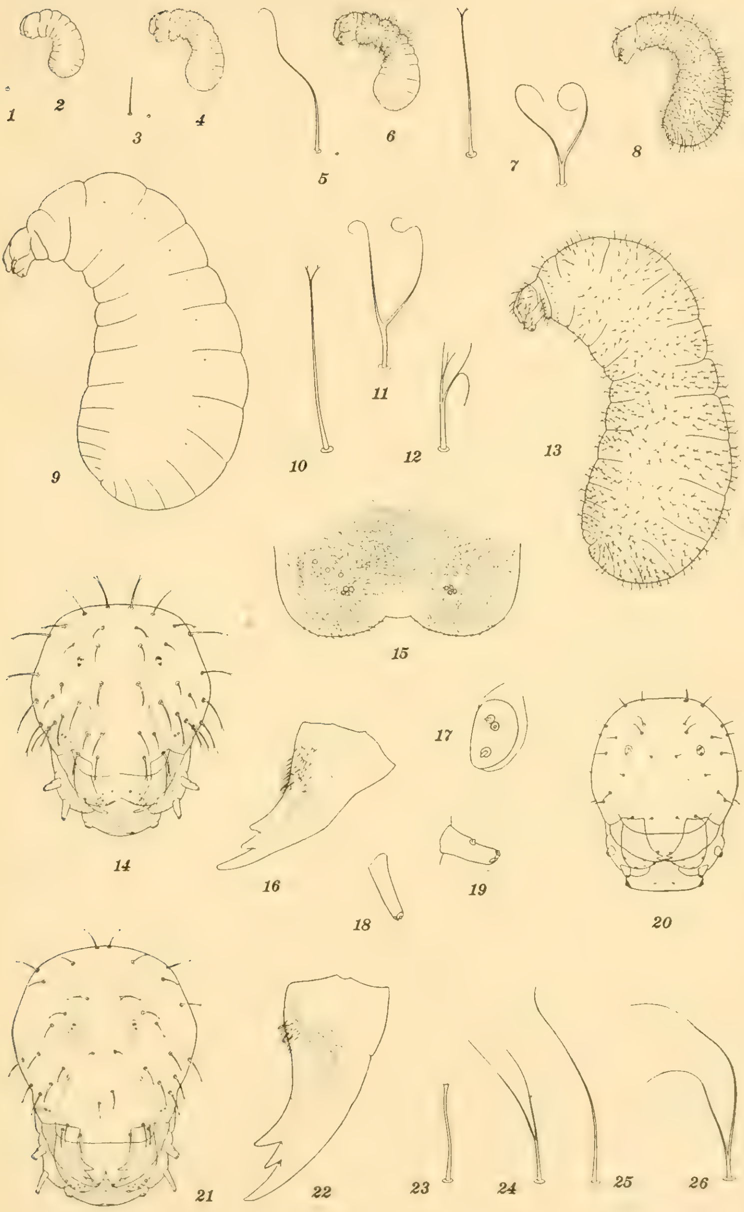
PLATE II. LARVAE OF PHEIDOLINI

Aphaenogaster (*Attomyrma*) *rudis* Emery, figs. 1-20—1, a body hair of first instar larva, ×190; 2, first instar larva in side view, ×16; 3, two body hairs from second instar larva, ×190; 4, second instar larva in side view, ×16; 5, two body hairs from third instar larva, ×190; 6, third instar larva in side view, ×16; 7, two body hairs from fourth instar larva, ×190; 8, fourth instar larva in side view, ×16; 9, submature (hairs omitted), ×16, 10-12, three body hairs from mature larva, ×190; 13, mature larva in side view, ×16; 14, head in anterior view, ×76; 15, labrum in posterior view, ×173; 16, left mandible in anterior view, ×173; 17, right antenna in anterior view, ×347; 18, left galea in anterior view, ×173; 19, left maxillary palp in anterior view, ×173; 20, head of second instar larva in anterior view, ×76. *Aphaenogaster* (*Deromyrma*) *araneoides inermis* Forel, figs. 21-26—21, head in anterior view, ×67; 22, left mandible in anterior view, ×188; 23, a hair from the ventral surface of the thorax, ×190; 24, a hair from the dorsal surface of the thorax, ×190; 25, a hair from the ventral surface of the abdomen, ×190; 26, a hair from the dorsal surface of the abdomen, ×190.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spinules. Maxillae with the apex spinulose; palp digitiform. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and arranged in rows which form a reticulate pattern.

Aphaenogaster (Attomyrma) rudis Emery

(Pl. II, figs. 1-20)

Mature.—Length about 4.2 mm. Body moderately stout; slightly constricted at the first abdominal somite; thorax turgid; abdomen swollen; diameter greatest at the fourth and fifth abdominal somites. No neck. Anus posteroventral. Leg, wing and gonopod vestiges present. About seven differentiated somites. Spiracles small, the mesothoracic slightly larger. Integument of the ventral surface of the thorax and first abdominal somite and the dorsal surface of the posterior somites spinulose, the spinules minute and in short to moderately long subtransverse rows. Body hairs moderately numerous and rather short. Of two types: (1) with long stout base and short dichotomizing tip, on the thorax and abdominal somites I, IX and X, 0.07-0.12 mm long; (2) with short base and long flexible dichotomizing branches, on abdominal somites I-VIII, 0.07-0.14 mm long; intergrades are rare. Cranium subhexagonal in anterior view; as long as broad. Antennae small, with three (rarely two) sensilla each. Head hairs moderately numerous, rather long (0.036-0.072 mm), simple or with the tip bifid. Labrum short (breadth 2X length), bilobed; anterior surface of each lobe with 4-6 sensilla and a few minute spinules; ventral border of each lobe with an isolated and two contiguous sensilla and a few short rows of minute spinules; posterior surface of each half with three isolated and a cluster of four sensilla; posterior surface densely spinulose, the spinules minute and in short arcuate rows which tend to form a reticulate pattern. Mandibles moderately sclerotized; subtriangular in anterior view; apex forming a long rather slender tooth which is slightly curved medially; two stout, round-pointed medial teeth; medial surface of basal half with several short to very long spinules. Maxillae with the apex paraboloidal and spinulose, the spinules minute and in short arcuate rows; palp digitform with four apical and one lateral sensilla; galea digitform with two apical sensilla. Labium with the anterior surface spinulose, the spinules minute and in short arcuate rows; palp a low elevation bearing five sensilla; opening of sericteries a short transverse slit hidden in a shallow furrow on the anterior surface of the labium. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and arranged in rows which form a reticulate pattern.

Submature.—Length about 4.3 mm. Diameter greatest at abdominal somites IV and V; diminishing anteriorly; anterior end bent ventrally; no distinct neck; posterior end broadly rounded. Otherwise very similar to the mature larva.

First Instar Larva.—Length about 0.95 mm. Stout, C-shaped, terete, diameter nearly uniform but greatest at abdominal somites IV and V.

Practically naked, hairs sparse on the head, thorax and first abdominal somite, very few elsewhere; exceedingly minute (about 0.001 mm long).

Second Instar Larva.—Length about 1.1 mm. Similar to first instar larva but with the addition of short (0.006-0.056 mm) simple hairs on head, thorax and abdominal somite I.

Third Instar Larva.—Length about 1.3 mm. Similar to the second instar larva, except that the hairs of the longer type are flexible, more conspicuous and relatively longer (0.036-0.11 mm) and occur as far back as abdominal somite II.

Fourth Instar Larva.—Length about 1.8 mm. Body shape similar to that of third instar larva but more slender. Body hairs similar to those of adult but shorter (about 0.1 mm long) and seemingly more abundant.

Material studied; numerous larvae from Massachusetts, Michigan, New Hampshire and New York.

Park, 1933*b*, p. 258: The ptiliid beetle *Limulodes paradoxus* Matthews feeds on surface oils and sundry accumulations of the integument of the ant brood. The larvae seem unhurt by the scraping.

Talbot, 1951, p. 303: The average number of larvae per nest was 160.56. Larvae overwintered in the nests.

From the notebook of G. C. Wheeler, 1920: April 11—The convex under surface of a fly's abdomen has been applied to the head of one of the queen larvae and it remains there when the larva is moved about the nest. A small larva has a smaller piece of fly; another queen larva has a mutilated *Lasius* larvae on its head. May 10—The workers seem very ''affectionate'' toward their larvae. Apparently they ''like'' to take larvae in their mandibles to the glass cover of the artificial nest and remain there for hours. Today I observed that a queen larva was held in this manner by two workers, one at either end. A third worker was usually in attendance standing beside the larva and facing it. May 28—This evening I isolated two queen larvae in a petri dish. Laying them on their backs I placed on the belly of each the abdomen of a freshly killed termite with the cut end pressed against the mandibles of the larva. May 30—Nothing remains of the termite abdomens except the dried skins, one still lying on an ant larva, the other nearby.

Aphaenogaster (Attomyrma) rudis picea Emery

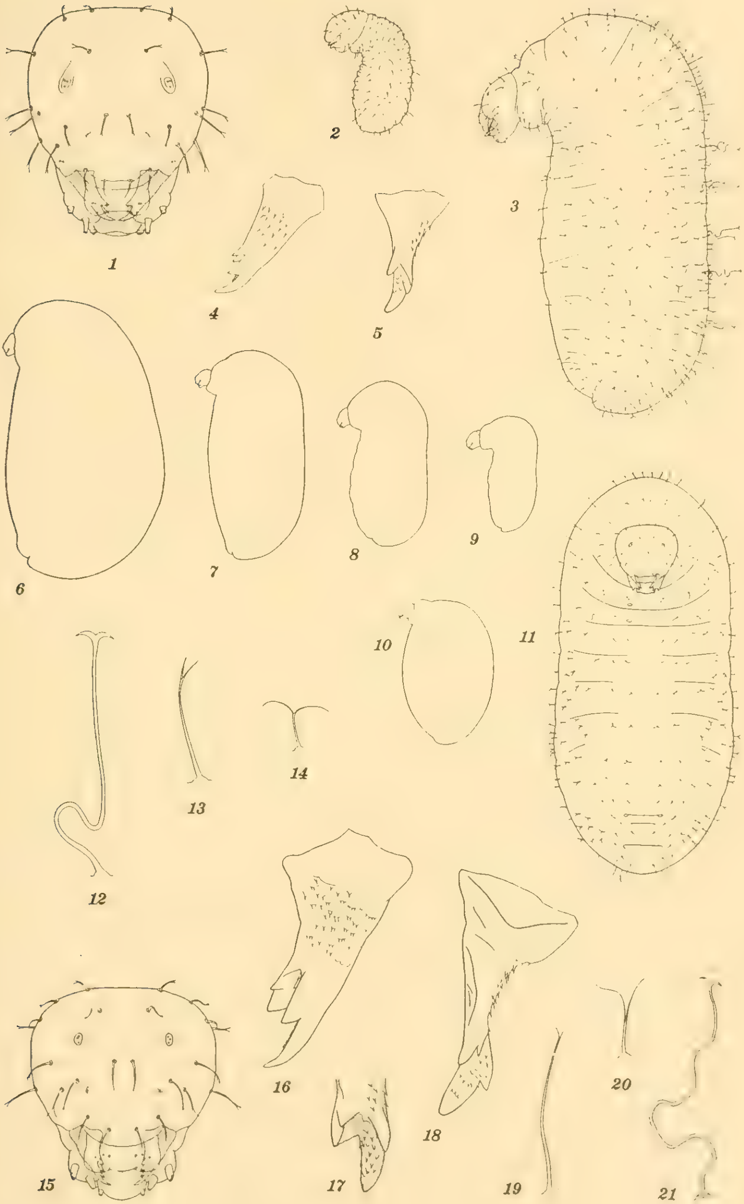
Fielde, 1901, p. 431-433: ''The feeding of the larva, which is bent nearly double in the egg, with regurgitated food begins as soon as it straightens itself and protrudes its mouth. When the larvae begin to appear in the egg-packet, the workers lift the packet and hold it free and still, while one of their number holds a translucent white globule of regurgitated food to the larval mouth projecting from the surface of the egg-packet. I have repeatedly seen the workers thus feeding the very young larvae, a single globule of regurgitated food serving for a meal of which four or five larvae successively partook.

''When the larva first emerges, its length is nearly double that of the egg. When well fed its growth is rapid and in a day or two its length is three or four times that of the egg. When about two millimeters long it is usually removed from the egg-packet and laid on the floor, or associated with others of its size in a separate bundle, the individuals being fastened together by the hooks on their surfaces, as the eggs were by their sticky shells. The habit . . . of assorting the young in accordance with the size and form, doubtless economizes labor and also tends to the preservation of the young. The flexible neck of the larva enables it to reach to a distance equal to a quarter of its body-length, and to fix its mouth upon anything edible that is within its reach. I have observed a gradual diminution of the eggs in every cell where the smallness of the working force prevented that segregation of the larvae and that assortment according to size which prevails in large communities; and I have also, in such circumstances, seen full-grown larvae, and even pupae, fall victims to the voracity of the unfed younger larvae.

''The older larvae are often fed when lying upon their backs, the ventral side serving as a place of deposit for food reached by the curving of the neck. . . . But this feeding posture is . . . scarcely more common than are others. Sometimes one larva is used as a table, not only for its own feeding, but for the feeding of two or three other larvae that are inclined against its sides to take their portion of the same morsel. I have also seen five larvae set on end around half the abdomen of a bisected house-fly, feeding voraciously from its interior, like pigs around a trough. Sometimes the larva is laid with its ventral side against a succulent portion of the insect, and is left there to take its fill; sometimes it has a portion of meat held to its mouth and forcibly removed as soon as it has had a brief repast, and sometimes a worker stands with her head over that of the larva and allows it to take food from her crop in a manner resembling that in which a mother-pigeon feeds her young. In my nests the very young larvae have been fed solely upon regurgitated food. The older larvae have been given particles of flies, mealworms, roaches, beetles, spiders, sponge-cake, white bread moistened with sweetened water, and of dried yolk of hens' eggs. They have also fed upon fragments of ants of other species, on pupae of alien colonies, and on the pupae and larvae of *Crematogaster lineolata* and of *Lasius umbratus.*

PLATE III. LARVAE OF PHEIDOLINI

Pheidole dentata Mayr, figs. 1-14—1, head in anterior view, ×105; 2, very young larva in side view, ×31; 3, mature worker larva in side view, ×31; 4, left mandible in anterior view, ×202; 5, left mandible in medial view, ×202; 6, profile of queen larxa, ×9; 7, profile of male larva, ×9; 8, profile of soldier larva, ×9; 9, profile of worker larva, ×9; 10, profile of immature sexual larva, ×9; 11, mature worker larva in ventral view, ×31; 12-14, three body hairs from worker larva, ×185. *Ischnomyrmex longipes* (F. Smith), figs. 15-21—15, head in anterior view, ×71; 16, left mandible in anterior view, ×216; 17, tip of left mandible in anteromedial view, ×216; 18, left mandible in medial view, ×216; 19-21, three body hairs, ×95.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"Larvae deprived wholly of insect food did not during a period of one hundred days produce one pupa. But larvae grew from the egg to nearly full size without insect food, and one pupa, that later on became a minim, had no insect food during the last twenty-two days of its larval stage." (First paragraph quoted by Wheeler and Bailey, 1920, p. 250.)

Wheeler, 1900*b*, p. 66: "One afternoon Miss Fielde left a lot of queen pupae and larvae of *Crematogaster lineolata* within reach of the [*Aphaenogaster*] colony. By the following morning the [Aphaenogasters] had carried these into their nest, cut off their heads and abdomens, and had distributed the pieces freely among the large, which could be seen singly and in groups of from two to five eagerly feeding on the juices in the same manner as Ponerine larvae. Thinking that this might be a very exceptional action, due to the confinement of the colony, I opened numerous nests in the woods during the month of August, while the ants were rearing their second brood. In nearly every one of these nests I found one or more larvae feeding on substances left among them by the workers. In one nest three larvae were feeding on a small Geometrid caterpillar; in another several had their heads and necks inserted into the thoraces of some small Carabid beetles that had been decapitated by the ants; in still another nest several larvae were devouring the pulp of a blackberry, etc." (Referred to by Wheeler, 1933, p. 15 and by Wheeler and Bailey, 1920, p. 251.)

Aphaenogaster (Attomyrma) famelica (F. Smith)

Generally similar to the young of *rudis*. (Material studied: integuments of five young larvae from Japan.)

Aphaenogaster (Attomyrma) fulva Roger

Park (1933*a*, p. 150) has reported that the pselaphid beetle *Tmesiophorus costalis* Lec. feeds on the brood of this ant.

Aphaenogaster (Attomyrma) gemella (Roger)

Gantes, 1949: "Chez une larve au premier stade le corps est en forme de poire: abdomen plus large que la tête. Le corps est légèrement arqué; seuls les segments thoraciques sont bien séparés. La tête est presque aussi large qu'eux. Le corps est nu. La tête est bien différenciée, mais les diverses parties sont à peine visibles, car transparentes. Les mandibules, 0 mm. 078, sont claires: ce sont de petits triangles aigus à l'apex, et sur un côté se notent deux minuscules dents. La larve au 5e stade a un peu la forme d'une haltère dont les segments thoraciques formeraient la barre médiane, et la tête plus le premier segment d'une part et l'abdomen d'autre part, seraient les boules. Les segments sont séparés par de profondes constrictions. Tout le corps est couvert de poils clairsemés de plusieurs types: 1. *Poils bifurqués* à leur extrémité, légèrement arqués, de 0 mm. 142, répartis sur le prothrax et ventralement. 2. *Poils bifurqués* plus courts, 0 mm. 115, droits et brusquement repliés à la hauteur de la fourche. Sur le bout de l'abdomen on retrouve ces poils fourchus mais beaucoup plus longs: 0 mm. 18. 3. *Poil coudé* à 90° à la moitié de sa longueur et se terminant par deux branches plus longues que dans les autres cas. La tête, petite, très mobile, est bien différenciée, beaucoup plus haute que large. Elle est couverte de poils, 42, répartis symétriquement. On retrouve les mêmes pièces buccales. Le labre est formé par deux lobes identiques, séparés par une échancrure profonde laissant voir la pointe des mandibules. Ventralement, sur chaque lobe on trouve trois sensilles accolées ensemble près de l'échancrure et une isolée plus à l'extérieur. Dorsalement on a deux minuscules poils. Les mandibules sont grandes, 0 mm. 161, brun foncé. Ce sont des triangles qui s'insèrent dans la tête par deux parties plus épaissies et arrondies ressemblant à une articulation, dont l'apex est une dent longue et fine sur laquelle se branchent deux autres dents plus fines. Les dents sont foncées, la base plus claire. Chez une larve due 3ᵉ stade, les poils sont plus variés. Sur la tête on a deux types de poils: 1. *Poils épineux:* ce sont des poils à deux branches qui sont couverts d'épines. Ces poils mesurent 0 mm. 023. 2. *Poils* de la même longueur, se divisant en deux branches qui n'ont d'épines qu'à l'intérieur. Sur le corps, nous avons des poils épineux du même genre, mais plus longs, 0 mm. 05'' (pp. 78-79). ''Les poils varient non seulement au point de vue quantité, mais aussi de forme et de taille au cours de la croissance. Prenons le cas d'*Aphaenogaster gemella,* qui est assez primitive. La larve néonate est nue. Au IIᵉ stade les poils apparaissent sur la tête et le prothorax assez serrés et sur les deux segments suivants plus clairsemés, ils sont épineux. Au IIIᵉ stade les poils sont répartis sur tout le corps, très abondants. Sur la tête ce sont des poils bifurqués épineux de l'ordre de 0 mm. 023; sur le corps, ils sont de deux types; poils épineux comme sur la tête, mais de 0 mm. 05 et des poils à double crochet de même taille. Au stade IV les poils épineux sont plus espacés et on trouve quelques poils bifurqués semblables à ceux du stade V'' (p. 87). Growth data p. 86. Pl. III, Fig. I, mature and young larvae and hairs; Pl. IV, md 1, mandible.

Aphaenogaster (Attomyrma) subterranea (Latreille)

Gösswald (1934/35, p. 125) has recorded this ant as a mermithid host. Presumably the nematode larvae were parasitic in the ant larvae.

Aphaenogaster (Attomyrma) subterranea occidentalis Emery

Apparently similar to *rudis.* (Material studied: two damaged integuments from Montana.)

Aphaenogaster (Attomyrma) tennesseensis (Mayr)

Apparently similar to *rudis* except as follows: head hairs with multifid tips; mandibular teeth more acute; spinulose area of mandibles larger. (Material studied: five damaged integuments from Missouri.)

Peterson, 1948, Pl. H12, fig. F: ''*Aphaenogaster* (prob.) *tennesseensis*

Mayr . . .F. g.l. [full grown larva or length] 3.5 mm. Lateral view of a dirty white somewhat pear-shaped larva with a very small, well developed head; most of the setae on the head and body appear to be bifurcate.'' Larva in side view; head enlarged in anterior view; two hairs enlarged.

Aphaenogaster (Attomyrma) texana Emery

Similar to *rudis* except that the head hairs have multifid tips. (Material studied: eight larvae from Arkansas.)

Aphaenogaster (Attomyrma) treatae pluteicornis G. C. and E. W. Wheeler

Both young and mature are similar to *rudis*. (Material studied: a dozen larvae from Oklahoma.)

Aphaenogaster (Attomyrma) sp.

Similar to *rudis* except that the longer head hairs are 2-4-branched and the shorter hairs simple. (Material studied: numerous larvae collected by G. C. Wheeler, Michigan #4; identified by Dr. M. R. Smith as ''*fulva* complex''.)

Aphaenogaster (Aphaenogaster) simonellii Emery

Menozzi, 1936: ''*Larva matura dell'operaia*—Colore bianco sporco, col capo cremeo-flavo, le mandibole ferruginee, le setole umbrine. La forma del corpo è subclaviforme, cioè con una porzione anteriore stretta e subcilindrica e coi segmenti abbastanza distinti, ed una parte posteriore rigonfiata in cui i limiti dei segmenti sono meno netti. Il cranio visto dal dorso è pressapoco così lungo che largo, a contorni arrotondati e fornito di numerose setole . . . Le antenne sono rappresentate da due placchette ovali, fornite ciascuna da tre minuti sensilli. Il clipeo è fortemente trasverso e appena distinto dalla fronte retrostante da un leggero ispessimento più chitinizzato, il quale non raggiunge i lati; anteriormente esso ha il margine subtroncato ed è fornito, a ciascuno dei lati della linea medio-longitudinale, di due setolette. Il labbro superiore è pure trasverso, con gli angoli anteriori ampiamente rotondati e col margine libero profondamente incavato nel mezzo; dorsalmente esso è provvisto di varie setolette e di tre sensilli circolari posti lungo il margine anteriore, ai lati della incavatura. Le mandibole sono fortemente chitinizzate e lunghe circa due volte la loro massima larghezza, tridentate, col dente apicale del doppio più lungo di quello più prossimale. Le mascelle, con le parti che le costituiscono, poco differenziate; la porzione anteriore mostra i lati diritti coll'apice arrotondato e fornite ognuna di due vistose formazioni chitinizzate in forma di articolo subconico di cui, l'una, l'esterna, è da riferirsi al palpo mascellare e l'altra, seguendo per ora il Grandi, indico col nome di processo distale della mascella. Il labbro inferiore, veduto dorsalmente, ha il margine anteriore e i lati diritti, coi palpi, posti in prossimità degli angoli anteriori, cortissimi, cupoliformi, e forniti, ognuno, distalmente, di quattro sensilli papilliformi. Ciascun segmento del corpo, nella larva di media età (lungh. mm. 2, 8), è provvisto lateralmente di 3-5 setolette bifide all'apice . . . inoltre, dorsalmente e ventralmente, rispettivamente, di 3 e 2 setole molto più lunghe, anch'esse bifide all'apice e per le quali propongo il nome di aptochete. . . Dette setole scompaiono tutte, o quasi, allorchè la larva ottiene lo stadio che precede quello di ninfa. Il sistema tracheale è olopneustico, con 10 paia di piccoli spiracoli tracheali; due paia nel torace e otto paia nell'addome, situati anteriormente nella regione pleurale di ciascun segmento. Lunghezza della larva matura mm. 3, 6" (pp. 273-275). Fig. V on p. 274: mature larva in side view; head in anterior and side views enlarged; hair enlarged; mandible enlarged. Menozzi called this ant *A. s.* var. *balcanica* Emery.

Aphaenogaster (Aphaenogaster) testaceopilosa (Lucas)

Athias-Henriot, 1947: "Le corps est en forme de poire et arqué (la courbure s'étend depuis le thorax jusqu'aux premiers segments abdominaux). La partie postérieure de l'abdomen est très volumineuse et la tête très petite—quoique très bien différenciée—les segments thoraciques sont très étroits. On trouve sur la tête tous les éléments, en particulier les mandibules pointues à longues branches d'insertion. On peut parfois voir le tube chitineux spiralé par transparence, dans le labium. Il y a sept segments abdominaux, trés nettement séparés par de profondes constrictions. Le corps est uniformément couvert de grands macrochètes simples clairsemés. La cuticule est un peu chagrinée (peut-être artefact). L'anus est bien visible. Les stigmates sont en entonnoir" (p. 252). Internal anatomy: pp. 254, 257, 259, 260, 263, 264, 266, 267 and Fig. 3.

Aphaenogaster (Aphaenogaster) testaceopilosa spinosa Emery

Emery, 1918: "Nel corso dell'estate, molte larve crebbero notevolmente e si avviavano a diventar femmine. A quanto pare, queste larve erano esclusivamente alimentate per degurgito, mentre le larve di operaia, quando avevano raggiunto una certa dimensione ed erano staccate dai cumuli di piccole larve, mangiavano anche frammenti d'insetti che le operaie distribuivano loro" (p. 68). "Pare che le larve destinate a svilupparsi in femmine vengono alimentate dalle operaie per degurgito, all'opposto delle larve di operaie." (p. 69).

Subgenus **Deromyrma** Forel

Similar to *Attomyrma* except in the following characters: Body hairs of three types: (1) short, stout, with frayed tip, on abdominal somites IX and X and on the ventral surface of the thorax; (2) long, simple, with distal half slender and flexible, on the ventral surface of the abdomen; (3) bifid, long, with the branches long and slender, on the dorsal and lateral surfaces. Head small. Head hairs few, rather short, with stout base and denticulate tip. Maxillary palp a skewed peg. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows.

Aphaenogaster (Deromyrma) araneoides inermis Forel
(Pl. II, figs. 21-26)

Body moderately stout; slightly constricted at the first abdominal somite; thorax turgid; abdomen swollen; diameter greatest at the fifth abdominal somite. No neck. Anus posteroventral. Leg, wing, and gonopod vestiges present. About seven differentiated somites. Spiracles small, the first slightly larger. Integument on the ventral surface of the thorax and abdominal somite I spinulose, the spinules minute and in subtransverse rows of various lengths. Body hairs moderately numerous and rather short. Of three types: (1) short (0.043-0.07 mm), stout, with frayed tip, on abdominal somites IX and X and on the ventral surface of the thorax; (2) long (0.07-0.14 mm), simple, with distal half slender and flexible, on the ventral surface of the abdomen; (3) bifid, long (0.09-0.18 mm), with the branches long and slender, on the dorsal and lateral surfaces. Head small; cranium subhexagonal in anterior view; breadth about equal to the length. Antennae small, with three sensilla each. Head hairs few, rather short, (0.036-0.09 mm), with stout base and denticulate tip. Labrum rather large, bilobed; anterior surface of each lobe with 7-9 sensilla; on and near the ventral border of each lobe are arcuate rows of minute spinules and two clusters of 2-3 sensilla and a single sensillum; posterior surface densely spinulose, the spinules minute and in short arcuate rows which tend to form a reticulate pattern. Mandibles moderately sclerotized; subtriangular in anterior view; apex forming a long rather slender tooth which is slightly curved medially; two stout round pointed medial teeth; medial surface of basal half with several short to long spinules; anterior surface of basal half with several oblique rows of minute spinules. Maxillae with the apex paraboloidal and spinulose, the spinules minute and in short arcuate rows; palp a skewed peg with four apical and one lateral sensilla; galea digitiform with two apical sensilla. Labium with the anterior surface spinulose, the spinules minute and in short arcuate rows; palp a low elevation with five sensilla; opening of sericteries a transverse slit. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows.

Immature Larva.—Length 3 mm. Shaped somewhat like a crookneck squash; thorax and abdominal somites I-III forming a long stout neck which is strongly arched ventrally; rest of abdomen swollen; diameter greatest at the sixth abdominal somite. Anus ventral. Otherwise similar to the mature larva.

Material studied: several young and one mature larvae from Panama Canal Zone collected by G. C Wheeler, No. 308.

Aphaenogaster (Deromyrma) sp.

Immature Larva.—Length 3.8 mm. Similar to immature *inermis* except as follows: Body hairs short, three times as numerous. Of three types: (1) bifid, 0.07-0.11 mm long, with short base and flexible branches, the most abundant type, distributed from the mesothorax through abdominal somite IX; (2) with stout base and a few apical denticles, 0.024-0.07 mm long, on the thorax, abdominal somites IX and X and ventral surface of abdominal somite I; (3) a few simple, minute (about 0.009 mm long), scattered hairs. (Material studied; seven larvae from Panama collected by G. C. Wheeler, No. 185; near *phalangium.*)

One of the above larvae has a eucharid planidium attached to the integument on the dorsal surface in the suture between prothorax and mesothorax.

Genus **Messor** Forel

Stout. Thorax curved ventrally. Body hairs sparse; minute to very short; of three types. Head moderately large. Head hairs moderately numerous; short. Posterior surface of labrum spinulose, the spinules arranged in short arcuate rows which tend to form a reticulate pattern. Mandibles small; apex slender and curved medially; no medial teeth; basal half of medial surface bearing several long spinules; anterior and posterior surfaces with a few rows of minute spinules. Maxillae not spinulose; galea a slender frustum. Labium not spinulose. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows.

Bischoff, 1927, p. 122: ''Die körnersammelnden *Messor*-Arten ernähren ihre Larven entweder mit dem Inhalt des Kropfes oder einer aus den Körnern hergestellten halbflüssigen Paste.''

Emery, 1921, p. 68: ''Ces fourmis mangent les graines, elles dissolvent l'amidon cru au moyen de leur salive et se nourrissent et nourrissent leurs larves de cet aliment.''

Forel, 1923: ''Pour nourrir leurs larves les *Messor* détachent des portions de graines qu'ils portent dans le nid'' (p. 38) (= 1928, Vol. II, p. 217: ''To feed their larvae, the *Messor* ☿ detach portions of seeds, which they bear into the nest.'') ''Les larves sont alimentées par les ☿, soit par la régurgitation du contenu de leur jabot, soit par la présentation directe de la pâte en question'' (p. 41). (= 1928, Vol. II, p. 220: ''The ☿ feed the larvae either by regurgitating the contents of their crop, or by directly presenting the aforesaid paste.'')

Stärcke, 1948, p. 26 and 28: ''The caudal extremity more swollen. The duct of the labial glands broader and its epithelium composed of taller cylindrical cells.''

Wheeler, 1928*a*, p. 202 (= 1926, p. 243): The larvae are fed on fragments of seeds but the very youngest larvae and the older queen and soldier larvae are fed on regurgitated food.

Messor barbarus (Linnaeus)

(Pl. I, figs. 14-20)

Stout, diameter greatest at the fifth abdominal somite, diminishing gradually toward the anterior end and rapidly to the posterior end which is broadly rounded. Thorax curved ventrally. Lateral longitudinal welts feebly developed. Anus ventral. Leg, wing and gonopod vestiges present. About eight differentiated somites. Spiracles small, the first slightly larger. A few minute spinules in short transverse rows on the dorsal surface of the last few abdominal somites. Body hairs sparse and very short. Of three types: (1) minute to very short (0.006-0.045 mm), stout, tapering rapidly to a sharp point, generally distributed; (2) much longer (0.027-0.09 mm), lanceolate, on the prothorax; (3) stout with frayed tip, about 0.07 mm long, a few on the prothorax. Head moderately large; cranium subhexagonal in anterior view, about as long as broad. Antennae small, with three sensilla each. Head hairs moderately numerous, short (0.012-0.045 mm), stout, spike-like. Labrum small, short (width $2\frac{1}{3}\times$ the length), narrowed dorsally, feebly bilobed; anterior surface of each lobe with 1-4 minute hairs and/or sensilla; on the ventral border of each lobe are 3-5 sensilla; posterior surface with a cluster of four sensilla on each half; posterior surface spinulose, the spinules minute and arranged in short arcuate rows which tend to form a reticulate pattern. Mandibles small; moderately sclerotized; apex slender and curved medially; no medial teeth; basal half of medial surface bearing several long spinules; anterior and posterior surfaces with a few rows of minute spinules. Maxillae lobose; palp a short stout peg with 4-5 sensilla; galea a slender frustum bearing two apical sensilla. Labial palp a low elevation bearing one small and four larger sensilla; opening of sericteries a short transverse slit. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows. (Material studied: numerous larvae from Tunis, labelled var. *politus*.)

Eidmann, 1926: ''Jedes Korn war wie kleine Schüssel oder ein Becher mehr oder weniger tief ausgehöhlt, und in der Höhlung hatte jedesmal eine Larve ihren Kopf stecken. Dies war durch die starke, hakenförmige Ventralkrümmung des Kopfes der Larve besonders leicht möglich. Es ist kaum zweifelhaft, dass diese Larven gerade beim fressen waren und die Löcher in den Körnern genagt hatten. Vielleicht hatten auch die Arbeiter die Körner erst angefressen und dann den Larven zur weiteren Mahlzeit vorgelegt. Es ist damit wohl ausser Frage gestellt, dass die Körnervorräte der *Messor*-Ameisen als Larvennahrung Verwendung finden. Damit soll nicht gesagt sein, dass sie nicht auch von den Arbeitern gefressen werden, nur wird man diesen Vorgang beim Öffnen eines Nestes nicht sehen, sondern lediglich im künstlichen Nest verfolgen können'' (p. 719). Fig. 8 (p. 720) shows seeds gnawed by larvae. Eidmann referred to this ant as *M. instabilis* var. *bouvieri* Bondr.

Emery, 1912, p. 113: ''Coi frammenti di pasta rammolliti dalla malassazione in bocca delle formiche, esse alimentano, almeno in parte, le larve. Si vedono le larve grandicelle applicare la bocca sulla pasta molle, come farebbero sopra altra esca. Non vi è dunque bisogno alcuno di procedere alla confezione, lunga e complicata, del 'pane delle larve' del Neger, poichè le larve del *Messor* mangiano direttamente la pasta rammollita; senza dubbio farebbero lo stesso del frumento, e di qualsiasi altro seme sminuzzato e impastato con la saliva delle operaie, perocchè la pasta per minestra è semplicemente farina di frumento impastata e disseccata, senza intervento di fermenti, e ancora meno di funghi.''

Emery, 1915, p. 185: ''Le formiche granivore alimentano anche le loro larve coi semi, sia col rigurgito del contenuto dell'ingluvie, sia col porgere a queste larve i frammenti di semi imbevuti di saliva; spesso vedo, nel nido artificiale, operaie della Formica dei cortili portare in bocca una o due larve, attaccate ad un frammento di grano masticato.'' (Translated by Wheeler and Bailey, 1920, pp. 251-252: ''The granivorous ants also nourish their larvae with seeds, either in the form of the regurgitated contents of the crop, or in the form of seed-fragments saturated with saliva and directly administered. In an artificial nest I have also seen a worker of the court-yard ant carrying in her mouth one or two larvae attached to a piece of masticated seed.'')

Fahringer and Tölg (1912, pp. 249-250) recorded the eucharid wasp *Eucharis adscendens* Fabricius as reared from the cocoons of this ant. Since myrmicine larva do not spin cocoons, the identification of the ant host is suspect. (Same host cited by Gösswald, 1932, p. 38 and 1934/35, p. 142 and by Ruschka, 1924, p. 84.)

Forel, 1923, p. 43: ''Une partie des graines germées et pelées est travaillée en masses pâteuses. A un certain moment ces masses sont sorties du nid en grande quantité et placées au séchage à l'air, comme les graines mouillées. Elles ressemblent beaucoup à des miettes de pain noir . . . Neger est persuadé que ce pain de fourmis sert aux *Messor* de provision de réserve et surtout d'aliment pour les larves. Emery demeure sceptique.'' (= 1928, Vol. II, pp. 222-223: ''Part of the material of the peeled and germinated seeds is worked up into masses of paste. At a certain moment a large number of these are taken out of the nest and laid out in the air to dry, like the damp seeds. They look very much like crumbs of black bread . . . Neger is convinced that the *Messor* use this ant-bread as a reserve-stock, and more particularly as food for the larvae. Emery remains skeptical.'') (Also discussed by Escherish, 1917, p. 158.)

Gantes, 1949: ''La jeune larve est très petite, 0 mm. 75, et en forme de poire. Le bout de l'abdomen est la partie la plus large et s'amincit régulièrement vers le thorax; la tête est plus large que le thorax. Le corps est nu; la 3[e] paire de stigmates est plus grande les autres. La larve du 5[e] stade est en poire, avec le bout de l'abdomen large, arrondi, anus subterminal, la tête fine. Les segments sont nettement séparés. Le corps est couvert de petits poils, 0 mm. 023, simples et très espacés. Ils sont plus denses sur la tête et le prothorax. La tête est bien différenciée. Le labre, qui comprend deux lobes, ne recouvre pas les mandibules. Dorsalement, six petits poils sont répartis en file parallèle au bord antérieur, de chaque côté de l'échancrure, et quatre plus grands en arrière. Ventralement, près du bord antérieur, on a un groupe de quatre sensilles sur chacun et une isolée plus externe. Les mandibules sont de simples triangles de 0 mm. 106 de long. Les maxilles, proéminents, portent deux palpes sensoriels et six poils autour des palpes dont quatre minuscules. Le palpe distal est un cône court dont le sommet est occupé par deux petites sensilles à soies très courtes. Le palpe proximal, presque aussi long; plus large, est creusé d'un sillon depuis le bout jusqu'à mi-hauteur; au fond de ce sillon on trouve une sensille, les quatre autres étant au sommet. Le labium, proéminent, est garni de six poils minuscules autour de chaque palpe, qui ont cinq sensilles dont deux sans soies'' (pp. 79-80). Growth data, p. 86. Pl. III, fig. II, larva in ventral view; fig. II, young larva. Pl. IV, mandible, labrum and labial palp.

Neger (1910): See Forel and Emery (1912) above.

Stäger (1929) proved (by actual observation under a microscope) that the larvae of this species are able to feed directly upon seeds without any previous preparation by the workers.

Messor barbarus aegyptiacus (Emery)

Athias-Henriot, 1947: internal anatomy—pp. 254, 256, 257, 260 and Fig. 3. Bernard, 1948, p. 107: internal anatomy.

Messor barbarus minor (Ern. André)

Emery, 1912, p. 108: ''Le uova delle operaie schiudono, ma le larve che derivano da quelle uova, quando divengono grandi, sono molto differenti dalle larve solite: si gonfiano, diventano, per così dire, idropiche . . . Sono larve di maschi, e sono d'aspetto differente dalle larve delle femmine e delle operaie; dunque. . .vi è un dimorfismo larvale in relazione col dimorfismo sessuale.''

Messor barbarus semirufus (Ern. André)

Fahringer (1922, p. 42) recorded the eucharid wasp *Eucharis punctata* Förster from the cocoons of *M. b. s.* var. *concolor* Emery. Since myrmicine larvae do not spin cocoons, the identification of the ant host is suspect.

Messor barbarus striaticeps (Ern. André)

(Pl. II, figs. 21-25)

Similar to *barbarus* except in the following characters: About 12 differentiated somites. Body hairs of three types: (1) minute to very short (0.009-0.045 mm), with the tip denticulate, generally distributed; (2) longer (0.054-0.13 mm), with the tip denticulate, numerous on the prothorax and near the posterior end of the abdomen, a few in a band around the middle of other somites; (3) simple, flexible, slender, longer (0.054-0.14 mm), restricted to the anterior portion of the ventral surface of the prothorax. Head hairs rather long (0.054-0.09 mm) and stout, with a few denticles near the tip. (Material studied: numerous larvae from Tunis, labelled var. *striatula*.)

Messor barbarus structor (Latreille)

Goetsch, 1937, p. 807: The larvae are fed with solid food, but the longer life cycle makes interruptions probable. Hence intermediate workers are produced. The life cycle is given as—egg 24-46 days, larva 16-36 days, pupa 13-28 days.

Meyer, 1927: "27. Mai. Das Weibchen sitzt zusammengekrümmt in der oberen Erdkammer des Nestes vor dem Eipaket mit 5-6 kleinen Lärvchen. Es legt binnen weniger als 1 Minute ein Ei, das es zwischen die mandibeln nimmt, anbeisst und, mit leichtem Drucke den Inhalt ganz allmählich wie aus einem Gummiballe hervorpressend, den Lärvchen der Reihe nach hinreicht. Dabei wird eine jede Larve zuerst mit den Fühlern betastet und durch Betrillern der Seiten des Vorderkörpers zum Fressen angeregt. Erst wenn die bis dahin Vollkommen regungslose Larve Kopf und Mundteile zu bewegen beginnt, hält das Weibchen ihr das Ei direkt an den Mund, worauf die erstere sofort zu saugen beginnt. Nach einer Weile nimmt das Weibchen ihr das Ei ab, hält es der zweiten Larve hin, dann einer dritten usw. So machte es unter allen Larven mehreremal die Runde, bis der ganze Inhalt des Eies aufgezehrt war, was im ganzen eine halbe Stunde in Anspruch nahm. . .17. Juni. Die Mutterameise sitzt vor dem Eipaket mit Larven von verschiedener Grösse und füttert diese mit einem eben gelegten Ei. Sie legt das Ei zuerst einer grösseren Larve nach Betrillern mittels der Fühler auf die nach oben gekehrte Bauchseite dicht hinter den zurückgebeugten Kopf und die Larve beginnt nun selbständig zu fressen. Das Weibchen hebt darauf die Larve mit dem Ei vom Eipaket, legt dieselbe daneben hin und lässt sie drei Minuten lang saugen. Um auch die übrigen Larven zu speisen, nimmt es das Ei der ersten Larve mit Gewalt ab, da sich diese an demselben mit ihren Kiefern festgebissen hatte. Nun wurde das angefressene Ei unter jedesmaligem Betrillern mittels der Fühler der Reihe nach drei weiteren, jedoch kleineren Lärvchen mit den Mandibeln und Vorderfüssen vor den Mund gehalten, wobei eine jede von ihnen 2-4 Minuten lang fressen durfte, bis der ganze Inhalt des Eies erschopft war" (p. 283). Larvae also ate the following food supplied by the author: bread crumbs; seeds of *Lepidium ruderale*, from which the hard outer shell had been removed; flies, which were cut to pieces by the workers. This food is simply laid in a pile among the larvae, which seem to be able to get hold of it independently. The life cycle (in artificial nests) is given as —egg 24-26 days, larva 16-36 days, pupa 13-28 days.

Wheeler, 1928*a*, p. 202: "Meyer (1927) . . . finds that the recently fecundated queens of several ants (notably *Messor structor*) while establishing their colonies not only devour many of their own eggs but also feed them to their first brood of larvae."

Messor rufotestaceus (Förster)

Athias-Henriot, 1947, pp. 256, 260, 264: internal anatomy.

Genus **Novomessor** Emery

Body hairs moderately numerous and short. Of two types (with intergrades on the metathorax): (1) most are bifid, with the long branches curled away from each other; (2) a few on prothorax, mesothorax and abdominal somites IX and X are straighter and have bifid or multifid tip. Antennae very small. Head hairs moderately numerous, rather short, with bifid or multifid tip. Posterior surface of labrum spinulose, the spinules minute and mostly in short arcuate rows which tend to form a reticulate pattern. Mandibles with the apex forming a long slender round-pointed tooth which is strongly curved medially; the two medial teeth are prominent and round-pointed; no spinules. Maxillae not spinulose. Labium sparsely spinulose. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows.

Novomessor albisetosus (Mayr)

(Pl. II, figs. 26-31)

Body hairs moderately numerous, short. Of two types: (1) most are bifid with the long branches curled away from each other, about 0.125 mm long; (2) a few on prothorax, mesothorax and abdominal somites IX and X are straighter, 0.025-0.15 mm long, with bifid or multifid tip; intergrades occur of the metathorax. Cranium subhexagonal in anterior view but with the angles indistinct; as long as broad. Antennae very small, with three sensilla each. Head hairs moderately numerous, rather short (0.045-0.09 mm), with bifid or multifid tip. Labrum short (width 2X length), bilobed; anterior surface of each lobe with 8-9 sensilla and/or minute hairs; ventral border of each lobe with two contiguous sensilla and a few spinules; posterior surface of each lobe with a cluster of three sensilla and 4-5 isolated sensilla; posterior surface spinulose, the spinules minute and mostly in short arcuate rows which tend to form a reticulate pattern. Mandibles moderately sclerotized, subtriangular in anterior view, the apex forming a long slender round-pointed tooth which is strongly curved medially; the two medial teeth are prominent and round-pointed. Maxillae with the apex paraboloidal; palp a short, stout peg with four apical and one lateral sensilla; galea digitiform with two apical sensilla. Labium with the anterior surface sparsely spinulose, the spinules minute and in short subtransverse rows; on the anterior surface near the base is a hemispherical bulge; palp a low elevation with five sensilla; opening of sericteries a short transverse slit. Dorsal portion of the hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in subtransverse rows. (Material studied: ten damaged integuments from Arizona and Texas.)

Genus **Pheidole** Westwood

Worker.—Plump, chunky and subellipsoidal; head ventral, near the anterior end, mounted on a small short neck formed from the anterior portion of the prothorax; anterior end broadly rounded, formed from the dorsa of prothorax and mesothorax. Body hairs sparse and mostly short. Of three types: (1) short, bifid, generally distributed; (2) on the dorsal surface of the mesothorax, metathorax and abdominal somites VI-X a few longer hairs with bifid tip; (3) anchor-tipped, long, with tortuous shaft, 2-4 in a row across the dorsum of each abdominal somite I-V. Head moderately large. Head hairs few, short, with the tip bifid. Posterior surface of labrum spinulose, the spinules minute and mostly in transverse rows. Mandibles rather small; apex forming a moderately long slender tooth which is curved medially and posteriorly; medial border with three stout blunt teeth surrounding a denticulate cavity; anterior surface with a few coarse denticles on the middle half. Maxillae with a few spinules on the apex. Anterior surface of labium rather densely spinulose, the spinules minute and in subtransverse rows of various lengths. Hypopharynx sparsely spinulose, the spinules minute and in transverse rows.

Soldier.—Similar to worker, but with the body longer (by about 40%) and larger and the head relatively smaller.

Queen.—About twice as long as worker; body voluminous and turgid; head relatively very small. Body hairs simple; a few on the prothorax; elsewhere exceedingly minute and widely scattered. Head hairs very short, sparse and simple. Otherwise similar to worker larva.

Male.—About 70% longer than worker; body voluminous and turgid. Head relatively smaller. Body hairs bifid, short, exceedingly scarce. Head hairs few, bifid, short. Otherwise similar to worker larva.

Clausen, 1940, p. 221: The eucharid wasps of the genus *Orasema* appear to be most frequently associated with *Pheidole* and *Solenopsis.* (Eucharid larvae are parasitic on ant larvae.)

Gantes, 1949, p. 88: Sexual larvae are quite different from worker larvae. The larvae of *Pheidole* are able to eat food which the workers have placed near them.

Stärcke, 1948, p. 28: ''Body still more swollen, of a short oval or nearly globose shape, with a small head projecting on the ventral side.''

Wheeler, 1910*a*, p. 421: ''Thus the ectoparastitic *Orasema* [Eucharidae] larva extracts important juices from the body of the *Pheidole* larva directly and with great rapidity, thereby reducing its host to a mere skin, which, though still able to pass on to the pupal stage, no longer possesses sufficient substance or vitality to reach the imaginal stage.''

Pheidole dentata Mayr

(Pl. III, figs. 1-14)

Worker.—Length about 2.3 mm. Plump, chunky and subellipsoidal; head ventral, near the anterior end, mounted on a small short neck formed from the anterior portion of the prothorax; anterior end broadly rounded, formed from the dorsa of the prothorax and mesothorax. Anus posteroventral. Leg, wing and gonopod vestiges present. Segmentation indistinct. Spiracles small, the first slightly larger. Integument of the ventral surface of the thorax and abdominal somites I-III sparsely spinulose, the spinules minute and in short transverse rows. Body hairs sparse, uniformly distributed and without alveolus and articular membrane. Of three types: (1) bifid, short (0.036-0.072 mm), generally distributed; (2) on the dorsal surface of the mesothorax, metathorax and abdominal somites VI-X are a few longer (0.027-0.10 mm) hairs, with bifid tip; (3) anchor-tipped, long (about 0.25 mm), with tortuous shaft, four in a row across the dorsum of each abdominal somite I-V. Head moderately large; cranium suboctagonal but with the angles inconspicuous, about as long as broad. Antennae small, each with three sensilla. Head hairs few, rather short (0.036-0.07 mm), with bifid tip. Labrum small, short (width 2½× length), slightly narrowed dorsally, ventral border with two ventrolateral lobes separated by a median plane; anterior surface of each half with 4-5 sensilla and/or minute hairs; ventral border with one isolated and two contiguous sensilla on each half; ventral border with a few coarse isolated spinules; posterior surface of each half with 2-3 isolated and 2-3 contiguous sensilla; posterior surface spinulose, the spinules minute and mostly in transverse rows. Mandibles rather small, moderately sclerotized; subtriangular in anterior view; apex forming a moderately long, slender tooth which is curved medially and posteriorly; medial border with three stout blunt teeth surrounding a denticulate cavity; anterior surface with a few coarse denticles on the middle half. Maxillae with the apex paraboloidal and spinulose, the spinules few, minute and in short arcuate rows; palp a skewed peg with three apical and two lateral sensilla; galea digitiform with two apical sensilla. Labium with the anterior surface rather densely spinulose, the spinules minute and in subtransverse rows of various lengths; palp a low irregular elevation with five sensilla; opening of sericteries a short transverse slit hidden in a shallow depression. Hypopharynx sparsely spinulose, the spinules minute and in transverse rows.

Soldier.—Length about 3.1 mm. Very similar to the worker except for the larger size of the body. The head, although actually a trifle larger, is relatively smaller.

Very Young.—Length about 0.62 mm. Diameter greatest at abdominal somite III, tapering rapidly to a narrow posterior end, constricted at the mesothorax. Body hairs sparse; more numerous on the prothorax, diminishing gradually to two each on abdominal somites VIII-X. Of two types: (1) with bifid tip, 0.018-0.036 mm long; (2) simple, with flexible tip, 0.009-0.018 mm long. Dorsal surface of posterior somites sparsely spinulose. Antennae very small.

Young.—Length about 0.8 mm. Body hairs somewhat longer than in very young, with bifid tip. Dorsal surface of posterior somites sparsely spinulose. Mandibles with all teeth stout, short and round-pointed; no spinules found. Maxillae apparently without spinules; palp a low irregular elevation bearing five sensilla; galea a short truncate cone bearing two apical sensilla. Otherwise similar to the mature worker larva.

Young.—Length about 1.0 mm. Generally similar to mature larva.

Queen.—Length about 4.6 mm. Body voluminous and turgid. Integument thin. Head actually a third larger than that of the worker, but very small in comparison with the body. Body hairs simple; a few on the prothorax which are very short (0.009-0.018 mm); elsewhere exceedingly minute and widely scattered. Dorsa of posterior somites sparsely spinulose, the spinules minute and in short transverse rows. Head hairs very short (about 0.009 mm), sparse and simple. Labrum subtrapezoidal, narrowed ventrally; ventral border slightly concave. Mandibles with the subapical teeth more acute. Otherwise as in the worker larva.

Male.—Length about 3.8 mm. Body voluminous and turgid. Integument thin. Head about equal in size to that of the worker but smaller in relation to body size. Body hairs sparser. Labrum subrectangular in anterior view, with the ventral corners rounded and the ventral border slightly concave. Mandibular teeth more acute. Otherwise similar to worker larva.

Immature Sexual.—Length about 2.8 mm. Similar to mature sexual larva except that the body is more inflated. It differs from the soldier larva of the same length by having the head and neck directed anteroventrally, by appearing much more inflated and by having the contours smooth.

Material studied: numerous larvae from three Texan colonies.

Van Pelt (1950) recorded larvae of the eucharid *Orasema robertsoni* Gahan as parasitic on the larvae and pupae of this ant. Fig. 1A showed an ant larva in side view with a eucharid larva attached.

Wheeler (1901) inferred that the larvae of macroërgates of this species (cited as *Ph. commutata*) had been infested with *Mermis* (Nematoda) while in the larval stage. (Also discussed by Wheeler: 1907, p. 18; 1910*a*, p. 420; 1910*b*, p. 420; 1928*a*, p. 204 (= 1926, p. 247); 1928*b*, p. 197.)

Wheeler (1907, p. 20) stated that this species (cited as *Ph. commutata*) "is exclusively carnivorous and feeds at least its older larvae with pieces of insect food.". On page 12 he reported finding *Orasema viridis* in *dentata* colonies. Presumably the eucharid larvae had been parasitic on the ant larvae.

Pheidole absurda Forel

Emery (1904) discussed mermithergates of this species and inferred that the nematode larvae were parasitic in the ant larvae. (Referred to by Wheeler, 1907 and 1928*a*, p. 204 (= 1926, p. 248).)

Pheidole ceres Wheeler

Wheeler (1907, p. 14) recorded *Orasema wheeleri* Ashmead from the nest of this ant; presumably the eucharid larva had been parasitic on an ant larva.

Pheidole fabricator (F. Smith)

Eidman, 1936: "Die jungen Larven sind dicht behaart mit gegabelten

Acrochaeten, . . . die auf der Dorsalseite von langen, gekrümmten und in ankerförmige Spitzen auslaufenden Oncochaeten überragt werden. Demgegenüber sind die Altlarven mit Ausnahme des Kopfes so gut wie unbehaart. Auch ihre Gestalt ist sehr eigenartig. Sie erscheinen zu dicken eiförmigen Körpern aufgebläht, an denen die Segmentierung verwischt und nicht mehr zu erkennen ist, und an welchen der relativ kleine Kopf wie ein winziges Anhängsel sitzt, überragt von dem mächtig aufgetriebenen Prothorax. Diese Altlarven sind ihrer Grösse nach vermutlich Larven von Geschlechtstieren'' (p. 40). Fig. 2d (p. 43) shows a mature larvae in side view.

Pheidole flavens Roger

Wheeler, G. C. and E. W., 1937: The larvae of the eucharid *Orasema costaricensis* G. C. & E. W. Wheeler are parasitic on the larvae of this ant. Pl. I, figs. 5, 6 and 10 show relation of eucharid larva to host larva. (Referred to by Clausen, 1940, p. 227.)

Pheidole hyatti Emery

Cranium transversely subelliptical; head hairs shorter. Otherwise similar to worker larva of *dentata*. (Material studied: one larva from Oklahoma.)

Pheidole kingi instabilis Emery

Generally similar to worker larva of *dentata* except in the following characters: Body hairs about twice as numerous (but still sparse); shorter; anchor-tipped hairs only two each on abdominal somites I-V. Cranium transversely subelliptical in anterior view, a third broader than long; head hairs shorter (about 0.018 mm long). Mandibles shorter and stouter, with the median teeth larger and more divergent. Soldier and male larvae are also similar to those of *dentata*. (Material studied: numerous larvae from Texas.)

Wheeler, 1900*a*: ''The very young larvae have only simple bifurcated hairs, but when half-grown they have on the dorsal surface of several of the segments, besides a much greater number of these simple bifurcated hairs, several rows of long and peculiarly contorted bristles, terminating in short bifurcations'' (p. 21), Fig. 10 on p. 21: ''*a*, very young larva; *b*, furcate bristle of same; *c*, half-grown larva; *d*, contorted furcate bristle of same.'' (Figure repeated Wheeler, 1910, as Fig. 43 on p. 77). We have a note in Dr. W. M. Wheeler's handwriting referring to the above-mentioned larvae: ''erroneously described and figured as *Solenopsis geminata!*''

Wheeler, 1907: ''Small, spherical, sexual larvae, fed with regurgitated liquids'' (p. 6). Pl. V, fig. 64, photograph showing queen and worker larvae. ''The larvae of all the castes are provided with several pairs of flexuous, anchor-tipped dorsal hairs, by means of which they may be temporarily fixed to the earthen walls of the chambers or to the rough surfaces of the stone covering the nest. While in this position they are fed by the workers with bits of crushed seeds or insect fragments in the same way as the larvae of the Ponerine ants. At least the younger larvae of the males and females, however, appear to be fed largely, if not exclusively, with regurgitated liquid food'' (p. 4). The eucharid *Orasema viridis* Ashmead was discussed (pp. 2-12) but Wheeler stated (p. 6) that the female wasp had ''nothing to do with the *instabilis* larvae but directs her attention to the pupae.''

Wheeler, 1910*a*: ''I have seen the workers . . . feeding the larvae directly with pieces of crushed seeds'' (p. 279). The young larva of the eucharid wasp *Orasema viridis* Ashmead ''attaches itself to the neck of the ant-larva, sucking out its juices and in the course of a few days undergoing several ecdyses, pupating and hatching, without necessarily withdrawing sufficient substance from the ant-larva to prevent its pupating in turn. But such larvae have nevertheless lost much of the material which in uninfested individuals goes to form the head, thorax and eyes of the adult, so that these parts are very poorly developed in the pupae. These pupae, which I have called phthisergates, phthisogynes and phthisaners . . . never hatch'' (p. 418). Also discussed in Wheeler, 1928*a*, p. 203 (= 1926, p. 246).

Pheidole megacephala (Fabricius)

Generally similar to the worker larva of *dentata* except in the following characters: Body hairs about twice an numerous (but still sparse); anchor-tipped hairs only two each on abdominal somites I-V. Cranium transversely subelliptical in anterior view; head hairs shorter (0.018-0.036 mm) and with multifid tip. (Material studied: 14 larvae from Rarotonga.)

Reichensperger (1913, p. 213) reported the larva of the eucharid *Psilogaster fraudulentus* Reichensperger as ectoparasitic on the larva of this ant.

Pheidole nitidula Emery

Gemignani (1933, p. 491) has recorded the eucharid *Orasema doello-juradoi* Gemignani from a nest of this ant. It is possible that the eucharid larvae had been parasitic in the ant larvae.

Pheidole nodus F. Smith

Generally similar to the worker larva of *dentata* except in the following details: Body hairs twice as numerous (but still sparse); somewhat longer. Mandible somewhat larger; apical tooth longer; all teeth sharper. (Material studied: six larvae from Japan.)

Pheidole opaca apterostigmoides Weber

Weber (1945, p. 31) found larvae of this species ''stuck by their hairs to the sides and ceiling of the cell.''

Pheidole pallidula (Nylander)

Athias-Henriot (1947): internal anatomy—pp. 257, 260, 266 and Fig. 3 on p. 256.

Berlese, 1902, pp. 241-253: ''Le larve più piccole . . . misuravano 1,350μ. Più grosse, più molli e carnose di quelle prima vedute, mostrano ancora il primo segmento toracico molto prodotto all'innanzi, così che il capo è infero o subinfero'' (p. 241). ''Larva di circa 2 mill. Le variazioni avvenute nella configurazione generale si limitano alla maggiore protrusione all'innanzi del primo anello del corpo, al di sopra del capo'' (p. 242). The remainder treats of internal anatomy, as do also Figs. 58, 59, 60 and 61. Fig. 60 is repeated as Fig. 949 in Berlese, 1909.

Emery, 1918, p. 71: ''Questa esperienza porta alle conclusioni seguenti: 1. Le larve dei soldati sono allevate con cure speciali molte operaie le coprono, e verosimilmente le alimentono per degurgito. 2. Le larve dei maschi sono allevate e alimentate allo stesso modo. 3. Verosimilmente le uova, che si sono sviluppate in maschi, sono state deposte da soldati. 4. Quantunque, in questa esperienza, non siano state allevate femmine, è presumibile che le larve, destinate a diventare tali, sarebbero soggette alle stesse cure ed allo stesso regime di quelle dei soldati e dei maschi.'' (Mentioned by Wheeler, 1937, p. 49.)

Gantes, 1949: ''a) *Sexués:* elles sont beaucoup plus grosses que les larves d'ouvrières et en diffèrent également par la forme. Une larve de femelle au 5^e stade mesure 8 mm., elle est très blanche et a la forme d'un oeuf: on ne distingue plus aucun segment qui soit séparé par une fine ligne blanche, seuls la tête et le prothorax se voient, car ils sont perpendiculaires au corps, le prothorax servant de cou. Ils n'ont pas été envahis par le corps gras comme le reste. Le corps est nu sauf le premier segment thoracique, la tête et la partie ventrale du mésothorax, sous la tête. La tête est longue, recouverte de poils simples. Le labre est formé de trois lobes: le lobe du milieu s'avançant à peine en avant des deux autres: il porte sur sa face ventrale deux groupes de trois sensilles, et chaque lobe latéral une sensille. Toute la surface interne est tapissée de poils courts qui sont par petits groupes et en rangs transversaux, formant un dessin réticulé. Ceci se trouve chez tous les genres sans exception, les poils étant plus ou moins grands. Les mandibules sont des triangles, mais à base moins large, et vers le sommet les bords tendent à devenir parallèles. L'apex est une dent émoussée, plus longue que celle qui se branche sur sa face interne; plus bas on en voit deux autres égales. Toute la zone interne est tapissée de petites dents émoussées. Ces mandibules sont petites: 0 mm. 078. Le labium porte des palpes de cinq sensilles.

''b) *Ouvrières:* ces larves sont beaucoup plus petites, 1 mm. 95, subcylindriques avec la tête repliée sur le ventre. Elles diffèrent surtout par les poils qui sont nombreux et de plusieurs types. La tête est identique. 1. *Poils à double crochet,* très longs, 0 mm. 20. Ils sont très souples et peuvent s'allonger grâce à un ressort en forme d'S. Ils sont placés en cinq rangs de deux poils sur le dos et à partir du premier segment abdominal. 2. *Poils fourchus* de 0 mm. 05, droits, sur le thorax et sur les côtés de l'abdomen. 3. *Poils fourchus,* plus courts, 0 mm. 041 et 0 mm. 032, répartis sur tout le corps. La fourche est légèrement plus grande. 4. *Poils simples,* de 0 mm. 041, répartis sur tout le corps'' (pp. 80-81). Pl. III: outline of sexual larva; hairs of worker. Pl. IV: mandible and labrum.

Goetsch, 1937*a*: If the larvae receive during a certain short period solid food so concentrated that they can grow suddenly, they develop into soldiers. The larvae must not be older than five days; if older they develop into workers regardless of food. The critical days are the fourth and fifth. The food must be rich in protein, e.g., pieces of insects, and it must be solid. Liquid food is dispensed by the workers, a little to each larva; thus no one larvae gets the unusual abundance required. The worker must lie beside the piece of food and feed independently. By interrupting the feeding during the critical period the author was able to produce small soldiers and also intermediates between small soldiers and workers—forms which do not occur naturally. Fig. 4 shows worker larvae and a soldier larva (repeated 1937*b*, p. 11). The life cycle was found to be: egg 7-12 days, larva 5-12 days, pupa 8-13 days, total 25-33 days (p. 803).

Vandel (1927, p. 44) maintained that ''le *Mermis* [Nematoda] ne pénètre pas dans la larve de *Pheidole, mais seulement dans la pronymphe au moment de la nymphose.*'' The same viewpoint was maintained in 1930. (See also Wheeler, 1928*b*.)

Pheidole pallidula arenarum Ruzsky

Menozzi, 1936: ''*Larva matura del soldato.*—Colore biancastro, col capo e con le parti rinforzate del tegumento di colore melleo, le mandibole uniformemente color crema e le setole biancastre. Il corpo è vescicoloso a contorno pressochè circolare, appena più lungo che largo, un poco ristretto nella parte anteriore, coi segmenti più o meno distinti e con una leggera protuberanza nell'ultimo urosternite, sulla quale si apre l'ano a forma di fessura. Nelle larve mature, o quasi, l'ipocefalia è appena accennata, mentre le giovani, sono nettamente ortocefale. Il capo è libero e relativamente molto piccolo rispetto al corpo. La capsula cefalica, vista dorsalmente, ha forma subcircolare, ed è un poco più larga che lunga, coi lati e col margine posteriore arrotondati e fornita di diverse setole semplici . . . Le antenne sono, come al solito, segnate da due placche rotonde, ciascuna delle quali ha quattro sensilli, tre dei quali sono posti entro la superficie di ognuna delle placche, mentre il quarto è situato al di fuori e anteriormente ad esse. Il clipeo è troncato anteriormente e senza limite ben distinto posteriormente. Il labbro superiore è assai più stretto del clipeo, di forma subtrapezoidale, coi lati appena convessi, col margine anteriore leggermente crenulato e provvisto di 6 setole alquanto più piccole di quelle del cranio; nella faccia ventrale (palato) esso ha numerose formazioni tegumentali, a forma di squame semilunare, disposte trasversalmente in serie regolari, ed una diecina di sensilli placoidei reggruppati nella porzione mediana, lungo il margine anteriore. Le mandibole sono di un terzo più lunghe della loro larghezza prossimale e tridentate. Le mascelle hanno ognuna una sola setoletta posta davanti al palpo mascellare. Questi è di forma cilindrica e generalmente un poco più corto del processo distale della mascella, che ha la medesima forma del palpo; entrambi sono forniti all'apice rispettivamente di 4 e 3 sensilli. Il labbro inferiore ha la parte anteriore trasversa, col margine libero subarrotondato, provvisto sulla medesima linea submediana trasversale di sei setolette, delle quali, le due di mezzo, sono un poco più lunghe di quelle laterali. I palpi labiali hanno la medesima forma di quelli mascellari, soltanto un poco più grossi e con 5 sensilli all'apice. Tutto il corpo della larva è fornito di numerose setolette semplici, senza alcuna aptocheta al dorso. Sistema tracheale olopneustico con 10 paia di spiracoli. Lunghezza della larva matura mm. 2, larghezza mm. 1, 7. *Larva dell'operaia.*—Colore pressapoco simile a quello della larva del soldato, il cranio è un poco più colorato e le mandibole, distalmente, sono ferruginee. La larva, sia giovane che matura, è nettamente ipocefala . . . e coi segmenti abbastanza distinti. Il cranio, è subcordiforme, più largo che lungo, con gli angoli occipitali fortemente arrotondati e col margine posteriore pressochè diritto. Complessivamente il capo risulta più grosso di quello della larva del soldato ed è fornito di un paio di setole semplice in più, cioè 28 (26 nel soldato). . . . Le antenne hanno soltanto tre sensilli circoscritti entro l'area delle placche, le quali, sono di forma ovale. Il clipeo è troncato anteriormente e leggermente concavo, senza setole e senza alcuna altra formazione tegumentale. Il labbro superiore è pressapoco simile a quello della larva del soldato, col margine anteriore distintamente crenulato, con 4 setole nella linea trasversale in prossimità della base, eguali a quelle del capo, e con altre due più piccole, collocate ai lati della linea mediana longitudinale, presso il margine anteriore. Le mandibole sono robuste, due volte più lunghe della loro massima larghezza e tridentate; il dente apicale è lungo quasi il doppio dei due subapicali e assai aguzzo. Il corpo mascellare ha lo stipite coi lati convessi e fornito apicalmente di due peluzzi. Il palpo mascellare è di forma cilindrica ed un poco più corto del processo distale mascellare, il quale, è alquanto rigonfio alla base, per cui la sua forma è piuttosto troncoconica. Ambedue queste appendici sono fornite all'apice di tre sensilli. Il labbro inferiore sembra sprovvisto di setolette, ed ha palpi labiali di forma eguale a quelli mascellari e, come questi, con tre sensilli all'apice. Tutto il corpo della larva è provvisto di numerose setolette biuncinate e di qualche altra, sparsa qua e là, semplice; gli urotergiti 2-6 hanno inoltre, ciascuno, da 3 a 4 aptochete. Sistema tracheale simile a quello della larva del soldato. Lunghezza della larva adulta mm. 1, 8-2'' (pp. 280-283). Fig. VIII on p. 281: young and mature soldier larvae in side view; head in anterior view, enlarged; mandible, enlarged. Fig. IX on p. 282: mature worker larva in side view: head in front and side views, enlarged: mandible, enlarged; three hairs, enlarged. This ant is referred to var. *orientalis* Emery.

Pheidole pilifera (Roger)

Probably similar to the worker larva of *dentata* except in the following details: Body hairs longer; anchor-tipped hairs four on each abdominal somites I-VI. Labrum as in subspecies below. (Material studied: A dozen damaged integuments from New Jersey.)

Pheidole pilifera subsp.

Generally similar to the worker larva of *dentata* except in the following characters: Body hairs twice as numerous (but still sparse); slightly shorter. Head hairs slightly shorter (0.027-0.045 mm long). Labrum not quite so short (breadth slightly less than twice the length); subrectangular; ventral border with a small median notch; anterior surface with a median longitudinal groove. Mandibles with the apical tooth more curved and the medial teeth more divergent. Soldier and male larvae are also similar to those of *dentata*. (Material studied: numerous larvae from North Dakota.)

Pheidole proxima Mayr

Brues (1934, p. 203) reported *Eucharomorpha wheeleri* Brues from nests of this ant. Presumably the eucharid larvae had been parasitic in the ant larvae.

Pheidole punctulata Mayr

Weber, 1948, pp. 32-33: "To the lower surface of the rock the ant larvae were attached by their long dorsal hairs. Many of the larvae were holding pieces of termites, sufficiently held that they stayed on the larvae when the rock carrying them was roughly overturned. . . They were held on the ventral surface next to the mouthparts. . . Later study showed that the larvae were held to the rock by a few long dorsal hairs, each terminating in a pair of hooks. The hairs grew directly from the body at right angles, then made a complete, irregular loop before proceeding by several irregular curves to their bifurcated apices. In addition there were much shorter and finer dorsal hairs, also bifurcated apically. The termite fragments were held in place by the bent head against the body, assisted by a few simple hairs on the ventral surface."

Pheidole sciophila Wheeler

Wheeler (1907, p. 12) recorded this ant as a host of the eucharid *Orasema viridis* Ashmead. Presumably the eucharid larvae had been parasitic in the ant larvae.

Pheidole sitarches Wheeler

Wheeler, 1910*a*, p. 279: "I have seen the workers . . . feeding the larvae directly with pieces of crushed seeds."

Pheidole strobeli Emery

Gemignani (1933, p. 489) recorded a eucharid wasp (*Orasema argen-*

tina Gemignani) found in the nest of this species ("var. *misera* Sant."). Presumably the eucharid larvae had been parasitic in the ant larvae.

Pheidole strobeli silvicola Borgmeier

Eidmann, 1936, p. 41: "Dabei fiel . . . die Trennung der Larven in 2 Grössenklassen, ganz junge und grosse Altlarven, auf, letztere vermutlich überwinterte Larven, erstere von der ersten Eiablage des Frühjahres stammened. Die Larven zeigen eine ähnliche dichte Behaarung, wie sie oben für die Junglarven von *Ph. fabricator* beschrieben wurde."

Pheidole vasliti Pergande

Mann (1914, p. 184) recorded this species (var. *acolhua* Wheeler) as the host of the eucharid wasp *Orasema tolteca* Mann. Presumably the eucharid larvae had been parasitic in the ant larvae.

Pheidole vinelandica Forel

Wheeler (1907, pp. 13-14) recorded this species as a host of the eucharid wasp *Orasema coloradensis* Ashmead. Presumably the eucharid larvae had been parasitic in the ant larvae.

Pheidole sp.

Girault (1915, p. 230) recorded the eucharid wasp *Orasema pheidolophaga* Girault from the pupae of this ant. Presumably the eucharid larvae had been parasitic in the ant larvae.

Wheeler (1900*b*, p. 68) "found dozens of larvae feeding on fragments of different insects collected and comminuted by the workers."

Genus **Ischnomyrmex** Mayr

Plump and chunky; anterior end formed from the dorsa of prothorax and mesothorax. Body hairs moderately numerous and mostly short. Of three types: (1) short, bifid, generally distributed; (2) longer, bifid-tipped, on the dorsal surface of the thorax and posterior abdominal somites; (3) long, anchor-tipped, with tortuous shaft, four in a row across the dorsum of each abdominal somite I-V. Antennae very small. Head hairs few, rather short, with bifid tip. Posterior surface of labrum spinulose, the spinules minute and arranged in subtransverse rows on the middle half and in sublongitudinal rows on the lobes. Mandibles thin and sinuous in profile; apical tooth, long, slender, bent medially near the tip, sharp-pointed; with two stout blunt medial teeth and one smaller and sharper; coarse spinules on the basal half of the anterior surface and on the medial surface near the apex. Maxillae and labium without spinules; galea a slender frustum. Dorsal portion of hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in numerous subtransverse rows.

Ischnomyrmex longipes (F. Smith)

(Pl. III, figs. 15-21)

Plump and chunky; anterior end formed from the dorsal surface of the prothorax and mesothorax; head on the ventral surface near the anterior end. Anus subterminal. Spiracles small, the first slightly larger. Body hairs moderately numerous, uniformly distributed. Of three types: (1) bifid, short (0.054-0.12 mm), without alveolus and articular membrane, generally distributed; (2) on the dorsal surface of the thoracic somites and posterior abdominal somites are a few longer (0.14-0.22 mm) hairs with bifid tip, without alveolus and articular membrane; (3) anchor-tipped, long (about 0.44 mm), with tortuous shaft, four in a row across the dorsal surface of each abdominal somite I-V. Cranium suboctagonal in anterior view; slightly broader than long. Antennae very small, each with two or three sensilla, each of which bears a rather long spinule. Head hairs few, rather short (0.035-0.07 mm), with bifid tip. Labrum small and short (breadth 2X length), slightly narrowed dorsally, ventral border with two prominent ventrolateral lobes separated by an indistinct medial lobe; anterior surface of each half with four minute hairs and/or sensilla; ventral border with three sensilla on each half; ventral border spinulose, the spinules minute and in short rows; posterior surface of each half with two isolated and a cluster of three sensilla; posterior surface spinulose, the spinules minute and arranged in subtransverse rows on the middle half and in sublongitudinal rows on the lobes. Mandibles moderately sclerotized, narrowly subtriangular in anterior view, thin and sinuous in profile; apical tooth long, slender, bent medially near the tip, sharp-pointed; medial border with two stout blunt medial teeth and one smaller and sharper; coarse spinules on the basal half of the anterior surface and on the medial surface near the apex. Maxillae lobose; palp a skewed peg with one lateral, one subapical and three apical sensilla; galea a slender frustrum with two apical sensilla. Labial palp a low irregular elevation with five sensilla; opening of sericteries a short transverse slit. Dorsal portion of the hypopharynx with sublongitudinal ridges; ventral portion spinulose, the spinules minute and in numerous subtransverse rows. (Material studied: two damaged integuments from Borneo).

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A NOTE ON THE NESTING HABITS OF MEGACHILE TEXANA CRESSON

(HYMENOPTERA, MEGACHILIDAE)

BY KARL V. KROMBEIN, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

During a collecting trip to Kill Devil Hills on the Outer Banks of coastal North Carolina I found the nesting site of a colony of a leaf-cutting bee, *Megachile* (*Litomegachile*) *texana* Cresson, on August 4, 1952. The bees were nesting in damp sand in a short vertical section of a 45° slope with western exposure. The burrows were horizontal, three to four inches in length, and three-eighths of an inch in diameter. One of the two excavated was straight, and the other curved slightly to the right.

I observed the first female bee (8452 B) entering her burrow at 1:52 p.m., E.S.T. with a fragment of leaf. She was captured half an hour later when she returned carrying a large load of pollen on the abdominal scopa. Upon excavation her burrow was found to contain one completely stocked cell, and a second cell which was ready for stocking with pollen. The contents of the first cell molded during the period August 6-10.

The second bee (8452 C) was captured at 2:07 p.m. as she hovered before her burrow entrance with a leaf fragment. Her burrow was located about three and a half feet from that of 8452 B with no visible intervening burrows. The burrow contained two completely stocked and sealed cells, and the bee was beginning construction of a third. One cell was opened on August 11th—it contained an almost full-grown larva which was preserved in alcohol the following night when it had completed its larval development. It is assumed from these data that the combined egg and larval stages require a minimum of ten days. The second cell was opened on the night of August 12th and contained a silken cocoon and full-grown larva. The cocoon was more or less cylindrical in shape with rather flattened ends, about half an inch long and a quarter of an inch in diameter in the middle. It was composed of an outer layer of loosely woven, coarse, dark brown silk, and an inner layer of closely woven, fine, pale brown silk. This larva transformed to a pupa between August 17th and 20th, a period during which I was absent from Washington. The pupa became infested with mold and died on August 29th.

The cells were arranged end to end in the burrow. The leaf cuttings forming the caps were about a quarter of an inch in diameter, and a cap contained about half a dozen such pieces. The walls of the cells were formed from roughly rectangular leaf cuttings cemented together with a secretion. There were several layers of such cuttings in the cell wall, and the pieces of leaf were about three-quarters of an inch long and varied from a quarter to half an inch in width.

The two bees reported on above were the only ones seen during the half hour that I was at the nesting site, but about six adjacent burrow entrances similar in size were presumably those belonging to other females of *texana*. Our premature departure from Kill Devil Hills on August 6th prevented any additional observations on this colony.

There have been no previously published accounts of the nesting habits of this bee. There is, however, in the collection of the U. S. National Museum a female *texana* pinned with the cocoon from which it emerged. This specimen bears Quaintance No. 12741 and was collected as a cocoon in the soil of a cranberry bog at Whitesbog, New Jersey by H. B. Scammell on October 27, 1915, and emerged as an adult on July 7, 1916

SOME GENERIC CORRECTIONS IN THE ELATERIDAE, IV

(COLEOPTERA)

By MERTON C. LANE, *Bureau of Entomology and Plant Quarantine, U. S. Dept. of Agriculture, Walla Walla, Wash.*

The generic names of *Adelocera* and *Lacon* have been reversed by authors in recent years at the suggestion of Hyslop (Proc. U. S. Natl. Mus. 58: 621, 1921). In checking up on the correctness of this, the present writer found that Hyslop (*ibid.*) had overlooked a genotype designation for the genus *Agrypnus* by Westwood (Syn. Gen. Brit. Insects, p. 26, 1838) which changes the whole matter of proper priority of the above names. The following chronological summary of the pertinent data will give the proper concept according to present rules:

1758 Linneaus (Syst. Nat., ed.10, v.1, p.406) described *Elater fasciatus* (no.18) and *murinus* (no. 19).

1761 Linneaus (Fn. Suec., p.208) lists *Elater fasciatus* (no.737) and *murinus* (no.738).

1767 Linneaus (Syst. Nat., ed.12, v.1, p.655) lists *Elater fasciatus* (no. 27) and *murinus* (no.28) again.

1775 Fabricius (Syst. Ent. p.211) lists *Elater murinus* (no.10) and *fasciatue* (no. 12), but credits them to Linnaeus (1761 and 1767).

1779 Herbst (Beschaft. Berl. Ges., p.336) described *Elater punctatus* as new.

1781 Schrank (Enum. Ins. Aust., p.184) described *Elater carbonarius* as new.

1784 Herbst (Fuessly, Arch. Insect., v.5, p.113) described *Elater quer-ceus* as new.

1790 Olivier (Ent., v.2, nr.31, p.32) described *Elater varius* as new, comparing it to *E. querceus* Herbst. and *E. fasciatus* L.

1795 Panzer (Deutsch. Insect., p.235) described *Elater pulverulenta* as new.

1798 Fabricius (Ent. Syst., Suppl., p.139) described *Elater atomarius* as new, apparently comparing it to *E. murinus* L. (1761 and 1767), with *E. pulverulenta* Panzer of Europe as synonym.

1801 Fabricius (Syst. Eleut., v.2, p.228-229) lists *Elater murinus* L., *atomarius* Fab., *fasciatus* L., and *varius* Oliv. as separate species.

1808 Gyllenhal (Ins. Suec., v.1, p.377-378) described *Elater conspersus* as new, and lists *Elater atomarius* Fab. as distinct from *E. murinus* L. and compares it to *E. fasciatus* L.

1817 Schönherr (Syn. Insect., v.1, p.282) lists *Elater atomarius* Fab., with *E. punctatus* Hbst. as a synonym, and distinct from *E. murinus* L. and *E. fasciatus* L.

1824 Germar (Ins. Sp. Nov., p.49) described *Elater ovalis* as new from Persia.

1829 Eschscholtz (Thon. Arch., v.2, pt.1, p.32) established the genus *Agrypnus* for 12 species, including *Elater murinus, atomarius, varius, fasciatus* Fab.

1829 Latreille (Cuv. Regne Anim., v.4, p.451) established the genus *Adelocera*, with *Elater ovalis* (Germar) and *E. fuscus* Fab. as the only included species, the latter being now referred to *Melanotus*.

1830 Stephens (Ill. Brit. Ent. Mand., p.374, note) wrongly proposed genus *Lipidotus* for three species, *E. murinus* L., *fasciatus* L., and *varius* Oliv. This name was preoccupied by Asso, 1801 in the Pisces.

1836 Laporte de Castelnau (Silbermann Rev. Ent. 4:11) established the genus *Lacon* for *Elater atomarius, varius, fasciatus*, etc. of Fabricius.

1838 Westwood (Intro. Mod. Class. Ins., v.2, Gen. Syn., p.26) properly designated *Elater murinus* L. as type of *Agrypnus* Esch.

1840 Laporte (Hist. Nat. Anim., Col., v.1, p.237) proposed the genus *Amaurus* for three species—*fuscipes* Fab., *senegalensis* Lap., and *tomentosus* Fab. This name was preoccupied by Burmeister, 1835 in the Hemiptera.

1859 Thompson (Skand. Col., v.1, p.103) wrongly designated *Elater fasciatus* L. as the type of *Adelocera* Latr. and *E. murinus* L. as the type of *Lacon* Lap. Neither of these species was originally included. He also proposed a new genus *Danosoma* with *E. conspersa* Gyll. as the type.

1864 Thomson (Skand. Col., v.6, p.61) placed *Danosoma* as a subgenus of *Adelocera* Latr., with *E. lepidoptera* Gyll., *fasciata* L., and *conspersa* Gyll. as included species. Under *Lacon* he included *E. murinus* L. as the only species.

1869 Gemminger and Harold (Cat. Coleop., v.5, p.1489-1493) placed *E. atomaria* F. as synonym of *punctata* Hbst., *varia* Oliv. as synonym of *quercea* Hbst. under *Adelocera* Latr. They also placed *murinus* L. and *ovalis* Germ. under *Lacon*.

1886 Gozis (Recher. Esp. Typ., p.23) proposed the genus *Archontas* for *E. murinus L.* (monobasic) because he considered *Adelocera* and *Lacon* as synonymous.

1891 Candeze (Cat. Method. Elat., p.12) listed under *Adelocera* Latr., *carbonaria* Schrank (1781), with *atomaria* Fab. (1798) and *punctata* Hbst. (1779) as synonymous. This is wrong synonymy by priority, *punctata* Hbst. being the older name. He also places (p.13) *varia* Oliv. in synonymy under *quercea* Hbst. He placed (p.22) *murinus* L. in *Lacon* Cast. with *Archontas* Gozis as a synonym.

1921 Hyslop (Proc. U. S. Nat. Mus. 58: 623-680) designated the following genotypes: *Adelocera* Latr.—*E. ovalis* Germar; *Lacon* Cast.—*E. atomarius* Fab.; *Lepidotus* Steph.—*E. varius* Oliv.; *Agrypnus* Esch.—*E. tomentosus* Fab. (for last see Westwood, 1838).

1925 Schenkling (Junk, Coleop. Cat., pars.80, p.8-21) follows Candeze, 1891, except he places names in proper priority.

1952 Arnett (Wasmann Jour. Biol. 10 (1): 103-126) recently estab lished the genus *Lanelater* to include the North American species *Agrypnus schotti* LeC. (genotype), *sallei* LeC., and *arizonae* Cand. He also established the genus *Colaulon* to include *Elater rectangularis* Say (genotype), *E. curtus* LeC., and *Lacon illimis* Horn formerly placed in *Lacon* in Leng's Catalogue (1920). He also established the following subgenera under *Lepidotus* Stephens: *Diphyaulon* (genotype *Adelocera pyrsolepis* LeC.) and *Aulacon* (genotype *Adelocera nobilis* Fall).

1953 Arnett (Coleop. Bul. 7: 5-7) corrected his previous paper (1952) establishing *Lacon* Cast., with *Elater punctatus* Hbst. (*E. atomarius* Fab.) as genotype, in place of *Lepidotus* Steph. For subgenus *Lepidotus* Stephens *sensu stricto* he proposed the new name *Zalepia*, with *Elater querceus* Hbst. (E. varius Oliv.) as genotype, under *Lacon*.

Proper present synonymy:

Agrypnus Eschscholtz, 1829
Type: *Elater murinus* L. by Westwood, 1838
Syn: *Archontas* Gozis, 1886
Type: *Elater murinus* L. (monobasic)
Adelocera Latreille, 1829
Type: *Elater ovalis* Germar by Hyslop,1921
Lacon Laporte de Castelnau, 1836
Type: *Elater punctatus* Hbst. (*E. atomarius* Fab. by Hyslop, 1921)
Syn: *Danosoma* Thomson, 1859
Type: *Elater conspersa* Gyll. (monobasic)
Lanelater Arnett, 1952
Type: *Agrypnus schotti* LeC. by Arnett, 1952
Syn: *Amaurus* Laporte de Castelnau 1840 (not Burmeister, 1835)
Type: *Amaurus senegalensis* Cast. by Hyslop, 1921
Colaulon Arnett, 1952
Type: *Elater rectangularis* Say by Arnett, 1952
Diphyaulon Arnett, 1952 (sg. of *Lacon* Cast.)
Type: *Adelocera pyrsolepis* LeC. by Arnett, 1952
Aulacon Arnett, 1952 (sg. of *Lacon* Cast.)
Type: *Adelocera nobilis* Fall by Arnett, 1952
Zalepia Arnett, 1953 (sg. of *Lacon* Cast.) n.n. for *Lepidotus* Stephens 1830, *not* Asso. 1801
Type: *Elater querceus* Herbst (*E. varius* Oliv. by Hyslop, 1921)

According to this synonymy and Arnett, 1952 and 1953, the North American species formerly placed in *Adelocera* in Leng Catalogue (1920) are now placed in *Lacon* and divided into several subgenera, as follows: *Lacon* s.s. with *brevicornis* LeC., and *obtectus* Say; *Zalepia* with *impressicollis* Say, *discoideus* Web., *auroratus* Say, *maculatus* LeC., and *candidus* Fall; *Diphyaulon* with *marmoratus* Fab., *sparsus* Cand., *pyrsolepis* LeC., and *rorulentus* LeC.; *Aulacon* with *mexicanus* Cand., *avitus* Say, and *nobilis* Fall. Those species (*sallei* LeC., *schotti*

LeC., and *arizonae* Cand.) formerly found under *Agrypnus* are now placed in *Lanelater*. The American species (*rectangularis* Say, *curtus* LeC., and *illimis* Horn) formerly found under *Lacon* (Leng Cat. 1920) are now placed in the genus *Colaulon* by Arnett. The genus *Agrypnus*, with *murinus* L. as genotype, apparently does not occur in North America at present.

THE PUPAL MORPHOLOGY AND CHAETOTAXY OF THE CULEX SUBGENERA MELANOCONION AND MOCHLOSTRYAX

(DIPTERA, CULICIDAE)[1]

BY RICHARD H. FOOTE, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

Until the appearance of a recent revision by Rozeboom and Komp (1950) of the subgenus *Melanoconion* based on male terminalia, this group had long been regarded as a difficult one in which to work because the adults lack distinct morphological and color characters, and because few of the larvae and pupae are easily distinguished from one another morphologically. The present pupal study is introductory, in part, to a taxonomic revision of the immature stages of the subgenera *Melanoconion* and *Mochlostyrax* which is currently being prepared for publication. The morphology and chaetotaxy of the larvae have already been treated in a manner similar to the present summary (Foote, 1952).

The first descriptions of *Melanoconion* pupae to be presented in considerable detail appear to be those of Lane and Whitman (1943) for *Culex nigrimacula* and *Culex ocellatus*. Very few other pupal descriptions in these groups are available in the literature. The pupa of *Culex opisthopus* was described by Pratt, Wirth and Denning (1945), that of *C. mulrennani* by Basham (1948), and that of *C. iolambdis* by Pratt and Seabrook (1952). The descriptions of pupae in other groups of the Culicidae are much more numerous. Knight and Chamberlain (1948) have given an excellent review of the literature on this subject and more recently Penn (1949, 1949a), Baisas and Pagayon (1949) and Darsie (1949, 1951) have contributed more to our knowledge of the pupal stage in broader groups of mosquitoes.

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The accompanying table has been prepared as a summary of the systems of nomenclature currently available for the designations of the pupal hairs. The system of Knight and Chamberlain (1948) has been used as a frame of reference, since their designations will be used in the pupal descriptions to be presented later. The following listing represents table headings, and gives the author and approximate groups which were used for each system:

K&C	Knight and Chamberlain (1948)	all genera
Mac	Macfie (1920)	*Aedes aegypti* and *Culex* sp.
Sen	Senevet (1930)	*Anopheles*
Chr	Christophers (1933)	*Anopheles*
Ev	Evans (1938)	*Anopheles*
Ba	Baisas (1936)	*Anopheles*
Bai	Baisas (1938)	culicines
Cra	Crawford (1938)	*Anopheles*
Ed	Edwards (1941)	*Anopheles* and culicines
R&K	Rozeboom and Knight (1946)	*Anopheles*
Penn	Penn (1949)	*Anopheles* and many genera of culicines (New Guinea)
B&P	Baisas and Pagayon (1949)	*Tripteroides* (Philippines)
Bel	Belkin (1952)	*Anopheles, Trichoprosopon, Tripteroides*

In addition to emphasizing the desirability of attaining a uniform basis for the designation of pupal hairs, this table should provide a convenient method for transposing any one system of hair designation to another.

The arrangement of the hairs of a *Culex* pupa is described in detail by Knight and Chamberlain (1948), who used *Culex* (*Lutzia*) *halifaxii* Theob. as an example. Investigations of the present study show the chaetotaxy of *Melanoconion* pupae to follow that of Knight and Chamberlain's *Lutzia* model almost hair for hair in arrangement. The principal differences between these two subgenera occur in the relative lengths and number of branches of the various hairs.

It is especially important that, wherever possible, several specimens of each species be studied, and attention be devoted to hairs of both right and left sides of every specimen, because of the well known variability of hair type and placement in mosquito pupae.

The characterization of pupal morphology and chaetotaxy within the two subgenera has been made from the study of pupae belonging to the following species: *aikenii, atratus, bastagarius, batesi, chrysonotum, commevynensis, dunni, educator, elevator, erraticus, iolambdis, lucifugus, mistura, mutator, phlogistus, psatharus, serratimarge, theobaldi, sursumptor, opisthopus, albinensis, castor, egcymon* and *carcinophilus*.

Summary of Notations Used for the Chaetotaxy of Mosquito Pupae

K&C	Mac	Sen	Chr	Ev	Ba	Bai	Cra	Ed	R&K	Penn	B&P	Bel
					Cephalothorax							
1	1	*	*	*	*	*	*	*	3	1	14	1
2	2	*	*	*	*	*	*	*	2	2	15	2
3	3	*	*	*	*	*	*	*	1	3	13	3
4	6	*	*	*	*	*	*	*	5	5	pro-3	4
5	4	*	*	*	*	*	*	*	4	4	pro-1	5
6	7	*	*	*	*	*	*	*	6	6	pro-5	6
7	5	*	*	*	*	*	*	*	7	7	pro-4	7
8	8(6)	*	*	*	*	*	*	*	8	8	meso-1	8
9	9(7)	*	*	*	*	*	*	*	9	9	meso-5	9
10	8	O	O	O	O	O	O	O	10	10	meta-1	10
11	9	P	P	P	P	P	P	P	11	11	meta-2	11
12	10	R	R	R	R	R	R	R	12	12	meta-5	12
					Abdomen—Segment I							
2	(C)	l	t	*	t	t	t	*	10	fl	1	1
3	(C″)	H	H	H	H	H	H	H	9	H	0	2
4	(C′)	K	K	K	K	K	K	K	6	K	?	3
5	(B)	M	M	M	M	M	M	M	4	M	2	5?
6	(B′)	L	L	L	L	L	L	L	5	L	3	*?
7	(A″)	S	S	S	S	S	S	S	2	S	8	6
8	(A)	U	U	U	U	U	U	U	1	U	6	7
10	(A′)	T	T	T	T	T	T	T	3	T	10	10
					Segment II							
1	D′	V	5	5	5	5	*	5	7	5	2	0
2	C	C	C	C	C	C	C	C	10	C	1	1
3	C″	IV	4	4	4	3	iv	4	6	C′	3	2
4	C′	III	3	3	3	B	iii	B	5	B	0	3
5	B	II	2	2	2	4	ii	2	8	3	5	4
6	B′	II′	2′	2′	2	2	ii′	3	4	4	4	5
7	A″	I′	1′	1	1	1	i	1	2	2	8	10?
8	A	**	A	A	A	A	A	A	1	A	6	7
10	A′	I	1	1	1	*	i′	*	3	1	10	6
12	**	**	**	**	**	**	**	**	**	**	13	**
13	**	**	**	**	**	**	**	**	**	*	*	**
					Segment III							
1	D	V	5	5	5	5	*	5	7	5	2	0
2	C	C	C	C	C	C	*	C	10	C	1	1
3	B′	IV	4	4	4	C′	*	B	6	4	3	2
4	C″	C′	3	3	3	B	*	C′	5	C′	0	3
5	C′	B	B	B	B	2	*	2	8	B	5	4
t	*	III	*	*	*	3(?)	*	3	3	3	10	*
6	B	II	2	2	2	4	*	4	4	2	4	5

K&C	Mac	Sen	Chr	Ev	Ba	Bai	Cra	Ed	R&K	Penn	B&P	Bel
7	A′	I	1	1	1	1	*	1	2	1	8	6
8	A	9	A	A	A	A	*	A	1	A	6	7
9	E	β	6	β	*	6	*	*	14	*	12	8
10	D	α	7	δ	*	1	*	*	15	*	7	10
11	C	E	E	E	*	D	*	*	16	*	9	14
12	B	γ	8	γ	*	8	*	*	17	*	13	13
13	A	*	*	*	*	9	*	*	*	*	*	12
Segments IV—VII												
1	D	V	5	5	5	5	v	5	7	5	2	0
2	C	C	C	C	C	C	C	C	10	C	1	1
3	C″	C′	4	4	4	C′	iv	C′	6	C″	3	2
4	C′	IV	C′	3,C′	C′	4	C′	4	5	4	0	5
5	B	B	B	B	B	B	B	B	8	B	5	4
**	*	III	*	*	*	3(?)	*	3	3	*	10[3]	*
6	B′	II	2	2	2	2	ii	2	4	2	4	3
7	A′	I	1	1	1	1	i	1	2	1	8	6
8	A	9	A	A	A	A	A	A	1	A	6	7
9	E	β	6-7(?)	β	*	6	al	*	14	*	12	8
10	D	α	D	δ,D(?)	*	7	pl	*	15	*	7	10
11	C	D[1]E[2]	E	E	*	D	pm	*	16	*	9	12
12	B	E[1]γ[2]	8	γ	*	8	am	*	17	*	13	13
13	A	1*2	*	*	*	9	ant	*	18	*	*	14
Segment VIII												
1	D	8	5	*	5	5	v	5	7	5	2	0
5	P	7	A′	*	A′	A′	acc A	A′	8	A′	5	4
8	A	6	A	A	A	A	A	A	1	A	6	7
13	A	*	*	*	*	9	*	*	18	*	*	*
Segment IX												
1[4]	*	*	†	†	†	*	†	*	†	V	†	1
Segment X												
8[5]	*	*	†	†	†	*	†	*	†	W	†	†
Paddle												
7	P″	5	ap[4]	*	ap	ap	acc p	ap	13	Z	*	1
8	P′	4	p	*	p	p	term	p	12	X	*	2

*No discussion; or shown but not numbered.

** These hairs do not occur in the groups studied; present only in some *Tripteroides*.

† These hairs do not occur in the groups studied.

[1] On segments V, VI and VII.

[2] On segment IV only.

[3] On segments IV and V.

[4] Present in *Culex* and *Uranotaenia* only.

[5] Present in *Megarhinus* only.

MORPHOLOGY

Cephalothorax, fig. 1.—The most commonly employed method of mounting mosquito pupae is to separate the metathorax and abdomen from the cephalothorax, separate the two halves of the latter dorsally and flatten them ventral side up on the slide. The metathorax and abdomen are mounted dorsal side up without any further separation. Plate I is drawn from a pupal skin mounted in this manner and shows the relationship of the various sclerites and sheaths to each other and the location of the various hairs. Since there are apparently no characters of taxonomic value in the arrangement and shape of the various parts of the cephalothorax, the plate will suffice to point out the important morphological features and terminology.

Metathorax, fig. 3.—In properly mounted pupal skins the metathorax is a single plate which remains attached by a narrow membrane to the first abdominal segment. It is composed of a narrowed central area and lateral wing-like flaps with rounded anterior shoulders which fit into concavities in the posterior margin of the dorsal plate of the cephalothrax. Posteriorly the flaps are drawn out into rather long, narrow processes which extend to or just beyond the posterior margin of the first abdominal segment.

Abdomen, fig. 3.—The abdomen is composed of 10 segments, the first eight of which are well defined and strongly marked from one another. The ninth segment is believed to be represented by the posterior median evagination, or dorsal flap, of the eighth tergite, and the 10th segment, the so-called ''genital pouch,'' contains the terminalia of the developing adult.

Segment I is relatively narrow and is heavily sclerotized along its anterior and lateral margins. Posteriorly it appears to articulate very closely with segment II, the membrane between these two segments being extremely narrow. The central area of the tergum appears to be thinly sclerotized and the so-called ''float hair'' of the pupa is borne on the end of a narrow sclerotized rod which extends over the lateral half of the tergite midway between the anterior and posterior margins. In addition, the chitin of the area of the tergite between the float hairs bears a reticulated pattern which is quite distinct in some species and intergrades with a completely smooth area in others.

Segments III through VII become progressively longer but somewhat narrower, each with a tergite and a sternite connected laterally without any evidence of pleural sclerites by a membrane. Segment VIII is shorter and narrower than segment VII and in these subgenera is usually provided with a distinct postero-lateral corner. The tergite bears a projection posteriorly which is usually about one-fourth as long as segment VIII and about half as wide, and is usually gently rounded behind, but may possess a median invagination resulting in two lateral arms extending rearward. This is segment IX. Segment X is represented by a sac-like structure connected by membranes to the sternum of segment VIII. In the male pupa it extends by at least half its length beyond the posterior border of the ninth segment and appears to be divided longitudinally, at least on its posterior margin, leaving faint impressions of the claspers and sidepieces. In the female this sac does not extend appreciably beyond the posterior margin of the ninth segment and does not exhibit the posterior median cleft.

The paddles are articulated internally on the eighth segment immediately ectad of the lateral corner of segment IX. The paddle is very lightly sclerotized except for the extreme base and the midrib, which does not appear to extend to the extreme tip of the paddle. A narrow ridge of sclerotization extends half-way around the lateral margin from the base, exhibiting an extremely fine sawtooth edge over this portion of the lateral margin. The remainder of the perimeter is so faint in ordinary mounts that it is discerned with difficulty.

CHAETOTAXY

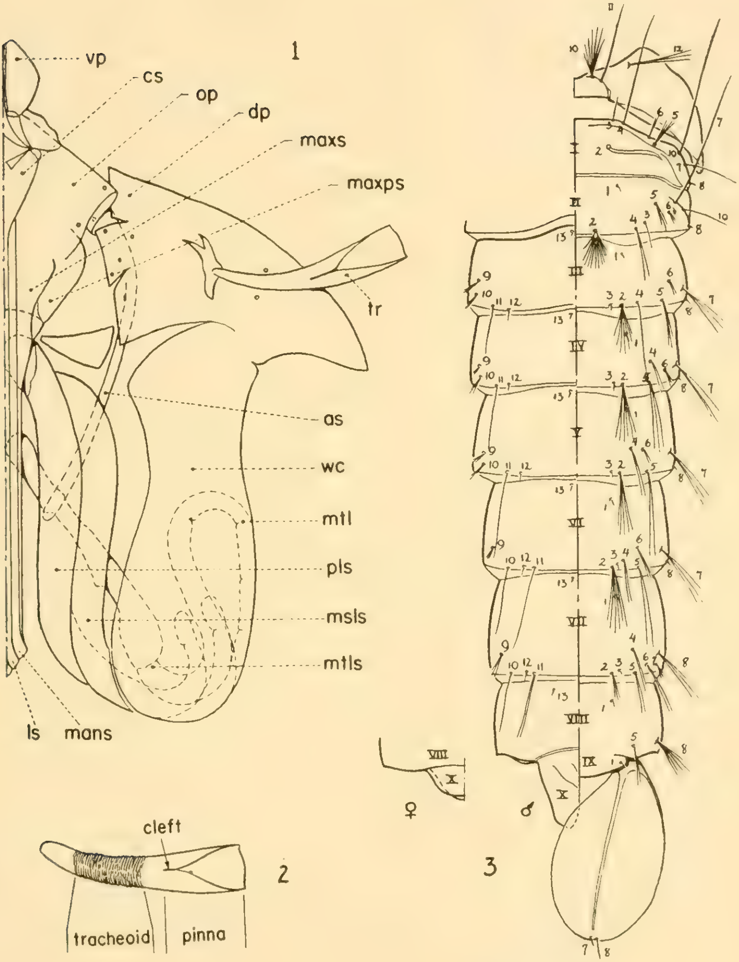
Cephalothorax, fig. 1.—There are three natural groupings of hairs on the cephalothorax, represented by the antero-ventral (hairs 1, 2 and 3), the anterothoracic (hairs 4, 5, 6 and 7) and the dorsal and supra-alar (hairs 8 and 9).

Hairs 1, 2, and 3, *Ocular* (antero-ventral, post-ocular). Positions of these hairs with respect to one another often extremely difficult to determine in pupal skins. Inserted on the ocular plate which covers certain portions of the adult head, and which folds upon itself when the skin is slide-mounted. Hair 3 inserted quite close to junction of ocular plate, maxillary sheath and palpal sheath, its socket may be seen when these structures are placed in focus. Hair 2 inserted near posterior border of folded ocular plate, usually at or near fold, half-way between dorsal and ventral margins. Hair 1 inserted at posterior dorsal corner of plate, usually a free corner but in some specimens still attached to antennal sheath. All three hairs multiple and quite long, hair 1 usually longest of the three.

Hairs 4, 5, 6, and 7, *Pronotal* (antero-thoracic). Inserted in a distinct and never-varying pattern on ventro-lateral edge of dorsal plate near junction of anterior portion of antennal sheath. Hair 5 inserted on an anterior projection of the small flap formed when dorsal plate is spread out and disjointed from antennal sheath, always multiple and next to longest of the hairs in this group. Hair 4 dorsal and somewhat posterior to hair 5, multiple, next to shortest of the group. Hair 6 the smallest hair of group, dorsal and slightly anterior to hair 5, always multiple. Hair 7 longest of these four hairs, multiple, situated immediately posterior and slightly ventral to hair 6.

Hair 8, *Dorsal*. In line with and dorsal to base of trumpet, in cast skins usually lying anterior to anterior edge of trumpet at about its basal third or half, always multiple, usually about one-half as long as trumpet, but often less.

Hair 9, *Supra-alar*. Slightly closer to mid-line, and posterior to hair 8, inserted just at posterior border of trumpet when latter lies in normal



Pupa of Culex (Melanoconion) batesi

Fig. 1, dorsal view of cephalothorax; fig. 2, trumpet; fig. 3, ventral (left) and dorsal (right) view of metathorax and abdomen. *Abbreviations.*—*as*—antennal sheath, *cs*—clypeal sheath, *dp*—dorsal plate, *ls*—labral sheath, *mans*—mandibular sheath, *maxps*—sheath of maxillary palp, *maxs*—maxillary sheath, *msls*—mesothoracic leg sheath, *mtl*—metathoracic leg, *mtls*—metathoracic leg sheath, *op*—ocular plate, *pls*—prothoracic leg sheath, *tr*—trumpet, *vp*—vertical plate, *wc*—wing case.

mounting position, double to multiple, usually about two-thirds as long as hair 8, but always with fewer branches than that hair.

Metathorax, fig. 3.—Hairs 10, 11 and 12, *Metathoracic*. Hair 10 multiple, rarely with as few as two branches, generally slightly shorter than hair 11. Hair 11 almost always single, rarely double, usually with fairly stout base thicker at basal fifth than at extreme base. Both hairs 10 and 11 mounted on a rounded shoulder which crosses the metathorax diagonally near center line. Hair 12 always multiple, usually about the same length as hair 10, but slightly removed laterally from the former two hairs, its socket directed toward the lateral margin of the metathorax.

Abdomen, fig. 3.—For the sake of convenience in the discussion to follow the 13 abdominal hairs have been treated in order, with notations of the deviations which occur in each hair from segment to segment. These hairs have not been given names.

Hair 1: Extremely small, single, inserted near anterior border of tergites II—VIII, midway between side and mid-dorsal line; absent from segment I; on segments IV—VIII sometimes hidden by hair 2 of preceding segment; on segment IX inserted on postero-lateral corner, indistinct in some specimens. Its form and location varies little from segment to segment and from species to species, making its taxonomic value low.

Hair 2: Float hair of segment I, quite constant in form in all species of *Melanoconion* and *Mochlostyrax* studied, distinctly fan-shaped, the distal border directed laterally, with 30—60 terminal branches exceeding width of segment. Close to centerline on posterior border of tergite of segment II, usually quite short, with 20—40 branches arising from a very stout, short stem; on segments II—V situated very close to posterior border of tergite midway between mid-dorsal line and lateral edge, six to 12-branched, usually extending about half-way along length of following tergite; on segments VI and VII somewhat shorter with fewer branches; absent from segment VIII. The relation of the length of this hair with that of hairs 4 and 5 has proved to be a valuable taxonomic character.

Hair 3: Single on all segments except VIII, where it is lacking, and only slightly longer than hair 1 but tending to grow progressively longer on the posterior segments; near anterior edge of tergite I about one-third the distance between centerline and lateral edge, always a short hair in association with the much longer hair 4; on segment II laterad of and slightly anterior to hair 4, and in many species is closer to that hair than to any other; on segments III—V inserted very close to socket of hair 2, near posterior border of that tergite and centrad of that hair; on segments VI and VII laterad of, but still very close to, hair 2; absent on segment VIII. The form and position of this hair is constant, and cannot be used as a recognition character.

Hair 4: Inserted near anterior border of tergite I about one-third the distance between centerline and edge, always just laterad of hair 3 of that segment, nearly always single, about the same length and weight as metathoracic hair 11, rarely double or longer; inserted on extreme posterior edge of tergite II about half way between the centerline and edge of segment, single or double, usually but not always longer than hair 2; inserted on tergite III about one-half the distance between hair 2 and edge, very close to posterior border, usually multiple and about the same length as hair 2; on segments IV—VII a much smaller hair, inserted between hairs 2 and 5 but distinctly anterior to them, always multiple and usually one-half to two-thirds as long as hair 2. The relative length of this hair has been found useful in separating several groups of the subgenus.

Hair 5: On segment I inserted very close to anterior border of tergite about half-way between centerline and lateral margin of segment, always small, directed anteriorly, multiple, always in close association with hair 6 (q.v.); on segment II a small multiple hair inserted anterior to all other dorsal hairs and always in association with hair 6; on segment III usually inserted midway between hair 4 and hair 6 in a diagonal line running across tergite, usually multiple and always shorter than hair 4, in a few species inserted directly anterior to socket of hair 4; on segments IV—VII usually longest of the dorsal hairs and may exceed posterior border of following tergite; on segment IV always multiple but on segments V and VI may be either multiple, with all branches nearly the same length, or single, double or triple with two of the branches distinctly longer than the third; on segment VII in the same position as on the preceding three segments, but always much reduced in length; on segment VIII always single or double, usually extending at least to basal fifth or sixth of paddle; inserted almost directly over insertion of paddle. The variation from segment to segment and from species to species makes hair 5 on segments IV—VI one of the most useful characters in grouping species within the subgenera.

Hair 6: On all segments a small, multiple hair. On segment I always very close to, and slightly posterior to, insertion of hair 5, always about twice as long as that hair and with a larger number of branches; a very small hair on the surface of tergite II in close association with hair 5 but laterad and slightly posterior to it; on segments III—VI it is the small dorsal hair closest to insertion of hair 7, its position varying somewhat from segment to segment; close to posterior border of tergite VII in line with and about midway between hairs 5 and 7, varying in length from species to species; entirely missing from segment VIII. It is a valuable adjunct to species recognition when used with the characters of hair 4.

Hair 7: Inserted on antero-lateral shoulder of segment I from as long to twice as long as mesonotal hair 11, always single; in a more or less vertical plane on a shoulder of segment II, always single, usually about the same length as this hair on segment I; on segments III—VI multiple (rarely single or double), inserted on tergite very close to and projecting over lateral margin, about the same length as hair II of these segments; on segment VII extremely small, multiple, inserted posterior to and slightly centrad of hair 8; absent from segment VIII; on paddle, closest to centerline, from one-tenth to one-half the length of paddle hair 8. In only a few instances has this hair been found to be of value in species identification.

Hair 8: On segment I a very fine single hair about the same length as hair I-3, inserted in line with hairs 7 and 10 but posterior to both of these and just anterior to postero-lateral corner; on segments II through VI extremely minute, at or very close to postero-lateral corner of segment, in some species very slightly ventral in position; on segement VII in the same position as hair 7 on segments III—VI but considerably longer and darker, the branches stouter, and often, but not always, spiculate; on segment VIII even darker, rather more heavily branched, more often spiculate than not, rarely single or double, nearly always on dorsal surface of tergite very close to postero-lateral corner, in two species (*aikenii* and *opisthopus*) on the extreme corner; longest of the two paddle hairs present, single, extremely variable in length. Hair 8, especially on segments VII and VIII, appears to offer valuable taxonomic characters.

Hair 9: No ventral setae on segments I and II. Always minute, three- to five-branched, inserted near lateral border of sternite usually one-half to two-thirds the distance from anterior to posterior borders, the anteriormost of the four large, distinct hairs appearing along posterior border of sternites of all segments.

Hair 10: On segments III—V almost directly posterior to hair 9 about one-half the distance between it and posterior border; on segment III distinctly shorter than hair 9; on segment IV either longer, the same length or shorter; on segment V nearly always longer; on segments VI and VII a long, slender, single or double hair at least as long as half the width of following sternite.

Hair 11: On segments III—VII a long single or double hair inserted very close to posterior border about three-fourths the distance from center line to posterior margin, at least one-half as long as following segment; on segments VI and VII about the same length as hair 10.

Hair 12: A minute single, double or triple seta on segments III—VII, appearing to grow somewhat longer on the following segments; on segments III—V usually single, very close to posterior border of sternite, centrad and very slightly anterior, but close to insertion of hair 10; on segment VI usually single but laterad of hair 10; on segment VII also laterad of hair 10, usually multiple; absent from segment VIII.

Hair 13: On segments III—VIII the smallest of all abdominal setae, invariably inserted at or very close to anterior margin of sternite very close to centerline. On segment VIII this hair lies nearly directly ventral to hair 1.

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NOTES ON MATING, PREY PROVISIONING, AND NESTING OF SPHEX PROCERUS (DAHLBOM)

(Hymenoptera, Sphecidae)

By George E. Bohart[1] and George F. Knowlton[2]

A large population of *Sphex procerus* (Dahlbom) was observed in an area of stabilized sand dunes near Pahvant, Utah, on July 24, 1951. Attention was drawn first to the intense mating activity. The females were clinging to small branches of squawbush, *Rhus trilobata* Nutt. In most cases each female was receiving attention from two to four males. The male rode astride the female and grasped her by the posterior part of the thorax with his fore- and mid-legs. His abdomen was rotated and turned under at the tip, giving a venter-to-venter contact of the copulatory structures. Less successful suitors formed a precariously balanced stack on top of the mating pair. Since each male grasped the thorax of the wasp beneath him, the stacks tended to be overbalanced at the rear. In the taller stacks, the uppermost males became restless and sometimes flew to other mating groups. This called to mind the impatient shopper in the grocery store who becomes convinced that his line at the checking stand is moving more slowly than the others.

The squawbush, which formed the dominant vegetation on the dunes, was at that time being defoliated by notodontid caterpillars (*Datana* sp.). These insects were gregarious and, when disturbed, assumed a grotesque U-shaped posture. Several female wasps (those not engaged in the mating activities described above) were seen to sting and carry off full-grown caterpillars to their nests at the base of the dunes. In the manner characteristic of many of the larger sphecids, the wasps deposited the larvae on the sand several inches from the nest entrance and then "inspected" the entrance before dragging the prey closer. The wasps then backed into their burrows, dragging their prey behind them. In the few cases observed they grasped the prey by the head with their mandibles.

In some areas there were five or more nests per square yard. Most of them were located in small flats between the dunes

[1] Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Logan, Utah.

[2] Utah State Agricultural College, Logan.

where the sand was dry and crusty at the top but moist below 3 inches. The nest burrows were nearly perpendicular and about 8 inches deep. They terminated in a single cell that rested on a stratum of wet blue clay. Many of the wasps were observed carrying excavated sand away from the nest entrances. They held the sand in a basket of curved hairs under their head and flew backwards with it several inches before flinging it away with a quick turn of their entire body. Other wasps were seen plugging the entrance to their burrows with small pebbles and sand grains and smoothing the surrounding area. These observations of nesting agree essentially with those made by Krombein (Amer. Phil. Soc. Yearbook 1950: 148, 1951) for the same species in North Carolina. The wasps he observed were also preying on notodontid caterpillars.

A NOTE ON HERTIGIA HERTIGI FAIRCHILD AND DESCRIPTION OF THE FEMALE

(DIPTERA, PSYCHODIDAE)

BY G. B. FAIRCHILD, *Gorgas Memorial Laboratory, Panama, Republic of Panama*

Since the description of this *Phlebotomus*-like fly (Proc. Ent. Soc. Wash. 51 (2): 81-84, 1949) three additional specimens have been collected in Costa Rica. These consist of two males from Pacuare, near Turrialba, taken Feb. 7, 1952 in rock crevices near a river by Marshall Hertig and a single female (the Allotype) from La Roca, April 29, 1951 taken between buttressed roots of a tree by R. Rosabal.

The female is similar to the male in external characters, though the eyes are more widely separated. Well developed, broad, blade-like mandibles are present, so that the species is in all likelihood haematophagous. The abdomen is clothed with rather strong, erect setae. The seventh sternite bears lateral patches of short, slender setae, the sides of the eighth tergite bear numerous setae, and the ninth tergite has at least some of its setae ligulate. The internal sclerotizations of the eighth sternite, the gonapophyses, are long, slender and crinkled and the genital fork has a very long and slender stem. The cibarium seems to be without teeth, though the high position of the chitinous arch obscures the tooth-bearing area in our specimen. The pharynx is well sclerotized and bears several rows of slender spines at its apex. (These spines are present also in the male, but were overlooked in the original description.) The spermathecae are relatively enormous, thin-walled, sac-like structures filling the posterior half of the sixth and most of the seventh abdominal segments.

Both sexes lack pleural setae and the antennae are quite thickly and evenly beset with slender, striate scales. This makes it difficult to see the very slender and thin-walled ascoids and it has been found impossible to ascertain the antennal formulae, though ascoids appear to be absent from at least the last three antennal segments. The wing venation is somewhat variable, R_5 forking closer to R_4 than in the Type specimen in the two males, and the two branches arising from nearly the same point in the female.

Spermathecae in side view and cibarium of *Hertigia hertigi* Fchld.

The species approaches *Warileya nigrosacculus* Fairchild and Hertig 1951 (Ann. Ent. Soc. Amer., 44 (3):428-429, pl. 3) in the structure of cibarium and spermathecae, but differs in head, palpi and antennae, in the lack of recumbent scale-like vestiture, and in wing venation. The male genitalia are quite like those of *W. rotundipennis* F. and H. 1951 (*op. cit.*, p. 424, pl. 1), but again the wing venation, palpi, and antennae are quite different.

A consideration of the position of the genus in the light of the structures of both sexes seems to place it close to *Warileya* and *Phlebotomus* rather than to *Bruchomyia* and *Nemopalpus*, in spite of the wing venation. The genitalia of both sexes, the head and mouth parts and the structure of the ascoids are like *Warileya* and *Phlebotomus*, only the wing venation being like *Nemopalpus*.

The accompanying figure shows the spermathecae and the cibarium, drawn to the same scale.

WILLIAM RANDOLPH WALTON

1873-1952

William Randolph Walton, Naturalist, Civil engineer, Artist, Writer, former President of our Society, and long-time Editor of the *Proceedings,* died on October 20, 1952, at age 79, at his home in Hyattsville, Maryland, after a long illness.

Born in Brooklyn, New York, September 23, 1873, he was the second son of 1st Lieut. Walter Walton, U. S. Marines, and wife Susan (MacArdell) Walton, and was of English-Scotch ancestry. A portion of his childhood was spent on a relative's farm near Middletown, New York, and quite early in life he began to manifest more than usual interest in the out-of-doors, plants, and animals, birds, and insects. As time went on, the growing lad also developed increasing manual, mechanical, and mathematical proficiency, and noteworthy skill in drawing. His early education was obtained in the public schools of Middletown, New York. However, at the end of grammar school, on the death of his father in 1890, he became family breadwinner, and not long thereafter, although still a mere youth, he trained for and soon attained a position as telegraph operator on the Erie Railway.

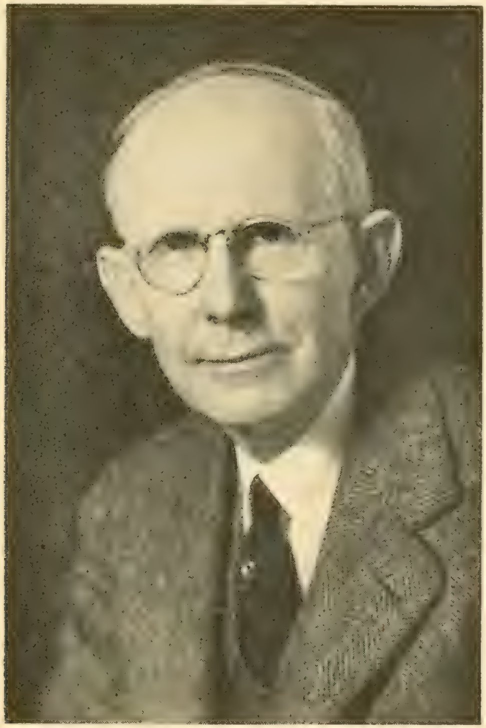
Important consequences many times develop from seemingly insignificant matters, and while performing service as night telegrapher, his post of duty at times would be lonely towers out in the country where many insects would come on warm nights attracted to the bright lights, and of these the boy would make numerous observations, collections, and rearings, during many long nocturnal vigils. Presently, he was in correspondence about them with Dr. J. A. Lintner, then State Entomologist of New York State, and it was his letters and interest in the lad and his drawings that encouraged him to continue and enlarge the scope of his studies. The first entomological publication from his pen appeared in 1897 in Dr. Lintner's 12th Report. After a time, however, the long hours and close confinement of the telegraph office compelled him to seek more wholesome work elsewhere. So, from time to time as opportunity offered, he became connected successively with the engineering departments of various railways in New York and Pennsylvania, as well as with a number of engineering firms. In these he served with highly varied duties, such as rodman, chainman, draftsman, instrumentman, and assistant engineer in railway surveying. It was during this general period of approximately nine years that he participated in Resurveys of the New York Central Railway. It was also during those years that he served as expert draftsman for the Division Engineer of the West Shore Railway. It was in

1899, at the age of 26, that he had the good fortune to serve as draftsman with the Pittsburgh and Western Railway, in Pittsburgh, under the highly valued leadership of Dr. Paul Didler, a French engineer of distinction, and in 1900 he was advanced to technical work with the City Engineer of Allegheny, Pennsylvania.

It is interesting to note that, at the same time he was pushing ahead in these various positions, he was carrying off honors in night classes at the Stevenson School of Art in Pittsburgh, for the unusual excellence of his sketches from life, and his drawings from antique. In 1904 and 1905 he was prize student of that institution. His studies in entomology also were not being neglected, but instead, were being continued more intensively, and wider contacts were being made by correspondence and otherwise with various professional workers in that field. These included Professor H. A. Surface, then in charge of the Pennsylvania State Department of Agriculture, Division of Economic Zoology, at Harrisburg, with result that in 1906 he became connected with that organization. From that year until 1910 he served as entomological draftsman, botanist, photographer, (including lanternslide and bromide enlargement work), and maker of museum plaster casts and models of insects, batrachians and reptiles, colored in oil. He had already specialized in Dipterology, especially in the families Syrphidae, Asilidae and Tachinidae, and had published a number of papers on the taxonomy of these and other flies. In 1909 he published a work, which had been long in preparation and upon which he had bestowed enormous toil and pains, entitled "An Illustrated Glossary of Chaetotaxy and anatomical terms used in describing Diptera." This in later years ultimately had a wide usefulness among technical workers, and is today perhaps the best known of all his writings. Because they probably are not elsewhere recorded, an effort is here made to enumerate all of the more important events of Mr. Walton's earlier years. However, to deal with equal fullness here with those of his career within the Federal Government seems both unnecessary and undesirable, for the reason that his own personal work was closely blended into and formed an important part of official activities already published elsewhere in full through various Governmental channels. A very brief statement here about that portion of his life therefore appears sufficient:

His 33 years of service with the U. S. Department of Agriculture began October 1, 1910, when at age 37, he was appointed as entomological illustrator in the then Bureau of Entomology. This was under the leadership of Professor F. M. Webster, in charge of the Division of Cereal and Forage

Insect Investigations, with whom he served for some six years in a wide variety of duties, as artist, technical office assistant, and general utility helper. At the same time his taxonomic studies in the Diptera were intensified, and in 1913-14 he investigated and published on certain predaceous and parasitic Diptera in northeastern New Mexico. Following the death of



Professor Webster on January 3, 1916, Mr. Walton was appointed acting in charge of the Division for a time, and on March 1, 1917, was appointed to leadership of the Division, serving in this position until September 1, 1923. In the autumn of 1917 there was added to the work in addition to the extensive research program already in progress, the organization and carrying out of large scale investigations of the European corn borer, recently introduced into this country. On September 1, 1923, he was appointed senior entomologist, and by that time practically all of the various projects of the Division had made substantial growth, particularly that on corn borer. Later, additional work was added that included more intensive research needed in effectively administering the ten million dollar European corn borer control campaign of 1927-28, extensive grasshopper control activities in the Central Great Plains and Rocky Mountain areas in 1932-40, and still later, there came research activities on the white-fringed beetle in certain of the Southern States. All of these made necessary from time to time additional administrative personnel, and increased greatly the load of an already steadily growing organization. On September 30, 1943, at age 70, he was retired from Government service, but thereafter was made USDA Collaborator for life. It is noteworthy that his entire period of Bureau service was spent in one Division, that of Cereal and Forage Insect Investigations. His valuable insect collection already had been presented to the U. S. National Museum some time before.

Mr. Walton's published works on entomology and related subjects from 1897 to 1947, inclusive, comprised 139 titles, and, in addition to those discussed elsewhere in this notice, they included economic treatment of a considerable number of the more outstanding insect pests of cereal and forage crops, such as European corn borer, hessian fly, greenbug, green June beetle, chinch bug and others. He was also interested in, made numerous studies of, and published articles on earthworms as pests and otherwise, and particularly on their reactions to experiments with alternating currents of electricity in the soil.

As part of his life-long love for the out-of-doors, he was an enthusiastic fisherman, and his remarkable facility in successful catches where others had failed, made him at once the envy and the despair of his associates. He likewise developed great skill in flytying and other lure making, and greatly enjoyed making and adding such material to his own and their fishing equipment.

In addition to his entomological writings elsewhere mentioned, he also contributed from time to time numerous articles on fresh-water fishing and related subjects to several outdoor periodicals, such as *The Pennsylvania Angler*, and others, under the nom de plume of "Bill Notlaw"—(the name Walton spelled backwards). Some of these were accompanied by humorous verse or by cartoons drawn by himself. These had wide circulation. He was also a zealous member of the Isaac Walton League and of the Potomac Anglers Association. For considerably more than fifty years he kept a journal in which he entered up, almost daily, data of interest to him on meteorological changes, on seasonal development of plant life, on bird migration and other phenomena in nature likely to be useful in later studies. Indicative also of the versatility of his talents and interests, mention also must be made of some of his other highly varied spare-time hobbies, such as books, pictures, music, photography, radio, television. Possessed of equal manual craftmanship in painting a picture, drawing up a house plan, repairing a time-piece, or making a radio set, or, perchance, electro copper or silver plating some long-to-be cherished small article of jewelry such as scarab beetle for a watch fob, or stick pin to be presented to a friend. It always gave him pleasure to do many and varied things like these as opportunity offered, in his studio-laboratory-workshop at home and to share them with his colleagues.

Mr. Walton's association with our Society is definitely worthy of special mention: He became a member of our organization on December 1, 1910, just two months after his arrival in Washington; he was over many years faithful in attendance at our meetings, participating actively in our deliberations, and he was our President for the two years 1920 and 1921. His first Presidential address was entitled "Entomological Drawings and Draftsmen, Their Relation to the Development of Economic Entomology," (Proc. Ent. Soc. Wash. 23(4):69-99, April 1921.) His second address, that for 1921, was entitled "The Entomology of English Poetry," (Proc. Ent. Soc. Wash. 24(7-8):159-203, Oct.-Nov. 1922.) Both of these addresses are outstanding. He later served for 16 years, 1927-42 inclusive, as our Editor! During the years following his retirement, he spent many months at irregular intervals in preparation of a comprehensive, general index as yet unpublished to the first forty volumes of our Proceedings, a task requiring prolonged toil and much patience. On the whole, our records show no other member who over the years has ever rendered anything like equal services to the progress and the welfare of our Society.

In addition to our Society, and other organizations elsewhere noted, his memberships and fellowships at various periods included also the Cosmos Club (1925-32) the American Association for the Advancement of Science, the American Association of Economic Entomologists, the Entomological Society of America, the New York Entomological Society, the Entomological Society of France, the Agricultural History Society, Biological Society of Washington, and Pi Gamma Mu. He was also a member of St. Jerome's Roman Catholic Church, Hyattsville, Md., and for several years was treasurer of the Holy Name Society, and member of the Parish Study Club.

Mr. Walton was married on June 9, 1904, to Mary Agnes Becher of Pittsburgh, Pennsylvania, who with one daughter, four sons and eleven grandchildren have survived him.

During his long professional career Mr. Walton, at various times, had under his leadership a considerable number of those who are today's foremost workers in economic entomology. And they, with his many other associates over the years, hold for his memory so much of veneration, of loyalty and of affection, that were it necessary it would be a matter of much difficulty, with them as with the present Committee, to attempt critically or impersonally to evaluate his career. However, "now he is set apart from all of us in a strange majesty: Death has touched his familiar image into historic grandeur" —into an eminence which would shame the futility of earthly praise, the emptiness of mortal eulogy. So, it becomes sufficient here merely to record that with the passing of William Randolph Walton our Society has sustained the loss of one of its most faithful and valued members and American Entomology one of its most capable and useful workers.

J. S. WADE, *Chairman*
W. A. BAKER
F. W. POOS

BOOK NOTICES

FLEAS, FLUKES AND CUCKOOS, A Study of Bird Parasites, by Miriam Rothschild and Theresa Clay. Cloth, octavo, 304 pages, 99 photographs, 4 maps, 22 line drawings, bibliography, indices of non-avian popular and scientific names, scientific names of birds, and general subject matter. A New Naturalist Special Volume published by the Philosophical Library, 15 E. 40th St., New York 16, N. Y., 1952. Price, $8.75. A fascinating account of the incredibly-large number of organisms which live intimately associated with birds, at their expense.

THE WONDERFUL WORLD OF INSECTS, by Albro Gaul. Plasticized fiber binding, octavo, 290 pages, 47 photographs, bibliography, index. Rinehart and Co., New York, 1953. Price $4.00. An extremely well-written, and factually accurate, series of short accounts of insects as parasites, our friends, or our foes.

ENTOMOLOGICAL SOCIETY OF WASHINGTON
621ST REGULAR MEETING, NOVEMBER 6, 1952

The 621st regular meeting of the Entomological Society of Washington was held in room 43 of the U. S. National Museum Thursday, November 6, 1952, attended by 38 members and 15 visitors. Acting President W. H. Anderson called the meeting to order at 8 P.M. The minutes of the previous meeting were read and approved.

The following were elected members of the Society:

Andrew Spielman, Department of Parasitology, School of Hygiene and Public Health, 615 North Wolfe Street, Baltimore 5, Maryland

Charles P. Kimball, Route 4, Box 942, Sarasota, Florida

Dr. Roland F. Hussey, Department of Biology, Florida Southern College, Lakeland, Florida

Herbert L. Dozier, Jr., U.S.F.A., Engr. Sec., A.P.O. 168, c/o Postmaster, New York, N. Y.

A letter from Professor Herbert Osborn thanking the Society for the congratulations on his 96th birthday was read by Kellie O'Neill. Professor Osborn recalled attending meetings in 1885 when C. V. Riley was president.

The death of W. R. Walton, president of the Society in 1921 and editor of the *Proceedings* from 1926 to 1943, was announced by W. H. Anderson, who appointed as obituary committee W. A. Baker, F. W. Poos and J. S. Wade, chairman.

The nominating committee, appointed by the First Vice President, D. J. Caffrey, because of the absence of President Reed from the country, consists of E. N. Cory, C. A. Weigel, and E. R. Sasscer, Chairman.

B. D. Burks read an obituary of Charles Orris Esselbaugh prepared by Dr. W. V. Balduf of the University of Illinois.

Charles Orris Esselbaugh died of a cerebral hemorrhage at Minot, South Dakota, on June 17, 1952, at the age of 54. He was born November 26, 1898, near Fostoria, Ohio, where he also received his grade and high school education. In 1918 he entered Ohio State University and, after some delay in military service, obtained his bachelor's degree in 1923. The next year he began graduate work in entomology at Ohio State, and was granted the M.S. degree in 1926. He received his Ph.D. in Entomology from the University of Illinois in 1945. In 1945-46 he was employed at the Tropical Research Station of the Shell Oil Company at Homestead, Florida. Later he worked on grasshoppers at Bozeman, Montana, and the wheat stem sawfly at Minot, South Dakota, with the U. S. Bureau of Entomology and Plant Quarantine, as well as working on a cooperative Army—U.S.D.A. project in Alaska, May-October of 1948.

His specialty was the family Pentatomidae, of which he accumulated a sizable collection. His chief publication was "Notes on the bionomics of midwestern Pentatomidae", in Entomologia Americana 28:1-73, 1948.

Dr. Burks exhibited the publication Cynipoidea (Hymenoptera) 1905-1950 by Lewis H. Weld. This book, privately published by the author, is for sale at 6613 North Washington Boulevard, Arlington 13, Virginia, for five dollars.

A. B. Gurney noted that Dr. C. P. Alexander, of the University of Massachusetts, recently was awarded the rank of Commander in the Order "Al Merito Bernardo O'Higgins" by the Chilean Government. This was in recognition of his comprehensive studies, including much on the crane flies of Chile. The award was made by the Chilean Ambassador Sept. 16, 1952, at the Embassy. As Dr. Alexander could not attend, the medal, diploma, and citation were received by Dr. Gurney for him. (Speaker's abstract.)

F. L. Campbell brought greetings from entomologists in Italy with whom he and Mrs. Campbell visited on their recent European trip.

Colored slides taken at the June picnic were shown by Helen Louise Trembley and brought forth a number of chuckles.

In the first principal paper of the evening Dr. J. C. Jones, of the National Institutes of Health, discussed the status of our knowledge concerning the morphology and physiology of insect blood cells. He pointed out that most hemocytes originate from mesodermal strips of the mesendodermal rudiment of the embryo. Post-embryonically, hemocytes are replaced, by mitosis, either directly within the hemolymph stream or from fortuitous sites of temporary accumulations within the hemocoel. No experimental proof has been presented to show that any of the so-called blood cell forming organs (lymph glands) of certain insects actually furnish new hemocytes. Amitosis apparently occurs in insect hemocytes, but is not a method of multiplication. Two groups of hemocytes always occur in insects: Basophilic cells without well developed or numerous cytoplasmic inclusions, and cells with specific inclusions. These arise from a circulating stem cell. Various other kinds of hemocytes occur in some, but not all insects. Total hemocyte counts vary enormously throughout the life span of most insects. In holometabolous insects the number of hemocytes tends to increase with development, in heterometabolous insects the number of cells increases up to pupation, then rapidly falls; the number is generally lower in the imaginal stage. Known functions of hemocytes are phagocytosis, trephocytosis, initiation of plasma coagulation, wound healing, formation of basal membrane, and possibly production of tyrosinase. One type of hemocyte may perform more than one function. (Speaker's abstract.)

Mr. Randall Latta of the Division of Stored Product Insect Investigations in the Bureau of Entomology and Plant Quarantine then described the organization of the Division and the scope of its research in his talk on some current research developments concerning stored products insects.

New developments discussed included the adaptation of an instrument to measure thermal conductivity across a gas field, for the instantaneous measurement of methyl bromide concentrations, the exploration of the value of HF radio waves and gamma rays for testing stored grain, the great effectiveness of DDT in protecting stored wool, the use of X-ray photographs for determining the degree of weevil infestation of stored wheat, and the use of aerosols in treating stored grains. (Speaker's abstract.)

Visitors introduced were Dr. Annamma Philip, Mr. T. R. Gardner, and Mr. Johannes Scheltema.

The meeting adjourned at 9:55 P.M.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON

622ND REGULAR MEETING, DECEMBER 4, 1952

The 622nd regular meeting of the Entomological Society of Washington, held in room 43 of the U. S. National Museum, Thursday, December 4, 1952, was attended by 41 members and 16 visitors. President W. D. Reed called the meeting to order at 8:00 P.M. and the minutes of the preceding meeting were read and accepted.

The Society voted to install six new members and reinstate a former member. These are:

Dr. Annamma Philip, c/o Dr. Alan Stone, U. S. National Museum, Washington 25, D. C.

Theodore R. Gardner, Bureau of Entomology and Plant Quarantine, Bldg. A, Beltsville, Md.

Joseph W. Gentry, Bureau of Entomology and Plant Quarantine, Washington 25, D. C.

Richard L. Hoffman, Clifton Forge, Virginia

Bernard A. App, Bureau of Entomology and Plant Quarantine, Bldg. C, Beltsville, Md.

S. C. Billings, Chief, Entomological Section, Insecticide Division, Production and Marketing Administration, U. S. Department of Agriculture, Washington 25, D. C.

President Reed remarked that the number of members now stands at an even 500.

The highlights of executive committee actions during 1952 were reported by President Reed. Important decisions were to continue the publication of the *Proceedings* by the Monumental Printing Company at an increase in price of approximately 15% over 1951, to publish A Manual of the Chiggers by G. W. Wharton and H. S. Fuller as Memoir No. 4, to permit the expenditure of not more than $45.00 per year by the program committee, and to donate $10.00 to the Washington Academy of Sciences for the National Science Fair. A preliminary review of the officers' reports to be given in February was given.

E. N. Cory presented the report of the nominating committee. Expressing deep regret that D. J. Caffrey had not accepted nomination for President, the committee proposed the following persons, who were elected officers for 1953:

Honorary President	C. L. Marlatt
President	W. H. Anderson
First Vice President	A. B. Gurney
Second Vice President	T. L. Bissell
Recording Secretary	Kellie O'Neill
Corresponding Secretary	Arlo M. Vance
Treasurer	E. P. Reagan
Editor	B. D. Burks
Custodian	Herbert J. Conkle

Representing Society as Vice President of
Washington Academy of Sciences .... F. W. Poos
Executive Committee .... W. D. Reed

Dr. E. G. Munroe of the Division of Entomology, Ottawa, Canada, spoke on some aspects of butterfly distribution in the West Indies. The butterfly fauna of the West Indies is depauperate as compared to that of the mainland. Absent or poorly represented groups are especially those that have sedentary habits. There are many endemic species, some relicts, others the product of autochthonous speciation. All degrees of geographic speciation exist, the unit of population-range being typically the single island. Geographic differentiation within islands exists only in *Calisto* (Satyrinae), which shows a correspondingly complex speciation-pattern. The present fauna has been derived by immigration over the following routes: (1) via Florida into Cuba, (2) via Yucatan into Cuba, (3) via the now submerged Honduras Banks into the Greater Antilles, and (4) via Trinidad into the Lesser Antilles. Routes 1 and 2 are now important but are of comparatively recent origin, route 3 was open, though not as an unbroken land-bridge, intermittently through the Tertiary and Quaternary, and route 4 has been assuming increasing importance since the later Tertiary. There are two main, West Indian faunal provinces: the Lesser Antilles with few species and little endemism and the Greater Antilles with many more species and much endemism. The Greater Antilles have distinctive faunas, those of Puerto Rico and Hispaniola being most closely related. The faunas of the Caymans and the Bahamas are of Cuban, that of the Virgin Islands of Puerto Rican, affinities. (Speaker's abstract.)

A Catalogue of the American Hesperiidae, Part 2, Pyrginae, Section 1, by Brigadier W. H. Evans, published by the British Museum, 1952; Life Histories of Japanese Butterflies, by Taro Iwase, Tokyo, 1952; and Audubon's Butterflies, Moths, and other Insects, by Alice Ford, New York and London, 1952, were exhibited by A. H. Clark. W. E. Bickley showed a Japanese Elementary Textbook on Entomology profusely illustrated with excellent drawings. Publications received from the Pan American Union Section of Science and Technology were exhibited by Kellie O'Neill and will be filed with the Custodian. These include the 1952 Guia de Instituciones y Sociedades Cientificas Latinoamericanas.

Visitors introduced were Dr. L. B. Holthuis of Leyden, Holland, Pedro Araoz of Peru, H. W. White, Forest Insects Laboratory at Beltsville, and Dr. Lewis J. Stannard, member from Illinois. The meeting adjourned at 9:55 P.M.

KELLIE O'NEILL, *Recording Secretary*

Actual publication date of vol. 55, no. 1, February 16, 1953.

THE PUBLICATION FUND

Now that Memoir No. 4 has been published, the Executive Committee of the Entomological Society of Washington wishes to call attention to the Publication Fund of the Society. Our Constitution, as amended in November 1950, states,

"The Society shall maintain a separate fund to be known as the Publication Fund which shall be derived from bequests and gifts, from the sale of complete sets of the periodical published by the Society, from the fees of life and sustaining members, and from the sum of fifty cents from the annual dues of each member. Only derived interest may be used for the Society's publication. At the discretion of the Executive Committee any unrestricted portion of the publication fund may be borrowed for publishing articles other than the regular periodical, such sums to be returned to the fund within five years."

The Publication Fund was started by a bequest of $1,400 by the late Frederick Knab in 1918. In 1927 a donation of $1,000 by the late E. A. Schwarz was added to it. During the more than 20 years since, no bequests or gifts have been added to this fund. The Executive Committee wishes to invite the attention of members and friends of the Society to the fact that this comparatively modest fund (very modest when present printing costs are considered) has made possible the publication of four Memoirs. It is hoped that interest can be aroused in obtaining additional funds for the publication of Memoirs by the Society. *Further contributions of any amount will be welcome.* At present the publication of each additional Memoir is mainly dependent upon funds derived from the sales of those already published.

Congress has recently raised the limitation on contributions to religious, charitable, or educational institutions from fifteen to twenty percent of gross income that may be deducted in computing Federal income taxes. The form printed below is suggested for the use of those who desire to leave the Society any personal property, such as money, stocks, bonds, works of art, or other objects of value.

FORM OF BEQUEST

Know All Men by These Presents, That I ________________,

of the city of ________________, county of ________________,

and state of ________________, do hereby give, grant, and convey unto The Entomological Society of Washington, at Washington, in the District of Columbia, an organization to promote the study of entomology

in all of its bearings, the sum of ________________ dollars ($________) to have and to hold the same unto itself and its successors forever for the promotion of the purposes thereof.

(Place and date)

WITNESSES: [SEAL]

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VOL. 55 JUNE 1953 No. 3

PROCEEDINGS

of the

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

PUBLISHED BIMONTHLY BEGINNING WITH FEBRUARY

BY THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

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KILL DEVIL HILLS WASPS, 1952

(HYMENOPTERA, ACULEATA)

BY KARL V. KROMBEIN, *Arlington, Va.*

In two earlier papers (Krombein, 1950 and 1953) I presented lists of the wasps collected at Kill Devil Hills, North Carolina during the periods May 23-June 5, 1948 and June 25-July 22, 1950.[1] These lists were supplemented by indications of the habitat preferences, inclusive dates of capture, flower or foliage preferences, taxonomic discussions of certain species, and prey records and nesting behavior for some of the species. A brief description of the habitats collected and vegetational characteristics of this coastal area on the Outer Banks of North Carolina were also presented in the earlier papers.

The purpose of the present contribution is to record similar data for two collecting trips made to Kill Devil Hills in 1952, May 23-26 with J. G. Franclemont and R. H. Arnett, Jr., and July 27-August 5 with my family.

It is of some interest to compare the number of species of wasps obtained during each of these trips. The first visit, May 23-June 5, 1948, yielded a total of 88 species. Collections from June 25-July 22, 1950 gave a total of 150 species. Making allowances for duplication of species in these two earlier years, the list of wasps known from this area at the end of 1950 stood at 166 species. The collections made during May 23-26, 1952 amounted to only 59 species, not too poor a representation as compared with the 1948 list considering the much shorter collecting time. The later 1952 visit, July 27-August 5, resulted in the capture of only 107 species, a substantially poorer representation than for the period June 27-July 22, 1950. The shorter collecting time does not seem to me an entirely plausible explanation for this paucity of species. I would guess that two other factors were possibly involved—first, the extreme drought conditions which prevailed during June and July of 1952 may have reduced populations of some

[1]The field work during 1950 was supported by a grant-in-aid from the American Philosophical Society.

soil-nesting species which might have more exacting soil moisture requirements than other species with similar nesting habits, and second, the mid-summer visit of 1952 might have been enough later in the season than that of 1950 so that some of the species were not represented because they were in the period before emergence of the second brood. Despite the smaller number of species taken in 1952 (a total of 126 allowing for duplication of species), a number of them were collected at Kill Devil Hills for the first time this year and these are listed below. An asterisk preceding the name indicates a species not recorded from North Carolina in the State List (Brimley, 1938) or either supplement (Brimley, 1942 and Wray, 1950).

Family **TIPHIIDAE**

Tiphia intermedia Malloch
Tiphia sp. #1
Tiphia sp. #2

Family **MUTILLIDAE**

Timulla rufosignata (Bradley)
**Ephuta b. battlei* Bradley
Ephuta sp. #1

Family **SCOLIIDAE**

Scolia bicincta Fabricius
Campsomeris quadrinotata (Fabricius)

Family **VESPIDAE**

Vespula maculifrons (Buysson)
Vespula maculata (Linnaeus)
**Polistes e. exclamans* Viereck
Stenodynerus p. perennis (Saussure)

Family **POMPILIDAE**

**Ageniella partita* Banks
Sericopompilus neotropicalis (Cameron)
**Anoplius americanus trifasciatus* (Beauvois)

Family **SPHECIDAE**

Tachytes aurulentus (Fabricius)
Philanthus gibbosus (Fabricius)
Philanthus ventilabris Fabricius
Cerceris flavofasciata H. S. Smith

The number of species listed from Kill Devil Hills in the Scolioidea, Vespidae, Pompilidae and Sphecidae now stands at 183 (*Timulla rufosignata* and *Anoplius americanus trifasciatus*, newly recorded in the above additions, were recorded previously under other names).

The species are listed systematically below in the order in which they are treated in the recently published synoptic catalog of North American Hymenoptera (Muesebeck, Krombein, Townes, *et al.*, 1951). The assistance of the following specialists is gratefully acknowledged for making identifications of the prey and inquilines collected in 1952: W. H. Anderson (Chrysomelidae), H. W. Capps (Lepidoptera), A. B. Gurney (Orthoptera), B. J. Kaston, (Araneae), C. W. Sabrosky (Diptera), and R. E. Warner (Curculionidae).

Biological Observations

Family VESPIDAE

Stenodynerus (Stenodynerus) lineatifrons R. M. Bohart

A female (72852 A) was captured at 8:10 a.m.[2] on July 28th on the barrens climbing over live oak foliage with a small (6.6 mm.), bright orange caterpillar in her mandibles. The prey, a last or penultimate instar tortricid larva, *Rhyacionia* sp. probably *frustrana* (Comstock), was capable of very weak reflex actions that evening.

While this species is moderately common on the barrens, I have not been able to discover its nesting site. It occurs so frequently on the stunted live and blackjack oaks that I have suspected it of nesting in empty twig galls on these bushes, but examination of several score of these galls has failed to produce any *Stenodynerus* cells. The possibility that this species does nest in live oak is strengthened by the fact that the specimen reported above on live oak foliage was carrying a caterpillar belonging to a genus composed entirely of pine needle feeders.

Family POMPILIDAE

Sericopompilus apicalis (Say)

A recently emerged female (8452 A) was captured on the barrens at 10:46 a.m. on August 4th as she flew into a stunted live oak bush with a small paralyzed spider in her mandibles. The spider, a female anyphaenid, *Aysha gracilis* (Hentz), was still completely paralyzed that evening.

Episyron biguttatus biguttatus (Fabricius)

A female (52652 A) was taken on the barrens at 9 a.m. on May 26th climbing over bayberry foliage 30 inches above the ground with a paralyzed, penultimate instar female epeirid, *Neoscona* sp. The spider was still thoroughly paralyzed that evening, and its legs were capable of only weak reflex actions.

A second recently emerged female (72952 A) was excavating an oblique burrow beneath a layer of pine needles in the woods at 3:30 p.m. on July 29th. Her paralyzed prey, a penultimate instar female epeirid, *Neoscona benjamina* (Walckenaer), was lying on the pine needles two inches from the burrow entrance. The wasp finished digging the burrow in two minutes and pulled in the spider. She reappeared at the entrance half a minute later and began to rake in dry sand to fill

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[2] All times given are Eastern Standard Time.

the burrow. She was captured before the burrow was completely filled in. The burrow penetrated the ground at an angle of 45° to the horizontal and ended in a cell in dry sand an inch and a half below the surface. The wasp egg had been laid on the lower left side of the abdomen anteriorly. The spider was thoroughly paralyzed that evening. The wasp egg hatched on July 31st, but the tiny larva was dead on the following evening.

The last female (8352 B), also a recently emerged specimen, was excavating her burrow in sand in a rut on the woods road at 2:25 p.m. on August 3rd. Her paralyzed spider, a male *Neoscona benjamina* (Walckenaer), was lying on the sand 18 inches from the burrow entrance. The wasp completed the burrow in a few minutes and had dragged the spider almost to the entrance, when a passing car destroyed the burrow. The wasp and spider were then captured. The spider appeared to be dead that evening, perhaps from having been stung too severely.

Episyron posterus (Fox)

A female (52452 B) was taken at 4:30 p.m. on May 24th along the edge of a road through a patch of open woods. She was dragging a paralyzed, adult female epeirid spider, *Eustala anastera* (Walckenaer). That evening the spider was completely paralyzed and showed no reflex actions.

Episyron snowi (Viereck)

A worn female (73152 A) was found digging a burrow on the barrens at 8:41 a.m. on July 31st. The burrow penetrated the sand in a westerly direction at an angle of 45° to the horizontal. After five minutes more of excavating the wasp visited her paralyzed prey, a mottled gray spider, which she had cached nine inches above the ground in a grass tuft located six inches from the burrow entrance. She returned to her excavating immediately and worked at it till 9 a.m. Then she flew to the spider, pulled it out of the grass tuft and jumped to the ground with it. She dragged the spider to within a couple inches of the burrow and left it lying on the sand while she went into the burrow. She emerged in a moment, grasped the spider near the tip of its abdomen with her mandibles, and backed into the burrow with it. The wasp was captured as she came to the surface a minute later to begin filling in the burrow, but I was unable to recover the spider from the dry shifting sand.

Anoplius (Lophopompilus) cleora (Banks)

A female (52652 C) was taken on the barrens by R. H. Arnett, Jr., at 8:30 a.m. on May 26th while she was dragging a paralyzed, adult male lycosid spider, *Arctosa littoralis* (Hentz), over the surface of the sand.

Anoplius (Arachnophroctonus) marginalis (Banks)

A female (52652 B) was first observed at 9:40 a.m. on May 26th on the barrens hunting for a spider. Her hunting was done mainly on foot with occasional short flights of several feet to unexplored areas. At 9:50 she found a spider burrow and rushed inside. I could observe some struggle going on in the depths of the burrow, but neither combatant ever came above ground. In a few seconds the wasp pushed up a plug of damp sand to the entrance with her abdomen and hind legs. The wasp did not reappear in several minutes. Since my visit to this area had to be terminated shortly, I excavated the burrow at 9:55. An open cyanide bottle was upturned over the entrance to the burrow, and I dug a trench nine inches deep and several inches from the burrow. By undercutting the side gradually I was able to uncover the paralyzed spider at the bottom of her perpendicular burrow at a depth of seven inches. The wasp was captured as she emerged into my excavation after I had removed the spider from the burrow. The spider, a juvenile female lycosid, *Geolycosa pikei* (Marx), did not bear a wasp egg.

Anoplius (Arachnophroctonus) semirufus (Cresson)

A worn female (8452 E) was captured just as she finished excavating a burrow on the barrens at 4:15 p.m. on August 4th. Her paralyzed prey, a juvenile lycosid spider, *Lycosa punctulata* Hentz, was lying on the sand an inch from the burrow entrance. It had completely recovered from its paralysis by 4:45 p.m.

Anoplius (Pompilinus) cylindricus (Cresson)

A recently emerged female (73052 A) was hunting for a spider on the barrens at 9:42 a.m. on July 30th. She seemed most interested in the burrowing species, for she entered several small holes. A recently emerged male attempted to mate during her search, but she showed no interest in him. At 9:55 she entered a small burrow with a diameter of an eighth of an inch and remained inside for three minutes. After emerging she again began to search and was captured after a few minutes. The burrow in which she remained for three minutes was excavated and was found to be perpendicular, four inches deep, and to contain the dry cephalothorax of a lycosid spider, probably a young *Geolycosa* sp.

Anoplius (Pompilinus) krombeini Evans

This was quite a common species over most of the barrens in late May, 1948, when a series of 20 females and 16 males was captured. There were relatively frequent rains during that period in 1948 and standing water in small depressions on the barrens. In 1950, when I collected in mid-summer, I captured only two females. In 1952 there was a long dry spell during June and July and the water level was very low. This species was found in only one habitat in 1952, the narrow sandy margins of Fresh Pond on the barrens where the sand was saturated with water. Several females were captured as they hunted for spiders among the sparse, short grass tufts, but nesting observations were made on only one individual. This worn female (8152 A) was captured just as she was sealing her burrow at 10 a.m. on August 1st. The paralyzed, penultimate instar lycosid spider, *Schizocosa* sp., was in a circular cell at the end of a perpendicular burrow an inch deep. The wasp egg was on the right side of the spider's abdomen and was very loosely attached, for it came off when the spider was placed in a tin of damp sand. The spider had fully recovered from the paralysis that evening.

Family SPHECIDAE

Sphex procerus (Dahlbom)

A female (73052 B) was finishing the excavation of a burrow in sandy soil in the woods at 12:30 p.m. on July 30th. She placed a few chips of wood in the burrow about half an inch below the surface to form a plug, but did not fill in above this with sand or make any attempt at camouflaging the burrow entrance, both of which are normal activities for this species. I revisited this site two and a half hours later and found that the burrow had now been stocked with prey, for it was entirely filled with sand. Upon excavation the burrow was found to penetrate the ground in an easterly direction at an angle of 30° to the horizontal and to end in a cell an inch and a quarter below the surface. The prey, a last or penultimate instar notodontid caterpillar, *Nadata gibbosa* (Abbot), bore the wasp egg on the left side of the second abdominal segment bearing prolegs. The caterpillar was paralyzed, but capable of very weak reflex movements and of voiding excrement. It was infested with miltogrammine maggots, and the development of these is discussed on a later page in this paper.

A second, somewhat worn female (8352 A), possibly the same individual reported on above for the two burrows were only 25 feet apart, was observed in the woods at 2 p.m. on August 3rd as she began to fill in her burrow. She was captured as she hunted for wood chips or other debris to form the plug in the bottom of the burrow. A notodontid caterpillar, a last or penultimate instar *Nadata gibbosa* (Abbot), was in a horizontal cell an inch and a half below the surface at the end of an almost perpendicular burrow. The wasp egg was attached near the spiracle on the right side of the second abdominal segment bearing prolegs. The egg had not hatched by the evening of August 4th and the caterpillar had voided three pellets of frass. The egg had hatched by the evening of the 5th and the larva was "nursing" on the caterpillar's blood. The caterpillar with attached wasp larva was preserved in alcohol at this time.

Cerceris bicornuta bicornuta Guérin

A worn female (8252 A) was excavating a burrow on the barrens at 9:28 a.m. on August 2nd. The excavation was being made on a 45° slope. The wasp pushed up sand with her abdomen and firmed it against the sides of the burrow. A fresh, paralyzed weevil was lying among some lumps of sand she had removed from the burrow. After capturing the wasp I excavated the burrow which penetrated the sand at an angle of 75° to the slope. A second large, fresh, paralyzed weevil was found in the burrow at about two inches from the surface, and a third smaller one at the bottom of the burrow at about four inches from the surface. I carried the excavation to a depth of 15 inches, but found no additional weevils. The paralyzed weevils were identified as a male *Calendra venata vestita* (Chittenden), and a pair of *Calendra cariosa* (Olivier).

Cerceris robertsonii Fox

In a previous paper (Krombein, 1953) I recorded at some length the observations made from June 26th to July 21st, 1950, on the nesting activities of a colony of this species located on a spur of the woods road. The site of this colony, herein designated as Colony I, was visited several times during the period May 23-25, 1952, but no specimens of *Cerceris* were seen, nor was there any evidence of recent burrowing activities.

However, another colony of this species, herein designated as Colony II, was located on May 24 1952, a mile or so distant from Colony I. It was several hundred feet from the edge of the fresh water pond on the barrens in a sandy area bearing only scattered tufts of grass and adjacent to a rather extensive patch of open to dense woods. The site of Colony II was exposed to the sun all day long, and this may be the explanation of why the nesting activities were already in progress here, while no such activities were to be seen at Colony I which is in a much more shaded locality.

Males of Colony II were flying in great numbers about the foliage of a stunted blackjack oak and several sweet gum trees located only a few feet from the burrows of the nesting females. Sixteen males were captured in five minutes at 7:30 a.m. on May 26th flying around one of the sweet gums. Apparently mating had already taken place, for no mating pairs were seen, nor did any of the numerous males attempt to mate with any of the females nesting nearby. No males were observed around Colony I in 1950, and only nine specimens of that sex were collected elsewhere in the period June 25-July 22, 1950.

The nesting site of Colony II covered an area approximately 10 by 25 feet, and apparently about a dozen females had burrows there in the period May 24-26. Four females were collected while flying over the nesting site with adult chrysomelid beetles, two of them each with a male cryptocephaline, *Cryptocephalus notatus* Fabricius, and two of them each with a female pachybrachine, *Pachybrachis dilatatus* Suffrian.[3] Additional specimens of these beetles were recovered from burrows of Cerceris A and B, two of the females which had been captured flying with beetles. The prey preference of the wasps of Colony II were

[3] This beetle has not been recorded previously from north of Georgia according to Dr. Anderson.

significantly different from those of Colony I. Wasps of the latter colony provisioned their cells with bronze colored, adult chrysomelid beetles, *Rhabdopterus picipes* (Olivier), the cranberry rootworm. Additional observations on Colony II later in the season are needed to determine whether the differences in prey selection are occasioned by possible later emergence of *Rhabdopterus* than of *Pachybrachis* and *Cryptocephalus*, or whether beetles of the latter two genera are used by Colony II because small black beetles with orange spots constitute the ancestral prey of that particular colony or are more abundant in that area than those of *Rhapdopterus*.

Provisioning of the burrows took place over a longer period of the day in Colony II than in Colony I. Females in Colony II were observed, or captured, bringing in beetles at the following hours over the three-day period—8:15 and 10:00 a.m., 2:37, 2:41, 3:09, 3:15 and 3:18 p.m. Provisioning of the cells in Colony I was not observed earlier than 11 a.m. Only a few flights of members of Colony II were timed: Wasp A emerged from her burrow at 2:32 p.m. on May 24th and returned at 2:37 with a beetle; she emerged again at 3 p.m. and returned with a beetle at 3:09; wasp B brought in a beetle at 2:41 p.m. on May 25th, left the burrow at 2:45, and returned with another beetle at 3:15. The females in Colony II were as prone as those in Colony I to plug the burrow entrance with sand after they had brought in a beetle, and also left the burrow entrances open after emerging for another provisioning flight.

Wasp A was captured as she returned with a male *Cryptocephalus* at 3:09 p.m. on May 24th. Her burrow was three-eighths of an inch in diameter, perpendicular to the ground surface and was open to a depth of five inches. One partly paralyzed female *Cryptocephalus* was found at this depth. No additional beetles were discovered although the excavation was carried to a depth of 12 inches and a diameter of 15 inches. I made an error in not carrying this excavation to a depth of 18 inches, for additional beetles might have been found in the 12-18 inch level. The beetle found at the bottom of the burrow could wiggle its legs and antennae, but was not able to walk.

I started to excavate the burrow of wasp B at 8:05 a.m. on May 26th. This burrow entered the ground at an angle of 45° and was open to a depth of six inches. The wasp was captured when she returned at 8:15 with a paraylzed female *Pachybrachis*. This excavation was carried to a depth of 18 inches and a diameter of 12 inches. Only one cell was found, and it was at the 16 inch level at the end of an open burrow six inches long which was at an angle of 90° to the first section. There was no evidence of a connection between these two sections of open burrow, but I believe that the cell must have belonged to wasp B, for I saw her bring in three beetles on May 24th and 25th, and no other females were nesting closer than 18 inches to her burrow. This single cell contained five beetles, all freshly paraylzed, but no wasp egg was found, and the cell was undoubtedly only partially stocked. There were two female *Cryptocephalus* and two female and one male *Pachybrachis*. While several specimens of both sexes were collected during the period July 28-August 5, 1952, on other parts of the barrens, no nesting activities were taking place at the sites of Colonies I and II, nor was I able to find any additional colonies. A test digging 18 inches in diameter and 18 inches deep was made at the site of Colony I on July 30th, but I found no *Cerceris* cells. I had planned to make additional similar diggings on the sites of Colonies I and II but our premature departure nullified such plans.

Wasp Visitors on Flowers and Foliage

In an earlier paper (Krombein, 1953) I presented lists of the wasps visiting foliage of *Quercus marilandica* Muench. (blackjack oak), *Q. virginiana* Mill. (live oak), *Pinus serotina* Michx. (pond pine), *Liquidambar Styraciflua* L. (sweet gum), and flowers of Virginia creeper, *Monarda punctata* L. (horse mint) and *Cephalanthus occidentalis* L. (button bush). Most of these plants were again attractive during one or both of the 1952 visits, though Virginia creeper was not in bloom during either visit, and only a few scattered bushes of *Cephalanthus* were still in bloom during late July. Sweet gum foliage was attractive in 1952 only during the earlier visit, and pond pine was nowhere nearly so attractive as during 1950. Blackjack oak foliage was more attractive than live oak foliage during the earlier visit in 1952, but the reverse was true during the later trip. A species of *Pluchea* growing on the narrow margins of Fresh Pond on the barrens was attractive to a certain number of species in 1952—I had not collected on it in previous years. I have listed below under the appropriate headings the species or sexes of species captured at certain foliage or flowers during 1952 which were not reported for these plants during 1950.

Visiting Foliage of Pinus serotina

Family **MUTILLIDAE**

♂ *Dasymutilla mutata*	♀ *Timulla ferrugata*

Family **SPHECIDAE**

♂ *Tachytes parvus*	♀ *Ammatomus moneduloides*

Visiting Foliage of Quercus marilandica

Family **TIPHIIDAE**

♀ ♂ *Tiphia conformis*	♂ *Tiphia* sp. # 1
♀ *Tiphia floridana*	♀ *Myzinum dubiosum*

Family **MUTILLIDAE**

♂ *Dasymutilla mutata*
♂ *Dasymutilla nigripes*
♂ *Dasymutilla v. vesta*

Family **VESPIDAE**

♂ *Rygchium molestum*
♀ ♂ *Stenodynerus* n. sp.
♀ *Stenodynerus p. pedestris*

Family **POMPILIDAE**

♂ *Ageniella faceta*
♀ *Sericopompilus neotropicalis*
♀ *Episyron posterus*
♀ ♂ *Anoplius bengtssoni*
♂ *Anoplius marginalis*
♂ *Anoplius relativus*
♀ *Aporinellus fasciatus*
♂ *Aporinellus t. taeniatus*

Family **SPHECIDAE**

♂ *Tachytes parvus*
♂ *Tachysphex similis*
♂ *Sceliphron caementarium*
♂ *Chalybion californicum*
♂ *Psammaecius nebulosus*
♂ *Cerceris blakei*
♂ *Cerceris robertsonii*
♀ ♂ *Crabro aequalis*
♀ *Crabro hilaris*
♂ *Ectemnius 10-maculatus 10-maculatus*
♂ *Ectemnius scaber*
♀ *Lestica producticollis*

VISITING FOLIAGE OF QUERCUS VIRGINIANA

Family **TIPHIIDAE**

♀ ♂ *Tiphia conformis*
♀ ♂ *Tiphia dryophila*
♀ ♂ *Tiphia floridana*
♂ *Tiphia intermedia*
♂ *Tiphia* sp. # 1
♀ *Tiphia* sp. # 2

Family **MUTILLIDAE**

♂ *Dasymutilla mutata*
♂ *Dasymutilla nigripes*
♂ *Timulla ferrugata*
♂ *Timulla rufosignata*
♂ *Ephuta b. battlei*

Family **VESPIDAE**

♂ *Polistes annularis*
♀ *Polistes f. fuscatus*
♀ *Polistes h. hunteri*
♀ *Rygchium molestum*
♀ ♂ *Stenodynerus ammonia histrionalis*
♀ *Stenodynerus lineatifrons*
♂ *Stenodynerus* n. sp.
♀ ♂ *Stenodynerus f. fulvipes*
♀ *Stenodynerus p. pedestris*

Family **POMPILIDAE**

♀ ♂ *Evagetes* n. sp.
♀ ♂ *Sericopompilus apicalis*
♀ *Episyron posterus*
♀ *Tachypompilus f. ferrugineus*
♀ *Anoplius amethystinus atramentarius*
♀ ♂ *Anoplius apiculatus pretiosus*
♂ *Anoplius marginalis*
♀ ♂ *Anoplius relativus*
♂ *Anoplius cylindricus*
♂ *Anoplius splendens*
♀ *Aporinellus fasciatus*

Family SPHECIDAE

♂ ♀ *Miscophus americanus*
♂ *Tachytes pepticus*
♂ *Tachytes parvus*
♂ *Tachytes mergus*
♀ *Tachysphex terminatus*
♂ *Chlorion pubidorsum*
♂ *Sphex procerus*
♂ *Sceliphron caementarium*
♀ ♂ *Chalybion californicum*
♀ ♂ *Nysson opulentus*
♂ *Zanysson fuscipes*
♂ *Sphecius speciosus*
♀ ♂ *Psammaecius denticulatus*
♀ ♂ *Psammaecius nebulosus*
♂ *Microbembex monodonta*
♂ *Cerceris b. bicornuta*
♀ *Cerceris blakei*
♂ *Cerceris flavofasciata*
♀ ♂ *Cerceris robertsonii*
♂ *Crabro hilaris*
♂ *Oxybelus emarginatus*

Visiting Foliage of Liquidambar Styraciflua

Family TIPHIIDAE

♂ *Tiphia dryophila*

Family MUTILLIDAE

♂ *Dasymutilla mutata*

Family SCOLIIDAE

♂ *Campsomeris plumipes fossulana*

Family VESPIDAE

♀ *Vespula maculifrons*
♀ *Polistes e. exclamans*
♀ *Polistes metricus*
♂ *Monobia quadridens*
♂ *Rygchium megaera*
♂ *Rygchium molestum*
♂ *Ancistrocerus campestris*

Family POMPILIDAE

♂ *Anoplius bengtssoni*
♀ *Anoplius marginatus*

Family SPHECIDAE

♀ *Motes argentata*
♂ *Cerceris robertsonii*
♂ *Crabro argus*
♂ *Lestica producticollis*

Visiting Flowers of Monarda punctata

Family SCOLIIDAE

♂ *Scolia bicincta*

Family VESPIDAE

♀ ♂ *Leptochilus tylocephalus monotylus*

Family SPHECIDAE

♂ *Bicyrtes quadrifasciata*

Visiting Flowers of Cephalanthus occidentalis

Family VESPIDAE

♂ *Zethus spinipes variegatus*
♂ *Monobia quadridens*

Family **SPHECIDAE**

♂ *Chlorion aztecum*

VISITING FLOWERS OF PLUCHEA SP.

Family **TIPHIIDAE**

♀ *Myzinum c. carolinianum*

♂ *Myzinum dubiosum*

Family **SCOLIIDAE**

♂ *Campsomeris plumipes fossulana*

Family **VESPIDAE**

♀ ♂ *Rygchium molestum*

♀ *Stenodynerus f. fulvipes*

♀ *Stenodynerus histrio*

Family **SPHECIDAE**

♂ *Tachytes aurulentus*

♂ *Tachytes pepticus*

♂ *Chlorion pennsylvanicum*

♂ *Chlorion aztecum*

♂ *Chlorion cinereum*

♀ ♂ *Chlorion pubidorsum*

♂ *Sphex procerus*

♂ *Philanthus gibbosus*

♀ ♂ *Philanthus ventilabris*

♂ *Cerceris b. bicornuta*

♀ ♂ *Cerceris flavofasciata*

In addition to the foliage and flowers listed above another type of vegetation proved to be very attractive to a great variety and number of wasps on August 3rd and 4th. This was a kind of grass growing rather sparsely in one area of the barrens. Many wasps were attracted to it and were climbing up and down the stems. The abrupt termination of my stay at Kill Devil Hills made it impossible to search for the reasons for the attractiveness of this grass further, but I did catalog the following visitors to it on August 3rd and 4th.

Family **TIPHIIDAE**

♀ ♂ *Tiphia conformis*

♀ ♂ *Tiphia floridana*

♂ *Tiphia transversa*

♂ *Tiphia* sp. # 1.

♀ *Myzinum dubiosum*

Family **MUTILLIDAE**

♀ *Dasymutilla lepeletierii*

♂ *Dasymutilla mutata*

♂ *Dasymutilla nigripes*

♂ *Timulla d. dubitata*

♂ *Timulla ferrugata*

♂ *Timulla rufosignata*

♂ *Ephuta b. battlei*

Family **VESPIDAE**

♀ *Rygchium megaera*

♀ *Stenodynerus a. ammonia*

♀ *Stenodynerus lineatifrons*

♀ *Stenodynerus f. fulvipes*

♀ *Stenodynerus histrio*

Family **POMPILIDAE**

♀ ♂ *Evagetes* n. sp.
♂ *Sericopompilus apicalis*
♀ *Sericopompilus neotropicalis*
♂ *Episyron b. biguttatus*
♀ *Episyron posteurus*
♂ *Anoplius amethystinus atramentarius*
♀ *Anoplius semirufus*
♀ *Anoplius cylindricus*
♀ *Anoplius splendens*
♀ *Aporinellus fasciatus*

Family **SPHECIDAE**

♀ *Miscophus americanus*
♂ *Tachytes pepticus*
♂ *Tachytes parvus*
♀ *Tachytes mergus*
♀ *Motes argentata*
♂ *Chlorion daggyi*
♂ *Zanysson fuscipes*
♂ *Psammaecius denticulatus*
♀ *Bembix carolina*
♂ *Cerceris b. bicornuta*
♂ *Cerceris blakei*
♀ *Cerceris robertsonii*
♂ ♀ *Oxybelus emarginatus*

MILTOGRAMMINE INQUILINES OF THE SOLITARY WASPS

Collections were made again in 1952 of the miltogrammine inquilines (Diptera, Sarcophagidae) of solitary wasps. To the seven species listed earlier (Krombein, 1953) from Kill Devil Hills there may now be added the following species:

Pachyophthalma floridensis Townsend
Senotainia trilineata (van der Wulp)
Metopia inermis Allen
Metopia lateralis (Macquart)

The species recorded as *Metopia* n. sp. (Krombein, 1953, p. 300) has been described recently as *Metopia krombeini* Sabrosky.

In that paper I cited evidence to show that in certain of the Miltogrammini the maggots deposited by the females actively search out and destroy the wasp egg before proceeding to feed on the paralyzed prey stored for the wasp larva. Most American workers as summarized in Allen (1926) had supposed that the death of the hymenopterous larva occurred because of the rapid decomposition of the prey stored for it due to the feeding activities of the miltogrammine maggots.

This year I was able to rear the miltogrammines which had been deposited on one lepidopterous larva stored by *Sphex procerus* (Dahlbom) (73052 B). I had marked the unstocked burrow of this wasp when she finished excavating it in sandy soil in the woods at 12:30 p.m. on July 30th. This burrow had been stocked with a paralyzed, last or penultimate instar notodontid caterpillar, *Nadata gibbosa* (Abbot), by 3 p.m. that same day.

The wasp egg was on the left side of the second abdominal segment bearing prolegs and several miltogrammine maggots were on the caterpillar near the attachment of the wasp egg when I dug up the caterpillar. That evening the wasp egg was shriveled up and nine maggots were clustered around the site of the egg. The maggots were still feeding on the surface of the caterpillar on the following evening, July 31st, apparently on blood exuding from punctures made by the mouthhooks of the maggots. The caterpillar was still alive that evening and could wiggle its palpi feebly—the maggots were larger than on the preceding evening and pale green in color.

The caterpillar was dead on the next night, August 1st, and the maggots continued to feed mostly inside the caterpillar until noon on August 3rd. By that evening they had pupated. Two weeks later, on August 17th, the adult flies emerged, eight female and one male *Metopia lateralis* (Macquart).

Taxonomic Observations

Family TIPHIIDAE

Tiphia conformis Malloch. 9 ♀♀, 30 ♂♂, July 28-August 5; the majority of specimens on barrens; 2 ♀♀, 3 ♂♂ on *Q. virginiana*, 2 ♀♀, 12 ♂♂ on *Q. marilandica*, and 2 ♂♂ on *Liquidambar;* most of the specimens had apparently emerged recently.

Tiphia convexa Allen. 3 ♀♀, 16 ♂♂, May 23-25; in woods; freshly emerged.

Tiphia dryophila Krombein. 2 ♂♂, May 24 and 25; 1 ♀, 6 ♂♂, July 28-August 2; on barrens; 1 ♀, 2 ♂♂ on *Q. virginiana;* 2 ♂♂ on *Q. marilandica*, and 1 ♂ on *Liquidambar;* the May specimens and all but one of the July-August specimens appeared to have recently emerged.

Tiphia egregia Viereck. 1 ♂, May 24; on barrens on *Liquidambar;* recently emerged.

Tiphia floridana Robertson. 12 ♀♀, 24 ♂♂, July 28-August 5; all on barrens except 1 ♀ in woods; 5 ♀♀, 3 ♂♂ on *Q. virginiana*, and 4 ♀♀, 16 ♂♂ on *Q. marilandica;* most of the specimens were unworn.

Tiphia intermedia Malloch. 3 ♂♂, August 1 and 2; on barrens on *Q. virginiana;* unworn.

Tiphia transversa Say. 4 ♂♂, August 3 and 4; on barrens; unworn.

Tiphia waldenii Viereck. 1 ♂, July 28; on barrens; unworn.

Tiphia sp. #1. 5 ♂♂, July 31-August 4; on barrens; one on *Q. virginiana* and one on *Q. marilandica;* apparently recently emerged.

Tiphia sp. #2. 1 ♀, July 28; on barrens on *Q. virginiana;* unworn. This and the preceding species, which are not conspecific, apparently represent undescribed species. Descriptions are withheld in the hope that additional material, including the opposite sexes, will be obtained in subsequent years.

Paratiphia algonquina Viereck. 1 ♂, May 25; 1 ♀, July 30; on barrens; the female on *Q. virginiana;* male recently emerged, and female badly worn.

Myzinum c. carolinianum (Panzer). 3 ♀♀, 4 ♂♂, July 29-August 3; on barrens; 1 ♂ on *Pinus,* and 1 ♀ on *Pluchea;* half the series worn; not all specimens seen were collected.

Myzinum dubiosum Cresson. 6 ♀♀, 6 ♂♂, July 29-August 4; on barrens; most of series unworn; 1 ♂ on *Q. virginiana,* 1 ♀, 2 ♂♂ on *Q. marilandica,* 1 ♂ on *Pinus,* and 1 ♂ on *Pluchea.*

Myzinum maculatum (Fabricius). 1 ♀, August 3; on barrens; worn.

Family MUTILLIDAE

Pseudomethoca sanbornii aeetis (Fox). 6 ♀♀, May 24 and 25; 1 ♀, 13 ♂♂, July 28-August 4; all on barrens except one male in woods; 1 ♂ on *Q. marilandica,* and 5 ♂♂ on *Q. virginiana;* fresh and worn specimens occurred together during both periods.

One male has more ferruginous on the thorax than the most extensively red individual recorded earlier (Krombein, 1953). In this specimen the mesonotum, scutellum and dorsum of propodeum are entirely red except for the margins, as well as the pronotum.

Pseudomethoca frigida (Smith). 1 ♀, May 23; in woods; mandibles worn.

Dasymutilla interrupta Banks. 1 ♀, 17 ♂♂, July 28-August 3; almost all in woods; 1 ♂ on *Q. marilandica;* almost all unworn.

Dasymutilla lepeletierii (Fox). 9 ♀♀, 1 ♂, July 28-August 5; both in woods and on barrens; most specimens showed some wear.

Dasymutilla mutata (Blake). 1 ♀, May 23; 8 ♀♀, 50 ♂♂, July 28-August 5; the majority of specimens in woods; 1 ♂ on *Pinus,* 1 ♂ on *Liquidambar,* 3 ♂♂ on *Q. virginiana,* and 1 ♂ on *Q. marilandica;* most specimens showed a little wear.

Dasymutilla nigripes (Fabricius). 4 ♀♀, 14 ♂♂, July 28-August 4; most specimens on barrens; 3 ♂♂ on *Q. marilandica,* and 1 ♂ on *Q. virginiana;* three of the females showed wear.

Dasymutilla o. occidentalis (Linnaeus). 2 ♀♀, July 28 and 30; on barrens and in woods; both slightly worn.

Dasymutilla v. vesta (Cresson). 1 ♀, 6 ♂♂, July 28-August 3; on barrens and in woods; 3 ♂♂ on *Q. marilandica;* most specimens showed wear.

Timulla (Timulla) d. dubitata (Smith). 1 ♀, May 23; 3 ♀♀, 4 ♂♂, July 30-August 5; two males on barrens, the others in woods; 1 ♂ on *Q. marilandica;* all specimens fresh.

Several of the males are transitional toward *T.* (*T.*) *dubitata fugitiva* Mickel in that the thorax and first tergite are more infuscated than normal for typical *dubitata.*

Timulla (Timulla) ferrugata (Fabricius). 1 ♀, May 26; 4 ♀♀, 13 ♂♂, July 31-August 5; the early specimen in woods, the others on barrens; 1 ♂ on *Q. marilandica,* 1 ♂ on *Q. virginiana,* and a pair in copula on *Pinus;* the early specimen freshly emerged, the later series in part worn.

Timulla (Timulla) ornatipennis (Bradley). 2 ♀♀, May 23; 3 ♂♂, July 29 and 30; all in woods and apparently freshly emerged except one female.

Timulla (Timulla) rufosignata (Bradley) (= *T. dubitatiformis* Mickel of my two earlier papers). 4 ♀♀, 4 ♂♂, August 2-5; on barrens; 1 ♂ on *Q. virginiana;* some worn and some apparently recently emerged.

Mickel (1937) in describing *T.* (*T.*) *dubitatiformis* from females only indicated that it was probably a composite species, and that *T.* (*T.*) *rufosignata* Mickel, *T.* (*T.*) *tolerata* Mickel, *T.* (*T.*) *subhyalina* Mickel, *T.* (*T.*) *h. hollensis* (Melander), *T.* (*T.*) *h. melanderi* Mickel, and *T.* (*T.*) *sayi* (Blake) probably represented the male sexes.

The four females taken in 1952 and the six females captured in 1948 and 1950 are conspecific, key to *dubitatiformis* in Mickel's key, and fall within the range of variation he ascribes to that species. They are quite constant in coloration, sculpture and vestiture, and differ from "*dubitatiformis*" females of the metropolitan Washington area in having the last three tergites with ferruginous integument, the scutellar scale evanescent or absent, and the posterior surface of the propodeum more coarsely sculptured, with a few longitudinal ridges and a tendency toward the development of small asperities on the upper third. The Kill Devil Hills series differs from the type of *dubitatiformis* from Boulder, Colorado in the same particulars.

T. (*T.*) *rufosignata* is the only male of this complex known from the southeastern states, and the capture of a series of it and a series of "*dubitatiformis*" females in an identical ecological niche leaves little doubt but that they represent the opposite sexes of a single species, or subspecies. Similar matched series from other parts of the range of "*dubitatiformis*" will be required before it can be decided whether this is a single polytypic species, or a set of allopatric species.

Ephuta b. battlei Bradley. 9 ♂♂, August 1-5; on barrens, 8 ♂♂ on *Q. virginiana;* all appeared to have emerged recently but one male.

Ephuta sp. #1. 1 ♀, August 5; in woods on pine leaf litter; unworn. Possibly the female of *b. battlei,* but found in another habitat.

Family **SCOLIIDAE**

Scolia (Scolia) bicincta Fabricius. 1 ♂, July 30; on barrens at edge of woods on *Monarda;* unworn.

Campsomeris (Campsomeris) plumipes fossulana (Fabricius). 1 ♀, 2 ♂♂, May 24 and 25; 2 ♂♂, July 29 and August 1; on barrens and in woods; 1 ♂ on *Liquidambar,* and 1 ♂ on *Pluchea;* all the early and one of the late specimens unworn.

Campsomeris (Campsomeris) quadrinotata (Fabricius). 1 ♂, May 26; on barrens at edge of woods; freshly emerged.

Family **VESPIDAE**

Vespula (Vespula) maculifrons (Buysson). 1 ♀, 1 ☿, May 24 and 26; in open woods; ♀ on *Liquidambar.*

Vespula (Vespula) squamosa (Drury). 1 ♀, May 24; in woods.

Vespula (Dolichovespula) maculata (Linnaeus). 1 ☿, July 30, in woods.

Polistes[4] **annularis** (Linnaeus). 3 ♀♀, May 24 and 25; 1 ♀, 1 ♂, July 28 and 31; in woods and on barrens; 2 ♀♀ on *Liquidambar*, ♂ on *Q. virginiana.*

Polistes e. exclamans Viereck. 1 ♀, May 24; on barrens on *Liquidambar.*

Polistes f. fuscatus (Fabricius). 2 ♀♀, May 24; 2 ♀♀, July 28 and August 4; on barrens; 1 ♀ on *Q. virginiana.*

Polistes h. hunteri Bequaert. 2 ♀♀, July 28 and 31; in woods and on barrens; 1 ♀ on *Q. virginiana.*

Polistes metricus Say. 2 ♀♀, May 24; 1 ♀, July 31; on barrens; 1 ♀ on *Liquidambar.*

Zethus (Zethusculus) spinipes variegatus Saussure. 1 ♂, May 24; 2 ♀♀, 2 ♂♂, July 29-August 1; in woods and on barrens; 2 ♀♀, 1 ♂ on *Monarda,* and 1 ♂ on *Cephalanthus;* none of specimens worn.

Monobia quadridens (Linnaeus). 2 ♂♂, May 24 and 25; 1 ♀, 1 ♂, July 28 and August 1; on barrens and in woods; 1 ♂ on *Liquidambar,* and 1 ♂ on *Cephalanthus;* none of specimens worn; much commoner than records indicate.

Rygchium megaera (Lepeletier). 3 ♂♂, May 24 and 25; 2 ♀♀, 1 ♂, July 29-August 4; on barrens and in woods; 1 ♂ on *Liquidambar;* none of specimens worn.

Rygchium molestum (Saussure). 1 ♂, May 26; 7 ♀♀, 2 ♂♂, July 28-August 5; in woods and on barrens; 1 ♂ on *Liquidambar,* 1 ♂ on *Q. marilandica,* 1 ♀ on *Q. virginiana,* and 3 ♀♀, 1 ♂ on *Pluchea;* a few of the later specimens showed wear.

Ancistrocerus campestris (Saussure). 1 ♂, May 24; on barrens at edge of woods on *Liquidambar.*

Leptochilus tylocephalus monotylus (R. M. Bohart) 4 ♀♀, 1 ♂, July 28-30; mostly in woods; 1 ♀, 1 ♂ on *Monarda;* none of specimens worn.

Stenodynerus (Stenodynerus) a. ammonia (Saussure). 1 ♀, August 4, on barrens; worn.

Stenodynerus (Stenodynerus) ammonia histrionalis (Robertson). 4 ♀♀, 2 ♂♂, July 29-August 5; on barrens on *Q. virginiana;* half of series showed wear.

Stenodynerus (Stenodynerus) lineatifrons R. M. Bohart. 1 ♀, 1 ♂, May 24; 11 ♀♀, 12 ♂♂, July 28-August 5; on barrens; 1 ♀ on *Myrica,* 8 ♀♀, 12 ♂♂ on *Q. virginiana;* the early pair unworn, the later series fresh and worn.

Stenodynerus (Stenodynerus) n. sp. (MS of R. M. Bohart). 1 ♀,

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[4]Social wasps of this genus were extremely common and no attempt was made to capture more than a few individuals.

6 ♂♂, July 28-August 5; mostly on barrens; 1 ♀, 3 ♂♂ on *Q. marilandica,* and 2 ♂♂ on *Q. virginiana;* unworn.

Stenodynerus (Parancistrocerus) f. fulvipes (Saussure). 1 ♀, 1 ♂, May 24; 6 ♀♀, 5 ♂♂, July 28-August 5; on barrens; 1 ♂ on *Liquidambar,* 2 ♀♀, 5 ♂♂ on *Q. virginiana,* and 1 ♀ on *Pluchea;* one specimen worn.

Stenodynerus (Parancistrocerus) histrio (Lepeletier). 1 ♂, May 25; 7 ♀♀, July 30-August 5; in woods or on barrens near edge of woods; 2 ♀♀ on *Pluchea;* none of specimens worn.

Stenodynerus (Parancistrocerus) p. pedestris (Saussure). 19 ♀♀, 17 ♂♂, July 28-August 5; almost entirely in woods; 2 ♂♂ on *Liquidambar,* 1 ♀ on *Q. marilandica,* and 1 ♀ on *Q. virginiana;* most of specimens unworn.

Stenodynerus (Parancistrocerus) p. perennis (Saussure). 1 ♀, May 23; 1 ♀, 2 ♂♂, August 3-5; mostly in woods; none of specimens worn.

Family **POMPILIDAE**

Ageniella (Ageniella) partita Banks. 1 ♀, May 25; in woods; unworn.

Ageniella (Ageniella) n. sp. (MS of H. K. Townes). 1 ♀, August 5; chasing small spider among leaf litter in woods; not worn.

Ageniella (Priophanes) faceta (Cresson). 1 ♂, July 31; on barrens on *Q. marilandica;* not worn.

Evagetes n. sp. (MS of R. R. Dreisbach). 29 ♀♀, 3 ♂♂, July 28-August 4; the majority on barrens; 6 ♀♀, 1 ♂ on *Q. virginiana;* most specimens worn.

Sericopompilus apicalis (Say). 5 ♂♂, May 24 and 25; 15 ♀♀, 16 ♂♂, July 28-August 5; both in woods and on barrens; 3 ♀♀, 1 ♂ on *Q. virginiana,* 1 ♀, 3 ♂♂ on *Q. marilandica,* and 2 ♂♂ on *Liquidambar;* the early series and about a third of the late series unworn; very common in mid-summer and I captured only a fraction of the specimens actually seen.

Sericopompilus neotropicalis (Cameron). 2 ♀♀, 1 ♂, July 29-August 3; male in woods, females on barrens; 1 ♀ on *Q. marilandica;* male unworn, females worn.

The male has segments 2 through 4 of fore tarsi with broad basal rings of white as well as the mid and hind tarsi.

This is the most northern record for this species on the east coast.

Episyron b. biguttatus (Fabricius). 1 ♀, May 26; 6 ♀♀, 2 ♂♂, July 29-August 5; in woods and on barrens; both fresh and worn specimens present in later series.

Episyron posterus (Fox). 8 ♀♀, 11 ♂♂, May 24-26; 7 ♀♀, 7 ♂♂, July 28-August 5; 3 ♀♀, 2 ♂♂ on *Liquidambar,* 3 ♀♀, 13 ♂♂ on *Q. marilandica,* 1 ♀, 2 ♂♂ on *Q. virginiana,* and 1 ♂ on *Pinus;* the early series fresh or showing very little wear, the late series with only a few showing wear.

Episyron snowi (Viereck). 1 ♀, May 26; 1 ♀, July 31; on barrens; latter specimen worn.

Poecilopompilus i. interruptus (Say). 1 ♂, August 3; on barrens; slightly worn.

Tachypompilus f. ferrugineus (Say). 2 ♀♀, July 28 and 29; in woods and on barrens; 1 ♀ on *Q. virginiana;* both worn.

Anoplius (Lophopompilus) bengtssoni (Regan). 3 ♀♀, 11 ♂♂, May 24-26; in woods and on barrens; 1 ♀, 5 ♂♂ on *Q. marilandica,* and 1 ♂ on *Liquidambar;* recently emerged.

Anoplius (Lophopompilus) cleora (Banks). 2 ♀♀, May 24 and 26; on barrens.

Anoplius (Notiochares) amethystinus atramentarius (Dahlbom). 1 ♀, 9 ♂♂, August 1-4; on barrens; 1 ♀ on *Q. virginiana;* only a few specimens unworn.

Anoplius (Arachnophroctonus) americanus trifasciatus (Beauvois). 3 ♀♀, August 1-5; on barrens; all showing some wear.

These females have paired red spots on first tergite and are referable to *americanus trifasciatus.* The two males taken in 1948 also should be assigned here rather than to typical *americanus* (Beauvois).

Anoplius (Arachnophroctonus) apiculatus pretiosus (Banks). 3 ♀♀, 1 ♂, August 1 and 4; on barrens; 2 ♀♀, 1 ♂ on *Q. virginiana;* some specimens fresh, others worn.

Anoplius (Arachnophroctonus) marginalis (Banks). 1 ♀, 2 ♂♂, May 24-26; 2 ♀♀, 1 ♂, July 31 and August 3; on barrens; 1 ♂ on *Q. marilandica,* and 1 ♂ on *Q. virginiana;* the later series worn.

Anoplius (Arachnophroctonus) relativus (Fox). 1 ♀, 4 ♂♂, May 24-26; 2 ♀♀, 2 ♂♂, July 28-31; 2 ♂♂ on *Q. marilandica,* and 1 ♀, 2 ♂♂ on *Q. virginiana;* the later series worn.

Anoplius (Arachnophroctonus) semirufus (Cresson). 4 ♀♀; July 28-August 4; in woods and on barrens; only one specimen showed wear.

Anoplius (Pompilinus) cylindricus (Cresson). 4 ♀♀, May 24-26; 13 ♀♀, 3 ♂♂, July 29-August 5; on barrens; one pair in copula; 1 ♂ on *Q. virginiana;* about half of later series showing wear, the others fresh.

Anoplius (Pompilinus) krombeini Evans. 7 ♀♀, July 31-August 4; on barrens; all but one showing wear.

Anoplius (Pompilinus) marginatus (Say). 2 ♀♀, 1 ♂, May 23 and 26; 2 ♀♀, August 1 and 3; all but one female in woods; 1 ♀ on *Liquidambar;* one of the later specimens worn.

Anoplius (Pompilinus) splendens (Dreisbach). 5 ♀♀, 3 ♂♂, July 30-August 4; on barrens; all fresh except two females; 1 ♂ on *Q. virginiana.*

Pompilus (Anoplochares) apicatus Provancher. 1 ♂, May 25; in woods.

Aporinellus fasciatus (Smith). 8 ♀♀, 2 ♂♂, July 29-August 4; on barrens; 4 ♀♀, 2 ♂♂ on *Q. virginiana,* and 2 ♀♀ on *Q. marilandica;* 6 ♀♀ showing wear.

Aporinellus t. taeniatus (Kohl). 1 ♂, July 31; on barrens on *Q. marilandica;* unworn.

Paracyphononyx funereus (Lepeletier). 1 ♀, 2 ♂♂, July 28-August 1; two in woods, one on barrens; only the female showed wear.

Family **SPHECIDAE**

Miscophus americanus Fox. 1 ♂, May 24; 5 ♀♀, 5 ♂♂, July 28-August 4; on barrens; 2 ♂♂ on *Q. marilandica,* and 3 ♀♀, 1 ♂ on *Q. virginiana;* most of specimens unworn.

Tachytes (Tachytes) aurulentus (Fabricius). 8 ♂♂, July 30-August 5; on barrens; 1 ♂ on *Pluchea;* none of specimens worn.

Tachytes (Tachytes) e. elongatus Cresson. 11 ♂♂, July 29-August 5; on barrens; 1 ♂ on *Myrica,* 5 ♂♂ on *Q. marilandica,* and 1 ♂ on *Q. virginiana;* only one specimen showed wear.

Tachytes (Tachytes) pepticus (Say). 1 ♀, 10 ♂♂, July 31-August 5; on barrens; 1 ♂ on *Q. virginiana,* and 1 ♂ on *Pluchea;* most of males showed wear.

Tachytes (Tachyplena) distinctus Smith. 1 ♂, July 31; on barrens; fresh.

Tachytes (Tachynana) obductus Fox. 2 ♀♀, 1 ♂, July 29 and August 3; on barrens; none of specimens worn.

Tachytes (Tachynana) parvus Fox. 18 ♂♂, July 28-August 5; on barrens; 9 ♂♂ on *Q. virginiana,* 1 ♂ on *Q. marilandica,* and 3 ♂♂ on *Pinus;* almost all showing wear.

Tachytes (Tachyoides) mergus Fox. 6 ♀♀, 5 ♂♂, July 29-August 4; on barrens; 1 ♂ on *Q. marilandica,* and 3 ♂♂ on *Q. virginiana;* only one specimen worn.

Tachysphex similis Rohwer. 1 ♀, 2 ♂♂, May 23 and 24; 1 ♀, 1 ♂, July 28 and August 3; both in woods and on barrens; 1 ♂ on *Q. marilandica;* female of later series worn.

Tachysphex terminatus (Smith). 2 ♂♂, May 26; 3 ♀♀, July 29-August 3; on barrens; 2 ♀♀ on *Q. virginiana;* two of later series worn.

Tachysphex n. sp. (MS of G. E. Bohart). 2 ♀♀, May 24; on barrens.

Tachysphex n. sp. (MS of G. E. Bohart). 1 ♂, May 24; on barrens; unworn.

Motes argentata (Beauvois). 2 ♀♀, 1 ♂, May 23-25; 16 ♀♀, 16 ♂♂, July 28-August 5; mostly on barrens, but a few in woods; 1 ♀, 2 ♂♂ on *Liquidambar,* 8 ♂♂ on *Q. marilandica,* and 1 ♀ on *Myrica;* the early series unworn, as well as most of late series; very common in mid-summer and I captured less than half the specimens seen.

Pluto arenivagus Krombein. 1 ♀, August 5; on barrens; worn.

Chlorion (Ammobia) pennsylvanicum (Linnaeus). 1 ♂, August 4; on barrens on *Pluchea;* unworn.

Chlorion (Isodontia) aztecum (Saussure). 2 ♂♂, August 1 and 4; on barrens, one on *Pluchea,* and one on *Cephalanthus;* unworn.

Chlorion (Isodontia) cinereum (Fernald). 1 ♂, August 4; on barrens on *Pluchea;* unworn.

Chlorion (Priononyx) pubidorsum (Costa). 5 ♀♀, 3 ♂♂; July 29-August 5; on barrens; 1 ♂ on *Q. virginiana,* and 2 ♀♀, 1 ♂ on *Pluchea;* most of series unworn.

Chlorion (Palmodes) daggyi (Murray). 1 ♀, 2 ♂♂, July 28-August 5; female in woods, males on barrens at edge of woods; one pair worn.

Sphex aureonotatus (Cameron). 1 ♂, July 28; in woods; unworn.

Sphex procerus (Dahlbom). 1 ♂, May 26; 1 ♀, 5 ♂♂, July 28-August 3; both on barrens and in woods; 2 ♂♂ on *Q. virginiana,* 1 ♂ on *Liquidambar,* and 2 ♂♂ on *Pluchea;* the early specimen unworn, and most of late series worn.

Sceliphron caementarium (Drury). 2 ♂♂, July 29 and 30; on barrens; one on *Q. marilandica,* and one on *Q. virginiana;* one worn.

Chalybion californicum (Saussure). 1 ♀, 3 ♂♂, July 31; on barrens; one pair on *Q. virginiana,* and 2 ♂♂ on *Q. marilandica;* none of specimens worn.

Nysson (Nysson) aequalis Patton. 1 ♀, July 31; on barrens; unworn.

Nysson (Epinysson) opulentus Gerstaecker. 7 ♂♂, May 24-26; 1 ♀, 3 ♂♂, July 28-August 1; in woods and on barrens; 4 ♂♂ on *Liquidambar,* 3 ♂♂ on *Q. marilandica,* and 1 ♀, 2 ♂♂ on *Q. virginiana;* none of specimens worn.

Zanysson fuscipes (Cresson). 4 ♂♂, July 31-August 4; on barrens; 3 ♂♂ on *Q. virginiana;* only one male unworn.

Ammatomus (Tanyoprymnus) moneduloides (Packard). 1 ♀, July 29; on barrens on *Pinus;* unworn.

Sphecius (Sphecius) speciosus (Drury). 1 ♂, July 31; on barrens on *Q. virginiana;* worn.

Psammaecius denticulatus (Packard). 3 ♀♀, 14 ♂♂, July 28-August 4; on barrens; 1 ♀, 10 ♂♂ on *Q. virginiana;* 3 ♀♀, 3 ♂♂ unworn.

Psammaecius nebulosus (Packard). 2 ♂♂, May 26; 2 ♀♀, 2 ♂♂, July 28-August 5; all but one female on barrens; 1 ♂ on *Liquidambar,* 1 ♂ on *Q. marilandica,* and 1 ♀, 2 ♂♂ on *Q. virginiana;* none of specimens worn.

Bicyrtes quadrifasciata (Say). 2 ♀♀, 1 ♂, July 30 and 31; in woods and on barrens; 1 ♂ on *Monarda;* all worn.

Microbembex monodonta (Say). 1 ♂, May 24; 1 ♀, 1 ♂, July 28 and 29; on barrens and in woods; 1 ♂ on *Q. virginiana;* the early male unworn, the later pair worn; very abundant in mid-summer and I took only a fraction of the specimens seen.

Bembix carolina (Fabricius). 1♀, August 4; on barrens; worn.

Philanthus gibbosus (Fabricius). 1 ♂, August 1; on barrens on *Pluchea;* unworn.

Philanthus ventilabris Fabricius. 3 ♀♀, 4 ♂♂, August 1 and 5; on barrens on *Pluchea;* all fresh except 1 ♀.

Cerceris b. bicornuta Guérin. 1 ♀, 23 ♂♂, July 31-August 5; 2 ♂♂ on *Q. virginiana,* and 20 ♂♂ on *Pluchea;* most of series unworn.

Cerceris blakei Cresson. 2 ♂♂, May 24; 3 ♀♀, 27 ♂♂, July 28-August 5; on barrens; 1 ♀, 13 ♂♂ on *Q. virginiana,* and 1 ♂ on *Q. marilandica;* the early series and half the later series unworn.

Cerceris flavofasciata H. S. Smith. 2 ♀♀, 4 ♂♂, July 31-August 3; 2 ♂♂ on *Q. virginiana,* and 1 ♀, 2 ♂♂ on *Pluchea;* most of series unworn.

Cerceris robertsonii Fox. 7 ♀♀, 55 ♂♂, May 24-26; 7 ♀♀, 5 ♂♂, July 28-August 5; on barrens; 36 ♂♂ on *Liquidambar,* 18 ♂♂ on *Q. marilandica,* and 4 ♀♀, 4 ♂♂ on *Q. virginiana;* the early series unworn as well as part of late series.

Crabro (Paranothyreus) aequalis Fox. 1 ♀, 6 ♂♂, May 24-26; on barrens; 4 ♂♂ on *Liquidambar,* and 1 ♀, 2 ♂♂ on *Q. marilandica;* unworn.

Crabro (Paranothyreus) hilaris Smith. 5 ♀♀, 10 ♂♂, May 25 and 26; 1 ♀, 9 ♂♂, July 29-August 3; on barrens; 4 ♀♀, 17 ♂♂ on *Q. marilandica,* and 2 ♂♂ on *Q. virginiana;* only 2 ♂♂ of late series worn.

Crabro (Norumbega) argus Packard. 1 ♀, 17 ♂♂, May 23-25; mostly on barrens, a few in woods; 5 ♂♂ on *Carya* foliage, 5 ♂♂ on *Q. marilandica,* and 4 ♂♂ on *Liquidambar;* none worn.

Ectemnius (Hypocrabro) 10-maculatus 10-maculatus (Say). 5 ♂♂, May 24 and 25; on barrens; 4 ♂♂ on *Q. marilandica;* none of specimens worn; one of the May 24th males is a melanic.

Ectemnius (Hypocrabo) scaber (Lepeletier and Brullé). 1 ♂, May 24; on barrens on *Q. marilandica;* unworn.

Lestica (Solenius) producticollis (Packard). 1 ♀, 1 ♂, May 24 and 26; in open woods; ♀ on *Q. marilandica,* ♂ on *Liquidambar;* unworn.

Oxybelus emarginatus Say. 2 ♂♂, May 24; 2 ♀♀, 7 ♂♂, July-29-August 4; in woods and on barrens; 3 ♂♂ on *Q. marilandica,* and 4 ♂♂ on *Q. virginiana;* the early series unworn, and all but three of late series worn.

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NOTES ON PUERTO RICAN SIMULIIDAE FROM LIGHT TRAPS (DIPTERA)

BY IRVING FOX, *School of Medicine, University of Puerto Rico, San Juan*

Authorities differ in regard to the use of light traps in population studies in Simuliidae. Dr. Dalmat (1950) indicates that they are not applicable because of the daytime activity of blackflies, but Dr. Frost (1949) demonstrated that they were of value in obtaining information on abundance and distribution. This latter point of view has been substantiated in Puerto Rico where light traps disclosed the presence of an undescribed species and gave interesting data on the known species. Collections were studied from two New Jersey type light traps run routinely at Henry Barracks, an Army post near the town proper of Cayey in the central mountainous region of Puerto Rico, during the period Sept. 20, 1949 to Jan. 2, 1952. From material taken in a total of 1540 trap-nights, there were identified 966 specimens of Simuliidae of which 753 were *Simulium haematopotum* Malloch, 189 were *S. quadrivittatum* Loew and 24 were *S. wolcotti*, a new species.

In the literature one finds four names of Simuliidae indicated as pertaining to the Puerto Rican fauna: *Simulium quadrivittatum* Loew, *S. haematopotum* Malloch, *S. minusculum* Lutz and *S. amazonicum* Goeldi. However, it is unlikely that *minusculum* (regarded by Lutz himself as a synonym of *amazonicum*) occurs in Puerto Rico. The record is based on a determination of Aldrich from examples of a lot consisting of seven specimens collected May 2, 1922 by F. Seín at Río Piedras, P. R. Six of these specimens are still extant in the University of Puerto Rico Experiment Station and they were found to be *quadrivitattum*, a determination which was corroborated by Dr. Alan Stone.

Simulium quadrivittatum Loew

Figs. 1, 2

Simulium quadrivittatum Loew, 1862, Berliner Ent. Zeitscher. 6: 186;

Malloch, 1914, U. S. Dept. Agric. Bur. Ent. Tech. Serv. No. 26: 61; Wetmore, 1916, U. S. Dept. Agric. Bull. 32: 66; Root, 1922, Amer. Jour. Hyg. 2: 396; Wolcott, 1924, Jour. Dept. Agric. Porto Rico 7: 213; Bradt, 1932, Puerto Rico Jour. Pub. Health and Trop. Med. 8: 69; Wolcott, 1936, Univ. Puerto Rico Jour. Agric. 20: 333; Vargas, 1945, Inst. Salub. Enf. Trop. Mexico Monog. No. 1: 189, 218; Wolcott, 1951, Univ. Puerto Rico Jour. Agric. 32: 443.

Simulium minusculum Wolcott (not Lutz), 1924, Jour. Dept. Agric. Porto Rico 7: 213; Bradt, 1932, Puerto Rico Jour. Pub. Health and Trop. Med. 8: 77; Wolcott, 1936, Univ. Puerto Rico Jour. Agric. 20: 333; 1951, idem, 32: 443.

Simulium amazonicum Vargas (not Goeldi), 1945, Inst. Salub. Enf. Trop. Monog. No. 1: 112, 218 (in part).

Records.—This species has been reported from the following localities in Puerto Rico: Aguirre, Barranquitas, Bayamón, Cidra, Corozal, Guaynabo, Lares, Las Marías, Martín Peña, Río Piedras, San Sebastián and Utuado. To these records are added the following ones which are in addition to Henry Barracks: Adjuntas, biting man, 1951 (J. F. Maldonado); Canóvanas, biting man, April, 1952 (M. Slusser); Mayagüez, light trap, Feb. 15, 1952 (J. Maldonado Capriles).

Remarks.—Of the three species of *Simuliidae* known to occur in Puerto Rico, this is the one which commonly bites man.

Simulium haematopotum Malloch

Figs. 3, 4

Simulium haematopotum Malloch, 1914, U. S. Dept. Agric. Bur. Ent. Tech. Ser. No. 26: 62; Wolcott, 1924, Jour. Dept. Agric. Porto Rico 7: 213; Dyar and Shannon, 1927, Proc. U. S. Nat. Mus. 69: 38; Bradt, 1932, Puerto Rico Jour. Pub. Health and Trop. Med. 8: 77; Wolcott, 1936, Univ. Puerto Rico Jour. Agric. 20: 333; Vargas, 1945, Inst. Salub. Enf. Trop. México Monog. No. 1: 144, 218; Wolcott, 1951, Univ. Puerto Rico Jour. Agric. 32: 443.

Records.—The published Puerto Rican reports of this species are only from Río Piedras. The following records from light traps are in addition to Henry Barracks: Manatí, May, 1949 (J. W. H. Rehn); Losey Field, Jan. 13, 1950 (C. E. Kohler).

Remarks.—The early records which refer to this species as biting man in Puerto Rico are suspect because some of the original material still extant in the University of Puerto Rico Experiment Station Collection show misidentification, e.g. one specimen caught while feeding on the arm by R. T. Cotton at Río Piedras June 25, 1917 and determined by him as *S. haematopotum* proved to be *S. quadrivittatum.* The two species are only superficially similar and may be readily separated without recourse to genital characters by the thoracic patterns which are illustrated in figs. 1–4.

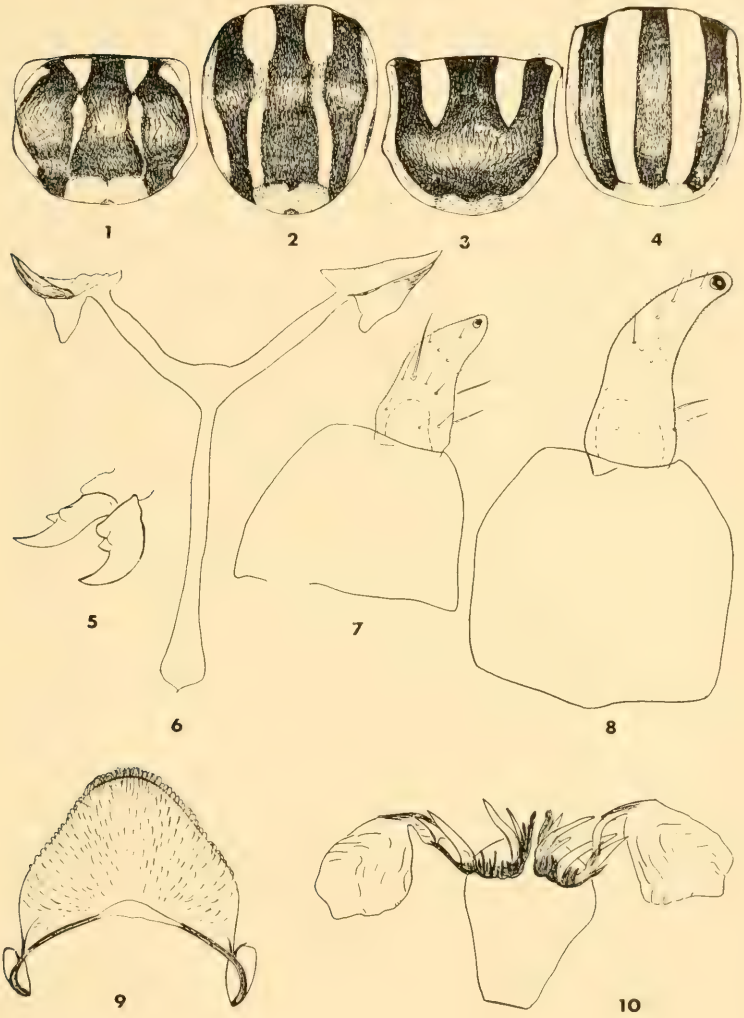

Fig. 1, *Simulium quadrivittatum* Loew, mesonotal pattern, male; fig. 2, the same, female; fig. 3, *S. haematopotum* Malloch, mesonotal pattern, male; fig. 4, the same, female; fig. 5, *S. wolcotti*, n. sp., hind tarsal claws; fig. 6, the same, genital fork; fig. 7, *S. ochraceum* (Walker), clasper and sidepiece; fig. 8, *S. wolcotti*, n. sp., clasper and sidepiece; fig. 9, the same, adminiculum; fig. 10, the same, adminicular arms. (Figs. 6–10 drawn to scale.)

Simulium (S.) wolcotti, new species

Figs. 5, 6, 8–10

Male.—About 2.0 mm. long. Head holoptic, the eyes large and the large facets extending down to the antennae, upper and lower portions black; clypeal area iridescent bluish; mouthparts black; antennae dusky distally, 11-segmented with the third segment much longer than the others. Scutum orange, yellow at the humeri; with two lanceolate silvery bands in the anterior half. Scutellum, postnotum and halteres concolorous with the scutum. Pleura dark brown, some portions bluish. Wings about 2.0 mm. long, a dense patch of dark setae at base of costa and on stem vein. Legs bicolorous, in general the femora light, the tibiae and tarsi black; calcipala well developed, pedisulcus deep. Abdomen dark, lighter basally. Clasper 0.104 mm. long; sidepiece 0.132 mm. long; adminiculum triangular with long setae forming a crown, 0.084 mm. long in the middle region and 0.118 mm. wide basally; adminicular arms with long prominent teeth, figs. 8–10.

Female.—About 2.5 mm. long. Head dichoptic, eyes and mouthparts black, frontal and clypeal areas iridescent bluish; antennae basically orange but the distal segments dusky, 11-segmented with the third segment larger than the ones which follow. Scutum, scutellum, halteres and pleura as in the male except that the silvery bands on the scutum are somewhat longer. Wings about 2.5 mm. long; Sc with a row of 6–13 widely separated dark setae in the basal three-fourths, but the rest glabrous. R_1 densely provided with macrotrichia and with an irregular row of black setae interspersed with spiniform ones along its entire length. Rs with a row of evenly separated dark setae beginning a short distance from its base and extending to its end. Sternal area dark brown. Legs in general with coxae and trochanters dusky, femora light, tibiae and tarsi black, the hind tibiae with a circumscribed wide light area beyond the basal third; calcipala well developed reaching to the deep pedisulcus; hind tarsal claws with a large subbasal tooth near which at certain angles there seems to be a smaller one, fig. 5. Abdomen black with some brown basally. Genital fork as shown in fig. 6; cercus rounded, pigmented; anal lobe large, cone-shaped.

Types.—All type specimens were collected by means of light traps at Henry Barracks, Puerto Rico and are in the entomological collection of the Department of Microbiology, School of Medicine, School of Tropical Medicine, San Juan, Puerto Rico. The male holotype taken in 1950 is pinned but its terminalia are mounted on a slide; the female allotype taken March 7, 1950 is pinned; there are also three male paratypes mounted on slides, two taken in 1950 and one Nov. 12, 1949 and four female paratypes mounted on slides taken in 1950.

Remarks.—Specimens of this new species were sent to two distinguished authorities on the Simuliidae, Dr. Alan Stone and Dr. Luis Vargas. Dr. Stone tentatively determined the species as *S. ochraceum* (Walker) suggesting that Dr. Vargas be consulted, and the latter's valuable opinion (in a letter dated June 18, 1952) is as follows, "Efectivamente se trata de una especie muy semejante a *Simulium ochraceum,* principalmente por lo que se refiere a algunos caracteres externos, pero aún en éstos mismos se observan diferencias, ya que sus ejemplares tienen las patas bicoloridas y *ochraceum* no, pero las más grandes se notan en las genitalias de ambos sexos, así es de que con seguridad su material no es de *ochraceum.* Hemos revisado nuestro material y todo difiere de sus ejemplares, por lo tanto no sabríamos decirle con seguridad de qué especies se trata, pero encontramos que son muy parecidos, tanto en sus caracteres externos como genitales, con *Simulium ignescens* Roubaud, 1906 de la cual hace Wygodzinsky (1951) una buena redescripción."[1] Through Dr. Wygodzinsky's kindness specimens of *S. ignescens* were received and these also did not agree with the species described above as new.

S. wolcotti, n. sp. is closely related to *S. ochraceum* (Walker) but differs particularly in the male genitalia; its clasper although similar in shape is much larger as will be seen by comparing figs. 7 and 8, the former being from a specimen of *S. ochraceum* from Mexico determined by Dr. Vargas and the latter from the holotype of *S. wolcotti;* its adminiculum is also larger, different in shape and not bent distally to the degree that occurs in *ochraceum. S. ignescens* Roubaud and *S. dinellii* (Joan) so well described by Dr. Wygodzinsky (1950, 1951) are also similar to this new species but the latter differs from them in having silvery bands on the mesonotum and in the shape of the adminiculum.

Acknowledgments

Thanks are expressed to Dr. Alan Stone, Dr. Luis Vargas and Dr. P. Wygodzinsky for helpful advice and generous exchanges of material; to the various commanders and chiefs of the laboratory service of the then Rodríguez General Hospital (U. S. Army) for securing light trap collections from Henry Barracks; to Miss Gloria A. Perkins, entomological technician, U. S. Army, for her careful curatorship of the

[1] "Really it is a question of a species similar to *Simulium ochraceum,* chiefly as regards some external characters, but even in these themselves differences are seen, since your specimens have bicolored legs and *ochraceum* has not, but the greatest differences are perceived in the genitalia of both sexes; and so your material certainly is not *ochraceum.* We have examined our material and all differ from your specimens therefore we could not tell you with certainty what species is concerned, but we find that your specimens are very similar both in the external characters and the genitalia to *Simulium ignescens* Roubaud, 1906, of which Wygodzinsky (1951) does a good redescription."

collections; and to Dr. George N. Wolcott, in whose honor the new species is named, for permission to study the collections in his charge.

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LABORATORY REARING OF CULEX SALINARIUS

(DIPTERA, CULICIDAE)[1]

By ROBERT CHARLES WALLIS and ANDREW SPIELMAN, *Department of Parasitology, The Johns Hopkins School of Hygiene and Public Health, Baltimore, Md.*

Mosquito rearing in the laboratory has become increasingly important in recent years due to the large number of laboratory investigations made which have involved these important vectors of disease. In spite of the multiplying needs and demands of research involving mosquitoes, however, only a small number of species have been successfully colonized for use in laboratory studies; up to this time only four species of *Culex* have been reared in the laboratory.

During the past summer eight egg rafts of *Culex salinarius* Coquillett were collected from a fresh water drainage pond near the marshy, brackish-water shore of Breezy Point, Maryland. From these eggs, enough larvae were obtained to enable us to attempt colonization of this species. The purpose of this paper is to describe the successful laboratory rearing of *Culex salinarius*.

Carpenter *et al.* (1946) indicate that *salinarius* is not confined to coastal areas, but is generally distributed across the United States from Massachusetts west to Utah, and south to the Gulf Coast. Breeding places include both fresh and brack-

[1] This study was aided by a grant from the National Microbiological Institute, Bethesda, Md.

ish water in grassy pools, ditches, ponds, and artificial containers. The adult females readily bite man outdoors and frequently enter houses. Rozeboom (1942), while collecting in Oklahoma, took this mosquito feeding on man more often than any other *Culex*.

We found the shiny black egg rafts of *salinarius* on the water in the shade of overhanging vegetation. We picked them up on wet filter paper, and packed them carefully into pill boxes for transportation to the insectary. Only two rafts were intact at the end of the trip, however, due to their extremely fragile nature. We placed each raft in a separate glass finger bowl filled with tap water, and observed for hatching. At the end of two days, we collected about 150 first stage larvae. We transferred these to a white enameled photographic tray containing two liters of tap water, and reared as described by Trembley (1944 a,b), using rabbit pellet laboratory feed.

Pupation began on the tenth day, and we had collected approximately one hundred pupae by the fifteenth day after hatching. We placed these, in a shallow pan of water, in a large screened cage, size 3′3″x2′6″. The adults emerging into this cage were then maintained in the laboratory at a temperature of $27\pm3^\circ$ C. A high humidity was maintained by partially covering three sides of it with flexible plastic sheets, and by applying wet paper toweling to the top of the cage. Later, additional moisture was added by placing in the cage an unglazed drain tile as described by Rozeboom (1936). With these provisions, the relative humidity, as measured by a sling psychrometer on five consecutive days, ranged from 52 to 78%, with a mean of 65%. The cage was located in the middle of a laboratory working compartment where illumination was fairly uniform, approximating one-fiftieth normal daylight.

Food for the adults was provided daily in the form of fresh apple slices, and, three days after emergence of the first adults, blood meals were offered daily by placing the bared forearm in the cage for fifteen minute intervals. At this time, a flat photographic tray containing three liters of tap water was placed in the cage to make available 144 square inches of oviposition area. During the first week of adult life of this initial laboratory-reared generation, little activity was observed. Except for a few females taking blood daily and feeding on the apple slice, the majority of the adults seemed to remain at rest on the sides of the cage. Mortality was high, and by the sixteenth day, only 38 females and about a dozen males remained alive. No copulation had been observed. Eighteen days after the emergence of the first adults, however, five small egg rafts were collected from the oviposition pan. Within three days, four of these rafts had hatched to provide a second generation of larvae.

At this time copulation in flight was observed. This mating flight was swift and brief, lasting only a few seconds, which probably had caused us not to observe it earlier. Perhaps, because of the few adults present in the cage, no semblance of swarming was seen as observed in nature by Smith (1904). With the observation of copulation in the cage, and the obtaining of fertile egg rafts from the first laboratory generation of adults, hopes of establishing the colony were much brighter, for, as Huff (1944) indicates, this seems to be the chief difficulty in adapting *Culex* mosquitoes to laboratory rearing.

Careful rearing of the second generation larvae resulted in the addition of about three hundred more adults to the colony. Twenty-seven days later these adults had produced 45 egg rafts, of which 41 proved to be fertile. From them, a large third generation of larvae was obtained, insuring the propagation of the colony.

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A CHANGE OF NAME IN THE FAMILY REDUVIIDAE

Hemiptera

I have to thank my friend Professor R. F. Hussey of the Florida Southern College for kindly calling my attention to the preoccupation of *Saica fuscovittatus* Barber, 1914 by Stål. 1859. *Saica florida* is herewith proposed as a new name for the Floridian species.—Harry G. Barber, *U. S. Bureau of Entomology and Plant Quarantine.*

NOTES ON THE DISTRIBUTION, SYSTEMATIC POSITION, AND VARIATION OF SOME CALLIPHORINAE, WITH PARTICULAR REFERENCE TO THE SPECIES OF WESTERN NORTH AMERICA

(DIPTERA, CALLIPHORIDAE)[1]

By MAURICE T. JAMES, *State College of Washington, Pullman*

Thanks largely to the works of Shannon (1923, 1924, 1926) and, recently, of Hall (1948), the taxonomic status of the North American Calliphoridae has been changed from a condition of chaos to one in which determinations of at least the more common forms can be made with reasonable certainty. Considerable experience in the group, however, is necessary for the wholly successful use of Hall's keys. The main difficulties stem from variations in chaetotaxy, proportions, and, to an extent, coloration. This is particularly true of the less known species, in which the extent of variability has not been fully determined (and in which, rather curiously it seems proportionately greater), and in populations of the western part of North America where, probably as a result of the wide range of ecological conditions, variability is more pronounced than in the east. The amount of western material which previous workers in the group had for study has been, apparently, not wholly adequate for a thorough study of the difficult fauna of this area.

In general, Hall's characters involving chaetotaxy seem to be very well chosen. The constancy of certain bristles, for example the weak first postintraalar in *Calliphora coloradensis* Hough and the three postacrosticals in *Phaenicia sericata* (Meigen), is surprising, in the light of the fact that characters involving chaetotaxy must often be used with caution (cf. Tothill, 1913, and the discussion below). Yet the occasional variable bristle may cause trouble, and a character which is constant in one species or species group may not be equally constant in another. Color characters give especial trouble in the genus *Calliphora, q.v.* As to the proportions, some very fine lines have been drawn, and these are objectionable for two chief reasons, namely variability and difficulty of use. When differences are too slight to be absolute, or to be determined positively without individual error, their use-

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[1] This investigation was supported in part by funds provided for biological and medical research by the State of Washington Initiative Measure No. 171. The information presented here has been obtained through field collecting and laboratory rearing of blowflies at the State College of Washington, and from examination of material in the United States National Museum, the California Academy of Sciences, and most of the important university and college museum collections of the western states.

fulness is reduced to the role of supplementing other, more decisive, characters.

Genus **Aldrichina** Townsend

The only known species of this genus, *A. grahami* (Aldrich), was introduced into the Nearctic Region from eastern Asia and has been reported by Hall from California and Oregon. On the Pacific Coast it extends into southwestern Washington (Ocean Park); eastward it occurs in Colorado (Colorado Springs) and New Mexico (Sandia Mts.; Albuquerque), being apparently rather common in the latter locality.

Genus **Acronesia** Hall

A male of *A. aldrichia* (Shannon) from Cameron Pass, Colorado has four strong lateral scutellars on one side and three on the other. Variation of this species in this same respect is discussed further in comparison with *Calliphora morticia* Shannon.

Genus **Calliphora** Robineau-Desvoidy

All of the six known Nearctic species of this genus occur in the western United States and Alaska. Except in *C. morticia,* the important characters based on chaetotaxy seem to be quite constant, even to the presence or absence of the usually weak first postintraalar. In Hall's key, color characters cause the most difficulty. In the western states, specimens of *C. livida* and *C. terrae-novae,* even when not teneral, may have under-colored buccae which may appear reddish and which, unless other characters are checked, may result in the species being traced to *coloradensis* and *vicina* respectively. An occasional *C. morticia,* again even when not teneral, may have yellowish or reddish cheek grooves, whereas in *C. vomitoria* the cheek grooves are frequently blackish or wholly black. The following key, based on those of Shannon (1923) and Hall (1948) will, I believe, prove more satisfactory.

Key to the Nearctic Species of Calliphora

1. Three postintraalars 2
   Two postintraalars 3
2. Bucca reddish; front of male 0.13 head width, about as wide as parafacial at its narrowest .... *coloradensis* Hough
   Bucca, when fully colored, black; front of male 0.05 head width, much narrower than parafacial at its narrowest .... *livida* Hall
3. Basicosta usually yellow to orange yellow; bucca reddish on anterior half or more; front of male at its narrowest 0.09 to 0.10 head width .... *vicina* Robineau-Desvoidy
   Basicosta black; bucca, when fully colored, black; front of male at its narrowest 0.04 to 0.06 head width 4
4. Cheek grooves normally black; bucca with hair wholly or almost wholly black; outer forceps of male straight, comparatively broad, gradually tapering to an obtuse point, clothed with short stiff hairs above and below .... *morticia* Shannon
   Cheek grooves normally red, if black, bucca with mostly reddish-orange hairs posteriorly; outer forceps of male gently curved, very slender, sharply pointed, nearly bare 5

5. Bucca with hair mostly or wholly black .... *terrae-novae* Macquart
   Bucca with hair mostly reddish-orange or reddish-yellow posteriorly .... *vomitoria* (Linnaeus)

C. morticia (not *mortica,* as given by Hall) is known only from Alaska. Chaetotaxy in this species is variable to the extent that a considerable representation in some series will not trace correctly in Hall's key, whereas, on the other hand, some specimens of *Acronesia aldrichia* (Shannon) will trace to *morticia*. *C. morticia,* which occurs where certain species of *Acronesia* are abundant, seems to form an intergrade between the two genera. Two series of *C. morticia* and *A. aldrichia* from Savonoski, Naknek Lake, Alaska, were compared in respect to the lateral scutellar bristles, with the following results.

Comparison of Number and Strength of Lateral Scutellars in Two Series of *C. morticia* Shannon and *A. aldrichia* (Shannon) from Savonoski, Alaska.

Calliphora morticia Shannon

MALES				FEMALES			
Right	Left	No. of Strong Bristles		Right	Left	No. of Strong Bristles	
1-5-0-5-5	5-5-0-5-1	3-3		3-5-4-5-5	5-5-2-5-2	5-3	(5-5)
3-5-4-5-5	5-5-4-5-3	5-5		2-5-3-5-5	5-5-3-5-2	4-4	(5-5)
0-5-0-5-5	4-5-0-5-1	3-3		3-5-3-5^{3}5	5^{3}5-3-5-3	6-6	
2-5-0-5-5	5-5-0-5-2	3-3	(4-4)	2-5-2-5-5	5-5-2-5-2	3-3	(5-5)
2-5-0-5-5	5-5-3-5-3	3-5	(4-5)	2-5-0-5-5	5-5-2-5-1	3-3	(4-4)
3-5-3-5-5	5^{4}5-4-5-2	5-5	(5-6)	1-5-5-1-5	5-4-3-5-1	3-4	
2-5-3-5-5	5-5-0-5-0	4-3	(5-3)	3-5-2-5-5	5-5-1-5-0	4-3	(5-3)
3-5-0-5^{3}3	5-5-4^{3}5-0	5-5		2-5-0-5-5	5-5-1-5-1	3-3	(4-3)
4-5-4-5-5	5-5-1-5-5	5-4		2-5-4-5-5	5-5-2-5-2	4-3	(5-5)
3-5-4-4-5	5-5-3-5-3	5-5		0-5-0-5-5	5-5-0-5-3	3-4	
3-5-3-5-5	5-5-4-5-2	5-4	(5-5)	2-5-0-5^{2}5	5-5-1-5-0	3-3	(5-3)
2-5-4-5^{3}5	5-5-3-5-3	5-5	(6-5)	3-5-3-5-5	5-5-0-5-3	5-4	
3-4-0-5-5	5-5-0-5-2	4-3	(4-4)	2-5-4-5-5	5-5-4-5-2	4-4	(5-5)
				2-5-3-5-5	5^{3}5-3-5-3	4-6	(5-6)

Acronesia aldrichia (Shannon)

2-5-0-5-5	5-5-0-5-2	3-3	(4-4)	1-5-5-0-5	5-5-0-5-0	3-3	
0-5-2-4-5	5-5-0-5-0	3-3	(4-3)	3-5-2-5-5	5-5-2-5-2	4-3	(5-5)
2-5-0-5^{3}5	5^{3}5-3-5-1	4-5	(5-5)	0-5-0-5-5	5-5-1-5-1	3-3	
1-5-2-5-5	5-5-2-5-1	3-3	(4-4)	1-5-0-5-5	5-5-0-5-1	3-3	
1-5-0-5-5	5-5-0-5-0	3-3		2-5-0-5-5	5-5-0-5-0	3-3	(4-3)
1-5-1-5-5	5-5-1-5-1	3-3		2-5-0-5-5	5-5-0-5-1	3-3	(4-3)
3-5-5-1-5	5-1-5-5-0	4-3					
1-5-0-5-5	5-5-3-5-1	3-4					
3-5-3-5-5	5-5-3-5-3	5-5					

Numbers given as superscripts indicate intercalary bristles set between the usual ones.

The table requires some explanation. The normal number of lateral scutellars appears to be five on each side, three of these being usually stronger than the other two, and located as follows: a stronger bristle at about the middle of the basal third, the middle third, and the apical third, respectively, of the side of the scutellum, and a weaker one, respectively, basad of the basal stronger bristle and between the two basal stronger ones. An arbitrary strength value of individual bristles, varyign from 0 to 5, is used for tabular purposes; ''0'' means a bristle indistinguishable from a seta or lacking, ''5'' a very strong one, ''3'' one about half the length of ''5,'' and '1'' a bristle but little stronger than a seta. The bristles read from the base of the right side to the apex, then from the apex of the left side to the base, with a reading of 1-5-1-5-5, 5-5-1-5-1 being symmetrical. Strong bristles are considered those of size 3 to 5, the symbol 5-3 indicating five strong bristles on the right and three on the left side; the numbers in parentheses, however, are calculated on a basis of size 2 to 5 for strong bristles.

Though based on a limited number of specimens (27 of *C. morticia,* 15 of *A aldrichia*), the table shows the hopelessness of trying to use the number of scutellar bristles as a generic character, so far as these two species are concerned. *A. aldrichia* usually has only three laterals on each side, and *C. morticia* usually has more than three, but there are enough exceptions to cause considerable trouble. The best characters I have found for separating the two species are the form of the male genitalia (cf Shannon, 1923) and the relation of the bend of vein M_{1+2} to the wing margin; in *A. aldrichia* the distance from the bend to the margin is fully, or at least almost, as great as the preangular section of M_{1+2} beyond cross-vein m, whereas in most *C. morticia* the distance from the bend to the margin is considerably less than the preangular section. This character was used by Shannon (1926), who recognized the intermediate nature of *C. morticia,* to separate that species from *Acronesia alaskensis* (Shannon) and *A. montana* (Shannon).

Genus **Cyanus** Hall

This genus, based on one species, *C. elongatus* (Hough), is characterized as having three postacrosticals and three lateral scutellars. However, one, two, or three postacrosticals may be present, and the irregularity in this respect is great enough to invalidate this as a generic character. Furthermore, the number of scutellars may vary; I have seen a male with four on one side and five on the other.

As Hall states, this species is uncommon in collections. I have seen specimens from North Dakota (Tokio), Nebraska (Sioux Canon, Monroe Co.), Colorado (Parshall; Russell), Montana (Blackfoot Indian Reservation), Utah (Lakepoint; Logan), Idaho (Priest Lake; Moscow; Soda Springs), Washington (Wawawai; Toppenish), Oregon (Antelope Mt., Grant Co.; Sparta, Baker Co.), and California (Hope Valley, Alpine Co.; Carson Pass; and Convict Lake and Sien, Mono Co.).

Genus **Phaenicia** Robineau-Desvoidy

I have seen males of *P. cluvia* (Walker) with one reclinate frontoorbital on each side, or on one side alone. In all cases, however, the frontoorbital is set behind the anterior ocellus, not before it as in *P. caeruleiviridis* (Macquart) and *P. problematica* (Johnson).

P. mexicana (Macquart) occurs in California; I have records from Orange County, Tanbark Flat, Sacramento, and Davis. *P. cuprina* (Wiedemann) (=*P. pallescens* (Shannon); see Waterhouse and Paramonov, 1950) occurs in California (Vacaville; Burbank; Davis) and Utah (Cedar City).

Genus **Bufolucilia** Townsend

Hall recognized two members of this genus, *B. silvarum* (Meigen) and *B. elongata* (Shannon), both characterized by an elongated head and strong median marginals on the second abdominal segment. A third species, however, traces to this couplet. In *Lucilia thatuna* Shannon 1926 (*Phaenicia thatuna* (Shannon) of Hall's monograph) the head is elongated as in *B. silvarum* and *B. elongata* and, in most cases, there are one or two pairs of median marginals on the second abdominal segment which are longer than the other bristles in the marginal row and which tend to be erect, although the distinctness of these bristles is not usually so pronounced as in *B. silvarum* and *B. elongata.* Except for the width of the male frontalia, which is subject to variation in this and related genera, Hall's generic diagnosis of *Bufolucilia* agrees with *thatuna* in all significant respects. I am therefore proposing

Bufolucilia thatuna (Shannon), new combination

for *Lucilia thatuna* Shannon, 1926, p. 132. To date, nothing is known of the biology of this species. Hall knew this species only from northern Idaho, but it is of wide, though rather uncommon, occurrence in the western states. I have records from Colorado (Colorado Springs), Montana (Belton), Idaho (Lake Waha; Craig Mts.; Moscow Mts.; Lewiston; Gold Hill, Latah Co.), Washington (Pullman; Field Springs, Asotin Co.; Kettle Falls; Puyallup), and California (Tanbark Flat, Los Angeles Co.; Yosemite; Sierraville; Moraga; Berkeley; Mill Valley; Soquel; Santa Cruz Mts.; Big Dalton Dam, Los Angeles Co.; Quincy, Plumas Co.; and Bumblebee, Tuolumne Co.); June to September in Washington, but as early as late March in California.

Bufolucilia elongata (Shannon) is a rare species, known only from Washington, Oregon, and possibly Colorado (James and Maslin, 1947), the last record needing confirmation since the determination was based on chaetotaxy and was made from a somewhat teneral female, the only reared specimen. This species seems somewhat variable as to chaetotaxy. I have a male from Lake Cushman, Wash., which has three postsutural acrosticals on one side and two on the other; I have seen another male with three acrosticals on each side.

Key to the Nearctic Species of Bufolucilia

1. Palpus wholly bright yellow, gradually expanded to a maximum (subapical) width, in the female not more than 0.8 length of third antennal segment; third antennal segment broadly yellowish toward the inner margin, in the female distinctly broader than the parafacial; male parafrontals, at their narrowest approach, almost contiguous .... *thatuna* (Shannon)

   Palpus black, at least apically, more abruptly expanded toward apex, in both sexes at least as long as the third antennal segment; third antennal segment black, about as wide as the parafacial; parafrontals, at their narrowest approach, separated by at least the minimum width of a parafrontal 2

2. Front broad, at narrowest 0.14 head width in male, 0.35 in female; normally two postacrosticals; fifth sternite of male prominent, as long as fifth tergite; body form distinctly elongated .... *elongata* (Shannon)

   Front narrower, at narrowest 0.08 head width in male, 0.31 in female; normally three postacrosticals; fifth sternite of male considerably shorter than fifth tergite; body not conspicuously elongated .... *silvarum* (Meigen)

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THREE NEW REARED BRACONIDAE

(HYMENOPTERA)

BY C. F. W. MUESEBECK, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

Names are needed for the following new species of Braconidae which are being utilized in the biological control of certain insect pests.

Agathis festiva, new species

Readily distinguished from *diversa* (Mues.), to which it is apparently related, by its clear hyaline wings, by its yellowish-brown antennal flagellum, by the presence of a conspicuous pale band across the middle of the abdomen and by having the third tergite completely smooth and polished.

Female.—Length about 5 mm. Head very thin from front to back, face flat and temples receding strongly from the eyes; face broad with well separated shallow punctures; malar space about one-third eye height; clypeal foveae slightly below level of lower eye margins; antennae nearly as long as body, tapering to apex, normally 31- to 34-segmented. Thorax higher than broad; notaulices sharply impressed, complete, meeting well before apex of mesoscutum, finely pitted; lobes of mesoscutum with shallow scattered punctures; propodeum reticulate rugulose; mesopleural furrow finely foveolate; hind coxae smooth; second cubital cell of forewing very small, triangular, petiolate. Abdomen with first tergite nearly twice as long as broad, broadening only slightly caudad, longitudinally striate; second tergite as long as broad, longitudinally aciculate behind the curved impressed line which crosses the tergite just beyond its middle, smooth or only faintly aciculate basad of this line; third and following tergites smooth and polished. Ovipositor a little shorter than the body.

Black; clypeus at apex, mandibles and palpi yellowish; antennal flagellum yellowish brown, darker apically; wings hyaline, stigma and some veins dark brown; anterior and middle legs entirely yellow except coxae which are piceus; hind leg black with trochanter and basal half of tibia yellowish white; abdomen black with basal half of second tergite pale yellow; venter pale basally.

Male.—Differs from female in having anterior and middle coxae yellow, and in having the abdomen more broadly banded, the pale color taking in the apex of the first tergite, all of the second and the base of the third.

Type.—U. S. N. M. no. 61687.

Type locality.—Province of Shantung, China.

Described from 20 females and 79 males, some including the type from Shantung Province, China, reared from larvae of the oriental fruit moth, *Grapholitha molesta* (Busck), the remainder representing progeny of specimens introduced from

China and reared in the Bureau's laboratory at Moorestown, N. J. on larvae of *G. molesta.*

Apanteles harrisinae, new species

Runs to couplet 84 in my key (Proc. U. S. National Museum 58: 484, 1921) but does not agree with either alternate or with any described species. The form and sculpture of the two basal tergites combined with the presence of a conspicuous yellowish white spot between eye and base of mandible distinguish this species from related forms.

Female.—Length 2.5 mm. Antennae a little shorter than body, tapering slightly to apices. Mesoscutum anteriorly covered with very shallow, closely placed punctures, posteriorly smooth with the punctures faint or absent; scutellum with scattered, very shallow punctures; propodeum largely smooth but with a little indefinite sculpture laterally; radius slightly longer than inter-cubitus; inner calcarium of hind tibia longer than outer bua hardly half as long as basitarsus. Abdomen with first tergite parallel-sided for most of its length but strongly rounded off on apical fifth so that it is much narrower at apex than at base, almost entirely smooth, with only a few scattered punctures toward apex; sclerotized plate of second tergite triangular, a little narrower at base than long, about twice as wide on posterior margin as long, smooth medially and with a little indefinite longitudinal sculpture laterally; following tergites smooth and polished; ovipositor sheaths very slightly exserted.

Black; palpi pale; a yellowish white spot covering space between eye and base of mandible; tegulae black; wings hyaline, stigma dark brown; legs yellow, but with all coxae black, and apical half of hind femur dorsally, apical half of hind tibia and most of hind tarsus strongly infuscated, middle femur sometimes with a small fuscous blotch near base below.

Male.—Like female but with hind femur often more extensively infuscated.

Type.—U. S. N. M. no. 61688.

Type locality.—Pomerene, Ariz.

Described from 20 females and 14 males: The type and 22 paratypes reared from *Harrisina brillians* B. & McD. at the type locality Aug. 24-26, 1950 by Owen J. Smith; 6 paratypes labeled "Ex *H. brillians*, Arizona, Aug. 1950;" 4 paratypes reared from the same host at Wilcox, Ariz. Aug. 28, 1950 and 1 paratype from *H. brillians* at Babocomari, Ariz. Sept. 1, 1950. The species is a gregarious parasite, 10 to 16 individuals normally developing in a single host larva. The cocoons are pure white.

Bracon lissogaster, new species

Most similar to *B. connecticutorum* (Vier.), but differing from that species in having the abdomen entirely smooth and polished, the notaulices less hairy, and the second abscissa of cubitus only half as long as the recurrent vein.

Female.—Length about 3.5 mm. Head, including face and frons, smooth and polished; transverse diameter of opening between clypeus and mandibles slightly longer than distance from opening to eye. Antennae 27- to 31-segmented, shorter than body, the first two flagellar segments about twice as long as broad, the rest shorter. Thorax smooth and polished. Notaulices weak, not strongly hairy. Propodeum without even a suggestion of a median longitudinal carina at apex. Radius arising from before middle of stigma; first abscissa two-thirds as long as, second abscissa only slightly longer than, first intercubitus, which is strongly oblique. Second cubital cell about three-fourths as long as third measured on cubitus. Abdomen entirely smooth and polished. Second suture fine, nearly straight and not foveolate. Ovipositor sheaths extending less than half the length of abdomen beyond last segment.

Usually mostly testaceous, with head, including antennae and palpi, pro- and mesopectus, apices of all tibiae, and all tarsi entirely, black; wings somewhat infumated; stigma and veins dark brown. In some of the female paratypes the thorax and legs are more extensively black.

Male.—More slender than the female. Antennae as long as body, 33- to 39-segmented. Head and thorax entirely black. Legs brownish to piceous, with coxae largely black.

Type.—U. S. N. M. no. 61020.

Type locality.—Choteau, Mont.

Described from 17 females and 28 males reared from the wheat stem sawfly, *Cephus cinctus* Norton by K. B. Maughan in August, September and October, 1950.

NOTES ON FOOD HABITS OF THE WESTERN HARVESTER ANT

(Hymenoptera, Formicidae)

By George E. Bohart[1] and George F. Knowlton[2]

The western harvester ant, *Pogonomyrmex occidentalis* (Cress.), is one of the most abundant insects in the intermountain region. Its nest mounds, composed of fine gravel and debris, are familiar sights on the dry plains and bench lands. The larger mounds, together with the denuded area surrounding them, may occupy 500 square feet or more. Where these are scattered throughout a field of dry-land grain or legume seed, the farmer suffers a conspicuous, if not drastic, loss of the use of his land.

In their search for food to carry back to the colony, har-

[1]Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Logan, Utah.
[2]Utah State Agricultural College, Logan.

vester ants may range about 100 feet from their nest. Seeds are their principal diet, but other dry, protein-rich substances may be taken also. They store surplus food in numerous chambers ranging from a few inches to several feet beneath the mound surface. These chambers are usually 1 to 2 inches high and several inches in diameter. In most of the nests examined, seeds occupied nearly all the storage space, but, where other colonial or gregarious Hymenoptera were nesting within foraging range, pillaged materials occupied several chambers.

Pollen is a favorite item of plunder. When a pollen trap is installed on a hive of honey bees, foraging ants from a nearby colony may enter the trap and carry off the pellets of pollen as rapidly as they fall through the screen. Michener[3] states that individual foragers of the California harvester ant, *Pogonomyrmex californicus* (Buckl.), show no tendency to return to the area in which they located food on a previous trip, but that a concentration of food does seem to attract ants. The authors have observed as many as a dozen harvester ants scurrying about in a pollen trap, but never an ''army'' such as one sees with trail-making species.

Harvester ants also pilfer pollen from the nests of the alkali bee, *Nomia melanderi* Ckll. While the bees are foraging, the ants enter their burrows and make off with pollen from unsealed cells. They shape a load of pollen into a rough ball about 3 mm. in diameter and carry it ahead of them in their mandibles. It only takes about four such thefts to empty a completely provisioned cell.

Near Wapato, Washington, H. Menke and the authors observed hundreds of ants carrying pollen from nests of alkali bees in a site containing several hundred thousand burrows. The mound of one ant nest, which was surrounded by *Nomia* burrows, had several chambers containing in all about 100 grams of pollen. This would be enough to provision about 750 *Nomia* brood cells. Probably the ants had already consumed much of the stolen pollen.

Harvester ants also forage for dead bees in the nesting sites of alkali bees. F. E. Todd first observed this at Delta, Utah, in 1946 following an application of DDT to an alfalfa field near the site. He reported that many ants could be seen dragging dead bees from the nesting site to their mound. The ants dragged bees to the mound without help from their sister workers until they had climbed the mound to the nest en-

[3]Michener, C. D. 1942. The history and behavior of a colony of harvester ants. Sci. Monthly 55:248-258.

trance. Then several ants usually cooperated in carrying the load underground.

In 1947 at Delta several ant mounds near a nesting site of alkali bees were examined for dead bees. None were found in any mound more than 100 feet from the site. One mound between two sections of the site contained about 54 bees, although some had to be reconstructed from fragments. Half of another mound, examined before an application of DDT to a nearby alfalfa field, was found to contain 4 dead bees in fragmentary condition. The other half, examined the day after the application, contained 16 bees, most of them in good condition. Thus, it appears that in some areas the effects of insecticide applications on bees could be compared in a general way by counting the dead bees stored in nearby ant mounds.

JAMES AUGUSTUS HYSLOP

July 7, 1884 — January 16, 1953

Many people have asked James Hyslop, "What good is a bug anyway?" "What good are you?" he often flashed back. At first he wanted to exterminate insects but the longer he worked with them the better he liked them. The more peculiar their habits, the more he was fascinated by them and wanted others to become interested in them. So great was his desire that he decided to write a book about them. Thirty-five years ago this dream began to take shape and the "Encyclopedia of Economic Insects of North America (North of Mexico)" was born.

About 10 years ago the enormity of the task of assembling facts about some 25,000 species of insects convinced him of the need of aid. Accordingly one of us (H. S.) had become sufficiently interested in the undertaking to join him as a junior author and to whom the manuscript of 189 volumes and the job of completing the task and of finding a publisher was willed.

Jim, as he was known to all his friends, began collecting insects as a child in Rutherford, N. J. Although he spent most of his youth there, he was born in Chicago, Ill. He entered Massachusetts Agricultural College, now the University of Massachusetts, at Amherst, where he received his B.S. degree in 1908. He was one of those industrious fellows who made the most of his summer vacations by doing entomological work for the Connecticut Agricultural Experiment Station and United States Bureau of Entomology (Cotton Insects in 1907). For his many extra-curricular activities in college, he was presented by the Dean with an academic medal (an award not instituted until recent years) in June 1948, at the time of his 40th reunion.

By 1909 he was on the West Coast and while working for the Division of Cereal and Forage Insects, he attended at night the University of Washington where he received his M.S. degree in 1911. Back to the East Coast in the same year, he was put in charge of the Hagerstown, Md., laboratory of that division. Here he reared and classified a number of wireworms. He published several papers on the taxonomy and ecology of those insects, and two U.S.D.A. bulletins on their destructiveness to cereal and forage crops.

According to Jim's associates, during the First World War, the idea of a new kind of Insect Pest Survey came to him. He knew that, prior to this time, surveys (even the one started by the Division of Entomology, but long since discontinued) were usually only geographic records of insects. But Jim Hyslop envisioned something much greater than this. Aware that vast amounts of data on insects had been kept as private notes of entomologists and in institutions, he felt that these records should be brought together in one large central file. Then, in the form of monthly reports, this information would be published so that entomologists the country over could be informed of insect conditions. His ultimate objective was to use these data to predict the degree of abundance of insects over the United States.

Some workers thought his plan almost fantastic, but not Jim. He was steeped in enthusiasm and, as one of his friends says, "He left no stone unturned that would lend interest and support to his project."

Finally, one night a small meeting took place in a hotel room during the 1920 Chicago meeting of the American Association of Economic Entomologists. E. G. Kelly, L. Haseman, W. P. Flint, H. E. Hodgkiss, and T. H. Parks, all extension workers interested in promoting an insect reporting service for the country, were there. The Insect Pest Survey was born in that meeting. The Association then adopted the recommendations made by the Committee on Policy that the Bureau establish an Insect Pest Survey.

Early in March 1921 Jim witnessed the formal inauguration of the Survey, with him in charge. The first Insect Pest Survey Bulletin appeared in May 1921. In his usual persuasive way he found no trouble in getting collaborators, and by 1928 the survey had representatives in every state in the Union. He so inspired C. R. Crosby and one of us (M.D.L.) that we sent in literally thousands of notes from New York state alone. By informal cooperative arrangements Jim re-

ceived monthly summary notes from Canada, Mexico, Hawaii, Haiti, and Puerto Rico. The value of a Federal survey so impressed him that he urged many states and a few other countries to start surveys of their own.

Jim was aware that notes from collaborators alone would not give the Survey repository all the data needed. For this reason he and his associates in Washington culled biological, ecological, host plant, and other pertinent data on insects from the literature. In 1934 Jim Hyslop became head of the newly created Division of Insect Pest Survey and Information. At this time, with an increased staff, he was able to more readily accumulate material from foreign literature. His idea in maintaining such a file was to make promptly available data on any insect that might be introduced or intercepted at port of entry in this country. By 1944, he had collected half a million reports on 50,000 species throughout the world. Before he retired in 1944, he drew up plans for an enlarged Survey on a regional basis. These plans were used in organizing the present economic insect reporting service in the Bureau.

Jim had many other interests. He was the first to compile a comprehensive statement on insect losses. His paper, "Losses Occasioned by Insects, Mites, and Ticks in the United States," still is a classic work on this subject. For many years he was interested in the periodical cicada and wrote several articles concerning its appearance. In 1936 he directed the work on a motion picture about the periodical cicada. Part of the film was made at his farm in Silver Spring, Md. Although he died a few months before the 1953 cicada emergence, we can still hear his wonderful voice on the sound track of that motion picture.

Other work included his promotion of approved common names of insects. He was Standing Chairman of the Committee on Nomenclature of the Association of Economic Entomologists for a number of years. He was one of the few entomologists who has ever studied weather in relation to insect abundance. One of his articles, "Insects and the Weather," appeared in the Agriculture Yearbook for 1941. In over 200 of his publications, his talent as a writer is readily evident. As an artist, he not only made insect drawings but in his spare time he painted portraits, as well as numerous other subjects.

He was a member of several scientific societies: Entomological Society of Washington which he joined in 1908 and which he served as President in 1927; American Association of Economic Entomologists; Entomological Society of America; Washington Academy of Sciences; American Association for the Advancement of Science; and the Cosmos Club.

Jim's dynamic personality impressed all who came in contact with him. His sparkling blue eyes and jovial manner immediately put everyone at ease. He loved people and was so hospitable that his country farm, known as Cameronia, became a meeting place for entomologists. The open house held every New Year's Day was an affair not to be missed. His wife, Grace, his sister Kate, his four children: Charles, James, Ryntha (Mrs. Donald R. Geehring), and Wynnifred (Mrs. Ray Shields), all of whom survive him, helped to make the merriment at the parties complete.

Jim Hyslop had the ability to reach out and pull together great masses of entomological information, mold them, and give them back to the people of this country in a form which promoted their own welfare. He always believed in people and has often said, "Remember, if you will just *believe* that you can do a job, you can do it."

HELEN SOLLERS, *Chairman*
FRED C. BISHOPP
MORTIMER D. LEONARD

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1952

TREASURER

General Fund

Cash on hand January 1, 1952	$ 782.75	
Receipts from all sources during 1952	3,138.98	
Total		$3,921.73
Cash on hand December 31, 1952	569.27	
Expenditures during 1952	3,352.46	
Total		$3,921.73

Memoir Publication Fund

Cash and securities on hand, January 1, 1952	$4,691.07	
Receipts and earnings during 1952	745.79	
Total		$5,436.86
Cash and securities on hand December 31, 1952	5,318.42	
Expenditures during 1952	118.44	
Total		$5,436.86

Respectfully submitted,
R. H. NELSON, *Treasurer*

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

CUSTODIAN

REPORT ON MEMOIRS

Memoir 1, 7 sold in 1952, 116 on hand.
Memoir 2, 5 sold in 1952, 69 on hand.

Memoir 3, 14 sold in 1952, 323 on hand.
Memoir 4, 75 sold in 1952, 725 on hand.

PROCEEDINGS

During 1952 we sold 39 complete volumes of the *Proceedings* and 47 individual numbers. We received, as gifts from members, 31 complete volumes, and 62 single numbers.

Respectfully submitted,
HELEN SOLLERS, *Custodian*

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

CORRESPONDING SECRETARY

Membership, January 1, 1952		469
Losses during 1952		
Resigned	8	
Dropped	2	
Deceased	5	
Total	15	
Elected to membership during 1952	46	
Net gain in membership, 1952	31	
Total membership Dec. 31, 1952		500
Classes of Membership:		
Active, dues paying	480	
Retired	13	
Honorary	2	
Life	5	
Total		500

The membership is distributed among 42 States, the District of Columbia, 6 territories, and 21 foreign countries.

Distribution of *Proceedings*:	
To members	479
To subscribers	172
Total	651

The *Proceedings* goes to members and subscribers in all 48 States, the District of Columbia, 6 territories, and 41 foreign countries.

Respectfully submitted,
ARLO M. VANCE, *Corresponding Secretary*

A complete copy of this report is on file in the office of the Corresponding Secretary.

ENTOMOLOGICAL SOCIETY OF WASHINGTON
623RD REGULAR MEETING, JANUARY 8, 1953

The 623rd regular meeting of the Entomological Society of Washington was called to order by President W. H. Anderson at 8:00 P.M. Thursday, January 8, 1953 in room 43 of the U. S. National Museum.

Thirty-eight members and 14 visitors braved a miserable night to attend. The minutes of the previous meeting were read and accepted.

The following committee appointments were announced by President Anderson: Program, Ralph Bunn, R. H. Nelson, C. W. Sabrosky, H. L. Trembley, and C. H. Hoffman, Chairman; Membership, Howard Baker, W. E. Bickley, J. H. Fales, R. I. Sailer, and Paul M. Woke, Chairman; Notes and Exhibition of Specimens, Howard B. Owens, L. M. Russell, Norman Mitlin, and David A. Young, Chairman; Memoirs, C. F. W. Muesebeck, Chairman, K. V. Krombein, R. H. Foote, and, *ex officio*, B. D. Burks; To Assist the Custodian, Helen Sollers; Reserve Stock of Publications, Alan Stone and Lucille Yates; Auditing, L. B. Reed, Chairman, and G. J. Haeussler.

The following persons were elected to membership in the Society: Walter C. Atcheson, Veterans Housing Project, Apt. 7-B, College Park, Maryland.

Pedro Araoz Ascencion, Estación Experimental Agricola, Tingo María (Huánuco), Peru.

George W. Lloyd, Production and Marketing Administration, U. S. Dept. of Agriculture.

W. C. Brothers, 2620 Poydras St., New Orleans 19, La.

A letter from Otto Swezey read by President Anderson asked to let his friends be told of his retirement to California. Mr. Swezey's address will be 10408 Fleming Ave., San Jose.

R. I. Sailer exhibited drawings made of an unusual shore bug, *Saldoida cornuta* Osborn, received from Professor Herbert Osborn. The illustrations were drawn by Heideman but were not published with the description in 1901. The species is one of four which show a peculiar distribution, this one and another being restricted to the southeastern United States, whereas a third species is known only from Formosa, and a fourth is known only from the Philippine Islands.

F. C. Bishopp remarked that Professor Osborn, who is now 96, is ill.

The first paper on the regular program was given by Col. Ralph Bunn of the Office of the Surgeon General, U. S. Army, who told of his impressions concerning entomological activities in post-war Germany. The greatest potential problem in medical entomology is typhus. Beneficial or rare insects are protected by German law; some of these were shown. The Germans also make common use of insects in art and decoration. A collection of porcelain figurines and dishes embodying insects in their decoration and design were displayed. Kodachrome slides of typical scenes in Germany were shown in conclusion. (Speaker's abstract.) The subject of the legal protection of insects received much attention in the discussion which followed.

The second paper was given by Dr. E. W. Laake of the Office of Foreign Agricultural Relations, on control of livestock insects in Central and Northern South America. The livestock insects found in that area were discussed and illustrated with kodachrome and lantern slides. Area projects initiated in Costa Rica, Nicaragua, and Ecuador for the control of the torsalo grub, *Dermatobia hominis* (L., Jr.) the fever tick, *Boophilus annulatus microplus* Can., and the louse *Haematopinus quadripertusus* Fabr. with toxaphene sprays and dips were outlined and the results in weight gained by treated over untreated animals obtained in tests in Nicaragua were described. Courses of training are being given native personnel in Central and South America, in the class room and in the field, to qualify them to handle livestock insect control. It is most likely that eventually this contribution by OFAR will effect a clean-up of the appalling torsalo-tick menace, and result in considerably enhancing the standard of living and the economy of the industry in the cooperating nations. (Speaker's abstract.) The unusually difficult problems of fly control encountered by Dr. Laake in this work were of special interest to the audience.

Visitors introduced were John G. Barker, graduate student of the University of Maryland, and H. C. Huckett, of the Long Island Vegetable Research Farm, New York State Agricultural Experiment Station.

The meeting adjourned at 9:50 P.M.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
624TH REGULAR MEETING, FEBRUARY 5, 1953

The 624th regular meeting of the Entomological Society of Washington, held in room 43 of the U. S. National Museum Thursday, February 5, 1953, was opened by President W. H. Anderson at 8:00 P.M. Several distant states and two other countries were represented among the 50 members and 35 visitors present. The minutes of the preceding meeting were read and accepted. Officers' reports for 1952 were given by A. M. Vance, Corresponding Secretary; Norman Mitlin for R. H. Nelson, Treasurer; Kellie O'Neill for B. D. Burks, Editor; C. H. Hoffman for Helen Sollers, Custodian; and Lucille W. Yates for the Committee to Assist the Custodian. The reports were accepted, with special thanks voted R. H. Nelson for his hard work as Treasurer, and the group rose to show appreciation of the officers' work for the year.

Dr. Edward L. Todd, Division of Insects, U. S. National Museum, Washington 25, D. C., was voted a member of the Society.

The death of J. A. Hyslop was announced, and President Anderson appointed a committee consisting of F. C. Bishopp, M. D. Leonard, and Helen Sollers, chairman, to prepare an obituary for the *Proceedings*.

A. B. Gurney announced the death, on about January 24, 1953, of Nathan Banks, who was President of the Society, 1905-06. Mr. Banks became a member in 1890, when he first became affiliated with the U. S. Department of Agriculture; in 1892 he was Recording Secretary. In 1916 he became Curator of Insects at the Museum of Comparative Zoology, Cambridge, Mass. His was a very active and productive career, and his rich and varied talents made him one of the most versatile and best known of taxonomists. He died at his home in Holliston, Mass., at the age of 84, after a brief illness, leaving his widow, three sons, and five daughters. (Speaker's abstract.)

E. N. Cory and M. D. Leonard commented further about the life and kind personality of Mr. Banks.

The address of the retiring president to have been given by W. D. Reed was omitted because of the illness of Mr. Reed, who sent his regrets to the Society. The second paper scheduled for the evening was given by Dr. J. C. Chamberlin of the Division of Truck Crop and Garden Insect Investigations, Bureau of Entomology and Plant Quarantine, at Forest Grove, Oregon. He spoke on characteristics of airplane spray patterns at low flight elevations. Spray is carried out beyond the wing tips by the wake of the airplane, which comprises primarily three expanding vortices of air produced by the propeller and wing tips. The propeller vortex also shifts much of the spray from the right side of the boom to a deposit zone left of center. Modifications in the arrangement of nozzles, fineness of spray at different points on the boom, and elevation of flight improve mean spray deposit rates across a treated swath, but it seems certain that aerodynamic effects can never be completely counteracted. The excellent slides and moving pictures illustrating Dr. Chamberlin's talk were enjoyed by the members. (Secretary's abstract.)

In lieu of Mr. Reed's address entomologists with the Division of Truck Crop and Garden Insect Investigations gave short papers. C. F. Doucette, in charge of the laboratory at Sumner, Washington, spoke on some insects affecting ornamentals in the Northwest, illustrating his talk with unusually colorful slides.

R. L. Wallis, in charge of the laboratory at Scottsbluff, Nebraska, discussed ecological studies of the potato psyllid. Surveys were made in Texas and New Mexico, where the potato psyllid overwinters, to determine the population and extent of movement into Nebraska, Colorado, and Wyoming.

O. A. Hills, in charge of the Phoenix, Arizona laboratory, told of his 60-day assignment under the auspices of the U. S. Army to assist personnel in the Ryukyu Islands on their vegetable insect problems. Agriculture in the Ryukyu Islands is practiced in a manner unfamiliar to most members of the Society.

Dr. N. G. S. Raghavan, Assistant Director of the Malaria Institute of India at Delhi, was presented by C. H. Hoffman and spoke briefly of his interest in mosquito borne diseases, particularly malaria and filariasis. It was much regretted that there was not time to introduce the many other visitors and out-of-town members who were present.

The meeting adjourned at 10:10.

KELLIE O'NEILL, *Recording Secretary*

Actual publication date of vol. 55, no. 2, April 27, 1953.

ANNOUNCEMENT

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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.

OFFICERS FOR THE YEAR 1953

PROCEEDINGS
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The Corresponding Secretary, Custodian, and Treasurer should be addressed care Bureau of Entomology and Plant Quarantine, Washington 25, D. C.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 55 AUGUST 1953 No. 4

A NEW SPECIES OF CULEX FROM ECUADOR

(DIPTERA, CULICIDAE)

BY ROBERTO LEVI CASTILLO, *Ecuadorian Center for Entomological Research, Guayaquil, Ecuador*

Among collections of larvae and pupae of mosquitoes taken by means of a hand glass pump from bamboo stumps located at Juan Montalvo, Los Rios Province, in Ecuador, males and females of a *Culex* were obtained. This species did not agree with descriptions of other members of the subgenus *Carrollia* from South America.

The author wishes to thank Dr. Alan Stone, of the U. S. Department of Agriculture, for his assistance in comparing a male sent for confirmation with specimens in the U. S. National Museum collection.

Culex (Carrollia) babahoyensis, new species

Adult Female.—Head: Proboscis and labella covered with dark scales, with violet metallic reflections; palpi short and covered with the same scales. Clypeus dark and bare. Vertex covered by white scales and bordered by dark setae, with long ones overhanging the clypeus; white, upright, forked scales over all the central area. Occiput with erect, white scales. Thorax: Prothoracic lobes white, bare, with long dark setae, with white tips. Mesonotum covered by long, metallic dark blue scales and setae in the middle, sparse white scales and dark setae forming a tuft in the pronotum, base of the wing with white scales and sparse dark setae, postnotum bare except for sparse, white scales; pleura with grey integument and white spots. Scutellum white with dark setae. Coxae covered by snow-white scales and setae. Abdomen: Dorsally dark sealed, with a metallic dark violet reflection; white bands at the basal portion of segments, with bright violet side spots. Venter covered with white scales, with the exception of patches of dark scales at the tips of the last three segments. White bristles arising from the tips of the last segments, with dark ones in the tips of the last two segments. Legs: Femora basally while and distally with some dark metallic scales with violet reflections. Tibiae with basal white spots. Tarsi entirely dark. Wings: Covered with narrow, dark scales.

Adult Male.—Shows an appearance similar to the female, with the last abdominal segment more hairy than in the female. The male terminalia shows the coxite, fig. 1, longer than wide, covered on the outer surface with some small scales and long setae. Observable on the inner surface: towards the tip a small columnar process; arising from a protuberance is a finger-like process, ending in two laminae, which are oval

Fig. 1, coxite and clasper; fig. 2, mesosome; fig. 3, ninth tergites.

and striated; and a small hair-like seta arising from a basal tubercle. An extensive setose lobe is present below the columnar and finger-like processes. Clasper long, slightly curved in the middle, with a round tip; clasper bearing a terminal spicule, which arises from a basal tubercle, and an inner spicule, which is longer and more heavily chitinized than the outer one; the outer sub-apical border of the clasper is serrated, ending in a small crest-like process; the inner border of the clasper with small setae. Tenth sternite with two terminal teeth and an interior spicule. Mesosome, Fig. 2, with inner plate like an italic *S*, with one end chitinized; outer plate elongated, beak-like at the tips, with the borders round and chitinized. Ninth tergites, Fig. 3, showing an interlobar, slightly convex space, with four long setae, arising from basal tubercles, and projecting outwards from each lobe.

Pupa.—With respiratory trumpet long, sclerotized. Hair 2 ramified. Hair 8 of segment VII is formed by four short elements; on segment VIII it is well developed, with six to eight elements. Paddles round, well developed, and chitinized.

Types.—Holotype: A male terminalia slide in the U. S. National Museum, type No. 61639. Paratypes: 5 ♂, 8 ♀ in the Collection of the Ecuadorian Center for Entomological Research.

Type Locality.—Hacienda Mora, Juan Montalvo (Los Rios Province), Ecuador.

Habits.—The adult females bite readily during the day and are observed specially at the sunny spots in the jungle. Oviposition is in bamboo stumps and tree holes, from which pupae were obtained.

Observation.—This species shows a very short upper division, as in *Culex* (*Carrollia*) *antunesi* Lane and Whitman, a finger-like process below the columnar process, as in *Culex* (*Carrollia*) *soperi* Antunes and Lane and *antunesi*, but its main difference is in the extensive setose lobe below the columnar process and the finger-like process. This new species was given the name *babahoyensis* because the main river flowing near the type locality is the Rio Babahoyo, one of the large tributaries of the Guayas hydrographical system of Ecuador.

References

Antunes, J. P. and J. Lane, 1937. Um novo Culex (Culex (Carrollia) soperi) encontrado em São Paulo. Rev. Biol. Hig. 8(1): 21-23.

Lane, J. and L. Whitman, 1943. Novas especies de Culex do Brasil. Rev. de Ent. 14(3): 389-392.

THE OCCURRENCE OF SEVERAL SCARCE ASSASSIN BUGS IN VIRGINIA

(Hemiptera, Reduvioidea)

By Richard L. Hoffman, *Virginia Agricultural Experiment Station, Blacksburg*

For several years I have been accumulating specimens for a survey of the heteropterous fauna of Virginia. Represented in the material currently at hand are several species of reduvoid bugs which are of special interest because of their general rarity in the eastern United States, or because the Virginia specimens constitute considerable extensions to their known ranges. Uncertainty on the final outcome of my project prompts the desire to publish the records separately for the benefit of other workers in the group. In connection with the present paper, I wish to express my thanks to Dr. R. I. Sailer for pertinent advice and information.

Phymata albopicta Handlirsch

On May 3, 1952, I found a thriving colony of small phymatids on the foliage of a beech tree (*Fagus* sp.) on the eastern side of Smith Mountain, near Sandy Level, Pittsylvania Co. A specimen submitted to Dr. Sailer was identified as *Phymata albopicta* Handlirsch. Originally described from Georgia, *albopicta* has been reported also from Mexico and Guatemala. It seems to be scarce over its entire range. Dr. Sailer informs me that the National Museum has only five specimens, these from the District of Columbia, North Carolina, South Carolina, and Texas, indicating a distribution coincident with the Lower Austral life zone. The Virginia locality is in the south-central part of the state, in what may be referred to as ''Inner Piedmont.''

The habitat of *albopicta* has not been noted in the literature; the present observation is of particular interest in reflecting a considerable difference from the typical flower-head haunts of the better-known phymatas. Being impressed with this fact at the time of collecting, I searched flowers in the vicinity as well as other trees, finding, however, no other specimens belonging to the genus. It is not clear why a presumably predacious bug should occur in such an unlikely place. No other kinds of insects were seen on the beech foliage.

Saica fuscovittata Barber

My duties as laboratory shift foreman at the Radford (Virginia) Arsenal involve working at all hours, and afford sufficient leisure to permit routine night inspection of windows and various outside lights for insects. On August 10, 1951, I secured a small reduviid attracted to lights outside the laboratory building at the Arsenal. This was tentatively identified at the time as a *Saica*, but it was regarded at the time only an adventive individual. On July 13, 1952, a second specimen of the same species was collected on the Arsenal property, and engendered a fresh interest in the matter. A specimen sent to Dr. Sailer was determined as *S. fuscovittata* Barber. It is felt that the collection of two individuals (both adult) in different years is a good indication that a colony of the bugs exists in Montgomery County. There is, to the best of my knowledge, no commerce between the Arsenal and any point in Florida, a circumstance which militates against the likelihood of accidental introduction.

Blatchley has pointed out that *Saica* is a tropical genus, represented in this country only by *fuscovittata* and another (somewhat dubious) species known only from nymphs. Both are restricted to southern Florida. The discovery of the Virginia colony poses something of a zoogeographic problem. The northward extension of some 850 miles would not seem so unusual—considering the ''spotty'' distribution of many insects—were the new locality in eastern Virginia and thus in a lowland, almost subtropical habitat. Radford Arsenal, however, is in the southwestern mountainous part of the state, and the presence there of *Saica* is in defiance of the usual distributional patterns. Perhaps the phenomenon of reliction is to be considered; perhaps the thinly-worn (but indisputable) explanation of ''inadequate collecting in intervening areas''! Dr. Sailer advises me that to the best of his knowledge there are no previous records for *fuscovittata* outside Florida.

Pygolampis sericea Stål

Although widely distributed over the eastern United States, *Pygolampis sericea* Stål has been reported from only a few localities. So far I have collected it at two localities in Virginia. These are at Lowmoor, Alleghany County, on December 6, 1951, and east of Blacksburg, Montgomery County, on October 20, 1950. In both cases only nymphs could be found, but these included individuals in the final instar, with the adult characteristics well developed. They were discovered under flat rocks and in dry grass clumps in open grassy areas.

Although these two localities are in western Virginia, they represent areas of invasion of the mountains by slender fingers of Lower Austral faunas extending up the larger river valleys. Many other typically lowland species of animals have been collected at both places.

Acholla multispinosa (Degeer)

Blatchley's manual of the eastern Heteroptera defined the range of this species as being essentially northern in character, there being no records for any of the southern states known at the time of the publication of the manual. More recently Brimley (1938, Insects of North Carolina, p. 74) cites a collection from Swannanoa, Buncombe County, North Carolina. Swannanoa is located in the Blue Ridge, and at the base of the imposing Black Mountain ranges.

In the collection of the Agricultural Experiment Station at Blacksburg I find two specimens of *multispinosa* which appear to constitute two new state records. These locality records help to fill in the gap between the northern and southernmost populations. One of these, a large specimen in excellent condition, was collected at Blacksburg, Montgomery Co., on August 22, 1951 by Helen Jordan. The other is a small, damaged individual from the collection of Rev. E. A. Smythe. It was taken at Berkeley Springs, Morgan Co., West Virginia, on July 25, 1887. From the available records it would appear that the range of *multispinosa* extends in a long, narrow tongue down through the Appalachians. Additional localities may be expected.

YOUNG'S RECLASSIFICATION OF WESTERN HEMISPHERE TYPHLOCYBINAE

(HEMIPTERA, CICADELLIDAE)[1]

Dr. Young has written an excellent review of the genera of the subfamily Typhlocybinae of the Western Hemisphere. In all, sixty genera are noted from North and South America, of which thirty-one are described as new. In contrast my catalogue of this group shows only eighty-five genera previously described from all parts of the world.

In this treatise, Dr. Young attempts to rehabilitate the genus *Dicranoneura* Douglas. This is, I believe, in error. Douglas (1875b: 27-28) described two species, *Dicranoneura citrinella* Zett. and *Dicranoneura mollicula* Boh. from England. There is nothing to indicate that he intended to describe a new genus or to emend Hardy's (1850a: 423) spelling *Dikraneura*. Evans (1947a: 201) assumed that Douglas intended to establish a new genus as Douglas did not include *Dikraneura variata*, the only species included in Hardy's genus. Evans establishes *Cicada* (nec *Cicadula*) *citrinella* Zetterstedt (1828a: 536) as the type of *Dicranoneura* Douglas. Nevertheless, Evans includes *Dicranoneura* Douglas as a synonym of *Dikraneura Hardy*.

Young, however, argues: "The names *Dikraneura* [Greek *dikroos*, forked] and *Dicranoneura* [Greek *dikranon*, a pitchfork] and the fact that a 'two-headed nerve' actually occurs in the hind wing of the species originally included suggests the idea that Douglas used the term by design and not through an effort to emend *Dikraneura*." I cannot accept this as Douglas and Scott (1876a: 80) write *Dicranoneura* without any bibliographic references and immediately beneath it *Dikraneura* Hardy (1850a: 423) and *Notus* Fieber (1866a: 508) as synonyms. The species *variata* Hardy is included. Douglas (1879a: 253) wrote: "The genus *Dicranoneura*, or as Hardy imperfectly wrote it, '*Dikraneura*,' appears not to be accepted on the continent vice *Notus* Fieb. (1866), although it is identical and dates from 1850. The character of the neuration of the type, *D. variata* is well expressed. . . ." These facts would seem to indicate that Douglas' name was clearly an emendation for *Dikraneura* Hardy. If *Dicranoneura* Young nec Douglas is a distinct genus as it appears to be, we will have to restore the name *Forcipata* De Long and Caldwell (1936a:70) with logotype *Forcipata loca* De Long and Caldwell. (References cited here are to my Bibliography of the Homoptera Auchenorhyncha, 1942).—Z. P. METCALF, *University of North Carolina, Raleigh.*

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[1] Univ. Kansas Sci. Bul. 35(1), 217 p., 38 pls., 1952.

TAXONOMY AND HOST RELATIONS OF THE TRIBE ORMIINI IN THE WESTERN HEMISPHERE

(DIPTERA, LARVAEVORIDAE)

BY CURTIS W. SABROSKY, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

The yellow to testaceous flies of the larvaevorid (tachinid) tribe Ormiini (*sensu* Townsend) are relatively uncommon in collections, and little has been known of their host relations. Their remarkable uniformity in habitus and characteristics has made them difficult to determine, and available names have often been misapplied. An important rearing by W. L. Nutting of a species in this group prompted an examination by the writer of available material and evidence. Even though it is still not possible to be conclusive in some respects, it is desirable, as a guide for future work, to bring together and evaluate the scattered records as far as possible, and to present a review of the present knowledge of the tribe as it occurs in the Western Hemisphere.

Approximately 260 specimens have been studied, including the holotypes of twelve species and one subspecies. Information on several other types has been furnished by J. E. Collin of Newmarket, England, F. van Emden of London, M. Beier of Vienna, and E. Séguy of Paris. C. H. Curran of the American Museum of Natural History [AMNH] arranged for the loan of two holotypes and other material, and M. Beier and H. Mayer of Vienna for the loan of the type of *Tachina deplcta* Wiedemann. I am deeply indebted to these correspondents for their generous assistance in the fundamental matter of types, and to J. Bequaert of the Museum of Comparative Zoology [MCZ], R. H. Beamer of the University of Kansas [KU], and particularly to H. J. Reinhard of Texas A. & M. College for the loan of specimens. The bulk of the available material is in the collection of the U. S. National Museum [USNM]. The most commonly cited collections have been abbreviated as noted above, in brackets.

Not all of the characters given prominence by Townsend in his key to genera (1936, Manual of Myiology 3:101) have proved reliable. Although Townsend defined *Ormia* Robineau-Desvoidy and *Euphasiopteryx* Townsend as having black epaulets, several species with yellow epaulets are now known. Further, he distinguished *Ormia* by the combination of ocelli present and male with callosities on both costa and second vein, but two new species described below have ocelli but the males lack the second callosity. One might conclude that there is only one genus, *Ormia*, with synonym *Euphasiopteryx*.

However, in my opinion the presence or absence of ocelli is a significant character, for these are almost universally present in muscoid flies. I here propose to recognize two genera —*Ormia*, with ocelli present, and *Euphasiopteryx*, with ocelli absent.

In view of the above remarks, the status of *Ormiophasia* Tns. may also be questioned. Although it is somewhat larger and darker than *Ormia*, I can find no fundamental differences. However, not having males before me, and recognizing a slightly different habitus that may have some significance even though not of great magnitude, I leave it as distinct for the present. It is included in the key to *Ormia*, having ocelli present.

Determining whether ocelli are present or absent offers little difficulty in the females, which have the front broad and the ocellar triangle moderately large; in those males (e.g., *Ormia punctata*) with a relatively broad front this also is not difficult. In males with the front narrow and the ocellar area reduced, however, there may be difficulty. In these, if ocelli are present (*Ormia*), the ocellar area is distinctly raised above the eye level as an ocellar tubercle. If ocelli are absent (*Euphasiopteryx*), the front is depressed at the vertex, there is no raised tubercle, and the small ocellar area is below the eye level and shows only as a low, indistinctly bounded area bearing a few pairs of bristles or hairs.

A certain amount of difference between species exists in the structure of the filter apparatus over the posterior thoracic spiracle. This character was utilized by Curran (1934, Bull. Amer. Mus. Nat. Hist. 66:495-496) in describing *Ormia guianica* and *O. dominicana* (see under *Euphasiopteryx*), and it can be useful if one does not attempt to differentiate too finely, or to use it on specimens not in good condition. It must also be cautioned that there is a great difference between the sexes in this character. In all males of the Ormiini, the posterior valve or flap is normally broad, with a long feathery fringe, completely covering the opening up to the anterior marginal fringe, which is also long in the males. In the females, the posterior valve may be similar to that of the male, or of moderate width, or quite slender and by no means completely covering the opening.

Host Relations

In 1911 (Annals Ent. Soc. Amer. 4:136-137), Townsend reported on dissections of three females (as *Phasiopteryx*) from Colorado, Vera Cruz ,and Peru. From these specimens still preserved in the U. S. National Museum, the three are now known to be, respectively, *Euphasiopteryx ochracea* (Bigot) (as *P. montana* Tns., holotype), *Ormia bilimekii* (B. & B.), and *E. australis* (Tns.) (holotype). He found first-stage maggots present, indicating the habit of larviposition. He had no idea of the hosts, though on a later page (p. 150), he speculated that the "*Phasiopteryx*-type of maggot" with smooth segmental plates would be well adapted to seek out and attack such hosts as crambid larvae working underground in silk-lined galleries. The following year (1912, Jour. New York Ent. Soc. 20:114-117), Townsend described these remarkable larvae in some detail for the first two of the above mentioned species.

Later in 1912, when Townsend published the description of the adult *E. australis* (1912, Proc. U. S. Nat. Mus. 43:352-353, as *Phasiopteryx*), he suggested that *australis* might be parasitic in larvae of a small coprophagous scarab, allied to *Onthophagus*, which was common at Piura, Peru, the type locality of *australis*. He was apparently led to suggest this partly because a related genus *Trixa* had been reared from coprophagous scarabs, and partly because the structure of the first-stage maggot was adapted both for enduring long exposure, such as might result if maggots were deposited at the edge of fresh dung and left to await the arrival of scarabs, and for attachment to chitinized surfaces, because the larvae might have to attach to the beetles until the dung pellet was formed, and thence transfer to the pellet. In 1913 (Canad. Ent. 45:54-55), in discussing the relationships of muscoid flies, Townsend reasoned from the type of larva that "the maggots [are] deposited where they must seek the host for themselves." By 1915 (Proc. Ent. Soc. Wash. 17:53), he was speculating that the highly specialized planidium type of maggot indicated "most likely a parasitism on ant or wasp pupae."

Greene (1922, Proc. U. S. Nat. Mus. 60, Art. 10:5) figured and described the puparium of *Euphasiopteryx ochracea* (Bigot) (as *Oestrophasia*). No data were published at the time, but the puparia of that series were found by F. C. Bishopp "under decaying cabbage on city dump, Dallas, Texas. Sept. 28. 1914," as noted by Townsend (1936, Manual of Myiology 3:102), and adults emerged Oct. 10, 1914. The host was unknown.

Subsequently, Reinhard (1922, Ent. News 33:72) published a record of "*Ormia ochracea* Bigot" as a parasite of *Gryllus assimilis*, based on three maggots which issued from an adult cricket on Sept. 22, 1920, and pupated the same day. No flies emerged, but the puparia were identified by C. T. Greene from comparison with those of the flies reared by Dr. Bishopp. In view of the other closely related species now known to occur in Texas, but as yet unknown from puparia, this record cannot be accepted postively for *ochracea*, but the peculiarity of the puparium, and the later developments reviewed below, are assurance that the record is undoubtedly that of an ormiine fly, and it may well be that of *ochracea*.

It is interesting to note that although this is the first published record of a host, *Euphasiopteryx ochracea* had already been reared from "crickets" at Chickasha, Okla., Sept. 1, 1914, by E. G. Kelly (Experiment K 508). Three adults (2 males, 1 female) of this material are now in the U. S. National Museum, probably from the W. R. Walton Collection.

Townsend (1936, Manual 3:99-102) described the female reproductive system in detail and speculated on the host relations of the tribe. The only host record known to him was the cricket recorded by Reinhard (1922) based on the fly puparia, but he doubted that this was a normal host. He noted that the only known rearing of adult ormiines was that of *ochracea* by Bishopp (cf. Greene, 1922, above), but those puparia might have come from any of a variety of hosts. He concluded that the armored planidia-like maggots are so well adapted for entering nests of social Hymenoptera that "their natural hosts would seem unmistakably to be ants, bees, or wasps." By the end of his Manual, however, Townsend was aware of the record by Wolcott (1940, q.v.), for he recorded it in the host catalogue (1942, Manual 12:239).

Wolcott (1940, Journ. Econ. Ent. 33:202) recorded "*Euphasiopteryx australis* (Tns.)" [in this case, actually *E. depleta* (Wied.), q.v.] as a parasite in Brazil of the changa or mole cricket, *Scapteriscus vicinus* Scudder. He also stated that E. G. Smyth had written him of rearing it or a related species from a green katydid, *Neoconocephalus* sp., at Trujillo, Peru. On two different occasions, "*E australis*" was introduced into Puerto Rico, but not in large numbers and without being successfully established, according to Wolcott (1951, Jour. Agr. Univ. Puerto Rico 32(3):476). He noted that parasitism of the changa in the Amazon region varied from one to five percent. The fly was found to be decidedly nocturnal, hiding by day but active at night, a habit which would correlate well with the habits of cricket and katydid hosts.

Nutting (in press) reared several specimens of a new subspecies of *Euphasiopteryx brevicornis* from *Neoconocephalus robustus* (Scudder) in Massachusetts, and is reporting on his observations and on the immature stages. This latest find, coupled with the slowly accumulated evidence reviewed above, suggests that contrary to past speculation, the ormiine flies are probably normal parasites of certain adult Orthoptera, especially those with nocturnal habits such as the crickets and katydids.

Immature Stages

Larvae.—Descriptions or figures, or both, have been published by Townsend for the first-stage maggots of *Ormia bilimekii, Ormiophasia busckii, Euphasiopteryx australis, E. ochracea* (as *E. montana*), *E. brevicornis,* and *E. dominicana* (all but *bilimekii* were dissected from holotype). Some striking differences are evident, and it will be interesting to investigate the larvae for all species in the group.

Puparia of three species of *Euphasiopteryx, E. ochracea, E. depleta* from Brazil, and *E. brevicornis nuttingi,* are available and they are easily distinguished at a glance. The puparium of *ochracea,* described and figured by Greene (1922), has long spiracular protuberances parallel to the longitudinal axis of the puparium. In *depleta,* however, the equally long protuberances are directed posterodorsad at 45° angle to the longitudinal axis. In *b. nuttingi,* the angle is not as great and the protuberances are much shorter and somewhat closer together. Nutting (in press) has given detailed figures of the three puparia. No puparia of *Ormia* or *Ormiophasia* are known to me.

Key to Genera of Ormiini of Western Hemisphere

Ocelli present; female with two or three proclinate orbital bristles .... *Ormia* R. D.
(including *Ormiophasia* Tns.)

Ocelli absent; female generally with a row of 4 to 7 proclinate orbitals .... *Euphasiopteryx* Tns.

Genus **Ormia** Robineau-Desvoidy

1830 *Ormia* Robineau-Desvoidy, Essai sur les Myodaires, p. 428. Type, *O. punctata* R. D., by monotypy.

1835 *Ochromyia* Macquart, Hist. nat. Insectes, Diptères, 2:250. [*Ormia* in synonymy.]

1878 *Ormia;* Osten Sacken, Catalogue Diptera N. Amer., p. 163 [*Ochromyia* Macq. in synonymy.]

1889 *Phasiopteryx* Brauer and Bergenstamm, Zweifl. Kais. Mus. Wein, pt. 4:78-79 (1890, Denkschr. Akad. Wiss. Wien, Math.-Nat. Classe, 56(1):146-147). [Two species, *P. Bilimekii* n. sp. and *Tachina depleta* Wied., the first apparently intended as genotype.]

1890 *Neoptera* Van der Wulp, Biologia Centrali-Amer., Dipt. 2:165. Type, *N. rufa* Wulp, by monotypy.

1893 *Phasiopteryx;* Brauer and Bergenstamm, Zweifl. Kais, Mus. Wein, pt. 6:71 (1893, Denkschr., etc. 60:159. [Generic description; *P. Bilimecki* (sic!) mentioned, and this has been accepted by Townsend (1938) as type designation.]

1895 *Ormia;* Brauer, Sitzber. Kais. Akad. Wiss. Wien 104: 597. [*Phasiopteryx* in synonymy.]

1897 *Oestrophasia* B. & B.; Coquillett, U. S. Dept. Agriculture, Div. Ent., Tech. Ser., Bull. 7:70 (Revision of Tachinidae). [*Phasiopteryx*, *Neoptera*, etc., in synonymy.]

1910 *Ormia;* Coquillette, Proc. U. S. Nat. Mus. 37:580. [Synonyms are *Neoptera*, p. 575, and *Phasiopteryx*, p. 588, the latter with designation of *P. bilimekii* as type.]

1919 *Ormia;* Townsend, Ins. Insc. Menstr. 6:182. [*Phasiopteryx* in synonymy.]

1919 *Ormia;* Surcouf, Nouv. Archives Mus. d'Hist. Nat. Paris, ser. 5, 6:115. [Brief descr.; type unknown to him, and genus not recognized.]

1922 *Ormia;* Aldrich, Proc. U. S. Nat. Mus. 62(Art. 11):5 [Synonyms are *Phasiopteryx*, *Neoptera*, *Euphasiopteryx*, *Ormiophasia*.]

1925 *Ormia;* Séguy, Bull. Mus. d'Hist. Nat. Paris, 31:440. [Key to five species of *punctata* group, some now in *Euphasiopteryx*.]

1926 *Ormia;* Séguy, Encycl. Ent., Ser. B, II, Dipt., 3:9. [In key to ''Oestridae dubiosae.'']

1927 [1926?] *Ormia;* Townsend, Revista Mus. Paulista 15:223. [In generic key.]

1927 *Ormia;* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [In key to four genera of Ormiina, recognizing *Plagiotormia*, *Pseudoneoptera*, and *Pseudormia* as distinct.]

1929 *Ormia;* Malloch, Ann. & Mag. Nat. Hist., ser. 10, 3:279. [Doubts propriety of separating *Euphasiopteryx* and *Ormiophasia* from *Ormia*.]

1932 *Ormia;* Malloch, Ann. & Mag. Nat. Hist., ser 10, 10:312. [Notes on generic characters.]

1934 *Ormia;* Curran, Bull. Amer. Mus. Nat. Hist. 66:495. [Key to 7 spp.]

1936 *Ormia;* Townsend, Manual of Myiology 3:101. [In key to genera of tribe Ormiini.]

1936 *Ormia;* Townsend, ibid. 4:278,280. [*Neoptera* and *Phasiopteryx* listed as synonyms of *Ormia*.]

1938 *Ormia;* Townsend, ibid. 7:234-235. [Detailed generic description, descr. of first stage larvae, synonymy of *Neoptera* and *Phasiopteryx*.]

There may be a number of undescribed species of *Ormia* (*s. str.*) in the Neotropical Region. Nine females before me may belong to as many as five different species, depending upon what is ultimately learned of variation in certain characters. Four specimens (Costa Rica, Panama, Venezuela) of possibly two species pass to *lineifrons* in the following key, whereas the other five (Guatemala, Panama, Ecuador, West Indies) of two or three species pass to couplet 7. In all cases, the lack of males and of good series make it impossible to do more with them. It is undesirable to add to the difficulties in this group by naming these weakly differentiated females.

Ormia serrei Séguy, described from a female from Costa Rica, also passes as far as couplet 6 in the key, but it must be classed with the other females impossible to recognize at this stage of our knowledge.

Key to Ormia and Ormiophasia [1]

1. One strong pair of presutural acrostichal bristles midway of prescutum, and sometimes a weaker anterior pair; front narrow, barely half the width of an eye in females; mesonotum and scutellum usually blackish, and abdomen predominantly brown to black, basally yellow, sometimes body all testaceous .... *Ormiophasia* (6. *O. busckii* Tns.) (7. *O. moradi* Séguy)
   Two or three pairs of presutural acrostichals, including one pair adjacent to mesonotal suture; front generally broader in females; body entirely yellow to testaceous (*Ormia*) 2

2. Epaulet yellow, concolorous with subepaulet; one stigmatal bristle; male with weak costal callosity between apices of first and second veins, but none on second vein 1. *Ormia wolcotti*, new species
   Epaulet black; two strong stigmatal bristles (occasionally one lacking on one side) 3

3. Males (costal callosity present) 4
   Females (no costal callosity) 6

4. Wing with two strong callosities, one on costa beyond end of first vein, the other behind it on second vein; front broad for males, obviously wider than distance across posterior ocelli, and one tenth or more times the width of head 5
   Wing with small but distinct callosity on costa beyond end of first vein, but none on second; front narrow, at most frontalia linear and total width of front less than .05 times the head width, or less than distance across posterior ocelli .... 2. *Ormia lineifrons*, new species

5. Front broad, at vertex .16 to .21 times the width of head; Florida, West Indies .... 3. *Ormia punctata* R. D.
   Front narrower, at vertex .11 to .125 times width of head; Texas, Mexico .... 4. *Ormia bilimekii* (B. & B.)

6. First vein joining costa distinctly beyond level of small crossvein, by at least length of latter; wing relatively long and not broadly rounded apically, the distance from small crossvein to apex of wing 1.2 times that from crossvein to epaulet .... 2. *Ormia lineifrons*, new species
   First vein joining costa opposite or basad the level of small crossvein; wing shorter and more bluntly rounded apically,

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[1] 5. *Ormia serrei* Séguy not included.

the distance from small crossvein to apex of wing equal to or shorter than from crossvein to epaulet 7

7.[2] West Indies and Florida; apical cell closed at margin, or very narrowly open .... 3. *Ormia punctata R. D.*

Mexico and Texas; apical cell broadly open, the third and fourth veins separated by a distance approaching length of small crossvein .... 4. *Ormia bilimekii* (B. & B.)

1. **Ormia wolcotti**, new species

1924 *Ormia punctata* R. D.; Wolcott, Jour. Dept. Agr. Puerto Rico 7(1):225, in part. [Puerto Rico: Pt. Cangrejos specimen here; the Aibonito specimen unknown to me.]

1931 *Ormia dominicana* Tns., Curran, Amer. Mus. Novitates 456:23. [Female, Coamo Springs, Puerto Rico, now in AMNH].

1936 *Ormia dominicana* Tns.; Wolcott, Jour. Agr. Univ. Puerto Rico 20(1):359 ("Insectae Borinquenses.") [Cites records of Wolcott, 1924 and Curran, 1931.]

1951 *Ormia punctata* R. D.; Wolcott, Jour. Agr. Univ. Puerto Rico 32(3):480 ("The Insects of Puerto Rico.") [Repeats records of Wolcott, 1936.]

Epaulet yellow, one stigmatal bristle, and male with weak callosity on costa, none on second vein.

Male.—Entirely yellow to testaceous except for conspicuous black spot at small crossvein and black bristles. Front at narrowest point about equal to breadth of third antennal segment and as wide or slightly wider than distance across posterior ocelli, the width in the four males .05, .06, .06, and .08 (holotype) times the width of the head; parafacials bare; third antennal segment twice the length of second; arista pubescent. Mesonotum with two pairs of presutural dorsocentral bristles and one or two pairs of presutural acrostichals, the pair adjacent to suture sometimes weak; mesonotal hairs brown to blackish, the pleural hairs yellow; one strong propleural bristle, usually with short black accessory bristle immediately below, and one stigmatal, surrounded by a number of yellow hairs. Abdomen without median marginal bristles on second and third segments (apparent first and second), and no discals on the third and fourth; hairs black. Wing not distorted as in *O. punctata*, the submarginal cell with longitudinal fold but not unusually broadened; first vein short, ending in costa opposite the small crossvein; costa with small callosity midway between apices of first and second veins, scarcely evident in side view but discernible at anterior edge of wing as a distinct though slight widening of the space between the two rows of black costal setulae.

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[2] I have not found a satisfactory way of separating females of *punctata* and *bilimekii*, except by geography and association with males. The above couplet applies to the nine specimens before me, including three *punctata* and six *bilimekii*, but evidence from other species suggests that the character is not to be trusted.

Female.—Color, general structure, and chaetotaxy as in male. Front of moderate width, at vertex .27, .28 and .30 (allotype) times the width of head, the sides diverging so that across the lunule the width is .39 (allotype) and .41 times the width of head; parafrontals not broad, each subequal to or less than width of frontalia; two pairs of strong proclinate orbital bristles; parafacials bare. Posterior thoracic spiracle with posterior valve of filter apparatus well-developed, fairly broad, with dense fringe. Wing without costal callosity, but otherwise as in male.

Length, 5 to 7 mm.

Types.—Holotype male, Guánica, Puerto Rico. Aug. 18, 1913 (E. G. Smyth). Type No. 61734 in the U. S. National Museum. Allotype, Pt. Cangrejos, P. R., May 10, 1920 (G. N. Wolcott). Paratypes: 1 ♂, Constitution Hill, Christiansted, St. Croix, Virgin Islands, April 1936 (H. A. Beatty); 1 ♀, St. Croix, V. I. (Beatty); 1 ♂, Santiago, Cuba, March 1906 (J. M. Espin) [USNM]; 1 ♂, Mayaguez, P. R., Dec. 2, 1930 (L. Martorell); 1 ♀, Coamo Springs, P. R., April 10, 1930 (W. T. M. Forbes) [AMNH].

Variation in wing as follows: Apical cell open in five specimens, closed at margin in one female, short petiolate in one male; angle of fourth vein generally rounded, one female with trace of appendage.

I take pleasure in naming this species for Dr. G. N. Wolcott, who has devoted many years to the insect fauna of Puerto Rico.

2. **Ormia lineifrons**, new species

1949 *Ormia* n. sp.; Fattig, Emory University Mus. Bull. 8:24 (Dallas, Ga.).

Black epaulet, two strong stigmatal bristles, and male with linear front and callosity on costa but not on second vein.

Male.—Yellow to testaceous except for black epaulet and bristles and brown to blackish spot at small crossvein. Front extremely narrow, approximately half the distance across posterior ocelli, the linear parafrontals touching except in Georgia paratype, the frontal width only .02 to .03 times the head width in four of the specimens, slightly wider in Georgia paratype (.046); parafacials bare; third antennal segment approximately twice length of second; arista microscopically pubescent. Mesonotal chaetotaxy somewhat variable, with 2 to 3 pairs each of presutural dorsocentrals and acrostichals; mesonotal hairs numerous, fine, long, and erect, brown to blackish; pleural hairs yellow to brown; one strong propleural bristle and short accessory bristle immediately below it; two strong stigmatal bristles, the upper slightly shorter and weaker, with a number of long yellow hairs surrounding them. Abdomen as described for *wolcotti.* Wing with normal shape, not distorted as in *punctata,* though submarginal cell with strong longitudinal fold; first vein longer than in *wolcotti* and *punctata*, ending in costa beyond level of small crossvein by at least the length of latter; wing slightly elongate, the distance from small crossvein to apex of wing greater than from crossvein to epaulet (1.10 to 1.17 times); costal callosity of moderate size, slightly larger than in *wolcotti*, evident in side view, and anteriorly well marked as a broadly fusiform, flattened area by the abrupt divergence of the two rows of black costal setulae.

Female.—Color, general structure and chaetotaxy as in male Front of moderate width, at the vertex .255 times, and across the lunule .40 times the width of head; parafrontal barely wider than frontalia; three pairs of strong proclinate orbitals; parafacials bare. Posterior valve of filter apparatus on hind thoracic spiracle not broadened, lanceolate, with moderate fringe. Wing without costal callosity, slightly elongate as in male, the distance between small crossvein and apex of wing 1.2 times that from crossvein to epaulet.

Length, 7.5 to 8 mm.

Types.—Holotype male, Bosch Finca, Cayey, Puerto Rico, Dec. 27, 1932 (R. G. Oakley). Type No. 61735 in the U. S. National Museum. Allotype, "Florida" (Mrs. Slosson [AMNH]. Paratypes: 1 ♂, "West Indies"; 1 ♂, Dallas, Ga., Oct. 22, 1941 (P. W. Fattig) [USNM]; 1 ♂, Dayton, Fla., April 8, 1919 (C. W. Johnson) [MCZ]; 1 ♂, San José del Cabo, Baja California, Mexico (W. M. Wheeler Colln.) [AMNH.]

Variation in wing as follows: Apical cell widely open in four males, in one male and the female closed at margin in one wing but open in other; angle of fourth vein rounded in one male, with short appendage in four males, and with long appendage in the female.

The paratype from Baja California is far distant from the others, but I can find no differences. This species may be an uncommon Neotropical form, and further collecting will connect up the extremes.

3. **Ormia punctata** Robineau-Desvoidy (s. str.)

1830 *Ormia punctata* Robineau-Desvoidy, Essai sur les Myodaires, p. 428. ["Antilles"; male, judging from descr.]

1835 *Ochromyia punctata* (R. D.) Macquart, Hist. nat. Insectes, Diptères 2:250. [Generic reference.]

1878 *Ormia punctata* (R. D.) Osten Sacken, Catalogue Dipt. N. Amer., 2nd edition, p. 163. [Listed.]

1887 *Ormia punctata* (R. D.) Gundlach, Anales Soc. Española Hist. Nat. 16:193 ("Fauna Puerto-Riqueña," pt. 6, p. 403) [In Muscidae; type said to come from Jamaica.]

1895 *Clytiomyia punctata* Coquillett, Jour. New York Ent. Soc. 3:52. [Florida, female, in USNM; locality not stated, but listed by Coq. (1897) as Charlotte Harbor, Fla. Synonym and homonym.]

1895 *Clytiomyia punctata* Coq.; Johnson, Proc. Acad. Nat. Sci. Phila., 1895, p. 333. [Charlotte Harbor, Fla.]

1897 *Œstrophasia punctata* (Coq.) Coquillett, U. S. Dept. Agriculture, Div. Ent., Tech. Ser. Bull. 7:71. [In key, distinguished from "*Phasiopteryx bilimekii* BB.," but Coquillett's example of latter was later described by Townsend as *Ormia brevicornis*.]

1905 *Œstrophasia punctata* (Coq.) Aldrich, Catalogue N. Amer. Diptera, p. 440. [Listed; *Ormia punctata* R. D. not mentioned.]

1913 *Œstrophasia punctata* (Coq.) Johnson, Bull. Amer. Mus. Nat. Hist. 32:71. [Biscayne Bay specimen in AMNH; Jacksonville spm. not found.]

1915 *Ormia punctata* R. D.; Townsend, Ent. News 26:366 [*Clytiomyia punctata* Coq. a synonym.]

1922 *Ormia punctata* R. D.; Aldrich, Proc. U. S. Nat. Mus. 62(Art. 11):5. [Fla. records refer to *punctata*, Mexican to *bilimekii*, as here recognized; *punctata* Coq. in synonymy.]

1936 *Ormia punctata* R. D.; Townsend, Manual of Myiology 3:101. [With *punctata* Coq. as synonym; distinct from *O. bilimekii* BB.]

1938 *Ormia punctata* R. D.; Townsend, Manual of Myiology 7:234. [Distinct from *O. bilimekii*.]

The type of *Ormia punctata* is not in the Robineau-Desvoidy collection in the Muséum d'Histoire naturelle at Paris, according to information received from M. Séguy, and apparently must be considered lost. This is most unfortunate, for the species is the oldest in the genus, it is the genotype of *Ormia*, by monotypy, and the name has been widely used, though obviously with various applications.

The original description does not mention the color of the epaulet, nor whether ocelli are present or absent, but taxonomists have generally used the name for a Neotropical species (or two as recognized here) with ocelli and black epaulet in which the male has the characteristically dilated costa and greatly broadened submarginal cell mentioned in the original description. Records based on males are undoubtedly either *punctata* or the related *bilimekii*, but those based on females are suspect until re-examined.

Townsend (1931, Revista Ent. 1:82) saw the type of *Phasiopteryx bilimekii* and identified it as a synonym of *Ormia punctata* R. D., as Aldrich had already done in 1924 (Annals Ent. Soc. Amer. 17:215). However, a few years later (1936), Townsend regarded *punctata* and *bilimekii* as distinct species. I agree with this, for I find that the Antillean and Floridian form is distinct from the Mexican. Inasmuch as the type of *punctata* came from the "Antilles," the name *punctata* must be restricted to the form occurring in that area.

The salient features of *punctata* are contained in the key. The distorted wing of the male, with greatly broadened submarginal cell and strong callosities on both costa and second vein, distinguishes that sex from all other known species in both *Ormia* and *Euphasiopteryx*, save *O. bilimekii*, which appears from available material to have a consistently narrower front than *punctata*. In eight available males of *punctata*, the ratios of width of front at vertex to width of head average .17 (range .16 to .21), whereas the ratios in nine males of *bilimekii* average only .12 (range .11 to .125).

In the female sex, the length and shape of wing, and the length of first vein, will separate *punctata* and *bilimekii* from *lineifrons*, but the first two are difficult to separate from each other. The character of the apical cell, used in couplet 7, is not dependable elsewhere in this group, and one should not place much reliance on it here. Geographic location, or association with characteristic males, will indicate the probable identity.

In both species, the propleural bristle is regularly accompanied by a black accessory bristle immediately below it, and both propleural and stigmatal bristles are surrounded by a number of pale yellow hairs. There are no median marginal bristles on the second and third (apparent first and second) abdominal segments, and no discals on the third and fourth. The veins are yellow, with black spot at the small crossvein. The angle of the fourth vein is generally rounded in the males, with an appendage in an occasional specimen, one of the latter having a short stub in the left wing and an appendage extending to the margin in the right wing. In the females the vein generally has a short stub at the angle. The posterior thoracic spiracle is small for this group, and in the females the posterior valve of the filter apparatus is relatively broad and with long fringe, nearly covering the opening.

Distribution.—Florida and West Indies, as far as known. I have seen seven males, three females as follows: FLORIDA: 1 ♂, "Fla."; 2 ♂, "Fla." (C. V. Riley), determined as *bilimekii* by Brauer and Bergenstamm; 1 ♂, Miami, Oct. 23 (C. H. T. Townsend); 1 ♀, St. Augustine, Nov. 8, 1911 [USNM]; 1 ♀, Biscayne Bay (Mrs. Slosson) [AMNH]. CUBA: 1 ♂, Santiago de las Vegas, Habana, Dec. 14, 1925 [AMNH]; 1 ♀, Isla de Pinos, 1923 (C. H. Ballou) [USNM]. HAITI: 1 ♂ Carrefour, Jan. 7, 1922 [USNM]. PUERTO RICO: 1 ♂, Jayuya, Dec. 1935 (A. Suarez) [AMNH].

Unverified Records:

1895 *Phasiopteryx bilimekii* B. & B.; Johnson, Proc. Acad. Nat. Sci. Phila., 1895, p. 333. [Georgiana, Fla.]

1913 *Œstrophasia bilimekii* (B. & B.) Johnson, Bull. Amer. Mus. Nat. Hist. 32:71. [Georgiana, Fla. record repeated.]

1919 *Œstrophasia punctata* (Coq.) Johnson, Bull. Amer. Mus. Nat. Hist. 41:436. [Linguanea Plain, Jamaica.]

1925 *Ormia punctata* R. D.: Séguy, Bull. Mus. d'Hist. Nat. Paris 31(6):440. [In key to females of five species, no spms. recorded; the key characters fit no *punctata* or *bilimekii* that I have seen, but possibly variations.]

1926 *Aestrophasia* [*sic!*] *punctata* (Coq.) Gowdey, Dept. Agric. Jamaica, Ent. Bull. 4:81. [Jamaica; *Ormia punctata* R. D. cited in synonymy.]

1927 *Ormia punctata* R. D.: Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [Costa Rica.]

1931 *Ormia punctata* R. D.: Engel, Konowia 10:138. [Male, N. Chiquitos, Bolivia.]

1934 *Ormia punctata* R. D.: Curran, Bull. Amer. Mus. Nat. Hist. 66:495. [In key; 3 females, Kartabo, British Guiana, but from the characters given in the key, these were not *punctata*.]

4. **Ormia bilimekii** (Brauer and Bergenstamm)

1889 *Phasiopteryx Bilimekii* Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien 4:78-79. (1890, Denkschr. Akad. Wiss. Wien, Math. Nat. Classe 56(1):146-147). [Orizaba, Mexico; male, female, in Vienna Museum.]

1890 *Neoptera rufa* Van der Wulp, Biologia Centrali-Amer., Dipt. 2:166, and Plate 4, figs. 11-12. [Mexico: male, Vera Cruz, and female, Tabasco, in British Museum (Nat. Hist.).]

1891 *Phasiopteryx bilimeki* B. & B.; Van der Wulp, Biologia Centrali-Amer., Dipt. 2:211. [*Neoptera rufa* a synonym; a female cotype of *Pyrrosia ochracea* Bigot, loaned him by Bigot, is also the same.]

1891 *Phasiopteryx Bilimekii* B. & B.; Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien 5:84, 108, 120, 134 (1891, Denkschr. etc., 58:388, 412, 424, 438). [In key with *P. depleta* (Wied.); *Neoptera rufa* listed as syn., also *Pyrrhosia ochracea* Bigot teste Van der Wulp.]

1893 *Phasiopteryx Bilimecki* [*sic!*] B. & B.; Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien 6:71 (Denkschr., etc. 60:159). [Description.]

1893 *Phasiopteryx ochracea* (Big.); Giglio-Tos, Mem. Reale Accad. Sci. Torino, Ser. 2, 44:522. [Synonyms: *P. Bilimekii* B. B., *N. rufa* Wulp, latter on authority of Van der Wulp.]

1894 *Phasiopteryx Bilimeki* B. & B.; Brauer and Bergenstamm, Zweifl., etc. 7:82 (1895, Denkschr., etc. 61:618). [Additional description.]

1895 *Ormia punctata* R. D.; Brauer, Sitzber. Kais. Akad. Wiss. Wien 104:597. [Synonym: *N. rufa* Wulp.]

1897 *Phasiopteryx Bilimeki* B. & B.; Townsend, Ann. & Mag. Nat. Hist., ser. 6, 19:33. [Notes on male, San Rafael, Vera Cruz, now in USNM.]

1905 *Œstrophasia bilimekii* (B. & B.) Aldrich, Catalogue N. Amer. Diptera, p. 439. [Listed.]

1908 *Phasiopteryx bilimeki* B. & B.; Townsend, Smithson. Miscell. Colln. 51:60. [Notes that several forms probably confused.]

1911 *Phasiopteryx* sp., probably *P. bilimeki;* Townsend, Annals Ent. Soc. Amer. 4:136-137. [Female, Orizaba, Vera Cruz, now in

USNM; description of first-stage maggot and internal characters of female.]

1912 *Phasiopteryx bilimeki* B. & B.; Townsend, Jour. New York Ent. Soc. 20:116. [Detailed description of first-stage maggot.]

1912 *Phasiopteryx bilimeki* B. & B.; Townsend, Proc. U.S. Nat. Mus. 43:353. [Reference to larval characters.]

1922 *Ormia punctata* R. D.; Aldrich, Proc. U. S. Nat. Mus. 62(Art. 11):5. [Descriptive notes; Synonyms: *P. bilimeki*, *N. rufa* Wulp, *Clytiomyia punctata* Coq.; Florida and Mexico, the spms. of former now referred to *punctata* s. str.]

1924 *Ormia punctata* R. D.; Aldrich, Annals Ent. Soc. Amer. 17:215. [Synonymy from male, female types of *bilimekii* loaned by Vienna Mus.]

1931 *Ormia punctata* R. D.; Townsend, Revista Ent. 1:82. [Synonymy from type of *bilimeki* in Vienna Mus.]

1936 *Ormia bilimekii* (B. & B.) Townsend, Manual of Myiology 3:101. [Synonym, *N. rufa* Wulp; distinct from *O. punctata* R. D.]

1938 *Ormia bilimekii* (B. & B.) Townsend, Manual of Myiology 7:234. [As in Townsend (1936).]

1942 *Ormia bilimekii* (B. & B.) Townsend, Manual of Myiology 12:324, plate 27, fig. 222, and plate 28, figs. 223, 224. [First-stage maggot, described by Townsend, 1911 and 1912.]

The principal characters of this species are contained in the key, and further discussion is given above under *O. punctata*, with which *bilimekii* has often been confused.

From notes kindly furnished by J. E. Collin, it is clear that the two females of the type series of *Pyrrosia ochracea* Bigot, described from Mexico, are *Ormia bilimekii*, whereas the male of *ochracea* (herein designated as lectotype) is a species of *Euphasiopteryx*. Mr. Collin and Dr. van Emden compared the females directly with the type of *Neoptera rufa* Wulp in the British Museum, and concluded that they are conspecific. This was the conclusion of Van der Wulp (1891), and his advice resulted in the synonymy published by Giglio-Tos (1893).

Distribution.—Southern Texas and Mexico, as far as known. I have seen the following: TEXAS: 3 ♂, 3 ♀, Donna, Hidalgo County, Oct. 1933 (J. W. Monk); 1 ♂, Donna, Dec. 19, 1933 (Monk); 1 ♀, Brownsville, Sept. 4, 1937 (C. S. Rude) [Reinhard Colln.]; 1 ♂, Laguna Madre, 25 miles SE. Harlingen, Feb. 17, 1945 (D. E. Hardy); 1 ♂, Lagford, Willacy Co., Dec. 1934 [USNM]. MEXICO: 1 ♂, Frontera, Tabasco, April 22 (C. H. T. Townsend); 1 ♂, San Rafael, V. C., March 9 (Townsend); 1 ♂, Sta. Engracia, Tam. (C. C. Plummer); 1 ♀, Dona Maria, Chiapas (Crawford); 1 ♀, Orizaba, V. C., Jan. 9-16, 1892 (H. Osborn) [USNM].

Unverified Records:

1895 *Phasiopteryx bilimeki* B. & B.; Townsend, Proc. Calif. Acad. Sci., ser. 2, 4:619 [Baja California, Mexico, 2 females, doubtfully identified; spms. not now in Townsend material in USNM or KU, probably destroyed with early collections of Calif. Acad. Sci. It is possible that they were females of the species herein described as *O. lineifrons*, of which a male is known from San José del Cabo.]

5. **Ormia serrei** Séguy

1925 *Ormia Serrei* Séguy, Bull. Mus. d'Hist. Nat. Paris 31:440. [In key to five species; no further description, no locality.]

1926 *Ormia Serrei:* Séguy, Bull. Soc. Ent. France, 1926, p. 62. [Costa Rica; female, in Paris Mus.]

1927 *Ormia Serrei;* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [Mention.]

1927 *Ormia Serrei:* Séguy, Encyl. Ent., Ser. B II, Dipt. 4:16. [In key to three species.]

This species, based on a female, cannot be recognized with certainty at this time. One must await much more material and associated sexes in order to clarify its status. It passes at least as far as couplet 6 in the key, and it seems likely to be nearest *O. bilimekii*. However, with scattered tropical material indicating that there may be a number of unrecognized species, it would be unwise even to suggest that synonymy.

Genus **Ormiophasia** Townsend

1919 *Ormiophasia* Townsend, Ins. Insc. Menstr. 6:164. Type, *O. busckii* Tns., by original designation and monotypy.

1922 *Ormia* R.-D.; Aldrich, Proc. U. S. Nat. Mus. 62(Art. 11):5. [*Ormiophasia* in syn.]

1926 *Pseudormia* (p. 5 and Index, p. 203), *Peudormia* (p. 9, in key) Séguy, Encycl. Ent., Ser. B, II, Dipt. 3:5,9,203. [Genus validated in generic key; the combination *Pseudormia inflata* mentioned on p. 5, but species not described.]

1926 *Pseudormia* Séguy, loc. cit., p. 20. [In key to three genera; no species cited.]

1926 *Pseudoneoptera* Séguy, loc. cit., p. 19. Type, *P. Morardi* Séguy by monotypy.

1926 *Plagiatormia* (pp. 19, 20), *Plagiotormia* (pp. 19, 203 in Index) Séguy, loc. cit., pp. 19, 20, 203. [Published as "*Plagiotormia obscura* n. sp." with no indication that the genus was new. In key to three genera, p. 20. Townsend (1936 and 1938) adopted the first spelling.]

1927 [1926?] *Ormiophasia;* Townsend, Revista Mus Paulista 15:223. [In key.]

1927 *Pseudormia* Séguy, Ann. Soc. Ent. France 96:262. One species. Type, by designation and virtual monotypy, *P. inflata* Séguy.

1927 *Plagiatormia* (p. 424; *Plagiotormia* p. 423), *Pseudoneoptera*, and *Pseudormia;* Séguy, C.-R. Congrès Soc. Savantes, Paris 1926, p. 423-424. [All recognized.]

1929 *Ormia* R. D.; Malloch, Ann. & Mag, Nat. Hist., ser. 10, 3:279. [Doubts that *Ormiphasia* (sic!) is distinct.]

1931 *Ormiophasia* Tns.; Townsend, Revista Ent. 1:82. [Genotypes of Séguy's three genera (see above) are synonyms of *O. busckii*, the genotype of *Ormiophasia.*]

1936 *Ormiophasia* Tns.; Townsend, Manual of Myiology 3:101. [In key to genera of *Ormiini:* the three genera of Séguy (see above) are synonyms of it.]

1938 *Ormiophasia* Tns.: Townsend, Manual of Myiology 7:236. [Generic description; synonymy as stated in Townsend (1936), but *Plagiatormia* and *Pseudormia* are incorrectly credited to Séguy (1931), the reference given being that of Townsend's paper on the types.]

I have nothing to add to this genus and it is included here only for completeness. Whether Townsend's synonymy of the three Séguy genera is justified or not cannot be verified at the moment. I can only comment that the characters of open or closed apical cell, and rounded or petiolate angle of the fourth vein, do not seem to me to be reliable, judging from the small series before me. Thus I have for the present accepted the synonymy as given by Townsend. One may also question whether *Ormiophasia* deserves separate recognition from *Ormia*, but I have left them distinct for the present.

6. **Ormiophasia busckii** Townsend

1919 *Ormiophasia busckii* Townsend, Ins Insc. Menstr. 6:165. [Panama, female, in USNM; genotype by original designation.]

1926 *Pseudormia inflata* Séguy, Encycl. Ent., Ser. B, II, Dipt. 3:5. [Mentioned; validated essentially as ''n.g., n.sp.'', but not formally described; Séguy, 1927, C. R. Congrès Soc. Savantes, Paris 1926, p. 424 (French Guiana); Séguy, 1927, Ann. Soc. Ent. France 96:262 (French Guiana; female, in Paris Museum.)]

1926 *Plagiatormia obscura* Séguy, loc. cit., p. 19. [Argentina; male, in Paris Mus.]

1927 *Plagiatormia obscura* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424.

1929 *Ormia* (by implication) *buscki* (Tns.) Malloch, Ann. Mag. Nat. Hist., ser. 10, 3:279. [Costa Rica; doubts that *Ormiophasia* is distinct from *Ormia.*]

1931 *Ormiophasia busckii* Tns.; Townsend, Revista Ent. 1:82 [Synonyms: *Pseudormia inflata* Séguy and *Plagiatormia obscura* Séguy; variety is *Pseudoneoptera morardi* Séguy. From types in Paris Museum.]

1934 *Ormia buscki* (Tns.) Curran, Bull. Amer. Mus. Nat. Hist. 66:495. [In key; British Guiana.]

1936 *Ormiophasia busckii* Tns.; Townsend, Manual of Myiology 3:101. [Synonymy as in Townsend (1931), except *morardi* given merely as "congeneric."]

1938 *Ormiophasia busckii* Tns.; Townsend, Manual of Myiology 7:236. [Synonymy as in Townsend (1936).]

1942 *Ormiophasia busckii* Tns.; Townsend, Manual of Myiology 12:325, and Plate 28, fig. 226. [Large figure of larva.]

I know the species from Panama, the Canal Zone, Costa Rica, and Venezuela.

7. **Ormiophasia morardi** (Séguy)

1926 *Pseudoneoptera Morardi* Séguy, Encycl. Ent., Ser. B, II, Dipt. 3:19. [French Guiana; female, in Paris Museum.]

1927 *P. Morardi;* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [Mention.]

1931 *Ormiophasia busckii* var. *morardi* (Séguy) Townsend, Revista Ent. 1:82. [Combination by implication; "scarcely more than a variety."]

1936 *Ormiophasia morardi* (Séguy) Townsend, Manual of Myiology 3:101. [Congeneric with *busckii.*]

1938 *Ormiophasia morardi* (Séguy) Townsend, Manual of Myiology 7:236. [Congeneric with *busckii.*]

Note: The treatment of the genus *Euphasiopteryx* Townsend will appear in the December *Proceedings.*—Editor.

A NEW SPECIES OF CULEX AND NOTES ON OTHER SPECIES OF MOSQUITOES FROM OKINAWA

(Diptera, Culicidae)

By Richard M. Bohart, *University of California, Davis*

Since publication of a treatise on the mosquitoes of Okinawa (Bohart and Ingram, 1946b) another visit to this Ryukyuan island was made in September 1951, under the auspices of the Department of the Army in collaboration with the Pacific Science Board of the National Research Council. Although time on Okinawa was limited to a few weeks, two trips were made to the northeast part of the island and some interesting material was collected.

The locality visited is a small stream near the ocean in a steep ravine near East Taira. The streambed and parts of the banks are mostly rock with numerous crevices above and below the water level of the stream. The collecting site was brought to my attention by Col. W. J. La Casse who spent several days surveying the northern part of the island in September 1951.

Among his finds near East Taira were larvae of a *Uranotaenia* which checks closely with the description and figures of *annandalei* Barraud as given by Barraud (1934). Adults reared from these larvae closely resemble those of *nanseica* R. Bohart and Ingram (1946b) and indicate that the two species are the same. My collecting in this locality yielded *Uranotaenia stonei* R. Bohart and Ingram (male, female, larva), *Aedes riversi* R. Bohart and Ingram (male, female, larva), *Anopheles sinensis* (Wiedemann) (female), *Culex vishnui* Theobald (female), *C. tritaeniorhynchus* Giles (female, *C. ryukyensis* R. Bohart (male, female, larva), *C. tuberis* R. Bohart and Ingram (male, female, larva), *C. infantulus* Edwards (male, female), *C. hayashii* Yamada (male, larva), and a new species of *Culex* (*Neoculex*) (male, female, larva). The finding of this material has prompted the following notes and descriptions.

Uranotaenia annandalei Barraud

Uranotaenia annandalei Barraud, 1926. Indian Jour. Med. Res. 14:343. Male, female, India and Burma.

Uranotaenia testacea Theo. (?) of Edwards, 1932. Bul. Ent. Res. 23:559. Larva, Hong Kong.

Uranotaenia nanseica R. Bohart and Ingram, 1946. Navmed 1055: 56, Bu. Med. and Surg., Navy Dept., Washington. Male, Okinawa. *New synonymy.*

The larvae are quite distinctive, with three plate-like appendages on the antenna, two being apical and the third borne on a projection near the middle of the shaft. The scutal integument varies from brown to dark brown.

Aedes (Stegomyia) flavopictus downsi R. Bohart and Ingram, new status

Aedes downsi R. Bohart and Ingram, 1946. Jour. Wash. Acad. Sci. 36:51. Male, female, larva, Okinawa.

At the time *Aedes downsi* Bohart and Ingram was described no specimens of *A. flavopictus* Yamada were available for study, and the original description of *flavopictus* indicated a somewhat different species. In 1951, through the kindness of Dr. Manabu Sasa, I was able to study Yamada's types housed in the Institute for Infectious Diseases of the University of Tokyo. There are 3 male and 2 female cotypes collected at Shiba, Tokyo, Honshu. Also, Dr. Sasa made available to me reared adults and their associated larval skins. From a comparison of this material with paratypes and other specimens of *downsi* it appears likely that a single species is involved.

I am of the opinion that *downsi* represents a subspecies with the following tendencies: (1) restriction of the silver stripe on the front surface of the hind femur to the basal two-thirds or three-fifths of the femur, (2) expansion of the white markings of hind tarsal IV to cover five-sixths to nine-tenths of the segment, (3) reduction of the tergal pale stripes of the abdomen to weak or incomplete bands especially on III. The gills are variable in length, often quite short, and always unequal. The fifth pentad hair almost always has more than 4 branches and this serves to distinguish it from *A. albopictus* (Skuse), *A. aegypti* (Linnaeus) and *A. riversi*. In the typical subspecies from various of the main islands of Japan the fifth pentad is 6 to 20 branched according to Sasa and Kano (1951) and 5 to 17 branched according to LaCasse and Yamaguti (1950).

Aedes (Finlaya) feegradei Barraud

Aedes feegradei Barraud, 1934. Fauna of British India. Diptera 5:164. Male, female, larva, Burma.

Larvae collected in tree holes on Ishigaki Island in the southern Ryukyus check exactly with those reported from Okinawa by Bohart and Ingram (1946b) as "*Aedes* (*Finlaya*) sp. in *gubernatoris* group." As noted at that time, the larvae agree with the description of *A. feegradei* from Rangoon, Burma. Adults reared from the Ishigaki material also check closely with *feegradei* and on this basis the species can be recorded rather definitely from Okinawa.

Culex (Lophoceraomyia) tuberis R. Bohart

Culex tuberis R. Bohart, 1946. Proc. Biol. Soc. Wash. 59:42. Male but not larva, Okinawa.

The new specimens, consisting of 3 males, 4 females, 7 pupal skins and 10 larvae or larval skins, are especially interesting since the species has previously been known only from 3 males and a doubtfully associated larval specimen. The larvae were extracted by means of a siphon from a deep cliffside rock hole in company with *U. stonei*. In the light of this additional material it appears that the larva previously described was an atypical specimen of *C. infantulus* Edwards. The original description can be supplemented as follows:

Female.—Agreeing with male in general coloration. Pleuron sometimes greenish, scutal integument medium to dark brown, scales of abdominal tergites all dark. Palpus about one-fifth as long as proboscis, torus with a small but sharp "point" at the upper inner angle corresponding to the pronounced knob of the male, no lower mesepimeral bristle.

Larva.—Antenna constricted and tufted a little beyond apical two-thirds, darkened at extreme base only, subapical bristles longer than apical long one, inserted about 3 subapical bristle diameters from apex (6 diameters in *infantulus*); clypeal spine stout, less than one-half as long as distance between insertion of spines (one-half in *infantulus*); head hair A with 4 or 5 branches, B single and reaching almost to antennal tube apex, C double and reaching to middle of antenna, d single; mentum with about 17 teeth. Shoulder hairs 1, 2, 3, 5, 6 and 8 single, 4 and 7 double (7 usually triple and 8 double in *infantulus*); thoracic integument without evident spicules. Lateral abdominal hairs double or triple on III to VI. Comb of about 70 apically fringed teeth in a patch; first pentad hair single or double, rarely triple, second and fourth pentads single, third pentad with 6 to 9 branches, fifth pentad single or double (usually with 3 to 5 branches in *infantulus*); siphon a little more than 7 times its basal diameter, with 4 pairs of double or triple hairs which are longer than diameter of tube at point of hair insertion, 10 to 14 pecten teeth each with 1 to 3 denticles (about 7 denticles in *infantulus*), pecten occupying about one-third of tube length (one-quarter in *infantulus*); anal ring with a very small double to quadruple hair; gills tapering, about equal, a little shorter than anal ring; 10 or 11 hair brushes in barred area; outer apical bristle single, inner apical bristle double (triple or quadruple in *infantulus*).

In the key to Okinawa mosquitoes given by Bohart and Ingram (1946b) this larva runs to the second half of couplet 28 on page 51 but differs in having only 4 pairs of siphon tufts.

Pupa.—Breathing trumpet 6 times as long as its apical breadth and about 11 times its median breadth. Submedian apical hair of tergite II (hair C) with about 10 branches from basal one-fourth and terminating in about 20 branchlets. Lateral hair of segment VIII with 3 to 5 main branches, the longest about one-half as long as paddle. Paddle somewhat pointed apically.

Culex (Culiciomyia) ryukyensis R. Bohart

Culex ryukyensis Bohart, 1946. Proc. Biol. Soc. Wash. 59:41. Male, female, larva, Okinawa.

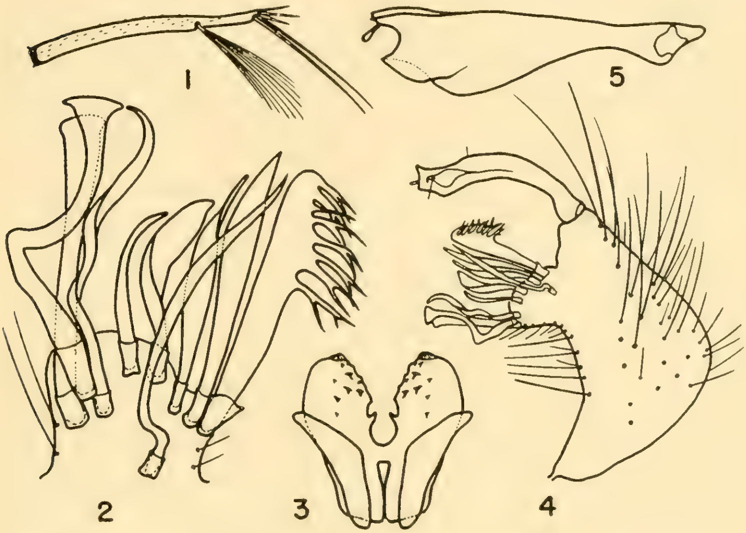
This species has been recorded from the Japanese islands of Kyushu and Honshu by LaCasse and Yamaguti (1950). However, examination of specimens in the collection of Dr. Manabu Sasa indicate that the Japanese form is a different and presumably unnamed species.

The females of the two are very similar except that *ryukyensis* is somewhat smaller. The male genitalia are, however, entirely different. *C. ryukyensis* has two black rods and one brown rod on the subapical dististyle lobe and the black ones are situated on projections. Furthermore, there is no crest on the dististyle. In the Japanese species there is one dark brown and two light brown rods, none on projections, and the dististyle has a cockscomb-like crest. These differences can be seen even on unmounted specimens under high power of a dissecting microscope. Still another point of separation is that the male palpus is only slightly longer than the proboscis in *ryukyensis* but longer by the length of the last segment in the other species. In the larvae, *ryukyensis* has three pairs of siphon bristles instead of four.

Culex (Neoculex) okinawae R. Bohart, new species

Figs. 1-5

Male.—Palpus and proboscis dark, former slightly more than one-half as long as latter, terminal palpal segment with short bristles except toward apex. Vertex with broad median area covered with gray to ochreous narrow curved and brown upright forked scales, pale broad



Figs. 1-5. *Culex okinawae,* not drawn to scale. Fig. 1, larval antenna; fig. 2, subapical lobe of basistyle, dorsal; fig. 3, mesosome; fig. 4, sidepiece of male genitalia, dorsal; fig. 5, dististyle, inner lateral view.

appressed scales laterally. Scutal integument brown covered with bronzy hair-like scales, scutellum with somewhat paler narrow scales; anterior pronotal lobe and pleuron apparently devoid of scales; one lower mesepimeral bristle; wing and halter knob dark scaled; legs dark except on femora behind, pale scales extending the whole length of fore and mid femora, and basal five-sixths of hind femur. Abdominal tergites all dark, scales somewhat iridescent, V to VII slightly longer than broad. Genitalia as in figs. 2 to 5; mesosome lobes stoutly bridged, with scattered, outwardly directed teeth toward inner edge; basistyle with five long hairs on inner margin below subapical lobe; latter with 9 oddly formed rods and paddles, fig. 2, the distal one with a series of apically directed, forked projections; dististyle peculiar, apical one-fourth forked in lateral view. Length of wing, 2.5 mm.

Female.—Palpus about one-seventh as long as proboscis. Color and sealing about as in male.

Larva (based on one whole larva and one cast skin).—Antenna slender, dark throughout, 2.6 times as long as distance between clypeal spines, constricted and tufted at apical two-thirds, with many spicules before tuft and a few beyond, apical setae as shown in fig. 1. Clypeal spine black, two-sevenths to one-third as long as distance between spines. Head hair A with 5 or 6 branches; B single at base but split into 2 before middle, 1.8 times as long as distance between clypeal spines; C single, very fine, two-thirds as long as B; d single or split, one-sixth as long as B.

Pupa (based on 3 cast skins).—Breathing trumpet about 4.5 times as long as its apical breadth and about 8 times its median breadth. Submedian apical hair of tergite II (hair C) with 50 or more fine branches, from a stout base. Lateral hair of segment VIII with four to five main branches, the longest about two-sevenths as long as paddle. Paddle rounded apically.

Holotype, male (U.S. National Museum) East Taira, Okinawa, September 21, 1951, R. Bohart. Paratypes, 8 males, 2 females, 1 larva and 1 larval skin, same data at type. Larvae were taken from a deep, shaded rock hole in a streambed in company with *Culex hayashii* and *Uranotaenia annandalei*.

Systematics.—This species is apparently closely related to *C. hayashii* from which it is indistinguishable in the female. However, it is separable at a glance by the male genitalia and the all dark antenna of the larva. *C. hayashii* has a simple and slender dististyle and relatively undeveloped rods and toothed paddles on the subapical lobe of the basistyle. Also *hayashii* has the male palpus three-fifths to three-fourths as long as the proboscis instead of one-half to four-sevenths. The larval antenna of *hayashii* is dark at the base and apex but pale in the middle.

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FIVE NEW NEOTROPICAL SPECIES OF GHILIANELLA

(HEMIPTERA, REDUVIIDAE)

BY J. MALDONADO CAPRILES, *College of Agriculture and Mechanic Arts, Mayaguez, Puerto Rico*

Five new species of *Ghilianella* Spinola 1850 are described in this paper from material collected by the author at Mona Island, Puerto Rico, and in Territorio Amazonas, Venezuela, S. A. The author is greatly indebted to Dr. Petr Wygodzinsky, from the Instituto de Medicina Regional, at Tucumán, Argentina, and to Dr. Reece I. Sailer, from the United States National Museum, whose assistance and suggestions made possible this publication.

Ghilianella puncticauda, new species

Male.—Black. Antenna bare; body covered with uniformly distributed, short, appressed, grayish-white pilosity which is heavier on head, prothorax, and fourth tergite; legs with very scarce pilosity.

Head from above as in fig. 1. Distinctly granulose; eyes large. Well developed interantennal spine, almost straight. Thoracic regions granulate. Prothorax narrowed posteriorly; meso- and metathorax very narrow to front of coxae, here suddenly expanded, fig. 2. Fourth antennal segment nearly one and one-half times longer than third. Claws of fore tarsi two, the inner short, closely appressed to base of outer. The inner row of armature of fore femur consisting of alternating longer fine hairs and short spines, the hairs arising from wart-like bases. First spine of fore femur four times its length from tip of trochanter; basal half of fore femur gradually thickened to first spine, fig. 3.

Abdomen gradually widening to base of fourth segment. Apical portion of fourth tergite forming minor part of bulbosity. Fifth constituting major part of bulbosity; with subangulate ridged elevations on lateral margins, these follow the general outline of the bulbosity, very slightly produced. Basal part of sixth tergite forming part of bulbosity; shorter than fifth; straight posteriorly, fig. 4. Seventh tergite slightly wrinkled posteriorly; over two and one-half times length of sixth; pointed, projecting beyond hypopygium more than visible length of claspers, fig. 5. Upper margin of hypopygium but slightly concave, with a very small apical process. From side, claspers parallel-sided. Overall body length 27 mm.

Female.—Head and thorax black. Abdomen black with lighter irregular spots ventrally and laterally; dorsally bases of second and third tergites brownish; two rounded brown spots laterally at base of fifth tergite. With short, appressed, light yellowish pilosity over body; slightly heavier on head, prothorax and fourth tergite. Mid- and hind femora with 2 incomplete yellowish annuli on apical half.

Head as in fig. 6, distinctly granulose. Well developed interantennal spine, straight. Thoracic regions granulate. Prothorax one-half length of mesothorax; shorter than metathorax. Prothorax narrowed posteriorly; meso- and metathorax narrowed anteriorly to front of coxae, here suddenly expanded. Claws of fore tarsi as in male. The inner row of armature of fore femur as in the male. First spine of fore femur at three times its length from tip of trochanter. Basal half of fore femur gradually thickened to first spine.

Abdomen gradually widening to base of fourth segment. Apical half of fourth tergite forming part of bulbosity. Fifth tergite constituting major part of bulbosity; with subangulate ridged elevations on lateral margins, produced near apical two-thirds. Bulbosity gradually diminishing on tergites six and seven. Sixth tergite shorter than fifth; straight posteriorly. Seventh shorter than sixth; hind margin with inconspicuous median elevation, apical angles slightly elevated and produced, fig. 7. Eighth tergite trapezoidal, wider than long, reaching to middle of ninth. Ninth corrugated, with thick lateral longitudinal elevations; a central narrower one anchor-shaped at tip, the narrow arms reaching under the lateral elevations, fig. 8. Hind margin of seventh sternite produced; one and one-half times longer than sixth. Hind margin of sixth sternite straight. Over-all body length 28 mm.

This female, although not collected in copula or at exactly the same place as the males, is included in this species because it will also run to *ignorata*, *recondita*, and *perigynium* in McAtee and Malloch's key to females. Besides, the shape of the thoracic regions and the fifth tergite agree in most considerations with that of the male. The male of this species is close to *ignorata*, *recondita*, and *perigynium* but differs from all by the much more elongate apex of the seventh tergite.

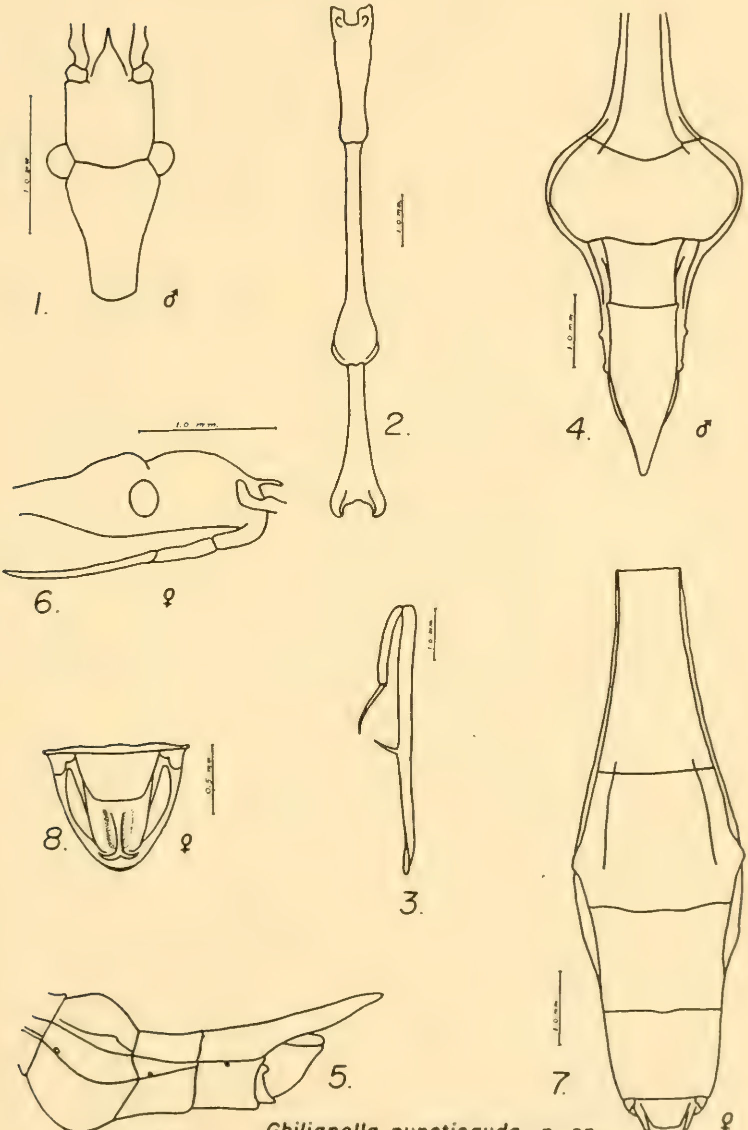
Types.—Holotype, male, collected in the savanna of Culebra, north of Mount Duida, Territorio Amazonas, Venezuela, April 7-16, 1950. U.S.N.M. Cat. no. 61611. Allotype, female, Tapara, upper Cunucunuma river, Territorio Amazonas, Venezuela, April 20, 1950. Paratypes, three males; same data as holotype. Two deposited in the U.S.N.M. and one in the author's collection.

Ghilianella atabapo, new species

Female.—Head and thorax black. Abdomen black with lighter irregular spots ventrally; dorsally with second segment brownish; others black. Fore legs blackish-brown. Mid- and hind femora each with one in-

PLATE I. GHILIANELLA PUNCTICADA

Fig. 1, male, dorsal aspect of head; fig. 2, male, dorsal aspect of thorax; fig. 3, male, fore leg; fig. 4, male, dorsal aspect of apex of abdomen; fig. 5, male, lateral aspect of same; fig. 6, female, lateral aspect of head; g. 7, female, dorsal aspect of apex of abdomen; fig. 8, female, genitalia from behind.



Ghilianella puncticauda n. sp.

complete yellowish annulus near middle, remaining portions blackish. Pubescense light golden-yellow, sparse; heavier on apical portions of abdominal sternites and forming a well-defined, wide stripe on prosternite.

Head a little swollen behind eyes, as in fig. 9. Not granulate; eyes large. Interantennal spine short, not well developed. Prothorax shorter than mesothorax; almost one and one-fourth times longer than metathorax. Mesothorax with scattered lateral granulations. First spine of fore femur at nearly three times its length from tip of trochanter; basal half of fore femur gradually expanded to first spine. Claws of fore tarsi as in *puncticauda*. Armature of inner row of fore femur consisting of a row of irregular, strong spines with fine hairs between.

Abdomen widening to apex of third segment, then parallel-sided to apex of sixth. Sutures between sternites at middle emarginate behind. Hind margin of sixth tergite straight; of seventh straight with shallow depressions on either side of median line. Eighth tergite reaching to middle of ninth; apex truncate, with two large, round impressions closer to upper margin; very slightly corrugated on sides. Ninth tergite elongate; slightly elevated near tip as seen from side; not corrugated; posterior margin truncate, narrowed, as in fig. 10. Hind margin of seventh sternite not produced; slightly longer than sixth. Over-all length 25 mm.

This species, although having the mesothorax slightly longer than the prothorax, is close to *pascoei*, *longula*, and *minimula*. It can be easily separated from these by the shape of the genitalia.

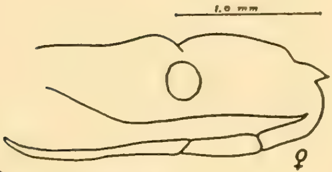
Type.—Holotype, female, collected in the small settlement of Anaben, Colombia, across the Orinoco River, in front of San Fernando de Atabapo, Territorio Amazonas, Venezuela. June 5, 1950. U.S.N.M. Cat. no. 61612.

Ghilianella lissa, new species

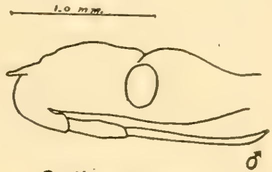
Male.—Head, thorax, fore coxae, and abdomen blackish-brown. Fore femur brown, with 3 light brown or yellowish annuli toward apex, the first near middle; inner side of femora with upper margin yellowish to first annuli. Antenna brown. Mid and hind femora with yellowish annuli near bases; three post-median annuli, the last two closer to each other. Mid and hind tibia brown, with yellowish, incomplete annuli near bases, each with apical half to three-fourths lighter; tarsi dark brown. Body and legs with very scarce, short, grayish pilosity.

PLATE II. SPECIES OF GHILIANELLA

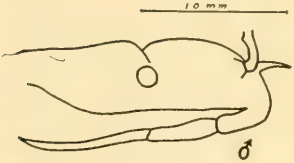
Fig. 9, *atabapo*, female, lateral aspect of head; fig. 10, *atabapo*, female, genitalia from behind; fig 11, *lissa*, male, lateral aspect of head; fig. 12, male, dorsal aspect of apex of abdomen; fig. 13, *lissa*, male, lateral aspect of same; fig. 14, *sulcata*, male, dorsal aspect of apex of abdomen; fig. 15, *sulcata*, male, lateral aspect of same; fig. 16, *monense*, male, lateral aspect of head; fig. 17, *monense*, male, dorsal aspect of apex of abdomen; fig. 18, *monense*, male, lateral aspect of same.



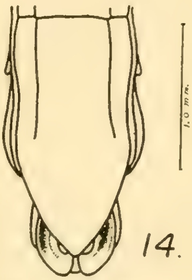
9. G. atabapo n. sp.



11. G. lissa n. sp.

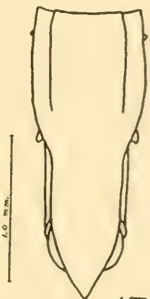


16. G. monense n. sp.



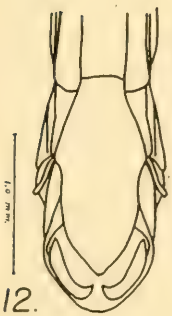
14.

G. sulcata n. sp.



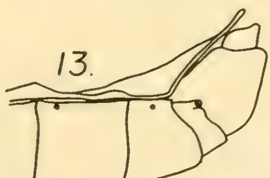
17.

monense



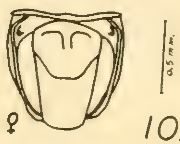
12.

lissa



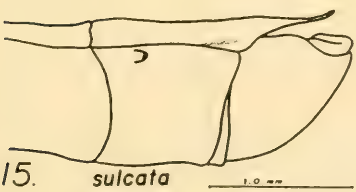
13.

lissa

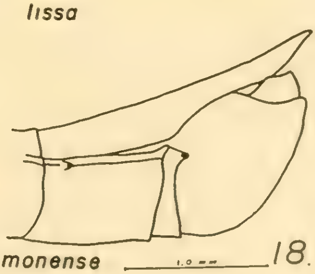


10.

atabapo



15. sulcata



monense 18.

Head from side as in fig. 11. Not granulate, eyes large. Interantennal spine well developed, straight. Fourth antennal segment two and a half times longer than third. Prothorax longer than mesothorax, three times as long as metathorax. Thorax not granulate. First spine of fore femur two times its own length from tip of trochanter. Basal half of fore femur gradually thickening to first spine. Claws of fore tarsus two, the the inner one very short, closely appressed to outer. The inner row of armature of fore femur consisting of hairs or bristles arising from wart-like bases.

Abdomen wider near segments three and four and at hypopygium; first two segments thicker than wide. Sutures between sternites emarginate behind, seventh more so. Sternites and tergites transversely corrugated. Posterior angles of tregites two to six slightly produced. Spiracles slightly elevated, not pedunculate. Eighth sternite visible on its entire width. Seventh tergite nearly one and one-half times longer than sixth, not surpassing claspers, with constriction beginning on basal third, transversely corrugated, more so after constriction. Claspers broadly triangular as seen from side, width at apex shorter than length; from above exposed. Upper margin of hypopygium slightly concave, figs. 12 and 13. Over-all length 15 mm.

This species will run to *personata* in McAtee and Malloch's key to males, but differs by the presence of yellowish annuli on the legs, lighter pilosity, absence of granulations, aspects of dorsum of abdomen and shape of the genitalia.

Types.—Holotype, male, collected near the base of the northern slopes of Mount Marahuaca, Territorio Amazonas, Venezuela, May 1-25, 1950. U. S. N. M. Cat. no. 61615. Paratype, male, same collecting data; in the author's collection.

Ghilianella sulcata, new species

Male.—Beak and apical half of fore femur brownish, remaining body portions black. Scarce, silvery, short, appressed pilosity over body; slightly heavier back of eyes and on bases of thoracic and abdominal segments. Seventh tergite with light brown lateral areas; apex of sixth and all seventh sternites with many light brown, irregular, rounded areas.

Head from above similar to *atabapo;* sparsely granulate. Interantennal spine short, not well developed. Thorax granulate. Prothorax slightly shorter than mesothorax, longer than metathorax; meso- and metathorax very narrow to front of coxae, here suddenly expanded. First spine of fore femur three and a half times its length from tip of trochanter. Basal half of fore femur gradually thickened to first spine. The inner row of armature of fore femur almost identical with *puncticauda.* Claws of fore tarsi lost.

Abdomen widening to apex of second segment, from here parallel-sided to hypopygium. Sternum with median carina, but not keeled. Sutures between sternites emarginate behind; straight on sides, only six arcuate. Seventh sternite slightly keeled on basal half. Seventh tergite, a little longer than sixth, transversely corrugated on apical third, with slight constriction ending before middle, then roundly tapering to an upcurved point which scarcely reaches end of hypopygium, fig. 14. Eighth sternite visible ventrally, sides and spiracle concealed. Upper margin of hypopygium as in fig. 15; with a caudal broad concavity which accommodates claspers. Claspers above with a deep, longitudinal furrow reaching from base to apical two-thirds. Over-all length 25 mm.

This species will run to *maculata* in McAtee and Malloch's key to males, but can be easily separated by the general coloration, the shape of the genitalia and especially the furrow in the claspers.

Type.—Holotype, male, collected in the savanna of Culebra, Territorio Amazonas, Venezuela, April 7-16, 1950. U. S. N. M. Cat. no. 61613.

Ghilianella monense, new species

Male.—Head, forelegs, and antenna brown; remaining parts of body black. Scarce pilosity on fore legs and head. Antenna bare. Rest of body with short, appressed pilosity, silvery on thorax and golden on abdomen; prothorax with scarce pilosity, mesothorax with slightly denser pilosity behind; metathorax with heavier pilosity on sides and scarcer below; second to fifth abdominal segments, above and on sides, with heavy pilosity on basal halves, giving the abdomen a banded appearance. Legs with sparse, very short, decumbent hairs in more or less straight lines.

Head from side as in fig. 16; sparsely granulate; eyes small. Well developed interantennal spine, slightly decurved. Prothorax and mesothorax equal in length, longer than metathorax. Thorax sparsely granulate. Claws of fore tarsus two, the inner very short and closely appressed to outer. First spine of fore femur four times its own length from tip of trochanter; basal half of fore femur gradually thickening to first spine. The inner row of the armature of fore femur consisting of bristles arising from wart-like bases. Abdomen almost parallel-sided, slightly wider at hypopygium; without appendages. Posterior angles of tergites normal; hind margins without any warts, straight. Posterior angles of tergites normal; hind margins smooth, straight. Spiracles normal. Seventh tergite with constriction beginning near middle; projecting a little beyond hypopygium, fig. 17. Hind margins of sternites slightly concave, seventh more so; sternites with median carina. Eighth sternite visible on its entire width. Upper margin of hypopygium with shallow concavity near middle. Claspers as seen from side trapezoidal, fig. 18. Over-all length 25 mm.

This species will run to *angulata* on McAtee and Malloch's key and is also close to *productilis* Barber, but can be separated from these species by the coloration and by the shape of the genitalia.

Type.—Holotype, male, collected in Mona Island, Puerto Rico, August 9, 1951. U.S.N.M. Cat. no. 61614.

FOUR NEW NEOTROPICAL REDUVIIDAE

(HEMIPTERA)

By ROLAND F. HUSSEY, *University of Florida, Gainesville*

The present paper deals with three reduviine and one ectrichodiine species, the types of which are in the collection of the Museum of Zoology, University of Michigan, Ann Arbor. My sincere thanks are due to Dr. J. Speed Rogers, Director, and Dr. Theodore H. Hubbell, Curator of Insects, for the privilege of studying the Hemiptera of that collection, and of describing these new forms. I am indebted to Mr. William L. Brudon, artist in the Museum of Zoology, University of Michigan, for the figures of two of the new species.

As in other recent papers, I have expressed all comparative measurements here in hundredths of a millimeter.

Leogorrus insculptus, new species

Female.—Length 11.2 mm., width of pronotum 3.2 mm.

Black, rather strongly shining, sparsely shortly setulose on the head, thorax, and veins of the corium; femora and tibiae with somewhat longer but rather remote erect hairs, the front femora beneath with several rows of long golden hairs, all the tibiae with dense pilosity on their inner (ventral) sides toward the tips; antennae with short oblique setae on the first two segments, the third segment pale, with longer setae, the fourth missing. Hemelytra matt, black, marked with yellow as follows: an abbreviated subquadrate fascia just before the apex of the corium, extending onto the membrane and narrowly invading the outer side of the apical cell, a slightly smaller spot on the inner margin of the membrane opposite this abbreviated fascia, a spot at the apex of the apical cell of the membrane, narrowly extended backward along the apical veins as diverging pale streaks; extreme tip of the clavus and extreme basal portion of the inner margin of the membrane faintly yellowish.

Head, seen from above, a little shorter than the pronotum (220:253), twice as long as the width of its postocular portion, the latter slightly narrower than the width across the eyes (110:130), the ante-ocular length about one-third less than the post-ocular length including the neck (68:100). Eyes hardly prominent, only about one-third of their width lying laterad of the tumid post-ocular portion, their length in dorsal view four-fifths greater than their width (63:35) and equal to the minimum interocular width of the vertex. Vertex with a median longitudinal impression extending from the post-ocular transverse sulcus to the base of the tylus, this impression narrowed before the bases of the antenniferous tubercles and bounded on each side by a low carina; antenniferous tubercles somewhat oblique as seen from above, freely prominent. First antennal segment stout, curved; second segment somewhat thinner, with a short intercalary segment at its base; third segment only half as thick as the second. Lengths of antennal segments I-III, 123:(18):200:78, fourth segment missing.

Pronotum one-fourth wider than long (320:255), the two lobes equally long, the anterior one three-tenths narrower than the posterior one (223:316), the anterior margin (including the prominent subnodose anterior angles) one-fourth wider than the head across the eyes (163:130). Interlobular transverse sulcus not interrupted; median longitudinal sulcus deepest just before the transverse sulcus, extended backward about to the middle of the posterior lobe. Posterior lobe with the entire surface minutely and closely etched with short, shallow but sharply angulate grooves running in all directions, but quite frequently arranged in minute stellate patterns that radiate outward from common centers. Anterior lobe with a submedian and two lateral sulci on each side which are broad, shallow and smooth, the outermost ones extending forward from the interlobular sulcus, each of the others terminating behind in a subquadrate smooth area on the hind margin of the anterior lobe, the ridges between these sulci etched and eroded like the posterior lobe, though more shallowly. Scutellum depressed on the disk, produced backward as a short, thick, horizontal spine, the entire scutellar surface (including the spine) very uneven.

Propleura almost smooth on the anterior lobe, the posterior lobe more or less horizontally rugulose; metapleura characteristic of the genus. Mesosternum destroyed in pinning the specimen; metasternum tectiform-carinate, the carina continuing onto the venter and becoming obsolete on the third ventral segment; venter smooth, strongly shining, with some remote erect hairs; first visible ventral incisure coarsely rugulose-punctate. Hind margins of ventral segments 3 to 6 concavely sinuate, the sixth most strongly so, the seventh segment longer on the middle line than the fifth and sixth combined (163:150), the other segments subequal in length. Hemelytra almost reaching the apex of the seventh tergite.

Front femora strongly incrassate, three times as long (on the ventral edge) as thick; fore tibiae gradually thickened from the base to the proximal end of the spongy fossa, the latter elongate-triangular, occupying about three-eighths of the length of the tibia (95:255). Middle tibia without a spongy fossa, but with a dense mat of long yellow hairs toward the apex.

Type.—Holotype, ♀, Los Santos, Guánico, Panamá, Sept. 15, 1925 (Fred. W. Walker).

The minutely intagliated surface of the posterior lobe of the pronotum and of the elevated ridges on the anterior lobe distinguishes this species from all others that have been described in the genus. As noted above, the etched grooves tend in many places to form strikingly stellate patterns, but in other areas they have a tendency to form abbreviated transverse series. The smooth sulci of the anterior lobe are as conspicuous (though not so deep) as those found in numerous species of *Sirthenea* and *Rasahus*.

This species appears most nearly related to *Leogorrus formicarius* (Fabr.), which also has the transverse sulcus uninterrupted and the posterior lobe of the pronotum rugose, but *formicarius* is a much larger species with prominent eyes and is differently colored. *L. incommodus* (Walker) has the front lobe of the pronotum "very convex and with slight furrows," but this lobe is shorter than the posterior one, the legs are red, and the coloration is otherwise different.

Zelurus gaigei, new species

Fig. 1

Female.—Length, 20.5 mm.; width between the bases of the humeral spines 4.35 mm., between their apices 5.66 mm.

General color yellowish. Head marked with black or piceous as follows: the narrow posterior margin and an abbreviated median longitudinal line on the vertex; the neck and post-ocular part of the head above and on the sides down to the level of the middle of the eye; lower part of the head before the eyes, the black color invading the lower part of the genae posteriorly. Tylus dark fuscous. Antennae entirely black; rostrum piceous, its first joint sordid flavo-testaceous.

Prothorax largely black, the discal spines of the anterior lobe and the humeral spines flavo-testaceous, the area between and in front of the discal spines yellowish; about one-fifth of the length of the pronotum occupied by a percurrent transverse yellow fascia, the yellow color extending forward a short distance along the lateral margins, the anterior margin of the fascia nearly straight, the posterior margin slightly invaded by fuscous at the intra-humeral impressions, beyond which it is directed outward and backward to the rear margin of the pronotum well behind the humeral spines, these latter situated somewhat behind the middle of the transverse fascia. Pleura piceous to black; all acetabula, coxae and trochanters yellowish, as also a vertically elongate spot near the anterior margin of the prothorax below, the upper part of the propleura, two large spots on the mesopleura, and the strigose area of the metapleura. Scutellum black, with a rounded, subcalloused, sordid yellowish area in each basal angle; scutellar spine entirely testaceous. Fore and middle legs testaceous or flavo-testaceous, the last tarsal segment darker. Hind legs largely black; extreme bases of the femur and the tibia yellow, as also a broad apical band occupying the distal fourth of the femur and another on the distal third of the tibia, that on the femur somewhat paler than the one on the tibia; entire hind tarsus dark, provided with yellow hairs.

Hemelytra brownish black. Corium with a large, very pale yellow spot extending inward from the costal margin to the base of the inner cell of the membrane, the hind margin of this spot becoming somewhat oblique inwardly; and at the same level the membrane inwardly bears a narrower, subtransverse testaceous marking which becomes paler and broader as it approaches the anal margin so as just to match in color and extent the pale marking of the opposite hemelytron when the wings are at rest. Claval vein (contiguous to the claval suture) pale testaceous, joining anteriorly a rather broadly lunate area on the base of the clavus which is subcalloused, finely punctulate, obliquely declivous, and narrowly carinate on its inner (upper) edge next to the base of the scutellum. Cubital vein similarly (though less distinctly) paler than the

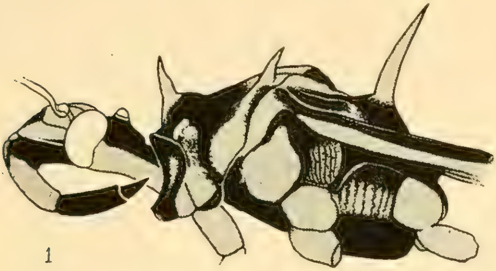

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Fig. 1, *Zelurus gaigei*, new species, lateral view of head and thorax, to show the distribution of colors (stippled areas are yellowish in the type specimen); fig. 2, *Zelurus multicinctus*, new species, lateral view of head. Drawings by William L. Brudon.

disk of the corium, and joining anteriorly an obsolete yellowish spot near the base of the corium. Costal margin narrowly yellowish on the basal third, this marking somewhat wider anteriorly. Brownish-black color of the corium extended far backward onto the membrane, its margin convex behind, attaining the apex of the median cell and somewhat surpassing that level in the outer cell; apical part of the membrane lightly infuscated, separated from the dark brown portion by a rather wide, curved, colorless zone, the lightly infuscated apical part with two divergent pale-bordered veins arising from the apices of the two outer cells and extending more than half way to the apical margin of the membrane; a similar vein arises from the apex of the inner cell but is vestigial (0.1 mm. long) and is not bordered by pale color.

Venter flavous, each segment except the basal one transversely banded with black on the anterior margin, the black bands broadest near the lateral margin of the abdominal lobule, narrowed inwardly, those of the 3d to 5th segments interrupted at the middle by the mid-ventral carina, that of the 6th segment percurrent, joined at the middle line by a longitudinal black line which extends backward to the middle of the segment; 7th segment (♀) with an oblong fuscous spot at the middle of the front margin, and lightly infuscated toward the sides; fasciae of the other segments continued onto the lower fold of the (double) connexivum but not visible on upper fold of the latter.

Head as seen from above shorter than the pronotum (300:354), about one-half longer than its own width across the eyes (300:196); interocular width of the vertex greater than the width of an eye (72:65). Jugae long and slender, parallel-sided, about three times as long as wide (53:18), very distinctly depressed below the level of the antenniferous tubercles. Genae rounded at the tips, not prominent. Lengths of antennal segments I-IV, 162:495:392:125 (the lengths of the last two segments approximate, as these are somewhat curved in the type specimen). Lengths of the rostral segments, 136:163:75.

Antero-lateral angles of the pronotal collar obtuse, only moderately prominent. All pronotal spines acute, the discal ones of the anterior lobe very little longer than the humeral spines (98:93), the latter nearly transverse, pointing outward and upward but scarcely directed backward. Scutellar spine stout, nearly vertical, its tip standing 1.41 mm. above the scutellar disk, 1.96 mm. above the apex of the scutellum. Anterior lobe of pronotum not very convex, provided with a median sulcus which becomes obsolete in front of the spines, and with two broad, shallow, somewhat oblique impressions at each side behind. Posterior lobe moderately declivous in front, rugose-punctate, most conspicuously so at each side of the median sulcus on its front portion. Costal margin of the hemelytra concave, the width across the hemelytra distinctly less at the base of the abdomen than at the sixth abdominal segment (370:480). Apex of the membrane surpassing the tip of the abdomen by about 2 millimeters.

Fore and middle femora with a few minute denticles beneath on the distal half, the middle ones also minutely denticulate toward the base; tibiae minutely serrulate on the basal half below. Spongy fossa of the fore tibia about one-fourth as long as the entire tibia (120:490), fossa of the middle tibia relatively shorter (103:517). All legs rather copiously pilose, the long hairs on the under side of the femora erect, those of the tibiae oblique.

Type.—Holotype, ♀, Santa Marta Mountains, Mt. San Lorenzo, 5600 feet, Colombia, June 14, 1920, swept from undergrowth in Vista Nieve Forest (F. M. Gaige).

It gives me great pleasure to name this species for its collector, who for many years was Director of the Museum of Zoology of the University of Michigan, under whose guidance I undertook my first studies in entomology.

This species belongs to the group typified by *Zelurus formosus* (Stål), and in the key to this group published by Lent and Wygodzinsky (1951, p. 2) it runs to the couplet containing *Z. formosus* and *Z. malaisei*. It is at once distinct from both these species in having the hind legs black, the femora and tibiae both very broadly banded with yellow on the distal part. The pale claval vein of the present species is another point of difference, as are also the coloration of the venter and (according to the descriptions) the presence of pale-bordered veins in the apical portion of the membrane, arising from the tips of the closed cells. The mid-ventral carina in the present species becomes evanescent at the middle of the fifth segment, and reappears before the middle of the seventh.

Zelurus multicinctus, new species
Fig. 2

Male.—Length, 11.8-11.9 mm.; width between the tips of the humeral spines 3.2-3.4 mm.; greatest width across the abdomen 3.7 mm.

Head yellowish, with a blackish stripe on each side before and behind the eye and with a narrow black mid-dorsal line extending forward from the base of the head to end in a black spot behind the ocelli; gula fuscous. Antennae fuscous; basal two-thirds of the first segment flavous, the second segment with a rather narrow yellow ring at the base and a wider one just beyond the middle. Third rostral segment and apical half of the second piceous.

Elevated ridges of the anterior pronotal lobe testaceous, separated by three darker smooth areas on each side which arise at the hind margin of the lobe and continue forward as sinuous stripes, the median ones bifurcate; collar yellowish at either side and broadly black at the middle, the black color continued onto the anterior lobe in front, narrowed between the discoidal spines, and extending as a median black line to the interlobular sulcus; discoidal spines flavous, their tips piceous. Posterior lobe flavo-testaceous, the disk with three fuscous vittae which are transversely connected before the hind margin, the outer ones ending anteriorly in rounded fuscous spots (in the paratype the outer vittae are obsolete, leaving only the pair of spots anteriorly and a median anchor-shaped fuscous mark whose shaft extends the entire length of the posterior lobe), the fuscous marks expanded postero-laterally to surround the bases of the humeral spines; humeral spines flavous, sometimes fuscous on the basal half, their tips not darkened. Scutellum black, the basal angles with a large yellow spot (almost concealed under the pronotum in one specimen), the terminal spine ochraceous, broadly banded with fuscous just beyond the middle.

Hemelytra dull brown, with a whitish or yellowish spot across the radial vein at the level of the scutellar spine, and a geminate pale spot across the same vein opposite the base of the inner cell of the membrane; the costal margin, the radial vein (except at base and apex), some of the outer veins of the membrane, and the claval suture (less distinctly) pale; middle and inner cells of the membrane with half a dozen or more rather large pale spots (some of them sometimes indistinct) arranged in a U-shaped pattern within each cell; apical part of the membrane paler beyond the closed cells, except for dark streaks along the veins.

Pleura largely piceous, the striate area of the mesothorax and all the acetabula flavous. Legs testaceous, the coxae marked with piceous; all femora tri-annulate with fuscous, the proximal band widest, the distal one narrowest, the bands of the fore and middle femora more or less interrupted on the antero-ventral side; tibiae with an ante-median and an apical fuscous band; tarsi infuscated only at the extreme tips. Venter piceous (the median carina narrowly testaceous on the basal segments in one specimen); yellow color of the connexivum slightly invading the ventral segments around the spiracles. Connexivum broadly banded with fuscous, the dark color occupying slightly less than the posterior half of each segment and narrowly crossing the incisure onto the next succeeding segment.

Head, seen from above, about one-fourth longer than its width across the eyes (173:140), the eyes slightly longer than wide (50:45) and narrower than the interocular space (45:53); vertical height of an eye one-half greater than its dorsal width (75:50). Vertex with a short median groove not surpassing the middle of the eyes; postocular groove deep; ocelli placed on a rounded elevation, directed upward. Lengths of antennal segments I-IV, 115:308:250:190 (the lengths of the last two segments approximate). Genae rounded at the tips, not prominent. Jugae as seen from above parallel and contiguous, their tips obtusely pointed and sometimes lightly divergent, about as long as the antenniferous tubercles; when seen from the side they reach the middle of the anteocular part of the head and their anterior edge is nearly vertical (Fig. 2). Head above with a single seta near each eye, the genae (especially toward the tips), tylus and rostrum sparsely long pilose.

Pronotum one-fourth shorter than its width between the tips of the humeral spines (250:330), the anterior margin (including the prominent subacute anterior angles) less than half as wide as the head across the eyes (60:140). Anterior lobe two-thirds as long as the posterior one, its lateral margin with a distinct tubercle behind the middle and with one or two smaller nodules in front of this; discoidal spines erect at the base, curved outward and slightly backward, two-thirds longer than the humeral spines (63:38), the latter rather stout, directed outward and backward. Posterior lobe coarsely rugulose-punctate, the wrinkles subtransverse on the anterior part, very irregular behind the middle; interlobular sulcus bridged by two rather indistinct carinae which are evanescent before the middle of the posterior lobe, the latter with a narrow, shallow, longitudinal groove each side midway between the middle line and the lateral margin. Scutellar spine about two-fifths longer than the scutellum itself (90:63), sharp-pointed, oblique in one specimen at hand, almost horizontal in the other, the tip lightly decurved. Costal margin of the corium distinctly but not deeply sinuate, thickly set with short, curved, pale silvery hairs toward its base.

Spongy fossa of the front tibia almost one-third as long as the tibia (100:338), that of the middle tibia slightly shorter (90:325). Femora and tibiae with many long setae on all sides, the fore and middle tibiae with additional rows of setae beneath which are longer than the thickness of the tibia, and with a single row of rather close-set teeth along the lower margin; fore and middle femora with two rows of much more widely separated teeth of various sizes, one or two of which are definitely spiniform.

Venter transversely regulose on all segments from the inner edge of the connexivum to the median carina, the latter extending to the apex of the sixth segment (♂). Apical angles of segments 3 to 5 slightly prominent and more or less acute, those of the second segment with a short acute spine.

Types.—Holotype ♂, and ♂ paratype, Magdalena District, Rio Frio, Colombia, May 5, 1926, collected at light (F. W. Walker).

This species would seem to have a very striking superficial resemblance to *Z. salyavatoides* Lent and Wygodzinsky 1947, which is known to me only from the description and the figures. They are the smallest species known in the genus, and both have similarly banded legs and somewhat similar markings on the hemelytra. *Z. multicinctus* seems separable from the other by the annulate antennae, the form of the jugae as seen from the side, the presence of the tubercle on the lateral margin of the anterior pronotal lobe, the humeral spines shorter than the discoidal spines, the scutellar spine banded with fuscous, the color of the venter, the much longer ventral carina, and certain details of the hemelytral pattern.

Pothea venatrix, new species

Male.—Length, 15.8 mm.; width of pronotum 3.8 mm.; width of abdomen 5.0 mm.

Shining, testaceous, tinged with reddish on the lateral portion of the posterior pronotal lobe, the disk of the venter, and to a lesser degree on the anterior margins of the propleura. Antennae and hemelytra black, the base of the corium and a vitta extending along the costal margin from the base about to its middle, flavotestaceous. Pronotum with two spots on the anterior face of the anterior lobe, the transverse interlobular impression, and two vittae on the posterior lobe, joining the transverse band in front and somewhat divergent behind, fuscous or piceous to black. Tips of the antenniferous tubercles embrowned. Scutellum pitchy black, the elevated portions more or less flavous. Dorsum of the abdomen red, the apex piceous; connexivum yellow, the last three segments with a large brown spot within (almost concealed beneath the hemelytra), the preceding segment with a much smaller, almost obsolete spot. Venter reddish testaceous, the lateral margins yellow, segments 3 to 7 each with a large piceous spot at each side, these spots confluent to form an irregular longitudinal inframarginal vitta, segments 4 to 7 also with a narrow piceous transverse basal fascia abbreviated at the sides and more or less interrupted at the middle; male genital segment piceous, with a small flavous spot each side. Pleura piceous (except the anterior margin of the propleura), the acetabula with a rather large flavous spot. Legs brown, the coxae, trochanters and bases of the femora flavous, the femora also with a rather indistinct yellowish preapical spot beneath. Femora with a few golden hairs above at the extreme apex; tibiae beneath with long decumbent golden hairs on much of their length, these hairs densely covering the apical part of the tibia on the sides as well as below; tarsi testaceous, hairy beneath, the last segment infuscated at the tip.

Head one-third longer than the pronotum (370:277), nearly as long as pronotum and scutellum together (370:408), the ante-ocular part to apex of tylus about one-half longer than the postocular part (190:131), the preocular length to apex of antenniferous tubercles almost one-half greater than the length of an eye as seen from above (88:60). Eyes very prominent, somewhat longer than wide (60:50), the interocular space becoming convex anteriorly, one-half wider than an eye (75:50). Tylus cariniform, without trace of a tooth, not angulate when seen from the side. Lengths of antennal segments, 170:330:138:95: (others missing). Vertex shallowly depressed transversely behind the eyes, then slightly elevated to form the ocelliferous tubercle which is distinctly transverse; head, seen from the side, sharply declivous behind the ocelli. Centers of the ocelli placed four-fifths the length of an eye (48:60) behind a line drawn between the hind angles of the eyes. Sides of the head (seen from above) roundly and rather abruptly narrowed behind the eyes (much as in *P. maculata* as figured by Champion), the neck short, cylindrical, a little thicker than the width of the interocular space (85:75).

Anterior lobe of the pronotum gibbous, vertical in front or nearly so, distinctly shorter than the posterior lobe (120:157), the median impression obsolete anteriorly, visible there only as a faintly impressed line; anterior angles nodose, visible from above. Interlobular sulcus coarsely rugose-punctate, as also a longitudinal impression at each side extending the entire length of the posterior lobe; humeral angles rounded, thick; posterior angles obsolete; posterior margin very lightly convex before the scutellum.

Type.—Holotype ♂, Tela, Honduras, May 26, 1923, collected on the Dakota Farm of the United Fruit Company, where it was swept from luxuriant herbage in a depression among banana plants (T. H. Hubbell).

This species is very near *Pothea bivittata* Champion, from which it can be distinguished by its non-annulate femora. It also differs in having the head abruptly and roundly narrowed behind the eyes, in having the ocelli set farther behind the eyes, and in the longer second rostral segment.

I have before me a male specimen which I identify as *P. bivittata*, taken by Dr. Hubbell in the Guaimas District at Tela, Honduras, May 10, 1923, which was found at night on a palm leaf a few inches above the ground. Dr. Hubbell's notes state that this bug moves very rapidly. In this specimen the proportions of the first four antennal segments are 163:280:113:95, and of the rostral segments 178:100:60. The ocelli lie at the sides of a globular elevation, and their centers are only half the length of an eye behind a line drawn between the hind margins of the eyes. The dark markings of the pronotum are less developed than in the unique female type described by Champion, those of the anterior lobe being reduced to a pair of large spots anteriorly and a pair of small oblique ones just before the interlobular sulcus, and the dark spot of the posterior lobe is divided into two by a median pale vitta. The tylus, seen from the side, is distinctly angulate but scarcely denticulate.

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BOOK REVIEW

THE APHID GENUS PERIPHYLLUS (FAMILY APHIDAE), A Systematic, Biological, and Ecological Study, by O. E. Essig and Frieda Abernathy. 166 pages, colored frontispiece, 43 text figures, bibliography. University of California Press, 1952. $3.00.

The title gives an accurate picture of the contents of this important contribution to the understanding of a biologically complex and unusual group of aphids. The volume treats the genus, and 10 species of Nearctic and Palearctic distribution giving detailed life histories observed by the writers, for three of them. The carefully prepared drawings of the numerous stages, forms, and their individual structures will prove invaluable to students of the group even though many of the illustrations are not reproduced in a completely satisfactory manner. Of special interest are the symbols based on the conventional male and female signs, that were originated by the authors and are used to designate numerous distinct forms. The association of a common name with each scientific one, a practice seldom followed in works of this nature, doubtless will be commended by many persons.

The volume has one pictorial key but does not contain written, couplet-type keys, an index, or a generic diagnosis, items whose inclusion would have contributed to the usability and completeness of the book. It contains such a wealth of information on various phases of the included insects, however, that it is a must for the aphidologist and is of more than usual interest to all persons inquiring into remarkable phenomena of insect development.—LOUISE M. RUSSELL, *U. S. Bureau of Entomology and Plant Quarantine.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
625TH REGULAR MEETING, MARCH 5, 1953

The Entomological Society of Washington held its 625th regular meeting on Thursday, March 5, 1953 in room 43 of the U. S. National Museum, attended by 39 members and 18 visitors. President W. H.

Anderson opened the meeting at 8:00 p.m., and the minutes of the previous meeting were read and approved.

Dr. J. C. Chamberlin, Box 278, Forest Grove, Oregon, and Dr. George J. Burton, Sanitary Engineering Branch, Engineering Research and Development Laboratory, Fort Belvoir, Va. were elected to membership in the Society.

President Anderson announced a proposal to change the Constitution which had been approved by the Executive Committee with a view to adding a Program Chairman to the elected officers. This was read and a copy circulated. The proposed change is as follows:

Article IV, Section 2: After ''a Custodian'' add ''a Program Chairman.'' Article V, a new section 10: The duties of the Program Chairman shall be to arrange a program for each meeting of the Society and to give due notice of all regular meetings to members of the Society.

A Textbook of Arthropod Anatomy by R. E. Snodgrass and the Society's Memoir 4, A Manual of the Chiggers by G. W. Wharton and H. S. Fuller, were exhibited by B. D. Burks. Alan Stone exhibited The Mosquitoes of the Northwestern States by H. H. Stage, C. M. Gjullin and W. W. Yates; and a new journal, Revista Ecuadoriana de Entomología y Parasitología.

A mosquito larva with a remarkably long air tube collected by D. C. Thurman in Thailand was also exhibited by Dr. Stone.

R. A. St. George reported on rearing eggs of walkingsticks collected during last year's outbreak. Under laboratory conditions the young nymphs could emerge in about 30 seconds, but approximately half of them failed to free one or two legs completely from the shell. A short moving picture taken by J. M. Davis which showed the feeding of adults and the hatching of the young walkingsticks was applauded.

R. I. Sailer called attention to a new entomological journal the *Revista Chilena de Entomología*. This excellent publication fills the gap that was left when the *Revista di Entomologia* in Brazil suspended publication. The new Chilean journal is edited by a group of well-known Chilean entomologists, one of whom, Raul Cortés, is a member of our Society. This new journal is to be congratulated on the capable way it handles papers written in four languages.

Dr. Sailor also gave a note about longevity in one of his stink bugs, *Hymenarcys nervosa* (Say.). In August 1951 he collected one adult female which laid eggs from which 14 nymphs hatched; these reached maturity in late September. One of these adults died November 1951, and another laid a mass of sterile eggs and died in April 1952. No further deaths occurred until Jan. 27, 1953. (Speaker's abstract.)

G. J. Burton offered ideas for collectors in the unbreakable plastic collecting tube and aspirator he exhibited. Tygon tubing in the aspirator permitted it to be folded into a comparatively small space.

The address of the retiring president was given by W. D. Reed, who spoke on the history of military entomology. Insect attack has a most important effect upon military operations. Insect reservoirs and vectors of disease have caused much illness and suffering among military personnel during wars of the past. Pest insects have also contaminated or destroyed stocks of food, clothing and other critical supplies. Entomologists were consulted in a limited way in connection with mosquito control during World War I, but the preparations for a general program of pest control were inadequate. During World War II a greatly expanded program of entomological services was conducted at Army installations and in connection with the operation of field armies. Malaria control and survey units were organized and trained by the Army medical service for supervision of work with field armies in malarious areas of theaters of operation. The work of these units was of great value in the control of malaria, dengue fever, scrub typhus, and schistosomiasis. (Speaker's abstract.)

Mr. Philip Spear of Amherst, Mass., Mr. C. F. Rainwater of College Station, Texas, Dr. F. Monrós of Argentina and member George Hutton were introduced.

The meeting adjourned at 9:50 p.m.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
626TH REGULAR MEETING, APRIL 2, 1953

The 626th regular meeting of the Entomological Society of Washington was held in room 43 of the U. S. National Museum on Thursday, April 2, 1953, attended by 31 members and 20 visitors. President Anderson opened the meeting at 8:00 p.m. and the minutes of the previous meeting were read and approved.

The Society voted the following persons to membership:

Harvey L. Goldstein, Dept. of Entomology, University of Massachusetts, Amherst, Mass.

Eugene J. Gerberg, Insect Control & Research Inc., Johnnycake Road, Baltimore 7, Md.

Howard V. Weems, Jr., Dept. of Zoology & Entomology, Ohio State Univ., Columbus 10, Ohio

Dr. F. Monrós, present address U. S. National Museum, Washington 25, D. C., permanent address Fundación Miguel Lillo, Miguel Lillo 205, Tucumán, Argentina

The copy of the proposed change in the Constitution which was read and circulated at the previous meeting was reread and upon a motion by A. B. Gurney the change was adopted.

A note prepared by Dr. H. L. Parker of the Bureau's European Parasite Laboratory in Paris was read by A. M. Vance. Dr. Parker made some observations on the luminous larvae of two species of Phengodidinae from Uruguay and Brazil, *Phryxothrix* (*Phengodes*) *heironomi* Hasse and *Phryxothrix* sp.

The larval stages of one (or both) species were found in soil following plowing. The larva is predaceous on white grubs, injecting a dark liquid into the grub which kills it immediately. The larval stage of the phengodid resembles a wireworm, is a reddish-brown color, and has eleven green lights on either side and a red light on the head. This headlight is actually red, not due to a white light shining through red integument. The female adult is larvaform and cannot be distinguished from the larva. The pupal form of the female is lighter in color and has very light conical mandibles, not hooked and pointed as in the larval stage. Adults were collected at lights, two species being found, one a uniform reddish-brown, the other with a black thorax. The male adult has 8 rather feeble yellowish lights on the sides. Azara, Haase, and Newton Harvey have published articles on this insect. (Mr. Vance's abstract.)

Dr. F. Monrós told of taxonomic entomological activities in Argentina, principally at Fundación Miguel Lillo, in Tucumán, where 5 entomologists are mainly devoted to taxonomic entomology, and the entomological sections in the Museo Bernardino Rivadavia in Buenos Aires and the Museo de La Plata. The Sociedad Entomólogica is the oldest society of its kind in South America. (Speaker's abstract.)

The first paper of the evening, on the purpose and operation of the USDA Extension Service, was given by M. P. Jones. This Service grew out of the need for more rapid spread of the results of research to the public. Seaman A. Knapp, T. H. Parks, and C. R. Crosby pioneered in the work of bringing to the farmers the necessary information on insect control. The present Extension Service provides a channel for the flow of information. (Secretary's abstract.)

The second address of the evening, on conjectures concerning the influence of the lipids of insects on the toxic action of DDT, was given by S. C. Munson, of the Washington University Dept of Biology.

If American roaches, *Periplaneta americana* (L.), are kept at different temperatures, those kept at lower temperatures have, after two weeks, fats which are less saturated than those which are kept at warmer temperatures. Roaches also vary in total lipid content with adult age, and females generally slightly exceed males in quantity of total lipids. If roaches are treated with DDT, those with less saturated lipids are more resistant than those with more saturated lipids, and females are significantly more resistant than males. It was theorized that the lipids of an insect (cuticular and reserve) acted in competition with a theoretical site of lethal action by solubilizing some of the applied DDT and thereby preventing it exerting a toxic effect. (Speaker's abstract.)

Visitors introduced were M. L. Weissmann, G. M. Padilla, Thomas E. Wilson, G. Bhenchitra of Thailand, Dr. Arnold Mayer of Germany, Victoriano J. Madrid of the Philippines, Robert Rozman, and H. E. Milliron of Delaware. The last two are members.

The meeting adjourned at 10.05 p.m.

KELLIE O'NEILL, *Recording Secretary*

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 55 OCTOBER 1953 No. 5

A NEW SPECIES OF CARDUICEPS

(MALLOPHAGA, PHILOPTERIDAE)

By K. C. EMERSON, *Stillwater, Okla.*

A new species of chewing louse, collected from birds of the genus *Limosa*, is herewith described.

Carduiceps lapponicus, new species

Male.—Head triangular in shape, length greater than width. Forehead with broad hyaline margin arising from the clypeal suture. Clypeal signature large, medianly pointed posteriorly. A medium-length setae located ventrally near the anterior end of each clypeal band. Heavily chitinized dorsal transverse antennal band. Antennae filiform. Heavy dorsal and ventral occipital bands. Temples broadly rounded, each with three long setae.

Prothorax short, rectangular in shape. Evenly rounded, convex lateral margins; each posterolateral angle armed dorsally with one long setae.

Pterothorax twice as long as prothorax and rectangular in shape. Evenly rounded convex lateral margins; each posterolateral angle armed dorsally with four long setae.

Abdomen elongate, slightly wider than the head. Pleurites transversely continuous without noticeable chitinous thickening and armed with a pair of medium-length setae located medianly on the posterior margin. Paratergal plates characteristic of the genus, each with three long setae. Sternites transversely continuous without noticeable chitinous thickening and armed with a pair of medium-length setae located medianly on the posterior margin.

Male genitalia as shown in fig. 2.

Female.—Essentially the same shape and size as the male. Except for the posterior abdominal segments, the chaetotaxy is the same as in the male.

Type host.—*Limosa lapponica lapponica* (Linnaeus), the Bar-tailed Godwit.

Type material.—Holotype male and allotype female and paratypes collected at Mainz, Germany, are deposited in the U. S. National Museum. Other material has been examined from the Pacific Godwit, *Limosa lapponica baueri* Naumann.

This new form closely resembles the other known species in the genus. Only slight differences in size, shape and chaeto-

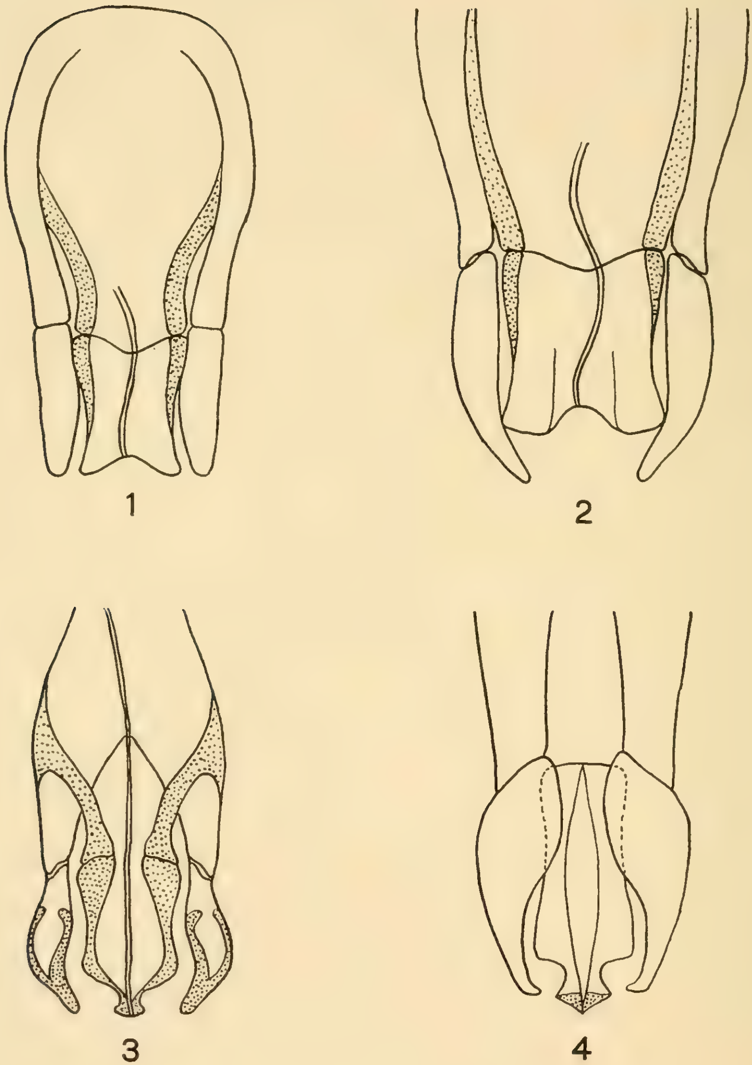

Fig. 1, male genitalia of *Carduiceps cingulatus;* fig. 2, *C. lapponicus;* fig. 3, *C. complexivus;* fig. 4, *C. scalaris.*

taxy exist between any of the species. The most diagnostic feature for separation is the structure of the male genitalia. The male genitalia of the new form and of the three most closely related species have been drawn to the same scale to show these differences.

Carduiceps cingulatus (Denny, 1842), fig. 1, is illustrated from material collected from *Limosa limosa limosa* (Linnaeus), the Black-tailed Godwit.

Carduiceps complexivus (Kellogg and Chapman, 1899), fig. 3, is illustrated from material collected from *Crocethia alba* (Pallas), the Sanderling.

Carduiceps scalaris (Piaget, 1880), fig. 4, is illustrated from material collected from *Philomachus pugnax* (Linnaeus), the Ruff.

DOLICHODERUS GRANULATUS PERGANDE, A SYNONYM

(HYMENOPTERA, FORMICIDAE)

BY MARION R. SMITH, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

In the 1896 (1895) Proceedings of the California Academy of Sciences (see reference below), Theodore Pergande described the ant, *Dolichoderus granulatus* from 12 workers collected by Messrs. G. A. Eisen and Frank H. Vaslit in Tepic, Mexico during September or October, 1894. The form, however, apparently escaped Emery's attention in his treatment of the ants of the world in the Genera Insectorum for it is not recorded there as a synonym or otherwise.

Recently 5 of the 12 cotype workers were located in the collections of the United States National Museum. The workers are mounted singly on a pin to which is attached a handwritten label, "Tepic, Mexico," and also a printed label, "Collection T. Pergande." One of the workers of the series bears a handwritten label, "*Dolichoderus granulatus*, n. sp., type, Perg." The handwriting on all of the labels appears to be that of Pergande. Upon carefully examining the specimens I was much surprised to find that they really are *Camponotus* (*Myrmobrachys*) *striatus* (F. Sm.), a well known form.

Camponotus (Myrmobrachys) striatus (F. Smith)

Formica striata F. Smith, 1862, Trans. Ent. Soc. London (Ser. 3) 1:30, *worker*. Type locality, Panama (specific locality not known, collector R. W. Stretch). Types in the British Museum (Natural History).

Dolichoderus granulatus Pergande, 1896 (1895), Proc. Calif. Acad. Sci. (Ser. 2) 5: 866-867, *worker*. Type locality, Tepic, Mexico (collectors G. A. Eisen and Frank H. Vaslit). Types in the United States National Museum. *New Synonymy.*

THE MOSQUITOES OF THE YEMEN

(Diptera, Culicidae)[1]

By Kenneth L. Knight, *U. S. Navy Preventive Medicine Unit No. 1, Naval Air Station, Jacksonville, Fla.*

This paper describes a collection of mosquitoes made by the author while a member of a medical survey team to the Yemen from U. S. Naval Medical Research Unit No. 3, Cairo, Egypt. Mount (1953) has published a general account of this survey.

Collecting was done in 1951 at Ta'izz from January 6th to the 25th, at Hodeida from January 28th to February 4th, at Ma'bar from February 5th to the 9th, and at San'a from February 11th to the 15th. A small amount of collecting was accomplished along the road between these various points. The land route of the party is shown in Fig. 1. The return from San'a to Aden was by air.

Representative sets of specimens from the collection are deposited in the U. S. National Museum and in the British Museum (Natural History).

The larval chaetotaxal nomenclature used in this paper is that of Belkin (1950).

I am deeply indebted to Mr. P. F. Mattingly, British Museum (Natural History), for making available to me the results of his critical examination of all the Yemen mosquito specimens contained in the collections of the British Museum. Dr. L. Merucci, West Aden Protectorate Medical Services, very kindly made several unpublished Yemen mosquito records available to me. Grateful acknowledgment is made to the other members of the mission, without whose assistance this part of the survey could not have been accomplished.

Description of the Country

The topography, climate, public health, and general biology of the Yemen have been described by Petrie (1939), Scott (1942), and Mount (1953) and need be reviewed only briefly here.

The Yemen lies on the Red Sea coast in the southwestern corner of the Arabian Peninsula. It is bounded on the north and east by Saudi Arabia and on the south by the Aden Protectorate. The country has an approximate area of 75,000 square miles and a population that is variously estimated to number between three and seven million people.

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[1]The opinions or assertions contained here are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval service at large.

Four main topographical features exist. First is the desert coastal plain or Tihama. No permanent surface water occurs here. Along its inland margin this area reaches an elevation

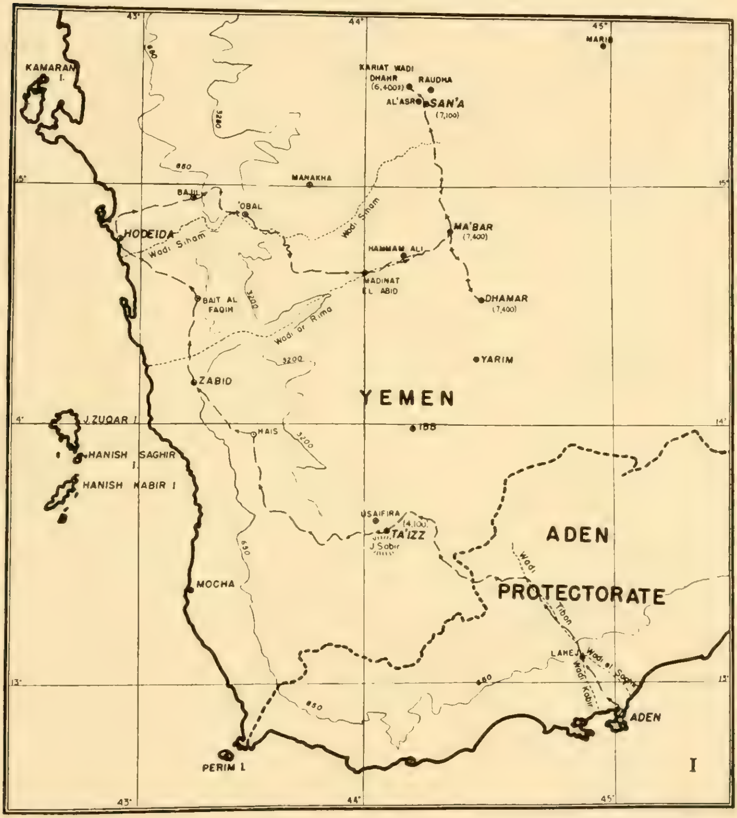

Fig. 1, Map of Yemen, adapted from Scott and Britton (1941); the land route of the Mission is indicated with dashed arrows.

of approximately 600 feet. Next occurs a broad belt of foothills and middle heights, some of which rise to elevations of more than 6,000 feet. This region is transected by innumerable stream courses or wadis, a number of which contain water throughout the year. The third area is comprised of the central highland plateaus. These occur principally between elevations of 7,000 and 8,000 feet and have mountain peaks more than 12,000 feet high. The fourth area is composed of the arid slopes from the plateaus to the Arabian desert on the eastern border of the country. Virtually nothing is known about the aquatic biology of this last region.

The meteorological data for the Yemen consists of only a few scattered observations (Petrie, 1939; Mount, 1953). Petrie (1939: 358) indicated that the average yearly rainfall of the coastal area is about two and one-half inches and that of the central highlands about 14-15 inches. In the highland areas the rains are mostly confined to the spring and autumn seasons. Shade temperatures below 70° F. are rare in the Tihama; whereas, at San'a the mean temperature varies from 50° F. in November to 68° F. in June (Petrie, 1939: 357).

Maximum and minimum temperatures (northern exposure) were recorded during our stay in the Yemen and are presented in the table below. No rainfall occurred in the areas visited during the period of our trip.

TABLE. RECORDED MINIMUM AND MAXIMUM TEMPERATURES (NORTHERN EXPOSURE) IN THE YEMEN, JANUARY AND FEBRUARY 1951.

Date	Temperature F° Min.	Temperature F° Max.	Date	Temperature F° Min.	Temperature F° Max.	Date	Temperature F° Min.	Temperature F° Max.
January	Ta'izz (4100′ el.)		January	Ta'izz (4100′ el.)		February	Ma'bar (7300′ el.)	
8	59.0	76.5	22	54.0	80.0	7	38.0	73.5
9	57.5	81.5	23	55.0	80.0	8	36.0	74.0
10	56.0	74.0		Hodeida		9&10	34.0	75.0
11	57.5	76.5		(Sea level)			San'a	
12	56.5	74.0	30	64.0	81.0		(7100′ el.)	
13	57.0	77.5	31	65.0	82.5	12	47.0	68.5
14&15	55.0	75.0	February			13	48.0	89.0
16	54.0	73.0	1	65.0	82.0	14	47.5	80.0
17	52.5	74.5	2	63.0	81.5	15	47.5	77.5
18	52.0	74.5	3	64.0	82.0	16	49.5	79.0
19	51.0	78.0	4	64.0	82.0	17	47.0	78.0
20	51.5	80.0				18	48.0	77.5
21	54.0	80.0				19	43.0	75.0

PREVIOUS MOSQUITO RECORDS FROM THE YEMEN

Prior to the making of this collection only five species of mosquitoes had been recorded in the literature from the Yemen. Edwards (1941) published Yemen records for *Culex mattinglyi* (erroneously identified by him as *C. laticinctus*) and *C. theileri* from a series of material collected by Scott and Britton in 1937-38 and later deposited in the British Museum. From specimens sent by Dr. C. Toffolon and Dr. L.

Merucci, resident physicians in the Yemen, to the London School of Hygiene and Tropical Medicine, Buxton (1944) published Yemen records for *Anopheles adenensis*, *A. dthali*, and *A. gambiae*. The distribution records for the remainder of the material in the above two collections, and for all of the material deposited in the British Museum by Dr. Rathjens, are given here for the first time.

The collection described in this paper contains 27 species. Of these, two *Culex* species proved to be new and have been described elsewhere (Knight, 1953). A total of 29 mosquito species is now known from the Yemen. Neither *Anopheles turkhudi* nor *Culex univittatus* var. *neavei* were taken by me. A preliminary list of the species contained in this collection has been published by Mount (1953). This list is corrected and expanded here.

Biologically, the Yemen belongs to the Northeast African Province of the Ethiopian Region and contains territory of both the subdivisions of this province: the Abyssinian Highland District and the Somali Arid District (Edwards, 1941: 452).

Collection Records for the Yemen Collection

To avoid duplication in the individual species treatments, a concise account of each collection is given here.

300. El-Amra, about 7 miles north of Ta'izz, el. about 3500 feet. Marshy seepage resulting from irrigation storage tank overflow. Emergent short grass and some filamentous green algae. pH 7-8. *Anopheles gambiae, A. cinereus,* and *Culex theileri.*

301. Two miles west of Ta'izz on road to Hodeida, el. about 3900 feet. Roadside covered cement basin for drinking water. Aperture very small and water deeply-shaded. *Anopheles rupicolus* and *Culex tigripes.*

302. Three and one-half miles west of Ta'izz on road to Hodeida, el. about 3700 feet. Roadside basin similar to 301. *Anopheles rupicolus* and *A. gambiae.*

303. About three-fourths of a mile north of Ta'izz on road to Usaifira, el. about 3900 feet. Roadside basin similar to, but much larger than, 301 and 302. *Culex tigripes* and *C. decens.*

304. Ta'izz, el. 4100 feet. Single adult taken on wall in house. *Culex nebulosus.*

308. El-Hauban, Wadi el-Malah, about 3 miles east of Ta'izz, el. about 3700 feet. Quiet marginal water of a drying wadi stream. Short emergent vegetation; a fine green floating watergrass. pH 8 ±. *Anopheles cinereus, A. pharoensis, A. sergentii* (a single specimen), *Culex theileri, C. simpsoni,* and *C. jenkinsi.*

309. Same locality as 308. Two female specimens taken on oiled paper placed in rodent burrows for the capture of *Phlebotomus.* Specimens in poor condition but probably *A. sergentii.*

310. Ta'izz, el. 4100 feet. Open cement basin in courtyard of mosque. *Culex tigripes, C. laticinctus,* and *C. decens.*
311. Same general locality as 308. Marshy seepage area along the margin of a small stream. *Aedes natronius* and *Culex theileri* were in dark brown water in drying hoof prints, and *Anopheles pharoensis* was in clear water nearer to stream margin. *Culex ? jenkinsi.*
312. Ta'izz, el. 4100 feet. Closed cement basin in mosque. *Culex pipiens.*
313. Wadi Raidan, about 17 miles west of Ta'izz on road to Hodeida, el. about 3000 feet. Quiet marginal water of a drying stream. Filamentous green algae. *Anopheles dthali, A. gambiae, A. pretoriensis,* and *Culex sinaiticus.*
314, 315, 318. Hodeida, sea level. Open cement basins in mosques. *Anopheles adenensis* and *Culex sitiens.*
316. Murawah, about 35 miles east of Hodeida, el. near to sea level. Open cement basin in mosque courtyard. *Culex quinquefasciatus.*
317. Locality same as 316. Large pottery water jugs within building. *Aedes aegypti.*
319. Hodeida, sea level. Large pottery water jugs within building. *Aedes aegypti.*
320. About 13 miles north of Hodeida near shore. Small pools and seepage in meadow at edge of high tide level, water brackish. *Culex sitiens.*
321. Wadi Siham, nr. 'Obal on road from Hodeida to San'a, el. about 1000 feet. Quiet marginal water of a drying stream. Emergent short vegetation and filamentous green algae. *Anopheles dthali, A. sergentii, A. pretoriensis, Culex ethiopicus, C. sinaiticus,* and *C. tritaeniorhynchus.*
322. Hamman 'Ali, el. about 5000 feet. Very small pools along overflow ditch from the hot spring baths. Water deep brown in color. *Culex pipiens, Aedes natronius,* and *Culiseta longiareolata.*
323. Birket Ghail Masnah, about 32 miles south of Ma'bar on Hodeida-San'a road, el. 7300 feet. Small permanent pond on arid high plain. *Potamageton,* stonewart, and filamentous green algae. *Anopheles cinereus* and *Culex theileri.*
324. Wadi Grab, about 14 miles southeast of Ma'bar, el. about 7300 feet. Natural small pools along ditch course. Stonewart, rushes and filamentous green algae. *Anopheles fluviatilis, Culex salisburiensis,* and *Culex theileri.*
325. Wadi Mal el-Ghail, about 14 miles west of Ma'bar, el. about 6500 feet. Pools along small stream flowing from a mountain spring. Filamentous green algae. *Anopheles cinereus, Culex jenkinsi,* and *Culex theileri.*
327. Dhamar, el. 7400 feet. Borrow pit for mosque drainage. *Lemma,* algae, and short emergent vegetation. *Culex theileri.*
328. Wadi Dhahr, el. about 7000 feet. Small open cement tank. *Culiseta longiareolata* and *Culex mattinglyi.*

329. Birket Ma'agel-Biet Myiad, about 2 miles south of San'a el. 7100 feet. A great open cement rain-catchment tank. *Potamageton. Culex theileri.*
330. Birket Sheikh Kunnaf, San'a, el. 7100 feet. Small open cement watering tank. *Culex mattinglyi.*
331. Wadi Dhahr, el. about 7000 feet. Large open well, about 5 meters to water level. Much flotage. *Culiseta longiareolata* and *Culex mattinglyi.*
332. Al-Asr, about 3 miles west of San'a; el. about 7600 feet. Very large open cement basin. Rushes and filamentous green algae. *Dixa* sp.
333. Rouda, about 3 miles north of San'a, el. about 7100 feet. Large open cement tank. Algae. *Culiseta longiareolata* and *Culex mattinglyi.*
334. Locality same as 333. Very large open cement pool in mosque courtyard. *Culiseta longiareolata.*
335. San'a, el. 7100 feet. Three adult specimens taken in house. The *Anopheles* was biting man in the evening. *Anopheles cinereus, Culiseta longiareolata, and Culex mattinglyi.*

Summary of the Yemen Mosquito Collection Records

The general mosquito situation during the period from January 6th to February 19th, 1951, was as follows:

Elevation Sea Level (*Tihama*).—Collecting sites (numbers 314 to 320): Hodeida; Murawah, 21 miles inland from Hodeida; and the Red Sea shore. *Anopheles adenensis* (in small numbers) and *Culex sitiens* were present in brackish water in the open cement basins of mosques in Hodeida. *Aedes aegypti* was found breeding in numbers in the large pottery water jars of homes in both Hodeida and Murawah. *Culex quinquefasciatus* was collected from foul tepid water in the open cement ablution basin of a mosque in Murawah. The basins of approximately eight other mosques were examined without finding any mosquito breeding. *Culex sitiens* was found in abundance in small pools of brackish water in a grassy area at the edge of high tide level along the Red Sea coast about 13 miles north of Hodeida. No adult mosquitoes were collected.

Elevation 1000 to 3000 feet (*lower foothills.*)—Collecting sites (numbers 313 and 321): Wadi Raidan 17 miles west of Ta'izz on road to Hodeida, and Wadi Siham near 'Obal. *Anopheles dthali, A. sergentii, A. gambiae,* and *A. pretoriensis* larvae were collected along the still margins of permanent small streams flowing through the rock-strewn narrow valleys (wadis) that drain the highlands onto the Tihama. *Culex sinaiticus, C. ethiopicus,* and *C. tritaeniorhynchus* were also collected from this habitat. Small villages of agricultural people are associated with these wadis. There is extensive caravan travel near both of these locations. No nights were passed in this zone.

Elevation 3500-5000 feet (*middle heights*).—Collecting sites (numbers 300-312, 322): Ta'izz area and Hamman 'Ali (site of royal hot springs resort). No anopheline breeding was found within the walls of Ta'izz, but Dr. Toffolon stated that after April small numbers of *Anopheles gambiae* may be found breeding in the open ablution pools of the mosques. *Culex laticinctus* was found breeding in these pools in sufficient numbers to constitute, potentially, a serious pest mosquito problem. *Culex decens* and *C. pipiens* were also collected from these places. Small numbers of *Anopheles rupicolus* and *A. gambiae* larvae were found in covered cement drinking water basins along the roads immediately outside of Ta'izz. *Anopheles gambiae, A. cinereus,* and *Culex theileri* were found breeding abundantly in a seepage area associated with an irrigation project about seven miles north of Ta'izz. *Anopheles cinereus, A. pharoensis, Culex theileri, C. simpsoni,* and *C. jenkinsi* were collected from the still water at the margins of a small stream three miles east of Ta'izz. One larva of *Anopheles sergentii* was collected from this same habitat. Two female anophelines, presumably *A. sergentii,* were collected on oiled paper placed in the openings of rodent burrows located near this stream. Only a few agricultural families live in this immediate area but heavy caravan traffic passes along the wadi daily, since it is beside the highland route from Ta'izz to San'a. The predatory larvae of *Culex tigripes* were found occasionally in the cement basin habitat in the Ta'izz area. At Hamman 'Ali, *Culex pipiens, Culiseta longiareolata,* and *Aedes natronius* were found breeding in the foul drainage water from the hot spring baths. Both here and at Ta'izz, *A. natronius* was collected from dark brown silt-ladened water. No adult mosquitoes were collected at Ta'izz during several attempted night-biting collections.

Elevation 6500-7600 feet (highland plateaus).—Collecting sites (numbers 323-335): Ma'bar, Dhamar, and San'a. *Anopheles cinereus* was abundant around the first two areas, breeding in small permanent pools surviving from the rainy season and in spring-fed stream pools. *Culex theileri, C. jenkinsi,* and *C. salisburiensis* were also collected from these habitats. Adults resembling *A. fluviatilis* were reared out from larvae collected here. None of these collection sites were closely associated with villages. Farmers and herders work in the areas in the daytime but nearly all return to the villages at night. No adult mosquitoes were seen.

In the San'a area not a single anopheline breeding site was found. However, one *Anopheles cinereus* female was captured in a building in San'a. Dr. Merucci, who has reported malaria present in San'a, collected *Anopheles turkhudi, A. cinereus,* and *A. sergentii* in the San'a area. The only water present in the San'a area at the time of our visit was that collected during the previous rainy season in huge open cement basins and that pumped from deep wells into drinking water basins and into the ablution basins of the mosques. *Culex theileri* was found in the former type of habitat, and *Culiseta longiareolata* and *Culex mattinglyi* in the latter. Unfortunately, no collecting was possible in the mountains arising from the highland plateaus.

Species Treatments

Anopheles (Myzomyia) adenensis Christophers

Descriptive Notes.—The only comprehensive description of the adult of this species (De Meillon, 1947:99) is based upon a single pair of specimens from Hodeida, Yemen. A series of one male and five females from this same locality are in the collection reported on in this paper. These agree satisfactorily with De Meillon's description except that the pale area on the stem of vein 5 of the female wing is more variable than he indicates. In one specimen, this area is completely lacking on one wing and represented by only two pale scales on the other; and in two other specimens it is much reduced in extent. Only one specimen has this pale area as prominent as figured by De Meillon.

De Meillon's (1947:99) larval description is based upon a larval skin from Hodeida and a whole larva from Assab, Eritrea. In this description he states that the two long mesothoracic pleural hairs are "simple or with one of the long hairs with a few branches." He does not state which specimen had the branched hair. The present collection contains a series of 14 larval skins and one whole larva, all from Hodeida. All of these specimens have both long mesothoracic pleural hairs simple. On the basis of this, it seems probable that it was the Assab specimen which possessed the branched mesothoracic hair mentioned by De Meillon, and suggests the possibility that this specimen actually represents some other species. In other details, the new Hodeida larval series agrees with De Meillon's description.

Distribution.—New records: 1 male, 5 females, 12 sets assoc. skins, 1 larva, Hodeida (314, 318). Previous records: Hodeida (Buxton, 1944: 211; De Meillon, 1947: 100).

Discussion.—The fact that the very closely related species, *A. culicifacies* Giles, has been reported from Bahrein Island (Afridi and Majid, 1938: 441) and the Oman and the Trucial Oman (Leeson, 1948: 254) indicates the necessity for a thorough study of the exact relationship of these two species.

Anopheles (Myzomyia) cinereus Theobald

Descriptive Notes.—The Yemen material of this species agrees satisfactorily with the description by Evans (1938:329). Females from a single larval collection show all degrees of variation in the dark area at the fork of vein 5 (on 5.2), from being entirely absent to being as long as figured by DeMeillon (1947:210, Pl. 71a). The dark area shown on vein 2 just distad of crossvein 2-3 in the wing figured by De Meillon was entirely absent in some of the Yemen specimens. This variation is not mentioned by Evans (1938:329). The apical pale spots on hind tarsal segments I-III are clearly distinct in all of these specimens, but that on IV is frequently indistinct or even absent. The upper mesepimeral hairs are dusky in color, not pale as described by Evans (1938:329).

Distribution.—New records: 22 males, 28 females, 27 sets assoc. skins, 14 larvae. El-Amra (300); El-Hauban, Wadi el-

Malah (308); Birket Ghail Masnah (323); Wali Mal el-Ghail (325); and San'a (335, single female taken while biting a human indoors). PREVIOUS RECORDS: None published. However, Dr. Merucci reported by personal communication (1950) the collecting of *cinereus* at San'a.

Discussion.—Leeson (1948: 254) reported one larva similar to *cinereus* in a collection of other species from Hoffuf in eastern Saudi Arabia. This larva differed from African material (Southern Rhodesia) in having prothoracic hair 13 with only three branches instead of with six to seven. All of the Yemen specimens agreed with the African larva in this respect.

Anopheles (Myzomyia) dthali Patton

Descriptive Notes.—No adults were collected. All of the larval specimens are in poor condition but they seem to show no unusual variation. In one specimen, the three dark areas immediately posterior to the frontal hairs are fused into a transverse band. In the other specimens all of the clypeal markings are rather indistinct.

Distribution.—NEW RECORDS: 4 whole larvae. Wadi Raidan (313) and Wadi Siham, nr. 'Obal (321). PREVIOUS RECORDS: Ta'izz (Buxton, 1944: 211).

Discussion.—*A. dthali* var. *wardi* Leeson and Theodor (1948: 222), which has recently been described from Socotra, differs from *dthali* only in small details of wing and palpal markings. Since no Yemen *dthali* adults were taken, it is not possible to compare Yemen and Socotra material.

Anopheles (Myzomyia) fluviatilis James

Descriptive Notes.—In the absence of larval specimens this identification is only tentative. The single female specimen resembles *cinereus*, but the pharyngeal cones (anterior view) are without roots, indicating that it must belong in either group *Myzomyia* or group *Neocellia*. This single specimen has the entire base of the costa dark, the tarsi all dark, only a single propleural bristle, and a patch of elongate scales before the wing base.

Distribution.—NEW RECORDS: 2 males, 1 female, Wadi Grab, nr. Ma'bar (324). PREVIOUS RECORDS: None.

Anopheles (Myzomyia) gambiae Giles

Descriptive Notes.—No four-banded female palpi occur in the Yemen series. The sector and accessory sector spots on vein 1 are coalesced in all of the specimens. The pale interruption in the third dark area of vein 1 is coalesced with the preceding pale area in most specimens but there are some exceptions.

Distribution.—NEW RECORDS: 5 males, 13 females, 17 sets assoc. skins, 3 larvae. El-Amra (300), Ta'izz (302), and Wadi Raidan (313). PREVIOUS RECORDS: Ta'izz (Buxton, 1944: 212). Madinat el Abid (Merucci, 1950).

Anopheles (Myzomyia) pharoensis Theobald

Descriptive Notes.—No significant differences were noted between the specimens collected and the description for this species by Evans (1938: 370).

Distribution.—New records: 7 males, 21 females, 7 sets assoc. skins, 2 larvae, El-Hauban, Wadi el-Malah (308, 311). Previous records: None.

Anopheles (Myzomyia) pretoriensis (Theobald)

Descriptive Notes.—The single pair of adults reared do not show any appreciable differences from the description by Evans (1938:358) except that the posterior portion of the female wing is much more darkly-scaled than figured.

Distribution.—New record: 1 male, 1 female, 5 larvae. Wadi Raidan (313) and Wadi Siham, nr. 'Obal (321). Previous records: None.

Anopheles (Myzomyia) rupicolus Lewis

Descriptive Notes.—A small series was collected at Ta'izz. Because of the presence of 2-3 well defined pale areas in the coastal region of the wing, the females of this series go to *rhodesiensis* Theobald instead of *rupicolus* in the recent Ethiopian region keys by De Meillon (1947:21; 1949: 467). In view of the possibility that this variation may possibly represent a valid geographical form of *rupicolus*, a rather full description is given here.

Adult Female.—Head: Scales narrow, rod-like, unusually long, the striations extending one-half or more of the length, brownish yellow, apices generally paler, in one specimen the scales were darker posterolaterally. Frontal tuft composed of one pair of scales in the single slide-mounted head, certainly no more than two pairs in the remainder of the specimens and absent entirely in one. Vertical bristles normal, dusky. A patch of recumbent pale narrow scales extending forward between the eyes. Torus without scales. First antennal flagellar segment with small dusky scales, which can be adequately seen only on a slide mount. Palpi thin and of uniform thickness, all dark; segment V is 0.3 as long as IV (measurement from one specimen only since the division between segments IV and V is difficult to see in anything except a slide mount). Proboscis dark, labella pale. Maxilla with 12 teeth, mandible with approximately 50 (impossible to accurately determine on the single slide-mounted specimen). Pharynx (one specimen) with a single row of 10 teeth with fimbriated apices, some of the teeth expanded apically, basally each tooth has a large tubercle and a pair of short stout teeth, spiculations present on all surfaces. Thorax: Scutum with grayish tomentosity when viewed from above, shiny brown areas present in some specimens, covered with lines of dark bristles and short hairs which are not at all scale-like; anterior promotory without true scales. Anterior pronotum without scales. Pleuron without scales, integument shiny, rather pale brownish. One propleural bristle, 1 spiracular, 2-3 prealers, 3-4 upper sternopleurals, 3-5 lower sternopleurals, 7-10 upper mesepimerals. ABDOMEN: Without scales, even on cerci. LEGS: Uniformly dark. Coxae without scales. WING: Length 3.4-3.9 mm, average 3.79. Costa with 2 pale areas of rather small size, basal one-third entirely dark, the costal spots repeated on vein 1. In addition, three of the ten specimens have a sub-apical pale area on the costa, represented by only a few pale scales on vein 1. In each of these specimens, this spot is more pronounced on one wing than on the other. The anterior margin of this spot on the costa is fringed with a line of black scales. Fringe without pale spots. Outstanding scales quite narrow.

Male.—Palpi uniformly dark. Wing markings much reduced. In 3 specimens the wings are all dark except for a few pale scales present subapically on the posterior margin of costa. The other 2 specimens have, in addition to this pale scaling, a few pale scales on vein 1 in the same position, and indistinct pale scaling at one or both of the other areas of the costa which bear spots in the females, the exact combination varying even between the two wings of one specimen. TERMINALIA (1 slide): Basistyle with some scaling. Four parabasal spines, normal. Accessory spine long. Harpago with club strongly convex laterally and strongly concave mesally; apical bristle about 1.5 the length of the club and 1.7 the length of the outer accessory hair.

Larva.—HEAD: Anterior clypeus without markings, posteriorly 3 dark patches usually present. Inner clypeal hairs with sparse fine fraying, may be only 1 spicule, completely simple in 1 specimen; outer clypeal hairs simple, 0.6 to 0.7 the length of the inner; posterior simple, 0.6-0.8 the length of the inner and approximately equal to the outer; postfrontal hair (hair 8) with 2-4 branches; vertical hair (hair 9) with 2-5 branches. Antenna with a conspicuous group of spicules on internal aspect of basal one-third; longer than those on other parts of the antenna; shaft hair slightly shorter than antennal width at insertion point, inserted at approximately the basal one-fourth; apical hair split before middle into 3-4 branches. Finger-shaped piece of maxillary palp slightly shorter than the paired pieces in length. THORAX: Shoulder hairs (submedian hairs) with basal tubercles of moderate size, distinctly separated, none flattened; outer hair single. Palmate hair with about 9-13 narrow lanceolate undifferentiated leaflets. Prothoracic pleural group with 1 long bristle feathered. Prothoracic hair 13 with 3-5 branches. Mesothoracic and metathoracic pleural groups each with 1 long bristle feathered, the other simple. ABDOMEN: Palmate hair on I small and more or less rudimentary, though some leaflets show differentiation into blades and filaments, with 10-13 leaflets. Palmate hair on II larger, with about 14-16 leaflets, all of which have indented shoulders and well-defined filament. On III-VII the palmate hairs are fully developed but still relatively small, with about 17-21 leaflets, these 8-10 times longer than wide, serrations generally rather few in number, variable in shape; filaments varying from being one-fifth to one-fourth of the total length of the leaflet; pigmentation of the leaflets mottled. Saddle hair simple, bifid in one specimen on one side. Tergal plate of IV and V of moderate size, being in length slightly more than one-half of the distance between the palmate hairs of these segments; one accessory plate, this however usually constricted medially to appear as two fused plates. Integument of the ventral surface of segments III-VII with rows of sparse microtrichia. Pecten with 4-5 long teeth alternating with groups of shorter ones which total about 9-12 in number. Lateral hair of IV with 3-4 branches, of V with 2-3, of VI with 2-3.

Distribution.—New records: 5 males, 10 females, 5 sets assoc. skins, 3 larvae, Ta'izz (301, 302). Previous records: None.

Discussion.—As De Meillon (1947: 97) has stated, it is questionable whether *rupicolus* is specifically distinct from *rhodesiensis* Theobald. From a consideration of the type of variation that has been described for these two names, it seems highly probable that *rhodesiensis* is a polytypic species containing two or more geographically-isolated subspecies. *A. rhodesiensis* typically has well-marked wings and palpi and is widespread in Africa south of a line from Sierra Leone to Ethiopia; *rupicolus* has the wings and palpi with less distinct pale markings and is apparently confined to the arid lands lying on or near to the Red Sea.

Anopheles (Myzomyia) sergentii (Theobald)

Descriptive Notes.—The single specimen (female) taken differs in wing and leg markings from the description by Christophers (1933:193) as follows: Wing with a small basal pale spot and a few pale scales at level of crossvein 2-3 on vein 2, a basal pale area on vein 4, and vein 6 all dark except for a few pale basal scales. Fore and mid femora without apical pale scales, the hind femora with a single line of pale scales apically. All of the tibiae with pronounced apical marks, the mid and hind tibiae also each with a dorsal pale spot at the base.

The associated larval skin did not differ significantly from the description by Christophers (1933:195).

Distribution.—New records: 1 female and assoc. skins, El-Hauban, Wadi el-Malah (308). Three whole larvae, Wadi Siham, nr. 'Obal (321). Two female specimens trapped on oiled paper at the entrances of rodent burrows in Wadi el-Malah (309) are possibly this species. Previous records: None published. However, Dr. Merucci reported by personal communication (1950) the collecting of *sergentii* at San'a.

Anopheles (Myzomyia) turkhudi Liston

Descriptive Notes.—No material of this species was collected by us in the Yemen, although specimens were taken not far across the border, at Wadi Tiban in the Aden Protectorate.

Distribution.—New records: None. Previous records: None published. However, Dr. Merucci reported by personal communication (1950) the collecting of *turkhudi* at San'a.

Culiseta (Allotheobaldia) longiareolata (Macquart)

Descriptive Notes.—Nearly all degrees of the variation in tergal markings described by Edwards (1941:69) were represented in the small series of specimens collected.

Distribution.—New records: 8 males, 6 females, 4 sets assoc. skins, 7 larvae, Hamman-Ali (322), Wadi Dhahr (328,331), and Rouda (333, 334). Previous records: None published. However, there are specimens in the British Museum from San'a, IX-1937, Rathjens and Guest House, 26-VIII-1946 (Mattingly, 1953).

Aedes (Stegomyia) aegypti (Linnaeus)

Descriptive Notes.—Many of the specimens reared had the dorsal surface of the abdomen almost completely pale in color. However, there were all degrees of intermediates between this condition and the normal dark condition.

Distribution.—New records: 29 males, 17 females, 57 sets assoc. skins, 6 larvae, Murawah (317). Eleven males, 14 females, 13 sets assoc. skins, Hodeida (319). Previous records: None.

Aedes (Aedimorphus) natronius Edwards

Descriptive Notes.—The Yemen specimens differ from Edwards' description (1941:199) for this species as follows: Diststyle finely-haired over much of length. Basal lobe of basistyle with several distinct spines apically. Wings of female usually with a short continuous area of whitish scales in the area of the apices of veins 1 and 2. Tergites of female with basal dull white bands, with whitish scales along basal half of lateral margins (reduced to lateral median patches on more distal segments), and with broad complete apical bands of brassy-yellow scales. The larva differs from that described by Hopkins (1952:205) as follows: Comb possessing 11-16 teeth. Pecten with 20-26 teeth.

Distribution.—New records: 27 males, 27 females, 12 sets assoc. skins, 7 larvae, El-Hauban, Wadi el-Malah, nr. Ta'izz (311). 2 males, 1 larva, Hamman 'Ali (322). Previous records: None.

Discussion.—Mr. P. F. Mattingly very kindly compared a description of the Yemen material with the series of *natronius* specimens in the collection of the British Museum (Natural History) and found them to be conspecific in every way. The discrepancies noted above between the Yemen specimens and Edwards' description of the adult of this species proved to be due to errors in the description. After studying a very large series of African larvae, Mattingly reported that the range in variation of the number of comb and pecten teeth was respectively, 12-28 and 13-31. Hopkins' statement that the larva possesses about 40 pecten teeth is thus evidently a misprint.

Culex (Lutzia) tigripes Grandpré and Charmoy

Descriptive Notes.—The single female and the three males taken resemble variant five of Edwards' (1941:249) in having pale scutal scaling, broad apical creamy bands on tergites II-V, tergites VI-VIII almost entirely yellow-scaled, and in having unbanded sternites. However, some of the sternites do possess definite apico-lateral patches of dark scales. Variant five has previously been reported only from the Aden Protectorate.

The larva matches the description by Hopkins (1952:249) except that head hair 9 (hair f) is 6-7-branched instead of double.

Distribution.—New records: 3 males, 1 female, 2 sets assoc. skins, 1 pupal skin, Ta'izz (301, 303, 310). Previous records: None published. However, there is a single male specimen in the British Museum from Usaifira, nr. Ta'izz, XII-1937, Scott and Britton (Mattingly, 1953).

Discussion.—Mattingly (1953) reported that the male specimen from Usaifira in the British Museum, although badly rubbed and incomplete, agrees reasonably well with some of the darker specimens of Edwards' variant five. The fact that variant five has to date been reported only from the Aden Protectorate and from the Yemen seems strong support for believing this to be a geographic variety. Perhaps more complete comparison of the larvae may throw some light on this matter.

Culex (Neoculex) jenkinsi Knight

Distribution.—New records: 3 males, 5 females, El-Hauban, Wadi el-Malah (308). 1 male, 1 female, Wadi Mal el-Ghail (325). Previous records: None.

Discussion.—The larva of this species is not definitely known. However, following the description of *jenkinsi* as a new species (Knight, 1953), a single larval skin (pupal skin associated but adult lost) was found in the Yemen collection (Lot No. 311), which is not only different from any other *Culex* larva collected in the Yemen, but also from any *Culex* described in Hopkins (1952). Since the collection containing this specimen was made from the same general locality as the one which produced the type collection of *jenkinsi*, it seems likely that this larval skin and its associated pupal skin represent *jenkinsi*.

In Hopkins' (1952: 246) key to the larvae of Ethiopian *Culex*, this larva keys to *Culex* (*Neoculex*) *sunyaniensis* Edwards. However, it differs from that species as described by Hopkins (1952: 259) in having the infuscation of the antenna confined to the extreme base and to the portion distad of the hair tuft, head hair 5 with 3 branches, five pairs of siphonal hair tufts of which the third and fourth are dorsally out of line, the distal margin of the anal plate finely spiculate, *isc* (hair 2) with 3 branches of which the most ventral is the longest, and the ventral brush with 6 pairs of tufts in the barred area (none proximal to this area). Additional details are: Head seta 8 with 3-4 branches, 9 with 5-6, 11 with 2, 12 with 3-4, and 13 with 3. Mentum with 7-9 teeth on either side of central tooth. Hair 6 on abdominal segments, I, II, and IV triple, on III and V double, and on VI single. Siphon index 7.8. Lateral hair of anal plate with 3 branches. Anal gills missing.

Culex (Neoculex) salisburiensis Theobald

Fig. 2

Descriptive Notes.—One male, two females, and two sets of associated larval and pupal skins were collected near Ma'bar. The adults show the following differences from the description by Edwards (1941: 257): Female palpi approximately one-sixth the length of the proboscis. Torus and first flagellar segments of the female antennae with some pale scales. Scutum with pale yellowish narrow scales, the scales paler in color marginally and on the prescutellar space. The scales on *apn* narrow above and broadened below. In addition to the pleural scale patches described by Edwards, there are a few scales on the lower prealar knob, and the mesepimeral patch is divided. One female specimen possesses two mesepimeral bristles on one side. Tergites II-VII with prominent apical creamy bands, these medially widened on II-IV in male, and only on II in the female. Sternites pale-scaled, baso-lateral dark scaling present on most of them. The leaf (g) of the subapical lobe of the male genitalia with a distinctive angular and serrate margin and with a distinctive median pigmented area (fig. 2). Three accessory setae present between the two groups of rods. Diststyle narrowed apically, with an indistinct dorsal membranous structure. Additional information: Upper fork cell of male 1.5 times longer than its stem, and the cross veins separated by somewhat more than the length of the posterior one. Upper fork cell of female 2.1-2.4 times longer than its stem. Male with fore and mid tarsal claws unequal, each unidentate; hind equal, simple. Female with tarsal claws equal, simple. Diststyle of male genitalia with two setae. Lateral lobes of ninth tergite not tuberculate, broad, and each bearing 4-6 stout setae.

The larva is completely similar to the larval description of *salisburiensis* in Hopkins (1952: 254).

Distribution.—NEW RECORDS: 1 male, 2 females, with assoc. larval and pupal skins, Wadi Grab, nr. Ma'bar (324). PREVIOUS RECORDS: None.

Discussion.—Because of the many differences noted between the Yemen adults and the description by Edwards (1941: 257), a full description of this material and a drawing of the

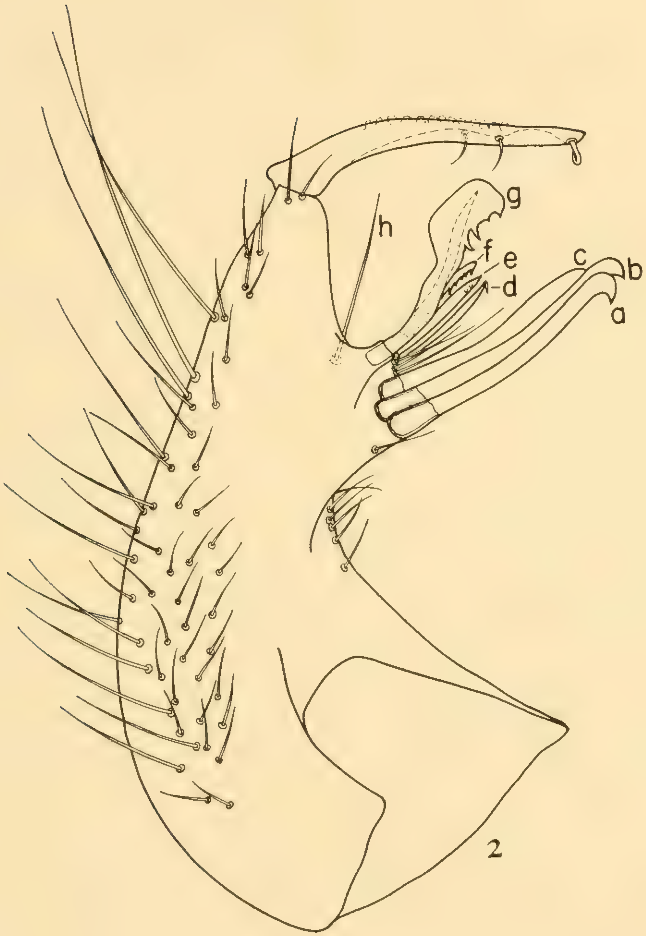

Fig. 2, *Culex* (*Neoculex*) *salisburiensis*, male genitalia; mesal aspect of basistyle.

male genitalia (fig. 2) were prepared and sent to Mr. P. F. Mattingly to be compared with the specimens of *salisburiensis* deposited in the British Museum (Natural History). The description and drawing were compared with the following material: Sudan: Kajo Kaji, 1 female. Kenya: Nairobi, 4 males, 3 females. N. Rhodesia: Chilanga, 2 females. S. Rhodesia: Salisbury, 6 females. Transvaal: Pretoria, 1 male, 1 female. Natal: Weenen, 1 male, 1 female; Ulundi, 1 male; Estcourt, 2 males, 2 females. Cape Province: Stellenbosch, 1 male, 1 female; Cape Town, 2 males, 2 females; Mossel Bay, 1 female. His reply following this study was as follows: "I am afraid almost all of the differences you noted are due to errors in Edwards' description. The only difference of any significance is that, while the Nairobi males have terminalia identical with the Yemen form, those from further south lack the longest of three accessory bristles on the subapical lobe and one of the two small setae on the diststyle. It is clear therefore that we have a northern and a southern form but it is impossible to say which is the type form since I have no males from Salisbury. . . . It may be possible eventually to distinguish two subspecies. The southern forms are certainly much darker than yours, especially with respect to the scutal scaling but the Nairobi specimens are intermediate and, I should think, would probably intergrade in Eritrea. Also the two specimens from Chilanga suggest that there is considerable seasonal variation since one, collected in January, is very dark, while the other collected in November, is as pale as the Nairobi form. Edwards' figure for the length of the female palps seems to have been based on a single aberrant or shrunken specimen; and the tergal bands are variable, even in the same locality. The other differences are just errors in description."

Culex (Culiciomyia) nebulosus Theobald

Descriptive Notes.—The single specimen (male) has a large patch of scales anteriorly on the propleuron, which would indicate that it is the East African representative of *nebulosus, n.* var. *pseudocinereus* Theobald. However, since it lacks the mesepimeral scale patch and the short hairs that are supposed to be associated with the lower mesepimeral bristle (definitive characteristics of var. *pseudocinereus* according to Edwards, 1941: 273), the identification is given here simply as the type form.

Distribution.—New records: 1 male, Ta'izz (304). Previous records: None.

Discussion.—The genitalia of this male and of males in the author's collection from Uganda and the A. E. Sudan differ from that figured by Edwards (1941: fig. 89a) in that the two blunt bristles associated with the narrow leaf each have one edge spiculated.

Culex (Culex) decens Theobald

Descriptive Notes.—The Yemen material resembles that described by Edwards (1941: 336) except that some females have proboscis lighter beneath. Frequently, the scutal scaling is lighter than reddish-brown, and all of the female specimens have straight narrow white basal abdominal bands.

The larva differs slightly from that described by Hopkins (1952: 330) as follows: Head hair 5 with 2-3 branches, hair 6 with 2, hair 7 with 6-8. Mentum with 7-8 teeth on each side of the main tooth. Lateral setae of abdominal segments III, V, and VI single, very long; of segment IV shorter and slenderer and with 1-4 branches. A distinctive character, not mentioned in Hopkins, is the presence of a very long pair of subdorsal setae on both segments IV and V. Comb composed of 46-62 scales. All of the pecten teeth with 4 or more denticles. Ventral brush composed of 12 hair tufts. Dorsal anal gills 0.9-1.1 the length of the anal plate and 1.4-1.6 the length of the ventral gills. This description is based upon 10 larval skins picked at random from the collection.

Distribution.—NEW RECORDS: 75 adults, 65 sets associated skins, 8 larvae, Ta'izz (303, 310). PREVIOUS RECORDS: None.

Culex (Culex) ethiopicus Edwards

Distribution.—NEW RECORDS: 2 females, 2 sets assoc. skins, 13 larvae, Wadi Siham, nr. 'Obal (321). PREVIOUS RECORDS: None.

Culex (Culex) laticinctus Edwards

Distribution.—NEW RECORDS: 44 males, 16 females, 36 sets assoc. skins, 4 larvae, Ta'izz (310). PREVIOUS RECORDS: None. The record of San'a by Edwards (1941: 314) has been found by Mr. P. F. Mattingly to be based upon specimens of the new species, *C.* (*C.*) *mattinglyi.*

Culex (Culex) mattinglyi Knight

Distribution.—NEW RECORDS: Type series. 6 males, 21 females, 2 sets assoc. skins, numerous larvae. Wadi Dhahr (328, 331), Birket Shiekh Kunnaf (330), Rouda (333), and San'a (335). PREVIOUS RECORDS: None published. However, there are specimens in the British Museum from: San'a, II-1938 (from house at Bir-el-Azab), I-1938, III-1938, Scott and Britton (Mattingly, 1953). These were erroneously identified and published by Edwards (1941: 314) as *laticinctus.*

Discussion.—This species is most closely related to *laticinctus.*

Culex (Culex) pipiens Linnaeus

Descriptive Notes.—The DV/D ratio (Sundararaman, 1949: 307) for three male genitalia from Hamman 'Ali were -0.11, -0.13, and -0.15 (all negative); all being similar in this respect to *pipiens* from Cairo, Egypt (Knight and Abdel Malek, 1951: 178).

Ten larval specimens selected at random had the subdorsal hair of abdominal segment III double 17 times, triple twice, and missing once. The subdorsal hair of abdominal segment IV was double 16 times, triple twice, and missing twice.

Distribution.—NEW RECORDS: 1 male, 2 females, Ta'izz (312). Nine males, 6 females, 9 sets assoc. skins, 5 larvae, Hamman 'Ali (322). PREVIOUS RECORDS: None published. However, there are specimens in the British Museum from: Hada, about 4 miles west of San'a, I-1938, Scott and Britton. San'a, IX-1937, from lucerne field, Rathjens. San'a, I and II, 1938, Scott and Britton. San'a, from house at Bir-el-Azab, I-1938, Scott and Britton. (Mattingly, 1953).

Culex (Culex) quinquefasciatus Say

Descriptive Notes.—The DV/D ratio (Sundararaman, 1949: 307) for three male genitalia were 0.89, 1.00, and 1.19. In the 10 larval specimens, the subdorsal hair of abdominal segment III was single 18 times and double twice. The subdorsal hair of abdominal segment IV was single 15 times and double five times.

Distribution.—NEW RECORDS: 4 males, 4 females, 10 sets assoc. skins, Murawah (316). PREVIOUS RECORDS: None.

Culex (Culex) simpsoni Theobald

Descriptive Notes.—Both specimens show indications of a longitudinal pale line on the mid femur (see Edwards, 1941: 310). The male genitalia most resembles Edwards' figure (1941: fig. 106f) of a specimen from the Anglo-Egyptian Sudan.

Distribution.—NEW RECORDS: 2 males, El-Hauban, Wadi el-Malah (308). PREVIOUS RECORDS: None.

Culex (Culex) sinaiticus Kirkpatrick

Descriptive Notes.—In general, these larvae resemble Hopkins' (1952: 295) description for this species. However, the Yemen specimens differ as follows: Comb composed of 32-40 spines and scales. Siphon index 7.3-7.9. Pecten with 10-18 spines. None of the siphonal hair tufts markedly out-of-line. Lateral hair of anal segment with 2-3 branches. Upper caudal seta with 1-4 branches. Ventral brush with 12 tufts (once with 11). Dorsal anal gills equal to anal plate in length and 1.5 length of ventral gills.

The larvae from 'Obal differ from those from Wadi Raidan in having the siphonal hair tufts 1.5 the width of the siphon at the point of attachment instead of only 1.0.

Distribution.—NEW RECORDS: 3 larvae, Wadi Raidan (313). 4 larvae, Wadi Siham, nr. 'Obal (321). PREVIOUS RECORDS: None.

Discussion.—Based upon Hopkins' (1952: 293) description of the larva of *simpsoni* Theobald, there appears to be no way by which the larva of *simpsoni* can be distinguished from that of *sinaiticus*. By combining the larval decription for *simpsoni* of MacGregor (1927) with his own, all known larval differences between these two species are eradicated. One possible remaining difference could be that the pecten teeth of *simpsoni*, according to the written description (Hopkins, 1952: 295), possess no more than two minute basal denticles. However, Hopkins' figure (1952: fig. 173) illustrates the pecten teeth with many ventral denticles and so, identical to *sinaiticus*.

Culex (Culex) sitiens Wiedemann

Descriptive Notes.—ADULT: The Yemen adults resemble the variation described by Edwards (1941: 298) from the Rea Sea coastal areas in that the background scaling is pale instead of dark, being brownish-yellow in the male and whitish-yellow in the female. Distinct areas of dark brown scaling occur anterior to the scutal angle (paired), before the prescutellar area, and above the wing base (paired). This dark brown scaling may become extensive enough to give the scutum an indefinite mottled appearance. Other differences are that the fore tibiae are anteriorly dark and the posterior margin of the coastal vein always has a variable amount of pale scaling. The male genitalia is generally similar to that figured by Edwards (1941: fig. 102b) for the Red Sea coastal variant.

Larva (described from 8 adult-associated skins and 2 whole larvae, representing 4 collections).—ANTENNA: Shaft pigmented at extreme base and along portion beyond hair tuft, spiculate from base to level of hair tuft, slenderer and nearly smooth from there to apex. Antennal hair tuft (hair 1) inserted shortly beyond middle (0.6 from base), with numerous elongate frayed branches, hairs 2 and 3 slightly subapical and extending anteriorly slightly further than hair 4. HEAD: Clypeal spines stout, pigmented, usually swollen medially, obtuse, sometimes spiculate medially; hair 4 single; 5 with 5-8 branches; 6 with 4-5 (once with 8); 7 with 7-11; 8 with 2-5; 9 with 2-4, 10 with 1-2; 11 with 2-3; 12 with 2 (once single); 13 with 2-3; 14 single; 15 with 2-3. Mentum with 7 teeth on each side of the median tooth. ABDOMEN, I-VII: Hair 6 of I with 3 branches, hair 7 single. Hair 6 of II with 3 (occasionally with 4), of III-VI double. ABDOMEN, VIII: Hair 1 with 6-9 branches, hairs 2 and 4 single, hair 3 with 8-10, hair 5 with 4. Comb consisting of a patch of 41-58 scales, each scale with an evenly-expanding lateral and apical fringe. SIPHON: Pale; index 3.6-4.8; acus present; 5 or 6 more or less paired multiply-branched elongate ventral hair tufts present, one pair of 2 or 3-branched subdorsal tufts beyond middle, the most basal pair of ventral tufts beginning either before or after the last pecten tooth; pecten composed of a line of 12-18 teeth, each tooth with numerous denticles ventrally along entire length. ANAL SEGMENT: Anal plate narrow, complete, with minute denticles along the dorso-posterior margin; hair 1 (*lh*) single, slightly longer than anal plate; hair 2 (*isc*) with 2-5 branches, each more ventral branch longer than the preceding; hair 3 (*osc*) single; hair 4 (ventral brush) with 12 tufts (twice with 11), each tuft arising from the barred area. Anal gills broadly tapered, the dorsal pair 0.5-0.6 the length of the anal plate and 1.0-1.4 the length of the ventral pair.

Distribution.—NEW RECORDS: 58 males, 60 females, 62 sets assoc. skins, 20 larvae, Hodeida (314, 315, 318, 320). PREVIOUS RECORDS: None published. However, there are specimens in the British Museum from near Hodeida, III-1938, Scott and Britton (Mattingly, 1953).

Discussion.—Hopkins (1952: 284) states that he has seen no definitely-identified Ethiopian material of this species. Because of this, a full description of the larva of Yemen *sitiens* is given here. It differs from the Red Sea variant as keyed by Hopkins (1952: 248) as follows: Very frequently the most proximal siphonal hair tufts begin before the last pecten tooth, the comb scales are 41-58 in number instead of "about 35," *lh* is only slightly longer than the anal plate, and the dorsal gils are 0.5-0.6 the length of the anal plate instead of less than one-half.

Culex (Culex) theileri Theobald

Distribution.—NEW RECORDS: A very large series of all stages, El-Amra (300): El-Hauban, Wadi el-Malah (308, 311); Birket Ghail Masnah (323); Wadi Grab (324); Wadi Mal el-Ghail (325); Dhamar (327); and Birket Ma'agel-Biet Myiad (329). Additionally, there are specimens in the British Museum from the following localities: Hada, about 4 miles west of San'a, I-1938, Scott and Britton. San'a, X-1937, Rathjens. San'a, I-1938, from lucerne field, Scott and Britton. (Mattingly, 1953). PREVIOUS RECORDS: San'a (Edwards, 1941-306). This record duplicates in part the one given just above.

Culex (Culex) tritaeniorhynchus Giles

Descriptive Notes.—The Yemen specimens key satisfactorily in Hopkins (1952: 249).

Distribution.—NEW RECORDS: 3 larvae, Wadi Siham, nr. 'Obal (321). PREVIOUS RECORDS: None.

Culex (Culex) univittatus var. **neavei** Theobald

Distribution.—NEW RECORDS: Not taken. However, there is one male and one female in the British Museum from Usaifira, nr. Ta'izz, XII-1937, Scott and Britton (Mattingly, 1953). PREVIOUS RECORDS: None.

SUMMARY

A collection of mosquitoes made early in 1951 in the Yemen is the basis for this paper. Taxonomic, biological, and distributional notes are given for the 27 included species. This collection raises the total of mosquito species known to occur in the Yemen to 29. Prior to the making of this collection, only five species of mosquitoes had been recorded in the literature from the Yemen.

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NEOTROPICAL MIRIDAE, XLVII—THE GENUS OFELLUS DISTANT, 1883, WITH DESCRIPTIONS OF THREE NEW SPECIES

(HEMIPTERA)

BY JOSÉ C. M. CARVALHO[1] and R. I. SAILER[2]

The genus *Ofellus* Distant, 1883, was established in the Biologia Centrali-Americana, Rhynchota-Heteroptera (vol. 1, p. 250) for the species *O. praestans* (*loc. cit.*, p. 251, pl. 25, fig. 11). Study of the type, and only specimen (a teneral famale), in the collection of the British Museum has revealed that the genus belongs to the tribe *Clivinemini* Reuter and is closely related to *Ambracius* Stål, 1860 (=*Fundanius* Distant, 1884). It differs from *Ambracius* especially by the appressed pubescence of the body, which is noticeably silky and golden-colored, the incrassate first and second segments of the antennae, and mainly by the long and narrow cuneus which is usually twice or more as long as wide at the base.

The type locality of *Ofellus praestans* is San Geronimo, Guatemala. We have at hand one female specimen belonging to the U. S. National Museum which is mature and has fully developed coloration (see fig. 4). This specimen was taken by C. H. Ballou at San Pedro de Montes de Oca, Costa Rica, Aug. 27, 1936 (on *Heresine herbstii*). Additional material has enabled us to recognize three more species, which are here

[1]Museu Nacional, Rio de Janeiro, Brasil.

[2]Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.

assigned to *Ofellus*. These species proved to be new and are described below. Following the descriptions there is a key for separating the species.

Ofellus mexicanus, new species

(Figs. 1, 11, 12)

Characterized by its color and male genitalia.

Male.—Length 5.4 mm., width 1.5 mm. HEAD: length 0.15 mm., width 0.9 mm., vertex 0.43 mm. ANTENNA: segment I, length 0.3 mm.; II, 1.8 mm.; III, 0.5. mm.; IV, 0.3 mm. PRONOTUM: length 1.1 mm., width at base 1.6 mm. CUNEUS: length 1.0 mm., width at base 0.4 mm. ROSTRUM: length 1.2 mm.

Color.—Cinnamon; abdomen reddish, membrane with a hyaline spot beyond apex of cuneus, antennae and legs darker.

Rostrum reaching the base of middle coxae.

Genitalia.—Aedeagus, typical of the genus, with very few minute, weakly-chitinized spines on endosoma. Left clasper (fig. 11) curved, with apical portion bladelike, the base beset with a few short hairs. Right clasper (fig. 12) small, slightly pointed at apex.

Female.—Similar to male, slightly more robust, with a fuscous to black terebra.

Host plant.—On foliage of *Eupatorium adenophorum.*

Types.—Holotype ♀ 1, Cuernavaca, Morales, Mexico, Aug. 9, 1944, N. L. H. Krauss; U. S. N. M. no. 61649; allotype ♂ and 5 female paratypes, same data as holotype.

This species differs from *O. praestans* Distant by the different and uniform coloration of pronotum, slightly larger size and structure of the male genitalia. It is distinguished from *O. costaricensis* and *O. mantiquerianus* by the much larger size as well as by color and genitalic structure.

Ofellus costaricensis, new species

(Figs. 2, 8, 9, 10)

Characterized by its color, long cuneus and male genitalia.

Male.—Length 4.0 mm., width 1.3 mm. HEAD: length 0.18 mm., width 0.7 mm., vertex 0.43 mm. ANTENNA: segment I, length 0.3 mm.; II, 1.3 mm.; III, 0.5 mm.; IV, broken. PRONOTUM: length 0.7 mm., width at base 1.2 mm. CUNEUS: length 0.8 mm., width at base 0.3 mm. ROSTRUM: length 0.9 mm.

Color.—Straw color with fuscous markings; head with two L-shaped dark, shining and hairless lines opposite to each other, converging towards their bases; pronotum with calli, anterior impressed line and a median narrow line between the calli, black and shining; disc of pronotum with one median and two sublateral fuscous longitudinal fasciae, the lateral margins also fuscous; hemelytra transparent on corium, scutellum, inner margins and apex of clavus, commissure of corium and a spot near its base, cuneus and membrane, fuscous to black, the latter with a hyaline spot beyond apex of cuneus; antennae, clypeus, genae and underside fuscous to black; third antennal segment (except apex), legs (except base of coxae), rostrum (except apex), margins of propleura and ostiolar peritreme, yellow; the tibiae very faintly infuscate at apex.

Genitalia.—Aedeagus (fig. 8) of the same type as in *Mantiqueiroa caipira* Carvalho, less spinose on endosoma. Left clasper (fig. 9) also hooklike, the apical portion flattened and wider, blade-shaped, with hairs on dorsal portion near base. Right clasper (fig. 10) small, slender.

Female.—Similar to male in color and dimensions.

Types.—Holotype ♂, San José, Costa Rica, May 6, 1946, Bierig. coll.; in the collection of the senior author; 1 ♀ paratype, same data as holotype.

This species differs from *O. praestans* Distant by its color and genital structure. It possesses silky, appressed golden pubescence, the second antennal segment of male is equal in thickness to first segment, the cuneus is two and half times longer than wide at base, the membrane is very short and densely pilose, scutellum strongly prominent at apex, almost as high as pronotum seen from side, with an excavation at base, rostrum reaching the apex of middle coxae.

Ofellus mantiqueiranus, new species

(Figs. 3, 5, 6, 7)

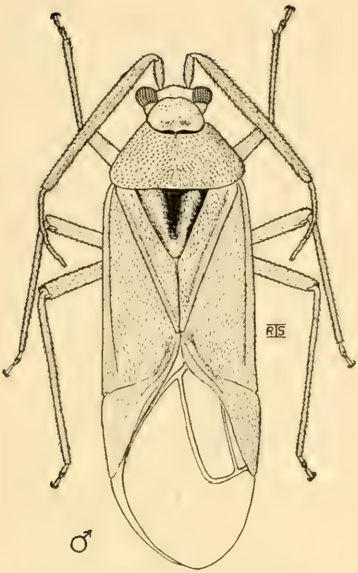
Male.—Length 3.6 mm., width 1.5 mm. HEAD: length 0.17 mm., width 0.7 m., vertex 0.38 mm. ANTENNA: I, length 0.15 mm.; II, 0.9 mm.; III, 0.4 mm.; IV, 0.3 mm. PRONOTUM: length 0.9 mm., width at base 1.3 mm. CUNEUS: length 0.69 mm., width at base 0.39 mm. ROSTRUM: length 0.6. mm.

Color.—Dirty brown to cinnamon color with shining and appressed golden pubescence; anterior area of pronotum and scutellum lighter, tending to orange; cuneus, antennae and membrane darker, the latter with a hyaline spot beyond apex of cuneus; frons and vertex with two black lines converging towards their bases. Underside cinnamon to luteous, clypeus, middle of mesosternum and pygophore black; femora with dark spots on upper margin.

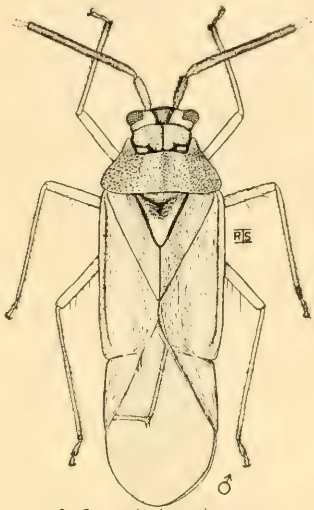
Genitalia.—Aedeagus (fig. 5) of the deraeocorinae type, with endosoma branched apically, the arms provided with short spines or teeth, each arm with a small branch attached near its base. The secondary gonopore opens between the two arms and near a central median small branch without spines. A distinct basal plate is present, the theca not very strongly chitinized. Left clasper (fig. 6) hooklike with the blade curved and falciform. A few hairs are present near middle, on dorsal side of more thickened part. Right clasper (fig. 7) small, with a distinct point.

Female.—Unknown.

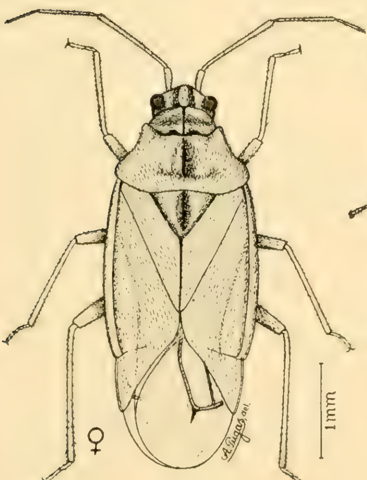
Type.—Holotype ♂, Campos do Jordao, Estado de São Paulo, Brazil, 1600 meters. Wygodzinsky leg.; in the collection of the senior author.



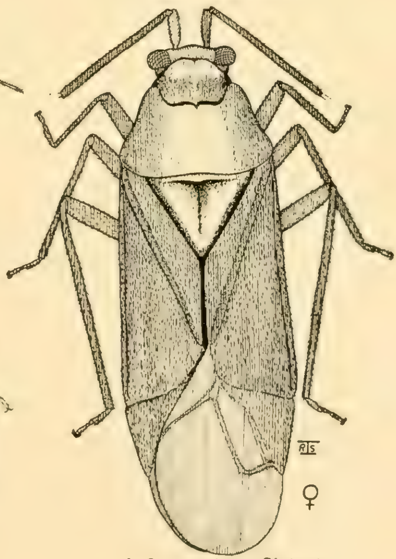
1. *Ofellus mexicanus*, n. sp.



2. *O. costaricensis*, n. sp.



3. *O. mantiqueiranus*, n. sp.



4. *O. praestans* Distant

Fig. 1, *Ofellus mexicanus*, new species, male allotype; fig. 2, *O. costaricensis*, n. sp., male holotype; fig. 3, *O. mantiqueiranus*, n. sp., male holotype; fig. 4, *O. praestans* Distant, female.

This species differs from the others in the genus by the presence of a longitudinal sulcus on the gibbous area of pronotum and anterior portion of the disc; scutellum with a wide and deep longitudinal furrow; cuneus slightly shorter, about twice as long as wide at base; rostrum reaching only the anterior portion of mesoscutum and first antennal segment very short, about half as long as width of vertex. In *O. praestans* and other species the first antennal segment is about as long as width of head.

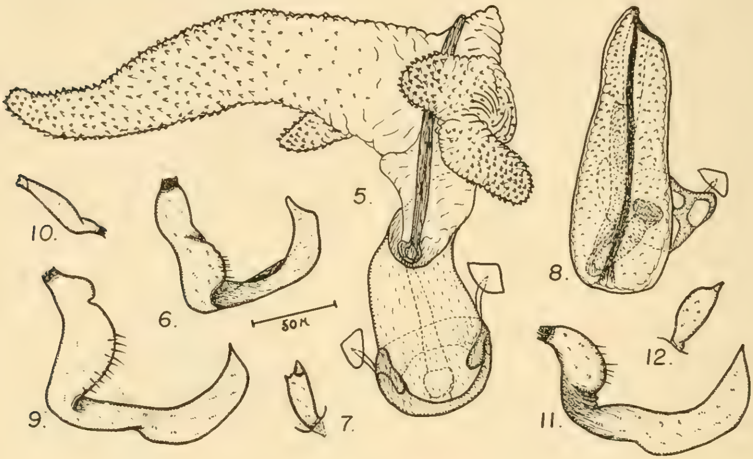


Fig. 5, *Ofellus mantiqueiranus*, new species, aedeagus, distended; fig. 6, *idem*, left clasper; fig. 7, *idem*, right clasper; fig. 8, *O. costaricensis*, new species, aedeagus, not distended; fig. 9, *idem*, left clasper; fig. 10, *idem*, right clasper; fig. 11, *O. mexicanus*, new species, left clasper; fig. 12, *idem*, right clasper.

Key to Species of the Genus Ofellus

1. Hemelytra transparent on corium; pronotum with a median and two sublateral fuscous or black fasciae .... *costaricensis* new species
   Hemelytra unicolorous, dull; pronotum without longitudinal fuscous or black fasciae 2
2. Pronotum reddish at middle .... *praestans* Distant, 1883
   Pronotum unicolorous 3
3. Frons with two black lines converging towards their bases; femora with dark spots on upper margin; second antennal segment about 0.9 mm. long .... *mantiqueiranus*, new species
   Frons without black lines; femora unicolorous; second antennal segment about 1.8 mm. long .... *mexicanus*, new species

ARBOREAL TABANIDAE IN PANAMA

(DIPTERA)

BY G. B. FAIRCHILD, *Gorgas Memorial Laboratory, Panamá, R. de P.*

The intensive studies of forest mosquitoes carried on during the last few years in Panamá by staff members of this Laboratory (Galindo *et al.*, 1950, 1951) have yielded a good deal of incidental information on the distribution and habits of other bloodsucking insects, especially Tabanidae and *Phlebotomus* sandflies. Although the main purpose of the work was the collection of mosquitoes, the collectors were also instructed to secure any other insects which came to bite them. Stations were set up in various parts of Panamá and run for varying periods, from a few months to a year. Each station consisted of one or more platforms built in large trees at elevations of from 20 to 84 feet above ground level. Collections were made at more or less regular intervals at each station, collectors working simultaneously at ground level and on the platforms. Nearly all the collections were made during daylight hours, from about 8 A.M. to about 4 P.M.

Since the collection of Tabanidae was quite a secondary consideration, there was considerable variation in the regularity and enthusiasm with which the field collectors took these insects, and the detailed information as to times of biting and other factors secured in conjunction with the mosquito catches was usually omitted. Enough information on preference for ground level versus forest canopy was, however, secured to seem worth reporting. The following stations are those from which Tabanidae in significant numbers were secured. The names and designations of the stations are those used by Galindo *et al.* in their papers and in work in progress. All the stations are in heavy forest.

La Victoria.—Three stations, B, C and D, located at 400, 1200 and 2100 ft. above sea level on the slopes of Cerro La Victoria. This area is about 20 miles east of Panamá City, on the Pacific slope of the continental divide, between the Rio Juan Diaz and the Rio Cabra. Although these stations were operated from February 1949 through January 1950 on a weekly basis, and some of them have been operated more or less regularly to date, the catching of Tabanidae has been rather inconsistent, only the period from February 1949 to June 1949 yielding much in the way of information.

Cerro Campana.—Five stations were operated at various altitudes from June into December 1950, or somewhat over 6 months. Collecting of Tabanidae was fairly consistent. The area is a rather isolated mountain mass about 40 miles west of Panamá City, reaching an altitude of nearly 4000 ft., though the highest collecting stations were at 2800 ft.

Progreso.—One station, located at about 300-400 ft. elevation, was operated from June through December 1950 on a weekly basis, with platforms at 64 and 83 ft. above ground level as well as at ground level. The area is in western Chiriqui province, near the Costa Rican border, on the Pacific side of the continental divide.

Santa Fe.—Three stations, each with a ground level and a single forest canopy platform were operated from May through August 1950. The area is on the Pacific slope of Cerro Tuti, near the town of Santa Fe, in Veraguas Province. The stations were at about 2000 ft. elevation and were operated on a weekly basis. The collection of Tabanidae was quite consistent.

Almirante.—Four stations, each with a single canopy platform, have been operated nearly continuously on a weekly basis from May 1951 to May 1953. The collecting of Tabanidae has been very consistent, and the work here has been expanded to include a number of night collections and the use of a Shannon trap at certain stations. The area is about 12 miles northwest of the town of Almirante, Bocas del Toro Province, on the Atlantic side of the continental divide at about 600 ft. elevation. The area is one of very heavy wet forest with about 100 inches annual rainfall.

Recent work in Africa (Gordon *et al.*, 1950, Haddow *et al.*, 1948, 1950, 1952, Lumsden, 1952) has shown that a number of species of Tabanidae are more or less arboreal, probably feeding mainly on monkeys. With the establishment of tree stations in Panamá in 1949 it quickly became evident that several species also showed a marked preference for an arboreal habitat here. Although no observations on the feeding of these Neotropical species on hosts other than man have been made, it is hardly surprising, in view of the pronounced arboreal element in the Neotropical mammal fauna, that such a development has taken place. The forests of the New World tropics probably harbor more kinds of mammals strictly adapted to an arboreal life than do all other areas of the world combined. In Panamá, aside from Primates of 5 genera, most of which are strictly arboreal, there are sloths of two genera, anteaters of two genera, several marsupial oppossums, one genus of prehensile-tailed carnivores (*Potos*), a prehensile-tailed porcupine, and numerous rodents, which are quite strictly arboreal. Quite a number of other forms, although not showing such marked physical adaptations, spend a great part of their lives in the trees. Furthermore, as sources of food for Tabanidae, reptiles and birds should probably not be overlooked.

The 54 species of Tabanidae taken at these various stations may be grouped arbitrarily into three categories in respect to their arboreal habits. Group 1 consists of species of which 75% or more of the specimens secured have been taken at platforms in the forest canopy. These are the truly arboreal species. Group 2 consists of those species of which from 25 to 74% were taken at canopy platforms, the indifferent group. Group 3 are those of which less than 25% were taken at canopy platforms, the terrestrial group. The accompanying table lists the mainly arboreal species and the more abundant terrestrial species taken, in the order of their arboreal preferences. The species included in the table account for 26 of those taken in this study; the remaining 28 species are represented by single specimens or are less than 1% arboreal.

Species	Taken at ground level	Taken in tree tops	Per cent arboreal
Tabanus (Philipotabanus) inauratus Fchld.	....	2	100.0
Stibasoma apicimacula Fchld.	....	4	100.0
S. stilbium Fchld.	....	4	100.0
Stenotabanus jaculator Fchld.	3	60	95.3
S. frondicolus Fchld.	5	89	94.6
Stibasoma fulvohirtum Wied.	4	76	95.0
Tabanus (Lophotabanus) defilippii Bell.	2	28	93.4
Dichelacera crocata Fchld.	7	40	85.2
D. (Catachlorops) umbratus Hine	2	16	88.9
Stibasoma panamensis Curr.	2	7	78.0
Dichelacera regina Fchld.	46	53	53.6
Fidena trapidoi Fchld.	45	33	42.3
F. schildi Hine	20	14	41.1
Chrysops soror Krob.	5	1	16.6
C. melaena Hine	5	1	16.6
Tabanus (Philipotabanus) magnificus Krob.	654	127	16.2
Chrysops mexicana Krob.	13	1	7.1
Dichelacera analis Hine	400	26	6.1
Psalidia fulminea Hine	111	4	3.4
Dichelacera rex Fchld.	35	1	2.8
Tabanus erebus O.S.	88	1	1.6
T. (Lophotabanus) piraticus Fchld.	252	2	.8
Dichelacera marginata Macq.	234	2	.84
Diachlorus jobbinsi Fchld.	3649	104	.27
Tabanus unistriatus Hine	1010	2	.19
T. (Lophotabanus) albocirculus Hine	777	1	.12

The arboreal habit appears to have been acquired by several diverse groups in the family. In Africa, the arboreal species seem confined to the genus *Chrysops*, and most of the observations refer to a single species, *C. centurionis* Aust. In Panamá at least four groups have arboreal representatives, *Stibasoma*, *Dichelacera*, *Stenotabanus*, and *Tabanus*. Of these *Stibasoma* seems the most definitely arboreal, for of the six species known from Panamá, four have been taken in the forest canopy at least as often as at ground level. The other two species were not taken in this study and are known from only a few scattered specimens. Of the 8 species of *Dichelacera* (including the subgenera *Dichelacera*, *Catachlorops*, and *Psalidia*) known from Panamá, two, *D.* (*Catachlorops*) *umbratus* Hine and *D.* (*Dichelacera*) *crocata* Fchld., are definitely arboreal, while *D.* (*Dichelacera*) *regina* Fchld. is taken in the canopy as often as at ground level. Only 3 of the 16 species of *Stenotabanus* (including *Aegialomyia* and *Brachytabanus*) recorded from Panamá were taken in this study, but two of these, *St. jaculator* Fchld. and *St. frondicolus* Fchld. are definitely arboreal. It is probable that other species of this group will prove arboreal when canopy collections are made in their habitats. Of the 39 species and 5 subgenera of *Tabanus* known in Panamá, only about a dozen were taken in this study, and of these only *T.* (*Philipotabanus*) *inauratus* Fchld. and *T.* (*Lophotabanus*) *defilippii* Bell. seem arboreal.

Of the indifferent and terrestrial group two species of *Fidena*, three of *Chrysops*, one *Philipotabanus*, and one *Dichelacera* show appreciable numbers taken in the forest canopy. One species of *Fidena* was taken for the first time in this study, the other hitherto known from but a few specimens, so that the data probably indicate a true tendency to invade the upper levels of the forest. The three species of *Chrysops* are mainly forest species fairly common elsewhere at ground level. The species *Tabanus* (*Philipotabanus*) *magnificus* Krob. shows crepuscular tendencies and has appeared in the forest canopy catches in fair numbers on the few occasions when night catches, from 6 to 9 p.m., have been made. The remaining species stray into the canopy only occasionally or not at all.

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NOTES ON MUSCOID SYNONYMY WITH DESCRIPTIONS OF THREE NEW SPECIES

(DIPTERA)[1]

BY H. J. REINHARD, *College Station, Texas*

The following notes have accumulated during the past several years and it seems desirable to place them on record since the revised nomenclature in some cases has been used in identification for other workers. I am indebted to Curtis W. Sabrosky for notes on certain types in the U. S. National Museum and also for making direct comparisons of type material in a number of cases. Types of the new species described below are in my collection.

Sarcophaga californica Parker

Sarcophaga californica Parker, 1918, Jr. Ent. Zool., Pomona College, 10: 32.

Sarcophaga postilla Reinhard, 1947, Jr. Kans. Ent. Soc. 20: 111.

I have recently seen a male specimen of *californica;* the genitalia clearly show that *postilla* is identical. Both type series are from California.

Sarcophaga pleomenda, new name

Sarcophaga mendax Reinhard, 1947, Jr. Kans. Ent. Soc. 20: 107 (*nec* Walker, 1859, Proc. Linn. Soc. London, Zool. 4: 132).

The overlooked preoccupation of *mendax* by Walker necessitates a new name for my species.

Frontiniella parancilla Townsend

Frontiniella pararcilla Townsend, 1918, Proc. Ent. Soc. Wash. 20: 21.

Achaetoneura stilla Reinhard, 1943, Jr. Kans. Ent. Soc. 16: 17.

Through some recent exchanges I acquired a pair of paratypes of *F. parancilla; A. stilla* is the same species. Use of the emended spelling has become customary as the original citation seems an obvious misprint.

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[1]Contribution No. 1701, Department of Entomology, Texas Agricultural Experiment Station.

Cistogaster atrota Reinhard

Cistogaster atrota Reinhard, 1935. Ann. Ent. Soc. Amer. 28: 173.

Hitherto the only known specimen of this species was the type female from Amherst, Ohio. Brooks, without seeing the latter, cited it in synonymy with *Gymnosoma dubia* West, which was designated as the type of *Siphopallasia* (Can. Ent. 77:226, 1945). I have seen the type series of *dubia* West in the Cornell University Collection. *Atrota* is readily distinguished from *dubia* in having a distinctly wider and less divergent front; third antennal segment nearly as wide as long and a trifle shorter than second; arista strongly swollen and rather sharply tapered on basal third, etc. Both species have longer antennae than any of the allied forms of *Cistogaster* and this seems to be the principal item cited in favor of a supposed need for more restricted generic limits here.

Euhallidaya genalis (Coquillett)

Biomyia genalis Coquillett, 1897, Rev. Tachin., p. 83.
Euhallidaya severinii Walton, 1914, Proc. Ent. Soc. Wash. 16: 130.
Orphanotrophus orbitalis Reinhard, 1943, Bul. Brk. Ent. Soc. 38: 83.

The synonymy of *severinii* is by Townsend (Manual of Myiology, pt. 9, p. 259, 1939). *O. orbitalis* is based upon the same type species and equals *E. genalis*.

Phytopsis californica (Coquillett)

Amobia californica Coquillett, 1895, Jr. N. Y. Ent. Soc. 3: 100.
Phytopsis californica (Coquillett) Townsend, 1915, Proc. Biol. Soc. Wash. 28: 20.
Athanatus knowltoni Reinhard, 1947, Jr. Kans. Ent. Soc. 20: 15.

The differences between the genotype specimens are primarily sexual, hence *A. knowltoni* falls as a complete synonym of *P. californica*.

Eupelecotheca celer Townsend

Eupelecotheca celer Townsend, 1918, Ins. Insc. Mens. 6: 169; Townsend, 1940, Manual of Myiology, pt. 10, p. 103 (recharacterization).
Pantagathus alogus Reinhard, 1935, Ann. Ent. Soc. Amer. 28: 168.

This synonymy has been verified by a comparison of the type specimens.

Neothelaira aurifrons (Coquillett)

Masicera aurifrons Coquillett, 1897, Rev. Tachin., p. 115.
Neothelaira dexina Townsend, 1912, Jr. N. Y. Ent. Soc. 20: 109.
Aulicomyia invulnerata Reinhard, 1943, Bul. Brk. Ent. Soc. 28: 80.

In redescribing the genotype, Townsend has stated that *dexina* equals *aurifrons* (Manual of Myiology, pt. 8, p. 346, 1936). Apparently *A. invulnerata* is likewise based upon the same type species and equals *N. aurifrons*.

Neothelaira pusilla, new species

Female.—Head pollen golden, occiput cinereous; frontal stripe brown, distinctly narrower than parafrontal width; outer verticals scarcely differentiated; frontal bristles in a single row, three beneath antennal base; parafacial fully one-half clypeal width; cheek about one-third the eye length; front at vertex 0.35 of head width (one specimen); first and second antennal segments rather elongate, reddish yellow, base of third segment also reddish but infuscated below arista; latter nearly two and one-half times length of second segment; arista shorter than antenna, thickened and tapering to about middle, thence very slender to tip; palpus pale reddish yellow, longer than haustellum; eye bare, not reaching to vibrissal level.

Thorax and scutellum black, moderately gray pollinose, showing four narrow dorsal stripes before suture and five behind. Chaetotaxy: acrostichal 2,3 (none immediately before suture); dorsocentral 3,3; presutural 1 (outer); sternopleural 3; pteropleural 1 (smaller than sternopleural); intrapostalar differentiated; scutellum with 1 approximated discal, 3 strong lateral and 1 small decussate apical pair; prosternum, propleuron and postnotal slope bare.

Wing subhyaline; costal spine distinct but not very strong; third vein setulose three-fourths way to small cross vein; last section of fifth vein two-fifths length of preceding section; first posterior cell narrowly open well before wing tip; calypters rather small, about as wide as long, white with a faint yellowish tinge.

Legs pale reddish yellow, tarsi blackish; claws and pulvilli shorter than last tarsal segment.

Abdomen as wide as thorax, pointed apically; fourth segment and entire venter wholly reddish, remainder of segments except lateral margins of third black, with thin gray pollen above which changes from light to dark on either side of median line when viewed in opposite angles; third segment with a complete marginal row of rather short bristles, one pair of median marginals on each preceding segment; intermediate segments with a smallish but distinct discal pair; anal segment with short bristles and hairs above extending from base to apex; genital orifice elongate and slitlike, caudoventral.

Length, 5.5 mm.

Type.—Holotype ♀, Atherton, Missouri, August 4, 1934, without collector's label.

Panacemyia Townsend

Panacemyia Townsend, 1919, Ins. Insc. Mens. 6: 164; type, *panamensis*, new, from Taboga Island, Panamá.

Ximiocauda Reinhard, 1943, Bul. Brk. Ent. Soc. 38: 78; type, *erilis*, new, from Wading River, L. I., New York, which is congeneric with above genotype.

The above synonymy is based upon a comparison of the genotypes. The principal distinction between the latter is the presence of smallish but distinct ocellars in the type series of *erilis*. Although *panamensis* is described as having no ocellars, there is a pair of minute hairs present in the type female specimen. *Erilis* may be considered provisionally distinct on presence of ocellars (four known females all agree in this respect); however, the undeveloped ocellars in *panamensis* may not prove a constant character.

Panacemyia pallipes, new species

Similar to *crilis* in build and general aspect, but the legs (except for the tarsi) are pale reddish-yellow.

Female.—Head black in ground color with heavy gray pollen on parafrontal, parafacial, cheek and occiput; frontal stripe deep brown to black, slightly narrower than parafrontal width; eye practically bare, strongly oblique and reaching nearly to vibrissal level; front at vertex 0.24 and 0.22 of head width (two specimens); frontals in a single row, extending one or two bristles below antennal base; proclinate orbitals two, ocellars small but distinct; inner verticals decussate (straight in one specimen) and rather short; parafacial strongly narrowed below; facial ridge bare except one or two hairs above vibrissa; latter near oral margin; cheek one-seventh eye length; antenna reddish black, third segment nearly two and one-half times length of second; arista micro pubescent, slender beyond moderately thickened base; palpus pale reddish yellow; proboscis short.

Thorax black, wholly gray pollinose except four well defined velvety black stripes above, all narrowly interrupted at suture; scutellum concolorous with thorax. Chaetotaxy: acrostichal 3,3; dorsocentral 3,3; presutural 2; humeral 3; posthumeral 1; sternopleural 3 (lowermost small or sometimes hairlike); pteropleural 1 (small); intrapostalar differentiated; scutellum without apicals, 1 small discal and 3 lateral pairs; postnotal slope, propleuron and prosternum bare.

Wing extending well beyond tip of abdomen, gray hyaline; veins including costa yellow; third vein with one bristly hair near base; first posterior cell narrowly open slightly before extreme wing tip; cubitulus without stump or fold, near hind margin of wing; costal spine distinct (in one specimen equal to length of small cross vein); epaulet and subepaulet infuscated; calypters pale tawny, longer than wide.

Legs moderately long and slender, rather weakly bristled; mid tibia with one smallish bristle on outer front side below middle; hind tibia with a row of about five widely spaced bristles on outer posterior edge, one near middle considerably stouter than rest; tarsi blackish, claws and pulvilli shorter than apical segment.

Abdomen black, gray pollinose, only the three basal segments visible in dorsal aspect, the fourth compressed and strongly deflexed; first and second segments each with one pair of long erect median marginals and third with a complete marginal row; one pair of good-sized erect discals on segments two and three; anal segment beset with scattered weaker bristles above, one pair near median basal margin somewhat stouter; hairs on upper surface rather sparse and depressed; in most views the abdomen shows a roundish black spot at the base of all macrochaetae and larger hairs; ovipositor elongate, telescopic, directed downward.

Length, 3.5-5.0 mm.

Type.—Holotype ♀, College Station, Texas, May 16, 1946 (H. J. Reinhard); 1 female paratype, same data, except collected May 15, 1943.

Panacemyia verticalis, new species

Male.—Similar to the preceding species except as follows: Front at vertex 0.18 of head width; frontal stripe wider than parafrontal on entire length; ocellar and vertical bristles vestigial; orbitals absent; frontal row irregular anteriorly, three or four bristles beneath base of antenna; latter black with a reddish tinge on apex of second segment and base of third; cheek about one-eighth of eye length; thinly gray pollinose; facial ridge with fine hairs on about lowest fifth; palpus black; occiput cinereous becoming blackish above; legs black, long and slender; claws and pulvilli elongate; abdomen moderately long and arched in profile, fourth segment normal in structure; intermediate segments each with two pairs of discals, hairs on upper surface long and erect; anal segment strongly bristled above; genitalia retracted, caudoventral; inner forceps blackish, short, tapering to a sharp tip, latter slightly divided and bowed forward; accessory process reddish, much wider than forceps and broadly rounded at apex; fifth sternite small, with a median V-shaped incision, lobes reddish black, clothed with pale pubescence on inner margin.

Length, 7.5 mm.

Type.—Holotype ♂, Amherst, Ohio, June 15, 1924 (H. J. Reinhard).

This is the first male specimen of the genus hitherto brought to light. It agrees with *panamensis* in having the ocellars reduced to small hairs and in some additional details, but the black palpi in the present form seem to indicate a specific difference. The marked reduction in size of the inner verticals is unusual, but this and the differences in abdominal chaetotaxy may prove to be secondary sexual items.

THE GENUS CHRYSOZONA MEIGEN IN NORTH AMERICA

(Diptera, Tabanidae)

By Cornelius B. Philip, *National Microbiological Institute, Public Health Service, Rocky Mountain Laboratory, Hamilton, Mont.*

The rarity of flies of the genus *Chrysozona* (syn. *Haematopota* Meig.) along the entire Atlantic Coast from Rhode Island south without a male showing up until within the past 2 or 3 years is most remarkable, considering the greater frequency of *Chrysozona americana* (O.S.) in the Northwest and elaboration of the genus in the Old World. The writer was provided a specimen of supposed *C. "rara"* through the generosity of Dr. A. B. Champlain which proves to differ from either of the eastern described species—*C. rara* (Jhns.) or *C. punctulata* (Macq.) This specimen has the marked dorsal notch subapically on the scape seen in *C. punctulata,* but not in *C. rara*, more attenuated and pointed palpi than in either, a taller front, and the tibial bands much broader than in either. It is also considerably larger than either. Subsequently, a second specimen was located in the University of Kansas collection and loaned for study by Dr. R. H. Beamer, along with another specimen from California representing another undescribed species of the genus.

The resemblance of the new species to variants of the European genotype *C. pluvialis* (Linn.) was so close that the opinion of Mr. H. Oldroyd of the British Museum was solicited since he has monographed the extensive African species. He replied as follows, "I agree that it is hard to give any distinct character which would separate [your new species] *champlaini* and *pluvialis* in a key, but the specimen you sent to me is certainly unlike *pluvialis* to look at. *H. pluvialis* is much bigger and blacker, like your *americana* in general appearance. The differences that your *champlaini* does show are comparative: e.g., first antennal segment more slender, red-brown instead of black; third antennal segment much narrower, and therefore relatively more elongate in shape; palpi with fewer black hairs; wing-pattern more blurred, the streaks making up the rosettes much less sharply-outlined." It also appears likely that if *C. pluvialis* had been introduced from Europe as early as the two specimens here described it would have become much more noticeable by this time.

The following new Nearctic species is therefore described.

Chrysozona champlaini, new species

Holotype ♀, 9 mm. Head with front subequal in maximum width to height; the callosity transverse, but deeper than the other two eastern species, the two sublateral velvety spots rounded with very narrow, short, lateral extrusions. Face whitish pollinose and pilose with the usual brown punctations. The apical segments of the palpi yellow, thickened basally and attenuated to points, with sparse yellow and brown hairs. Scapes of the antennae less swollen compared to either of the others, the subapical notch, as marked as in *C. punctulata;* third segment plus annuli closer to *C. rara* in shape, not compacted as in *C. punctulata*.

The usual thoracic grayish lines for the genus, and abdominal patterns of sublateral grayish spots and gray incisures prolonged in median triangles; scutellum gray.

Wings with "water markings" and dark areas more dilute than in the other species, the former broader, the hyaline circle in cell R_1 at the end of the stigma complete, and the apical crossband single, decurved and attenuated in cell R_4, parallel to but not reaching the margin of the wing. Legs dark with broad tibial bands as follows: one broad one on basal third of tibia 1, two on tibiae 2 and 3, one basally on metatarsus 3.

Types.—Holotype ♀, Hummelstown, Pa., VI.10.20, J. G. Sanders. Temporarily in collection of the author through courtesy of A. B. Champlain, an avid collector, for whom the species is cordially named; 1 ♀ paratype, "R.I., U.S.A.," "U of K Lot 769." In Kansas University collection. This is obviously a very early collected specimen.

The species is closest to *C. rara* of the Nearctic species, but is readily separated by the characters given above, and in the key below. It is a larger species with more grayish-appearing abdomen, the median triangles appearing almost as an obscure grayish longitudinal line.

Both Johnson (1912) and Stone (1938) redescribed *C. punctulata* without mentioning that Macquart's description was based, as he states and Dr. Séguy confirms, on a type in the Paris Museum with a substitute glued head of another tabanid. In addition, the abdomen is now also missing. The type locality, "Carolinie" of the early days, could have been quite different than now, and in the absence of confirmatory specimens, makes records of *punctulata* north of the Atlantic Coast of Georgia very doubtful. A diagram of the wing of the type, through kindness of Dr. Séguy, agrees with the fine punctations of specimens seen from Jacksonville, Florida, but his statements regarding the legs might refer to still another unrecognized species—"Tibia I avec deux anneaux blancs; tibia II avec trois anneaux blancs, un basal; tibia III avec un anneau prebasal blanc. . . . . ." Further comparative study of the mutilated type is desirable.

Chrysozona willistoni, new species

Through courtesy of Dr. R. H. Beamer, the writer received an unusual, small, brownish-appearing California specimen which had stood for many years in a series of *C. americana* (O.S.) at Kansas University. That this was an undescribed western species was confirmed by two fresh ones taken in California by Mr. Larry Quate and Mr. E. I. Schlinger, which showed the more characteristic blackish ground color of the other American species suggesting that the former had faded somewhat with age. The shape of the antenna and fore tibia, reduced tibial rings and wing pattern, dark halteres, and small size are closer in appearance to *C. punctulata* of Florida than to *C. americana* of the North and West.

Holotype ♀, 6.5 mm. Front but little wider across the vertex than high; cinereous with concolorous hairs, gray pollinosity along the lateral borders, and narrowly margining the two sublateral, rounded, velvety spots, plus a smaller central spot, but not extending downward laterally between the eyes and edges of the callosity, as in most *C. americana*. Callosity piceous, relatively taller than in *C. americana*, upper margin gently convex, the corners projected upward. Face gray with gray hairs and the usual dark punctations above, which in part are confluent. Antennae black with blackish hairs, scapes shiny, slender, and with pronounced, subapical dorsal notches, distinctly shorter than the third segment, the plate of which is longer than the flagellum. Palpi robust, ashen colored with yellow hairs and a few black ones intermixed.

Thorax and scutellum blackish with only two abbreviated, narrow, sublateral, gray lines anteriorly, the median line vestigial, and with sparse, pale-yellow hairs; no gray, integumental spots in front of the scutellum; pleural hairs brown and gray intermixed. Legs blackish, fore tibiae markedly incrassate and a pale band on about the basal fourth, two rather narrow rings on the mid-tibiae, the hind pair with two less distinct pale bands and with a marked fringe of black and pale hairs. Wings dark brown, the markings much narrower but sharper than in *C. americana*, rosettes not very plain, the subapical, sinuous marking reaching the hind margin in cell R_4, and continuing narrowly along the entire hind margin as an interrupted band. Halteres brown, the seams of the knobs narrowly yellowish.

Abdomen blackish, incisures above and below, narrowly gray, the usual double row of sublateral gray, isolated spots from tergite 3 on, no gray middorsal triangles except a suggestion on tergite 2; sternal hairs predominantly yellowish.

Types.—Holotype ♀, 5 mi. S. E. Wilbur Hot Springs, Colusa Co., Calif., 27 May 1950, L. W. Quate; through the generosity of Mr. Quate this specimen is in the author's collection. Paratypes: 1 ♀, Calif. Unfortunately, the labels for this older paratype, which is in the University of Kansas collection, state only "Calif." and "det. by S. W. Williston."—the specimen is in essential agreement except for the more brownish appearance and broken antennae; 1 ♀, Walter Spring, Napa Co., Calif., 15 May 1951, E. I. Schlinger. This latter specimen is much larger (9 mm.), but is in essential agreement, with the hind tibial rings more distinct from an outer viewpoint, and the sublateral gray spots more evident on tergites 4 and 5.

C. willistoni is quite distinct from any of the other four Nearctic species as indicated in the following key.

Key to Nearctic Chrysozona Females

The males of all but the more common boreal and western species, *C. americana* (O.S.), are undescribed. A few males of *C. rara* have recently been taken attracted to lights and are readily associated on characters of the appendages.

1. Size medium, 9-10 mm.; tibiae with pale rings broad, those of the fore pair occupying at least the basal third; pale, sinuous, subapical wing-band not usually reaching hind margin 2

   Size usually small, 6-7.5 mm.; tibial rings very narrow, the anterior rings not wider than the basal fourth of the fore tibiae; subapical wing band crossing to hind margin 3

2. Antennae blackish, or deep mahogany brown, scape very swollen without dorsal, subapical notch; halteres very pallid; scutellum black; boreal and northwestern species .... *americana* (O.S.)
   Antennae brown and red, scape not especially swollen and with a strong dorsal notch, subapically; halteres with knobs predominantly brown; scutellum with grayish bloom; Pennsylvania and Rhode Island .... *champlaini*, new species
3. Scape swollen, without dorsal notch (plate slender and much longer than the flagellum); fore tibiae hardly, if any, more swollen than the others; mid-Atlantic Coast States .... *rara* (Jhns.)
   Scape with a strong subapical, dorsal notch; fore tibiae strongly dilated 4
4. Palpi slender, longer than antennal scape which is moderately dilated basad of the notch (plate and flagellum chunky, subequal in length); hind-tibial rings definite, at least basally; knobs of halteres entirely brown; northern Florida .... *punctulata* (Macq.)
   Palpi robust, subequal in length to the more slender scape (plate and flagellum slender, the former a little longer); hind tibial rings less definite; seams of halteres pale; California .... *willistoni*, new species

References

Johnson, C. W., 1912. The North American species of the genus Haematopota. Psyche 19: 181-183.

Stone, A., 1938. The horseflies of the subfamily Tabaninae of the Nearctic Region. U. S. Dept. Agr. Misc. Publ. No. 305, p. 171.

A NEW CENTRAL AMERICAN MILLIPED OF THE GENUS PLATYRHACUS

(Polydesmida, Platyrhacidae)

By Richard L. Hoffman, *Clifton Forge, Va.*

A large and striking milliped, found in the unworked neotropical material belonging to the U. S. National Museum, represents a very interesting undescribed species. A name is herewith proposed, and the opportunity taken to present some comments upon certain other species belonging to the genus *Platyrhacus*.

In another paper, now in press, I suggested that Koch's name *Platyrhacus* be restricted to the group of species of which *clathratus* Gervais, *montivagus* Carl, *pococki* Brolemann, and *javarynus* Schubart are representatives. It is the largest group of American platyrhacids, embracing at the present time some 29 species, and ranging from Costa Rica south to the upper Amazon basin in northeastern Peru. Under the name *Tirodesmus*, it was treated by Attems in 1938 as a subgenus of *Platyrhacus*. But *Tirodesmus* in Attems' usage included, in addition to the present ensemble, also members of several other genera, such as *Psammodesmus*, *Nyssodesmus*, and *Aymaresmus*, as well as *Tirodesmus* in its original sense.

A satisfactory treatment of the species of *Platyrhacus* is virtually impossible at the present, owing to several handicaps. First, several of the South American genera proposed by O. F. Cook in 1896 were based upon female specimens or upon specimens no longer available for study. A considerable number of Cook's genera remain to be evaluated. Some of them are almost certainly congeneric with *Platyrhacus*.

Second, numerous species have been founded upon female specimens, and until such a time as males have been collected, such entities must be considered *species inquirendae*. In fact, some of the earliest described forms, including *P. scaber* (Perty), *P. bilineatus* (Lucas), and *P. mexicanus* (Lucas) fall into this lamentable category.

Still, although no comprehensive study of the genus can be made at this time, it seems advisable to make some attempt at synthesis with the hope that other workers will find the information of some value. I believe that an emended diagnosis of *Platyrhacus* is in order, with a list of the adequately described species which conform to the stipulated characters. Some notes on synonymy and new combination are also given.

Genus **Platyrhacus** C. L. Koch

Platyrhacus C. L. Koch, 1847, Syst. der Myriapod., p. 58. Pocock, 1909, Biol. Centr.-Amer., Diplop., p. 138. Hoffman, 1953, Journ. Wash. Acad. Sci., in press.

Tirodesmus (*non* Cook, 1896) Attems, 1938, Das Tierreich, lief. 69, p. 229 (in part).

Type species.—*Polydesmus scaber* Perty (as determined by Koch, *op. cit.*) by designation of Cook, 1896. Attems has sought to replace this type with a species belonging to an entirely different genus, as I have already pointed out.

Diagnosis.—Platyrhacidae in which the body is of medium to large size (10-20 mm in width); lateral carinae well developed, horizontal, their lateral margins serrate or dentate, front and rear margins subparallel; pores removed from edge of keel usually by a distance of four or five times their diameter; preanal scale subtrapezoid, its setiferous tubercules large and conspicuous; and male gonopods very simple, composed of a small, ovoid coxa, heavily setose prefemoral portion (lacking any trace of a prefemoral process) imperceptably merging into the femur, forming a nearly straight trunk; tibiotarsus represented by a thin laminate process from near the base of which projects a simple digitiform solenomerite; these distal elements are curved or bent slightly back in the direction of the coxa.

The gonopods are rather constant in their general pattern throughout the genus, and for specific characters appeal is usually made to small details of body form, color pattern, and size, in which characters occur considerable interspecific variability.

To the best of my knowledge, no one has yet proposed a formal distinction between the two species-groups of platyrhacids which occur in Central America. Pocock (*op. cit.*, p. 139) seems to be the first author to recognize them, and Attems (*op. cit.*, p. 229) stated the primary means of distinction between the two in the first couplet of a key, which was "Gonopodenfemur gerade" as opposed to "Gonopodenfemur mit einem starken Knie im rechten Winkel abbiegend." Now it is true that in 1896 Cook proposed the name *Nyssodesmus* for a Nicaraguan species the gonopods of which were bent as described by Attems, but as I have said, it is not possible to be sure that any of the other species described by Cook were congeneric with the *Platyrhacus* species as here understood. In his paper on Central American millipeds (1922), Chamberlin used *Nyssodesmus* for all of the species known from that region in much the same way that Attems used *Tirodesmus* in 1938. In view of the remarkable degree of infrageneric stability in gonopod pattern which obtains in most platyrhacids, I think it not only convenient but systematically justifiable to resurrect *Nyssodesmus* as a valid genus, embracing the following species: *N. alboalatus* Cook (the generotype), *N. tristani* (Pocock), *N. antius* (Chamberlin), *N. mimus* Chamberlin, *N. bivirgatus* (Carl), and *N. limonensis* (Attems). All of these species are restricted to Nicaragua and Costa Rica.

Attems' treatment of the Neotropical playtrhacids in his 1938 monograph accounted for "19 sichere und 3 unischere Arten." Of these species, one (*fimbriatus*) is referable to the monotypic genus *Tirodesmus;* another (*helophorus*) may be reallocated, on the basis of smooth-margined keels, to *Aymaresmus;* two (*fasciolatus* and *camerani*) belong to the genus *Psammodesmus;* and two more are best considered unidentifiable (*bilineatus* and *mexicanus*). Of the remaining species, six (listed in the preceding paragraph) belong to *Nyssodesmus* and eight to *Platyrhacus.*

Nyssodesmus valeri Chamberlin (1933) from Costa Rica does not seem to differ in any respect from *Platyrhacus montivagus* Carl (1902) from the same country. *N. albomarginis* Chamberlin, described in the same paper, appears to be identical with *Platyrhacus biolleyi* Carl, a probability further enhanced by the fact that the type specimens of both came from the same place (La Palma, Costa Rica)! Chamberlin has postulated conspecificity between *biolleyi* and Peters' much older name *fimbriatus;* if this surmise is correct, *albomarginis* may be disposed of in the synonymy of *fimbriatus.*

Since the publication of Attems' monograph, fourteen species of *Platyrhacus* have been described by Chamberlin (1941) from northeastern Peru. One of them (*cainarachus*) has recently been transferred to *Psammodesmus,* following my examination of its type specimen. Several others of Chamberlin's species, based upon females, are, as their author states, somewhat aberrant and only tentatively placed in *Platyrhacus.*

The recent description of *P. javarynus* by Schubart (1950) brings the number of tolerably recognizable species in the genus to 29. A list follows the description of the new species from Panama, which I am pleased to name for Dr. E. A. Chapin, who has done so much to facilitate my studies of the National Museum collections.

Platyrhacus chapini, new species

(Figs. 1-3)

Holotype.—Male, U.S.N.M. no. 2079; from Los Siguas, Chiriqui, Panamá, collected by Henri Pittier on March 17, 1911.

Diagnosis.—A *Platyrhacus* characterized primarily by the absence of yellow markings and by the bifid tip of the tibiotarsus of the male gonopod.

Description.—The following notes were made from the type specimen: length, *ca.* 76 mm., width, 15.7 mm. Entire dorsum dark brown, almost black, without any traces of yellow pigment. Underparts more reddish brown, especially basal articles of legs.

Head of the usual form; a prominent calloused tubercule on each side of the vertex above the antennal socket; latter with a definite ridge on its upper margin. Frons with a median triangular area of small flattened granules; labrum narrow, transverse, smooth and flat, with four setigerous pores.

Disk of collum very finely granulose, front margin set off by a shallow groove, and beset with small crowded tubercules. Lateral ends of collum evenly acuminate, the rear margin with a fine ridge, the front margin with three small teeth near the end on each side.

Dorsum of most segments granular, the keels being also tuberculate (many of the tubercules are concave, many have radiating grooves). Metazonites slightly arched, keels nearly horizontal, interrupting slope of dorsum. Prozonites very finely and densely granular. Front and rear margins of midbody keels nearly smooth and subparallel (caudal margins slightly concave and sometimes dentate); lateral margins usually with four, occasionally with three or five prominent teeth, fig. 1. Caudal angles of keels of 13th-19th keels produced posteriorly, those of the 19th rounded.

Anal valves granular, their mesial margins thick and becoming much wider in approaching the telson. Preanal scale subtrapezoidal, its setiferous tubercules large; basal margin convex and overlapping caudal margin of 19th sternite; entire scale considerably swollen, particularly so basally.

Sternites with a conic tubercule at the base of each leg. Legs, especially the tarsi, moderately setose.

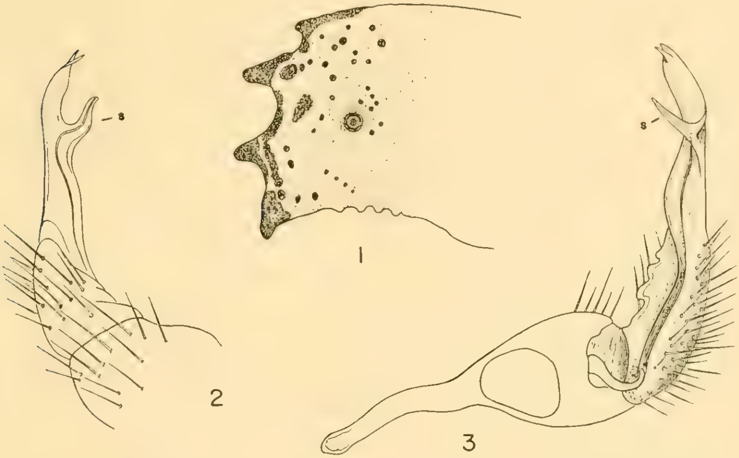

Fig. 1, *Platyrhacus chapini*, keel of left side, 10th segment; fig. 2, left gonopod of male, dorsal aspect (the face held against the sternite when at rest); fig. 3, left gonopod, mesial aspect (*s*-solenomerite).

A small series of spines or biscuspid tubercules occur on the caudal margins of the metazonites above the second pair of legs of each segment. Pleurites otherwise finely granular.

Male gonopods, figs. 2, 3, of the typical *Platyrhacus* appearance. Tracheal rod about as long as coxite, and slightly sinuate. Coxite subovoid, its lateral side with a few long setae. Prefemur only very slightly swollen, rather heavily setose on its lateral and outer surfaces, its inner surface conspicuously pleated. Femoral portion (glabrous) short, its inner edge expanded slightly. Tibiotarsus represented by a thin, hyaline lamina having an abruptly tapering distal acumen which is subtended by an accessory spiniform process of nearly equal size. Solenomerite short, evenly tapering, somewhat sigmoid. Sternal aperture of gonopods of moderate size, broadly oval but with the lateral ends tending to appear obtusely angular. Caudal margin of aperture with a raised rim.

Relationships.—The only other species of *Platyrhacus* known to me in which the end of the tibiotarsus is notched or bifid is *P. chuncho* Chamberlin from Peru. In all other respects, however, there is little close resemblance between that species and *chapini*. Probably a nearer relationship occurs with *P. fraternus* Carl, a Costa Rican species which differs chiefly in having the margins of the keels yellow.

Platyrhacus chapini is the first member of the genus to be reported from Panamá. Heretofore the boundaries of that Republic have encompassed a hiatus between the Costa Rican and Colombian populations.

The Species of Platyrhacus

The following list is arranged in alphabetical order, and designed to provide an indication of the distribution of each species as well as citation to the original description and in some cases supplementary literature references.

acompus Chamberlin (PERÚ: Iquitos)
1941, Bull. Amer. Mus. Nat. Hist., 78: 491, ff. 103-107.
aequinoctius Attems (ECUADOR: Quito)
1914, Arch. Naturg., 80 (A 4): 249.
aequitoralis Silvestri (ECUADOR: San Jose)
1897, Boll. Mus. Torino, 12 (305): 16, f. 42.
atratus Chamberlin (COLOMBIA: Atrato River)
1947, Proc. Acad. Nat. Sci. Phila., 99: 34, f. 22.
balsapuertus Chamberlin (PERÚ: Moyobamba)
1941, Bull. Amer. Mus. Nat. Hist., 78: 491, figs. 108-112.
bombonus Chamberlin (PERÚ: Rio Bombo, Alto Tapiche)
1941, Bull. Amer. Mus. Nat. Hist., 78: 491, ff. 113-115.
brolemanni Attems (Locality unknown)
1914, Arch. Naturg., 80 (A4): 250.
chapini Hoffman (PANAMÁ: Los Siguas)
1953, Proc. Ent. Soc. Wash., 55: 254, figs. 1-3.
chuncho Chamberlin (PERÚ: Contayo, Alto Tapiche)
1941, Bull. Amer. Mus. Nat. Hist., 78: 493, ff. 136-139.
clathratus (Gervais) (COLOMBIA: ?Bogota)
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1900, Brolemann, Mem. Soc. Zool. France, 13: 113.
contayus Chamberlin (PERÚ: Contayo, Alto Tapiche)
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dunali (Gervais) (COLOMBIA)
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fraternus Carl (COSTA RICA)
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gualaquizensis (Silvestri) (ECUADOR: Gualaquiza)
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incus Chamberlin (PERÚ: Rio Alto Maranon)
1941, Bull. Amer. Mus. Nat. Hist., 78: 492, ff. 124-126.

javarynus Schubart (BRAZIL: Amazonas, Rio Javari)
1950, Pap. Avul. Dept. Zool., 9 (11): 149, f. 4.
loretus Chamberlin (PERÚ: Pongo de Manseriche)
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manserichus Chamberlin (PERÚ: Pongo de Manseriche)
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montivagus Carl (COSTA RICA: Volcan Turrialba)
1902, Rev. Suisse Zool., 10: 662, ff. 84-88.
pococki Brolemann (COSTA RICA: Rancho Redondo)
1911, Bull. Soc. ent. France, 1: 14.
propinquus Carl (COSTA RICA: Santa Clara)
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retentus Chamberlin (PERÚ: Dept. of Loreto)
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riparius Carl (COSTA RICA: Rio General)
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tenebrosus (Silvestri) (ECUADOR: Rio Peripa)
1898, Boll. Mus. Torino, 13 (324): 3, f. 3.
trichotypus Chamberlin (PERÚ: Tabalosas-Chasuta)
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utoquinus Chamberlin (PERÚ: La Frontera, Alto Utoquinia)
1941, Bull. Amer. Mus. Nat. Hist., 78: 494, ff. 152-154.
zygethus Chamberlin (PERÚ: Moyobamba)
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IDENTIFICATION OF ALASKAN BLACK FLY LARVAE

(DIPTERA, SIMULIIDAE)

BY KATHRYN M. SOMMERMAN[1], *Orlando, Fla.*

This paper is one of several on black fly taxonomy and biology based on field work carried on from April to November by the 1948 Alaska Insect Project.[2] Since it concerns the identification of larvae only, it might be considered supplementary to a paper by Stone,[3] which includes keys to, and descriptions of, males, females, and pupae as well as species distribution as determined from collections of pupae and adults. A third paper, dealing with the bionomics and the geographic and seasonal distribution of the immature forms, is in preparation.

Population samples of immature forms were taken weekly from 15 streams in the vicinity of Anchorage and 12 near Fairbanks and also from approximately 260 locations on streams along the main highways of Alaska, which were visited three times during the summer. Larvae and pupae were removed with forceps from their places of attachment and placed usually in procaine tubes containing 75 to 80 percent ethyl alcohol, although occasionally methyl alcohol had to be used. Pupae were prepared for rearing by carefully removing the dark ones with forceps and placing them on moist towel paper in individual shell vials. The vials were plugged lightly with cotton and kept at cool room tempera-

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[1]Formerly with the Department of Entomology, Army Medical Service Graduate School, Army Medical Center.

[2]This project was conducted under a transfer of funds from the Department of the Army to the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

[3]Stone, Alan, 1952. The Simuliidae of Alaska (Diptera). Proc. Ent. Soc. Wash. 54 (2): 69-96.

ture in racks placed on a slant. Usually emergence was completed within a week. After one day allowed for hardening, the adults and associated pupal cases and exuviae were preserved in alcohol prior to pinning.

Larval identifications were made in the following manner: Pupae were reared and the emerged adults identified. Then by studying the pupal exuviae of the reared specimens and comparing the filaments with the pupal filaments on mature larvae, it was possible to associate mature larvae with pupae. When reared material was not available and preserved pupae could be identified, the larval-pupal association was made in the same manner. Sometimes larval exuviae found in the pupal cases further substantiated the association. Then by comparing the mature larvae with progressively smaller ones previously taken at the same location, it was possible to determine the species composition of the weekly larval population samples.

The larvae of many species were associated with pupae or adults that could not be keyed out readily; so the author used letters and symbols to substitute for names in the identification of this material. The author's preliminary identifications of all pupae and reared adults were checked by Alan Stone, who in turn employed numbers to designate pupae and adults of undescribed or doubtful species. These symbols, letters, or numbers are the only species indications on the larval material, which has been deposited at the United States National Museum, but has not yet (1953) been incorporated in the collection.

For the convenience of future workers who may wish to examine this material, the scientific names that were finally assigned to these species are given in the accompanying table, followed by the symbols, letters, or numbers that now accompany the specimens.

In this work it was desirable to distinguish some larval developmental stages, since the various instars could not readily be determined. The following four categories were established and are used in the accompanying table: *sm*—small, first instar or larger, with no evident histoblasts; *med*—medium, with small histoblasts visible only with the microscope; *mg*—maturing, with small to well developed white histoblasts visible to the unaided eye; and *mat*—mature, with well developed, dark histoblasts. It is hoped that the information in this table regarding the approximate number of specimens studied, the larval-growth range, and the number of localities where each species was taken may indicate the degree of reliability of the characters used in the accompanying key, on the assumption that species complexes are not involved.

BLACK FLY LARVAE AND PUPAE COLLECTED IN ALASKA IN 1948

Species and Designations on Specimens[4]	Individually Reared Adults	Approximate no. of Larvae	Approximate no. of Larvae	Larval-Growth Range[4]	Number of Localities
Gymnopais					
dichopticus Stone : T	45	138	465	sm—mat	47
holopticus Stone : T	138	313	685	sm—mat	21
Prosimulium					
alpestre D., R.&V. : D Z 30	247	2112	9381	sm—mat	150
decemarticulatum (Twinn) : II	0	0	3	mg—mat	3
dicum D.&S.	0	0	0	——	0
fulvum (Coq.) : F	7	24	393	sm—mat	3
hirtipes (Fries) : C O ★ VI	381	1013	3828	sm—mat	101
onychodactylum D.&S. : I Q	37	74	1466	sm—mat	59
pleurale Mall. : H □ IV	0	43	2379	sm—mat	23
travisi Stone : P 44	2	3	61	med—mat	6
ursinum (Edw.) : VIII XI	12	33	131	med—mat	34
sp. X	0	12	12	mat	2
sp. #	0	0	85	med—mg	5
Cnephia					
emergens Stone : III 79	0	3	344	sm—mat	24
eremites Shewell : ?? 24	2	402	249	sm—mat	8
minus (D.&S.)	0	0	0	——	0
mutata (Mall.)	0	0	0	——	0
saileri Stone : Y 28	59	249	829	sm—mat	35
sommermanae Stone : * 77	19	85	539	sm—mat	41
Simulium (Neosimulium)					
vittatum Zett. : A ●	140	639	6623	sm—mat	23
Simulium (Simulium)					
arcticum Mall. : B	45	105	485	sm—mat	31
corbis Twinn : N	41	451	365	sm—mat	27
decorum Walk. : L	93	427	1649	sm—mat	21
hunteri Mall. : IX	0	0	33	med—mg	2
malyschevi D., R.&V. : X 72	2	30	210	med—mat	4
meridionale Riley	0	0	0	——	0
nigricoxum Stone : 80	0	0	0	——	0
rubtzovi Smart : L? (?) 40	4	4	?	——	2
rugglesi N.&M.	0	0	0	——	0
tuberosum (Lund.) : S	314	1088	5690	sm—mat	104
venustum Say : J	346	2476	10428	sm—mat	63
Simulium (Eusimulium)					
aureum Fries : M R	115	264	525	sm—mat	25
baffinense Twinn : W 26	32	80	43	sm—mat	10
bicornis D., R.&V. : K	87	207	1513	sm—mat	81
furculatum Shewell : 25	0	4	1	mat	1
gouldingi Stone : 27	0	3	8	mg	1
latipes (Meigen) : U	143	500	439	med—mat	18
pugetense (D.&S.) : E G 34	100	299	1097	sm—mat	19

[4]For explanation of symbols and abbreviations, see the accompanying text, p. 259.

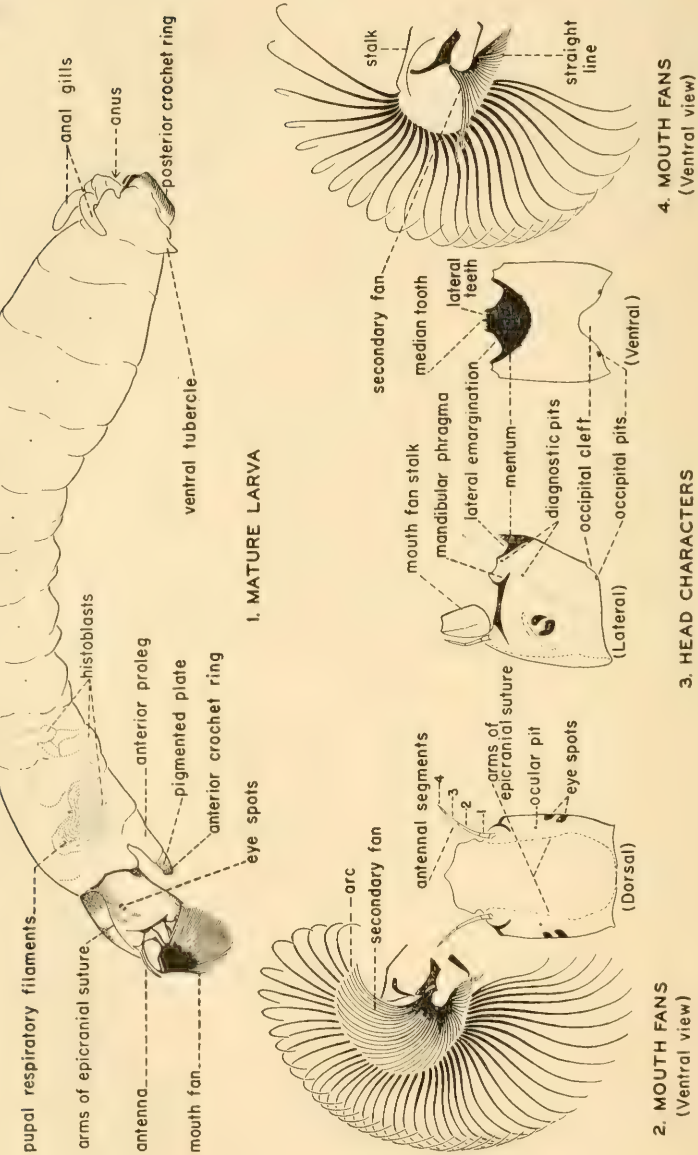
I am particularly indebted to the following people whose cooperation made this paper possible: B. V. Travis for suggesting this study, Alan Stone for the identification of pupae and reared adults, the late C. O. Esselbaugh and Siegfried Lienk for material collected and reared in the Fairbanks area, R. I. Sailer and his assistants for material collected and reared from streams along the highways of Alaska, and L. H. Dover, E. P. Marks, R. I. Sailer, and G. Nielsen for assistance with the collecting and rearing in the Anchorage area. Many thanks are due Lt. Col. Robert Burrows and Lt. Col. Robert Traub for making possible the completion of this study after project funds became exhausted. I also wish to thank W. V. King for suggestions regarding this paper.

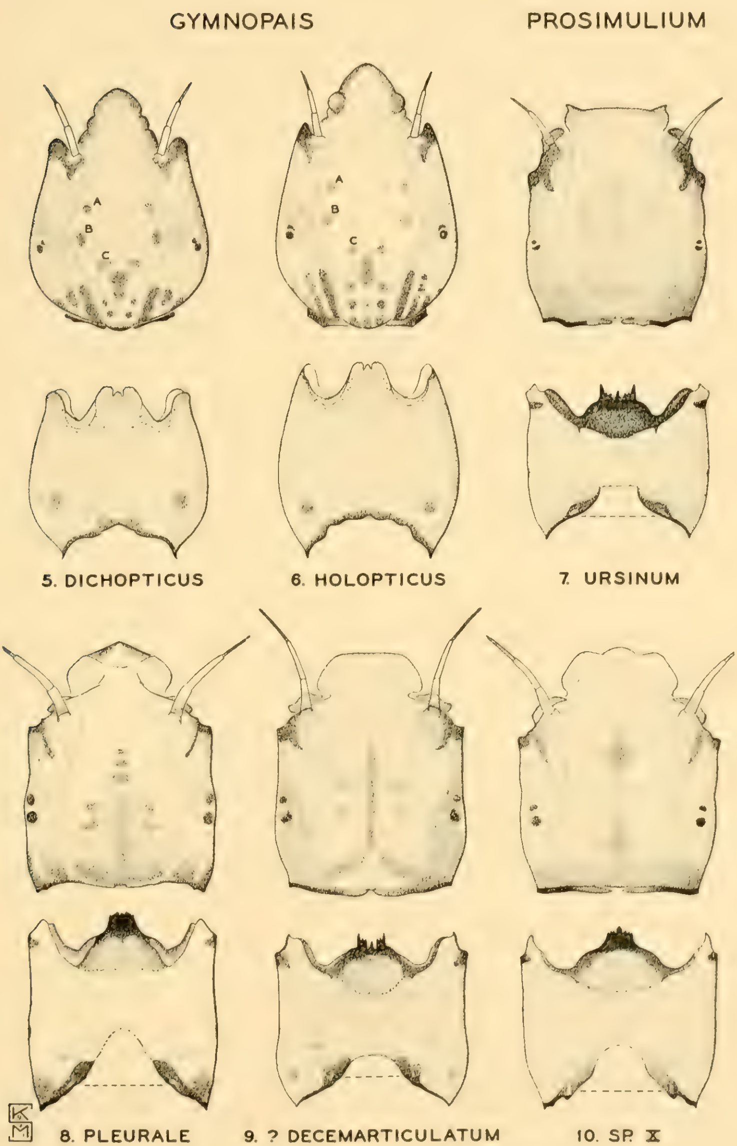
The following are a few hints for the successful handling and identification of black fly larvae. The key has been constructed primarily for the identification of maturing and mature larvae (those with histoblasts well developed and either white or dark), but with reservations it can be used for small and medium larvae as well. For the location of the following structures see figs. 1 to 4.

The *pupal filaments* can be dissected easily if the larva is grasped firmly about midway with a pair of forceps, and an insect pin is slipped under the integument at the edge of the histoblast, raised slightly, and turned along the histoblast margin, tearing a circular patch of integument loose. Then the histoblast can be removed, if necessary, after it has been cut free at the base with a pin and the filaments counted or their pattern of branching noted.

It is sometimes necessary to dissect the *anal gills,* as often they are not extruded. This is not difficult. Usually just anterior to the anus there is a pellet of excrement lodged in the gut, which appears as a dark spot through the integument. If a pin is inserted through the integument just above this patch, making a crosswise slit, the gut can be pierced and raised through it. Then by making a dorsal slit in the gut the fecal pellet can be removed, leaving the anteriorly directed (usually), flattened anal gills exposed.

The number of *rays in the mouth fan* as used in the key is for the most part a supplemental character. The total number of rays per fan increases from the first to last instar. That is why mature larvae were used for counts when available; allowances should be made when one is identifying younger instars. The rays of the mouth fan are easy to count when expanded. If they are not expanded and the integument of the larva is intact, they can usually be forced to do so merely by gripping the larva firmly with forceps just behind the thorax. They can also be opened for viewing the *secondary fan* by holding the larva, ventral side up, with forceps and placing a pin under the tips of a few of the end rays and gradually lifting them up and out. The whole fan will then open.


pupal respiratory filaments
arms of epicranial suture
antenna
mouth fan
histoblasts
anterior proleg
pigmented plate
anterior crochet ring
eye spots
anal gills
anus
posterior crochet ring
ventral tubercle
1. MATURE LARVA
arc
secondary fan
2. MOUTH FANS
(Ventral view)
antennal segments
4
3
2
1
arms of epicranial suture
ocular pit
eye spots
(Dorsal)
mouth fan stalk
mandibular phragma
lateral emargination
mentum
diagnostic pits
occipital cleft
occipital pits
(Lateral)
(Ventral)
median tooth
lateral teeth
secondary fan
3. HEAD CHARACTERS
stalk
straight line
4. MOUTH FANS
(Ventral view)


GYMNOPAIS
PROSIMULIUM
A
B
C
5. DICHOPTICUS
6. HOLOPTICUS
7. URSINUM
8. PLEURALE
9. ? DECEMARTICULATUM
10. SP. X

The *length of the antenna* relative to the length of the mouth-fan stalk decreases as the larva increases in size; so some allowance should be made when medium or small larvae are being identified. The antennae are considered to be composed normally of four segments—the first (basal) relatively short, the second and third long, and the apical one extremely small. The second and third long, and the apical one extremely small. The second segment may be secondarily ringed.

The general shape of the *occipital cleft* seems to be a reliable character and one easily seen. The posterior limit of the cleft is determined by the pits along the border of the capsule. On the illustrations this limit is indicated by a broken line extending across the cleft from pit to pit.

The general pattern of the *mental teeth* is reliable, especially in mature specimens, but there is variation in the minute details. The mental teeth are more easily seen under the stereoscopic dissecting microscope if the labium is pushed aside. This can be done by inserting a pin between the labium and the mentum and pushing the labium to one side severing the muscles and thereby producing a white background.

The shape of the *lateral plate of the proleg* is of some use in identifying *Prosimulium*, especially as a supplemental character.

On the side of the head are two tiny pits (Fig. 3), called *diagnostic pits*, which are of use in separating smaller larvae of *Prosimulium onychodactylum* and *alpestre* from those of *hirtipes* and *travisi*, especially if the biarctate condition of the occipital cleft is not distinct.

The *dorsal head pattern* is a reliable character, but the intensity of the pattern varies considerably.

For lack of Alaskan specimens the following species are not treated in this key: *P. dicum*, *C. minus*, *C. mutata*, *S. meridionale*, *S. nigricoxum*, *S. rubtzovi*, and *S. rugglesi*. However, specimens of *mutata* collected in the United States were available for study. This species is similar to *emergens* but is larger and has a single median ventral tubercle, which readily distinguishes it from all other known Alaskan species.

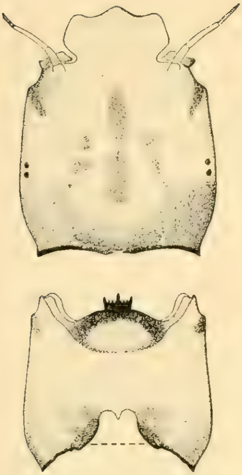
For the most part in the key the distinguishing characters precede the figure citation, and those following it are supplementary.

Key to Maturing and Mature Larvae

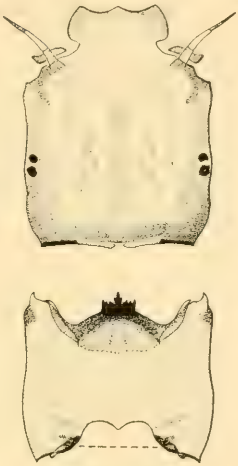
1. Larvae lacking mouth fans. *Gymnopais* ... 2
   Larvae with mouth fans, fig. 1 ... 3

2. Two pupal filaments plus two stubs; outer limits of spots C-C about equal to distance between spots A-B; lateral emargination of mentum approaching angular, V-shaped, fig. 5 ... *dichopticus* Stone
   Only two pupal filaments; spots C-C closer together than spots A-B; lateral emargination of mentum U-shaped, fig. 6 ... *holopticus* Stone

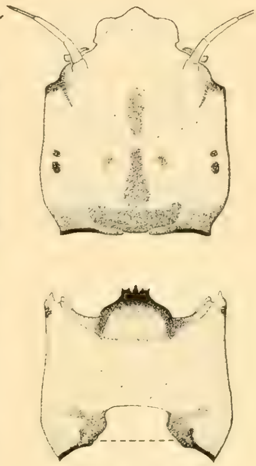
PROSIMULIUM (CONTINUED)



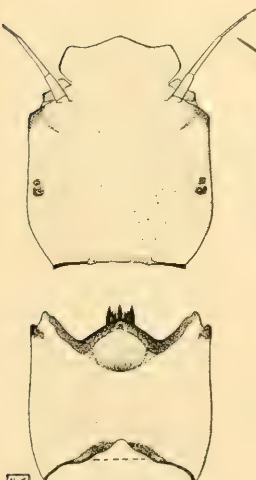
11. ONYCHODACTYLUM



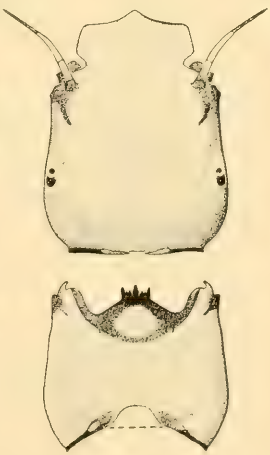
12. ALPESTRE



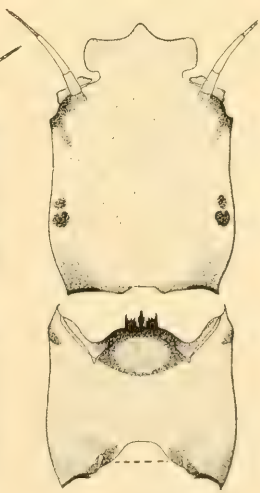
13. SP #



14. FULVUM



15. TRAVISI



16. HIRTIPES

3. Tips of secondary mouth fan (under primary fan), when expanded, falling in a straight line, fig. 4, *Prosimulium* 4
Tips of secondary fan, when expanded, forming an arc, fig. 2, *Cnephia* and *Simulium* 13

4. Mandibular phragma extending to or almost to mentum; antenna two-thirds length of mouth fan stalk with first segment as long as wide; median mental tooth sunken, appearing considerably shorter than lateral teeth, fig. 7; 20-26 rays in mouth fan of mature specimen; 14-15 pupal filaments; mature larvae 8.5 to 9.5 mm. .... *ursinum* (Edw.)
Mandibular phragma not extending more than half way to mentum; antenna three-fourths or more length of mouth fan stalk with first segment much longer than wide 5

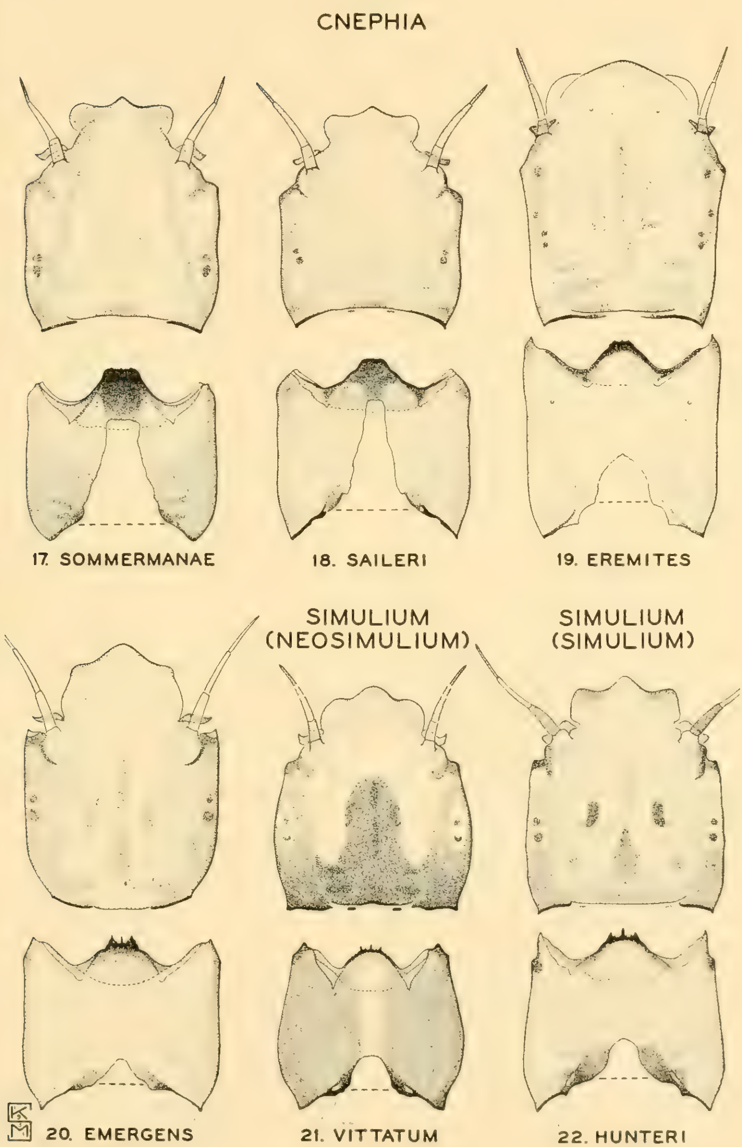
5. Median mental tooth shortest; antenna longer than mouth fan stalk 6
Median mental tooth conspicuous, as long or longer than longest lateral teeth; antenna equal to or shorter than mouth fan stalk 7

6. All mental teeth short; limit of occipital cleft indistinct, extending about half way to mentum, fig. 8; about 54 rays in mouth fan of mature specimen; approximately 32 pupal filaments; mature larvae 9.0 to 9.5 mm. .... *pleurale* Mall.
Lateral mental teeth longest; limit of occipital cleft distinct, extending a third or less of way to mentum, fig. 9; about 44 rays in mouth fan of mature specimen; 9 pupal filaments; mature larvae 7.5 to 8.0 mm. .... (?)*decemarticulatum* (Twinn)

7. Last lateral mental tooth shortest, fig. 10; antenna as long as mouth fan stalk; about 44 rays in mouth fan of mature specimen; 16 pupal filaments; mature larvae 5.5 mm. .... *P.* sp. *X*
Last lateral mental tooth not shortest 8

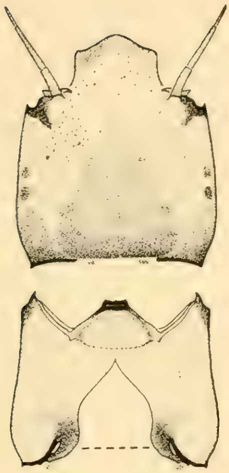
8. Occipital cleft biarctate; antenna extending three-fourths length of mouth fan stalk 9
Occipital cleft simple; antenna extending to or almost to tip of mouth fan stalk 10

9. Last of lateral mental teeth longest; secondary projections of median mental tooth basal, their tips considerably below tip of last lateral tooth, fig. 11; line projected through diagnostic pits, fig. 3 bisects or extends above eye spots; 24 to 28 rays in mouth fan of mature specimens; many pupal filaments arising from two main corrugated trunks; mature larva 9.0 mm. .... *onychodactylum* D. & S.
Lateral mental teeth all about same size; secondary projections of median mental tooth elevated, their tips above tip of last lateral tooth, fig. 12; line projected through diagnostic pits bisects or extends above eye (as in *onychodactylum*); about 38 rays in mouth fan of mature specimen; approximately 44 pupal filaments; mature larvae 7.5 to 10.0 mm. .... *alpestre* D., R & V.

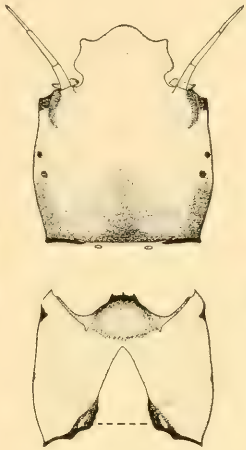

CNEPHIA
17. SOMMERMANAE
18. SAILERI
19. EREMITES
SIMULIUM
(NEOSIMULIUM)
SIMULIUM
(SIMULIUM)
KM
20. EMERGENS
21. VITTATUM
22. HUNTERI

10. Occipital cleft about as wide as mental plate; lateral mental teeth all short, fig. 13; about 32 rays in mouth fan of maturing larva; 20 (?) pupal filaments; maturing larva 6.0 mm.; larvae almost transparent .... *P.* sp. #
    Occipital cleft at most slightly wider than combined width of mental teeth; last of lateral mental teeth decidedly longest ... 11
11. Occipital cleft slight (at tip less than combined width of mental teeth); last lateral mental tooth as long as median tooth, fig. 14; head capsule pale, dorsal pattern almost absent; body opaque white; 17 to 19 rays in mouth fan of mature larva; 16 pupal filaments; mature larva 10.0 mm. .... *fulvum* (Coq.)
    Occipital cleft pronounced, at least as wide as combined width of mental teeth; last lateral mental tooth not quite so long as median tooth 12
12. Head pattern with median broken line and two lateral spots on each side and a dark area posteriorly, fig. 15; line projected through diagnostic pits clearly extends below eye (as in *hirtipes*); approximately 26 rays in mouth fan of mature larva; 14 to 16 long pupal filaments; mature larva 7.75 mm. .... *travisi* Stone
    Head pattern usually without extensive median pigmentation, fig. 16; line projected through diagnostic pits clearly extends below eye; 20 to 28 rays in mouth fan of mature larvae; 16 pupal filaments; mature larvae 8.0 to 8.5 mm. .... *hirtipes* (Fries)
13. Ventral tubercles absent. *Cnephia, Simulium* (*Neosimulium*), *Simulium* (*Simulium*) 14
    Two ventral tubercles present caudally, just anterior to posterior crochet ring, fig. 1. *Simulium* (*Eusimulium*) 25
14. Anal gills simple (occasionally with secondary bumps). *Cnephia, Simulium* (*Neosimulium*) 15
    Anal gills many branched. *Simulium* (*Simulium*) 19
15. Second antennal segment with two hyaline bands distally; occipital cleft quadrangular, extending about one-third of way to mentum, fig. 21; *Simulium* (*Neosimulium*). Approximately 50 rays in mouth fan of mature specimen; 14 to 16 pupal filaments; anal gills simple (occasionally with secondary bumps); mature larva about 6.75 mm. .... *vittatum* Zett.
    Antennae without hyaline bands on second segment; occipital cleft not quadrangular; *Cnephia* 16
16. Occipital cleft deep, extending slightly beyond (cephalad) posterior margin of mentum 17
    Occipital cleft extending less than half way to mentum 18
17. Occipital cleft wide, width of anterior end about one-third length of cleft; pigmentation along arms of epicranial "suture" pronounced, fig. 17; approximately 60 rays in mouth fan of mature specimen; approximately 48 terminal pupal filaments; mature larva about 8.5 mm. .... *sommermanae* Stone
    Occipital cleft narrow, width of anterior end about one-fifth length of cleft; arms of epicranial "suture" not margined

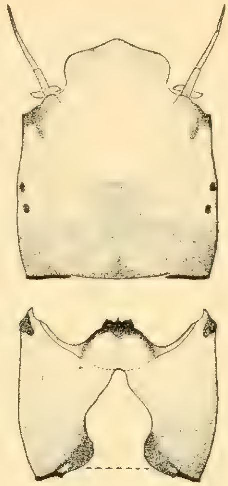
SIMULIUM (SIMULIUM) (CONTINUED)



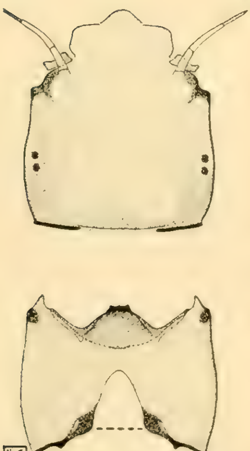
23. ARCTICUM



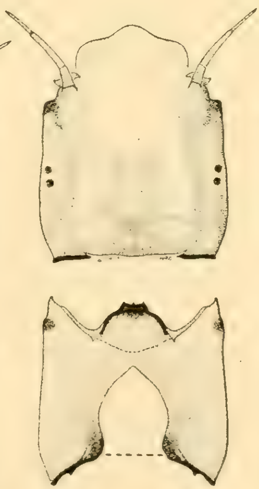
24. CORBIS



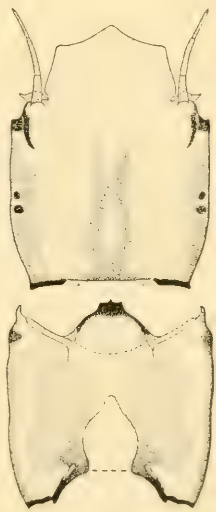
25. MALYSCHEVI



KM 26. TUBEROSUM



27. VENUSTUM



28. DECORUM

with deeper pigmentation, fig. 18; approximately 57 rays in mouth fan of mature specimen; approximately 48 terminal pupal filaments; mature larva about 7.5 mm. .... *saileri* Stone

18. Antenna shorter than mouth fan stalk; occipital cleft extending almost half way to mentum; mental teeth small, fig. 19; approximately 60 rays in mouth fan of mature specimen; about 25 to 28 pupal filaments; mature larva about 90.0 mm. .... *eremites* Shewell

Antenna longer than mouth fan stalk; occipital cleft extending about one-fourth of way to mentum; mental teeth conspicuous, median tooth long and slender, fig. 20; approximately 50 rays in mouth fan of mature specimen; 11 pupal filaments; mature larva about 5.5 mm. .... *emergens*[5] Stone

19. Occipital cleft extending less than half way to mentum; first and third antennal segments dark, fig. 22; approximately 43 rays in mouth fan of maturing specimen; many long, very fine pupal filaments; slight indication of presence of ventral tubercles (?); maturing larva about 6.75 mm. .... *hunteri* Mall.

Occipital cleft extending almost two-thirds or more of way to mentum; first and second antennal segments concolorous 20

20. 10, 12, or 16 pupal filaments 21

6 or 8 pupal filaments 23

21. 12 pupal filaments; ocular pit usually dark; median mental tooth about as long as lateral teeth, hence toothed margin almost straight, fig. 23; approximately 50 rays in mouth fan of mature specimen; mature larva about 7.25 mm. .... *articum* Mall.

10 or 16 pupal filaments; ocular pits usually inconspicuous; median mental tooth and last lateral teeth more pronounced, hence toothed margin biarctate 22

22. 10 pupal filaments; dorsal head pattern usually lacking isolated darker spots; occipital cleft usually tapering uniformly, fig. 24; approximately 48 rays in mouth fan of mature specimen; mature larva about 7.0 mm. .... *corbis* Twinn

16 pupal filaments; lateral pigmentation usually extending to arms of epicranial ''suture''; occipital cleft generally extending to mentum, fig. 25; approximately 49 rays in mouth fan of mature specimen; mature larva about 6 mm. .... *malyschevi* D., R. & V.

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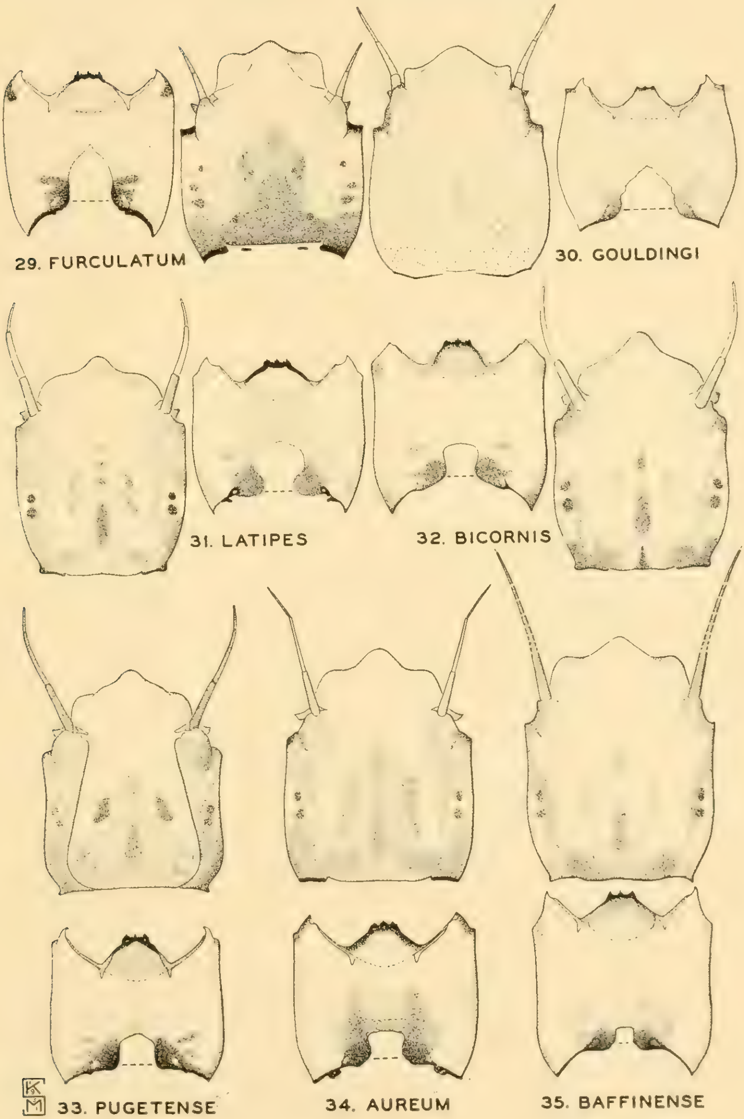
[5]Reexamination of the single pupa determined as *Cnephia mutata* from College, mentioned in my paper, ''The Simuliidae of Alaska,'' p. 82, shows this actually to be *C. emergens*. A comparison of this pupa with pupae of *mutata* from New York State shows them to be very similar, but in *emergens* the respiratory filaments arise from three main trunks of 4, 3, and 5 filaments, respectively, whereas in *mutata* the first two trunks are on one petiole so that there are two main trunks of 7 and 5 filaments, respectively.—Alan Stone.

SIMULIUM (EUSIMULIUM)



29. FURCULATUM 30. GOULDINGI

31. LATIPES 32. BICORNIS

33. PUGETENSE 34. AUREUM 35. BAFFINENSE

23. Dorsal head pattern with median pale spots surrounded by cloudy areas; antenna reaching only to tip of mouth fan stalk .. 24
Dorsal head pattern with median dark spots; antenna reaching slightly beyond tip of mouth fan stalk; occipital cleft uniformly tapering, fig. 26; approximately 43 rays in mouth fan of mature specimen; 6 pupal filaments; abdomen of larva dusky; mature larva about 5.75 mm. .... *tuberosum* (Lund.)
24. 6 pupal filaments; lateral pigmentation of head extending to arms of epicranial "suture"; occipital cleft deep and rounded, fig. 27; approximately 45 rays in mouth fan of mature specimen; mature larva about 7.0 mm. .... *venustum* Say
8 pupal filaments; lateral pigmentation of head not reaching arms of epicranial "suture" anteriorly; occipital cleft rounded but not so deep as in *venustum*, fig. 28; approximately 50 rays in mouth fan of mature specimen; mature larva about 9.0 mm. .... *decorum* Walk.
25. Antenna extends beyond tip of mouth fan stalk 26
Antenna shorter than mouth fan stalk; third segment (of first 3) shortest; occipital cleft extending more than half way to mentum; ocular pits heavily pigmented, fig. 29; approximately 60 rays in mouth fan of mature specimen; 8 pupal filaments (4 simple and 2 bifurcate); anal gills many branched; mature larva about 5.75 mm. .... *furculatum* Shewell
26. Second antennal segment with secondary membranous hyaline bands (whole segment flexible), antennae dark; occipital cleft extending only about one-fifth of distance to mentum, fig. 35; approximately 70 rays in mouth fan of mature specimen; 3 stout pupal filaments; anal gills many branched; mature larva about 7.5 mm. .... *baffinense* Twinn
Second antennal segment rigid, lacking secondary membranous bands 27
27. Occipital cleft roughly triangular or circular (sometimes pentagonal) and extending half way or more to mentum 28
Occipital cleft roughly quadrangular and extending about one-third of way to mentum 29
28. Occipital cleft triangular; head pale, fig. 30; approximately 40 rays in mouth fan of maturing specimen; 6 pupal filaments; anal gills simple; extremely small species, maturing larva approximately 3.5 mm. .... *gouldingi* Stone
Occipital cleft circular, fig. 31; integument pilose dorsally on two or more segments immediately preceding anus; approximately 48 rays in mouth fan of mature specimen; 4 pupal filaments; anal gills many branched; mature larva about 6.75 mm. .... *latipes* (Mg.)
29. Anal gills simple (sometimes with secondary bumps) 30
Anal gills many branched; integument bare dorsally immediately preceding anus, fig. 32); approximately 46 rays in mouth fan of mature specimen; 4 pupal filaments; mature larva about 6.75 mm. .... *bicornis* D., R. & V.

30. Antennae dark and conspicuous; arms of epicranial ''suture'' dark; mentum darker than adjacent area; lateral spots of dorsal head pattern double, fig. 33; approximately 40 rays in mouth fan of mature specimen; 4 pupal filaments; anal gills simple (sometimes with secondary bumps); mature larva about 7.5 mm. .... *pugetense* (D. & S.)

Antennae pale, also arms of epicranial ''suture''; posterior half or more of mentum concolorous with adjacent area; dorsal head pattern consisting of longitudinal patches, fig. 34; approximately 55 rays in mouth fan of mature specimen; 4 pupal filaments; anal gills simple; mature larva about 6.0 mm. .... *aureum* Fries

A REVISION OF THE GENUS KLEIDOCERYS STEPHENS IN THE UNITED STATES

(Hemiptera, Lygaeidae)

By Harry G. Barber, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

The genus *Kleidocerys* has a wide distribution throughout the Holarctic region and extends into the Neotropical region as far south as northern South America. *K. resedae* (Panzer) is an holarctic species; *franciscanus* (Stål) (=*ericae* (Horvath) probably was introduced on our west coast from Asia.

Because of the great similarity among the various species of the genus occurring in the United States there has been much confusion regarding the identity of several of them. *K. resedae geminatus* (Say) is the best known species from southern Canada and much of the eastern and southern states, where it is known to feed on the dried seeds of a number of plants. Of the seven species treated here three are new. Aside from color differences the author has had to rely mainly on proportionate dimensions of body parts for differentiating the species.

Genus **Kleidocerys** Stephens

Type *Lygaeus resedae* Panzer 1797, fixed by Westwood, 1840 (*teste* China, 1943).

Kleidocerys Stephens (Westwood Ms.), 1829 Nomencl. Brit. Ins., p. 64; Cat. Brit. Ins., v. 2, p. 342.

Cymus Burmeister, 1839, Hanb. Entomol., p. 292 (part).

Cymus (*Kleidocerys*) Westwood, 1840, Modern Class. Ins., v. 2, Synopsis genera Brit. Ins., p. 123.

Cymus (*Lyctus*) Flor, 1860, Rhynch. Livl., v. 1, p. 296.

Ischnorhynchus Fieber, 1861, Europ. Hemip., p. 51,199; Stål, 1862, Ofv. Vet. Akad. Forh. 11:210; 1872, *loc. cit.* 29:44; 1874, Enum. Hemip., pt. 4, p. 123, 124.

Kleidocerus Puton, 1878, Synops. Hemip. Heterop. France, pt. 1, Lygaeidae, p. 18, 19.

Ischnorhynchus Provancher, 1886, Petit Faun. Entomol. Canada 3: 74; Van Duzee, 1917, Cat. Hemip. No. Amer., p. 162; Barber, 1917, Psyche 24: 132; Blatchley, 1926, Heterop. E. No. Amer., p. 357; Bueno, 1946, Entomol. Amer. 26:27.

Kleidocerys China, 1943, Generic names Brit. Hemip., Appendix, p. 237.

The description for the genus *Ischnorhynchus* Fieber (*op. cit.*, p. 51, 199) applies, with the additions noted below, to the genus *Kleidocerys*.

''Body long oval, depressed, glabrous. Basal segment of antenna a little extended before apex of head, second segment not doubly longer, third segment about three fourths as long as second, both filiform, fourth fusiform, acute, as long as second segment. Pronotum very much contracted anteriorly, anterior margin is to the posterior margin as 3:7 and the length is to the posterior margin as 5:7. Scutellum is an equilateral triangle. Basal segment of posterior tarsus as long as second and third combined. Pronotum and scutellum, deeply, closely punctate, each puncture with a golden yellow hair. Hemelytra much wider than body, corium reaches almost to apex of abdomen. Membrane large, much extended beyond abdomen.''

To the above description should be added: Eyes large; bucculae short, preocular antenniferous tubercles, except in *obovatus*, very short; rostrum extended to or frequently beyond the metasternal coxae; pronotum with the anterior angles often slightly produced; scutellum somewhat wider than long; corium often translucent; clavus with three regular series of punctures.

Kleidocerys resedae (Panzer) s. str.

Lygaeus resedae Panzer, 1797, Faun. Germ. Hemip., fasc. 40, tab. 20.

Lygaeus didymus Zetterstedt, 1819, Vet. Akad. Forh., p. 71.

Lygaeus puncticollis Fallen, 1829, Hemip. Suec. Cim., p. 95.

Kleidocerys resedae Stephens, 1829, Nomencl. Brit. Ins., p. 64; Cat. Brit. Ins., v. 2, p. 342.

Cymus resedae Burmeister, 1839, Hanb. Entomol., p. 292.

Cymus (Kleidocerys) resedae Westwood, 1840, Modern Class. Ins. v. 2, Gen. Brit. Ins., p. 123.

Cymus (Lyctus) *resedae* Flor, 1860, Rhynch. Livl., V. 1, p. 296.

Ischnorhynchus didymus Fieber, 1861, Europ. Hemip. 199; Stål. 1874, Enum. Hemip., pt. 4, p. 124 (*geminatus* Say and *franciscanus* Stål as synonyms).

Ischnorhynchus didymus Stål, 1874, Enum. Hemip., pt. 4, p. 124 (*geminatus* Say and *franciscanus* Stål as synonyms).

Kleidocerus didymus Puton, 1878, Synops. Hemip. Heterop. France, pt. 1, Lygaeidae, p. 19.

Ischnorhynchus resedae Distant, 1882, Biol. Cent. Amer. Rhynch., v. 1, p. 193 (*geminatus* Say as synonym).

Ischnorhynchus resedae Provancher, 1886, Petite Faun. Entomol. Canada 3:74 (*geminatus* Say and *franciscanus* as synonyms). Oshanin, 1906, Verzeichn. Palaeark. Hemip., p. 269 (*geminatus* Say and *francisca-*

nus Stål as synonyms): Van Duzee, 1917, Cat. Hemip. No. Amer., p. 162; Blatchley, Heterop. E. No. Amer., p. 357 (*geminatus* Say as synonym).

Kleidocerys resedae China, 1943, Generic names of Brit., Ins., Appendix, p. 237.

Ischnorhynchus resedae Bueno, 1946, Entomol. Amer. 26:30.

Head, pronotum and scutellum ferrugineous. Intraorbital and basal region of head, cicatrices of pronotum and base of scutellum fuscous. Corium and clavus yellow testaceous to reddish brown, spot at apex of clavus, two prominent discal and four spots along posterior margin of corium, fuscous. Antennae yellow testaceous, with the basal, terminal and the base and apex of the second and third segments, fuscous. Legs with the femora ferrugineous, apices and tibiae paler.

Head much wider than long: preocular portion, most commonly equal to the remainder (dorsal view); interocular space much wider than the length of the preocular region. Antenna a little longer than head and pronotum combined; rostrum extends posteriorly onto the first ventral segment. Pronotum much wider than long (36x22); cicatrices sharply defined, area about them often infuscated. Scutellum nearly one-fourth wider than long, sparsely punctate. Commissure about two-thirds the length of the scutellum. Costal margin gently rounded from base, but little longer than head, pronotum, and scutellum combined. Length 4.50-5.10 mm.

Distribution.—Newfoundland, Canada, eastern and northern parts of the United States west to the Pacific Coast, British Columbia, and Alaska.

In 1908, Doctor Horvath in his article "Remarques sur quelques Hémiptères de l'Amérique du Nord," Ann. Mus. Nat. Hung. 6: 560, briefly discussed the differences between *Ischnorhynchus geminatus* and *I. resedae*, and maintained that the two species occur in the United States. He mentions in particular, as distinguishing characters for separating *geminatus* from *resedae*, its smaller size, narrower form, and differences in the character of the corium, as well as a difference in the food habits.

For some inexplicable reason in the more northern forms the corium has a more opaque, brownish testaceous color, resembling *resedae* of Europe, while in the eastern and southern forms the corium is more hyaline. As a result of many measurements of both forms it was found that no reliance could be placed on comparative dimensions of body parts and segments of the antennae as distinguishing characters. Although the two forms overlap to some extent in their outer limits of distribution, each occupies a rather definite region in the United States. The author therefore concludes that Say's name should be retained for a separate subspecies to include the form found in the eastern and southern United States.

Occurring in the west coast states is another form of *resedae* which has a rather more opaque corium heavily blotched with fuscous.

Kleidocerys resedae geminatus (Say), new status

Lygaeus geminatus Say, 1832, Heterop. No. Amer., p. 14; Le Conte, 1859, Compl. Writ., v. 1, p. 330.

Ischnorhynchus geminatus Horvath, 1908, Am. Mus. Nat. Hung. 6:560; Van Duzee, 1917, Cat. Hemip. No. Amer., p. 163; Parshley, 1917, Occas. Papers Boston Soc. Nat. Hist., no. 7, p. 41; Barber, Connect. Geol. and Nat. Hist. Surv. Bull. 34, p. 716; Bueno, 1946, Entomol. Amer. 26:29.

General coloration much as in *resedae s. str.*, but the corium is more hyaline, translucent and the spots on the corium less prominent.

Distribution.—Quebec, Eastern United States: New England to Florida and west to Michigan, Minnesota, Illinois, Iowa, Missouri, Kansas, Oklahoma, Louisiana, and Texas.

Kleidocerys resedae fuscomaculatus, new subspecies

Head ferrugineous, extreme base fuscous; antennae and legs as in the typical species. Pronotum varicolored as follows: ferrugineous anteriorly, median fascia on the posterior disk and the posterior margin, on either side, pale yellow; cicatrices, surface of the posterior disk on either side and the humeri fuscous or ferrugineo-fuscous. Scutellum ferrugineous, a short basal fuscous streak, apex pale, pruinescent spots on either side. Hemelytra pale yellowish, rather opaque, central disk more or less blotched and the posterior margin fuscous with a conspicuous pale spot near the inner angle of the corium.

Types.—Type ♂, Livermore, Calif., Apr. 30, 1928, collected by the author on alder trees; Paratypes, males and females; CALIFORNIA: 28, same data as the type; 3 San Mateo Co.; 11, Alameda Co.; 1, Mt. Cordelia; OREGON: 1, McMinville, K. M. Fender; 6, Cedar Mills; WASHINGTON: 1, Silver L.; 1 Olympia; 1, Wanatchee. All in the United States National Museum. U. S. N. M. no. 61652.

Paratypes deposited in the Snow Collection, University of Kansas: CALIFORNIA: 8, Clayton; 2, Kernville; 9, Claremont; 2, Bray; OREGON: 1, Hood R.; BRITISH COLUMBIA: 1, Oliver.

This is a heavily infuscated, opaque species which, in its outer limits, overlaps the range of *resedae s. str.* and is frequently difficult to distinguish from that species.

Distribution.—California, Oregon, Washington, and British Columbia.

Kleidocerys obovatus (Van Duzee)

Ischnorrhynchus obovatus Van Duzee, 1931, Pan Pac. Entom. 7:110.

Head and scutellum ferrugineous; posterior two thirds of pronotum and corium ochraceous; cicatrices, two spots on the disk of corium and three along posterior margin fuscous. Antennae testaceous, segments marked with fuscous as in *resedae.*

Head long, but little wider than long (20x18) and little shorter than the pronotum; preocular part, dorsal view, subequal to the remainder; preocular margin a little less than one half the length of an eye. Antennae but little shorter than length of head and pronotum combined; basal segment not quite extended to apex of the tylus. Pronotum almost one third wider than long. Corium with costal margin strongly, convexly rounded from base to apex, much wider than pronotum. Membrane rather short. Rostrum extended behind metasternal coxae. Length 4 mm.

Types.—Cypress Ridge, Marin Co., Calif., Apr. 30, 1922 on Sargeant's cypress, in the collection of the California Academy of Sciences. Several paratypes with the same data deposited in the United States National Museum.

The relatively longer head and preocular margin, more strongly convexed costal margin, and shorter membrane distinguished this species from *resedae.*

Kleidocerys franciscanus (Stål)

Cymus franciscanus Stål, 1859, Freg. Eugen. Resa, Ins., p. 252.

Ischnorhynchus geminatus Fieber, 1861, Europ. Hemip., p. 209 (not Say).

Cymus truncatulus Walker, 1872, Cat. Hemip. Heter. Brit. Mus., v. 5, p. 142.

Ischnorhynchus franciscanus Stål, 1874, Enum. Hemip., pt. 4, p. 124 (as synonym of *didymus* Zett.).

Kleidocerus geminatus Puton, 1878, Synops. Hemip. Heterop. France, pt. I, Lygaeidae, p. 20 (not Say).

Ischnorhynchus ericae Horvath, 1908, Amm. Mus. Nat. Hun. 6:560 (Footnote, new name for *geminatus* Fieber).

Ischnorhynchus franciscanus Van Duzee, 1914, Trans. San Diego Soc. Nat. Hist. 2:8; Parshley, 1919, Occas. Papers Mus. Zool., Univ. Mich. no. 71, p. 16.

Kleidocerys ericae China, 1943, Generic names Brit. Ins., Appendix, p. 237.

Ischnorhynchus franciscanus Bueno, 1946, Entom. Amer. 26:28.

Kleidocerys franciscanus Barber, 1949, Proc. Ent. Soc. Wash. 51:273.

Pronotum and corium flavotestaceous, the latter translucent; head and scutellum ferrugineous; intraorbital region of head, cicatrices, two spots on disc and three on posterior margin of corium, fuscous (these spots often faint or even effaced); antennae yellow testaceous, basal and terminal segments, base and apex of second and base of third segment fuscous; femora ferrugineous with apices narrowly pale.

Head short, nearly one-third wider than long, nearly one-third shorter than prontum; preocular part subequal to the remainder; somewhat longer than an eye; interocular space about one-fourth wider than the preocular length. Antenna with the second segment almost twice as long as basal and subequal to terminal. Pronotum almost one-third wider than long, closely, evenly punctate. Scutellum a little wider than long, sparsely punctate. Costal margin of corium gently rounded from base to apex. Length 4 mm.

Distribution.—Europe, California, Oregon, Washington, British Columbia, Idaho, Montana, and Colorado.

The general coloration and short head will distinguish *franciscanus* from most of the other species of the genus.

Kleidocerys ovalis, new species

Head, pronotum anteriorly and scutellum ferrugineous; posterior two-thirds of pronotum and the hemelytra yellow testaceous, the latter translucent, inner vein paralleling the claval suture often ferrugineous; two spots on the disk and three or four along posterior margin of corium fuscous; antennae testaceous, terminal segment fuscous, paler at base.

Head one-third wider than long; preocular part (dorsal view), longer than the remainder, interocular space but little wider than the preocular length; preocular margin almost one-third as long as an eye. Antennae somewhat shorter than head, pronotum, and scutellum combined; basal segment of antenna slightly exceeds apex of tylus, terminal segment about one-third shorter than second. Pronotum nearly one-third wider than long, cicatrices unicolorous, lateral margin of anterior lobe slightly impressed. Scutellum about one-third wider than long, coarsely, sparsely punctate. Corium with the costal margin gently, convexly rounded from base to apex, somewhat longer than head, pronotum, and scutellum combined. Length 5 mm.

Types.—Type ♂, Benton, New Hampshire, Aug. 21, 1934, P. W. Oman; Paratypes, males and females; New Hampshire: 3, same date as type; 1, Glen, Aug. 20, 1934, P. W. Oman; 1, North Conway, Sept. 20, 1912, G. P. Engelhardt; 1, Claremont, July 10, 1911; Maine: 1, Hartland, Oct. 25, 1932; Massachusetts: 1, Cummington, July 21, 1941, A. B. Gurney; Ontario: 1, Gull Lake, June 10, 1921, H. S. Parish; New York: 1, Keen Valley, Essex Co., June 23, 1917, H. Notman; Michigan: 1, Marquette Co., May 11, 1923, H. Notman; Minnesota: 2, South Dakota: 1, So. of Lead, July 22, 1935; P. W. Oman; Utah: 10, Logan Canyon, May-Sept., G. F. Knowlton, T. O. Thatcher, W. P. Nye and D. E. Hardy; 2, Granite, June 26, 1935, G. F. Knowlton; 2, Providence Canyon June 4, 1933, G. F. Knowlton and T. O. Thatcher; 1, Far West, June 3, 1937, G. F. Knowlton and C. F. Smith; 1, Round Valley, Aug. 21, 1925, G. F. Knowlton; 1, Fruitland, July 16, 1935, P. W. Oman; Idaho: 1, Boise, June 14, 1915, A. K. Fisher; Colorado: 2, Ft. Collins, June 15, 1898, E. D. Ball, C. F. Baker; 2, Manitou, June 3, 1879, and Aug. 1885; 1, near Ward, June 29, 1933, H. G. and H. S. Rodeck; 1, Poudre R., June 15, 1883; 1, Platte Canyon, July-Nov. 1927, Oslar; 1, Veta Pass, Aug. 9, 1925, C. J. Drake; 2, Trinidad, Aug. 7, 1925, C. J. Drake; 1, Ft. Garland, Aug. 11, 1925, C. J.

Drake; 1, "Col." P. R. Uhler coll.; CALIFORNIA: 1, Eureka, H. S. Barber; 1, Placer Co.; 1, Camp Baldy, Sierra Madre, June 16, 1921; 1, Siskiyou Co.; 6, Marin Co., Aug. 16, 1937, F. Andre; 1, Smith's Springs, Apr. 19, 1879; 1, Avalon, Catalina Is., Oct. 28, 1908, H. O. Marsh. ARIZONA: 2, Verde Valley, July 11, 1924; BRITISH COLUMBIA: 1, Salmon Arm, Oct. 1, 1933, H. Leech; 1, Saanich Distr. May 3, 1918, W. Downes. All in the collection of the United States National Museum, U. S. N. M. no. 61653.

Paratypes in the Snow Collection, University of Kansas, and unless otherwise noted, collected by R. H. Beamer; NEW HAMPSHIRE: 2, N. Haverhill, Aug. 21, 1934; MICHIGAN: 1, Cheboygan Co., July 23, 1932, J. O. Hottingham; 1, July 26, 1936, L. R. Penner; 1, July 30, 1939, H. B. Hungerford; 1, July 6, 1939, R. I. Sailer; 1, Douglas Lake, Aug. 16, 1929, H. B. Hungerford; IDAHO: 6, Bliss, July 7, 1931. WYOMING: 1, 40 mi. E. Laramie, July 13, 1933; 1, 23 mi. N. E. Bosler, July 13, 1937, C. L. Jackson; UTAH: 1, Barclay, July 2, 1931; 3, Emory, Aug. 16, 1929, and Cedar City, Aug. 13, 1929, P. W. Oman; COLORADO: 3, Glen Haven, July 1916, P. B. Lawson; 1, Mishawanka, July 11, 1937, C. L. Johnson; 1, Pancho Canyon, Larimer Co., B. Moore; 2, Cheyenne Canyon, Colorado Springs, and Manitou, E. S. Tucker; CALIFORNIA: 1, San Jacinto Mts., July 21, 1929; 1 Giant Forest, July 28, 1929; Yosemite Valley, July 10, 1933; OREGON: 2, Grants Pass, July 12, 1935; 11, Dixie, July 8, 1931; WASHINGTON: 1, Republic, Aug. 6, 1921; 4, Toppenish, July 8, 1935.

Distribution.—Canada, New England States, Northern New York, Michigan, South Dakota, Idaho, Wyoming, Utah, Colorado, Washington, Oregon, British Columbia, California, and Arizona.

Ovalis is closely related to *resedae* but its different coloration of antennae and body parts, longer head, narrower hemelytra and longer rostrum will differentiate it.

Kleidocerys modestus, new species

Head ferrugineous; pronotum and hemelytra yellow testaceous, much the color of *franciscanus;* cicatrices concolorous; corium immaculate, translucent; antennae yellow testaceous, basal segment ferrugineous, bases of second and third as well as the terminal segment, fuscous.

Head about one-third wider than long (38x30); preocular length (dorsal view) longer than an eye and about one-third shorter than the interocular space, rather coarsely, confluently punctate. Antennae relatively short, two and one-half times longer than the head, basal segment scarcely exceeds apex of head, second segment twice as long as basal, third about one-fourth shorter than second and the terminal segment subequal to second. Rostrum extended to posterior coxae. Pronotum much wider than long (58x35), less closely punctate than head; posterior margin almost twice as wide as the anterior margin. Scutellum about one-fourth wider than long. Hemelytra rather narrow, about one-fourth wider than across the humeral width of the pronotum, costal margin very gently rounded from base to apex, one-fifth longer than its greatest width. Length: 4 mm.

Types.—Type ♂, Point Reys, Marin Co., California, Aug. 11, 1937, H. G. Barber. Paratypes, males and females: CALIFORNIA: 9, same data as the type; 1, Dalzura, San Diego Co., March 26, 1928; 3, Griffith's Park, Los Angeles, March 30, 1928; 1, Palo Alto, Apr 30, 1928, all collected by H. G. Barber; 2, San Diego Co., Aug. 4, 1913, E. P. Van Duzee; 2, Pasadena, July 30, 1909, Grinnell; 5, Los Angeles Co., Co-Quilette; 2, Paynes, June 27, 1935, P. W. Oman; 6, Three Rivers, June 9, 1935, P. W. Oman; 1, Humboldt, June 18, 1903, H. S. Barber; 5 adults and 6 nymphs from Davenport and 2, Yucaipa, intercepted at inspection house, Washington, D. C., on Rhododendron pods; ARIZONA: 10, Atacosh Mt., E. D. Ball; 4, Oracle, E. A. Schwarz. All in the collection of the United States National Museum, U. S. N. M. no. 61654.

Paratypes in the Snow collection, University of Kansas: CALIFORNIA: 10, San Jacinto Mt., July 21, 1929; 1, San Gabriel Canyon, July 27, 1935; 1, Atascadero, July 19, 1933; 2, Golden Gate Park, July 17, 1933; 2, Sargeant, July 23, 1935; 1, Grant Forest, July 28, 1929; 1, San Diego, Dec. 24, 1941; 1, Dunsmuir, June 29, 1936, all collected by R. H. Beamer; 5, Alameda Co., July 19, 1933, J. Russell; 1, San Antonio Canyon, Aug. 4, 1938, R. I. Sailer; OREGON: 1, Hood River, July 1931; WASHINGTON: 9, Naches, July 7, 1935, R. H. Beamer.

K. modestus is most closely related to *franciscanus* in general character as well as in its geographical distribution. The difference in the fuscous markings, longer preocular part of the head, relatively narrower pronotum and hemelytra, shorter and differently colored antennae will serve to separate it from *franciscanus*.

Distribution.—Washington, Oregon, California, and Arizona.

Kleidocerys dimidiatus, new species

Head, pronotum, and scutellum testaceous in fresh specimens, in part pruinose; introrbital region of head and the pronotal cicatrices fuscous; corium translucent, two discal spots and four along the posterior margin fuscous, the latter connected by a narrow line; antennae testaceous, basal, terminal, base and apex of the second and third segments fuscous.

Head nearly one-third wider than long (32x20); preocular length a little less than the width of the interocular space, much longer than an eye. Antennae twice a slong as pronotum; basal segment about one-third shorter than second, second and third segments subequal, each a little shorter than the terminal segment; proportional lengths of the segments are 12:20-20:23. Rostrum extended to the metasternal coxae. Pronotum nearly one-third wider than long. Scutellum but little wider than long, very sparsely punctate. Corium two and one-half times longer than the pronotum, the costal margin strongly convexly arcuated, much more so than in *resedae geminatus;* each hemelytron but little wider than the pronotum (42:40). Length 3.70 mm.

Types.—Type ♂, Tucson, Arizona, June 30, 1929, E. D. Ball. Paratypes, males and females, 1, with same data as the type; 8, Chiricahua Mts., Arizona, H. G. Hubbard. All specimens in the United States National Museum, U. S. N. M. no. 61655.

Paratypes deposited in the Snow collection, University of Kansas: ARIZONA: 4, Santa Rita Mts. July 2nd and 7th, R. I. Sailer and D. W. Craik; 1, Oak Creek, Aug. 9, 1932, R. H. Beamer; NEW MEXICO: 1, Cloudcroft, June 27, 1940, L. J. Lipovsky.

This species resembles *resedae geminatus* in general facies; besides being much smaller, the antennae are relatively shorter, the pronotum much narrower and the costal margin of corium more strongly arcuated.

Kleidocerys championi (Distant)

Ischnorhynchus championi Distant, 1882, Biol. Cent. Amer., Rhynch., v. 1, p. 193, pl. 19, fig. 3.

Head, pronotum and scutellum ochraceous, punctate with fuscous, in part, more or less pruinose. Pronotal cicatrices narrow, fuscous. Scutellum commonly with a short fuscous fascia or spot at base and the apex pale. Hemelytra translucent, apices of clavi, two spots on the disk and four along posterior margin, fuscous. Antenna ochraceous, with the basal, terminal, base and apex of the second and apex of the third segment fuscous. Femora castaneous with the apices pale.

Head about one-third wider than long, preocular part equal to the remainder (dorsal view) and nearly as long as an eye. Antenna subequal to the length of the head, pronotum and scutellum combined, basal segment not extended quite to apex of tylus, subequal to the preocular part of the head, second segment about twice as long as basal. Rostrum extended behind metasternal coxae. Pronotum much wider than long and about one-third longer than head. Scutellum about one-fourth wider than long. Corium with costal margin gently convexed, nearly equal to the head, pronotum and scutellum combined. Length: 2.50 mm.

Described from Guatemala. Specimens in the United States National Museum are: FLORIDA: 18, from Ft. Pierce and 24, from Vero Beach; 1, collected on eggplant in Florida, 10, from Sanford and 3, from Tampa, E. D. Ball. The Snow collection, University of Kansas has 4 from British Honduras.

This is much the smallest member of the genus with fuscous punctations on a paler surface which is often more or less pruinose; frequently the entire head is fuscous. The preocular part of the head is usually not much longer than an eye.

Dr. R. F. Hussey reports that he has taken this species at Lakeland, Florida, on Goatweed, *Scoparia dulcis*.

Key to Species of Kleidocerys[1]

1. Head but little shorter than pronotum, scarcely wider than long, interocular space wider than the length of the preocular region; preocular margin nearly one-half as long as eye. Membrane short. California .... *obovatus* (Van Duzee)
   Head evidently shorter than pronotum; most often wider than long; preocular margin much shorter 2
2. Preocular region of head, subequal to or but little longer than an eye 3
   Preocular region of head evidently longer an an eye 4
3. Small species, less than 3 mm. long. Color testaceous with fuscous punctations. Antennae scarcely shorter than the length of head, pronotum and scutellum combined. Rostrum extended behind metasternal coxae. Florida, Neotropical region .... *championi* (Distant)
   Larger species over 3 mm. long. Color, yellow testaceous with concolorous punctations. Antennae shorter than head, pronotum, and scutellum combined. Rostrum extended to metasternal coxae. Western United States .... *franciscanus* (Stål)
4. Corium and most often the head and proontum immaculate. Costal margin gently convexed, an hemelytron scarcely wider than head. Basal three segments of antennae most commonly testaceous. Rostrum extended behind metasternal coxae. Arizona, California, Oregon, and Washington .... *modestus*, new species
   Corium most commonly with two discal and three or four fuscous spots along posterior margin 5
5. Commissure very nearly equal to length of scutellum. Head but little wider than long; interocular space but little wider than length of preocular region. Color and maculations of body and color of the antennae much as in *resedae geminatus*. Southern Arizona and New Mexico .... *dimidiatus*, new species
   Commissure evidently shorter than scutellum. Head commonly wider than long. Interocular space much wider than length of preocular region 6
6. Ferrugino-testaceous; intraocular region of head and pronotal cicatrices concolorous; most frequently only the terminal segment of antenna fuscous. New England states west across the northern states to the Pacific .... *ovalis*, new species

---

[1]Body parts measured in horizontal plane.

Ferrugineous; intraocular region of head and pronotal cicatrices heavily infuscated; basal, terminal and apices and bases of second and third segments of the antenna fuscous. Canada, eastern and southern part of the U. S. west through northern states to California, Oregon, Washington, British Columbia and Alaska .... *resedae* (Panzer)

NOTES ON THE BIONOMICS OF THE ALLUAUDOMYIA OF BAKER COUNTY, GEORGIA. I. OBSERVATIONS ON BREEDING HABITATS OF BELLA AND NEEDHAMI

(Diptera, Heleidae)[1]

By Roger W. Williams, *School of Public Health of the Faculty of Medicine, Columbia University, New York, N. Y.*

Johannsen (1943) reports 45 genera of the family Heleidae from the New World. Several of these genera contain haemophagous species while others, although they possess biting mouthparts, have unknown food habits. One such genus is *Alluaudomyia* Kieffer. Wirth (1952) discussed the taxonomy and distribution of this genus in North America and indicated that *Alluaudomyia bella* (Coquillett) and *A. needhami* Thomson had been collected by Dr. R. A. Foote at or near the Emory University Field Station, Newton, Georgia. *A. needhami* was collected on June 9, 1948, and *A. bella* was reared to adults on March 30, 1949.

While the author was investigating the bionomics of the *Culicoides* of Baker Co., Georgia, during the months of August, September, and October 1952,[2] specimens of these two species of *Alluaudomyia* were trapped in adult recovery cages (see Dove, Hall, and Hull, 1932, for structure of cages) and certain preliminary observations were made on their breeding habitats. Traps were placed in three distinct localities, each displaying different ecological conditions, and adults of both species were secured from each locality.

Ichaway-Notchaway Slough.—Near the Emory University Field Station is a cypress slough in a relatively thickly wooded area which fluctuates in water level with that of the Ichaway-Notchaway Creek flowing a few hundred feet away on the far side of a small ridge. In years of normal rainfall, the water level may stand two or more feet deep in the areas where the recovery cages were placed. Both 1951 and 1952 were, however, exceedingly dry years and there was no standing water in the vicinity of the cages when they were placed in posi-

[1]Thanks are due to Miss Jane Wise for technical assistance.

[2]A project of the Communicable Disease Center, U. S. Public Health Service, Atlanta, Ga., and Emory University.

tion on the moist mud on August 22. By the end of the first week in September the water stood at a depth of 6 or 7 inches, where it remained for about two weeks before receding. Between August 25 and October 6, both sexes of *A. bella* were trapped in about equal numbers. At the time the last adults were secured from this area, the water level was about 15 inches below ground level and the ground surface was dry enough to walk upon without boots. A single male specimen of *A. needhami* was trapped bewteen September 16 and 19, during the period when the soil surface was submerged.

No vegetation was growing in the immediate area where the cages were placed. The soil was composed largely of decaying leaves and roots. The morning temperature (at about 9 a.m.) of the top 3 inches of soil fluctuated between 77° F on August 23 and 62° F on October 6, roughly the period during which the adults were being caught. By November 24, the soil temperature had dropped to 49° F. The pH of the soil, as determined by a Hellige Comparator, was 6.7 on September 22, October 23, and November 24.

Mossy Pond.—The water level in this pond is dependent entirely upon rainfall in the immediate area. In 1951 it was completely dry, and in 1952 it contained only from 1.5 to 2 feet of water. The fluctuaiton of water level in 1952, which amounted to several inches, made a considerable difference in the total area covered by water around the pond edge. Recovery cages were placed in areas where *Polygonum setaceum* (water smartweed), *Saururus cernuus* (lizard's-tail), and *Riccia fluitans* and *Ricciocarpus natans* (liverworts) were growing profusely, and where sunlight would fall directly upon them for several hours each day. Some were placed in a few inches of water while others were above the water level. The water receded so that eventually all traps were above the water level.

The morning soil temperature (at about 10 A.M.) 3 inches below the surface ranged from 90° F on August 18 to 61° F on October 20. By November 24 it had dropped to 52° F. The pH of the soil ranged from 5.8 to 6.2 at different cage locations on September 23 and from 5.7 to 6.0 on November 24.

Specimens of *A. bella* were trapped between September 19 and October 16-20 as they emerged from the soil. The sexes were equal in number. One female of *A. needhami* was secured between September 19 and 22.

DeSoto White Springs.—This area, where Hernandez DeSoto and his men are said to have camped for two nights in March 1540, is fed constantly by ground-water flow through a limestone deposit. The water from the spring flows into a thickly wooded area. Traps were placed along the low margins of the stream. Other traps were placed above the stream level, in areas of wet soil fed by a small spring in the side of a hill a few feet away. No vegetation was growing in the areas where any of the cages were placed, although the soil was rich in decaying leaves and roots from many nearby trees and shrubs. The pH of the soil, covered by water from DeSoto White Springs, was 6.8 on September 23 and the temperature 3 inches below ground level was 68° F (roughly 10:30 A.M.). On October 30 and November 24, the pH was the same but the soil temperature had reached a low of 48° F between these dates. The pH of the soil above the streambed was 7.3 on September 23, 7.1 on October 20, and 6.8 on November 24. The temperature of the soil varied between 68 and 49° F between September 23 and November 24. A single female of *A. bella* was caught on September 11 and a single male on October 12, one from stream level and one above stream level. Eight specimens of *A. needhami*, five females and three males, were taken between September 6 and October 12, some from each level.

Summary

Alluaudomyia bella and *A. needhami* were trapped in recovery cages in Baker Co., Georgia, as they emerged from the ground. Specimens of *A. bella* were caught between August 25 and October 12, 1952, and *A. needhami* between September 6 and October 12. Adults of both species had previously been reported from this area, *A. bella* in March and *A. needhami* in June.

Both species were found breeding in three types of habitats which exhibited the following ecological variations: a.) areas of permanent flowing water to areas of temporary water, the soil of the latter dry enough to walk upon; b.) soil supporting a dense growth of vegetation to areas where no vegetation was growing; c.) sunny areas with a maximum soil temperature of 90° F, to shady areas having a maximum soil temperature of about 80° F; and d.) soils ranging in pH from 5.7 to 7.3.

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Wirth, Willis W., 1952. The genus *Alluaudomyia* Kieffer in North America. Ann. Ent. Soc. Amer. 45: 423-434.

A NEW SPECIES OF BITING MIDGE FROM JAPAN

(DIPTERA, CERATOPOGONIDAE)

BY MASAAKI TOKUNAGA[1] AND YUKIO SHOGAKI[2]

During the course of a survey of biting flies initiated in April 1952 by the Far East Medical Research Unit, a number of species of biting midges were encountered in light trap collections at Kyoto, Honshu, Japan. Collections were made in the vicinity of Midoro Pond, on the outskirts of Kyoto, throughout the season from May to November by the junior author and Joe M. McClendon.[3] In addition to the new *Culicoides* herein described, the following species were encountered: *Culicoides arakanae* (Arakawa), *C. erairai* Kono and Takahashi, *C. kibunensis* Tokunaga, *C. oxystoma* Kieffer, *C. sigaensis* Tokunaga, *Forcipomyia metatarsis* Tokunaga, and a species of *Dasyhelea*. Identifications of all the midges collected were made or confirmed by the senior author.

The present paper includes a description of the adult female of the new *Culicoides* and brief notes on its collection. The illustrations were made by scientific illustrators of the Taxonomic Entomology Section, 406th Medical General Laboratory, at Kyoto. Logistical support for the survey work and the preparation of illustrations was furnished by the U. S. Army Hospital, Kyoto, 8164 Army Unit.

Culicoides pictimargo, new species

A medium-sized dark species with pruinose mesonotum and wings with several marginal white spots.

Female.—Body length about 1.8 mm. Wing 1.4 mm. by 0.6 mm. Head dark brown; eyes very narrowly separated by a distance about as wide as the diameter of a facet. Clypeus with three pairs of marginal setae. Antennae, figs. 2-4, brown, but basal short flagellar segments pale on basal half; antennal ratio about 1.5, relative lengths of distal eight segments 9:9:9:19:20:21:21:28, ultimate segment without distinct stylet. Palpal segments, fig. 6, in proportion of 4:12:18:6:6; third segment distinctly swollen, with very large sensory pit of *verbosus* subtype.

Mesonotum, fig. 5, reddish dark brown; scutum with mat-like brown pruinescence; caudo-scutal area with gray pruinescence and a pair of dark spots; scutellum dark. Legs brown, with pale yellow rings before and beyond dark knee-joints; tibiae extensively dark brown on middle part.

Wings, fig. 1, with macrotrichiae long and rather dense, except just above and below M_1, before cross-vein r-m and above and below stem of medio-cubital fork. Small pale spots distinct along margin as fol-

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[1]Professor of Entomology, Saikyo University, Kyoto, Japan.

[2]Adviser, Entomology Section, Far East Medical Research Unit 8003rd Army Unit, APO 500, San Francisco, Calif.

[3]Sergeant, First Class, Far East Medical Research Unit.

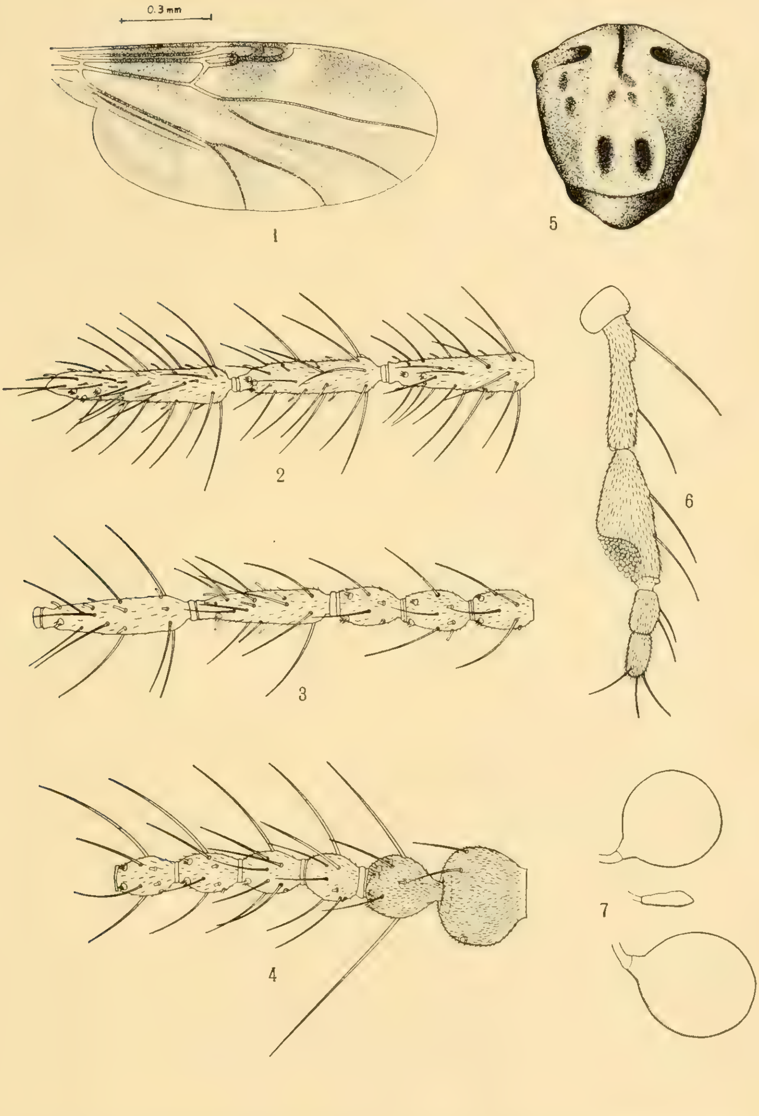

Fig. 1, *Culicoides pictimargo*, female, wing; figs. 2-4, antenna; fig. 5, mesonotum; fig. 6, maxillary palpus; fig. 7, spermathecae.

lows: First spot at r-m narrow and extending just beyond median vein, second spot not covering second anterior radial cell, third spot at extreme tip of cell R_5, semicircular spot at tip of cell M_1 and M_2, somewhat elongated semicircular spot at tip of cell M_4, a small spot under medio-cubital fork, a semicircular spot along anal margin before Cu_1. In addition to these distinct marginal spots there are several obscure light markings as follows: Small oval spot at base of cell M_1, linear light areas along both sides of vein M_1, a faint linear light marking arising from light wing base and extending longitudinally between veins M and Cu_1, a small longitudinal spot at basal area of anal cell. Halteres brown.

Abdomen dark brown on dry specimens and pale brown and with dark clouds on lateral membranes on specimens preserved in alcohol; tergal sclerite reduced to small paired and a small median plates; sternal sclerite reduced to small paired plates.

Spermathecae, fig. 7, two, spherical, slightly unequal, each with a very short sclerotized duct; rudimentary spermatheca tubular.

Male.—Unknown.

Types.—Holotype and 9 ♀ paratypes, Midoro Pond, Kyoto, August 1952. Holotype and 5 paratypes deposited in United States National Museum; 2 paratypes in collection of senior author and 2 paratypes in the collection of the junior author.

This species is very closely related to *C. verbosus* Tokunaga from Formosa, but differs in the following points: Eyes not contiguous, wings longer and with more distinct light spots; spermathecae spherical.

Biological note.—Thirty-nine female adults of this species were collected in a light trap from August 9 to September 27, 1952 on the outskirts of the northern section of the city of Kyoto. The greatest number of adults of *C. pictimargo* attracted to light was in the latter part of August. This tendency is also shown in the case of *C. arakanae*, *C. oxystoma*, and *C. erairai*.

The life history and habits of *pictimargo* are unknown.

The dates of collection of *C. pictimargo* by light trap are as follows (all specimens taken in 1952): Aug. 9, 11 ♀; Aug. 16, 4 ♀; Aug. 23, 1 ♀; Aug. 30, 15 ♀; Sept. 13, 5 ♀; Sept. 20, 2 ♀; Sept. 27, 1 ♀.

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TAXONOMY AND HOST RELATIONS OF THE TRIBE ORMIINI IN THE WESTERN HEMISPHERE, II

(DIPTERA, LARVAEVORIDAE)[3]

BY CURTIS W. SABROSKY, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.*

Genus **Euphasiopteryx** Townsend

1915. *Euphasiopteryx* Townsend, Proc. Biol. Soc. Wash. 28:23. Two species; type, *Phasiopteryx australis* Tns. (1911, 1912), by original designation.

1927 (1926?). *Euphasiopteryx* Tns.; Townsend, Revista Mus. Paulista 15:223. [In key.]

1929. *Ormia?;* Malloch, Ann. & Mag. Nat. Hist., ser. 10, 3:279. [Doubts propriety of separating *Euphasiopteryx* from *Ormia.*]

1936. *Euphasiopteryx* Tns.; Townsend, Manual of Myiology 3:101. [In key to genera of Ormiini.]

1938. *Euphasiopteryx* Tns.; Townsend, Manual of Myiology 7:231. [Description of genus, female internal genitalia, and first-stage larva.]

KEY TO EUPHASIOPTERYX

1. Epaulet yellow, concolorous with subepaulet 2
   Epaulet black 5
2. Abdominal segments 2 to 4 each with a pair of strong median marginal bristles, but without discals; all leg bristles black; male with weak, scarcely evident costal callosity basad the apex of second vein .... 8. *E. reinhardi,* new species
   At least second abdominal segment (apparent first segment) without median marginals, and one or two pairs of discal bristles on segments 3 and 4 3
3. All leg bristles black .... 9. *E.* sp. or spp.
   Tibial bristles yellow 4
4. Propleural and stigmatal bristles surrounded by inconspicuous pale yellow hairs; female front relatively narrow, less than width of eye, and at vertex less than one-third width of head

[3]Part I appeared in the August 1953 issue of the *Proceedings,* vol. 55, pp. 167-183.

(.26 to .31); parafrontals narrow, their greatest width 1.4 to 1.7 times the greatest breadth of third antennal segment
........................10. *E. brevicornis brevicornis* (Tns.)

Propleural bristle accompanied by a weaker black accessory bristle; stigmatal bristle generally surrounded by conspicuous, brown to blackish hairs; female front broad, obviously wider than an eye and at vertex approximately 2/5 width of head (.35 to .43); parafrontals broad, their greatest width 2 to 2.5 times the greatest breadth of third antennal segment ....
........................10. *E. brevicornis nuttingi*, new subspecies

5. Males (see discussion under "*Euphasiopteryx* with black epaulet.") The two species known only from the male sex may be separated as follows:

   5a. Narrowed distal portion of the fused inner forceps sharply bent posteriorly........................13. *E. depleta* (Wied.)

   5b. Narrowed distal portion of inner forceps straight or nearly so ....14. *E. ochracea* (Bigot)

Females (also see discussion under same heading as males)[4]........ 6

6. Front narrow, obviously less than width of an eye, at vertex about one-fifth (.13 to .23) the width of head, and but little wider at level of lowest orbital (.16 to .34); parafrontals relatively narrow throughout, only slightly wider opposite lunule, and generally narrower than frontalia measured at level of lowest orbital (*E. tarsalis* also comes here, but cannot be placed farther)........ 7

Front broader, at vertex one-fourth to one-third (.23 to .34) times the width of head, and at level of lowest orbital .36 to .53 times the head width; parafrontals often greatly widened anteriorly, and much wider than frontalia 8

7. Parafacials with distinct black hairs extending below frontal bristles at least to a point opposite base of arista, and usually opposite middle of third antennal segment........................
........................11. *E. dominicana* (Tns.)

Only a few pale yellow, scarcely noticeable hairs below frontal bristles, extending at most to point opposite middle of second antennal segment ....12. *E. guianica* (Curran)

8. Parafacials with distinct black hairs to or below a point opposite apex of third antennal segment ....13. *E. depleta* (Wied.)

Parafacials bare, occasionally a very few hairs above, opposite the second antennal segment and base of arista........................ 9

9. See main discussion under *E. ochracea*. The following species come here:

   14. *E. ochracea* (Bigot)—Southern U. S. and Mexico; possibly also West Indies and Central America.

   15. *E. australis* (Tns.)—Peru.

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[4]Species omitted from key: 18. *E. pellucida* (Séguy), and 19. *E. tarsalis* (Séguy).

16. *E. aldrichi* (Séguy)—French Guiana.
17. *E. nocturna* (Curran)—British Guiana.

8. **Euphasiopteryx reinhardi**, new species

1910. *Oestrophasia ochracea* (Bigot) Smith, Insects of New Jersey, p. 777 (New Jersey State Museum, Ann. Rept. for 1909). [Lahaway, N. J., spm. now in MCZ; Orange Mts. spm. unknown to me and may not belong here.]

Epaulet yellow, a pair of strong median marginal bristles but no discals on abdominal segments 2 to 4, all leg bristles black, and very weak callosity on costa.

Female.—Entirely yellow to testaceous, except for black bristles, blackish spot at small crossvein, and some infuscation on veins in the area of basal and anal cells. Front of moderate width, at the vertex .32, and at the lower orbitals .405 times the width of the head; each parafrontal ⅔ the width of frontalia; two pairs of strong proclinate orbital bristles; parafacials bare, rather broad, each nearly twice the breadth of third antennal segment. Mesonotal bristles strong, three pairs each of presutural dorsocentrals and acrostichals; mesonotal hairs black and sparse, pleural hairs principally yellow to brownish; one strong propleural with a weak accessory bristle below at its base; one strong stigmatal, surrounded by short, pale yellow hairs; filter apparatus of posterior spiracle greatly reduced, the posterior valve slender, with short fringe, and anterior marginal fringe short. Abdomen characteristic, with a pair of strong, erect median marginal bristles on each of segments 2 to 4, the median pair on the fourth well separated from the lateral bristles. Wing with first vein ending in costa opposite the small crossvein, apical cell open, and angle of fourth vein with short appendage.

Male.—Color, general structure and chaetotaxy as in female. Front narrow, .05 times the head width, at most subequal to distance across posterior ocelli, the linear parafrontals almost touching at the narrowest point. Wing with barely evident callosity on costa between apices of first and second veins, and nearest the latter, the two rows of costal setulae slightly separated and the area darker.

Length, 7 to 7.5 mm.

Types.—Holotype female, Amherst, Ohio, July 20, 1935 (H. J. Reinhard.) Type No. 61736 in the U. S. National Museum, deposited through the courtesy of Professor Reinhard. Allotype, Lahaway, New Jersey, July 5 (C. W. Johnson) [MCZ]; Paratype, male (abdomen missing), S. Georgia (Morrison) [USNM; basis of Georgia record of *ochracea* by Coquillett 1897, p. 71.]

The presence of strong median marginal bristles on the second abdominal segment (apparent first segment) is unique among the known Ormiini.

I am pleased to dedicate this species to Professor Reinhard, who has contributed so much to the study of American Muscoid Diptera, and who has provided much interesting material for this study.

9. Euphasiopteryx sp. or spp.

Two females (Kits Peak, Rincon, Baboquivari Mts., Ariz., Aug. 1-4, 1916, about 4050 ft., in AMNH) agree well with the type of *E. brevicornis* except in having black leg bristles, slightly wider front (.32-.35 times the head width, similar to *brevicornis nuttingi*), and slightly longer third antennal segment (1.4 and 1.3 times the second segment). One male (Klamath Falls, Oregon, July 1, 1935 (R. H. Beamer) in KU) is similar to males of *brevicornis* but has all black leg bristles and slightly wider front. It is possible that these represent distinct species, or subspecies of *brevicornis*, but until further material is available to evaluate the differences and to associate the sexes, I do not choose to describe them in this difficult group.

10. Euphasiopteryx brevicornis (Townsend), new combination

1897. *Œstrophasia bilimekii* (B. & B.) Coquillett, U. S. Dept. Agriculture, Div. Ent., Tech. Ser. Bull. 7:71 (Revision of Tachinidae). [Texas; this specimen, bearing B.B. label *Phasiopteryx Bilimekii*, became holotype of *brevicornis*.]

1919. *Ormia brevicornis* Townsend, Proc. U. S. Nat. Mus. 56:548. [Texas; female, in USNM; note on first-stage maggot.]

1934. *Ormia brevicornis* Tns.; Curran, Bull. Amer. Mus. Nat. Hist. 66: 495. [In key.]

1938. *Ormia brevicornis* Tns.; Townsend, Manual of Myiology 7:235. [Note on first-stage maggot.]

Although Townsend continued to place the species in *Ormia s. str.*, the holotype lacks ocelli and has yellow epaulet, and accordingly does not agree with that genus as Townsend himself defined it.

The species is entirely yellow to testaceous, with black bristles except on the tibiae; no median marginal bristles on second (apparent first) abdominal segment and one or two pairs of discal bristles on third and fourth segments; wing of male without callosities on both costa and second vein. The original description stated that the third antennal segment is ''no longer than the second,'' but by actual measurement it is one and one-quarter times as long in the holotype. I have seen no other specimens with as short a third segment, but from the considerable range (1.375 to 2 times), I conclude that the type is merely an extreme example. Of the 23 specimens before me (6 males, 17 females), only two have the angle of fourth vein rounded and without appendage, only one has strong preapical antero- and posteroventral bristles on the mid femur, and the apical cell varies from rather widely open to closed and very short petiolate.

Certain differences seemed apparent between specimens from northern (especially northeastern) United States and those from Texas. An analysis of a number of features revealed that in several respects, the two series can be distinctly characterized, except for two intermediate specimens. It is therefore proposed to regard these samples as representing two subspecies distinguished by the characters given in the key, and based upon the following material:

E. brevicornis brevicornis (Tns.): TEXAS: 1 ♀, "Texas" (Belfrage), holotype; 2 ♀, "Texas," Aug. 28 and 29, 1940; 1 ♂, Victoria, Aug. 18, 1915 (J. D. Mitchell) [USNM]; 2 ♀, "Texas" (?Belfrage); 1 ♀, Blanco County [MCZ]; 2 ♀, "Texas," Aug. 30 and 31, 1940 [AMNH]; 1 ♂, 1 ♀, Forestburg, Montague County, Aug. 20, 1940 ([Reinhard Colln.]. The Victoria male has a linear front, whereas in the Forestburg male the eyes are distinctly separated and the frontalia at is narrowest is as wide as the ocellar tubercle. This may represent variation, or it may mean that still another species or subspecies is involved.

E. brevicornis nuttingi, new subspecies: Holotype male, allotype, and two ♂ paratypes, East Brewster, Mass., emerged Aug. 17, 1952 (pupated Aug. 5), from adult *Neoconocephalus robustus* (Scudder) collected Aug. 3, 1952 (W. L. Nutting). Type and allotype in the Museum of Comparative Zoology, paratypes in the U. S. National Museum. Paratypes: 1 ♀, East Brewster, Mass., emerged Mar. 10, 1952 (pupated Aug. 22, 1951), from adult *N. robustus* collected Aug. 21, 1951 (Nutting) [USNM]; 1 ♀, Upper Montclair, N. J. (A Nicolay); 1 ♀, Effingham, Kan., July 1900 [MCZ]; 1 ♂, Orient, Long Island, N. Y., July 20, 1932 (Roy Latham) [AMNH]; 1 ♀, Diggs P. O., Mathews County, Va., Aug. 13, 1914 (R. C. Shannon) 1 ♀, Plummer's Island, Md., July 30, 1919 (Schwarz and Barber, at light) [USNM].

In addition to the characters given in the key, *nuttingi* usually has the basal portion of the wing, proximad the basal crossveins, more conspicuously infuscated than in typical *brevicornis*, and the posterior valve of filter apparatus on hind spiracle is longer and more slender.

I take pleasure in naming this subspecies after Dr. Nutting, who has added an important link to the accumulating chain of evidence that this group of flies regularly parasitizes Orthoptera.

E. brevicornis (intermediates); 1 ♀, College Station, Texas, June 21, 1946 (H. J. Reinhard) [Reinhard Colln.]; 1 ♀, Dickinson, Texas, June 1929 [MCZ]. The width of the front is intermediate, being a trifle less than .33 times the width of head. The black accessory propleural bristle is present on only one side in each specimen. The parafrontals of the two are 2.02 and 2.25 times the width of their third antennal segments.

EUPHASIOPTERYX WITH BLACK EPAULET

Accepting *montana* Tns. as a synonym of *ochracea* Bigot, we have still to deal in this group with nine described species. Of these, seven were described from and are known positively only from females, one (*ochracea*) is fairly common and known from both sexes, and one (*depleta*) is known from the type male and a few other specimens of both sexes.

Males.—The male type of *depleta*, and three other males which are apparently conspecific, are distinguished by having the narrowed distal portion of the fused inner forceps sharply recurved posteriorly. In all other ormiine species of which males are known to me (*Euphasiopteryx ochracea*, *E. brevicornis*, *E. reinhardi*, *Ormia punctata*, *O. bilimekii*, *O. lineifrons*, and *O. wolcotti*), the narrowed distal portion is straight or nearly so.

Aside from a long series of *ochracea*, and the four males of *depleta* noted above, I have before me 12 males (Cuba to Paraguay) and all are remarkably similar. All have straight inner forceps like *ochracea* and its allies. There is a slight difference in the width of the front, some having a linear front with frontal vitta obliterated above, as in *ochracea*, and others having the frontal vitta visible throughout its length, though still quite narrow, as in the male of *depleta*. All but one have a moderate callosity on the costa between the apices of first and second veins, the other having a slight callosity on second vein also. One cannot be sure whether there are only a few widely distributed Neotropical species, or whether there are many species and the males will prove to be particularly difficult to distinguish. There is no advantage in describing these various forms unassociated with females, hosts, or adequate material.

Of this group of species with black epaulet, only two are known to me to occur in the United States, one of them being the fairly common *E. ochracea* (Bigot) (= *montana* Tns.). As for the second species, known from two females from Biscayne Bay and Hollywood, Florida, which appear to be *E. dominicana*, the male is unknown and accordingly no key can be offered at this time.

Females.—A prolonged study of nearly one hundred females that come to this point in the key, including the holotypes of five nominal species, has failed to reveal characters that can be depended upon for recognition of species, especially in the Neotropical Region. Two of the forms, *dominicana* and *guianica*, appear distinct from the others because of extremely narrow front and parafrontals, and they have accordingly been separated in the key on that basis. However, barely over a half dozen specimens are known, and one cannot rely on the mean or range of variation.

The major part of the series is composed of females from southern United States, especially Texas, with a rather uniform habitus of extremely wide front. This species is accepted as *E. ochracea* (Bigot) (= *E. montana* Tns.), and enough material is available to allow a statement of certain quantitative characteristics. Only one other distinct form, the narrow-fronted *E. dominicana*, has been identified from the

United States, and consequently couplet 6 will serve adequately as a key to our known species.

Neotropical material is limited and of diverse origin, and except perhaps for *depleta* I have been unable satisfactorily either to distinguish specific or subspecific populations or to define the already described "species" from the material before me. Some differences are suggested, such as the generally narrower front and parafrontals in Central American material, but there are exceptions which may indicate either a mixture of species or wide range of variation. Several females with broad parafrontals and parafacials have numerous black hairs on the parafacials, and on this basis they have been identified here as the female of *E. depleta*. Other Neotropical specimens with broad parafrontals and bare parafacials cannot be differentiated surely from Nearctic *ochracea*, and indeed, the latter may extend its range southward a distance as yet undetermined. Certainly at least two species are involved, however, because Townsend showed distinct differences in the first-stage maggots of *australis* from Peru and *ochracea*.

In this complex, in both males and females, it is certainly wisest to bide our time until adequate materials allow a clearer insight, rather than to multiply the difficulties by describing individuals from obviously variable populations.

I have not personally examined the types of Séguy's three species (*tarsalis, pellucida, aldrichi*) which fall in this group, and cannot be sure of their status. However, I may comment that the variation in the long series of *ochracea* and in smaller series of other species, indicates that the characters used by Séguy in his key (1925, Bull. Mus. d'Hist. nat. Paris 31:440) are variable and unreliable as specific criteria.

11. **Euphasiopteryx dominicana** (Townsend), new combination

1919. *Ormia dominicana* Townsend, Proc. U. S. Nat. Mus. 56:548. [Santo Domingo; 3 females, USNM; note on first-stage maggot.]

1938. *Ormia dominicana* Tns.; Townsend, Manual of Myiology 7:235. [Note on first-stage maggot.]

1942. *Ormia dominicana* Tns.; Townsend, Manual of Myiology 12:325, and plate 28, fig. 225. [Head of first-stage maggot.]

The species is referred to *Euphasiopteryx* because of the absence of ocelli. No holotype is specifically cited in the original publication, though the specimens are labeled "Type" and two "paratypes" in the collection, and they may be accepted as such by some workers. To obviate any further doubt, I hereby designate as lectotype, and have so labeled, the female which bears the red label "Type No. 22269 U. S. N. M.," Townsend's determination label, and also his label "TD 4434," indicating that this specimen was dissected to obtain the first-stage maggots.

The species, like *E. guianica* (Curran), is characterized by its extremely narrow front. In the limited material before me, I can find no differences between *dominicana* and *guianica* except in the development of parafacial hairs, and even this difference must be used with caution until much more material demonstrates whether or not it is a valid distinction. There is a pattern of four dark reddish, interrupted mesonotal stripes in *dominicana*, especially noticeable in the type series, but inasmuch as this appears darker in greasy specimens and pale and unnoticeable in somewhat general specimens, it is probably not a very significant point, or at least not very usable.

In the type series, the width of front at vertex is .21 to .22 times, and at the lowest orbital .30 and .33 times, the width of the head. Each parafrontal is about ¾ the width of the frontalia. In other specimens recorded below, the ratios are similar, with one specimen much narrower and one a trifle broader (Hollywood, Fla. example: head ratios .14 and .165; a Guatemala specimen: .23 and .35).

In addition to the type series, the following specimens, all females, appear to belong here [all USNM except Hollywood, Fla., spm. from KU]; FLORIDA: Biscayne Bay (Mrs. Slosson); Hollywood, March 2, 1939 (W. Benedict) [latter with dark spots, but believed to be only an extreme form of *dominicana*.] CUBA: Pan de Matanzas Mt., June 12, 1932 (Bruner, Otero, Scaramuzza). PANAMA: Pan de Azucar, Oct. 10, 1952 (F. S. Blanton, at light). CANAL ZONE: Ft. Sherman, Jan. 30, 1952 (F. S. Blanton, at light). GUATEMALA: two, Volcan Sta. Maria (Schaus & Barnes).

Two females from Texas [Brownsville, March 19, 1948 (D. E. Hardy), in USNM, and Cameron County, Aug. 3, 1928 (R. H. Beamer) in KU] have the front at vertex slightly wider, and dark hairs well down on the parafacials. Again, the limited material is only suggestive of species yet unrecognized.

For *Ormia dominicana* as recorded from Puerto Rico by Curran (1931), see *O. wolcotti*, new species.

12. **Euphasiopteryx guianica** (Curran), new combination

1934. *Ormia guianica* Curran, Bull. Amer. Mus. Nat. Hist. 66:495 (in key), 496. [British Guiana; female, in AMNH.]

The holotype, kindly loaned for study by Dr. Curran, differs from that of *E. dominicana* by the character listed in couplet 7 of the above key, and also in the relative widths of parafrontals and frontalia, these being subequal in *guianica* but the former only ¾ the frontalia in *dominicana*. However, other specimens of both, if I have correctly associated them, show variation in this character. Both species run directly to *guianica* in Curran's key. Material is limited, and it remains to be seen whether the key character will prove to be reliable.

Besides the holotype of *guianica*, I have seen only two other specimens which can be referred to the species, a female without locality label, "May, S. W. Williston Collection" [AMNH], and a female, Tumatumari, Rio Potaro, British Guiana, April, 1912 [Acad. Nat. Sci. Phila.]

In addition to the characters noted in the original description, I may record from the holotype that the ocelli are absent; width of front at vertex .23 times, and at the lowest orbital .31 times the width of the head; only a few pale yellow, scarcely noticeable hairs immediately below the frontal bristles; parafacials narrow, at their narrowest point less than the breadth of third antennal segment; the latter 1.75 times the length of second segment; one propleural and one stigmatal bristle, each surrounded by coarse conspicuous black hairs, on one side a short weak bristle below at base of propleural; no median marginal bristles on second and third (apparent first and second) abdominal segments, and no discals on third and fourth segments; epaulet black; apical cell narrowly open, almost at apex of wing; bend of fourth vein forming a right angle, short appendiculate.

13. Euphasiopteryx depleta (Wiedemann)

1830. *Tachina depleta* Wiedemann, Aussereurop. zweifl. Insekten, 2:298. [Brazil; male, now in Vienna Museum.]

1889. *Phasiopteryx depleta* (Wied.) Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien. pt. 4:79; 1890, Denkschr. Akad. Wiss. Wien., Math. -Nat. Classe 56: 147. [Generic reference, though actual combination not made in print.]

1891. *Phasiopteryx depleta* (Wied.) Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien. pt. 5:84, 108, 123 (1891, Denkschr., etc. 58:388, 412, 427. [keyed from *P. Bilimekii.*]

1893. *Phasiopteryx depleta* (Wied.) Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien, pt. 6:95, note 23 (1893, Denkschr., etc. 60:183. [Suggests *Myobia ochracea* Bigot as synonym of *depleta.*]

1931. *Euphasiopteryx depleta* (Wied.) Townsend, Revista Ent. 1:81. [Notes on type in Vienna Museum; claimed to recognize specimens from French Guiana and Pará, Brazil.]

1936. *Euphasiopteryx depleta* (Wied.) Townsend, Manual of Myiology 3:101. [Mention.]

1940. *Euphasiopteryx australis* (Tns.) [misident.] Wolcott, Jour. Econ. Ent. 33:202. [Parasite of changa or mole-cricket, *Scapteriscus vicinus* Scudder.]

1945. *Euphasiopteryx australis* (Tns.) Callan, Tropical Agriculture 22(8):146-149. [Repeats record of Wolcott.]

1950. *Euphasiopteryx australis* (Tns.) Wolcott, Jour. Agric., Univ. Puerto Rico 32(1):58. [Parasite of changa in northern Brazil; two percent of large adults parasitized under favorable conditions; twice introduced into Puerto Rico, but not established.]

1951. *Euphasiopteryx australis* (Tns.) Wolcott, Jour. Agric., Univ.

Puerto Rico 32(3):476. [One to five percent parasitism of changa in Brazil.]

The male holotype of *depleta* was borrowed for study through the kindness of Drs. M. Beier and H. Mayer of the Vienna Museum. It belongs in the group with black epaulet, and like most of the males in *Euphasiopteryx* it has a callosity on the costa but not on the second vein. Unlike most males of the genus, however, it has two unique features in the posteriorly curved apex of the fused inner forceps and the distinctly haired parafacials.

Wolcott (see references above) reported on a parasite of the changa or mole-cricket, *Scapteriscus vicinus*, as "*Euphasiopteryx australis*," but males from his material show that he was actually dealing with *depleta*, a species whose status has long remained unclarified. Males of true *australis* from Peru are unknown to me, and I cannot be sure that the genitalic difference between *depleta* and other species as used in the key will also distinguish *depleta* from *australis*. Pending that information, however, the presence of parafacial hairs in the former should separate the two species as well in the males as it does in the females.

For future reference, the following additional description of the type may be noted: Entirely yellow to testaceous except for black epualets, bristles, most hairs, and the small crossvein. Front narrow, .07 times the width of the head, the parafrontals not touching and the frontalia visible throughout; frontal bristles weak, extending one or two below the base of the antennae; each parafacial relatively broad, at its narrowest slightly wider than the breadth of third antennal segment; facialia strongly broadened opposite the vibrissae and below, with numerous strong setae; epistoma elongate, extending well below the vibrissae; head much higher than long, by 1.7 times, the cheeks broad, .44 times the height of an eye and .31 times the height of the head; occiput with one row of black hairs behind the eyes, the rest of the hairs yellowish; third antennal segment twice the length of the second; arista moderately long pubescent.

Mesonotum dull yellow; thoracic chaetotaxy as in *ochracea* and other species, except for extra presutural acrostichals and dorsocentrals; propleural and stigmatal bristles surrounded by black hairs, the propleural also with a much weaker bristle below it. Abdomen without bristles anteriorly, with a row of marginal bristles on the fourth segment (apparent third), and two irregular rows of bristles on the fifth, which may be interpreted either as two rows of discals or as one of discals and one of marginals somewhat removed from the margin. Wing approximately as in *ochracea*, this specimen having a very short appendage at bend of fourth vein.

In addition to the holotype, I have seen the following specimens [all in USNM]: Brazil: 2 ♂, Belem, Pará, January 1945 (G. N. Wolcott, reared from changa); female, Bahia, 1929 (R. C. Shannon); female, Viçosa, Minas Geraes, Nov. 10, 1932 (E. J. Hambleton); 1 ♀, Maracajú, Matto Grosso, August 1937. HONDURAS: 1 ♂, Puerto Castilla, May 6, 1926 (R. H. Painter). PERU: female, Tingo Maria, November 1947 (Weyrauch).

The Honduran and Peruvian localities are far distant from Brazil, but the specimens agree with *depleta* as I understand it at present. The Honduran male does show a slight difference in the lateral marginal bristles of the third abdominal segment (3 or 4 compared with one in typical *depleta*) which may have some significance and should be watched for.

14. Euphasiopteryx ochracea (Bigot)

1888. *Pyrrosia ochracea* Bigot, Ann. Soc. Ent. France, ser. 6, 8:268. [Mexico; 3 specimens (J. E. Collin Colln.); mixed series, see discussion.]

1891. *Phasiopteryx bilimeki* B. & B.; Van der Wulp, Biologia Centrali-Amer., Dipt. 2:211. [Female cotype of *ochracea*, loaned by Bigot, referred to *bilimeki*.]

1891. *Phasiopteryx Bilimekii* B. & B.; Brauer and Bergenstamm, Zweifl. Kais. Mus. Wien, pt. 5:120 (1891, Denkschr. Akad. Wiss. Wien, Math.-Nat. Classe 58:424). [Lists *ochracea* Bigot as synonym of *Neoptera rufa* Wulp, teste Van der Wulp, and both as synonyms of *Bilimekii*.]

1893. *Phasiopteryx depleta* (Wied.) Brauer and Bergenstamm, Zweifl. Kais. Akad. Wien, pt. 6:95, note 23 (1893, Denkschr., etc. 60: 183). [*Myobia ochracea* Bigot appears to equal *depleta*.]

1897. *Phasiopteryx ochracea* (Bigot) Brauer, Sitzber. Akad. Wiss. Wien, Math.-Nat. Classe 106:42. [Related to *depleta*, but smaller.]

1897. *Œstrophasia ochracea* (Bigot) Coquillett, U. S. Dept. Agriculture, Div. Ent., Tech. Ser. Bull. 7:71. [Generic reference; Texas and Colorado; for the Georgia spm. see *E. reinhardi*, n. sp.]

1905. *Œstrophasia ochracea* (Bigot) Aldrich, Catalogue N. Amer. Diptera, p. 439. [Listed.]

1906. *Œstrophasia ochracea* (Bigot) Crevecoeur, Trans. Kansas Acad. Sci. 20:93. [Onaga, Kansas; spm. now in USNM.]

1911. *Phasiopteryx* sp.; Townsend, Annals Ent. Soc. Amer. 4:136. [Colorado, female; description of first-stage maggot and internal characters of female.]

1912. *Phasiopteryx montana* Townsend, Jour. New York Ent. Soc. 20:114. [Colorado; female, in USNM; description chiefly of characters of first-stage maggot, same spm. as Townsend, 1911.]

1915. *Euphasiopteryx montana* (Tns.) Townsend, Proc. Biol. Soc. Wash. 28:23. [Generic reference, though actual combination not made in print.]

1922. *Oestrophasia ochracea* (Bigot) Greene, Proc. U. S. Nat. Mus. 60 (Art. 10): 5 (in key), 13 (descr. of puparium), fig. 12. [Figured specimen was puparium of male, Dallas, Texas, Oct. 10, 1914 F. C. Bishopp), in USNM, data not published.]

1934. *Ormia ochracea* (Bigot) and *Ormia montana* (Tns.) Curran, Bull. Amer. Mus. Nat. Hist. 66:495. [In key.]

1936. *Euphasiopteryx ochracea* (Bigot) and *E. montana* (Tns.) Townsend, Manual of Myiology 3:101. [Maintained as distinct species.]

1942. *Euphasiopteryx montana* (Tns.) Townsend, Manual of Myiology 12:324, and Plate 27, figs. 220, 220A; Plate 43, fig. 221. [Figs. of maggot from female holotype.]

Bigot's three-line description, said to be based on two males and a female from Mexico, gave nothing of importance for recognition. Van der Wulp (1891) saw a female cotype loaned him by Bigot and declared it was conspecific with female *bilimekii*, but he knew nothing of the rest of the series or the males. Brauer and Bergenstamm (1893) noted that because of the slight difference in wing venation between male and female wings, "scheint *Myobia ochracea* Big. zu *Ph. depleta* Wd. zu gehören." Later, Brauer (1897) reported on the cotypes of *ochracea*, loaned by Verrall, and referred them to *Phasiopteryx*, related to *depleta* but smaller. He found that there were actually one male and two females.

I am indebted to Mr. J. E. Collin, the present owner of the Bigot types, for detailed information on certain characters not brought out by previous authors. The male, which is the only one bearing a locality label "Mexique," lacks ocelli and has a black epaulet, distinctly pubescent arista, apical cell widely open, front narrow (only a little wider than the ocellar tubercle), and a swelling on the costa beyond the end of first vein, but not on second vein. These characters indicate that the male is the species of *Euphasiopteryx* which has been customarily identified as *ochracea*. The two females, however, have ocelli present, epaulet black, apical cell broadly open, each parafrontal nowhere wider than frontalia, and two strong stigmatal bristles. These features clearly indicate the species of *Ormia s. str.* here recognized as *O. bilimekii* (B. & B.)

In order to fix the status of *ochracea*, I hereby designate the male specimen as lectotype and restrict the name to the species which it represents.

Euphasiopteryx ochracea, while variable in certain quantitative respects, nevertheless displays a remarkably homogenous habitus. Both sexes are yellow to testaceous, with black bristles and black epaulet; one propleural bristle, with a shorter and weaker accessory bristle immediately below it; one stigmatal bristle, surrounded at its base by a number of long blackish hairs. In the males, the front is extremely narrow, with parafrontals touching or nearly so, a slight callosity between ends of first and second veins, and the third (apparent second) abdominal segment usually bears a pair of median marginal bristles. In the females, the appearance of the head is a characteristic feature:

Front broad and appearing swollen, the frontal profile strongly arcuate; front broad, in 37 measured specimens the ratios of width at vertex to width of head averaging .31 (range .28 to .34) and the ratios of width at lowest orbital to width of head averaging .47 (range .44 to .54, with 33 of the 37 ratios falling between .45 and .49); parafrontals usually strongly broadening anteriorly, at level of lowest orbital the ratios of parafrontal to frontalia averaging 1.9 (range 1.3 to 2.5, scattered, but with 27 out of 37 ratios being over 1.75); front appearing strongly bristled, on each side of frontalia with a long row of cruciate to convergent frontals, and midway on each parafrontal a row of 5 to 7 strong, proclinate and divergent orbital bristles, besides several irregular rows of black hairs, of which the row between the orbital and frontal bristles is slightly stronger and may in the larger specimens appear as a secondary row of bristles; ocellar triangle with a reddish area on each side between it and inner vertical bristle; median marginal bristles typically absent from third abdominal segment (apparent second), occasionally present.

In both sexes, the wing characters are variable, the apical cell varying from closed at margin to rather widely open, and the bend of the fourth vein either rounded or angulate with a short appendage, rarely with long appendage. The ratio of parafrontal to frontalia is not good except for gross distinctions because the boundary lines between parafrontals and frontalia are not always well defined, and the ratio also varies considerably. However, the total width of the front seems little changed, and the effect is still that of an extremely broad and distended front.

The adults are apparently on the wing mainly in late summer and fall. With the exception of a few scattered specimens taken in July and August, one of May 29 and one of June 16, most available specimens were collected in late September and October, with a few in November, and two Florida specimens on January 15 and February 15. Many specimens were collected in light traps.

Distribution.—One hundred four specimens (60 males, 44 females) have been examined, from Arizona (Cochise County, Douglas, Miami, Huachuca Mts., Santa Catalina Mts.), Arkansas (Hope), Colorado (no locality, holotype of *montana*), Florida (Belleair, Ft. Drum, Fort Myers, Hollywood, Morrison Field, South Miami), Kansas (Onaga), Missouri (Cook Co.), Oklahoma (Payne County, Chickasha, Crescent), Texas (38 males, 26 females, from Palopinto and Webb Counties, Brownsville, Brownwood, College Station, Cresson, Dallas, El Paso, Kingsville, Mission, Plano, San Juan, Sonora, Victoria), and Mexico (Matamoros, Tam.; Tlahualilo, Dgo.).

I have also seen four females from Cuba (Habana, Torriente, Isla de Pinos) and Puerto Rico (La Plata), and a male from Cuba (Miranda), which agree with *ochracea*. A few specimens from Central America may also belong here, but in the absence of material from intervening areas, and lacking associated males and better understanding of the Neotropical fauna, I hesitate to record them at this time. These specimens might rather be *E. australis* or some still unrecognized species having superficially similar adults.

Unverified Records:

1910. *Oestrophasia ochracea* (Bigot) Smith, Insects of New Jersey, p. 777 (New Jersey State Mus., Ann. Rept. for 1909). [Orange Mts. spm. unknown to me; the Lahaway example is *E. reinhardi*, n. sp.]

1922. *Ormia ochracea* (Bigot) Reinhard, Ent. News 33:72. [College Station, Texas; larvae emerged from *Gryllus assimilis* and pupated, no adults emerged, puparia identified by C. T. Greene by comparison with puparia of flies reared by F. C. Bishopp at Dallas, Texas.]

1929. *Ormia montana* (Tns.) Allen, Annals Ent. Soc. Amer. 22:684. [Miss.]

15. **Euphasiopteryx australis** (Townsend)

1911. *Phasiopteryx* sp.; Townsend, Annals Ent. Soc. Amer. 4:136-137. [Peru, female; description of first-stage maggot and internal characters of female.]

1911. *Phasiopteryx australis* Townsend, loc. cit., p. 149. [Name provided for above; further notes on uterus.]

1912. *Phasiopteryx australis* Tns.; Townsend, Proc. U. S. Nat. Mus. 43:352. [Described; Peru, two females, in USNM.]

1915. *Euphasiopteryx australis* (Tns.) Townsend, Proc. Biol. Soc. Wash. 28:23. [Genotype of *Euphasiopteryx*, by original designation.]

1929. *Euphasiopteryx australis* (Tns.) Malloch, Annals & Mag. Nat. Hist., ser. 10, 3:279. [''Very similar to *punctata*, if not indentical with it.'']

1938. *Euphasiopteryx australis* (Tns.) Townsend, Manual of Myiology, 7:231. [Listed as genotype.]

The holotype and paratype (Piura, Peru) and four other females from Peru (Piura, Chosica, Eulalia, and Ferranefe) are before me. They agree in all details with the description given above for *E. ochracea*, and in the various frontal characters their ratios fall well toward the broad end of the range. In the type and paratype, respectively, the front at vertex is .305 and .29 times the head width, and at the lower orbital .44 and .46 times. At present, I can find no good means of distinguishing adult *australis* from *ochracea*, though the two must be distinct, judging from the differences in the first-stage larvae recorded by Townsend (1911). The similarity in the adults suggests that the elucidation of this complex, and perhaps future determinations, may depend on having gravid females for dissection of the first-stage larvae.

The third specimen from Piura, Peru, noted by Townsend (1912, p. 353) seems to me to be merely a small specimen of *australis*. The third sternopleural mentioned by Townsend is an extra and smaller one on the left side, between the usual two strong bristles.

As indicated in the discussion under *E. depleta*, the name *australis* was not correctly applied to the Brazilian changa parasite. The published records of parasitism of the changa by "*australis*" are to be found under *depleta*.

16. Euphasiopteryx aldrichi (Séguy), new combination

1925. *Ormia Aldrichi* (*nomen nudum*), Séguy, C. R. Acad. Sci. Paris 181:735.

1925. *Ormia Aldrichi* Séguy, Bull. Mus. d'Hist. Nat. Paris 31(6):439 (description), 440 (in key). [French Guiana; female, in Paris Museum.]

1926. *Ormia Aldrichi;* Séguy, Encyl. Ent., Ser. B, II, Dipt. 3:4, figs. 4 (head), 5 (wing). [No description.]

1927. *Ormia Aldrichi;* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [French Guiana, 3 localities.]

From the description and figures, *E. aldrichi* can be included with the species having a broad front in the female sex. Beyond that, it is impossible to go at the present time, for the wing characters are too variable to be relied upon. The figure of the head suggests that this may be the same species later (1934) described by Curran as *Ormia nocturna* (see next species).

17. Euphasiopteryx nocturna (Curran), new combination

1934. *Ormia nocturna* Curran, Bull. Amer. Mus. Nat. Hist. 66:495. [Kartabo, British Guiana; female, in AMNH.]

The holotype, kindly loaned me for study by C. H. Curran, agrees with *ochracea* in general habitus and chaetotaxy. The front is not as broad, and does not have the inflated appearance so characteristic of *ochracea*. However, until many specimens are available for measurement, one cannot determine the mean ratios of the various characters and the range of variation in them. Only one other specimen before me, a female from Bartica, British Guiana [AMNH], in the same district as the type locality, can be identified as *nocturna*. The ratios in the holotype and this specimen are, respectively, .25 and .27 for front at vertex to head width, .43 in each for front at lower orbital to head width, and 1.5 in each for width of parafrontal to frontalia. In the first two characteristics, the ratios are somewhat narrower than the lower limit of the range of *ochracea*.

The other character, pointed out by Curran, may be important, though sometimes difficult to use, and of course useful only for females. The posterior valve of the filter apparatus on the hind thoracic spiracle is slender and short-fringed in the two specimens of *nocturna*. In *ochracea*, this flap or valve is usually appreciably broader and longer fringed, though the fringe may be destroyed or matted together. In both species the fringe along the anterior margin of the spiracle is also short, so that the spiracular opening is not completely covered by fringe and flap together.

Some available specimens from Panama, the Canal Zone, Honduras and Guatemala have as narrow a front as typical *nocturna*, but a broader and longer fringed flap on the posterior spiracle. As with other problems in this complex, one can only point out the existence of difficulties that apparently can be overcome only by population studies based on adequate samples.

18. **Euphasiopteryx pellucida** (Séguy), new combination

1925. *Ormia pellucida* Séguy, Bull. Mus. d'Hist. Nat. Paris 31:440. [In key to five species; no further description, no locality.]

1926. *Ormia pellucida;* Séguy, Bull. Soc. Ent. France, 1926, p. 62. [Briefly compared with *O. Serrei.*]

1927. *Ormia pellucida;* Séguy, Encycl. Ent., Ser. B, II, Dipt. 4:16. [In key to 3 species; no other description, no locality.]

1928. *Ormia pellucida;* Séguy, Études sur les Mouches Parasites, Tome 1, p. 101, fig. 111 (female; side view of head and anterior half of thorax). [No description, no locality.]

I cannot find that a complete description of this species has been published. The first three references above specify that it lacks ocelli, and thus it may be referred to *Euphasiopteryx*. M. Séguy has also kindly informed me that the epaulet is black. The wing characters are deemed unreliable, however, as discussed elsewhere in this paper.

I may note that the figure given in Séguy (1928) shows two equally strong stigmatal bristles, a characteristic that I know only in three species of *Ormia s. str.* (*lineifrons, punctata, bilimekii*) of all the ormiines that I have studied. I do not know whether some error is involved, whether the two bristles are actually characteristic of *E. pellucida*, or whether the second bristle is an adventitious occurrence without specific significance in this instance.

19. **Euphasiopteryx tarsalis** (Séguy), new combination

1925. *Ormia tarsalis* (nomen nudum) Séguy, C. R. Acad. Sci. Paris 181:735.

1925. *Ormia tarsalis* Séguy, Bull. Mus. d'Hist. Nat. Paris 31:440. [In key to five species; no other description, no locality.]

1927. *Ormia tarsalis;* Séguy, C. R. Congrès Soc. Savantes, Paris 1926, p. 424. [French Guiana.]

1927. *Ormia tarsalis;* Séguy, Encycl. Ent., Ser. B, II, Dipt. 4:16. [French Guiana: female, in Paris Museum; full description, and in key to three spp.]

It is clear from the description that this species has a narrow front, its width equal to the length of the third antennal segment. This places it near *dominicana* and *guianica,* but it cannot be definitely identified at present.

MARSHALLOTHYAS, A NEW GENUS BELONGING TO THE SUBFAMILY THYASINAE

(ACARINA, HYDRACARINA)[1]

BY DAVID R. COOK, *Wayne University, Detroit, Mich.*

Collections made in certain springs and seepage areas in Michigan, Illinois, and Minnesota during the summers of 1950-52 have turned up specimens of an interesting new genus of *Thyasinae.* The genus is named in honor of Ruth Marshall for her outstanding contributions to the study of North American hydrachnids. The author wishes to thank Mr. Rodger Mitchell of the University of Michigan, Ann Arbor, for the opportunity to examine some of his specimens belonging to this genus.

Genus **Marshallothyas**, new genus

Diagnosis.—Lateral eyes in capsules, median eye without pigment; prefrontalia, postfrontalia and dorsocentralia 1 united into two elongated plates lying on each side of the median eye, occasionally these two plates fused for a short distance posterior to the median eye, fig. 6; postocularia usually located on the two enlarged frontal plates but occasionally lying free in the integument; all other dorsal plates as in *Thyas;* prefrontalia and postfrontalia fused in the nymph but dorsocentralia 1 and the postocularia are free, fig. 8; genital field of adult similar to that found in *Panisoides.*

Genotype.—*Marshallothyas asopos,* new species.

This new genus seems to be intermediate between *Thyas* Koch, 1836 and *Panisoides* Lundblad, 1926. *Marshallothyas* differs from *Thyas* in that the dorsocentralia 1 are fused to the pre- and postfrontalia and in usually having the postocularia lying on these frontal plates. The genital field resembles that found in *Panisoides.* However, in the latter genus the prefrontalia, postfrontalia, dorsocentralia 1 and the postocularia are united into a single frontal shield completely surrounding the median eye. *Marshallothyas* shows a tendency in this direction in that the two frontal plates occasionally may be

[1]Contribution from the University of Michigan Biological Station.

united for a short distance, fig. 6. In *Panisoides* dorsocentralia 5 and all of the dorsolateralia are greatly expanded. Since the nymph of *Panisoides* is unknown a comparison with the new genus is impossible. Nymphs of *Marshallothyas*, however, differ from those of *Thyas* in having the genital flaps reduced to small setae-bearing sclerites, fig. 7.

Marshallothyas asopos, new species

Male.—Length of body 0.87-1.43 mm.; length of frontal plates 0.26-0.31 mm.; length of genital field 0.25-0.31 mm.; length of capitulum 0.23-0.26 mm.; length of chelicerae 0.27-0.29 mm.

Body oval, integument papillated; the pigmentless median eye lying free in the integument; pre- and postfrontalia fused with dorsocentralia 1 on both sides of the median eye to form two elongated frontal plates which are widest near the middle, occasionally these plates are fused for a short distance in the region of greatest width, fig. 6; postocularia usually situated on a bulge on the outer side of the frontal plates (occasionally the postocularia may be free in the integument); all other dorsal plates of moderate size, with dorsolateralia 1-3 being the largest; genital field similar to that found in *Panisoides setipes* (Viets, 1911); genital flaps projecting slightly beyond the anterior genital acetabula, these flaps with four pairs of setae along the anterior margin, fig. 10; middle pair of genital acetabula nearer posterior pair; typically with three pairs of genital acetabula, however, there may be one or two smaller, supernumerary acetabula; inner margin of genital flaps with a row of setae beginning just posterior to the first acetabula and ending slightly anterior to the third pair; a lobed sclerite, bearing 13-17 setae, located mesad to the third pair, fig. 10; capitulum, chelicerae and palpi, figs. 4, 5, 9, typical of the Thyasinae in general; dorsal lengths of the palpal segments varied as follows: P-I, 0.050-0.059 mm.; P-II, 0.116-0.127 mm.; P-III, 0.049-0.058 mm.; P-IV, 0.168-0.188 mm.; P-V, 0.043-0.048 mm. Fig. 3 shows the chaetotaxy of the second leg.

Female.—Similar to the male except that it averages slightly larger, possesses a small pregenital sclerite in the median line just anterior to the first pair of genital acetabula, fig. 2, and has fewer and stouter setae (5-8) on the lobed sclerites located mesad to the third acetabula; these sclerites also smaller in female.

Nymph.—Resembles nymphs of the genus *Thyas* except that the pre- and postfrontalia are fused into a pair of plates on either side of the median eye; dorsocentralia 1 are triangular plates which are only slightly smaller than the frontal plates; provisional genital field with two pairs of acetabula; genital flaps reduced to setae-bearing sclerites, usually with two pairs of setae, fig. 7; one or two setae present just anterior to the first pair of acetabula.

Types.—Holotype, adult ♂, taken in a spring at the base of the Maple River Dam, Emmet Co., Michigan (T36N/R4W/S10), June 17, 1952; allotype, adult ♀, same date and locality

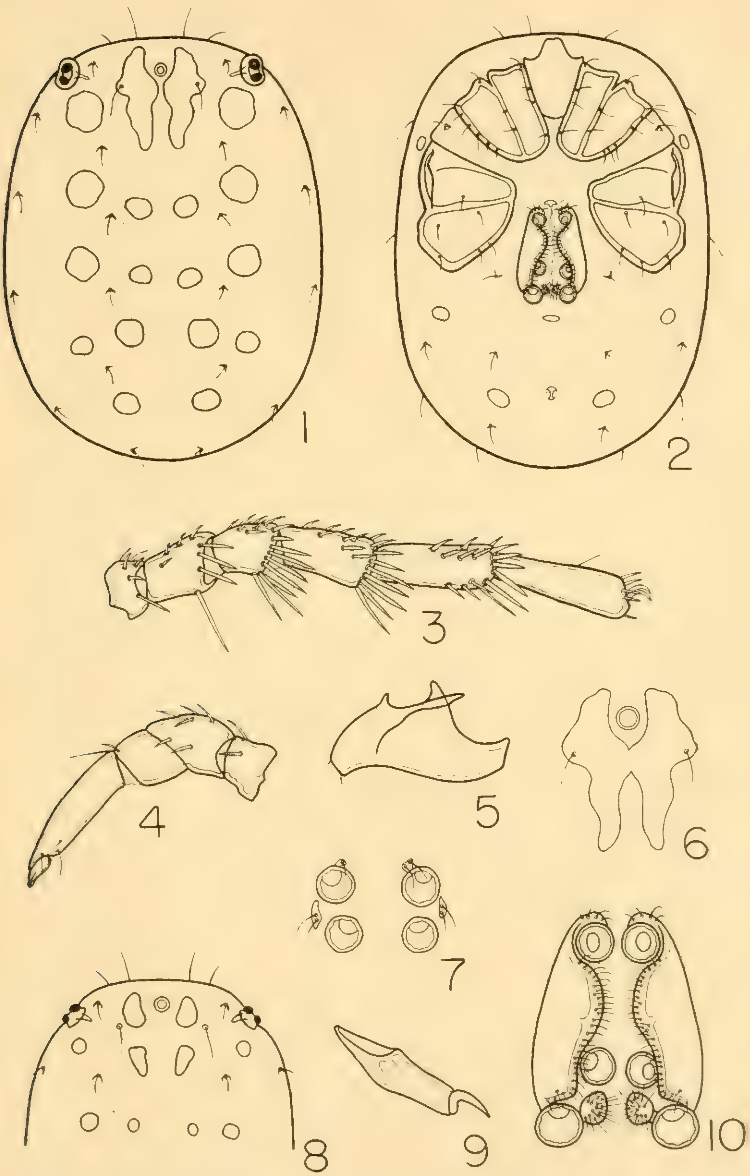

Fig. 1, dorsal view, male; fig. 2, ventral view, female; fig. 3, second leg, anterior view; fig. 4, left palp, outer view; fig. 5, capitulum, lateral view; fig. 6, ocular region of an individual in which the frontal plates are touching; fig. 7, provisional genital field, nymph; fig. 8, anterior dorsal view, nymph; fig. 9, chelicera; fig. 10, genital field, male.

as the holotype; paratypes, 11 ♂, 9 ♀, 2 nymphs, same locality, June 17-July 1, 1952; 1 ♂, collected in a cold spring in "The Gorge," Cheboygan Co., Michigan (T37N/R3W/S33), July 2, 1951. The holotype and allotype will be deposited in the Chicago Natural History Museum, paratypes will be placed in the United States National Museum. The author has several specimens which differ in certain details from the Emmet County population. Three ♀ collected in a cold seepage area (temperature, 10° C.) associated with Laughing Whitefish Falls, Alger Co., Michigan have the two frontal plates fused at a point farther behind the median eye than that shown in fig. 6. Two specimens taken in Beaver Creek, Houston Co., Minnesota, July 4, 1950 (R. Mitchell) differ in that there is a tendency for the postocularia to lie free in the integument. In one individual both postocularia were separate while in the other only one of the postocularia was fused with the frontal plates. All of these individuals are tentatively assigned to *M. asopos*, but are not included in the type series. One ♂ belonging to the genus *Marshallothyas*, but representing a second species, was taken from a seepage area in Illinois (R. Mitchell). Description of this species will be postponed until more specimens are available.

Habitat.—Found in cold springs and seepage areas.

Range.—*Marshallothyas asopos* has been collected in Michigan and Minnesota.

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NEW SPECIES AND VARIETIES OF OPIUS

(HYMENOPTERA, BRACONIDAE)

BY DAVID T. FULLAWAY, *Honolulu, Hawaii*

Some species of *Opius* are well-known parasites of the fruit infesting Tephritidae, but some of the latter infest flower-buds and young shoots as well as fruits. The species described immediately below was reared by Mr. N. L. H. Krauss from a tephritid found in the flower heads of a Malayan plant, *Hyptis capitata*. Its procurement was incidental; the species itself has no connection with the fruitfly parasite introduction project conducted by the U. S. Bureau of Entomology & Plant Quarantine *et al.* in 1948-1951.

The four new varieties described subsequently are well defined segregates of the *longicaudatus* complex. They are named and described particularly for the convenience of the laboratory workers who are engaged in their propagation, distribution, and recovery. The other form recognized as belonging to the *longicaudatus* complex is *formosanus*, described by me in 1925. Its distinctive characters are given in connection with the description of var. *novocaledonicus.*

Opius leveri, new species

Female.—Length of body about 2 mm., smooth and shining, sparsely clothed with silvery hairs. Color of body ochreous to brunneus, the vertex and occiput of head, antennal scape, mesonotum, scutellum, and abdomen sometimes all or only partly polished black; legs mostly yellowish-brown outwardly from the coxae; antennae beyond scape and sheaths of the ovipositor blackish.

Head transverse, width three times length, wide between the eyes, which are convex, ocelli near the middle of the vertex, the members arranged in the form of an equilateral triangle, the anterior and lateral members an equal distance apart but the distance from the latter to the border of the eye is many times greater; antennae longer than the body, inserted not too close together on the front of the head where the same merges into the face, the sockets shallow with elevated rims which laterally approach—but not too closely—the inner border of the eye, 26-segmented, scape and pedicel stout, the flagellum filamentous, first segment six times as long as wide, following segments decreasing in length outwardly; face as wide as long, slightly convex although depressed at the sides beneath the antennal sockets; clypeus distinct, the fossae deep, cheeks rather wide, mandibles stout, curved and apically toothed, black at the tips; distance from base to margin of eye along clypeocular line exceeding slightly basal width; maxillary palpi 5-segmented, very long, labial 3-segmented, very short.

Thorax robust, nearly as deep as long, but not so wide, about as wide as head; sides of the pronotum deeply sulcate; mesothoracic scutum convex, without complete parapsidal furrows, the same indicated by short, deep, and wide fossae extending inward from the antero-lateral corner; transverse prescutellar sulcus wide and deep and divided by costae into six pits; scutellum short, triangular, pointed apically, slightly convex on the disc, declivous at sides, hind margin with fringe of silvery hairs; metanotum with a median knob to the raised anterior margin, elevated behind to form a deep groove or sulcus which is more or less rugose; propodeum short and wide, slightly convex, declivous behind and at sides where it is hairy, coarsely rugose above and with a short median carina anteriorly; mesopleurae smooth and polished, with a wide costate furrow anteriorly and a rather large pit posteriorly at about middle depth; stigmata small and oval.

Abdomen ovate, somewhat compressed apically, the sides anteriorly collapsed, first tergite widening outwardly so that the apical width is more than twice the basal, two laterally placed longitudinal carinae rim a deep basal excavation and extend posteriorly on the disc nearly its whole length, sides also margined; the first tergite is separated from the following by a deep furrow which is interrupted in the middle by a knob-like projection from the second tergite; the following tergites all have a transverse line of silvery hairs near their posterior margins; ovipositor exserted as long as or a little longer than the abdomen. Legs rather slender, the femora and tibiae, however, somewhat enlarged.

Wings hyaline, veins fuscous, radius of anterior wing arising slightly forward of the middle of the stigma, which is twice as wide as the first abscissa of the radial vein is long; second abscissa four times as long as the first and exceeding in length the first cubital cross-vein by one-third, which is almost if not quite interstitial with the recurrent. Nervulus is decidedly post-furcal, nervus parallelus joins the median below the middle of the apical abscissa. Hind wing is without a post-nervellus.

Male.—Similar to the female in all except secondary sexual characters.

Described from 33 female and 14 male specimens (holotype ♀, allotype ♂, and paratypes) reared from flower-heads of *Hyptis capitata* at Kuala Lumpur, Malaya, VIII 1948 by N. L. H. Krauss. Four additional specimens (1 ♀, 3 ♂) reared ex pupae *Spheniscomyia sexmaculata* in flowerheads of *Hyptis capitata*, same locality, VI 1948 (1312 A).

Named *leveri* as a compliment to R. J. A. W. Lever, entomologist of Kuala Lumpur, who gave Mr. Krauss assistance in his work in Malaya.

Opius longicaudatus (Ashmead)

Opius longicaudatus var. **chocki**, new variety

Female.—Length of body about 5 mm., smooth and shining, finely clothed with silvery hairs; ochraceous throughout, sparsely punctuate with microscopically fine setiferous punctuations, face closely beset; eyes, ovipositor sheaths apically and basally, and antennae distally from middle black or blackish.

Head transverse, nearly twice as wide as long, wide between the eyes, which are convex, ocelli near the middle of the vertex forming an obtuse triangle and with a depression on outer face, the lateral members farther apart than anterior and lateral (1 ½x), but distance to margin of eye greater than width of base of triangle (1 ¼x); antennae longer than the body, fairly close together at bases, farther removed from eye than from each other, the sockets deep with elevated rim, 48-segmented, the scape and pedicel stout, the flagellum filamentous; face wider than long, convex in the middle, depressed at sides, and receding somewhat below, clypeus distinct, the fossae deep; cheeks fairly wide, mandibles stout, curved and apically toothed and black, distance from base to eye margin equalling basal width; maxillary palpi 5-segmented, labial 3-segmented, only one-half so long.

Thorax robust, nearly as deep as long, and only one-half as wide, but wide as the head; sides of the pronotum deeply sulcate; mesothoracic scutum with deep, smooth parapsidal furrows converging to a small longitudinal median depression situated a little before the posterior margin; transverse prescutellar sulcus with four deep fossae; scutellum triangular, metanotum costate; propodeum convex, declivous behind, irregualrly areolate and with a short median carina extending caudad from anterior margin, sides rather hairy; stigmata small and round; mesopleurae with deep and fossulated sulci.

Abdomen ovate, somewhat compressed apically, the sides anteriorly collapsed; first and second tergites longitudinally striate and separated by a deep sulcus, the former also longitudinally bicarinate sublaterally and the sides strongly margined as well; following tergites smooth and shining, with a transverse line of fine silvery hairs close to the posterior border; ovipositor exserted and longer than the abdomen by one-half.

Legs rather slender, femur fairly stout, concolorous, only tips of tarsi black.

Wings hyaline, veins fuscous, radius in anterior wing arising at about the middle of the stigma, which is lanceolate, first transverse cubitus broken near apex and extended at nearly right angles to the cubitus; second abscissa of the radius and first section of first transverse cubitus about equal in length.

Male.—Similar except for sexual characters; abdomen with transverse black bars caudally.

Described from five specimens (holotype, ♀, allotype, ♂, and paratypes). Holotype labelled x Dacus Philippines 10/4/47 Q C Chock; allotype labelled x D. dorsalis Batangas P.I. 11/6/47 Q C Chock; paratypes ♂ and ♀ labelled same as preceding.

Opius longicaudatus var. **novocaledonicus**, new variety

Female.—Length of body about 5 mm., smooth and shining, finely clothed with silvery hairs, ochraceous throughout, finely punctuate with microscopically fine setiferous punctuations, face closely beset; eyes, ovipositor sheaths and antennae distally from first flagellar segment black or blackish.

Head transverse, twice as wide as long, wide between the eyes, which are convex; ocelli near the middle of the vertex forming an obtuse triangle, the lateral members farther apart than anterior and lateral (1 ½x) but distance to margin of eye greater than basal width of triangle (1 ¼x); antennae longer than body, fairly close together at bases, farther removed from eye than from each other, the sockets deep with elevated rim, 48-segmented, the scape and pedicel stout, the flagellum filamentous;

face wider than long, convex, clypeus distinct, the fossae deep, cheeks fairly wide, mandibles stout, curved, apically toothed and black, distance from base to eye margin greater than basal width; maxillary palpi 5-segmented and long, labial 3-segmented and short.

Thorax robust, nearly as deep as long and only half so wide, but as wide as the head; sides of the pronotum deeply sulcate; mesothoracic scutum with deep, smooth parapsidal furrows converging to a small longitudinal median depression situated a little before the posterior margin; transverse prescutellar sulcus with four deep fossae; scutellum triangular; metanotum costate; propodeum convex, declivous behind, irregularly areolate but with a definite short median carina extending caudad from anterior margin, which bifurcates posteriorly into transverse branches, sides rather hairy; stigmata small and oval; mesopleurae with deep and fossulated sulci.

Abdomen ovate, somewhat compressed apically, the sides anteriorly collapsed; first and second tergites longitudinally striate and separated by a deep sulcus, the former also longitudinally bicarinate sublaterally and the sides strongly margined as well; following tergites smooth and shining with a transverse line of silvery hairs close to the posterior border; ovipositor exserted and longer than the abdomen by a half.

Legs rather slender, femur fairly stout; concolorous with body except hind tibiae and tarsi, which are fuscous; tibiae yellowish-brown at bases.

Wings hyaline, veins fuscous, radius in anterior wing arising at about the middle of the stigma, which is lanceolate; first transverse cubitus broken near apex and extended at nearly right angles to cubitus so that the first cubital cell is pedicellate and the second five-sided; first abscissa of radius one-half as long as second, the latter shorter than first transverse cubital and longer than second cross-vein. Nervulus postfurcal, nervus parallelus arising from median below the middle of terminal abscissa. Post-nervellus present in hind wing.

Male.—Similar in most respects, but distinguished from its closest ally, *formosanus* Full. by the presence of five transverse dark bars on tergites 3 to 7. These are never seen in the males of *formosanus.*

Described from two specimens (holotype ♀ and allotype ♂) labelled Noumea, N. Cal. 6/8/50 Krauss ex guava.

Opius longicaudatus var. **malaiaensis**, new variety

Female.—Length of body about 5 mm., smooth and shining, finely clothed with silvery hairs; ochraceous, sparsely punctuate with microscopically fine setiferous punctuations, face closely beset; eyes, ocelli, antennae completely, hind legs completely, ovipositor sheath and transverse band on abdomen caudally black.

Head transverse, twice as wide as long, wide between the eyes, which are convex, ocelli near the middle of the vertex forming an obtuse triangle and with a depression on outer face, the lateral members farther apart than anterior and lateral (1 ½x) but distance to margin of eye greater than width of base of triangle (1 ¼x), antennae longer than the body, fairly close together at bases, a little farther removed from eye than from each other, the sockets deep with elevated rim, 54-segmented, the scape and pedicel stout, the flagellum filamentous; face wider than long, convex in the middle, depressed at sides, and receding somewhat below, clypeus distinct, the fossae deep, cheeks fairly wide, mandibles stout, curved and apically toothed and black, distance from base to eye margin equalling basal width; maxillary palpi 5-segmented, very long, labial 3-segmented, very short.

Thorax robust, nearly as deep as long and only one-half as wide, but wide as the head; sides of the pronotum deeply sulcate; mesothoracic scutum with deep, smooth parapsidal furrows converging to a small longitudinal median depression situated a little before the posterior margin; transverse prescutellar sulcus with four deep fossae; scutellum triangular; metanotum costate; propodeum convex, declivous behind, irregularly areolate and with a short median carina extending caudad from anterior margin, sides rather hairy; stigmata small and round; mesopleurae with deep and fossulate sulci.

Abdomen ovate, somewhat compressed apically, the sides anteriorly collapsed; first and second tergites longitudinally striate and separated by a deep sulcus, the former also longitudinally bicarinate sublaterally and the sides strongly margined as well, following tergites smooth and shining with a transverse line of silvery hairs close to the posterior border; ovipositor exserted and longer than the abdomen by one-half to three-fourths.

Legs rather slender, femur fairly stout.

Wings hyaline, veins fuscous, radius in anterior wing arising at about the middle of the stigma, which is lanceolate, first transverse cubitus broken near apex and extended at nearly right angle to cubitus so that the first cubital cell is pedicellate and the second five-sided, first abscissa of radius short, one-fourth length of second, which is shorter than first transverse cubitus and longer than second, nervulus post-furcal, nervus parallelus arising from apical abscissa of median below its middle. Postnervellus present in hind wing.

Male.—Similar except in sexual characters. Abdominal segments 3-7 with transverse black bands, first and last rather wide, intermediate narrower.

Described from three specimens (holotype ♀, allotype ♂ and ♀ paratype). Holotype labelled Serdang, Selangor, Malaya, III-1949 on carambola fruit N. L. H. Krauss 1393; allotype labelled BAF Insectary Honolulu T H II-1953; paratype also BAF Insectary Honolulu T H.

Opius longicaudatus var. **taiensis**, new variety

Female.—Length of body about 4 mm., smooth and shining, finely clothed with silvery hairs; ochraceous throughout, sparsely punctuate with microscopically fine setiferous punctuations, face closely beset; eyes, antennae (except scape which is golden yellow), tarsi and tibiae of hind legs (tibiae with darker middle portion, lighter basally and apically), sheaths of the ovipositor black or blackish (antennae proximally except scape more or less brownish black).

Head transverse, twice as wide as long, wide between the eyes, which are convex; ocelli near the middle of the vertex forming an obtuse triangle and with a depression on outer face, the lateral members farther apart than anterior and lateral (2x) but distance to margin of eye greater than width of base of triangle (1 ¼x); antennae longer than body, fairly close together at bases, farther removed from eye than from each other, the sockets deep with elevated rim, 48-segmented, the scape and pedicel stout, the flagellum filamentous; face wider than long, convex in the middle, depressed at sides and receding somewhat below; clypeus distinct, the fossae deep; cheeks fairly wide; mandibles stout, curved, apically toothed and black; distance from base to eye margin equalling basal width; maxillary palpi 5-segmented, long, labial 3-segmented, short.

Thorax robust, nearly as deep as long and only one-half so wide, but wide as the head; sides of the pronotum deeply sulcate; mesothoracic scutum with deep, smooth parapsidal grooves converging to a small longitudinal median depression situated a little before the posterior margin; transverse prescutellar sulcus with four deep fossae; scutellum triangular; metanotum costate; propodeum convex, declivous behind, irregularly areolate and with a short median carina extending caudad from anterior margin; sides rather hairy; stigmata small and round; mesopleurae with deep and fossulate sulci.

Abdomen ovate, somewhat compressed apically, the sides anteriorly collapsed; first and second tergites longitudinally striate and separated by a deep sulcus, the former also longitudinally bicarinate sublaterally and the sides strongly margined as well; following tergites smooth and shining with a transverse line of fine silvery hairs close to the posterior border; ovipositor exserted and longer than the abdomen by one-half.

Legs rather slender, femur fairly stout.

Wings hyaline, veins fuscous, radius in anterior wing arising at about the middle of the stigma, which is lanceolate; first transverse cubitus broken near apex and extended at nearly right angle to cubitus so that the first cubital cell is pedicellate and the second five-sided; first abscissa of the radius one-fourth as long as the second, which is slightly longer than first section of first transverse cubitus; recurrent and second cubital cross-vein shorter; nervulus post-furcal, nervus parallelus joining apical segment of median below middle; hind wing with post-nervellus.

Male.—Similar except in sexual characters. Abdomen caudally with transverse black bars, not too clear-cut.

Described from four specimens (holotype ♀, allotype ♂, and paratypes) labelled Siam 3, 12-14-50.

Types of the new forms described here are deposited in the Hawaiian Entomological Society collection.

THE NEW-WORLD DISTRIBUTION OF ALYDUS CALCARATUS (L.) WITH COMMENT ON THE DISPOSAL OF THE NAME CORISCUS SCHRANK, 1796

(HEMIPTERA, COREIDAE)

BY R. I. SAILER, *Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C.*

Members of the coreid genus *Alydus* are among the most common insects to be found in mixed grass and legume meadows throughout the United States. The genus and its relatives have been studied by Fracker (1918), and it has been assumed that the North American species are well known. Recently, when I attempted to identify a specimen of *Alydus* from Matanuska, Alaska, I found that it was unlike any of the species recognized by Fracker as occurring in North America. Since many Alaskan species also have extensive distribution in the Palearctic Region of the Old World, I checked the specimen against the Old World species. It was immediately apparent that the specimen belonged to the species *Alydus calcaratus* (L.). Upon examination, the series of specimens identified as *A. eurinus* (Say) in the U. S. National Museum collection was found to contain *calcaratus* from several localities in northwestern United States and western Canada. The data on these specimens are as follows:

ALASKA.—Matanuska, Aug. 10, 1944, J. C. Chamberlin; Anchorage, Eagle River Flats, May 9, 1948 (one, third instar). BRITISH COLUMBIA.—Terrace, Sept. 1938, Mrs. M. E. Clark. ALBERTA.—Banff, July 21, 1925, O. Bryant. MANITOBA.—The Pas, July 31, 1937, D. G. Denning; The Pas, Aug. 11, 1937, R. H. Daggy. WASHINGTON.—Cathlemet, Oct. 7, 1943, on alfalfa; Chimacum, Sept. 27, 1943; Sumas, Sept. 8, 1943, on vetch; Pullman; Seattle (Uhler Coll.); Quilcene, Aug. 1920, R. C. Shannon; Puyallup, July 13, 1937. OREGON.—Cascade Locks, Aug. 2, 1944, on lupine; Mayger, Sept. 7, 1944, on beans; Corvallis, various dates, July 31 through Nov. 5, 1931; Scio, July 14, 1931. CALIFORNIA.—Placer Co., E. C. Van Dyke; Gazelle, Sept. 4, 1897. IDAHO.—Idaho Falls, Aug. 6, 1944, P. E. Telford; Troy, July 18, 1931, R. E. Rodock. WYOMING.—Paint Creek, July 29, 1896, R. P. Currie.

Alydus eurinus, the closely related nearctic species, is common throughout the eastern United States but appears to be much less abundant in the Northwest than *calcaratus*. The two species are readily distinguished from each other in both sexes by the structure of the external genitalia (see figs. 1, 2, 3, 4, and 5). Although the species have been confused in collections, most of the literature concerns *eurinus*, outside the range of *calcaratus*. Oshanin (1907, p. 216) recorded *calcaratus* from "Nearctic (Northern States)"; however, his record was clearly based on Uhler's (1861) remark "*Lygaeus eurinus,* Say belongs to *Alydus* and seems to be the common *Alydus calcaratus* Linn., found so abundantly in some parts of Europe." Since Uhler did have some *calcaratus* in his col-

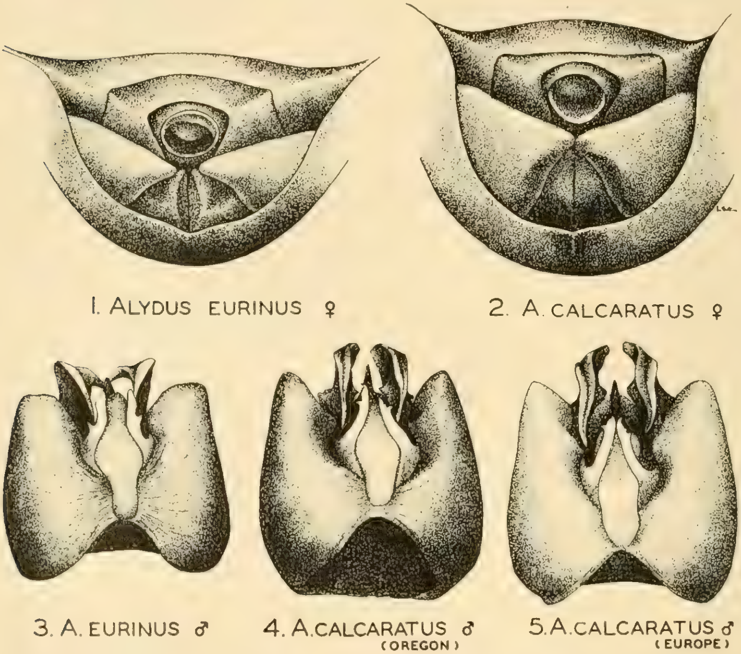

Fig 1, *Alydus eurinus* (Say); Virginia; external genitalia of female; fig. 2, *Alydus calcaratus* (L.); Washington; external genitalia of female; fig. 3, *Alydus eurinus* (Say); Virginia; dorsal view of external genitalia of male; fig. 4, Alydus calcaratus (L.); Oregon; dorsal view of external genitalia of male; fig. 5, Alydus calcaratus (L); Europe; dorsal view of external genitalia of male.

lection, this remark would seem to have been well considered. However, Uhler changed his mind and in all his later works he used the name *eurinus.* Van Duzee (1918, p. 112) and all subsequent authors also used *eurinus.*

For several years now the literature has reflected considerable confusion regarding the generic name for *calcaratus* and its congeners. The name *Alydus* Fabricius, 1803, was used consistently in North America until 1926 when Blatchley

(p. 264) accepted the opinion of Reuter (1888, p. 534) and Horvath (1917, p. 378) and placed the name as a synonym of *Coriscus* Schrank, 1796. After 1926 *Coriscus* came into general use in the United States and in Continental Europe. In 1948 (Hemming, pp. 464-465) the International Commission on Zoological Nomenclature placed *Coriscus* on the Official Index of Rejected and Invalid Names in Zoology and restored *Alydus*. It was, and is, my opinion that this action was ill advised. Few name changes are more disturbing than one which requires the restoration of an old name after it has fallen into disuse.

Through correspondence with Dr. W. E. China who submitted the case to the Commission for a decision, I have learned that the case, which was first submitted in 1943 and acted upon in 1948, was actually written in the early 1930's. Had it been submitted and acted upon at that time, there would have been no grounds for objection. However, by 1945 it was my view that affirmative action would be detrimental to the purpose which the Commission should strive to serve, namely stability of usage. In his account of the Commission's decision, Mr. Hemming paraphrased my comments and made it appear that certain changes had removed my objection to the case. Subsequently, Mr. Hemming has ignored a proposal that the Commission entertain an appeal to the decision. Admittedly the names involved are scarcely worthy of such consideration, but there is the element of confidence in the objective intentions of the Commission which should be considered.

Rather than create further confusion with respect to the names *Alydus* and *Coriscus* it seems best to accept the Commission's 1948 decision. For my part, this is under protest and I feel strongly that the case provides another example of the Commission's failure to properly evaluate the importance of the time element in name usage. If a name is to be conserved, the Commission should determine the degree to which usage is uniform *at the time action is taken.* Where a case is clearly based on information as much as ten years out of date, no action should be taken in the absence of a review of current world literature demonstrating continued uniformity.

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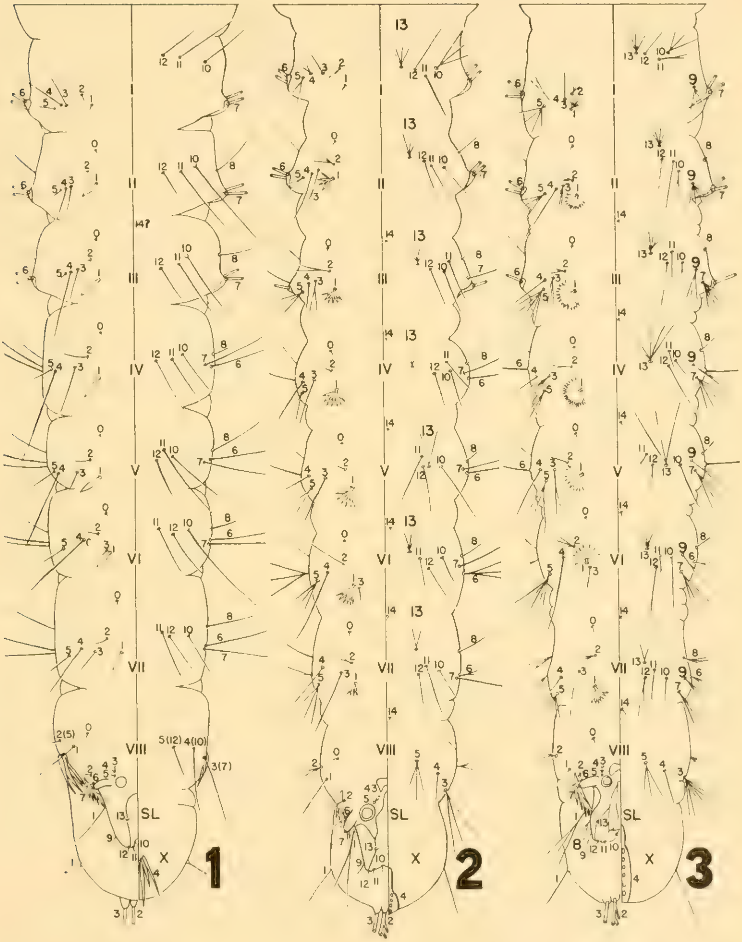
CORRECTED INTERPRETATIONS OF SOME ELEMENTS OF THE ABDOMINAL CHAETOTAXY OF THE MOSQUITO LARVA AND PUPA

(Diptera, Culicidae)

By John N. Belkin, *University of California at Los Angeles*

Since the publication of the revised homologous terminology of the chaetotaxy of the mosquito larva and pupa (Belkin, 1952), considerable additional evidence, particularly in the form of anomalies, has come to hand. Some of this evidence requires a reinterpretation of certain elements of the abdominal chaetotaxy, some strengthens the original interpretations and finally other evidence indicates homologies not apparent before. Moreover, some of the errors which have crept into earlier interpretations need to be corrected. While the changes proposed here and before may seem to add further confusion to that already existing in the nomenclature of the chaetotaxy of the mosquito larva and pupa, my contention is that a useful stable terminology can be arrived at only if it is a homologous one, for then it can be used not only for diagnostic purposes but also to show the relationship of the different groups of mosquitoes. In all probability, few additional changes will have to be made and these must await the completion of a comparative study of all the subgenera now in progress. Anomalies have been particularly useful in establishing homologies but unfortunately their occurrence is limited and unpredictable, and it is hoped that other workers will report them as they come to light. Opportunity is here taken to present a series of labelled diagrams of the abdominal chaetotaxy of the four larval instars and the pupa of *Anopheles freeborni* Aitken, 1939 to illustrate more clearly the homologies and the system of nomenclature.

As pointed out earlier (Belkin, 1952) one of the most vexing problems in the homology of the abdominal chaetotaxy of the larva and pupa is that presented by the transitory abdominal hairs which appear in the



Figs. 1-3, abdomen of first, second and third instar larva respectively of *Anopheles freeborni;* left, dorsal; right, ventral; *SL,* siphon lobe; large *13,* transitory hairs first appearing in second instar; large *9* and large *SL-8,* transitory hairs first appearing in third instar.

second and third instar larva and normally disappear in the pupa. Originally, I interpreted these as hairs 9 and 11. Recently, in studying the pupae of the anophelines of California, I have encountered a large number of anomalies in *A. freeborni*, western race of *A. punctipennis* (Say), 1823, and several races of *A. occidentalis* Dyar and Knab, 1906, which indicate beyond any doubt that the more mesal of the two transitory hairs is actually hair 13 and not 11. It will be noted that in the pupa (fig. 5) this hair, labelled 13 in larger figures, occupies the same position in relation to hairs 11 and 12 on segments II-VII that it does in the second, third and fourth instar larvae (fig. 2-4). Particularly significant is the location of hair 13 on segment V, for it will be noted that in the pupa as well as in the older larval instars it is found caudad and laterad of hair 11. While it is located mesad of hair 12 on this segment in the pupa, this does not necessarily disturb the homology, for similar lateral migrations of hairs are not uncommon elsewhere on the pupal abdomen. On segment VII, pupal hair 13 also occupies a position strikingly similar to that found on the corresponding segment of the larval instars 2 to 4. A further support for this interpretation of hair 13 will be found by comparing the first and second instar larvae (fig. 1 and 2, respectively). Although there is a slight shift of the hairs interpreted as 10, 11 and 12 between the two instars it will be noted that the most likely interpretation is that the new hair appearing in the second instar is the one labelled with the large figure 13, and that on segment II it is the most mesal of all the ventral hairs. I have checked this interpretation in several culicines and find that it also fits the facts. F. E. Baisas (1951) in a personal communication also interpreted this same transitory hair as hair 13 in *Tripteroides microcala* Dyar, 1929 from the Philippines. These two lines of evidence taken together indicate without any doubt that this must be the correct interpretation. It will also be noted that hair 13 is absent on segment VIII of the larva and is not represented by an anomaly in the pupa. The latter of course is not a proof in itself for it may merely mean that no favorable material was encountered; nevertheless, the absence of the anomaly on this segment and its presence on all the others, except the second which has the venter reduced, is also in line with the present interpretation.

The evidence for the interpretation that the second, more lateral, of the transitory hairs is hair 9 is not nearly as strong but it appears very likely that it is correct. First of all, inspection of figs. 2-4 reveals that it is hair 9 which appears for the first time in the third instar larva. By analogy with hair 13, this hair (9) should then be the second transitory hair which is normally absent in the pupa. In the pupa, anomalous retention of hair 9 is not as common as in the case of hair 13 in the material that I have examined. I have already reported (Belkin, 1952: 128) its presence in *Uranotaenia quadrimaculata* Edwards *in* Paine & Edwards, 1929. In the material of the anophelines of California, I have encountered it to date on segments V and VI only (fig. 5). Although it

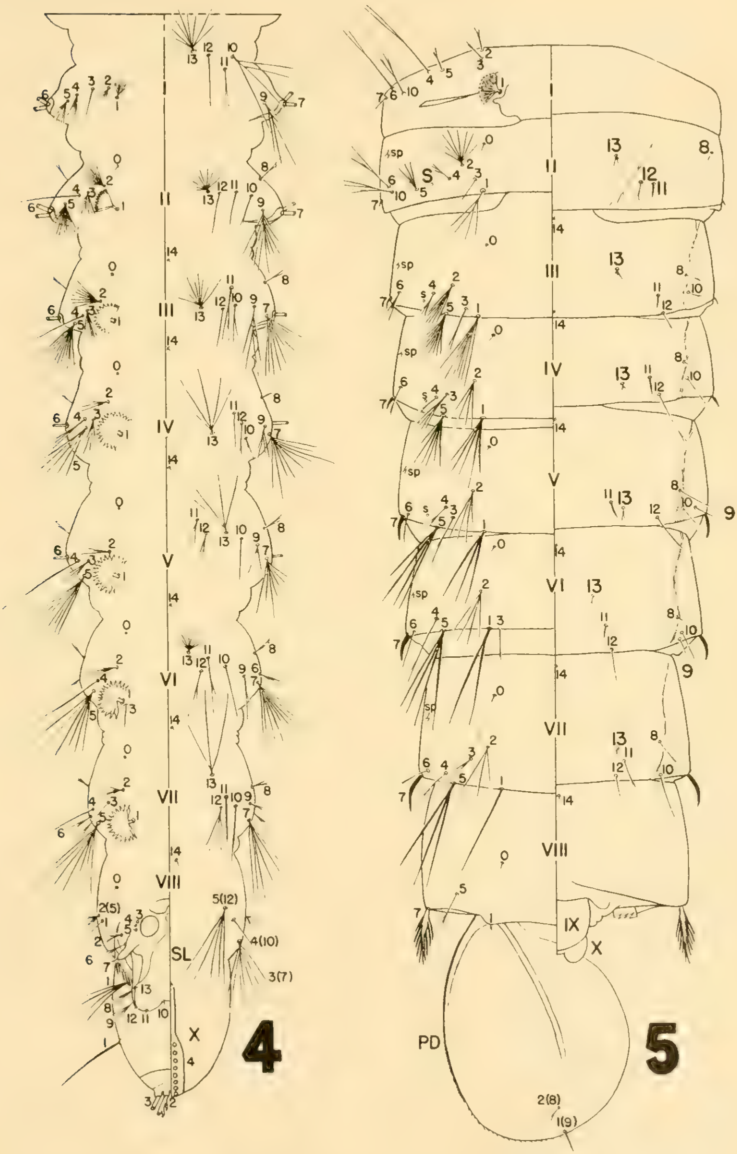


Fig. 4, abdomen of fourth instar larva of *Anopheles freeborni;* left, dorsal; right, ventral; *SL,* siphon lobe; fig. 5, abdomen of female pupa of same; left, dorsal; right, ventral; transitory hairs *9* and *13* in large figures; anomalous hairs of segment II (*8, 11, 12*) in large figures; *PD,* paddle; *s,* dorsal sensillum; *S,* anomalous dorsal sensillum on segment II; *sp,* spiracle (some transitory and anomalous structures added from *A. punctipennis* and *A. occidentalis*).

would be possible to interpret these latter anomalies as duplications of hair 10, the position of the hairs, as illustrated, strongly suggests that they are really hair 9 (see figs. 4 and 5).

On the basis of the above mentioned evidence, I am changing the nomenclature of the two mesal ventral hairs of the pupa to hairs 11 and 12. Usually hair 11 is considerably more cephalic in position than hair 12; in the nomenclature of Knight and Chamberlain (1948) it was known as hair 12 and in that of Belkin (1952) as hair 13. Hair 12 of my present interpretation was so interpreted by me in 1952 and was known as 11 by Knight and Chamberlain. The reason for calling the more caudal hair 12 is that in all the larval instars it occupies a more mesal position on the proximal segments and particularly so on segment II, which is the basic segment for general and serial homologies. Furthermore hair 11 has a tendency to move laterad on some segments; in the sabethine larvae this movement is very pronounced on segments III and IV. Unfortunately in the pupa hair 11 is often mesad of 12, but there is considerable variation in this respect in the various groups and on different segments. It appears that in the pupa, hair 11 may assume the position shown by the corresponding hair on the first, second, third or fourth instar larvae. In figures 11 and 12 (Belkin 1952-125) of *Trichoprosopon digitatum* (Rondani), 1848, pupal hair 14 should be relabelled 13, since, as I pointed out (1952:128), it represents the retention of the more mesal of the two transitory larval hairs. The other corrections to be made in the nomenclature of the ventral abdominal hairs on the figures in that paper (Belkin, 1952) are as follows: fig. 5, pupal 12 to 11, pupal 13 to 12, pupal 7 (the spine) is not labelled; fig. 7 and 8 are of abdominal segment IV and not II, pupal 13 to 11; fig. 11, 12, 13 and 14, pupal 13 to 11. In the figures of Knight and Chamberlain (1949) hair 12 and 11 should be reversed in all genera; hair 13 on the figure of *Trichoprosopon* should remain as 13, since it is not homologous with their hair 13 (14 in the terminology of Belkin) in the other genera.

The other anomalous retentions of hairs on the abdomen of the pupa are to be found on the venter of segment II and clearly involve hairs 8, 11 and 12, labelled in larger figures (fig. 5). It will be noted that hair 12 on this segment is drawn as being slightly cephalad of 11. Such is not always the case for it may be at the same level or slightly caudad. It is significant that the same relationship is to be found in the larval instars on this segment (fig. 3 and 4). The anomalous hairs 8, 11 and 12 of segment II are not in the same class as hairs 9 and 13 and they are regularly present as fully developed hairs in many species of mosquitoes.

A second point of discrepancy involves the nomenclature of hairs 4 and 5 on all abdominal segments. In the revision of the pupal chaetotaxy (Belkin, 1952) I followed the pupal nomenclature of Knight and Chamberlain and reversed these two hairs as compared with the original anopheline larval terminology. After examining representatives of the majority of the genera, including several first instar larvae, I have come to the conclusion that these hairs shift their position laterad a great deal but appear to retain a cephalocaudal relationship much more consistently. Since the nomenclature of the chaetotaxy is based on the anophelines it would appear advisable to retain the terminology originally used in this group. In anophelines the more anterior of the two hairs is hair 4; hair 5 frequently moves mesad and caudad of it, although in the first instar larva it is found laterad of 4 (fig. 1). This mesocaudal movement is most strikingly exhibited in the pupa (fig. 5). Accordingly the terminology used by me (Belkin, 1952) should be reversed for these two hairs and the following changes should be made in the figures: figs. 5 and 7, interchange hairs 4 and 5 in larva and pupa; fig. 9, interchange hairs 4 and 5 for pupa only; figs. 10 and 11, no change; figs. 12 and 13, interchange hairs 4 and 5 for larva and pupa; fig. 14, interchange hairs 4 and 5 on all segments. In the figures of Knight and Chamberlain (1948) hair 5 should remain as labelled while hair 6 should be changed to hair 4. Further study of these hairs is needed, for in some culicines it appears that hair 4 and 5 may show disruption of the normal cephalocaudal relationship on some segments.

A similar situation is found with hairs 2 and 3. It appears that hair 2 is generally anterior to hair 3, but, as in the case of hairs 4 and 5 and 11 and 12, there is a considerable lateral shifting between members of the pair. In anophelines it is quite evident that the small hair mesad of hair 1 on the abdominal segment VI is hair 3 and not 2 as usually interpreted (fig. 1-5). Knight and Chamberlain correctly interpreted this hair in the pupa of anophelines. In other mosquito pupae there is a similar hair moving mesad of hair 1 on several segments, but Knight and Chamberlain interpreted it as hair 2 and I followed this interpretation. In some forms this hair is cephalad of 3 (some sabethines) while in others it is caudad of that hair. The question as to the homology of this hair cannot be settled without further study of the larval chaetotaxy of culicines and examination of pupal hairs *in situ* in the fourth larval instar. Until this is accomplished it is suggested that the terminology of Knight and Chamberlain as homologized by me be followed. It must be remembered that, if a change is made, the terminology of the anophelines should be adopted, for otherwise the well-known and widely used anopheline hair 2 would have to be renumbered.

Additional homologies have become evident in the terminal abdominal segments of the larva and pupa and are indicated in parentheses in figures 1, 4 and 5. On segment VIII of the larva, the first pentad hair is apparently homologous to hair 1; in sabethine larvae its position and degree of development are identical with hair 1 of the preceding segments. The second pentad hair appears to be homologous to hair 5 in these forms also and the corresponding hair in the pupa has also been interpreted as hair 5. The third pentad hair is almost certainly hair 7 from its position both in the larva and the pupa. The remaining pentad hairs, absent in the pupa, are in all probability hairs 10 and 12. Certainly pentad 5 cannot be hair 13 as interpreted by some workers, since it is present in the first instar larva while hair 13 is entirely absent in this instar (fig. 1). As these homologies are tentative only, I am retaining the arbitrary designation 1-5 for the pentad hairs of segment VIII of the larva. The two hairs of the pupal paddle (fig. 5) appear to be homologous with the two lateral hairs of the ventral valve; hair 1 is probably homologous with 9, and hair 2 with 8 (figs. 4 and 5). In this connection it is interesting to note that paddle hair 2 is often absent in the pupa and that its homologue in the larva (SL-8) is a transitory hair, appearing in the third instar (fig. 3).

The ''dorsal hairless setal ring'' has been interpreted by some workers as an element of the pupal chaetotaxy. In a recent paper (Belkin, 1953) I have attempted to show that this structure cannot be homologous with any regular hair and I have renamed it the *dorsal sensillum*. The accompanying figure shows this sensillum on segments III-V on which it regularly occurs (fig. 5,s) as well as its anomalous development on segment II (fig. 5,S).

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MORPHOLOGICAL CONSIDERATIONS AFFECTING THE TAXONOMY OF CERTAIN GENERA OF ANTS

(Hymenoptera, Formicidae)

By Robert E. Gregg, *University of Colorado, Boulder*

In the course of identifying series of ants from Colorado and other western areas, the writer's attention was drawn to a peculiar structural feature of the genus *Formica*. The significance of this structure for the classification of these ants has not been appreciated. The morphological trait in question involves the thorax and particularly the promesonotal suture. In a great many ants, this suture is but a crease between the first two segments of the thorax, and in others it is even obsolete so that the two segments are immovably united. It has been assumed that the latter situation (thoracic rigidity) obtains in *Formica*, probably as a result of the fact that most myrmecologists have dealt only with dried and fixed specimens mounted on pins. Inasmuch as all my specimens are preserved in alcohol, and are therefore still pliable, I have noticed for a long time past that the promesonotal suture of *Formica* is actually an articulated or movable joint. Until recently, no particular attention was paid to this fact, but when using the keys in Dr. Creighton's book on North American Ants, I found the thoracic structure of *Formica* could no longer be ignored.

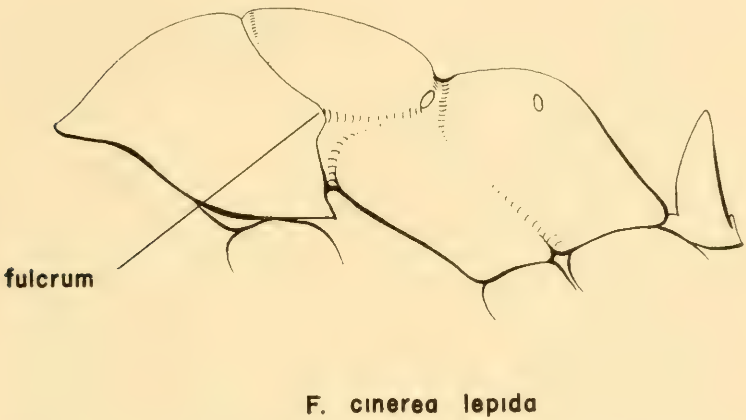

Fig. 1, profile of the thorax of *Formica cinerea lepida* Wheeler, showing the promesonotal joint with articular surface exposed.

The above mentioned keys pertaining to the identification of the *fusca* group contain a couplet for the separation of the forms of *cinerea* (p. 529, couplet No. 8), which states that in *F. montana* the anterior edge of the mesonotum stands distinctly above the pronotum and descends to the latter in an abrupt slope, and that in *F. altipetens* no such structural feature is to be seen, the pronotum and mesonotum usually forming a smooth convexity with little or no rise in the anterior level of the mesonotum. Examination of the type specimens upon which these differences are based (dried specimens), confirms Dr. Creighton's split in the key, but it will be observed that the key uses qualified statements, to wit, "usually form a single convexity . . ." and, "slightly or not at all raised above the level of the pronotum . . . etc." This was calculated to cover presumably exceptional instances. There is nothing unusual about such an approach to taxonomic characters (in fact it is highly desirable), but in the case in point, the writer noticed that by moving the prothorax and the remainder of the thorax behind the promesonotal joint, it was possible to make any individual ant pass to either "lug" of the key with perfect ease, and thus vitiate the value of the key split. Incidentally, the articular surface exposed by these manipulations is very shiny and therefore easily distinguished from the adjacent subopaque and pubescent external surface of the thoracic dorsum. The articular surface also represents the steep decline from mesonotum to pronotum mentioned in Creighton's key. The fulcra for this articulation are located, one on each pleuron, midway between dorsal and ventral surfaces of the thorax, in this way producing a hinged joint, fig. 1.

The character thus destroyed was employed by Dr. Creighton as the primary trait, but a secondary one was also given. At first it seemed we had no reliable method of separating *montana* from *lepida*, but further study serves to salvage these forms from synonymy and I believe we now have adequate means for recognizing them. The secondary characters given in Creighton's treatment concern pilosity and in reality are the best available; in fact they are the ones previously used in part by Wheeler in his revision of *Formica* in 1913. By arranging the *cinerea* complex on the basis of hair pattern, it is possible to recognize all forms without difficulty, and the characters, moreover, seem to be sufficiently constant. Pilosity as a separatory trait may be objected to by some, but it appears, so far, to be the only adequate criterion in the species involved. Hairiness, like color, is a minor characteristic in ants, but there is no intrinsic reason why these cues should be discarded as long as they can be shown to have constancy and geographic significance in any given case. Accordingly, the arrangement followed for detecting the species herein concerned is given below (see fig. 2):

Formica pilicornis Emery—covered with abundant, short, erect blunt hairs, the pilosity extending also to all parts of the head including very obvious hairs on the eyes and all surfaces of the antennal scapes.

Formica cinerea lepida Wheeler—abundant, long, erect hairs present on most surfaces of the body including thoracic dorsum, petiolar scale, the gula, occipital border of the head and the genae, on the latter particularly near the insertions of the mandibles.

Formica cinerea montana Emery—hairs present on most parts of the body, but not so abundant as on *lepida,* including the gula and occipital border, but noticeably absent on the genae. Normally the cheeks are free of any hairs.

Formica altipetens Wheeler—hairs relatively sparse on the body with

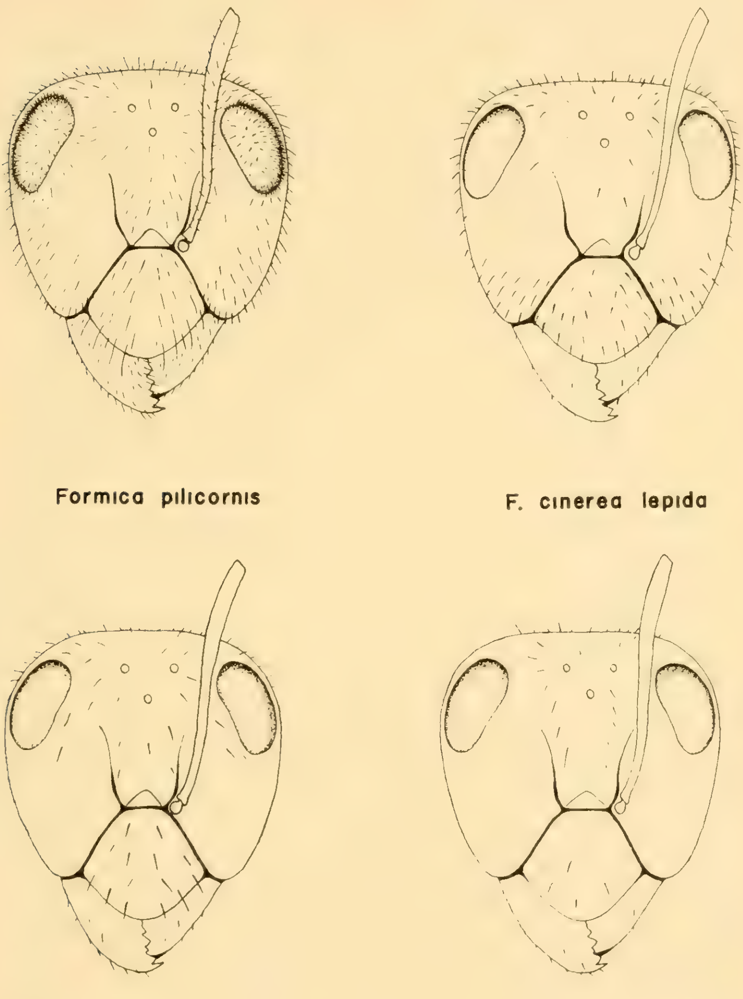

Fig. 2, frontal views of the heads of ants in the *cinerea* complex, arranged in the order of decreasing pilosity.

a few present on the gula, clypeus, front, and middle of the occiput. The genae and most of the head free of any hairs.

It will be seen from this list that there is a definite and consistent trend from a condition of dense pilosity (*pilicornis*) to one in which hairs are very sparse (*altipetens*). Study of an adequate series convinces me that these facts hold true, and that the relatively hairless condition of *altipetens* is not merely traceable to rubbed specimens. It will also be noticed that the nomenclature has been changed slightly to agree with what is considered to be the relationships of these forms, but it departs from Dr. Creighton's handling only in that *montana* is reduced from full species rank to that of a subspecies of *cinerea*. In my opinion, the fact that the typical *cinerea* is palaearctic does not make it impossible for its subspecies to occur in North America. The typical form and the American forms are so close morphologically, it does not seem proper to separate them specifically. That *pilicornis* is a full species, I have no doubt, for its dense pilosity extending to the scapes, makes it a very different ant, and its restriction to the Pacific Coast areas lends support to this view. *Montana* and *lepida* appear to be relatively slight departures from the European type, and seem to represent New World variants occupying respectively the eastern and the western portions of the United States, with a broad overlap in the Rocky Mountains of Colorado. (For distribution of all these ants see Creighton, 1950, pp. 531, 534, and 538.) Intergrades between *montana* and *lepida* are frequent in material coming from Colorado, as evidenced primarily by the fact that specimens with moderate pilosity and in all other respects referable to *montana*, may have 1 to 3 hairs on the lower genae near the mandibular insertions.

Altipetens blankets most of the range of *lepida*, and extends further south even as far as the Mexican border. It occurs fairly abundantly in the Colorado mountains, but is not known to reach as far east as *lepida*, that is, to the western Dakotas. *Altipetens* is the least pilose member of the series and therefore quite unlike *F. cinerea*. Since it is largely sympatric with *lepida*, it should for these reasons be regarded not as a geographic race of the true *cinerea*, but as a full species.

The author has no further information on the form described by Santschi as *F. cinerea canadensis*, and agrees with Creighton that it may be necessary, after examination of the types, to conclude that it belongs either to *altipetens* or to *lepida*. As it was described from a relatively low altitude (plains of Saskatchewan), I am inclined to believe it may be a northern sample of the *lepida* population.

The discovery of a movable thoracic joint in *Formica* has made certain other sections of Dr. Creighton's keys suspect, and with this in mind the point was pursued further. An articulation of the same sort exists in *Lasius, Acanthomyops, Camponotus, Myrmecocystus, Brachymyrmex, Oecophylla, Cataglyphis, Plagiolepis, Prenolepis, Paratrechina,* and *Polyergus,* as ascertained from an examination of specimens in my collection, and while a similar joint seems to be present in *Polyrhachis,* the amount of movement obtainable in this genus may be infinitesimal. I have examined several species of *Polyrhachis* in alcohol belonging to Dr. Creighton, and have found a surprising situation. Two species, in the subgenera *Hagiomyrma* and *Hedomyrma*, have a definitely mobile thorax, four species, in the subgenera *Polyrhachis*, *Campomyrma*, and *Hagiomyrma*, have a joint showing limited movement, and one belonging to the subgenus *Chariomyrma* has the suture evident but no movement whatever is obtainable. It would appear, however, that this feature is broadly evident in the subfamily *Formicinae* as far as the genera observed are concerned, and will probably prove true in others as well. Other subfamilies were tested also with the following results. Among the Dolichoderinae, the genera *Tapinoma*, *Iridomyrmex*, *Dorymyrmex*, *Azteca*, *Liometopum*, and *Dolichoderus* all showed a very easily moved promesonotal articulation. In the Myrmicinae, the genera *Aphaenogaster*, *Myrmica*, *Manica*, *Pogonomyrmex*, *Crematogaster*, *Pheidole*, *Solenopsis*, *Leptothorax*, *Myrmecina*, *Monomorium*, and *Stenamma* all demonstrated that the thoracic segments are firmly ankylosed into a single tagma. Among the Dorylinae, the genera *Eciton*, *Dorylus* and *Cheliomyrmex* also have absolutely immovable thoraces with hardly any trace of sutures visible dorsally. The only example of the Pseudomyrminae available, *Pseudomyrmex* itself, presented a movable promesonotal joint. And in the subfamily Ponerinae, (*sens. lat.*) we observe an inconstant condition of the articulation. *Ponera*, *Neoponera*, *Euponera*, *Leptogenys*, *Odontomachus*, *Anochetus*, *Pachycondyla*, and *Stigmatomma* all possess easily moved joints, while *Ectatomma*, *Proceratium*, *Sysphincta*, *Paraponera*, *Cylindromyrmex* and *Cerapachys* have no motion, and their thoraces are as immovable as in the myrmicines. The genus *Paraponera* possesses a definite suture, even dorsally, but the joint seems to be completely fixed as all attempts to elicit movement failed.

These genera represent only a random sampling of the conditions to be found in ants, and no doubt other genera would throw additional light on the question. But enough have been investigated to make it reasonably certain that the use of such a character as we encounter in the keys of the Ant Book can only be valid if the genus involved possesses a rigid thorax. With this fact clearly in sight, it is gratifying to state that couplet No. 18, p. 141, for the species of *Aphaenogaster* should cause no trouble. Unfortunately, as much cannot be said for the reliability of couplet No. 10, p. 441-2 for the genus *Myrmecocystus*, since the level at which the epinotum lies with respect to the anterior edge of the pronotum will depend entirely upon the angle assumed by the pronotum at its junction with the mesonotum. This angle in pinned specimens, though fixed by drying, is bound to vary from ant to ant, depending, of course, on its degree when the ants were killed.

It should also be pointed out that the advantage to be gained from linear measurements of the thorax of an ant when drawing up its description, as compared to total length of the specimen, is not as great as we might have expected, in genera that have a movable thoracic suture. Such thoracic measurements will always have their value, but the taking of these data and their interpretation will have to be made with extra caution and due care to insure uniformity of procedure.

The apparently trivial structure discussed in this paper would seem to be of importance only for the separation of a rather small number of species, but when we regard the array of genera which have, or do not have, a movable joint, we are faced with a character that is of more fundamental nature. All the genera examined in Formicinae, Dolichoderinae, Myrmicinae, and Pseudomyrminae are consistent, that is to say, they possess or they lack, an articulating promesonotal junction, and only the Ponerinae show much variation with respect to this feature.

If we consider the Arthropods as a whole, and the insects in particular, it is evident that a multiplicity of separate, though repeated parts, is a primitive condition, and that as one progresses upward through these groups there is a tendency for replicative structures to fuse, and therefore suffer reduction in their numbers. This behavior can be shown to have occurred probably on numerous occasions and may consequently be interpreted as a polyphyletic phenomenon. Then if this reasoning can be extended to the present situation, it may be suggested that the mobile condition of the thoracic juncture in ants is primitive (or perhaps generalized), and the immobilized state a derived or advanced condition. It will be recalled that in the Ponerinae both phases are observable, with some genera showing evolution toward fixity of the thorax. The ankylosed or fused state turns up again in the army ants and the myrmicine genera, possibily as independently evolved phenomena, while in the dolichoderines and formicines, though in many ways admittedly highly specialized groups, the relatively primitive mobility has been retained. What correlation these structural aspects may have with the behavior and physiology of various ants, and with the causes of such evolutionary divergences, is not apparent at this time. It might be emphasized, however, that a correlation exists between the presence of a mobile thorax, and the agility and tempo of behavior of ants. In general it may be said that dolichoderine and formicine ants are very active and responsive insects, and this is true of *Pseudomyrmex* also, while as a rule myrmicine species by comparison are stolid and show a more plodding behavior. It must be recognized, of course, that there are degrees in either one of these categories. To what extent the ponerine genera would confrom to this characterization is uncertain, but it would be worthy of investigation.

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NEW SPECIES OF UTAH MAYFLIES. II. BAETIDAE, CENTROPTILUM

(EPHEMEROPTERA)[1]

BY GEORGE F. EDMUNDS, JR., *University of Utah, Salt Lake City*

Part I of this paper appeared in the December 1951 (vol. 51:327-331, pl. 41) issue of this journal. The present paper presents the descriptions of two new species of the mayfly genus *Centroptilum* which are found within the borders of Utah. The holotypes, allotypes and paratypes of these species are deposited at the University of Utah; paratypes of each species are in the collections of the California Academy of Sciences and of Dr. J. R. Traver.

Centroptilum oreophilum, new species

(Figs. 8-12)

Male imago.—Length: Body, 7-8; wing, 7-8 mm.

Head dark brown, antennal scape and pedicel dark brown, flagellum paler, turbinate portion of eyes orange, lower portion gray; turbinate eyes large, stalk short, figs. 11 and 12. Thorax dark brown, fuscous on mesoscutellum; a pale spot on each side at the anterior confluence of the parapsidal furrows; pleural membranes whitish; the mesepisternum medium brown. Forelegs medium brown; the middle and hind legs lighter brown. Wings hyaline, venation brown; costal margin, especially the stigmatic area, cloudy. Hind wing venation variable, figs. 8, 9, veins behind the second longitudinal vein attached or free, usually weak, occasionally absent.

Abdominal tergites medium to light brown; pleural margin pale; posterior margin narrowly pale giving a faint annulate appearance to the abdomen; the dark tracheal trunks often visible beneath the tergites, faint paired oblique streaks near the front margin on the anterior segments.

Sternites much paler than tergites, light brown to yellowish; smoky paramedian oblique streaks followed by a smoky dot in the anterior half of each sternite, these markings obscure or absent on the posterior seg-

[1]Extracted from a thesis submitted to the Department of Entomology, University of Massachusetts in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

ments; lateral margins of sternite nine dark brown. Genitalia as in fig. 10. Tails smoky brown basally, paler distally.

Female imago.—Length: Body, 7-8; wing, 7-8 mm.

Similar to male except for usual sexual differences, but much paler. Head, thorax, and legs lighter than in male. Wings as in male.

Abdominal tergites light yellow brown with no pale markings as in male; tracheal trunks purplish brown and quite conspicuous. Sternites paler than tergites, without smoky markings as in male. Apex of subanal plate deeply notched. Tails pale with a faint suggestion of smoky brown at the base.

Types.—Holotype, ♂, Home Creek, Steens Mountains, Oregon, 22-V-50, K. Fender and S. Jewett. Allotype, ♀, Blacksmith Fork Canyon, Cache Co., Utah, 14-VI-46, F. C. Harmston. Paratopotypes, 10, ♂♂. Paratype, 1 ♂, same data as allotype. Also 1 intersex, same data as allotype.

Taxonomy and Biology

Centroptilum oreophilum is apparently most closely related to *C. elsa* Traver but is considerably larger than that species, the venation is brown rather than whitish, and there appear to be several differences in the male genitalia.

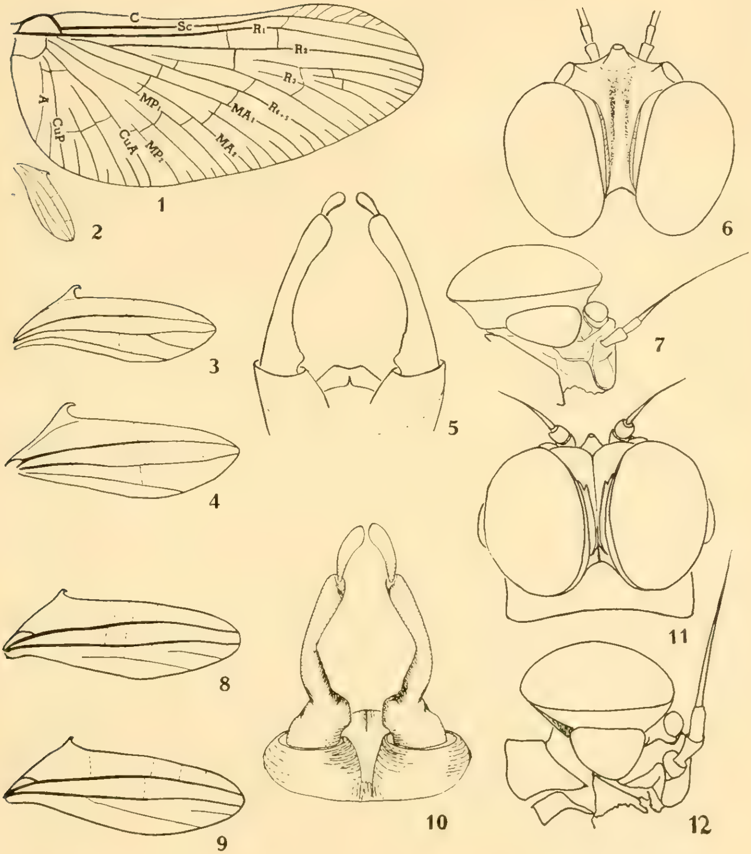
Little is known of the biology of this species except that it is a mountain species that has been collected in late May and early June. Mr. Jewett reports (in letter) that this species was exceptionally abundant at the type locality.

Centroptilum selanderorum, new species

(Figs. 1-7)

Male imago.—Length: Body 5-6, wing 5-6 mm.

Top of head between eyes yellowish brown, with a reddish brown median marking; front of head reddish brown, paler along margin of frontal carina and near bases of antennae; antennal scape pale, pedicel reddish brown, flagellum reddish brown, becoming paler distally; lower portion of compound eyes black, stalk of upper portion yellow, faceted area orange brown, figs. 6, 7. Pronotum reddish brown; mesonotum reddish brown, somewhat paler along median line and parapsidal furrows, darker between inner parapsidal furrows; alabaster white or light yellow brown laterad of outer parapsidal furrows, anterior to base of wing and on posterior and postero-lateral margins, and on scutellum; anterior half of metanotum alabaster white, posterior half deep reddish brown; thoracic pleura reddish brown with extensive white areas above the coxae, especially near the base of the forewing; venter of thorax reddish brown, paler between legs. Forelegs and coxae of middle and hind legs opaque white, remainder of other legs pale hyaline yellowish brown. Wings hyaline, venation pale, as in figs. 1 and 2; hind wing relatively broad; costal projection strongly curved; second vein single, forked, or with the



Figs. 1–7, male paratypes of *Centroptilum selanderorum;* fig. 1, forewing; fig. 2, hind wing, same scale as forewing; figs. 3–4, hind wings, enlarged; fig. 5, genitalia; fig. 6, head, dorsal view; fig. 7, head, lateral view. Figs. 8–12, male paratypes of *Centroptilum oreophilum;* figs. 8–9, hind wings; fig. 10, genitalia; fig. 11, head, dorsal view; fig. 12, head, lateral view.

detached fork appearing as an intercalary; crossveins obsolescent, figs. 3, 4.

Abdominal segments one to six semi-hyaline, seven to ten opaque; tergites one to six brownish except that the brown does not attain the anterior or lateral margins, thus leaving a hyaline margin; tergites seven to ten reddish brown with median and paramedian hyaline streaks; tergite ten paler than seven to nine. Sternites one to six hyaline; seven to ten alabaster white, washed with reddish brown near the pleural line. Genitalia as in fig. 5. Forceps and tails white.

Female imago.—Length: Body 5.5-6.5; wing 5.5-6.5 mm.

Head yellowish, antennal scape white, pedicel and flagellum light brown; eyes black. Prothorax pale yellowish brown, narrowly margined with reddish brown; mesothorax pale yellowish brown, pleural sclerites alabaster white, a reddish brown marking anterior to the wing base; metanotum darker brown. Legs white. Wings as in male. Abdominal segments opaque; tergites one to seven brownish, similar to male, eight to ten paler; trachea underlying segments one to seven dark purplish brown. Sternites white. Apex of subanal plate with a deep flaring V-shaped notch. Tails pale.

Types.—Holotype, ♂, Brigham City, Utah, 15-VI-50, J. C. Downey and R. B. Selander, from windows. Allotopotype, ♀. Paratopotypes, 25 ♂♂, 5 ♀♀. This species is named for my good friends Richard and Robert Selander who have collected numerous specimens of Utah Ephemeroptera for me.

Taxonomy and Biology

In Traver's key (The Biology of Mayflies, 1935:705) to the males of *Centroptilum*, *C. selanderorum* keys to couplet 10. It can be distinguished here from both *C. bifurcatum* and *C. semirufum* by the color of the abdominal tergites. It appears to be most closely related to *C. bifurcatum* from which it can be distinguished also by the male genitalia, the fact that the femora are not deeper in color than the other parts of the legs, and by the absence of a dark broken line along the spiracular area. The species *Centroptilum bifurcatum* McD., *C. semirufum* McD., *C. victoriae* McD., and *C. selanderorum* form a natural species group characterized by the presence of a small spine between the bases of the forceps and distinguished from one another by color characters and details of the male genitalia.

Practically nothing is known of the habits or habitat of this beautiful little mayfly. All the adults were collected from windows in Brigham City, Utah in mid-June. They probably originated from Brigham Canyon Creek which passes through the town nearby. It is also likely that the adults were attracted to the windows by lights the evening before.

THE DACUS SUBGENERA NEODACUS AND GYMNODACUS OF THE WORLD

(DIPTERA, TEPHRITIDAE)[1]

BY D. ELMO HARDY, *University of Hawaii, Agricultural Experiment Station, Honolulu*

Dr. Alan Stone, Division of Insect Detection and Identification, U. S. Department of Agriculture, recently reported (in correspondence) that the type of *Chaetodacus bakeri* Bezzi (Genotype of *Asiadacus* Perkins) had just been discovered in the U. S. National Museum collection and that it does not fit the description of *Asiadacus* Perkins. Perkins used as his diagnostic character for *Asiadacus* the absence of cilia on the third abdominal segment of the male. Bezzi's original description of *Chaetodacus bakeri* (1919, Phil. Jour. Sci. 15(5): 426-428) clearly states that the third segment has "black cilia on sides." Bezzi made an error in his key to the species of *Chaetodacus* (*op. cit.*, p. 419) and stated that the third abdominal segment of the male of *bakeri* is not ciliated; Perkins obviously repeated this error. More complete details concerning the type of *C. bakeri* have been supplied by Dr. R. H. Foote of the U. S. Department of Agriculture and it apparently fits in the subgenus *Neodacus*. *Asiadacus* is herein treated as a synonym on the bases of the congeneric genotypes. In this case much less confusion will be caused if page priority is not followed.

Perkins included *Dacus diversus* Coquillett in his *Asiadacus* and it properly fits his description in that the male has a supernumerary lobe and no cilia on the third segment. *D. diversus* is being treated under the subgenus *Gymnodacus* (see discussion under that subgenus). I am able to find significant differences which would warrant the erection of a new subgenus to contain *diversus*.

Dacus (Neodacus) Perkins

Neodacus Perkins, 1937, Proc. Roy. Soc. Queensland 58 (9):58

Asiadacus Perkins, 1937, Proc. Roy. Soc. Queensland 58 (9):57. New synonymy.

The subgenus *Neodacus* is very close to *Dacus* (*Strumeta*) Walker and differs only in the absence of prescutellar bristles, fig. 1a. This group contains the largest known species of the subfamily Dacinae. Many of them are beautifully marked and the species usually have extensive maculations of brown

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[1]Published with the approval of the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 287.

through the wings. The subgenus is known only from the Pacific and oriental regions.

Genotype: *Dacus* (*Neodacus*) *newmani* (Perkins).

KEY TO THE KNOWN SPECIES OF DACUS (NEODACUS)

1. Mesonotum with no postsutural yellow vittae .... (Australia) .... *newmani* (Perkins)
   Mesonotum with at least lateral yellow vittae present 2
2. Wings with extensive brown markings through the central portion, figs. 2a, 3c 3
   Wing with a costal band and a cubital streak, fig. 1b but with no brown markings through the center of the wing (except for brownish infuscation along the m crossvein in *lanceolatus*) 4
3. The yellow lateral vittae end before reaching the inner postalar bristles. Wings with a hyaline streak extending longitudinally through the middle from the base to a point in cell 1st M_2 about the lower apex of the r-m crossvein, fig. 3c .... (Russell Island and Soloman Islands) .... *pepisalae* Froggatt
   The yellow lateral vittae extend to the inner postalar bristles. No such longitudinal streak through cell 1st M_2, fig. 4 6
4. Humeral and notopleural calli joined by a yellow band. The m crossvein is infuscated .... (Papua) .... *lanceolatus* (Perkins)
   Sides of thorax not yellow between the humeri and notopleural calli. The m crossvein not infuscated 5
5. Wings with a broad costal band continuing to or beyond vein R_{4+5}, fig. 5e. Mesonotum with three postsutural yellow vittae, except in *bakeri* (Bezzi) 7
   Costal band interrupted, wings with a small, isolated, apical spot at the tip of vein R_{4+5}, fig. 1b. Mesonotum with two postsutural vittae .... (India) .... *affinis* n. sp.
6. The r-m crossvein is situated before the middle of cell 1st M_2 (discal cell), the lower apex of the crossvein is at about the middle of cell 1st M_2; wing pattern as in fig. 4. Length of body 9.5 mm. .... (New Guinea) .... *seguyi* (Hering)
   The r-m crossvein is situated beyond the middle of 1st M_2, the lower apex of r-m is at about the apical two-thirds of cell 1st M_2, fig. 2; wing maculations not as above. Length of body 11.5-12.0 mm. .... (New Guinea) .... *curvifer* Walker
7. Wings with a large apical spot, fig. 5e. Face with large black spots, fig. 5a 8
   Wings with no apical spot. Face with very small black spots .... (Papua) .... *emarginatus* (Perkins)
8. Three postsutural yellow vittae present. Thorax chiefly reddish, with no black markings except on the apex of the scutellum .... (India) .... *watersi* n. sp.
   Two yellow vittae present on mesonotum. Mesonotum with extensive black markings. Scutellum yellow except for a nar-

row stripe of black on the base. ....
.................(Philippine Islands).................. *bakeri* (Bezzi)

Dacus (Neodacus) affinis, new species

(Figs. 1a-b)

This species is very different from all known members of the subgenus *Neodacus*. It appears to be more closely related to *Dacus* (*Strumeta*) *zonatus* (Saund.) and *D.* (*Strumeta*) *paratuberculatus* (Philip) then to any known species of *Neodacus*. This provides still further evidence to support the viewpoint that the presence or absence of prescutellar bristles is not of generic importance in the *Dacus* (*sens. lat.*) *D. affinis* so closely resembles *D. zonatus* that it can be easily separated only by the absence of the prescutellar bristles. The female ovipositors would probably show distinctive characteristics but *affinis* is known only from the males. The species differs from other *Neodacus* as is stated in the above key.

Male.—A predominantly pale species devoid of conspicuous black markings. HEAD: The front is about one and one-half times longer than wide and is parallel sided. Two pairs of inferior fronto-orbital bristles and one pair of superior fronto-orbitals are present; these are black in color and are much shorter than are the genal bristles. The bristles of the head, beside those on the front and on the occipit, are yellow. The antennae are yellow to rufous, the third segment is three times longer than wide and slightly longer than the face. The basal third of the arista is yellow. The facial spots are dark brown to black and are rather small and usually oval in shape. They vary somewhat in size and shape but the vertical length of the spot is usually about equal to three-fourths or four-fifths the width of the third antennal segment. The front is entirely rufous, the hind portion of the occiput is usually discolored with brown. THORAX: All rufous or yellow except for brown to black markings on the sides of the metanotum and on the hypopleura, peteropleura and sternopleura. The scutellum also has a very narrow line of brown to black across its base, fig. 1a; it is otherwise yellow. The mesonotum is all rufous, except for the yellow lateral vittae and the humeri. The mesonotum sometimes has a pair of submedian brownish discolorations extending longitudinally about one-third to one-half its length. The bristles of the thorax are yellow to yellow-brown, they are arranged as is typical of this subgenus. LEGS: Entirely yellow to rufous, except for slight brownish discolorations on the inside edges of the middle and hind tibiae. WINGS: Almost entirely hyaline, only the stigma (third costal section), the cubital cell and a spot near the apex of the wing are distinctly yellow fumose. Cell R_2 is very slightly yellowish. The apical spot occupies a position at the end of vein R_{4+5} extending along the costa from the apical third of cell R_3 through almost the top half of cell R_5, fig. 1b. The entire basal portion of the wing, including the first two sections of the costa, the base of cell R, cell M and the posterior lobe, is devoid of microtrichia. The r-m crossvein is slightly curved and its lower end is situated at the apical third of cell 1st M_2. The distance from the apex of the cubital cell to the wing margin is equal to one-half the length of the narrowed portion of the cubital cell. ABDOMEN: Predominantly rufous, covered with white pubescence. The third tergum has a narrow brown to blackish band across its base. The fifth tergum has a narrow black vitta extending longitudinally down the middle. The shining spots on the sides of the fifth tergum are reddish brown. The abdomen is almost circular in shape, it is approximately as broad as long. Length: Body and wings, 5.0 mm.

Female unknown.

Types.—Holotype ♂, Yercaud, South India, taken with methyl eugenol,[2] June 6-8, 1950 (G. Beevor). Seventy-nine paratypes (all males): 62, same as type and 17 from Hessarghatta, S. India (probably from methyl eugenol bait trap), Feb. 22, 1950 (T. C. Lawrence).

The type and a series of paratypes are being deposited in the United States National Museum. The reminder of the paratypes are being distributed among the following Museums and Institutions: B. P. Bishop Museum, Honolulu, T. H., British Museum (Natural History); the Zoological Survey of India and the University of Hawaii.

Dacus (Neodacus) bakeri (Bezzi), new combination

Chaetodacus bakeri Bezzi, 1919. Phil. Jour. Sci. 15(5):426-428.

As was stated under the discussion of *Neodacus* the type of *Chaetodacus bakeri* was recently discovered in the United States National Museum and it fits in the subgenus *Neodacus* not in *Asiadacus* (as described by Perkins, not as defined by the genotype) as it has previously been treated. The species can be differentiated from other *Neodacus* which have the costal band of the wing expanded into a large apical spot by having the mesonotum extensively marked with black and with just two postsutural yellow vittae. Length: Body, 6.5 mm.; wings, 6.0 mm.

Type locality.—Davao, Mindanao; host unknown.

Type in the United States National Museum.

I have not seen this species; it is evidently known only from the type. The original description and figure appear to be quite adequate.

Dacus (Neodacus) curvifer Walker

(Fig. 2)

Dacus curvifer Walker, 1862, Proc. Linn. Soc. Lond. 7:229.

This appears to be very close to *D. pepisalae* Froggatt and

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[2]This is a powerful male lure but does not attract females.

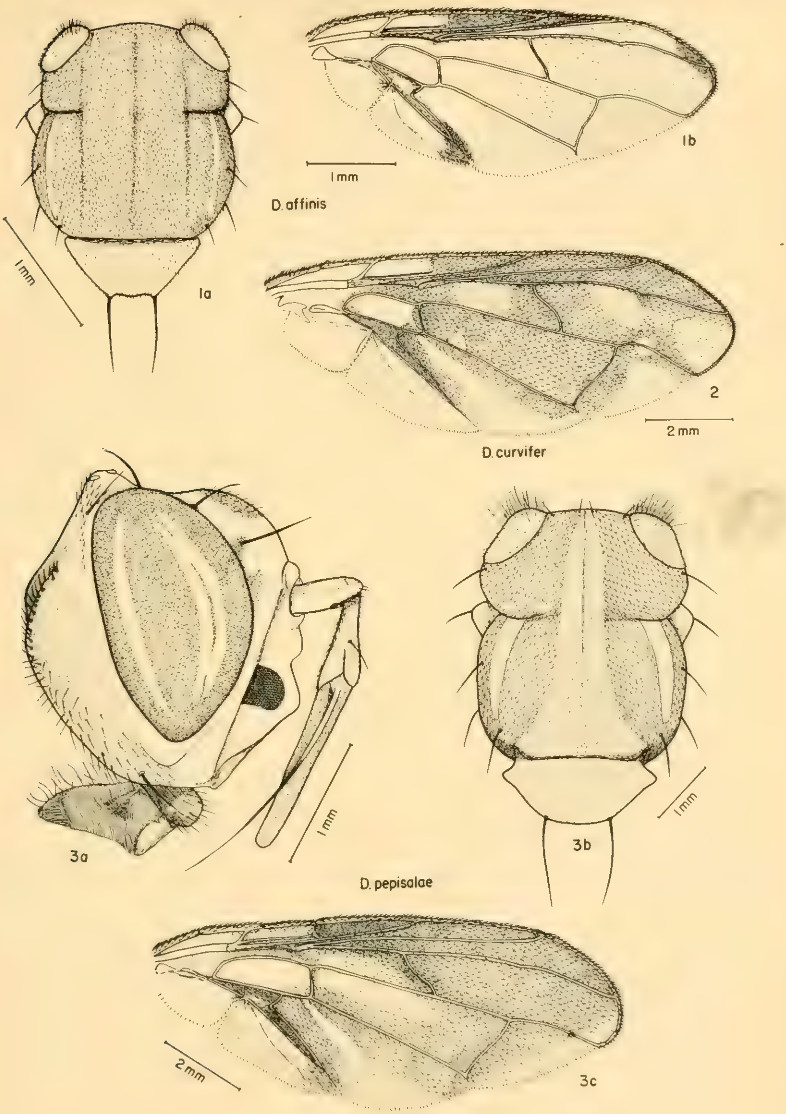

Fig. 1, *Dacus* (*Neodacus*) *affinis*, new species, a, thorax, dorsal view; b, wing of male; fig. 2, *D.* (*Neodacus*) *curvifer* Walker, wing of male; fig. 3, *D.* (*Neodacus*) *pepisalae* Froggatt, a, head, lateral view; b, thorax, dorsal view; c, wing of male. Drawings by Marian S. Adachi, Univ. of Hawaii.

apparently differs by having no hyaline streak extending longitudinally through the middle of the wing and also in the details brought out under the discussion of *D. pepisalae* Froggatt. The original description has been adequately supplemented by Perkins (1939, Univ. Queensland, Dept. Biol. Papers 1(10):21-22, fig. 1) except for the following details.

The median longitudinal hoary stripe is divided into two vittae by a very fine black line running down the middle. The postsutural yellow vittae on the mesonotum extend beyond the bases of the posterior supraalar bristles. The basal cells of the wing, including the costal and subcostal cells, are yellow fumose and are devoid (or nearly so) of microtrichia. Cell m is nearly all hyaline and has microtrichia only on the apical portion. The radial cell has a large square-shaped hyaline spot in the middle portion, this does not extend into cell 1st M_2 in the specimen at hand. Cell R_5 has a hyaline spot extending transversely from vein R_{4+5} just below the middle of the cell toward the large hyaline portion of cell 2nd M_2; the two clear areas are connected except for two narrow streaks of brown which isolate a round clear spot on vein M_{1+2}. The apical portion of cell R_5 has a large hyaline spot. Cell M_4 has a hyaline streak which extends through the median portion from the wing margin to the m-cu crossvein. The anal cell and the posterior lobe of the wing are hyaline, fig. 2. Length: Body 11.5-12.0 mm.; wing. 8.5-9.0 mm.

The specimen at hand had been identified (apparently by Froggatt) as *Dacus speculifer* Walker. It does not, however, fit Walker's original description. Walker's species cannot be placed to subgenus until the type is restudied.

Type locality.—Waigiou; host unknown

Type in the British Museum (Natural History).

Perkins' specimens were from New Guinea and Papua. I have seen it from Rabaul, New Guinea, 1-4-34 (J. L. Froggatt).

Dacus (Neodacus) emarginatus (Perkins)

Neodacus emerginatus Perkins, 1939, Univ. Queensland, Dept. Biol. Papers. 1(10):24, pl. 1, fig. 11.

This species is related to *D. watersi* n. sp. because of the presence of three yellow vittae down the mesonotum. It is distinguished by its broad, continuous costal band, chiefly black thorax, and by the small black spots on the face. Length: Body 6.0 mm.; wings, 5.5 mm.

The species has been adequately described and figured by Perkins.

Type locality.—Mondo, Papua; no host given.

Type in the British Museum (Natural History).

Dacus (Neodacus) lanceolatus (Perkins)

Neodacus lanceolatus Perkins, 1939 (June), Univ. Queensland Papers, Dept. Biol. 1(10):22-23, pl. 1, fig. 1.

Dacus (*Chaetodacus*) *albolateralis* Malloch, 1939 (Sept.), Proc. Linn. Soc. N. S. Wales. 64 (3-4):413, pl. XI, fig. 2.

This species is readily distinguished from all known members of this subgenus by having the m crossvein infuscated and by having the humeral and notopleural calli joined by a yellow band. Length: Body, 7.5 mm.; wings, 6.5 mm.

The species was adequately described by Perkins.

Type locality.—Papua; no host given.

Type in the British Museum (Natural History).

Dacus (Neodacus) newmani (Perkins)

Neodacus newmani Perkins, 1937, Proc. Roy. Soc. Queensland, 48(9): 58-59.

This species is distinguished from all known members of this subgenus by the lack of postsutural yellow vittae on the mesonotum. Length: Body, 6.5-7.0 mm.; wings, 4.6 mm.

The species has been adequately described by Perkins. It is known only from west Australia.

Type locality.—Carnarvon West Australia; "bred from native fruits."

Type in the Queensland Museum.

Dacus (Neodacus) pepisalae Froggatt, new combination

(Figs. 3a-c)

Dacus pepisalae Froggatt, 1911, Proc. Linn. Soc. N. S. Wales, 35:869.

This species is very closely related to *Dacus* (*Neodacus*) *curvifer* Walker. From Walker's description of *curvifer*, as supplemented by Perkins, 1939, Univ. Queensland, Dept. Biol. Papers 1(10):21-22, fig. 13, *D. pepisalae* appears to differ in the following ways: terga three to five are blue-black in color, not "dark mottled brown"; the yellow lateral vittae end well before the inner posterior supraalar bristles, not extending to the bristles as in *curvifer;* the upper three-fifths of cell 1st M_2 and the lower one-third to one-fourth of cell R_5 are occupied by a hyaline streak extending from the base of vein M_{3+4} to a point about opposite the r-m crossvein, not extensively brown, with not more than a small hyaline spot near base of 1st M_2 as in *curvifer;* cell 2nd M_2 is all brown except for the narrow apical portion, fig. 3c, not all hyaline, except for the basal edge along the m crossvein as in Perkins' figure of *curvifer.* The r-m crossvein is also strongly curved in the specimen of *pepisalae* on hand, it is straight in Perkins' figure of *curvifer* but is curved in the specimen which I have, fig. 2. Perkins (op. cit., 6) places the species in the genus (subgenus according to my concept) *Strumeta* "on the assumption that the male has a supernumerary lobe in the wing and the third abdominal tergite ciliated." The species at hand fits in the subgenus *Neodacus* because of the lack of the prescutellar bristles. Length: Body 12.0 mm.; wings, 10.0 mm.

This species is distinguished from other members of this subgenus by the hyaline streak which extends through the middle of the wing, fig. 3c, the sinuate r-m crossvein and by the abbreviated yellow vittae on the sides of the mesonotum, fig. 3b. The occiput is about two-thirds as broad as the compound eyes and the third antennal segment is equal in length to the face, fig. 3a. Malloch's description, 1939, Ann. Mag. Nat. Hist. 4(11):242-243, pl. x, fig. 8, is adequate for this species.

Type locality.—Russell Island; host unknown.

Type in British Museum (Natural History).

Malloch recorded the species from Tulaga, Solomon Islands. I have seen it from Vella Lavella, Brit. Sol. Isls., X-12 to 20-1943 (P. D. Hurd).

Dacus (Neodacus) séguyi (Hering)

(Fig. 4)

Strumeta (*Bactrocera*) *seguyi* Hering, 1939 [April], Verh. VII. Internat. Kongr. Entom. 1:165, f. 1.

Dacus peculiaris Malloch, 1939 [August], Ann. Mag. Nat. Hist. 4(11): 235, pl. X, f. 3.

This species apparently differs from *D. curvifer* and other related species by having the r-m crossvein situated before the middle of cell 1st M_2; by having a hyaline spot near the apex of cell R which extends through the basal portion of cell 1st M_2 and by having the hyaline area in cell 2nd M_2 extending through cell R_5 to vein R_{4+5}, fig. 4.[3] Length: Wing, 8.5 mm.

Type locality.—Bay of Humboldt and Dorey, New Guinea; host unknown.

Type in the Paris Museum.

Dacus (Neodacus) watersi, new species

(Figs. 5a-g)

This species appears to be more closely related to *D. emarginatus* (Perkins) from New Guinea, than to any other described species. It is distinguished by having the costal band expanded into a large spot in the wing apex; by its rufous thorax, and its larger size.

This species definitely occupies a boarderline position between two subgenera (genera of authors). It perhaps would be as correctly placed in *Dacus* (*Paradacus*) as in *Dacus* (*Neodacus*). One, two, or more secondary scutellar bristles or bristle-like hairs are developed in over fifty percent of the specimens at hand but since the supplementary setae show varying degrees of development and are not so strongly de-

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[3]Copied from Hering's figure.

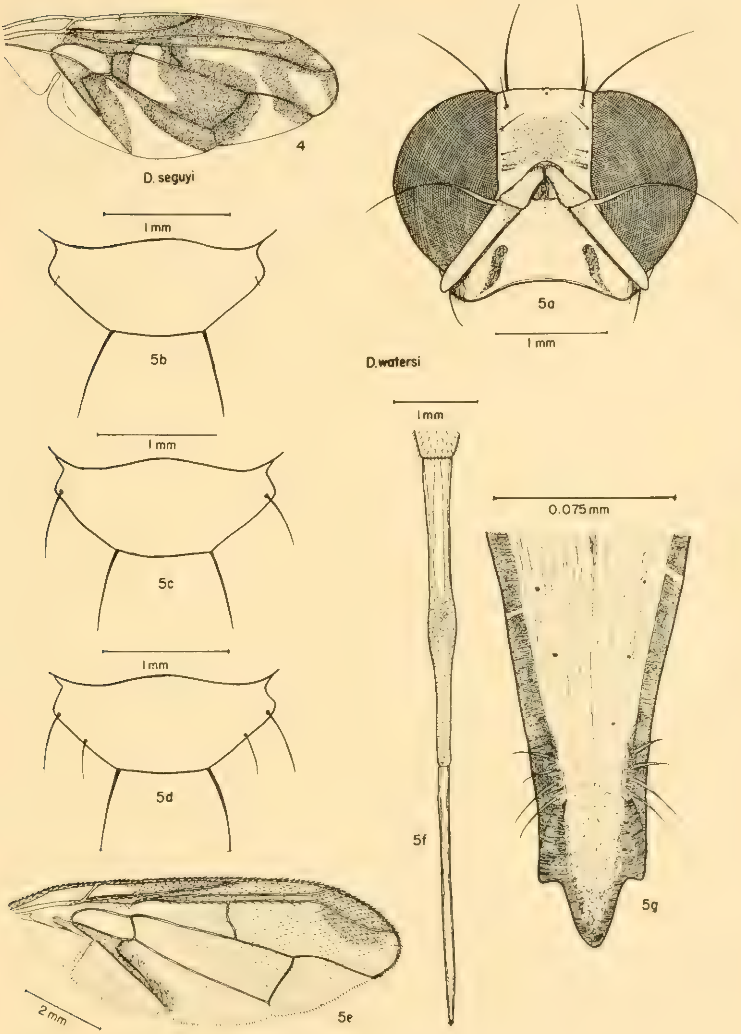


Fig. 4, *D.* (*Neodacus*) *seguyi* (Hering), wing (copied from Hering, 1939, Verh. VII. Intern. Kongr. Entom. 1:165, f. 1); fig. 5, *D.* (*Neodacus*) *watersi*, new species, a, head, front view; b, outline of scutellum showing two scutellar bristles; c, scutellum with four bristles; d, scutellum, with six bristles; e, wing of male; f, female ovipositor, showing inversion membrane and piercer; g, apex of piercer. Drawings by Marian S. Adachi.

veloped as in the *Zeugodacus* complex of subgenera it is perhaps best to consider this in the *Neodacus*. Some of the specimens which have four well developed scutellar bristles, fig. 5c would fit in *Paradacus*. Some have two strong and two weak bristles. Some have three bristles, the third may vary from moderately strong to weak. One specimen in the series possesses six scutellar bristles; the second and third pairs are rather poorly developed, fig. 5d. Some of the specimens have small humeral bristles and would thus fall into *Notodacus* as defined by some authors.

Male.—HEAD: Predominantly yellow to rufous. The front is discolored with brown to black on the gibbosity and at the bases of the bristles. The face has an elongate black spot occuppying about the basal half of each antennal furrow, fig. 5a. The face often has an indistinct brown to black line extending longitudinally down the middle. The front is one and one-half times longer than wide and is almost equal in width to one eye. Three pairs of inferior fronto orbital and one pair of superior fronto-orbital bristles are present. One to two pairs each of moderately strong gular and genal bristles are present. All of the head bristles are black. The antennae, including the basal third of the aristae, are yellow; the third segment is slightly discolored toward its apex. The third segment is four times longer than wide and extends to the upper margin of the epistome. THORAX: Chiefly reddish in ground color, faintly tinged with brown. The humeri possess a pair of enlarged bristle-like hairs in the position where the humeral bristles arise in *Notodacus*. These are pale, concolorous with the other setae on the humeri, in most specimens. In some specimens they are black and are nearly as well developed as in *Dacus* (*Notodacus*) *xanthodes* Brown. The humeri are yellowish to rufous, in most specimens they possess a distinct reddish or brownish tinge. The mesonotum has no black markings and has three postsutural yellow vittae. The lateral vittae extend to the inner postalar bristles. The median vitta extends from the suture about three-fifths of the distance to the scutellum. The mesopleural yellow stripe occupies the posterior half of the sclerite and its posterior and anterior margins are almost parallel. The anterior half of each mesopleuron is chiefly brownish red and is discolored by a transverse brown to black streak. The scutellum is largely reddish, the apical edge is black. The scutellar bristles are as described above and as in figures 5b, 5c, and 5d. The halteres are yellow. LEGS: The basal two-thirds of the femora are clear yellow, the apical portions are brownish red; the front femora are blackish on the outer dorsal surface. The tibiae and the apical subsegments of the tarsi are brownish yellow. The basal subsegments of the tarsi are yellow. WINGS: The first section of the costa is yellow fumose, the second is yellow around the edges and hyaline in the central portion. The first two sections are devoid of microtrichia except in the apex of the second. The costal band is yellow and occupies all of the front margin of the wing through cell R_3 from the subcostal vein to the apex. Toward the apex the costal band expands into a large black spot which extends half way through cell R_5, fig. 5e. The r-m crossvein is distinctly curved and is situated at or near the middle of cell 2nd M_2. The supernumerary lobe and the cubital streak are well developed. The narrowed portion of the cubital cell is nearly three times longer than vein Cu_1 + 1st A. ABDOMEN: Predominantly reddish with a black band across the base of the third tergum and with a median black vitta extending longitudinally from the base of tergum three to the apex of the abdomen. The apex of the second tergum is pale yellow. Length: Body, 8.5-9.0 mm.; wings, 8.0 mm.

Female.—The cubital streak extends just slightly beyond the apex of the cubital cell and the narrowed portion of the cubital cell is but slightly longer than vein Cu_1 + 1st A. Otherwise the female is like the male except for sexual characters. OVIPOSITOR: The exposed portion of the ovipositor is equal or slightly longer than the combined lengths of abdominal segments three to five. The visible portion is brownish red in color. The ovipositor is very elongate and slender, when fully extended it measures 9.0-9.5 mm. The piercer is about 3.2 mm. long by .14 mm. at its widest point. The extreme apex of the piercer is strongly constricted so that a short (.025 mm. long) point is developed, fig. 5g. Four pairs of preapical setae are present, the distad pair are approximately .05 mm. from the apex of the piercer. The oviduct is situated about .26 mm. from the apex. The inversion membrane measures about 3.5 mm. long by .39 mm. at its widest point. The rasper occupies a rather narrow band at about the middle of the segment, the segment is slightly expanded at this point, fig. 5f. The margins of the rasper are situated about 1.48 mm. from the apex of the segment and about 1.4 mm. from the base. The basal segment (7th abdominal segment) is about 2.8 mm. long by 1.7 mm. at its widest point. The spiracles are about .52 mm. from the base of the segment, measured on the lateral margins. Length: Body (excluding ovipositor) and wings, 9.2-9.5 mm.

Types.—Holotype ♂, allotype ♀, and 22 paratypes 4 males, 18 females: Kodaikanal, South India, Jan. 1951, ex *Bryonia* sp. (N. Waters).

Type, allotype, and a series of partypes are in the United States National Museum collection. Paratypes have been deposited in the following collections: B. P. Bishop Museum, Hawaiian Sugar Planters' Association, University of Hawaii.

Dacus (Gymnodacus) Munro

Dacus (*Gymnodacus*) Munro, 1938, Proc. Roy Soc. Lond., ser. B, Tax. 7(5):117.

This subgenus is separated from *Dacus* (*Strumeta*) by the absence of a row of strong cilia on each side of the third abdominal tergum. The previous concept of this group has included the lack of a supernumerary lobe in the wings of the males at the apex of vein Cu_1 + 1st A. The presence or absence of this lobe does not appear to be of enough importance to warrant erecting a new subgenus to contain *D. diversus* Coquillett. The genotype, *D. mesomelas* Bezzi, has no indication of this lobe; *D. absonus* (Hering) shows but a slight indication of it; the lobe is poorly developed in *D. calophylli* (Perkins and May) and in *hastigerinus* n. sp. and is well developed in *D. diversus* Coquillett.

This subgenus is known from the Pacific, Oriental, and Ethiopian regions.

Key to Known Species of Dacus (Gymnodacus)

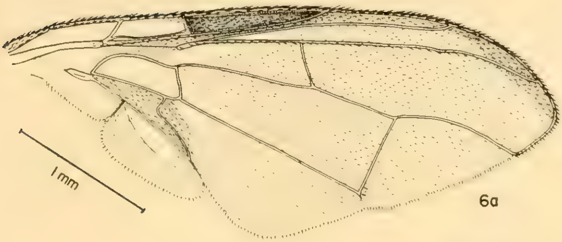
1. Crossveins r-m and m distinctly infuscated; costal band not continuous, interrupted in cell R_2 ....(Burma)........ *absonus* (Hering)
   Crossveins not infuscated; costal band not interrupted 2
2. Mesonotum with a median yellow vitta .... (Ceylon, Burma, India)..................*diversus* Coquillett
   Mesonotum with just two yellow vittae 3
3. Thorax chiefly black. Exposed portion of female ovipositor not longer than the combined lengths of abdominal segments four and five 4
   Thorax chiefly pale colored with no distinct black markings. Exposed ovipositor equal to the combined length of segments three to five ....(New Britain)................ *hastigerinus* n. sp.
4. Costal band broad, extending through most of cell R_3. Abdomen with black bands across the bases of segments one to three; sides of abdomen otherwise yellow to rufous. Ovipositor (*in situ*) not as long as the fifth abdominal segment ....(Australia).................. *calophylli* (Perkins and May)
   Costal call narrow, very faint in cell R_3 and with a small apical spot developed. Abdomen black on the sides, with no basal bands on segments two and three. Ovipositor about equal to the combined lengths of segments four and five .... (Africa) .... *mesomelas* Bezzi

Dacus (Gymnodacus) absonus (Hering)

Asiadacus absonus Hering, 1941, Arkiv för Zoologi 33B(11):1-2, fig. 1.
Dacus (*Gymnodacus*) *absonus* (Hering), Hardy, 1951. Pacific Science 5(2):129.

This species is readily distinguished from all known members of this subgenus by the infuscated crossveins in the wing and by the discontinuous costal band; the band is broadly interrupted in cell R_2. It has been adequately described and figured by Hering. Length of wing, 5.0 mm.

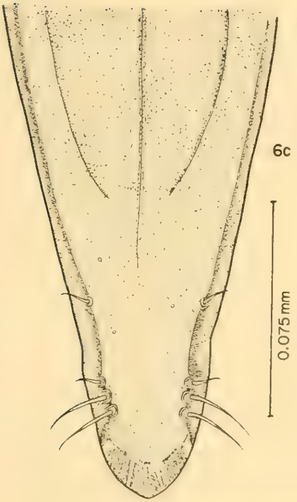
Fig. 6, *D.* (*Gymnodacus*) *diversus* Coquillett, a, wing of male; b, female ovipositor, extended; c, apex of piercer; fig. 7, *D.* (*Gymnodacus*) *hastigerinus*, new species, a, wing of female; b, extended female ovipositor; c, apex of piercer; fig. 8, *D.* (*Gymnodacus*) *mesomelas* Bezzi, a, wing. Drawings by Marian S. Adachi.



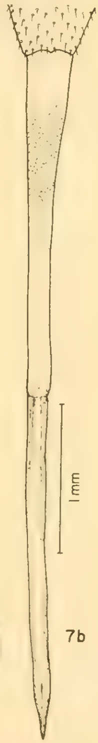
6a

D. diversus

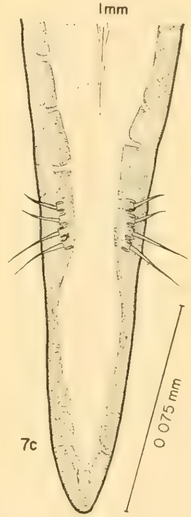
6b



6c

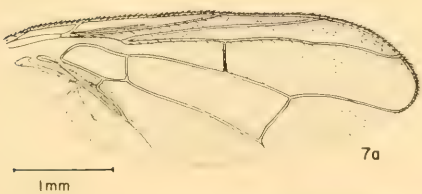


7b

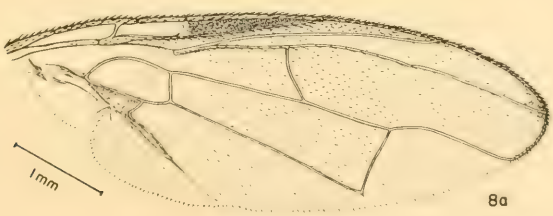


7c

D. hastigerinus



7a



8a

D. mesomelas

Type locality.—Kambaiti, Burma; host unknown.
Type in the Naturhistoriska Riksmuseum, Stockholm.
I have not seen this species.

Dacus (Gymnodacus) calophylli (Perkins and May)

Asiadacus calophylli Perkins and May, 1949, Univ. Queensland. Dept. Biol. 2(14):16-18, fig. 8.

Dacus (*Gymnodacus*) *calophylli* (Perkins and May), Hardy, 1951. Pac. Sci. 5(2):130, figs. 6a-b.

This species appears to be rather closely related to *D. mesomelas* Bezzi, of Africa. It is best separated by the broad costal band in the wing; the coloration of the abdomen and by the very short ovipositor of the female as brought out in the key. The structure of the ovipositor, as described and figured by Hardy (1951, l.c.) will distinguish it from other members of the subgenus. *D. calophylli* has been adequately described and figured by Perkins and May and by Hardy (l.c.). Length: Body, 5.0-5.5 mm.; wings, 4.5-5.0 mm.

Type locality.—Cairns, Queensland.
Type at the University of Queensland.
This is a common species in the Cairns area, infesting the fruits of *Calophyllum inophyllum* Linn.

Dacus (Gymnodacus) diversus Coquillett, new combination

(Figs. 6a-c)

Dacus diversus Coquillett, 1904, Proc. Ent. Soc. Wash. 6:139.

This species is distinguished from all known species of *Gymnodacus* by having three postsutral, yellow vittae on the mesonotum and by the details given in the description below.

Male and female.—HEAD: The face of the male is clear yellow with no dark markings. The female has a brown to black transverse band across the lower portion of the face. The front has two pairs of inferior fronto-orbital bristles and one pair of superior fronto orbitals. A distinct black spot is present at the base of each frontal bristle. The ocellar triangle is black. A transverse band of brown (sometimes slightly interrupted) extends across the vertex. The anterior one-third of the occiput is yellow, the hind portion is brown to black. The first two antennal segments are yellow, the third is tinged with brown. The third segment is about equal in length to the face. THORAX: Chiefly shining black in ground color, gray pollinose on the dorsum. The thorax is densely covered with fine gray to silvery pile. The yellow markings are as follows: The humeri, notopleura, mesonotal stripes, hypopleura, scutellum, and the three postsutural vittae. LEGS: Chiefly yellow, tinged with brown on the tibiae and on the apical subsegments of the tarsi. WINGS: The costal cells are hyaline and devoid of microtrichia. The costal band is rather narrow and does not extend into cell R_3 along the underside of vein R_3; the band expands slightly at the wing apex, fig. 6a. An indistinct spot of brown is present at the lower edge of the m crossvein. A very pronounced lobe is present at the apex of vein Cu_1 + 1st A and the cubital streak is distinct. The free end of vein Cu_1 + 1st A is about one-third as long as the narrowed portion of the cubital cell in the male. In the female this vein is about two-thirds as long as the narrowed portion of the cubital cell. ABDOMEN: The first tergum is rufous in the middle and black on the sides. Terga two to four have a broad black band across their bases and are yellow to rufous on their apices. The fifth tergum has a black spot on each antero-lateral margin, it is otherwise yellow to rufous. FEMALE OVIPOSITOR: Long and slender, fig. 6b, the exposed portion, *in situ*, is almost equal in length to the remainder of the abdomen. The basal segment is about three times longer than the fifth abdominal segment. The entire ovipositor, fig. 6b, is approximatly 5.0 mm. long. The piercer is about 1.17 mm. long by about .16 mm. at its widest point. The opening of the oviduct is about .11 mm. from the apex of the piercer. The preapical setae are tiny and are scarcely discernible except at magnifications of 660 times; one pair of very small setae are displaced well behind the three distad pairs, fig. 6c. The setae are situated near the apex of the piercer (about .025 mm. measured from apical pair). The inversion membrane is 1.95 mm. long by .32 mm. at its widest point. The rasper extends to within .75 mm. of the base of the segment. The basal segment of the ovipositor is 1.82 mm. long by about 1.0 mm., measured across its anterior margin. The spiracles are situated .4 mm. from the base of the segment. Length: Body, 5.0-6.0 mm.; wings, 5.3-5.7 mm.

Type locality.—Colombo, Ceylon, and Bangalore, India.

Type in the United States National Museum.

This species has been recorded from numerous localities throughout India, Burma, and Ceylon. It infests a wide range of fruits ranging from citrus to cucurbits and is of considerable economic importance in some areas.

I have studied a large series of specimens from several localities in the United Province, reared from several species of cucurbitaceae.

Dacus (Gymnodacus) hastigerinus, new species

(Figs. 7a-c)

This species is more closely related to *D. calophylli* (Perkins and May) than to any other known member of this subgenus and is distinguished by the long, slender ovipositor of the female and by the predominantly pale coloration of the mesonotum in both sexes. In *D. hastigerinus* the exposed portion of the ovipositor, *in situ*, is approximately equal in length to the combined lengths of abdominal segments three to five. In *D. calophylli* it is scarcely over half as long as the fifth segment.

Male.—HEAD: The front is slightly over two times longer than wide.

The front is all yellowish except for a brownish red median discoloration on the tumescence. Two pairs of inferior fronto-orbitals and one pair of superior fronto-orbital bristles are present. The head bristles are black, with a faint brownish tinge in the color of those on the vertex and occiput. The black facial spots are moderately large and are quadrate to oval in shape. The antennae are all yellow to rufous, the third segment is three and one-half times longer than wide and is about equal in length to the face. THORAX: Predominantly pale colored, with no distinct black markings. The mesonotum has a pair of narrow, submedian, brownish colored vittae, extending anteriorly from the scutellum, just outside the prescutellar bristles to a point, about opposite the middle of the humeri. In one specimen on hand these vittae are blackish. A brownish colored spot is also present on the dorsum behind each humerus. The yellow vittae on the mesonotum do not extend to the posterior supraalar bristles. The scutellum is entirely yellow, there is no discernible brown or black area at its base. The halteres are all yellow. The metanotum is largely brown, the median portion is rufous. LEGS: Entirely yellow. The apical spurs of the middle tibiae are nearly equal to twice the width of the tibiae. WINGS: The first and second costal cells are very faintly yellowish fumose and are devoid of microtrichia except in the apical half of the second portion. The costal band extends below vein R_3, one-half to three-fourths the distance through cell R_3. At the wing apex the band extends one-third to one-half the distance between the tips of veins R_{4+5} and M_{1+2}. Vein M_{3+4} ends just beyond the junction with the m crossvein. The cubital streak is comparatively narrow and is pale yellow-brown fumose; the streak occupies the basal portion of cell M_4 to about the hind edge of the m crossvein. The r-m crossvein is straight and is situated at about the apical three-fifths of the discal cell, fig. 7a. The narrowed portion of the cubital cell is nearly equal in length to that portion of the wing from the apex of the cubital cell to the margin. ABDOMEN: Chiefly yellow to rufous except that the first tergum is largely brown to blackish; the second tergum has a brown to blackish transverse band across the median portion and the third tergum has a narrow brown to black basal band. A faint to distinct brown to blackish colored vitta extends longitudinally down the middle of terga three and four, and extends a short distance onto the anterior part of tergum five. Length: body, 5.0 mm.; wings, 4.6 mm.

Female.—The narrowed portion of the cubital cell is equal in length to that section from the apex of the cell to the wing margin. The sides of abdominal trega three to five are brown and no distinct median vitta is present. OVIPOSITOR: Long and slender, fig. 7b, conspicuously extending beyond the apex of the abdomen. *In situ,* the extruded ovipositor is about equal to the combined lengths of abdominal segments three to five. The extended ovipositor is about 6.5 mm. long. The piercer measures approximately 2.26 mm. in length by .13 mm. wide. The piercer is straight sided, tapering abruptly just beyond the opening of the oviduct to a sharp point at the tip, fig. 7c. The opening of the oviduct ex-

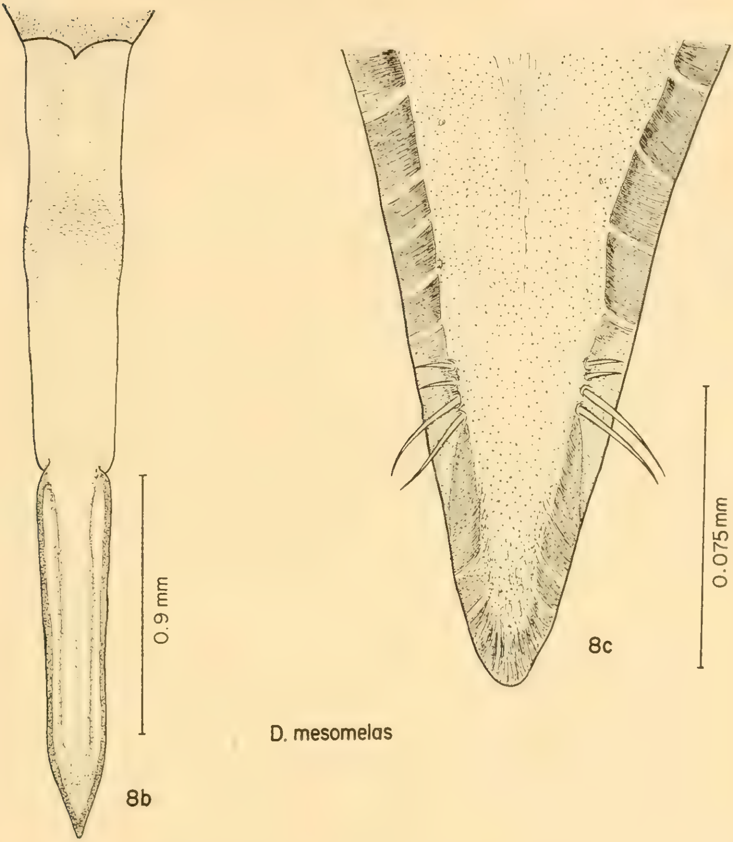


Fig. 8b, female ovipositor, full length; c, apex of female ovipositor. Drawings by Marian S. Adachi.

tends to within .26 mm. of the apex. The setae are located about .08 mm. from the apex of the piercer. The inversion membrane is about 2.55 mm. long by .38 mm. at its broadest point. The rasper extends to within about .56 mm. of the base of the inversion membrane. The basal segment is about 1.7 mm. long by 1.3 mm. at its widest point. Length: Body, 5.5-5.8 mm.; wings, 4.5 mm.

Types.—Holotype ♂, allotype ♀, and three paratypes, two males and one female: Keravat, New Britain, ex fruit of *Spondias* sp., Oct., 1949 (N. L. H. Krauss).

Type and allotype in the United States National Museum. One paratype each in the B. P. Bishop Museum, Hawaii Board of Agrictulture and Forestry, and the University of Hawaii.

Dacus (Gymnodacus) mesomelas Bezzi

(Figs. 8a-c)

Dacus mesomelas Bezzi. 1908. Ann. Soc. Ent. Belg. 52:386.

Dacus (*Chaetodacus*) *aethiopicus* Munro. 1933. Amer. Mus. Novit. 597-1-3.

This species is similar, in many respects, to *D. calophylli* (Perkins and May). It is readily differentiated by the narrow, poorly developed costal band, fig. 8a; by the lack of transverse black bands on the abdomen and by the more elongate female ovipositor, fig. 8b.

Female.—HEAD: The facial spots are large and round. Front unspotted and nearly two times longer than wide. Two pairs of inferior fronto-orbital bristles and one pair of superior fronto-orbitals are present. THORAX: The mesonotum is chiefly brown to black, with a pair of yellow lateral vittae and pair of broad, submedian, gray pollinose vittae extending the full length of the mesonotum; the area between the two gray vittae is subshining brown to black. The scutellum is yellow except for a slight brownish discoloration at the apex. LEGS: The femora are yellow to rufous. The posterior tibiae are brown to blackish and the other pairs are slightly discolored with brown. The tarsi are predominantly yellow. WINGS: The first two costal cells are hyaline, devoid of microtrichia except in the apical half of the second section. The stigma is dark brown fumose. The costal band is very narrow and poorly developed; it is light brown in cell R_2 and fills all of this cell but does not extend below vein R_3. Cell R_3 is very slightly fumose along the costal margin, the costal band is often interrupted through much of this cell. A light brown spot is developed at the apex of the cell R_3, extending into the upper portion of cell R_5, fig. 8a. The r-m crossvein is strongly oblique and is situated at the apical third of cell 1st M_2. The cubital streak is faint and is confined to the cubital cell. The narrowed portion of the cubital cell extend about half way to the wing margin in both sexes. ABDOMEN: A large black spot is developed on each side of terga one to four and a small black spot is present on the anterior lateral margins of tergum five. A narrow black vitta extends the entire length of terga one to five down the middle. OVIPOSITOR: The visible ovipositor (*in situ*) is about equal in length to abdominal segments four and five. The extended ovipositor is about 4.0 mm. in length. The piercer is moderately tapered at its apex and has two pairs of rather large (apical) setae and two pairs of minute setae, fig. 8c. These are preapical in position and are situated about .07 mm. from the apex. The opening of the oviduct is located .13 mm. from the apex of the piercer. The invasion membrane is 1.58 mm. long by .31 mm. wide; the rasper extends to within .42 mm. of the base of the segment. The basal segment is 1.13 mm. long by 1.0 mm. wide and the spiracles are .31 mm. from the base of the segment. Length: Body, 5.5-7.9 mm.; wings, 5.0-6.8 mm.

Type locality.—Kinchassa. Host not given. (Dr. A. Collart informs me in correspondence that the larvae infest the fruits of *Parinarium.*)

Type in the Institut Royal des Sciences Naturelles de Belgique.

Specimens at hand are from Amani, Tanganyika, Mar. 1936, "big palmate leaved tree" (F. A. Bianchi).

NOTES AND SYNONYMS IN CHRYSOMELIDAE

(COLEOPTERA)

BY F. MONRÓS, *Universidad Nacional de Tucumán, Argentina*

While studying the chrysomelid collection of the U. S. National Museum in Washington, I have come across some interesting species that are considered in the present paper. I want to express my thanks to the John Simon Guggenheim Memorial Foundation, that has made my stay in the United States possible, and to the authorities of the U. S. National Museum for the facilities they have made available to me.

The names preceded by an asterisk (*) designate those species of which I have seen the types in the U.S.N.M. collection.

CLYTRINAE

Anomoea laticlavia (Forster) (Nov. Spec. Ins., 1771, p. 27)

* *A. laticlavia* v. *kansana* Schaeffer. (Journ. N. Y. Ent. Soc. 41, 1933, p. 310, 314, 315). This represents nothing but a yellow color-form of *laticlavia* and seems to have no racial significance. (New synonymy.)

* *A. crassicornis* Schaeffer. (*l.c.*, p. 310, 311, 313)—This differs from *laticlavia* only in the color pattern and cannot be specifically separated. (New Synonymy.) The following names refer to forms which, in addition to being synonyms of *laticlavia*, are plainly the same as the color form which was named *crassicornis*:

* *A. laticlavia* v. *floridana* Schaeffer. (*l.c.*, p. 310, 311, 315, 316). (New synonymy.)

* *A. angustata* Schaeffer. (*l.c.*, p. 310, 316, 317). (New synonymy.)

Megalostomis (*Minturnia*) *dimidiata* Lacordaire. (Mon. Phyt. II, 1848, p. 526).

= *Coscinoptera major* Crotch (Trans. Amer. Ent. Soc. 19, 1892, p. 11). (New synonymy.)

Babia quadriguttata (Olivier) (Enc. méth. Ins. VI, 1791, p. 37).

The following names represent nothing but color variations of this species, and all degrees of intermediate forms can be found between them and the typical *quadriguttata*:

* *B. quadriguttata* v. *tenuis* Schaeffer. (Journ. N. Y. Ent. Soc. 41, 1933, p. 319, 320). (New synonymy.)

* *B. tetraspilota* v. *texana* Schaeffer. (*l.c.*, p. 320, 321). (New synonymy.)

* *B. oregona* Schaeffer. (*l.c.*, p. 320-321). (New synonymy.)

Urodera crucifera Lacordaire. (Mon. Phyt. II, 1848, p. 454).

* *U. texana* Schaeffer. (Journ. N. Y. Ent. Soc. 27, 1919, p. 325) is a color variation of the present species and corresponds to a form more commonly found in Mexico and Central America. (New synonymy.)

CHLAMISINAE

There seems to be no reason not to consider *Diplacaspis* Jacobs. a good genus. Besides the exceptional character of possessing meso- and metascutellum with the corresponding metanotal modifications involved in it, the larval morphology, as shown in *Diplacaspis paradoxa* (van Emden, Zool. Anzeiger C I, 1932, p. 9-16) also differs sufficiently from that of a typical *Chlamisus* larva for maintaining both genera.

If this statement is accepted, the following species belong to *Diplacaspis*:

* *Chlamys prosternalis* Schaeffer. (Bull. Mus. Brooklyn I (9), 1906, p. 227, 229). (New combination.)

* *Boloschesis scabripennis* Schaeffer. (Proc. Ent. Soc. Washington 28, 1926, p. 184). (New combination.)

* *Boloschesis subelata* Schaeffer. (*l.c.*, p. 184). (New combination.)

All three of these species are related to *Diplacaspis moestifica* (Lacordaire).

Chlamisus arizonensis (Linell) (Proc. U. S. Nat. Mus. 20, 1898, p. 476, 479).

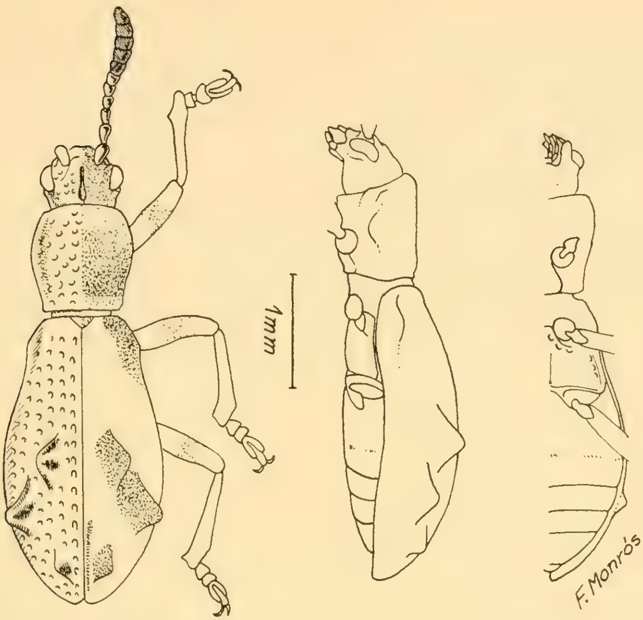
* *Chlamys huachucae* Schaeffer. (Bull. Mus. Brooklyn I (9), 1906, p. 228, 230) represents nothing but a color form of the present species, in which the dorsal pattern is less conspicuous. It cannot be specifically separated from *arizonensis;* furthermore, as both forms have been collected together, *huachucae* cannot be considered to be a geographical subspecies of *arizonensis*.

EUMOLPINAE

The late H. S. Barber described a new insect from Cuba, for which he established the genus *Cubispa* (Mem. Soc. Cubana Hist. Nat. 28, 1946, p. 19-22). He placed this genus in the Hispinae and related it to *Stenispa* or *Cephaloleia* in the tribe Cephaloleini.

From this tribe, *Cubispa* may be easily separated by the following main characters: (1)—subclavate antennae, (2)—pronotum without bristles in any angle, (3)—elytra tuberculated, (4)—absence of metathoracic wings, (5—different type of tarsi and claws.

From the remaining Hispinae it may be distinguished by the following characters: (1)—mouth placed at the front of the head, (2)—different shape of head capsule and antennal insertion, (3)—absence of a shortened scutellar row of punctures, always present in the American Hispinae and absent only in some unrelated Old World genera.



Cubispa turquino Barber, holotype ♀ in U.S.N.M.—In dorsal view, color pattern is indicated on right side, the punctuation and structure on the left. (The mesothoracic lateral sclerites are not shown in the figure, because they are hidden by the glue in the unique available specimen.)

Barber considers that *Cubispa* ''differs from most hispids in the position of its mouth, which is near the front of the head, but this is also true of *Demotispa* Baly, which has become confused by recent authors with the very similar cassidid (?) genus *Imatidium* F. Perhaps it is most nearly related to *Stenispa* Baly, the larva of which (recently found living exposed on a marsh sedge by Wm. H. Anderson) is almost identical in appearance with larvae of *Cephaloleia, Arescus* [*Areschus* ex err.] and some other tropical genera.''

The mouth position in *Cubispa*, fig. 1, shows nothing in common with that of *Demotispa* which is a typical *Cryptostome.* There is an hispid genus, *Homalispa*, in which the mouth parts are placed on the front of the head but, in that case, it is due to the fact that the gular area has extended abnormally to occupy the whole ventral part of the head and *Homalispa* remains in spite of it a typical *Cryptostome;* this is not the head structure of *Cubispa*, which is typically Eumolpid-like.

Besides the differences between *Cubispa* and Cephaloleini already pointed out, all the genera of Hispinae with which *Cubispa* is compared belong to the *Alurnites* group (Monrós and Viana, An. Mus. Arg. Ciencias Nat. 42, 1947, p. 149) which includes the monocotyledonous, Neotropical Hispinae with free-living larvae and a principal character of which is the absence of elytral tubercles, the antennae not clavate at the apices, the elytra with 10½ rows of punctures and another type of tarsi and claws, together with a flattened body, adapted to living between monocotyledonous leaves.

In my opinion, the present insect belongs to the Eumolpinae and constitutes the type of a tribe of its own which has no connection with Hispinae, the similarity between *Cubispa* and the true Hispinae (which is based mainly on the elytral tubercles and the approximate antennae) being purely superficial. This tribe seems to represent an aberrant type of independent evolution in Eumolpinae rather than a connecting form between Hispinae and Eumolpinae.

The new tribe may be briefly described as follows:

Cubispini new tribe of **Eumolpinae**

Type genus: *Cubispa* Barber, described in Hispinae.

Anterior margin of prothorax without ocular lobes. Claws simple, equal and divergent . Tibiae without apical incision on external margin. Body glabrous. Antennae dilated from 7th joint and pilose from 6th, approximated but not contiguous on insertion. Pronotum without lateral, well-defined margins and without bristles or sensorial tubercules on its angles. Elytra with 8 semi-regular striae of deep punctures, without shortened scutellar row, without basal epipleural lobes and with conical tubercules on apical half. Metathoracic wings lacking.

The present tribe may easily be distinguished from all other Eumolpinae. It seems to have diverged from the rest of that subfamily a long time ago and developed in an independent way.

HONEY BEES ATTACKED AT THEIR HIVE ENTRANCE BY THE WASP PHILANTHUS FLAVIFRONS CRESSON

(Hymenoptera)

On June 20, 1949, at Delta, Utah, a female *Philanthus flavifrons* Cresson (determined by K. V. Krombein) was seen in an apiary on the entrance board of a hive. She was running parallel to the entrance slot and darting at guard bees that were lined up facing her just outside the entrance. The bees backed away when the wasp closed in on them, but four were seized in rapid sucession and stung in the throat. They offered no apparent resistance and were immobilized as soon as they were stung, except for an ocasional twitching of the legs. The wasp grasped the fourth victim by one antenna and had pulled her several yards across the bare ground in front of the hive when the philanthid was collected for identification. No other

Philanthus was seen bothering the colonies in the course of brief observations made during the next few days.

Philanthus flavifrons is a common species in the arid portions of western North America. The literature, however, contains no reference to its biology. In fact, of the 31 species and subspecies of *Philanthus* in North America, Strandtmann states that we have definite knowledge on the biology of only two, *gibbosus* (Fabr.) and *ventilabris* Fabr. (Strandtmann, 1946, A review of the North American species of *Philanthus*, North of Mexico, Ohio State Univ., 126 pp.). Both species are well known as predators of solitary bees. Small bees of the families Halictidae and Andrenidae (Panurginae) are the principal prey of these two species (Reinhard, 1924, The life history and habits of the solitary wasp, *Philanthus gibbosus*, Smithsn. Inst. Ann. Rpt. for 1922, pp. 363-76; also Krombein, 1936, Biological notes on some solitary wasps, Ent. News 47:93-99).

Although I have seen no previous record of attacks on honey bees by philanthid wasps in North America, *triangulum* (Fabr.), a large European species known as the bee wolf, stores its nests principally with honey bees that it attacks on flowers. *P. gibbosus* and *ventilabris* also attack their prey on flowers.

It was truly astonishing to see so small a wasp as *flavifrons* "beard the lions in their den" and so obviously dominate the situation. The honey bees, which appeared to be terrorized by the wasp, outweighed her at least two fold. Was the *Philanthus* attempting to provision her brood cells with honey bees? It remains to be seen whether or not the burrows of this wasp could accommodate insects of such size.—GEORGE E. BOHART. *Agricultural Research Service, Logan, Utah in cooperation with the Utah Agricultural Experiment Station.*

NEW SPECIES AND DISTRIBUTION RECORDS OF THE GENUS CAECULUS IN NORTH AMERICA

(ACARINA, CAECULIDAE)

BY STANLEY MULAIK AND DORALD M. ALLRED,
University of Utah, Salt Lake City

Mites of the genus *Caeculus* appear to be very widely distributed. Representatives are known from Africa, Australia, Japan and the Philippine Islands, to mention only a few. Collections in North America have been primarily southern. Recent collections of specimens in Oregon, Utah, North Carolina, Mexico and Guatemala show a wide distribution in the Western Hemisphere.

Until recent years, mites of this genus have been represented in North America by few known species. Banks (1899 and 1905) described *Caeculus americanus* from the region of Washington, D. C. and *C. clavatus* from California. Nevin described *C. pettiti* from Virginia in 1943. In 1945 Mulaik described nine new species from the southern part of the United States and one new species from Puerto Rico.

Through the courtesy of Dr. E. W. Baker of the United States National Museum, a series of mites of the genus *Caeculus* were received for study. Among this lot were several new species and new distributional records, some of which are reported in this paper. In addition, several mites representing new distribution records and new species have been received from Dr. C. Lynn Hayward and Dr. D. Elden Beck of the Brigham Young University, and through collections of the senior author. The five new species included in this paper makes a total of eighteen species known to occur in North America. The new records for some previously described species considerably extends their known geographic range.

Caeculus oregonus, new species

(Figs. 5, 9, 13, 19)

Body.—The holotype is of small size, having a length of .63 mm. to the anterior edge of the dorso-lateral gnathosomal tubercules. The width at the fourth pair of legs is .49 mm. The propodosomal plate does not project anteriorly over the gnathosoma, and does not cover the palps from above. This plate has eleven setae situated laterally in two groups of six and five, respectively. The median metapodosomal plate is longer than wide, and is distinctly separate from the other plates. It has eight setae arranged in a 2-2-4 sequence. The left lateral metapodosomal plate has three setae in a 1-1-1 sequence, and the right lateral metapodosomal plate has four setae in a 2-1-1 sequence. The anterior transverse opisthosomal plate has seven setae arranged in a slightly irregular line. The posterior transverse opisthosomal plate has five setae in an irregular line. There are three setae in an irregular line on the posterior end of the hysterosoma. The dorso-lateral gnathosomal sensillae are expanded distally into racket-like organs. The dorso-medial gnathosomal setae are large, clavate, and arise from prominent tubercules.

Legs.—Leg I has six segments, is .43 mm. long, and is shorter than the body but slightly longer and more strongly developed than the other legs. Trochanter I has one tuberculed seta on the anterior edge, one seta located dorso-medially, and one seta on a tubercule set in slightly from the posterior edge. Femur I has two clavate setae on its inner edge, the distal one being longer. Genu I has one seta on its inner edge. Tibia I has two long spines on its inner edge. Tarsus I has three spines on the inner edge.

Discussion.—This species is very similar to *C. brevis* Mulaik,

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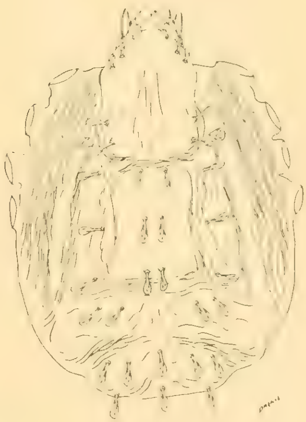

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PLATE I. SPECIES OF CAECULUS

Fig. 1, *C. mexicanus,* dorsal view of body; fig. 2, *C. orchidicolis,* dorsal view of body; fig. 3, *C. potosi,* dorsal view of body; fig. 4, *C. hardyi,* dorsal view of body.

but differs from it in having the dorso-lateral gnathosomal sensillae much expanded distally, forming racket-like organs. The dorso-medial gnathosomal setae of *C. oregonus* are much thicker than in *C. brevis*. The number and arrangement of the setae of the lateral metapodosomal plates vary only slightly between the two species. In *C. oregonus* the posterior seta of trochanter I is set in slightly from the edge, whereas in *C. brevis* it is located on the posterior edge.

Type.—Holotype, collected from moss at Oak Ridge, Oregon by Stanley Mulaik, June 22, 1952. Deposited in the Acarina collection of the University of Utah.

Caeculus orchidicolis, new species

(Figs. 2, 8, 17, 20)

Body.—The length of the body to the anterior edge of the dorsolateral gnathosomal tubercles varies in this species from .88 mm. to 1.69 mm. for thirteen specimens with an average length of 1.09 mm. The holotype is 1.18 mm. long. The width of the body at the fourth pair of legs varies from .66 mm. to 1.28 mm. for thirteen specimens with an average of .83 mm. The holotype has a width of .94 mm. The propodosomal plate does not project anteriorly over the gnathosomal tubercles and does not cover the palps from above. This plate has twenty-four laterally-placed setae arranged in four distinct rows, with twelve setae on each side of the plate. The median metapodosomal plate has fifteen setae arranged in a 4-6-5 sequence. The left lateral metapodosomal plate has ten setae arranged in a 3-4-3 sequence, and the right lateral metapodosomal plate has nine setae arranged in a 3-3-3 sequence. The anterior transverse opisthosomal plate has an irregular row of nine setae. The posterior transverse opisthosomal plate has seven setae in an irregular row. There are three setae on the posterior end of the hysterosoma.

Legs.—Leg I is stout and heavily spined, and consists of six segments. Its length is 1.06 mm., being slightly shorter than the body. Trochanter I has one curved seta on its anterior (inner) edge set in a depression on the tip of a prominent tubercle. There are two similar setae located dorso-medially and two setae on the posterior (outer) edge. Femur I has two long, roughened spines on its inner border, and genu I has two dagger-like spines on the inner edge. Tibia I has four dagger-like spines on the inner edge, the distal ones being longest. Tarsus I has five spines on its inner border. Near the tip of all tarsi on the dorsal side is a long curved seta which projects past the ends of the claws. This seta is set in a depression. On the dorsal side of tarsi I and II there is found a sensory pit which is located a distance from the end equal to the length of the claw. This pit is over fifty microns deep, and its outer border is slightly raised. Its diameter is about twelve microns.

Discussion. — This species is similar to *C. puertoricus* Mulaik and *C. potosi*. It differs from the former in having more dorsal setae, and in the chaetotaxie of leg I. *C. orchi-*

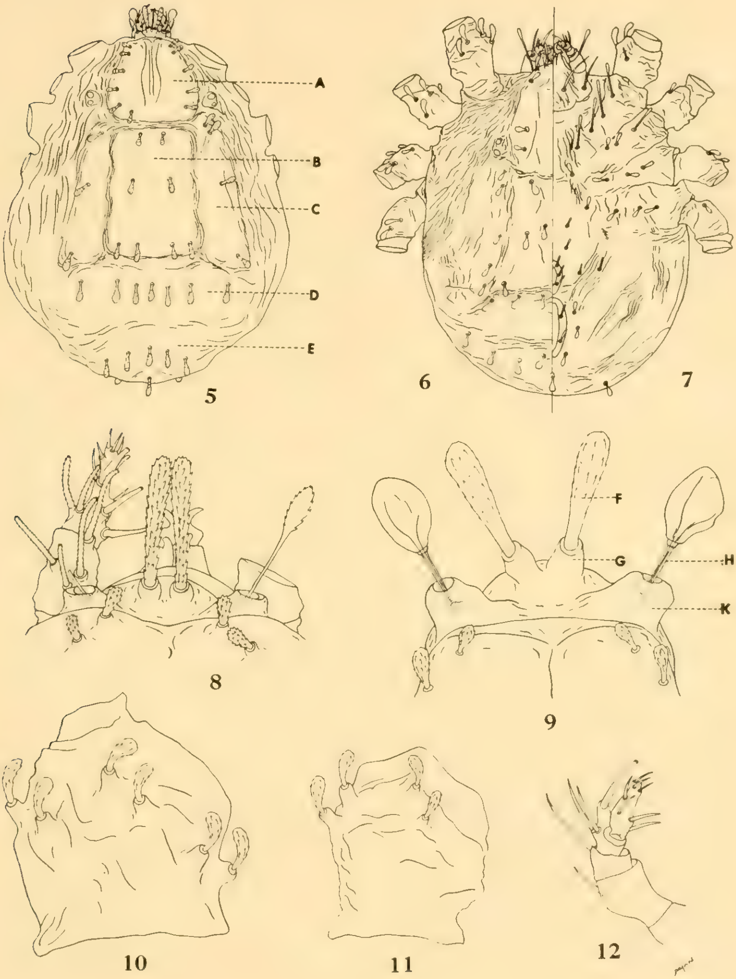

PLATE II. SPECIES OF CAECULUS

Fig. 5, *C. oregonus*, dorsal view of body; A, propodosomal plate; B, metapodosomal plate; C, lateral metapodosomal plate; D, anterior transverse opisthosomal plate; E, posterior transverse opisthosomal plate; fig. 6, *C. tipus*, left dorsal half of body; fig. 7, *C. tipus*, left ventral half of body; fig. 8, *C. orchidicolis*, dorsal view of anterior end of hysterosoma; fig. 9, *C. oregonus*, dorsal view of anterior end of hysterosoma; F, dorso-medial gnathosomal seta; G, dorso-medial gnathosomal tubercle; H, dorso-lateral gnathosomal sensilla; K, dorso-lateral gnathosomal tubercle; fig. 10, *C. potosi*, dorsal view of right trochanter I; fig. 11, *C. tipus*, dorsal view of right trochanter I; fig. 12, *C. tipus*, ventrolateral view of right palp.

dicolis can be separated from *C. potosi* by the setae on leg I and by the setae on the dorsal plates.

Types.—Holotype, from Chilpancingo, Mexico, collected from orchid plants at Laredo, Texas by R. M. Fouts and Mr. Cary, March 27, 1946. Deposited in the United States National Museum. Paratypes: Fourteen specimens from Mexico were collected from orchid plants which were intercepted at plant quarantine stations as follows: 1 specimen from San Luis Potosi, intercepted at Laredo, Texas by C. D. Babb, May 14, 1946; 1 specimen intercepted at Laredo, Texas by Mr. Leary, May 7, 1946; 1 specimen from Chilpancingo, Gro. intercepted by R. M. Fouts and Mr. Cary, March 27, 1946; 1 specimen intercepted at Laredo, Texas by R. M. Fouts, December 10, 1945; 1 specimen from Veracruz, intercepted at Laredo, Texas by C. D. Babb, May 13, 1946; 1 specimen from Tamazunchale, S. L. P., intercepted at Laredo, Texas by E. L. Talbert, July 30, 1946; 1 specimen from Tamazunchale, intercepted at Laredo, Texas by Mr. Leary, Mr. Cary, and R. M. Fouts, April 26, 1946; 1 specimen from Tamazunchale, intercepted at Laredo, Texas by Mr. Cary, June 10, 1946; 1 specimen from Arriaga, Chis., intercepted at Laredo, Texas by R. M. Fouts, December 4, 1950; 1 specimen intercepted at Brownsville, Texas, October 13, 1950; 1 specimen from Tamazunchale, intercepted at Laredo, Texas by Mr. Cary, August 10, 1946; 1 specimen from Chilpancingo, Gro., intercepted at Laredo, Texas by Mr. Walters, August 29, 1946; 1 specimen from Guerrero, intercepted at Laredo, Texas by Mr. Watt, February 28, 1946; 1 specimen intercepted at Brownsville, Texas, September 5, 1946. In addition, 3 paratypes were collected as follows: 1 specimen from Guatemala was collected from *Odontoglossum maculatum* intercepted at San Francisco, California, May 6, 1946; 1 specimen from Belize, Br. Honduras collected from orchid plants intercepted at Brownsville, Texas, April 7, 1950; 1 specimen from Dolores, Hidalgo, Gto., Mexico collected from selaginella plants intercepted at Laredo, Texas by Mr. Chapman, January 31, 1949. All 17 paratypes are deposited in the United States National Museum.

Caeculus potosi, new species

(Figs. 3, 10, 15)

Body.—The holotype is of large size, having a length of 1.54 mm. to the anterior edge of the dorso-lateral gnathosomal tubercles. The width of the body at the fourth pair of legs is 1.16 mm. The dorsal plates are not as distinct as in *C. orchidicolis,* which this species resembles. The propodosomal plate does not project anteriorly over the gnathosomal tubercles, and does not cover the palps from above. It has twenty-eight setae which are situated laterally in two groups of fifteen

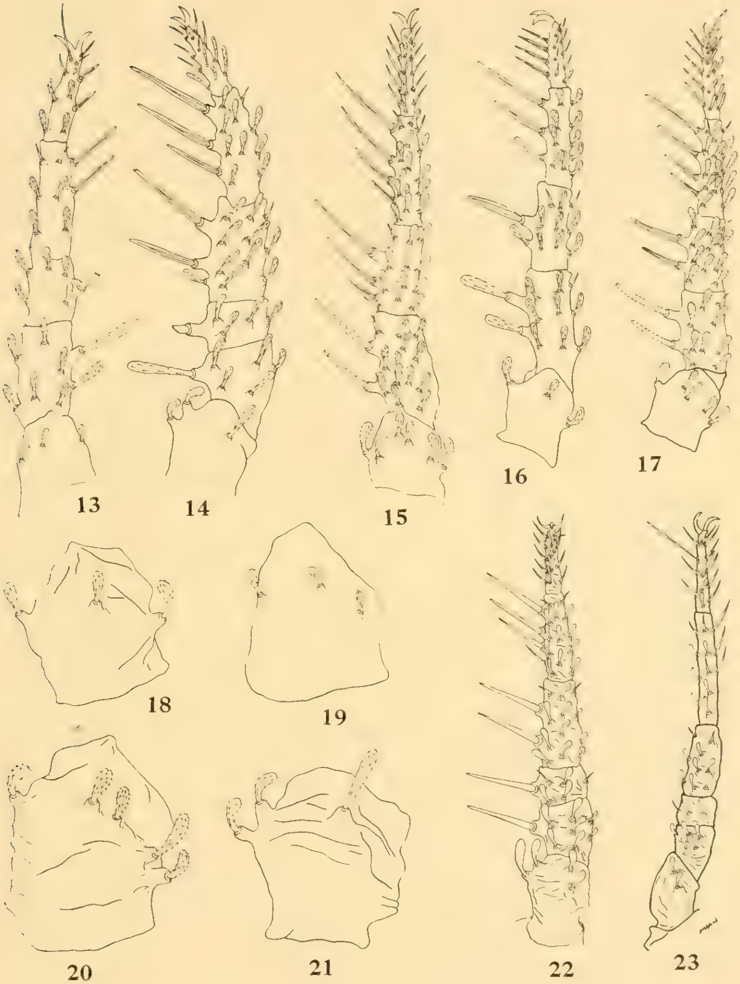

PLATE III. SPECIES OF CAECULUS

Fig. 13, *C. oregonus*, dorsal view of left leg I; fig. 14, *C. hardyi*, dorsal view of right leg I; fig. 15, *C. potosi*, dorsal view of right leg I; fig. 16, *C. mexicanus*, dorsal view of right leg I; fig. 17, *C. orchidicolis*, dorsal view of right leg I; fig. 18, *C. mexicanus*, dorsal view of right trochanter I; fig. 19, *C. oregonus*, dorsal view of right trochanter I; fig. 20, *C. orchidicolis*, dorsal view of right trochanter I; fig. 21, *C. hardyi*, dorsal view of right trochanter I; fig. 22, *C. tipus*, dorsal view of right leg I; fig. 23, *C. tipus*, dorsal view of right leg IV.

and thirteen, respectively. The median metapodosomal plate is about as wide as long, and has twenty setae arranged in a 4-8-8 sequence. Each lateral metapodosomal plate has ten setae arranged in a 3-3-4 sequence. The anterior transverse opisthosomal plate has fourteen setae in an irregular line. The posterior transverse opisthosomal plate has twelve setae in an irregular line. There are three setae in an irregular row on the posterior end of the hysterosoma. The dorso-lateral gnathosomal sensillae are whip-like, being expanded only very slightly on the ends. These are set in depressions in prominent tubercles. The dorso-medial gnathosomal setae are of medium size, weakly clavate, and arise from prominent tubercles.

Legs.—Leg I has six segments and is 1.29 mm. long, being shorter than the body. All the legs are of about equal size, legs I being only slightly longer and more strongly developed than the others. Trochanter I has two curved setae on the anterior edge, two curved setae located dorso-medially, and two curved setae on the posterior edge. All setae of trochanter I are on prominent tubercles. Femur I has two long, tapered setae on the inner edge. Genu I has two long and one short dagger-like setae on its inner edge. Tibia I has four dagger-like setae on the inner edge, the distal one being longest. Tarsus I has five spines on its inner edge.

Discussion.—This species resembles *C. orchidicolis*, but can be separated from it by the following characters. The dorso-medial gnathosomal setae of *C. potosi* are not as strongly developed as in *C. orchidicolis*. The dorso-lateral sensillae of *C. potosi* are whip-like, whereas in *C. orchidicolis* these are more expanded distally. Trochanter I of *C. potosi* has two anterior clavate setae, whereas *C. orchidicolis* has only one. Genu I of *C. potosi* has three spines on the anterior edge, whereas *C. orchidicolis* has only two spines. In addition, the number of setae on the dorsal plates is greater in *C. potosi* than in *C. orchidicolis*.

Type.—Holotype, from Tamazunchale, S. L. P., Mexico, collected by R. M. Fouts, Mr. Leary and Mr. Cary from orchid plants intercepted at Laredo, Texas, April 26, 1946. Deposited in the United States National Museum.

Caeculus mexicanus, new species

(Figs. 1, 16, 18)

Body.—The length of the body to the anterior edge of the dorso-lateral gnathosomal tubercles varies from .57 mm. to 1.01 mm. for fifteen specimens, with an average length of .84 mm. The holotype is .88 mm. long. The width of the body at the fourth pair of legs varies from .35 mm. to .72 mm. for fifteen specimens, with an average width of .60 mm. The holotype has a width of .69 mm. The propodosomal plate does not project anteriorly over the gnathosomal tubercles and does not cover the palps from above. This plate has eighteen setae situated laterally in two groups of nine. The median metapodosomal plate is as broad as it is long, and is distinctly separated from the other plates. It has thirteen setae arranged in a 4-4-5 sequence. The left lateral metapodosomal plate has seven setae arranged in a 2-3-2 sequence, and the right lateral metapodosomal plate has six setae arranged in a 2-2-2 sequence. The anterior transverse opisthosomal plate has six setae in an irregular line. The posterior transverse opisthosomal plate has seven setae in an irregular line. There are three setae in an irregular line on the posterior end of the hysterosoma. The dorso-lateral gnathosomal sensillae are clavo-capitate, arising from two prominent tubercles. The dorso-medial gnathosomal setae are large and clavate, arising from prominent tubercles.

Legs.—Leg I is composed of six segments and is .89 mm. long, being about the same length as the body. All legs are of about equal size, with legs I being only slightly larger than the others. Trochanter I has one slightly curved seta on a prominent tubercle on the anterior edge, one seta on a tubercle located dorso-medially, and one curved seta on a tubercle on the posterior edge. Femur I has two long clavate setae on its inner edge, the anterior one being longer. Genu I has one long, dagger-like spine and one short, clavate seta on the inner edge. Tibia I has two long, dagger-like spines and one short, clavate seta on the inner edge. Tarsus I has four dagger-like setae on the inner edge. Tibia III and IV are normal, not constricted in diameter.

Discussion.—*C. mexicanus* is similar to *C. brevis* Mulaik and *C. oregonus*. It is distinct from *C. brevis* by the greater number of setae on the dorsal plates, and by the number and arrangement of the setae on leg I. It differs from *C. oregonus* in having a greater number of dorsal setae, and in not having the dorso-lateral gnathosomal sensillae expanded distally to form racket-like organs.

Types.—Holotype, from San Luis Potosi, Mexico, collected from orchid plants intercepted at Brownsville, Texas, March 31, 1950. Deposited in the United States National Museum. Paratypes: Twelve specimens, deposited in the United States National Museum, were collected at quarantine stations from various plants which came from Mexico as follows: 7 specimens of the same data as the holotype; 3 specimens collected by R. Alexander from Bromeliads at Brownsville, Texas, March 14, 1951; 1 specimen collected by R. Alexander from Spanish moss at Brownsville, Texas, May 16, 1951; 1 specimen collected by Mr. Danos from Purple Sage at Laredo, Texas, July 17, 1951. In addition, 2 specimens, deposited in the acarina collection of the University of Utah, were collected from "coccid infested hosts" by F. F. Bibby at Mission, Texas, April 4, 1927.

Caeculus hardyi, new species

(Figs. 4, 14, 21)

Body.—This species is of medium size, varying in length to the anterior edge of the hysterosoma from .94 mm. to 1.31 for three specimens, with an average length of 1.07 mm. The holotype is .94 mm. long. The average width of three specimens is .69 mm. The holotype is .72 mm. wide at the fourth pair of legs. The propodosomal plate projects anteriorly over the gnathosoma, and covers the gnathosomal tubercles from above. This plate has three pairs of anterio-lateral setae and two pairs of posterio-lateral setae. The median metapodosomal plate is very distinctly separated from the other plates. It has three pairs of median setae arranged in a 2-2-2 sequence. The lateral metapodosomal plates each have three setae arranged in a 1-1-1 sequence. The anterior transverse opisthosomal plate has two pairs of setae, each pair being situated near the lateral ends of the plate. The posterior transverse opisthosomal plate has five setae arranged in an irregular line. There are three setae in an irregular line on the posterior end of the hysterosoma.

Legs. Leg I is composed of seven segments, is .81 mm. long, and is slightly shorter than the body but longer and thicker than the other legs. Trochanter I has two curved setae on prominent tubercles on the anterior edge, and one long (59 microns) seta located dorso-medially. The basifemur and the telofemur each have one long seta on their inner edge. The genu has two long, dagger-like setae and one short, clavate seta on the inner edge. The tibia has three dagger-like spines on the inner edge, the distal ones being longest. The tarsus has one clavate seta and three spines on the inner edge. Tibia III and IV are constricted, being only half the diameter of tibia I.

Discussion.—This species is similar to *C. gertschi* Mulaik, but it differs in the number and arrangement of the setae of the opisthosomal plates, the propodosomal plate, and trochanter I. In *C. hardyi* the two anterior setae of trochanter I are curved and normal, not elongated, and the single median seta is elongate and club-shaped. In addition, the body of *C. hardyi* is more rounded and not as elongate as *C. gertschi*. *C. hardyi* also differs in having the basifemur and telofemur distinctly separate on all legs.

Types.—Holotype, from Villaldama, N. L., Mexico, collected by Mr. Lewis from resurrection plants intercepted at the quarantine station at Laredo, Texas, July 28, 1948. Deposited in the United States National Museum. Paratypes: One specimen, deposited in the United States National Museum, collected from a nest of *Neotoma micropus* (woodrat), July 18, 1945 at Harlingen, Texas by Mr. Wooley and Mr. Hardy (for whom this species is named); 1 specimen, deposited in the acarina collection of the University of Utah, collected at San Pedro, Tam., Mexico by Stanley Mulaik, May 1936.

Caeculus americanus Banks

Caeculus americanus Banks. 1899. Proc. Ent. Soc. Wash. 4(3):221-222.

New Records.—Two specimens were collected from *Hilaria rigida* (a grass) from the Colorado Desert, 25 miles west of Blythe, California by J. D. Hood, August 19, 1927.

Caeculus calechius Mulaik

Caeculus calechius Mulaik, 1945. Bull. Univ. Utah, 35(17):5-6.

New Record.—One specimen was collected at the Desert Range Experiment Station, Millard County, Utah by Dr. D. Elden Beck, September 10, 1950. This is a very great extension of the known range to the northwest.

Caeculus dorotheae Mulaik

Caeculus dorotheae Mulaik, 1945. Bull. Univ. Utah, 35(17):9-10.

New Records.—One specimen was collected eight miles west of Sierra Blanca, Texas by Stanley and Dorothea Mulaik, September 5, 1946. One specimen was collected from Saltillo, Coah., Mexico from *Mammillaria* sp. (a cactus) intercepted at Laredo, Texas by C. P. Trotter, March 5, 1946.

Caeculus gertschi Mulaik

Caeculus gertschi Mulaik, 1945. Bull. Univ. Utah, 35(17):8.

New Record.—One specimen was collected from soil and leaf mold near Uvalde, Texas by H. M. Brundrett, March 15, 1943.

Caeculus kerrulius Mulaik

Caeculus kerrulius Mulaik, 1945. Bull. Univ. Utah, 35(17)8-9.

New Record.—One specimen was collected from soil and humus on "Y" mountain, east of Provo, Utah by Dr. C. Lynn Hayward in 1944. This record is a great extension of the known range to the northwest.

Caeculus pettiti Nevin

Caeculus pettiti Nevin, 1943. Ann. Ent. Soc. America, 36(3):389-393.

New Record.—One specimen was collected from the Duke Forest, Durham, North Carolina by Stanley Mulaik, August 18, 1952.

Caeculus valverdius Mulaik

Caeculus valverdius Mulaik, 1945. Bull. Univ. Utah, 35(17):6-7.

New Records.—Two specimens were collected seven miles west of Las Lunas, New Mexico by Stanley and Dorothea Mulaik, September 6, 1946. Two specimens were collected 17 miles northeast of Victoria, Taum., Mexico by Stanley Mulaik, January 8, 1950. One specimen was collected from the burrow of a Say's ground squirrel, 11 miles south of Roswell, New Mexico by Dr. G. E. Davis, August 19, 1940. A single specimen of this species was identified by the late Dr. H. E. Ewing as *C. americanus* Banks. Comparison with the type of *C. valverdius* indicates it to be of this species. It was collected from *Hilaria rigida* (a grass) by J. D. Hood on the Colorado Desert, 25 miles west of Blythe, California, August 19, 1927.

Caeculus tipus Mulaik

Caeculus tipus Mulaik, 1945. Bull. Univ. Utah, 35(17):7

New Records.—Two specimens were collected 12 miles north of Alice, Jim Wells County, Texas by Stanley and Dorothea Mulaik, June 6, 1941. Several specimens were collected from under small rocks in a dry area, 17 miles northeast of Victoria, Tam., Mexico by Stanley and Dorothea Mulaik, January 8, 1950. Several nymphs and adults were present in this latter lot. The nymphs are in many respects so similar to the adults that there can be little doubt of their identity. A description of the nymph follows:

Description of the Nymph of Caeculus tipus Mulaik, 1945

(Figs. 6, 7, 11, 12, 22, 23)

Body.—The body is slightly oval, nearly round, having a length of 1.06 mm. and a width of .88 mm. The nymph is generally more round than the adult, and does not have the dorsal plates as well differentiated. However, the posterior borders of the propodosomal plate are distinct. The anterior border of this plate has three pairs of setae, the two central pairs set on prominent tubercles. The lateral pair are small and are situated slightly posterior to the others. The posterior half of the plate has two setae on each side. The median metapodosomal plate has eight setae arranged in a 2-4-2 sequence. Each of the lateral metapodosomal plate areas has five setae arranged longitudinally in a 2-1-2 sequence. The anterior transverse opisthosomal plate area has six setae arranged in an irregular line. The posterior transverse opisthosomal plate area has nine setae arranged in an irregular line. Three setae are located at the posterior end of the hysterosoma. The dorso-lateral gnathosomal sensillae are long, reaching past the end of the palps. These sensillae are filiform and slightly enlarged distally. The dorso-medial gnathosomal setae are weakly clavate, and do not reach past the end of the palps. The anal plates each have two setae. The genital plates each have three setae. There are two pairs of setae in the medial area just anterior to the genital plates, and two pairs of setae are located lateral to the genital plates. There are three pairs of setae surrounding the anal plates, with a single median seta located posterior to the plates.

Legs.—Leg I is composed of seven segments. Coxa I has four long, slightly clavate setae and one short seta. Trochanter I has two setae on tubercles located on the inner edge, and two clavate setae situated dorso-medially. The basifemur and the telofemur each have a long, tapered spine on the inner edge. Genu I has two long spines on the inner edge, and tibia I has three long spines and one short spine on the inner edge. Tarsus I has five spines on its inner edge. Coxa II has one long and two short setae, coxa III has three setae, and coxa IV has four clavate setae respectively. Tarsi I and II each have a gland near the distal end, and tarsi III and IV each have a long slender seta on the distal third of the segment.

Discussion.—With respect to both the nymph and the adult, the number and arrangement of the setae on the dorsal plates vary slightly among individuals. It is of interest to note that occasionally one seta may be missing from a paired position on one side, or an extra seta may occur. However, the number and arrangement of the setae on the coxal plates and trochanter I are constant for the species on both nymphs and adults in the specimens examined.

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THE PUPAL MORPHOLOGY OF THE PINE NEEDLE MINER

(LEPIDOPTERA, GELECHIIDAE)

BY WM. H. BENNETT, *New York State College of Forestry, Syracuse*

The pupation period of the pine needle miner, *Exoteleia pinifoliella* (Chamb.), occurs in May. Pupae were located by holding infested pine needles to the light. Some were killed by cyanide and placed dry in tightly corked vials; others were preserved in 70 percent ethyl alcohol. Living specimens were used for color determination and measurements. Observation of very fine sutures and the various fused appendages was facilitated by boiling the pupae in 10 percent potassium hydroxide solution.

MORPHOLOGY

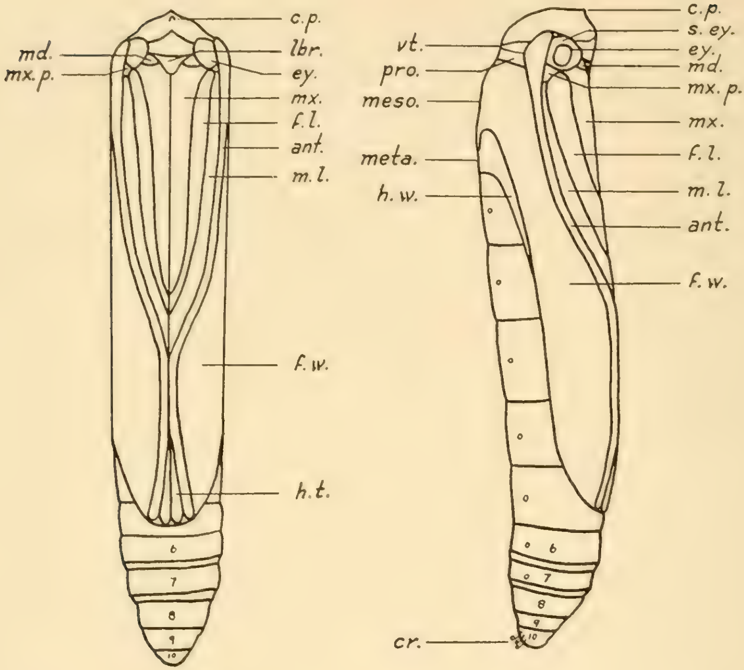
Pupa (see figure) cylindrical, quite elongate, varying from 4.1 to 5.0 mm. in length; general color shiny, dark-brown to almost black. Most structures characteristic of imago present, although folded and closely appressed to each other and to the body. Head, thorax and abdomen evident.

Head—Vertex much reduced; distinguished from frons by a very fine, broadly V-shaped epicranial suture. Frons helmet-like, separated from clypeus by a narrow epistomal suture, and with a distinct raised point; ''the cutting plate,'' situated dorso-anteriorly. Nearly straight clypeolabral suture between simple labrum and clypeus; edges of suture curving anteriorly to meet compound eyes. Compound eyes and bases of antennae laterad to frons. Antennae long, slender, meeting ventrally about two-thirds of length of front wings, diverging and terminating near wing tips. Mandibulary sclerites small, laterad to labrum, embracing compound eyes. Maxillae distinct, along midventral line caudad to labrum; maxillary palpi, small triangular, extending from beneath eyes to antennae. Labial palpi, so conspicuous in imago, not visible.

Thorax.—The three thoracic sclerites apparent dorsally, running somewhat laterally. Prothorax narrow, transverse, constricted slightly at middle. Mesothorax large; front wings indistinctly separated from it, almost reaching sixth abdominal segment ventrally. Prothoracic and mesothoracic legs folded between antennae and maxillae. Tarsi of metathoracic legs between diverging tips of antennae. Apices of hind wings covered by hind tarsi and front wings.

Abdomen.—Ten abdominal segments present, first seven segments bearing spiracles. Posterior one-third of sixth and seventh segments quite constricted, yellow, sharply contrasted to dark-brown body color. Cremaster consisting of approximately 12 small, bright-yellow, apically hooked setae, arising from minute swellings on tergum of last segment.

At ecdysis the frons splits along the epicranial and epistomal sutures, and their positions become clear. The apically hooked setae of the cremaster become entangled with silk spun by the larva, and serve to hold the pupal exuviae in place when the adult emerges.



Pupa of *Exoteleia pinifoliella* (Chamb.): A, lateral view; B, ventral view. Abbreviations: *ant.*, antenna; *c.p.*, cutting plate; *cr.*, cremaster; *ey.*, eye; *f.l.*, fore leg; *f.w.*, fore wing; *h.t.* hind tarsus; *h.w.*, hind wing; *lbr.*, labrum; *md.*, mandible; *meso.*, mesothorax; *meta.*, metathorax; *m. l.*, mesothoracic leg; *mx.*, maxilla; *mx.p.*, maxillary palpus; *pro.*, prothorax; *vt.*, vertex.

BOOK REVIEWS

Natural Regions of the U.S.S.R., by L. S. Berg. xxxi + 436 pp., 23 maps, 81 illustrations. Translated from Russian to English by Olga Adler Titelbaum, under the Russian Translation Project of the American Council of Learned Societies. Edited by John A. Morrison and C. C. Nikiforoff. MacMillan Co., 1950. $10.00.

This work was first published in 1937 as *Priroda S.S.S.R.*, and in view of the paucity of anything comparable in English, the growing interest in the Arctic fauna and flora, and the increasing amounts of Russian scientific literature, the book is a logical one to have been chosen for translation. Not only does the English speaking scientific world owe a great debt to the translator for completing her laborious task, but it is evident that a serious effort was made to make the translation of scientific terms and the handling of plant and animal names (including vernacular names) as accurate as possible.

The author has experienced some 50 years of scientific activity with outstanding contributions in climatology and other aspects of natural science, and we are told that, during the World War I period alone, he produced 20 books and monographs, including his compendium, Fresh-water fishes of Russia, which since has appeared in a 4th edition as a 3-volume work. Added to Dr. Berg's record of accomplishments and high honors received, is the fact that he has travelled and collected in the principal parts of Russia.

Most of the book is a factual recording of data in a well organized manner, and it is very readable and conclusions are drawn in clear, logical sequence. There are 20 chapters dealing with the chief landscape zones of Russia. Those of the lowlands are tundra, temperate forest, forest steppe, steppe, semidesert, desert, and subtropical forest. The mountains include those of 12 principal areas ranging from the Caucasus to the Arctic and Kamchatka. Careful attention is given to elevations and resulting altitudinal zones, characteristic plants and animals, soils, and temperature and rainfall patterns. Though various insects and other arthropods are mentioned, the group is not emphasized. There are appended a short bibliography, a list of maps and atlases, a glossary of technical terms, a Russian transliteration table, indices of plants and animals mentioned (22 and 18 pages, respectively), and a general index.

THE ORIGIN AND HISTORY OF THE BRITISH FAUNA, by Bryan P. Beirne. 164 pages, 60 maps. Methuen and Co., London, 1952. 18 shillings, $2.52.

As stated in the introduction, ''this book is an attempt to explain the present composition of the fauna of the British Isles, and the distributions, habits, and local variation of representative species of animals, by reconstructing how the animals arrived in these islands and their subsequent histories.'' It is a concisely and clearly written source of background for all who desire a sound understanding of the British fauna. That insects share much attention in a fairly proportioned study such as this one is indicated by the fact that of approximately 25,000 British species of animals over 20,000, or about 88 percent, are insects. It is logical, therefore, that the author should be an entomologist, in this case one who has made special studies of British Lepidoptera in particular, but also of other groups, including vertebrates. Since Dr. Beirne has been associated only a few years with the Division of Entomology in Ottawa, Canada, for some American entomologists this book will serve as an introduction to a research entomologist whose breadth and versatility may permit him to contribute much that is original in studies of the Nearctic fauna.

This book will be very useful to those teaching zoögeography and to those interested in the relation of distributional patterns to glaciation.—ASHLEY B. GURNEY, *Washington, D. C.*

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.

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PROCEEDINGS

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ENTOMOLOGICAL SOCIETY OF WASHINGTON
627TH REGULAR MEETING, MAY 7, 1953

The 627th regular meeting of the Society was called to order at 8 p.m., Thursday, May 7, 1953 by President W. H. Anderson in room 43 of the U. S. National Museum. Fifty-five members and 36 visitors were present. The minutes of the previous meeting were read and approved.

The following were elected to membership:

Alva H. Bender, 4610 Amherst Rd., College Park, Md.

Dr. Clifford Wester, Dept. of Entomology, Harker Hall, U. of Illinois, Urbana, Ill.

John V. Thompson, Div. of Bee Culture & Biological Control, Bldg. ''A,'' Agr. Research Center, Beltsville, Md.

George D. Reynolds, PMA, Insecticide Testing Lab., Agr. Research Center, Beltsville, Md.

Dr. Ching-Hsi Tsao, Bldg. ''A,'' Agr. Research Center, Beltsville, Md.

Melvin Abramovitz, Div. of Insecticide Investigations, Bldg. ''A,'' Agr. Research Center, Beltsville, Md.

Dr. Samson R. Dutky, Div. of Bee Culture & Biological Control, Bldg. ''A,'' Agr. Research Center, Beltsville, Md.

The Society voted to join the Insecticide Society of Washington and the EPQers Club for the June picnic meeting. Norman Mitlin will be assisted in planning by Alice Renk and Louis G. Davis.

W. E. Bickley gave the following note. In Baltimore aphids infesting shade trees along streets produce honey dew which drops on parked cars and makes spots on the paint. Many complaints reach the Claims Manager of the Department of Law, and in past years the City has paid claims amounting to hundreds of dollars. One automobile manufacturer in a ''User's Guide'' stated that chemicals present in honey dew were harmful to finishes. In July 1952 Mr. Wm. B. Henkel of the City Solicitor's Office requested help in ascertaining the chemical content of honey dew. Several published analyses were found; there were sufficient data in Weber's ''Biologie der Hemipteren'' (1930) to show that honey dews consist of water, sugar, and other carbohydrates. None of these could permanently injure painted surfaces. (Speaker's abstract.)

A letter from Ernestine B. Thurman, telling how her husband, D. C. Thurman, Jr., met death in Thailand, was read by Alan Stone, who then spoke briefly on Dr. Thurman's life and work in entomology.

An obituary of Morris Schlosberg was given by W. A. Baker. Morris Schlosberg, was born in Brooklyn, New York, December 25, 1899. He obtained a B. S. degree in 1925, and a M. S. in 1926 from Ohio State University. In 1927 he worked in Ohio and Texas as a field scout for the Bureau of Entomology and Plant Quarantine. On July 2, 1928, he joined the Division of Cereal and Forage Insect Investigations of the Bureau and was assigned to work at Toledo, Ohio, on the control of the European corn borer. He was transferred March 16, 1942, to Lafayette, Indiana, to continue his investigations on the European corn borer, and on April 3, 1950, he continued the same type of work at Ankeny, Iowa.

Jan. 1, 1951 he was transferred to Sacramento, California, to study the resistance of alfalfa to the pea aphid. He died of a heart attack at that place at age 52 on June 17, 1952.

R. I. Sailer announced that after considerable difficulty he had succeeded in hybridizing *Euschistus servus* (Say) with *E. variolarius* (P. de B.). He exhibited specimens including F_2 hybrids and the progeny resulting from a backcross between F_1 hybrids and the two parent species.

A. B. Gurney discussed the unusual habits of young nymphs of the roach genus *Perispherus*, which are born alive and then cling to the lower side of the body of the mother. The head of the first instar nymph has a very elongate face and slender, specialized galeae. (Speaker's abstract.)

R. A. St. George gave the following note. Following an outbreak of the walkingstick, *Diapheromera femorata* (Say), on Polish Mountain in Western Maryland, a large number of adults were brought to Beltsville and caged to obtain eggs. About 1,500 eggs were obtained and kept at room temperature. After about 70 days, the first nymphs emerged. They developed to maturity in 4 to 5 weeks time, mated, and began to lay eggs again. Practically all of the eggs held at room temperature hatched, indicating that there may not be a diapause in this area, at least under laboratory conditions. In the Lake States, under natural conditions, only a few eggs of this species hatch the following spring and the remainder the next one. (Speaker's abstract.)

The principal paper of the evening was "Entomological and Parasitological Observations in Liberia," by Willard H. Wright, of the U. S. Public Health Service. In Liberia, parasitic diseases show a high endemicity: Malaria 30 to 90%; onchocerciasis 20%, trypanosomiasis 20%; filariasis 15%; hookworm 50%; *Ascaris lumbricoides* 40%; *Schistosoma haematobium* 25 to 40%; *S. mansoni* 5 to 10%; and *Endamoeba histolytica* 15%. The chief vectors of malaria in the hinterland are *Anopheles gambiae* Giles and *A. funestus* Giles and in the coastal regions *A. gambiae* and *A. gambiae melas* Theobald. The latter is a less efficient vector of malaria than is *A. gambiae*, but a more efficient vector of *Wuchereria bancrofti*. At certain seasons of the year *A. gambiae melas* is the only vector of malaria in the coastal areas. Out-of-doors feeding by *A. gambiae* and *A. gambiae melas* reaches a peak between 3:00 and 5:00 a.m.; in-door feeding takes place mainly from midnight until dawn. (Speaker's abstract.)

A preview of the expected emergence of Brood X periodical cicadas was given in the U. S. D. A. moving picture made of the cicadas during the 1936 emergence. Some interesting facts were added by Louise M. Russell. "The European Corn Borer," also a U. S. D. A. moving picture, was shown.

Visitors introduced were George G. Gyrisco and Arthur A. Muka, Cornell University Department of Entomology; Dr. José M. Carvalho, Museo Nacional, Rio de Janeiro; and Hamilton Laudani, member from Savannah, Georgia.

The meeting adjourned at 10:10 p.m.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
629TH REGULAR MEETING, OCTOBER 1, 1953

The 629th regular meeting of the Society was called to order at 8:00 p.m., Thursday, October 1, 1953 by President W. H. Anderson in Room 43 of the U. S. National Museum. Forty-six members and 34 visitors were present. The minutes of the previous meeting were read by H. J. Conkle, substituting for Miss Kellie O'Neill, and approved.

The Society elected the following to membership:

Wm. H. Bennett, N. Y. State College of Forestry, Syracuse, N. Y.

Prof. George C. Varley, Hope Department of Entomology, University Museum, Oxford, England.

Herkus W. V. Letkemann, Box 7728, Washington 4, D. C.

Harvey Robert Levine, Dept. of Entomology, University of Massachusetts, Amherst, Mass.

W. W. Boyle, Cornell University, Ithaca, New York.

Dr. José C. M. Carvalho, Museo Nacional, Rio de Janeiro, Brazil.

R. C. Heller, Division of Forest Insect Investigations, gave a short talk on detecting outbreaks of the Southern Pine Beetle and Spruce Bud Moth illustrated with movies showing the methods used for mapping the infestations and air shots of the terrain surveyed. These showed how outbreaks could be detected by variations in foliage coloration.

T. E. Snyder presented a note on the large termite, *Zootermopsis angusticollis* (Hagen). Since the autumn of 1951 this termite has been found in two inch thick Douglas fir lumber shipped from Oregon to lumber yards in Philadelphia (two instances); Oxford, Ohio; Dallas, Texas; Indianapolis (three instances); Howell, Mich.; Kansas City Mo.; and Wichita, Kans. In no instance has the infested lumber been found used in buildings, since most of it has been destroyed at the yards. This termite does considerable damage to buildings on the Pacific Coast and possibly it could become established elsewhere. It can withstand a wide range of temperatures and conditions. Although called a rotten, or damp-wood termite, it can continue to live in dry, sound wood. It does not nest in the soil. (Author's abstract.)

The principal talk of the evening was given by C. W. Sabrosky. He reviewed his experiences while attending the XIVth International Congress of Zoology in Copenhagen, Denmark. He also visited other cities in Sweden, Norway, Finland, and England. He showed a number of excellent slides in color of places he visited and of persons he met.

Visitors introduced were: Miss Ailsa M. Clark of the British Museum of Natural History; Floyd P. Harrison, University of Maryland; Walter A. Connell, University of Delaware; James R. Foster, recently returned from Korea; Dr. G. C. Wood, National Research Council; A. H. Bender, Chairman of the Termite Committee of the National Pest Control Association; Dr. R. T. Scholer and Dr. T. Soot-Ryen from Tromsö, Norway and his daughter, Helen Rost, who is his assistant.

The meeting adjourned at 10:00 p.m.

H. J. CONKLE, *Acting Secretary*

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The *Proceedings* has completed 55 volumes, and during that period has carried almost no advertising. The combination of a large backlog of unpublished manuscripts with increasing printing costs resulted in the decision to try to sell advertising space in our periodical. The writer was requested to undertake the job of interesting potential advertisers.

This issue of the *Proceedings* carries the first of this advertising. The commercial firms that were contacted are established concerns of known reliability. Members and readers who are interested in either household, public health, or agricultural pesticides are invited to write our advertisers—and to mention the *Proceedings* when so doing.—R. H. NELSON, *Agricultural Research Service, Beltsville, Md.*

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VOL. 56 APRIL 1954 NO. 2

THE SPECIFIC IDENTITY OF TWO SPECIES OF HAEMAGOGUS

(DIPTERA, CULICIDAE)

BY WILLIAM H. W. KOMP, *Laboratory of Tropical Diseases, Public Health Service, Bethesda, Md.*

The purpose of this paper is to show the manner in which two specific names of mosquitoes of the genus *Haemagogus* were found to apply definitely to the species *splendens* Williston 1896 and *equinus* Theobald 1903, and to give due credit to several collaborators who obtained the material which is the basis for fixing these names.

In 1896 Williston founded the genus *Haemagogus* on eight female specimens collected on the Island of St. Vincent, British West Indies (1).* He gave the type species the name *splendens*. The original description follows:

"♀. In ground-colour deep black, the base of the femora, and the coxae in part, somewhat yellowish. Occiput, mesonotum, and scutellum wholly covered with brilliant green and coppery squamulae; pleurae densely snow white squamulate. Abdomen brilliant steel blue, in some reflections, black; a spot on the side of each segment snow white. Legs blue, like the abdomen, shining black in some reflections; the undersides of the femora, towards the base, with white squamulae. Wings hyaline, somewhat brownish in front, squamulae black, evenly distributed. Length, 5 mm."

No type locality is mentioned. It is evident that this brief description is insufficient to characterize even a species, much less the type of a genus, according to present-day standards.

In correspondence with F. W. Edwards, Harrison G. Dyar learned that the type specimens of *H. splendens* in the British Museum had a few fine setae on the postnotum; he therefore believed that the genus should be referred to the Sabethini. Later Dyar (2) believed that the brilliant metallic coloration and day-flying habits, together with other characteristics of the Sabethini, were an example of evolutionary convergence, without significance in determining relationships. As knowledge of the genus increased, particularly as the larval stages

*Numbers in parentheses refer to citations in the bibliography below.

became known, it became evident that *Haemagogus* is a specialized offshoot of *Aedes*, as the larvae are typically aedine in structure.

The taxonomy of the genus is much confused, as earlier workers did not rear males and examine the terminalia, and did not associate the larval skins with the corresponding adults. In 1917, Howard, Dyar, and Knab (3) recognized only four species of the genus, *splendens, equinus, albomaculatus*, and *capricornii*. The distribution given for these species is in most part incorrect, as many other species, unrecognized in 1917, are included among the distribution records of these four species. Thus, the distribution of *splendens* is stated as extending from Bluefields, Nicaragua, to Minas Geraes and Sao Paulo, Brazil. It is now (1953) known to be present in Grenada, St. Vincent and Trinidad, British West Indies, and in Colombia and Venezuela. The distribution given for *equinus* is substantially correct, but solely by chance, as accurate identification was impossible without males from all localities. It is now known to extend from Mexico through Central America to Trinidad, and to Ecuador (Komp), Venezuela, and Colombia, but is absent from Brazil. The distribution of *albomaculatus* is egregiously erroneous, as it is stated to be distributed from Sonsonate, Salvador, through Central America and Panama to Trinidad and British Guiana. It is now (1953) believed to be confined to British and French Guiana, and probably also Dutch Guiana, as authentic males have been taken in only the first two countries. The writer collected larvae which produced males in British Guiana, at Mazaruni, and obtained a single male from Haute Mana, French Guiana, through the courtesy of Dr. Hervé Floch, in 1944. The male arbitrarily assigned to this species by Dyar (7) was collected in British Guiana.

In 1942 the writer approached Dr. E. Cochrane, Senior Medical Officer in the Colonial Government at St. George's, Grenada, British West Indies, in an attempt to obtain *Haemagogus* material from this island, which lies just south of St. Vincent, B. W. I. Dr. Cochrane kindly obtained males and females of *Haemagogus* from Richmond Hill, St. George's, Grenada, on July 25, 1942. These were sent to the writer, and found to be *H. splendens*, the females having simple claws, and fine setae on the postnotum; the males have typical terminalia, and sparsely plumose antennae. Dr. Cochrane kindly put the writer in touch with Dr. W. Leslie Webb, Senior Medical Officer of the Colonial Government in Kingstown, St. Vincent, B. W. I. One of his field men collected larvae from a tree hole at Lowmans, St. Vincent, in 1944. This is in the type area, which is not specified in Williston's original description of *H. splendens*. The larvae produced males and females, which with the larval skins were sent to the writer. The male terminalia proved to be identical with those of the Grenada material, and with those of *H. celeste* Dyar and Núñez-Tovar (4). The females had simple claws, and setae on the postnotum. The material from St. Vincent, the type area for *splendens*, is deposited in the U. S. National Museum.

The identity of *H. celeste* as a synonym of *H. splendens* was mentioned to Dr. Henry W. Kumm, who was stationed in Colombia in 1944, investigating the relation of *Haemagogus* mosquitoes to yellow fever. Kumm *et al.* (5) state:

"The original description [of *H. splendens*] dates back to 1896 and was based on 8 females from the Island of St. Vincent, B. W. I. No males were secured until 1943, when Komp received several from the type area. These proved to be identical with *H. celeste*, which had been described in 1926 from Maracay, Venezuela, by Dyar and Núñez-Tovar. Thus the name *H. celeste* is a synonym of *H. splendens.*"

This is the first record of the new synonymy of which the writer is aware. Kumm and his collaborators (6) in Colombia thereafter used the name *splendens* for the species found in Colombia, which had hitherto been called *celeste*.

Dyar (7) correctly surmised that *splendens* is "probably the same as one of the mainland species, of which three are known at present" [1928], *janthinomys* [= *spegazzinii*], *albomaculatus*, and *celeste*.

The writer found the larvae of *splendens* abundant in tree holes, rot holes in fence-posts, etc., around Caripito, State of Monagas, Venezuela, in 1936, and the species has been found at Upatá, State of Bolivar, west of Ciudad Bolivar, and elsewhere in Venezuela by Pablo Anduze who sent mounted terminalia to the writer for verification.

The second species under discussion is *H. equinus* Theobald 1903 (8). This was described from a single female taken by Dr. Michael Grabham while it was biting a horse (hence the name "*equinus*"), in Kingston, Jamaica. Parts of the original description follow:

"♀. Head clothed with flat metallic violet scales; except a patch between the eyes which are (sic) white . . . prothoracic lobes and pleurae silvery white. Abdomen rich metallic violet . . . the fifth, sixth, and seventh segments with basal white bands . . . legs unbanded, deep brown, with metallic violet reflections, and a pale knee spot to the mid and hind pair; femora white beneath; ungues [claws] small, equal, and simple. Wings with first submarginal cell slightly longer and narrower than the second posterior cell, its base nearer the apex of the wing, its stem longer than the cell; . . . ."

Kumm *et al.* (5, p. 19) state: "*Haemagogus equinus* was originally described by Theobald . . . from a single female taken near Kingston, Jamaica. Since no males have ever been caught in the type locality, there is some doubt as to whether Theobald's type is identical with the mainland species bearing that name. However, it is interesting to note that Theobald did observe the characteristic pale knee spot on the middle and hind legs."

Howard, Dyar, and Knab (9) redescribe what they believed to be the larva, female, and male of *equinus*, stating that the claw-formula is 1.1-1.1-0.0, which means that the claws of the front and middle legs of the female are toothed, while those of the hind legs are simple. They further state (p. 874):

"In describing *Haemagogus equinus* Theobald states positively that the claws of the female are simple ["ungues simple"], and repeats the statement in the fourth volume of his work [Mon. Culic. Vol. 4, p. 555]. However, he mentions two specimens, one of which was in the possession of Dr. Grabham. This we have examined, through the kindness of Dr. Grabham, and find the claws to be toothed. Dr. Howard has since examined the other specimen [the female type] in the British Museum, and found the claws to be toothed. We are therefore able to identify positively this species [*equinus*] with our *Aedes philosophicus*, described from Mexico. *Aedes affirmatus* [from Mexico and western Costa Rica] proves to be the same species, the describers [Dyar and Knab] having been misled as to its characters by the imperfect condition of the captured [female] specimens."

The authors apparently were not aware of the possibility that other species of *Haemagogus* with toothed female claws might exist in the same territory with *H. equinus*, so that their identification of the type female of this species, and of Dr. Grabham's female specimen from the same locality in Jamaica, with the Mexican form, is open to question. However, they give a recognizable figure of the male terminalia of the form they call *H. equinus* (10), probably drawn from material obtained in Mexico. Dyar (2) states:

"*H. equinus* was described from Jamaica from two females [actually from only one] with toothed claws. No male has been described [as of 1921]; but as *H. philosophicus* D. & K. [a synonym of *equinus*] ranges from Mexico to Trinidad, and is the only species with toothed claws in the female known from this latitude, it is probable that the Jamaican form is the same."

In the light of our present knowledge, it seems rash to have identified an insular species, separated by 700 miles of ocean, with a mainland species from Mexico, solely on characters of the female. Yet strangely enough, the identification is correct.

In 1941, Dr. Rolla B. Hill, of the Rockefeller Foundation, was stationed in Jamaica. Knowing of Dr. Hill's interest in mosquitoes, the writer pointed out to him his opportunity to confirm or disprove the disputed identity of *H. equinus*. From time to time, over a period of several years, Dr. Hill searched for *Haemagogus* larvae without success, but finally larvae were found in cut bamboo stumps near Constant Spring, St. Andrew, a few miles from Kingston. The males reared from these larvae, with their associated larval skins, were sent to the writer for identification. They proved to be the same as specimens taken in Vera Cruz, Mexico, and in many localities in Panama, by the writer. The male terminalia agreed with the figure given by Howard, Dyar, and Knab (10), and the larval characters were the same as those of larvae from the mainland, from which similar males were reared. In his pamphlet on the mosquitoes of Jamaica (11), Dr. Hill records the finding of the larvae and of two females. Dr. Hill's unique material was deposited by the writer in the U. S. National Museum.

The species seems to be rare and local in Jamaica, as Dr. Grabham took only two specimens, one of which is the female type, and Dr. Hill records finding the larvae only once, and capturing two females, one taken a year later than the other. The writer visited Jamaica several times during World War II, and searched intensively for *Haemagogus* larvae in many localities without success. Also *H. equinus* was not found by Dr. Harry D. Pratt or by Mr. George A. Thompson, Jr. of the U. S. Public Health Service, who were at various times during World War II stationed in Jamaica, in charge of malaria control for the U. S. Army.

To the writer's knowledge, no other species except *equinus* has been found in Jamaica.

Summary

Haemagogus splendens was described from female specimens from the Island of St. Vincent, B. W. I. The identity of the species was uncertain until males were obtained from the type area. The terminalia of these proved to be the same as those of *H. celeste,* so that *celeste* becomes a synonym of *splendens.* No other species of *Haemagogus* is known from St. Vincent.

Haemagogus equinus was described from a single female specimen from Kingston, Jamaica. The identity of the mainland form called *equinus* by various authors was in doubt until larvae and males were obtained from Jamaica, near the type locality. The terminalia proved to be the same as those of the species figured and described as *equinus,* from the mainland, by Howard, Dyar, and Knab. No other species of *Haemagogus* is known from Jamaica.

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THE SCIOMYZIDAE OF ALASKA

(Diptera)

By George C. Steyskal, *Grosse Ile, Mich.*

During the last seven or eight years, and especially since 1947, much information and many specimens of Alaskan Diptera have been accumulated. The chief results of this work are cited in the appended bibliography. It is as a continuation of these contributions that the present report is submitted. Material gathered by Clifford O. Berg as a by-product of several seasons' work with the U. S. Public Health Service forms the largest basis of this report, but some important material belonging to the U. S. National Museum has been examined through the courtesy of Curtis W. Sabrosky. To Berg and Sabrosky I wish to extend sincere thanks for the privilege of working on the material.

Besides the material already deposited in the U. S. National Museum, most of the material taken by Berg and W. C. Frohne will ultimately also be deposited there. A few duplicates and some paratypes, as listed below, remain in my collection.

Previous records of Sciomyzidae (*s. s.*) from Alaska have been very scanty. Coquillett recorded *Pteromicra glabricula* (Fallén) and *Tetanocera plumosa* Loew, Melander added *T.*

triangularis Loew and *T. vicina* Macquart and I added *Sepedon borealis* Steyskal and *S. spinipes americana* Steyskal a total of six species.

Thirty species are now listed, of which three (*Hedroneura connexa*, *Renocera bergi*, and *Tetanocera bergi*) are described as new species, and of which one (*Sciomyza dryomyzina* Zetterstedt) is a previously known palaearctic species now reported for the first time from the nearctic region. Thirteen of the total are holarctic in distribution.

In this paper the following abbreviations of names of collectors and institutions have been used: CNC—Canadian National Collection; COB—Clifford O. Berg; DPW—D. P. Whillans; GCS—George C. Steyskal; JCC—J. C. Chamberlin; JMA—J. M. Aldrich; JRV—J. R. Vockeroth; M-S—Marks and Sommerman; RHW—R. H. Washburn; RIS—Reece I. Sailer; USNM—U. S. National Museum; WCF—W. C. Frohne.

Subfamily **SCIOMYZINAE**

Genus **Pherbellia** Robineau-Desvoidy

I am including under this name the preoccupied genus *Melina* and a number of other names, the proper application of which must await a satisfactory classification and nomenclatural research. Besides the species here listed, a few others have been taken, satisfactory determination of which is not possible at present.

Pherbellia albocostata (Fallén)

Dipt. Sueciae, Sciomyz.: 12, 1820 (*Sciomyza*); Cresson, Trans. Amer. Entom. Soc. 46: 45, 1920 (*Melina*); Melander, Ann. Entom. Soc. Amer. 13: 314, 1920 (*Melina*).

Lower Yukon River (Holy Cross), 16 June 1951 (COB). A species of holarctic distribution.

Pherbellia fuscipes (Macquart)

Suites á Buffon II: 407, 1835 (*Sciomyza*); Melander, Ann. Entom. Soc. Amer. 13:314, 1920 (*Melina*).

Fairbanks, 2 July 1921 (JMA) USNM. Holarctic in distribution.

Pherbellia griseola (Fallén)

(Fig. 1)

Dipt. Sueciae, Sciomyz.: 14, 1820 (*Sciomyza*); Melander, Ann. Entom. Soc. Amer. 13:314, 1920 (*Melina*).

Anchorage, 27 July 148 (RIS) USNM; Glenn Highway, mile 154, nuska, rotary trap, 27, 29, 30 April, 7, 10, 11, 12, 17, 18, 20, 27, 31 May, 6, 7 June 1944, 14, 19, 21 May 1945, 31 ♂♂, 33 ♀♀ (JCC) USNM. The greatest number (10 ♂♂, 22 ♀♀) were taken on 10 May 1944.

This is a holarctic species, of which the only previous North American record is that of Melander, citing Montana and Wyoming as localities. A figure of the male terminalia of one of the Matanuska specimens is presented to facilitate eventual check against palaearctic material.

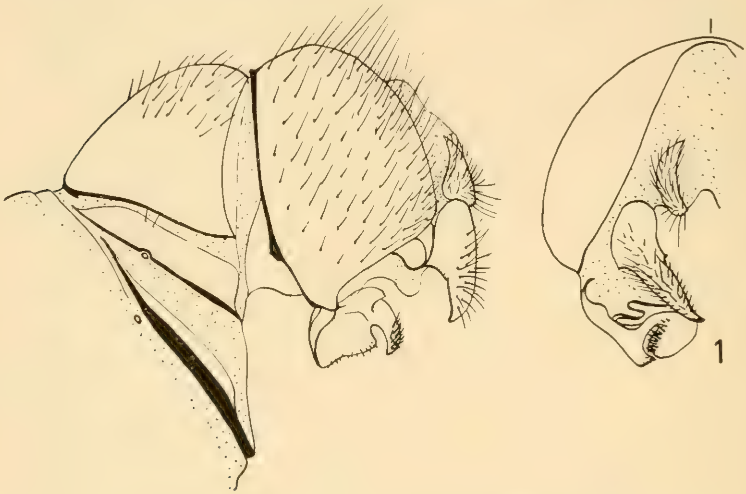


Fig. 1, *Pherbellia griseola* (Fallén) (Matanuska, Alaska), ♂ terminalia.

Pherbellia nana (Fallén)

Dipt. Sueciae, Sciomyz.: 15, 1820 (*Sciomyza*); Cresson, Trans. Amer. Entom. Soc. 46:47, 1920 (*Melina*, subgenus *Graphomyzina*); Melander, Ann. Entom. Soc. Amer. 13:315, 1920 (*Melina*).

Anchorage, 27 July 1948 (RIS) USNM; Glenn Highway, mile 154, 23 August 1948 (Morris) USNM; Matanuska Valley, 1 July 1950, 2, 14 August 1952 (COB). Widespread and abundant in holarctic regions; in North America south to Mexico City.

Pherbellia schoenherri (Fallén)

Dipt. Sueciae, suppl.: 13, 1826 (*Sciomyza*); Melander, Ann. Entom. Soc. Amer. 13:316, 1920 (*Melina*, subgenus *Graphomyzina*); Steyskal, Pap. Michigan Acad. Sci. Arts, Letters 33:177, 1949 (*Pherbellia*).

Anchorage, 8 April 1948 (RIS), 9 April 1948 (K. M. Sommerman), 25 May 1948 (E. Lepage), 4 August 1948 (RIS) USNM; Fairbanks, 28 May 1948 (Lienk and Marks) USNM; Healy, 26 June 1921 (JMA) USNM; Lower Yukon River (Fortuna Ledge = Marshall), 1 August 1951 (COB); Matanuska Valley, 24 Sept. 1944, 17 May, 2 Oct. 1944 (JCC) USNM; Matanuska Valley, 10 August 1950, 2, 4 August 1952 (COB); Palmer Highway, mile 16, 14 August 1952 (COB). An abundant holarctic species.

Genus **Pteromicra** Lioy

Pteromicra glabricula (Fallén)

Dipt. Sueciae, Sciomyz.: 15, 1820 (*Sciomyza*); Coquillett, Proc. Washington Acad. Sci. 2:458, 1900 (*Sciomyza*); Hendel, Abhandl. Zool.-Bot. Ges. Wien 2:61, 1902 (*Dichrochira*); Cresson, Trans. Amer. Entom. Soc. 46:40, 1920 (*Dichrochira*); Melander, Ann. Entom. Soc. Amer. 13:312, 1920 (*Pteromicra*).

Popoff Island, 13 July 1899 (Kincaid) USNM. Although widespread in Europe and Siberia, this is apparently the only nearctic record. I have checked the specimen against Hendel's description.

Genus **Sciomyza** (Fallén)

KEY TO THE KNOWN SPECIES

1 (4). Mesopleura with a posterior row of bristly hairs; largely tawny species.

2 (3). Center of face polished and blackish; palpi apically blackish; arista densely black-plumose; 1-3 pteropleural bristles (Nearctic) .... *S. aristalis* Coquillett

3 (2). Face white-pruinose and yellow; palpi yellow; arista loosely plumose; usually three pteropleural bristles (Holarctic) .... *S. simplex* Fallén

4 (1). Mesopleura bare or with a few small hairs.

5 (6). Thoracic dorsum black; palpi black; arista sparsely plumose; wing veins bordered with brown (Nearctic) .... *S. varia* Coquillett

6 (5). Thoracic dorsum tawny.

7 (8). Third antennal segment blackish; fore tibiae and tarsi blackish only toward tips (Palaearctic) .... *S. testacea* Macquart

8 (7). Third antennal segment tawny; fore tibiae and tarsi wholly black.

9 (10). Thoracic dorsum pruinose, silvery laterally; clypeus matt, narrow; mesopleural suture with a few small hairs; lunule wholly covered (Palaearctic and Alaskan) .... *S. dryomyzina* Zetterstedt

10 (9). Thoracic dorsum shining, not silvery laterally; clypeus shining, very broad; mesopleural suture entirely bare; lunule somewhat free (Palaearctic) .... *S. lucida* Hendel

Sciomyza dryomyzina Zetterstedt

Dipt. Scand. 5:2094, 1846 (*Sciomyza*); Hendel, Abhandl. Zool.-Bot. Ges. Wien 2:55, 102 (*Bischofia*).

Matanuska Valley, 1, 8 July 1950, 25, 27 June, 11, 23 July 1952, 4 ♂♂, 3 ♀♀, Palmer Highway, mile 16, 14 August 1952, ♀ (all COB).

Not previously reported from North America, but widespread in the palaearctic region.

Sciomyza simplex Fallén

Dipt. Sueciae. Sciomyz.: 12, 1820; Melander, Ann. Entom. Soc. Amer. 13:312, 1920.

Kotzebue, 20 June 1951, ♀ (RIS) USNM; Matanuska Valley, 27 June, 2 August 1952, 5 ♂♂ (COB). Widespread in the nearctic and palaearctic regions.

Subfamily **TETANOCERINAE**

Genus **Dictya** Meigen

Dictya umbroides Curran

Amer. Mus. Novitates, no. 517:4, 1932.

Matanuska Valley, 1, 8 July 1950, 24, 25, 27 June, 2, 11, 23, 24 July, 2 August 1952, 49 ♂♂, 21 ♀♀ (COB). Occurs across North America to Newfoundland, but more abundantly west of Hudson Bay.

Genus **Hedroneura** Hendel

KEY TO THE KNOWN SPECIES

1 (2). Mesopleura with at least one bristle near posterior margin; submarginal cell of wing apically with two conspicuous dark spots occupying full width of cell; mesopleura with a roundish brown spot posteriorly; abdomen with lateral row of roundish brown spots (Palaearctic) .... *H. cucularia* (L.)

2 (1). Mesopleura without bristles, with small hairs only, dorsally with a brownish longitudinal stripe.

3 (4). Wings with dark spot in submarginal cell at apex of second vein; frontal orbits with very narrow whitish pruinosity; fore femora with well developed ventral bristles (Holarctic) .... *H. rufa* (Panzer)

4 (3). Wings without dark spot at end of second vein; frontal orbits with broader white pruinosity; fore femora usually without distinct bristles beneath .... *H. divisa* (Loew) (Germany)
H. rufina Hendel (Kamtschatka)
H. connexa n. sp. (Nearctic)

The last three species form an apparently closely related group. The available descriptions of the first two of the group are inadequate to distinguish them from each other or from *H. connexa*. Little seems to be known of *H. divisa;* Sack's description (1930:60) refers to a considerably paler form than *H. connexa*. Hendel's statement (1932:2) that the "styli" of the single male of *H. rufina* are of "annähernd kreisförmiger Gestalt," rather than apically pointed, and his lack of mention of any vesicles on that part, seem to point to a species distinct from *H. connexa*.

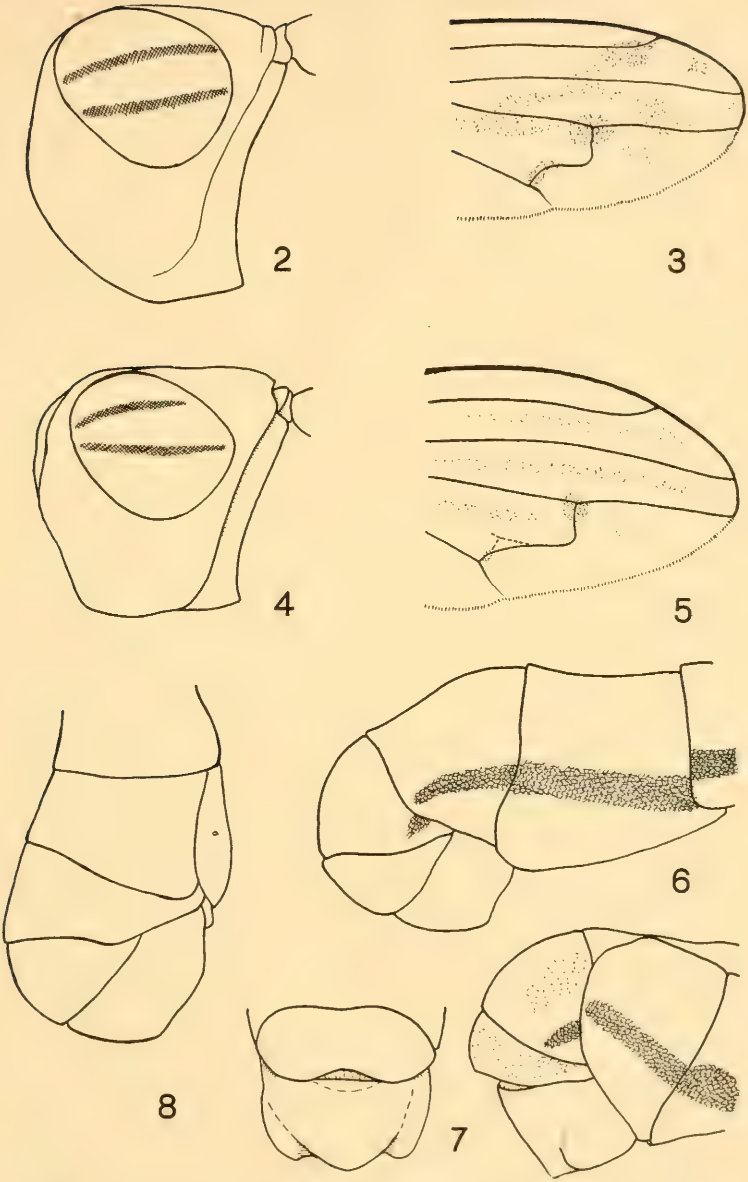


Fig. 2, *Hedroneura rufa* (Panzer), lateral view of head; fig. 3, apical half of wing; fig. 4, *H. connexa*, new species, lateral view of head; fig. 5, apical half of wing; fig. 6, tip of ♂ abdomen (Pingree Park, Colo., with small hypopygial swellings); fig. 7, tip of ♂ abdomen (Matanuska, Alaska, with large hypopygial swellings); fig. 8, *H. rufa*, tip of ♂ abdomen.

Hedroneura connexa, new species

(Figs. 4-7, 9)

Hedroneura connexa Malloch (nomen nudum), in Knowlton, Harmston, and Stains, 1939, Utah Agric. Expt. Sta. Mimeogr. Ser. 200 (Tech.), pt. 5:12.

Male.—Length of wing, 5.2 to 6.5 mm. (average of 12 specimens, 6.0 mm.).

Head as in fig. 4; cheeks 0.65 of eye-height; mid-frontal stripe not wider than ocellar triangle, parallel-sided, practically attaining anterior margin of front; whitish pruinosity of frontal orbits of considerable width, attaining posterior fronto-orbital bristle and reaching halfway to anterior fronto-orbital; eyes before drying olive-green, with two reddish-purple bands; otherwise much as in *H. rufa* (Panzer), chaetotaxy, hairing, color, and pruinosity very similar.

Thorax very similar to that of *H. rufa;* propleura, mesopleura, and pteropleura with scattered small hairs; prosternum with at least a few hairs.

Legs very much as in *H. rufa;* fore femora with a few small bristles apicoventrally, these sometimes distinct, sometimes scarcely distinguishable from adjacent hairs; hind femora with a double ventral row of spiny bristles in apical half or two-thirds; hind coxae usually with a few hairs at tip above.

Wings as in fig. 5; yellowish anterad of third vein, elsewhere grayish; anterior crossvein and areas indicated in figure dark gray; posterior crossvein strongly bisinuate or biangulate, sometimes with a ''stump-vein'' at posterior bend.

Abdomen as in figs. 6, 7, and 9, clayey yellow pruinose, with conspicuous brown lateral stripe; terminal segments robust; hypopygium (ninth tergite) usually with a pair of swellings, one at either side of the para-anal lobes; fifth tergite ventrally with slender, simple processes directed anteromesad, fig. 9c. Terminalia as in fig. 9a, b; compound tergite with long, ventrally curved process on left side; surstyli with conspicuous vesicle posterobasally, attached by a small neck; hypandrium and aedeagus as in fig. 9a, aedeagus asymmetrical and largely composed of thin, membranous tissue.

Female.—Length of wing, 5.9 to 7.0 mm. (average of 12 specimens, 6.5 mm.). Similar to male, except abdomen, which is somewhat pointed apically, but like the male has conspicuous lateral brown stripes.

Types.—Holotype ♂ and allotype ♀: Matanuska Valley, Alaska, 2 August 1952 (COB), no. 51609 in USNM. Paratypes: ALASKA: same data as types, 2 ♂♂, ♀; same locality, 1 July 1950 (♀), 15 July 1950 (♂), 10 August 1950 (♂, 3 ♀♀), 15 August 1950 (2 ♂♂), 12 June 1951 (3 ♂♂, ♀), 27 June 1952 (♂), 3 July 1952 (♂), 14 August 1952 (14 ♂♂, 10 ♀♀) (all COB) USNM, GCS, COB; same locality, 13 May 1945, rotary trap, ♀ (JCC) USNM; Anchorage, 19 July 1921, ♀

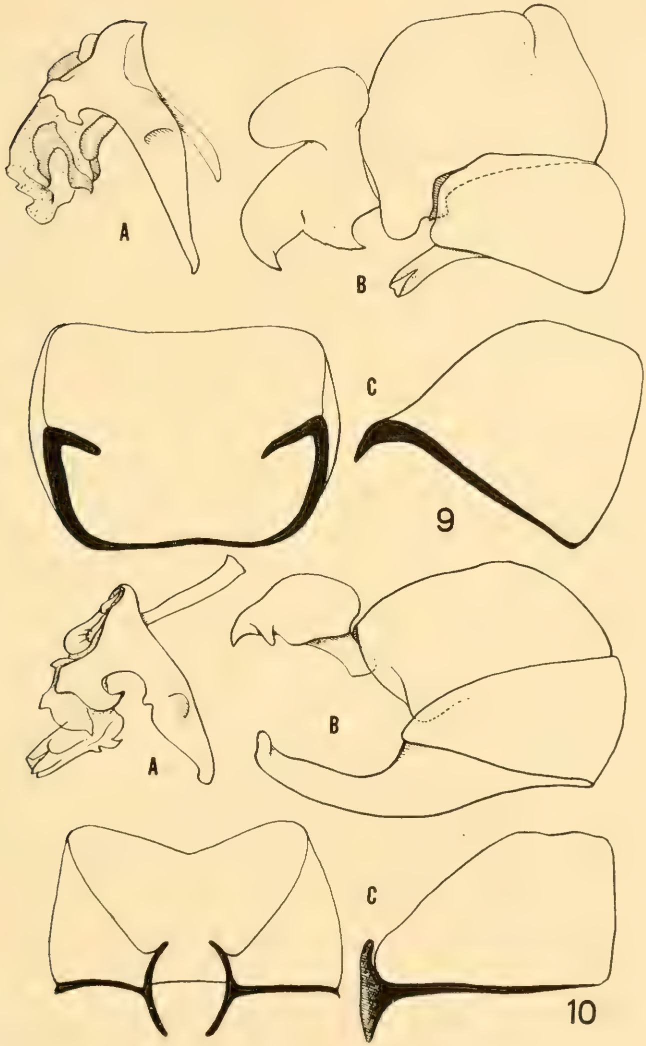


Fig. 9, *Hedroneura connexa,* new species, ♂; fig. 10, *H. rufa* (Panzer), ♂. *a,* inner copulatory apparatus; *b,* hypopygium and preceding tergite; *c,* sixth tergite.

(JMA), 9 May 1948, 3 ♂♂ (F. S. Blanton) USNM; Lower Yukon River (Holy Cross), 25 June 1951 (♀), 3 August 1951 (♂), 4 August 1951 (♂) (COB) USNM; Tanana, 14 June 1951, ♂ (RIS) USNM; YUKON: Rampart House, 28 May 1951, ♀ (C. C. Loan) CNC; NORTHWEST TERRITORIES: Aklavik, 4 August 1930, ♂ (O. Bryant) GCS; Fort Simpson, 25 August 1951; ♂ (DPW) CNC; Reindeer Depot, Mackenzie Delta, 5-6 August 1948, 4 ♂♂, 3 ♀♀ (W. J. Brown) CNC; Tununuk, 15 August 1930, ♂ (O. Bryant) GCS; ALBERTA: Banff, 5, 25, 26 May, 1 June 1922, 5 ♂♂, 2 ♀♀ (C. B. D. Garrett); Nordegg, July 1921, ♂ (J. McDunnough) CNC; SASKATCHEWAN: Great Deer, 8 Sept. 1948, ♂♀ (JRV); Hepburn, 11 Sept. 1948, ♂ (JRV); Saskatoon, 27 Sept. 1948, 2 ♂♂, 2 ♀♀ (JRV), 30 May 1949, ♀ (A. R. Brooks), 21 June 1949, ♂ (L. Konotopetz) CNC; MANITOBA: Aweme, 19 May 1927, ♂ (N. Criddle); Churchill, 28 June 1948, 3 ♂♂, ♀ (G. E. Shewell), 1 Sept. 1948, ♂♀ (R. Richards), 2 Sept. 1948, ♀ (L. A. Miller); Stockton, 25 August 1925, ♂ (R. M. White) CNC; ONTARIO: Moose Factory, 9 June 1949, 2 ♂♂, 3 ♀♀ (DPW), 10 June 1949, 5 ♀♀ (E. J. LeRoux), 11 June 1949, 2 ♀♀ (DPW, D. P. Gray, D. F. Hardwith) CNC; UTAH: Wasatch, 1 Sept. 1937, sex? (Knowlton-Harmston) Utah Agric. Expt. Sta.; COLORADO: "Colorado," 2 ♂♂, USNM; Pingree Park, 14 August 1934, 2 ♂♂, ♀ (C. W. Sabrosky) CWS, 15 August 1934, ♂ (A. E. Pritchard) USNM; Platte Canyon, near Idlewild, 10 June 1927, ♂, 4 ♀♀ (JMA) USNM; Walden; elev. 8500 ft., 1-3 Sept. 1938, ♂ (C. L. Fluke) Univ. of Wisconsin; NEVADA: Steamboat, 3 Sept. 1915, ♀ (H. G. Dyar) USNM.

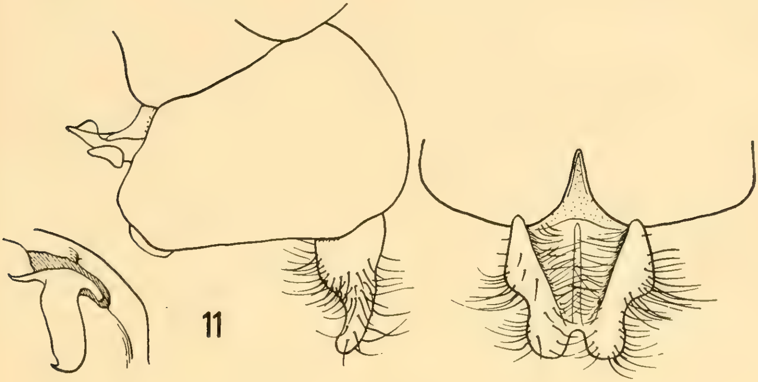
The foregoing key will serve as a diagnosis of the form, and a more detailed comparison between it and the only other species found in North America, may be made by use of the figures and the notes given under *H. rufa*. The name *connexa* is an unpublished manuscript name by J. R. Malloch, who in 1938 kindly furnished me with the specimens listed from the Northwest Territories, collected by Owen Bryant.

Hedroneura rufa (Panzer)

(Figs. 2, 3, 8, 10)

Faunae Insectorum Germanicae, Heft 54, 1798 (Musca); Cresson, Trans. Amer. Entom. Soc. 46:81, 1920; Melander, Ann. Entom. Soc. Amer. 13:322, 1920; Sack, in Lindner, Die Fliegen d. Pal. Region 5 (lfg. 125):60, 1939 (*Hedroneura*).

Anchorage, 28 May 1948 (N. Hoffman), 14 July 1952 (COB); Holy Cross (Lower Yukon River), 18, 19, 22, 23 (reared), 24, 26 June 1951 (COB); Kotzebue, 24 June 1951 (RIS); Matanuska Valley, 7 May 1944, rotary trap (JCC) USNM, 20-26 June, 15 July 1950, 12 June 1951, 25,



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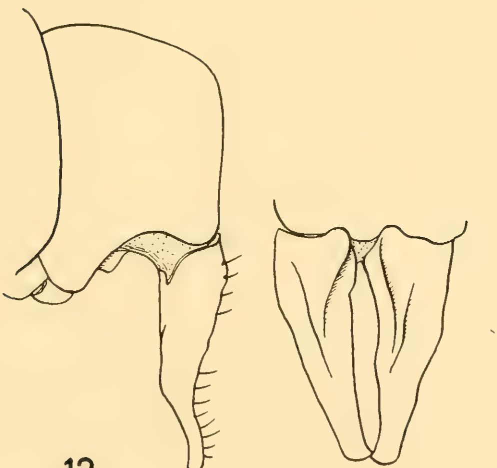

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Fig. 11, *Renocera johnsoni* Cresson, ♂ terminalia; fig. 12, *Tetanocera bergi,* new species, ♂ terminalia.

27 June, 1, 11, 15, 17, 19, 22, 23 July, 2 August 1952 (COB); Nenana, 16 June 1951 (RIS) USNM; Tanana, 14 June 1951 (RIS) USNM. Widespread and abundant in the palaearctic and nearctic regions.

I have found European material to be conspecific with North American in all respects, including male terminalia. Since this is the only species found in North America besides *H. connexa*, figures and the following descriptive notes are given to afford a comparison between *H. rufa* and *H. connexa*.

Head, fig. 2, with cheek nearly as high as eye; midfrontal stripe broader than ocellar triangle, with convex sides; frontal orbits with very narrow white pruinosity. Prosternum bare. Wing pattern, fig. 3, with characteristic arcuate mark in first posterior cell anterior to posterior crossvein and with heavy spot at end of second vein. Fore femora with well developed bristles below. Abdomen with but inconspicuous brownish lateral stripes; the male terminalia, figs. 8 and 10, less robust than in *H. connexa;* fifth tergite ventrally with a pair of opposed curved ridges, like parentheses; compound tergite strongly produced ventrally on left side; hypopygium lacking intumescences; surstyli without vesicles; hypandrium and aedeagus, fig. 10a, quite different in detail from *H. connexa*.

Genus **Limnia** Robineau-Desvoidy

Limnia boscii (Rob.-Desv.), var. **sparsa** (Loew)

Essai sur les Myodaires: 608, 1830 (*Tetanocera boscii*); Loew, Monogr. Dipt. No. Amer. (Smithsonian Misc. Collns.) 1:117, 1862 (*Tetanocera sparsa*); Cresson, Trans. Amer. Entom. Soc. 46:77, 1920 (*Limnia combinata* var. *sparsa*); Melander, Ann. Entom. Soc. Amer. 13:323, 1920 (*Limnia boscii* var. *sparsa*).

Lower Yukon River (Holy Cross) 2 July 1951; Matanuska Valley, 25, 27 June, 2, 11, 23 July, 2 August 1952 (all COB), total 30 specimens. Distributed across North America. The variety is similar in male terminalia to the typical form and appears to occur throughout the range. All of the Alaskan material, however, is referable to the variety.

Genus **Renocera** Hendel

Renocera bergi, new species

Female.—Length of wing, 5.0 to 5.2 mm.

Color brown; midfrontal stripe, lower pleura, apical half of fore tibiae, entire fore tarsi, and apical two segments of middle and hind tarsi blackish. Wings rather evenly tinged with yellowish brown, both crossveins surrounded by heavy blackish infumation, a little of which is also to be seen along ultimate section of third and fourth veins. Broad parafacials and more or less of lateral part of medifacies white pruinose; upper and posterior orbits narrowly white pruinose. Thorax grayish pruinose, with four rather narrow longitudinal brown stripes and broad brown stripe on upper part of pleura. Abdomen and legs subshining.

Head with front somewhat tumid; frontal orbits only slightly convergent anteriorly; midfrontal stripe shining, approximately as wide as distance across posterior ocelli, parallel-sided, extending to anterior margin of front; remainder of front dull tawny; cheek 0.33 to 0.39 as high as eye. Bristles of top of head and bristly hairs of upper occiput long;

ocellars extending to anterior margin of front; one fronto-orbital bristle (duplicated on one side of one specimen; one inner and one outer vertical; two genal bristles. Anterior half of front with rather conspicuous scattered erect hairs. Parafacials with numerous small hairs from oral margin up to midway to antennae. Cheeks with scattered short hairs except close to eyes. Antennae unicolorous brown; third segment 1.5 times as long as wide; arista black, thickened on basal fourth, long pubescent to tip, the pubescence a little longer than diameter of thickest part of arista.

Thorax with long and strong dorsal bristles, as follows: one humeral, two notopleural, one presutural, one supra-alar, two postalar, two dorsocentral, one prescutellar, and two scutellar bristles. Pleura bare except for bristly hairs on sternopleura and a few fine hairs on lower propleura. Prosternum with three long bristly hairs and with or without several smaller hairs.

Wings with long basal costal bristle; hind crossvein straight or slightly bowed outwardly; sections of costa from humeral crossvein to tip as 0.7:1:1.5:0.7:0.6. Squamae and halteres yellowish, the former with long yellowish ciliae.

Legs with bristles as follows: fore coxae with two laterals; fore femora in apical half with three dorsal bristles and three somewhat weaker posterior bristles; middle femur with mid-anterior bristle; hind femur with one or two anterodorsal and one or no posterodorsal subapicals; hind tibia with one long preapical. Hind coxae without dorsal hairs and hind femora without ventral bristles.

Abdomen with rather long recumbent black bristly hairs, none of which are stout enough to be called a bristle.

Types.—Holotype ♀, Matanuska Valley, Alaska, 11 July 1592 (COB), no. 61790 in USNM; Paratypes: female, one, same data, USNM; one, 23 July 1952, GCS.

Although only females are at hand, this species seems worthy of description since it is the first *Renocera* which I have seen with hairy prosternum. In possessing a humeral bristle, but one fronto-orbital, and dull anterior front, it is apparently related to *R. cyathiformis* Melander, known from a single male from Mount Constitution, Orcas Island, Washington. That species has shining parafacials, front narrowed at antennae to two-thirds the width at ocelli, and hind femora bristly below. These may be sexual differences, but in this genus that does not seem likely.

Renocera johnsoni Cresson

(Fig. 11)

Trans. Amer. Entom. Soc. 46:53, 1920; Melander, Ann. Entom. Soc. Amer. 13:319, 1920; Curran, Amer. Mus. Novitates, no. 682:9, 1933.

Fairbanks, 1 July 1921, 2 ♂♂, 2 ♀♀ (JMA) USNM; Matanuska Valley, 28 June, 1, 8, 15 July 1950, 12 June 1951, 27 June, 2 August 1952, 8 ♂♂, 6 ♀♀ (COB) USNM, GCS.

The original description cites the holotype from Fort Kent, Maine, and one paratype from Bear Lake, British Columbia. I have seen material from Alberta, Utah, and Colorado. A figure of the hypoygium of a male of the Matanuska Valley material is given to assist in the identification of this form, which is closely related to or even synonymous with *R. quadrilineata* Melander and *R. pacifica* Curran.

Genus **Sepedon** Latreille

Sepedon borealis Steyskal

Wasmann Jour. Biol. 8:283, 1950.

Matanuska, 18 May 1945, ♀ (JCC) paratype, USNM, 11, 23 July 1952, 6 spms. (COB); Palmer Highway, mile 16, 14 August 1952, 3 spms. (COB). Occurs across northern North America.

Sepedon fuscipennis Loew

Wiener Entom. Monatschrift 3:2109, 1859; Steyskal, Wasmann Jour. Biol. 8:287, 1950.

Matanuska Valley, 5, 9, 11 August 1950, 12 June 1951, 27 June 1952, 14 spms. (COB). Occurs across the continent, south to Texas.

Sepedon spinipes americana Steyskal

Wasmann Jour. Biol. 8:277, 1950.

Matanuska, 13 May 1945, ♀ (JCC) USNM; Nenana, 16 June 1951, ♂ (RIS) USNM. Recorded also from Alberta, Ontario, Washington, Oregon, Michigan, and New York. The typical subspecies is widespread in the palaearctic region.

Genus **Tetanocera** Dumeril[1]

Tetanocera bergi, new species

(Fig. 12)

Male.—Length of wing, 5.5 to 6.0 mm.

Color: Tawny, only apical one or two tarsal segments sometimes blackish; arista dark brown to blackish, with black hairs; thoracic dorsum with two distinct dark brown dorsocentral lines and a pair of less distinct sublateral lines on each side; pleura with broad brown dorsal band; face and cheeks with heavy whitish pruinosity, face sometimes yellowish medially; front uniformly dull yellowish brown, except shining midfrontal stripe and very narrow white pruinosity along orbits; wings yellowish anteriorly, grading to grayish posteriorly, both crossveins conspicuously surrounded by blackish infumation.

Head: Midfrontal stripe narrow and parallel-sided, extending approximately 0.7 of distance to anterior margin; fronto-orbital bristles two,

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[1]It is quite likely that this name is untenable, but since this is hardly the place to discuss this complicated matter, the traditional usage will be maintained.

close together, the anterior one but slightly anterad of anterior ocellus; hairs of anterior middle of front few and shorter than diameter of an ocellus; antennae with second segment half length of third, which is 0.32 mm. wide and 0.44 mm. long; arista 0.9 mm. long, with moderately sparse hairs, the longest of which is 0.16 mm. long.

Thorax: Prosternum without hairs; scutellum convex, projecting slightly beyond insertion of apical bristles, which are farther from each other than from laterals.

Legs: Middle femora lacking posterodorsal preapical bristle.

Wings without stump veins.

Abdomen: Hypopygium as in fig. 12, ventral margins emarginate, but not deeply, anus far basad of surstyli; subgenital plate small, apparently developed only mesally; surstyli slender, with small mediobasal humps, tapering to blunt tips with minute point turned mesally, in lateral view a little bent backwards, setae inconspicuous and short.

Female.—Length of wing, 6.4 to 6.9 mm.; similar to male except in sexual characters.

Types.—Holotype ♂ and Allotype ♀, Matanuska Valley, Alaska, 27 June 1952 (COB), no. 61791 in USNM; paratypes: ALASKA, same as types, 2 ♂♂, 3 ♀♀, USNM, GCS; same locality, 1 July 1950, ♂, 2 August 1952, 2 ♂♂ (COB); Auke Bay, 22 May 1952, ♂ (WCF) USNM.

The absence of a posterodorsal preapical bristle on the middle femur, the dull anterior front with parallel-sided midfrontal stripe, and the lack of stump veins place this form close to *Tetanocera ferruginea* Fallén, from which it may be distinguished by the shorter aristal hairs, shorter and fewer anteromedian frontal hairs and the different male terminalia.

Tetanocera ferruginea Fallén

Dipt. Sueciae, Sciomyz.: 9, 1820; Cresson, Trans. Amer. Entom. Soc. 46:65, 1920 (*Chaetomacera*); Melander, Ann. Entom. Soc. Amer. 13: 327, 1920 (*Tetanocera*); Verbeke, Bull. Mus. Roy. Hist. Nat. Belgique 24:20, 1948 (*Tetanocera*).

Synonym.—*Tetanocera huronensis* Steyskal, Occas. Pap. Mus. Zool. Univ. Michigan, no. 386:6, 1938 (new synonymy).

Matanuska Valley, 1, 8, 15 July 1950, 12 June 1951, 27 June, 2, 14 August 1952, 57 spms. (COB). This species has been found to be relatively abundant and widespread in North America. It extends across the continent, south to Oregon, Colorado, South Dakota, Michigan, and New Jersey. I have recently compared European material which reveals the inadequacy of the available figures of the male terminalia, except one by Verbeke (l.c.).

Tetanocera montana Day

Canadian Entom. 13:87, 1881; Melander, Ann. Entom. Soc. Amer. 13:328.

Eklutna, 28 July 1951, ♂ (WCF); Matanuska Valley, 2, 14 August 1952, 2 ♂♂ (COB).

A rather scarce species, described from Wyoming, reported from Montana by Melander, and seen by me from the above Alaskan localities, Alberta, Wisconsin, and Michigan.

Tetanocera nanciae Brimley

Entom. News 36:75, 1925; Steyskal, Occas. Pap. Mus. Zool. Univ. Michigan, no. 386:4, 1938.

Anchorage, 11 July 1938, ♀ (G. P. Englehard) USNM; Eagle River, southeast Alaska, 20 July 1952, 3 ♂♂ (WCF); Kadiak, 20 July 1899, ♂, 2 ♀♀ (T. Kincaid); Kukak Bay, 4 July 1899, 3 ♂♂, ♀ (T. Kincaid) USNM; Matanuska Valley, 28 June, 1, 8, 15 July 1950, 27 June, 21, 23 July, 2 August 1952, 37 ♂♂, 18 ♀♀ (COB); Nenana, 28 June 1921, ♀ (JMA) USNM; Valdez, tidal flats, 7 July 1948, ♂ (RIS) USNM. Occurs across North America, extending well southward into the United States.

Tetanocera phyllophora Melander

Ann. Entom. Soc. Amer. 13:330, 1920.

Anchorage, 17 June 1950, ♀ (COB); Fairbanks, 6 July 1948, ♂ (Lienk and Jefferson) USNM; Lower Yukon River (Holy Cross), 16, 19 June 1951, 5 ♂♂, 3 ♀♀ (COB); Matanuska Valley, 10 July 1944, ♂ (JCC) USNM, 25, 27 June, 21 July 1952, 4 ♂♂, 3 ♀♀ (COB). Described from Mount Constitution, Orcas Island, Washington, and seen by me from several localities in Alberta; Lake Abitibi, Ontario; and Isle Royale, Michigan.

Tetanocera plebeia Loew

Monogr. Dipt. No. Amer. (Smithsonian Misc. Collns.) 1:120, 1862; Cresson, Trans. Amer. Entom. Soc. 46:61, 1920 (*Chaetomacera elata* var. *plebeia*); Melander, Ann. Entom. Soc. Amer. 13:326, 1920.

Anchorage, 20 July 1921, ♂ (JMA) USNM; Eagle River, 18 July 1952, ♀ (WCF) USNM; Matanuska Valley, 1, 2 July 1950, 27 June, 11 July 1952, 3 ♂♂, 4 ♀♀ (COB); Nebesna, 13 July 1948, ♂ (RIS); Nushagak, 9 August 1889, ♂ (McKay) USNM. This is likely the most abundant and widespread species of *Tetanocera* in North America, being found across the continent south to New Mexico in the west and to North Carolina in the east.

Tetanocera plumosa Loew

Stettiner Entom. Ztg. 8:201, 1847; Monogr. Dipt. No. Amer. (Smithsonian Misc. Collns.) 1:121, 1862; Coquillett, Proc. Washington Acad. Sci. 2:457, 1900.

Melander and Cresson considered *T. plumosa* synonymous with other species, but examination of the type, from Sitka, Alaska, is necessary. Coquillett recorded material from Yakutat, Virgins Bay, Kukak Bay, and Kadiak, all in Alaska; I have examined most of his material and the records will be found under *T. nanciae* and *T. unicolor*, but I have seen no material from Yakutat.

Tetanocera robusta Loew

Stettiner Entom. Ztg. 8:197, 1847; Frey, Notulae Entom. 4:51, 1924; Séguy, Faune de France 28:280, 1934; Verbeke, Bull. Mus. Roy. Hist. Nat. Belgique 14:22, 1948.

Synonym: *Tetanocera papillifera* Melander, Ann. Entom. Soc. Amer. 13:330, 1920 (*sec.* Frey, *l.c.*).

Anchorage, 16 mi. NE, 24 June 1948, ♀ (M-S) USNM; Kotzebue, 26 June 1951, ♂ ♀ (RIS) USNM; Lower Yukon River (Holy Cross), 22 June 1951, ♀ (COB); Matanuska Valley, 12 June 1951, 26 (reared), 27 June 1952, 2 ♂♂, 5 ♀♀ (COB); Savonoski, Naknek Lake, 27 July 1919, ♀ (Basinger) California Acad. Sci. Frey prefaced the synonymy of Melander's species with a ?, but the figures of the male terminalia given by him, Séguy, and Verbeke leave little doubt. The species occurs in North America south to New Mexico and east to Isle Royale, Michigan.

Tetanocera rotundicornis Loew

Berliner Entom. Zts. 5:344, 1861 (Cent. 1, 70); Monogr. Dipt. No. Amer. (Smithsonian Misc. Collns.) 1:123, 1862; Cresson, Trans. Amer. Entom. Soc. 46:61, 1920 (*Chaetomacera elata* var. *rotundicornis*); Melander, Ann. Entom. Soc. Amer. 13:328, 1920.

Lower Yukon River (Holy Cross), 19 June 1951, ♂ emerged from puparium collected 12 June (COB); Palmer, 11 July 1950, ♂ (RHW) USNM; Palmer Highway, mile 40, 28 June 1950, ♀ (D. A. Sleeper) USNM; Matanuska Valley, 28 June, 1, 8, 15 July 1950, 12 June 1951, 27 June, 11 July, 2, 14 August 1952, 37 ♂♂, 36 ♀♀ (COB). Occurs across North America, south to Colorado and Pennsylvania.

Tetanocera silvatica Meigen

Syst. Beschr. 6:41, 1830; Cresson, Trans. Amer. Entom. Soc. 46:65, 1920 (*Chaetomacera*); Melander, Ann. Entom. Soc. Amer. 13:326, 1920.

Matanuska Valley, 1, 8 July 1950, 12 June 1951, 24, 27 June, 2, 14 August 1952, 109 spms. (COB); Palmer, 11 July, ♂ (RHW) USNM; Tanana, 7 June 1951, ♂ (RIS) USNM. Widespread in the palaearctic region. Besides the above records, the only North American citation is that published by Cresson from Aweme, Manitoba, which I have checked. I have also seen a couple of specimens from Gull Lake, Alberta.

Tetanocera triangularis Loew

Berliner Entom. Zts. 5:344, 1861 (Cent. 1, 69); Monogr. Dipt. No. Amer. (Smithsonian Misc. Collns.) 1:122, 1862; Cresson, Trans. Amer. Entom. Soc. 46:63 (*Chaetomacera elata* var. *triangularis*); Melander, Ann. Entom. Soc. Amer. 13:327, 1920.

Matanuska Valley, 8 July, 10 August 1950, 2 August 1952, 5 ♂♂, ♀ (COB); Palmer, 11 July 1950, ♂ (RHW) USNM. Melander cited this species from "Alaska." It occurs across North America, well southward in the United States.

Tetanocera unicolor Loew

Stettiner Entom. Ztg. 8:199, 1847; Cresson, Trans. Amer. Entom. Soc. 46:59, 1920 (*Chaetomacera*); Melander, Ann. Entom. Soc. Amer. 13: 328, 1920.

Anchorage, 16 mi. NE, 24 June 1948, ♀ (M-S) USNM; Eagle River, southeast Alaska, 23 July 1952, ♂ (WCF); Matanuska Valley, 1, 15 July 1950, 24, 25, 27 June, 2, 23 July, 2, 14 August 1952, 99 spms. (COB); Palmer Highway, mile 16, 14 August 1952, 7 ♂♂, 4 ♀♀ (COB); Popoff Island, 9, 16 July 1899, ♂ ♀ (T. Kincaid); Tanana, 14 June 1951, ♂ (RIS); Thane, 1 July 1952, ♀ (WCF); Virgins Bay, 26 June 1899, ♂ (T. Kincaid) USNM. This species is apparently abundant in the palaearctic region and occurs also across North America, south to Iowa.

Tetanocera vicina Macquart

Dipt. exot. 2(3):180, 1843; Melander, Ann. Entom. Soc. Amer. 13:328, 1920; Steyskal, Occas. Pap. Mus. Zool. Univ. Michigan, no. 386:4, 1938.

Melander's ''Alaska'' record, previous to the time when Brimley pointed out that his *T. nanciae* had been confused with *T. vicina*, likely actually refers to Brimley's species (*q.v.*).

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ACTINOTHRIPS (HYBRIDOTHRIPS) ONEILLAE, NEW SUBGENUS AND SPECIES

(Thysanoptera, Phlaeothripidae)

By Lewis J. Stannard, Jr., *Illinois Natural History Survey, Urbana*

When I visited the United States National Museum in December 1952, Miss Kellie O'Neill pointed out to me two unusual thrips specimens of the *Actinothrips* complex. Both specimens were from Central America; one was from Honduras and the other was from San Luis Potosi, Mexico. Apparently they represent a new species which Miss O'Neill has permitted me to describe herein. This species is named in her honor.

At least nine different types are now known in the *Actinothrips* complex. Except for the subgenus *Hybridothrips* described in this paper, each of these types was accorded full generic rank. They were distinguished chiefly by the size of certain setae, which are either enlarged or normal in thickness and length. When plotted such differences show no correlation, that is, if most of the cephalic setae are enlarged it does not necessarily follow that most of the prothoracic setae are enlarged, to cite one example. Most of the characteristics involved are repeated over again in the separate types or groups but in different combinations. Because of this independent scattering of like features between the groups it seems more feasible to me to consider the entities as subgenera and thereby emphatically point out their close relationship.

One of the entities of the *Actinothrips* complex, *Zactinothrips*, was regarded as peculiar because the third and fourth antennal segments bore a number of small sense cones around the apexes. It was of interest, then, to discover that the new Central American entity, *Hybridothrips*, also bears similar sense cones on these antennal segments. In the number of enlarged head setae, *Hybridothrips* is more nearly like *Zeuglothrips* but in the characteristic of the antennae and by the characteristic of the large fore tarsal tooth in the male sex, *Hybridothrips* is more like *Zactinothrips*. In these respects *Hybridothrips* is suggestive of the expected result that might be produced from an ancient cross between *Zactinothrips* and *Zeuglothrips*.

Actinothrips may be defined as a genus of the family Phlaeothripidae which has heavy maxillary stylets and which has the antero-lateral prothoracic setae placed near the mid lateral setae, back of the normal position. No species in this genus has prothoracic praepectal plates and many have a large pelta shaped much as in fig. 6. They vary greatly in size from medium, 2 mm., to large, over 7 mm. It is their tendency to bear enlarged setae on the body including certain segments of the antennae and legs, and to have long hairy tubes.

As mentioned before the various species have been grouped into several genera. These groupings may be continued in use but I prefer to consider them as subgenera. Included as subgenera could be: *Actinothrips* s. str. Bagnall, 1909; *Hystricothrips* Karny, 1912; *Zeugmatothrips* Priesner, 1925; *Zeugmatothripoides* Bagnall, 1929; *Zactinothrips* Hood, 1936; *Zeuglothrips* Hood, 1936; *Cyphothrips* Hood, 1952; and *Saurothrips* Hood, 1952. *Hystricothrips* is not known to me but as nearly as I can tell from its description and illustrations it seems likely that this genus rightfully belongs with *Actinothrips*. Karny's figure of *Hystricothrips phasgonura* shows that the antero-lateral prothoracic setae are displaced posteriorly and arise near the mid lateral pair just as in typical species of *Actinothrips*. By this characteristic as well as by the characteristic of the long, hairy tube and the presence of many enlarged setae on the body and antennae, it is most reasonable to suppose that the two entities are relatives if not congeneric. However, my opinion is not shared by some other thysanopterists; Hood in 1925, for reasons not stated, placed *Hystricothrips* in another tribe apart from the rest of the *Actinothrips* complex.

Despite the similarity of the names, *Actinothrips* is very distinct from *Anactinothrips*. Unlike *Actinothrips*, *Anactinothrips* has praepectal plates and its mesopraesternum is well developed. *Anactinothrips* is more closely related to such genera as *Elaphrothrips* and *Idolothrips*. *Actinothrips* which lacks praepectal plates and has a degenerate type of mesopraesternum is more closely related to such genera as *Atractothrips*.

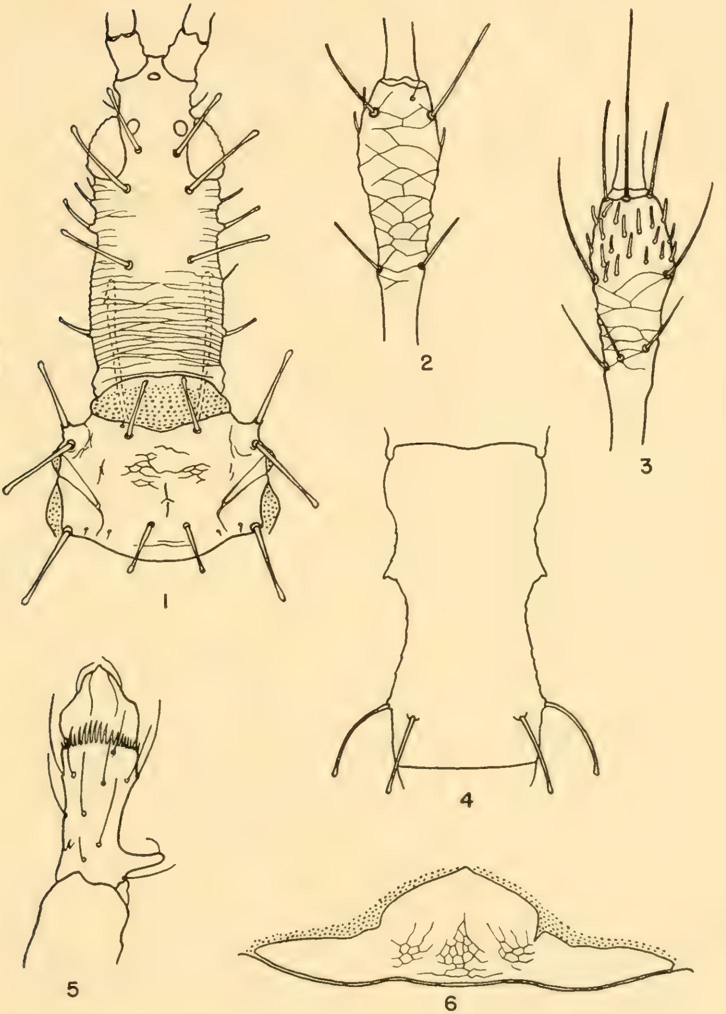

Fig. 1, head and prothorax, dorsal aspect; fig. 2, apex of left antennal segment III, dorsal aspect; fig. 3, apex of left antennal segment III, ventral aspect; fig. 4, outline of abdominal segment VIII, dorsal aspect; fig. 5, left fore tarsus; fig. 6, pelta (differentiated shield on dorsum of abdominal segment I).

Genus **Actinothrips** subgenus **Hybridothrips**, new subgenus

Head transversely striate, strongly elongated beyond eyes; with three pairs of enlarged cephalic setae; with two pairs of prominent enlarged cheek setae and one pair of slightly enlarged cheek setae near the region of the eyes; antennal segments III and IV each with numerous small sense cones on the ventral surface near the apex. Prothorax with all major setae enlarged, fig. 1; fore tarsus of male, at least, with a large inner tooth. Abdominal segment VIII of male, at least, with a pair of lateral tooth-like projections, fig. 4; tube elongate, moderately hairy.

Type of subgenus.—Actinothrips (*Hybridothrips*) *oneillae,* new species.

Actinothrips (Hybridothrips) oneillae, new species

Male (macropterous).—Length distended, exclusive of the antennae, about 5.5 mm. Color of body black; legs beyond the base of the femora yellow; antennal segments I and II black, segments III to VI yellow except apex of V and VI which are blackish brown, segments VII and VIII blackish brown. Wings, each with a dark median streak.

Head as in fig. 1; antennal segments I and II with several stout setae which are dilated at the tips, antennal segments III and IV greatly elongate, each with about 15 small ventral sense cones at the apex in addition to the normal longer sense cones, figs. 2 and 3. Fore tarsus with a strong prominent tooth, fig. 5; fore wings with about 20 accessory subapical fringe setae. Body and legs with many enlarged setae which are dilated at the apexes.

Types.—Holotype ♂; San Luis Potosi, Mexico (intercepted at Laredo, Texas, on orchid); October 7, 1946; (Cary); lot no. 46-17211. 1♂ paratype; Honduras (intercepted at Brownsville, Texas, on orchid); November 25, 1947; (R. A. Alexander); lot no. 47-16710. These types, cat. no. 61856, are deposited in the collections of the U. S. National Museum.

BOOK NOTICE

A REVISIONAL STUDY OF THE BEES OF THE GENUS PERDITA F. SMITH, WITH SPECIAL REFERENCE TO THE FAUNA OF THE PACIFIC COAST. Part I. By P. H. Timberlake. Univ. Calif. Publs. Ent. 9: 345-432, pls. 13-26, 1954.

Part I of this long awaited revision includes a key to the 19 subgenera recognized by the author, nine of which are new, and detailed revisionary treatment of the first 15 subgenera. Keys to the component forms are included for all but monotypic subgenera. More than 40 new species and subspecies are described. The illustrations are of the male genitalia and subgenital plates of the forms treated in this part.—KARL V. KROMBEIN, *Agricultural Research Service, Washington, D. C.*

FOUR NEW SPECIES OF AMERICAN TINGIDAE

(HEMIPTERA)

BY CARL J. DRAKE, *Ames, Iowa*

The present paper contains the descriptions of four American species of lace-bugs. Unless otherwise stated, the types are in my collection.

Tingis paranana, new species

Moderately large, broadly ovate, testaceous with veinlets considerably embrowned and variegated with dark fuscous. Head and pronotum (save hind projection) black. Legs and antennae brown. Body beneath black. Reticulations rather densely clothed with long, fine, upright, pale hairs. Antennae moderately clothed with long, straight, pale hairs; segments I and II short, stout, the latter smaller; III moderately long, a little variable in length, approximately twice as long as IV, the latter slightly enlarged apically. Rostrum brown, darkened apically, reaching to base of mesosternum, the channel open behind. Bucculae meeting in front. Orifice distinct. Hypocostal ridge uniseriate. Length, 3.00 mm.; width, 1.45-1.54 mm.

Head with five stout, short spines, the hind pair usually appressed. Pronotum moderately convex, coarsely punctate, tricarinate; carinae thick, each composed of one row of tiny areolae; lateral pair constricted just behind the middle, extending as far anteriorly as base of hood. Hood small, arched above, longer than high, brownish, compressed laterally. Paranota moderately wide, considerably reflexed, angulate opposite humeral angles, there triseriate, biseriate in front. Elytra widest near middle, thence roundly narrowed posteriorly; costal area moderately wide, triseriate, testaceous with some transverse veinlets dark fuscous, the areolae hyaline, moderately large, not arranged in very regular rows; subcostal area narrower, triseriate in widest part, uni- or biseriate behind; discoidal area large, nearly three-fourths as long as elytra, narrowed at both base and apex, widest near middle, there six cells deep, veinlets brown, sometimes partly fuscous; sutural area with veinlets brown or fuscous.

Types.—Holotype ♂, allotype ♀, and numerous paratypes, Parana, Entre Rois, Arg., in Hungarian National Museum. Paratypes also in my collection.

This variegated species resembles somewhat *T. beieri* Drake, of Brazil and Paraguay, but differs in having constricted lateral carinae, costal area triseriate, hood not inflated, and the shape of body.

Leptodictya sinaloana, new species

Small, oblong, testaceous with a few elytral veinlets brownish; hood brownish; head black, shining; pronotum (save testaceous hind part) black-fuscous, somewhat shining. Body beneath black-fuscous. Appendages, rostral laminae and cephalic spines pale testaceous. Length, 2.75 mm.; width, 1.25 mm.

Head distinctly convex above, with five long, porrect spines, the hind pair longest Bucculae large, brownish, reticulate, with ends meeting in front. Rostrum brownish, black at tip, almost attaining end of sulcus; laminae broad, areolate, with ends barely meeting behind. Orifice with prominent pale rim. Hypocostal laminae uniseriate. Antennae slender, inconspiculously pilose; segment I rather stout, moderately long, larger than II; III three and one-half times as long as IV, the latter moderately hairy, slightly enlarged and brownish apically.

Pronotum moderately convex, punctate, tricarinate, each uniserate, the cells very small; lateral carinae as high as median, from base of disc anteriorly slightly divergent and slightly convex within. Paranota moderately wide, with outer part (one complete row and a few extra cells at middle) reflexed so that the outer margin rests on the surface of the pronotum, the part not reflexed as wide as reflexed part. Hood small, bell-shaped. Elytra moderately broad, considerably longer than the abdomen, with sutural areas partly overlapping but with tips separated; costal area broad, mostly triseriate, with a few extra cells in widest part, the areolae rather large and hyaline; subcostal area narrow, biseriate, the cells very small; discoidal area extending a little beyond middle of elytra, narrowed at both ends, widest near middle, there seven cells deep, the areolae larger with areolae scarcely larger than in costal area. Wings a little longer than abdomen.

Type.—Holotype ♂, Sinaloa, Mex., taken on orchid plants at Inspection Port-of-Entry, Nogales, Ariz., in U. S. National Museum.

Separated at once from other North American members of the genus by the smaller size, form and large cells in costal area.

Gargaphia schulzei, new species

Small, oblong, head and pronotum (hind triangular part testaceous) brown; hood, collar, paranota and carinae whitish testaceous; elytra whitish testaceous with a narrow oblique apical fascia (apical part of subcostal area), a mark beyond middle of vein separating discoidal and subcostal areas and the transverse veinlets between outer row of large cells in costal area dark fuscous. Body beneath brown to dark fuscous, with bucculae and rostral laminae whitish testaceous. Length, 3.00; width, 1.25 mm.

Head with five testaceous spines; anterior pair porrect, short, median spine slender, extremely long, nearly erect, shorter than the first antennal segment; posterior pair of the same size and color as median, leaning a little forward and outward. Eyes black. Antennae long, slender, smooth, with pale hairs on terminal segment; segment I long, moderately incrassate, three times as long as II, the latter moderately long and slenderer; III approximately three times as long as IV, the latter feebly enlarged and moderately long. Bucculae moderately large, areolate, closed in front. Rostrum brown, with apex darkened, scarcely extending beyond mesosternum; laminae diverging posteriorly, interrupted on metasternum.

Pronotum slightly convex between humeral angles, punctate, areolate behind, tricarinate; median carina higher behind than in front, the cells also distinctly larger posteriorly; lateral carinae higher than the median in front but not as high as it is behind, constricted just behind centre of disc, uniseriate. Paranota moderately wide, moderately reflexed, biseriate, with outer margin gently rounded, the areolae rounded and clear. Hood small compressed laterally, slightly produced in front, highest in front, there not as high as long. Elytra much longer than abdomen, with sides subparallel, obliquely roundly narrowed within at apex, overlapping apically but with apices separated; costal area moderately wide, biseriate, with the outer row very large, with inner row of cells small to widest part, thence larger; subcostal area triseriate, the cells small; discoidal area almost extending to middle of elytra, tri- or quadriseriate in widest part; sutural area with small cells immediately behind discoidal area, the rest of cells large. Wings not much longer than abdomen.

Types.—Holotype ♂, allotype ♀, and 11 paratypes, Asunction, Paraguay, A. Schulte.

Separated from *G. lunulata* (Mayr) by areolation of costal area, elevated median carina posteriorly and the obliquely rounded within apex of each elytron.

Gargaphia socorrona, new species

Short, rather broad, pale testaceous with pronotum largely dark fuscous; some specimens with a few transverse veinlets in costal area dark fuscous and apical part of discoidal area shaded with brown. Body beneath dark fuscous with venter brown. Bucculae and rostral laminae whitish testaceous. Length, 3.00 mm.; width, 1.15 mm.

Head brown, with five long testaceous spines; frontal spines straight, shortest, porrect; median spines longer, straight, porrect; hind pair longest, gently bent outward. Rostrum dark brown or fuscous, barely reaching base of mesosternum. Rostral channel interrupted on metasternum. Legs slender, with short bristly hairs. Bucculae large, areolate, closed in front. Entire body beneath rather densely clothed with fine pale hairs. Antennae moderatly long, slender, rather longly setose; segment I moderately swollen, slightly more than twice as long as II, the latter slenderer and not very short; III three times as long as IV, the latter slightly thickened.

Pronotum moderately convex, pitted, areolate behind; median carina low in front, raised and arched behind centre of disc, biseriate in highest part, mostly uniseriate; lateral carinae not quite as high as median, constricted behind disc, uniseriate, with dorsal vein gently rounded from base to apex. Orifice distinct. Hypocostal laminae uniseriate. Reticula tion of entire dorsal surface and outer margin of paranota rather densely clothed with very fine pale hairs, these hairs not very conspicuous on elytra; exterior margins of elytra beset with shorter bristly-like spines. Elytra broad, much broader than abdomen with outer margins subparallel, broadly rounded behind, with subcostal areas partly overlapping but with tips a little separated; costal area broad, triseriate, quadriseriate in widest part. The areolae moderately large and clear; subcostal area very narrow, triseriate, with areolae very small and rounded; discoidal area rather large, finely areolate, scarcely attaining middle of elytra, somewhat rounded behind, six or seven areolae deep in widest part, the areolae small and round; sutural area large, with some small areolae just behind discoidal area, the other areolae large. Wings very little longer than abdomen, much shorter than elytra, whitish.

Types.—Holotype ♂, allotype ♀, and paratypes, Socorro Island, Revilla Gigedo Islands, Pacific Ocean, off the Western Coast of Mexico.

This finely hairy little species may be separated from *G. lunulata* (Mayr) and other small species by the arched median carina, bristle-like spines on exterior margins of elytra, quadriseriate costal area in widest part and the long cephalic spines.

A REVIEW OF THE MELANTHRIPINAE WITH DESCRIPTIONS OF TWO NEW SPECIES

(THYSANOPTERA, TEREBRANTIA)

BY STANLEY F. BAILEY, *University of California, Davis*

Previous papers by the writer (1937, 1939, 1940) have covered portions of this group of thrips, namely *Dactuliothrips* and *Ankothrips*. With the present addition of *Melanthrips* to our North American fauna we can evalute more properly some of the rather ambitious taxonomic categories established for certain thrips genera. The 1939 report mentioned the upgrading of the melanthrips group to the status of a family and at the same time we saw no reason to retain the family Dactuliothropidae. Priesner (1949) recognizes only the sub-family Melanthripinae. As time passes and more species are discovered in the Aeolothripoidea, it is probable that even more of the higher level catogries will become unnecessary for such a small group of insects. Newly discovered variations in the armature and sensoria of the species call for a broader concept of the genera rather than setting up new genera or sub-genera for each variation noted.

In addition to the two new species of *Melanthrips* described below we believe it desirable to redescribe and illustrate *Dorythrips* Hood and *Cranothrips* Bagnall to complete the review of this unit of the aeolothripids. Priesner has reviewed *Melanthrips* in 1936. For the benefit of other workers we are also including illustrations of *Ankothrips*, Pl. I, fig. 4; Pl. II, fig. 3, and *Dactuliothrips* to facilitate identification.

This group of aeolothripoids has only certain very general characteristics in common: Antennae nine-segmented, terminal segments not fused, ocelli present in both sexes, maxillary palpi three-segmented, labial palpi two-segmented; pronotum with a prominent row of bristles along posterior margin, fore wings nearly always broad, bluntly rounded, with two longitudinal veins and a varying number of cross veins, ovipositor up-turned, and frequently with various projections on basal antennal segments, frons, or fore legs, Pl. II, figs. 1-6. The sensory areas are linear or oval and are placed at the tip of antennal segments III and IV, with the exception of *Dactuliothrips* in which they are oval and paired, Pl. I, fig. 3, similar to *Orothrips*. *Dactuliothrips* appears the most atypical genus in the sub-family, but we believe should be retained in the Melanthripinae for the present.

This group of thrips appears to be nearly world wide in its distribution, as its representatives are known from Europe, Africa, North and South America, and Australia.

Genus **Melanthrips** Haliday

Melanthrips Haliday, 1836, Entom. Mag. 3: 450.

Antennae nine-segmented, the terminal segments not closely joined. Segments III and IV with linear sensory areas partly encircling segment at tip usually at an angle. Head usually wider than long. Pronotum with row of bristles along posterior margin. Maxillary palpi three-segmented, labial palpi two-segmented. Fore legs somewhat thickened, the tibiae armed at the tip with spurs. Wings broad and usually bluntly rounded at tip, Pl. II, fig. 8. Ovipositor up-turned. First abdominal segment of male elongated dorsally.

Type of the genus:—Melanthrips fuscus (Sulzer), 1776, from *Thrips*.

Melanthrips digitus, new species

(Pl. I, fig. 8; Pl. II, fig. 7, 12-14)

Female:—Color uniformly dark brown. Wings wholly dark with veins and tip heavily pigmented. Antennae uniformly dark brown.

Head wider than long, eyes not strongly protruding, cheeks not strongly arched. Ocelli present. Dorsum reticulated posteriorly. Antennae short, sensory areas on segments III and IV, small, located distally, not strongly oblique and not encircling segment. Two interocellar bristles and two postocular bristles. Maxillary palpi three-segmented, labial palpi two-segmented.

Pronotum wider than long. Five pairs of setae along posterior margin. One midlateral bristle on each side. Claw absent on fore tarsus. Tip of fore-tibia prolonged into a finger-like process from the tip of which arises an articulated thumb-like process. No femoral spurs. Pre-apical bristle on hind tibia absent. Wings small, slender, bluntly pointed, cross-veins in posterior portion usually missing. Regularly spaced setae present on longitudinal wing veins.

Abdomen bluntly pointed. Dorsum of first segment with striations, one line heavier than remainder. The venter of abdominal segments with a single row of widely spaced setae on posterior margin and one pair in center of segment; striations faint. Ovipositor up-turned.

Male—Smaller than female, normal. First abdominal segment with usual dorsal ridges. Terminal segments normal without claspers or heavy dorsal spurs.

Measurements (in mm.) of female holotype: Total body length 1.33; head, length .112, width, .144; interocellar bristles, length .032, post oculars .035; pronotum, length, .131, width, .180, midlateral bristle, .032, posterior laterals, .048; fore wings, length, .742, width at center, .073; antennal segments of female, length, I, .014; II, .038; III, .039; IV, .041; V, .035; VI, .036; VII, .028; VIII, .021; IX, .023; total length, .284.

Described from a long series of specimens collected from red shanks, *Adenostoma sparsifolium*, taken at Pine Valley, San Diego County, California, on April 26, 1950, by the author. The holotype female carries this data. The allotype and additional specimens were taken by R. M. Bohart on *Ericameria pinifolia* near Idyllwild, Mt. San Jacinto, Riverside County, California, on April 7, 1939. Another series was taken by H. E. Cott and the writer on *Prunus* sp. on April 25, 1950, at Aguanga, Riverside County, and two females at Warner Springs, San Diego County, beating shrubs on May 25, 1951. The types are in the author's collection.

This new species is closest to *acetosellae* John according to the Priesner arrangement (1936) and also similar to *faurei* Hood, 1937. It can be told from the European and African species by the smaller size, shorter antennae and pronotal bristles, and particularly by the presence of the thumb-like process at the tip of the fore tibia (cf. *Erotidothrips mirabilis* Pr.).

Melanthrips insulus, new species

(Pl. I, fig. 7; Pl. II, figs. 5, 10, 11)

Female—Color brown, fore tibiae, all tarsi and antennal segments II-IV yellowish brown, remainder brown. Fore wings brown with basal third pale.

Head wider than long, eyes moderately protruding, cheeks arched. Ocelli present. Dorsum striated. Sensory areas on antennal segments

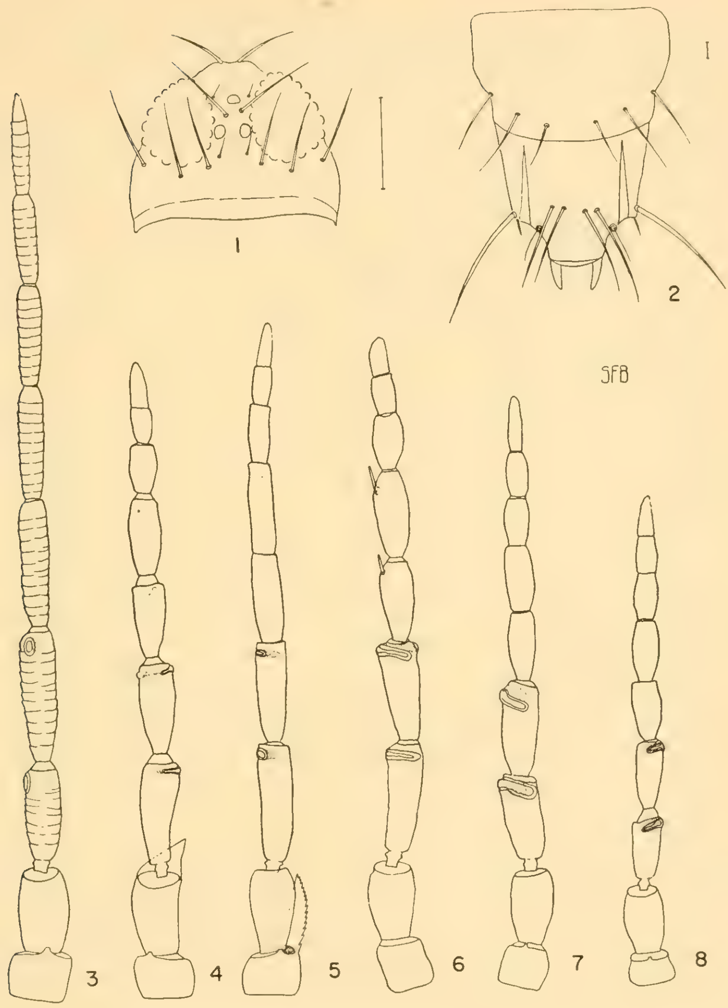

PLATE I

Fig. 1, *Cranothrips poultoni* Bagn., co-type ♀, dorsum of head; fig. 2, *Dorythrips chilensis* Hd., topotype ♂, terminal abdominal segments, dorsum; fig. 3, *Dactuliothrips spinosus* Mlt., ♀, antenna; fig. 4, *Ankothrips robustus* Mlt., ♀, antenna; fig. 5, *Cranothrips poultoni* Bagn., ♀, antenna; fig. 6, *Dorythrips chilensis* Hd., ♀, antenna; fig. 7, *Melanthrips insulus* Bailey, n. sp., holotype ♀, antenna; fig. 8, *Melanthrips digitus* Bailey, n. sp., holotype ♀, antenna. Scale—fig. 1, 1 line equals 0.1 mm.; figs. 2-8, 1 line equal 0.01 mm.

III and IV broad and nearly encircling segment at tip. One pair of interocellar bristles and four postocular bristles behind each eye. Maxillary palpi three-segmented, labial palpi two-segmented.

Pronotum wider than long. Eight pairs of bristles, including posterior angulars, along posterior margin. Mid-lateral bristles very weak as are the central anterior-marginals and the anterior-angulars. Fore tarsi without claw. Tip of fore tibia with one large spur which has a collar-like swelling at base. Fore femora swollen. Hind tibia without pre-apical bristle. Wings broad, bluntly rounded. Longitudinal veins of fore wings with regularly spaced bristles.

Abdomen bluntly pointed. Ovipositor up-turned. Dorsum of first segment strongly straited. Venter of segments as in *digitus.*

Male—Unknown.

Measurements (in mm.) of female holotype: Total body length 1.75; head, length, .121, width, .177; interocellar bristles, length, approximately .014; postoculars, .028; pronotum, length, .175, width, .256; posterior-lateral bristles, .041; fore wings, length, .864, width at center, .135. Antennal segments, length: I, .019; II, .041; III, .057; IV, .054; V, .041; VI, .041; VII, .028; VIII, .026; IX, .032; total length, .351.

Described from one female collected on yucca flowers at Sonoita, Santa Cruz County, Arizona, on June 14, 1947 by A. T. McClay.

This second new *Melanthrips* from North America appears to be most closely related to *areolatus* Pr. In *insulus* the mid-lateral bristles on the pronotum are minute and the remaining bristles on the pronotum and head are much shorter than *areolatus,* as are the antennae.

Genus **Cranothrips** Bagnall

Cranothrips Bagnall, 1915, Ann. Mag. Nat. Hist., ser. 8, 15:315, fig. 1.

Antennae nine-segmented with the ventral portion of segment I prolonged inwardly, terminal segments not fused. Segments III and IV with linear sensory areas partly encircling segments at tip. Head and pronotum wider than long. Maxillary palpi three-segmented. Labial

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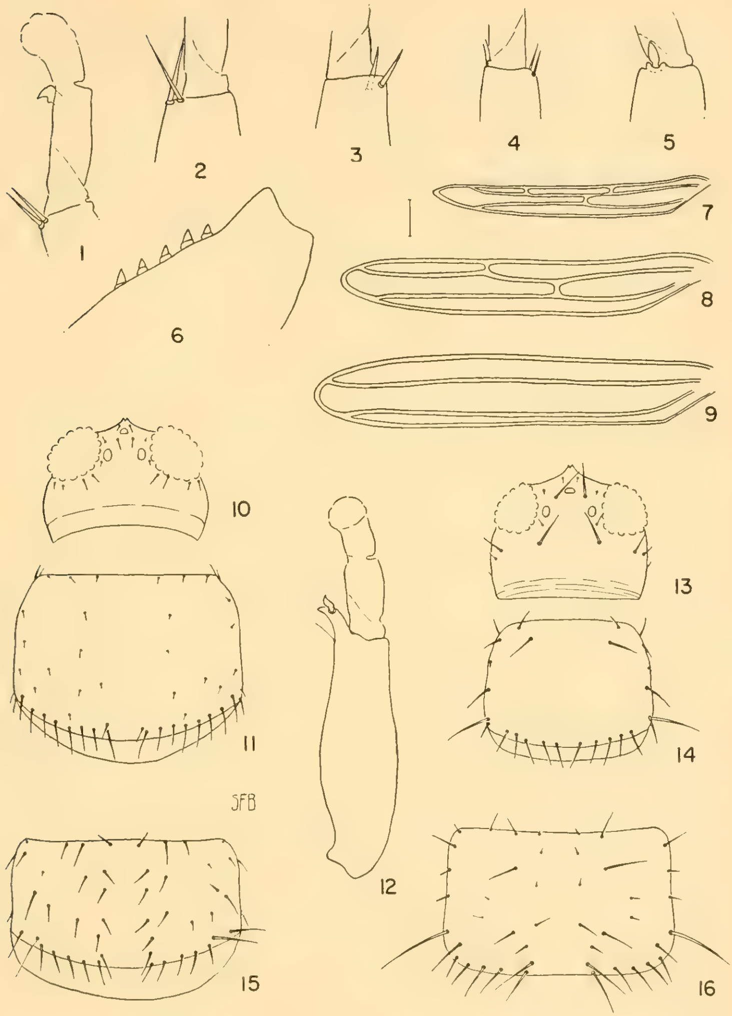
PLATE II

Fig. 1, *Dactuliothrips spinosus* Mlt., ♀, fore tarsus and tip of tibia, showing armature; fig. 2, *Cranothrips poultoni* Bagn., ♀, tip of fore tibia; fig. 3, *Ankothrips robustus* Mlt., ♀, tip of fore tibia; fig. 4, *Dorythrips chilensis* Hd., ♀, tipof fore tibia; fig. 5, *Melanthrips insulus* Bailey, n. sp., ♀, tip of fore tibia; fig. 6, *Dactuliothrips spinosus* Mlt., ♀, illustrating spurs on inner face of fore femur; fig. 7, *Melanthrips digitus* Bailey, n. sp., holotype ♀, fore wing; fig. 8, *Melanthrips fuscus*



Hal., ♀, fore wing; fig. 9, *Cranothrips poultoni* Bagn., ♀, fore wing; fig. 10, *Melanthrips insulus* Bailey, n. sp., dorsum of head; fig. 11, *Melanthrips insulus* Bailey, n. sp., dorsum of pronotum; fig. 12, *Melanthrips digitus* Bailey, n. sp., holotype ♀, fore tibia and tarsus; fig. 13, *Melanthrips digitus* Bailey, n. sp., holotype ♀, dorsum of head; fig. 14, *Melanthrips digitus* Bailey, n. sp., holotype ♀, dorsum of pronotum; fig. 15, *Dorythrips chilensis* Hd., ♀, dorsum of pronotum; fig. 16, *Cranothrips poultoni* Bagn., co-type ♀, dorsum of pronotum. Scale—figs. 1-6, 12, 1 line equals 0.01 mm.; figs. 7-9, 10, 11, 13-16, 1 line equals 0.1 mm.

palpi two-segmented. Wings broadly rounded. Pronotum with distinct row of setae along posterior margin, Pl. II, fig. 16. Ovipositor not strongly upcurved. Legs without claws or spurs. Terminal abdominal segments of male similar to *Ankothrips.*

Type of the genus—Cranothrips poultoni Bagnall, 1915.

There are now two known species, *poultoni and karrooensis* Jacot-Guillarmod, the first from Australia and the latter from South Africa. We have seen only *poultoni* which is illustrated (Plate I, figs. 1, 5; Plate II, figs. 2, 9, 16) from Australian specimens in the Moulton collection. In the specimen available no cross veins could be seen in the fore wing.

Genus **Dorythrips** Hood

Dorythrips Hood, 1931, Bul. Brook. Ent. Soc. 26(1):1-3, fig. 1, a-c.

Similar to *Melanthrips* and *Ankothrips.* Head with saw-toothed projection extending forward between the bases of the antennae. Antennae nine-segmented, all the terminal segments freely movable; segments III and IV each with a transverse sensory area, nearly encircling tip, similar to *Melanthrips*, Pl. I, fig. 6. Maxillary palpi three-segmented. Labial palpi two-segmented. Fore tibiae and tarsi without claws or heavy spurs, Pl. II, fig. 4. Wings broad and rounded.

Type of the genus.—Dorythrips chilensis Hood, 1931.

The original description was based on female specimens only. We have studied several specimens with the original collection data (1928) which were kindly loaned by Miss Kellie O'Neill, Washington, D. C. Among these was found one male. It is smaller than the female, uniform brown, and with the first abdominal segment enlarged dorsally in the characteristic manner. The terminal abdominal segments are without claspers or heavy spines, Pl. I, fig. 2 and in appearance are similar to *Ankothrips yuccae* Moulton.

The genus is still monotypic and is illustrated (see above illustrations and also Pl. II, fig. 15) for comparison with its relatives. It is limited presently to South America.

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THE IDENTITY OF BRACHYCISTIS NOCTICOLA BRADLEY

(HYMENOPTERA, TIPHIIDAE)

BY KARL V. KROMBEIN, *Agricultural Research Service, Washington, D. C.*

Recently I was using J. C. Bradley's publication on North American *Brachycistis* males (Trans. Amer. Ent. Soc. 43:247-290, 5 pls., 1917) to identify some material from California. While examining the genitalic figures, I came upon a specific name, *nocticola* Bradley, in the explanation of figures, which was unfamiliar to me. A description of this species was not included in the text, nor was the species included in the accompanying key, but the figures of the wings (fig. 19) from a paratype, and of the genitalia (figs. 39 and 40) from the holotype, are sufficient to validate the name for nomenclatorial purposes. The name was missed by the cataloguers for the Zoological Record and the Section of Insect Identification, and also by me during preparation of the section on Tiphiidae for the synoptic catalog of North American Hymenoptera (U. S. Dept. Agr., Agr. Monogr. 2:735-748, 1951). It was also unnoticed by Malloch in his treatment of brachycistidine males (Proc. U. S. Natl. Mus. 68, Art. 3:1-28, 4 pls., 1926).

The species remained a mystery to me for several months, since wing venation is not specifically diagnostic, and the value of the male genitalia in specific differentiation in this group has not been established. Recently, however, H. E. Evans was successful in locating the holotype and sent it to me, together with the genitalia mounted dry on a point on another pin. The specimen bears a label, "Coalinga, Fresno Co., Cal., June 9, 1907, bel. 500 ft., Bradley," beneath that another label, "J. C. Bradley, 1916, Comp. w. type *B. nevadensis*," and finally a third red holotype label with *nocticola* written on it in pencil. The genitalia mount bears a single red label, "Holotype, *Brachycistis nocticola* Br."

Comparison of this specimen with material in the U. S. National Museum collection demonstrated that it agreed very well with the type series of *B. inaequalis* Fox, 1899, from Los Angeles, California, differing only in being smaller, 8.6 mm. long as compared to 10-11 mm., and in having the marginal vein bent downward directly after leaving the stigma instead of running along the costal margin for a short distance beyond the stigma. Both of these characters appear to be variable in other material of *inaequalis* from California, and I have no hesitancy in placing *nocticola* in the synonymy of *inaequalis*.

Finally, it is necessary to select a lectotype of *inaequalis*, since none of the specimens bears a label indicating it as type. I am selecting the one of six males from Los Angeles County, California, September, which bears a label in Fox's handwriting, "*B. inaequalis* Fox." U. S. N. M. Type No. 61980 has been assigned to this specimen.

ARCTIC ALASKAN DIPTERA

By Neal A. Weber, *Swarthmore College, Swarthmore, Penna.*

The following records are in addition to those reported previously.[1] They were taken in 1948-50 during field work supported by the Office of Naval Research or the Arctic Institute of North America. All are from the Arctic slope of the Brooks Range north to the Arctic Ocean. Geographical data for the localities have previously been published, in the papers cited below.

No group of insects is of greater importance in the life of the tundra than the Diptera. It is much to be regretted that the abundance of species, difficulty of classification, and scarcity of taxonomic specialists have made it impossible to have many of the specimens determined. The considerable amount of time and skill, therefore, which has been spent by the identifiers on the material below is greatly appreciated. It has been identified at the British Museum (Natural History) by R. L. Coe, P. Freeman, P. F. Mattingly, H. Oldroyd, F. van Emden, the Canadian Department of Agriculture, Division of Systematic Entomology, J. G. Chillcott, H. C. Huckett, and the U. S. Department of Agriculture, Division of Insect Identification, C. W. Sabrosky, A. Stone, W. W. Wirth. Some of the Tipulidae will be reported on by Dr. C. P. Alexander separately.

[1]In Ent. News, 1948, 49: 253-257; *ibid.*, 1949, 50: 118-128; *ibid.*, 1954, in press; Trans. Amer. Ent. Soc., 1950, 76: 147-206.

NEMATOCERA

Melusinidae (Trichoceridae)

Melusina (*Trichocera*) sp.: Noluk Lake; Pt. Barrow, the latter specimens from loose turf of lemming runways and emerging from lemming nests, also a female ovipositing July 28 in lemming debris.

Tipulidae

Tipula carinifrons Holmgren: Pt. Barrow. Specimens of both sexes were compared with Holmgren cotypes from Novaya Zemlya by Mr. Freeman.

Tipula oklandi Alexander (?) (det. Freeman): Pt. Barrow, *in copula* July 15.

Erioptera (*Psiloconopa*) *aldrichi* Alex.: Umiat, male, July 7.

Pedicia (*Tricyphona*) *hannai*, n. subsp., Alexander MS (det. Alexander): Pt. Barrow, July 12, 27, 29, 30; Anaktuvuk; Noluk Lake, July 6.

Prionocera n. sp., Alexander MS (det. Alexander): Pt. Barrow, male, July 12, female, July 27.

Tendipedidae (Chironomidae)

Hydrobaeninae (Orthocladiinae)

Cricotopus sp.: Umiat.

Hydrobaenus (= *Orthocladius*) spp.: Anaktuvuk; Umiat; Pt. Barrow.

Hybrobaenus (*Psectrocladius*) sp.: Pt. Barrow; Noluk Lake, very large numbers at 9:00 p.m. July 6 were *in copula* on the lake shore, swarming over the slight irregularities in a frenzy of activity and crawling rather than flying.

Hydrobaenus (*Smittia*) sp.: Ikakevik Lake.

Hydrobaenus (*Spaniotoma*) 3 spp.: Pt. Barrow; Noluk Lake; Ikakevik Lake. At least two species in each locality. They are active from 40° to 70° F., but sluggish at the lower temperature. A large swarm was *in copula* July 7 during temperatures in the seventies.

Metriocnemus 2 spp.: Pt. Barrow.

Metriocnemus (*Dolichoprymna*) ? *longipennes* Holmgren: Pt. Barrow.

Metriocnemus (*Gripekovenia*) sp.: Pt. Barrow. These midges were crawling on driftwood close to a lake filled with ice. A wind blew directly from the ice to them. Their legs and bodies were closely appressed to the wood and they were reluctant to fly, usually crawling to the opposite side of the wood or to the underside, when disturbed.

Pelopiinae

Anatopynia sp.: Pt. Barrow.

Pentaneura sp.: Anaktuvuk.

Procladius sp.: Pt. Barrow.

Tendipedinae (Chironominae)

Pentapedilum (*Sergentia*) sp.: Pt. Barrow.

Tendipes: Pt. Barrow; Anaktuvuk Pass; Oumalik; latitude 68° 24′ N., longitude 150° 30′ W.

Tendipes (*Microtendipes*) sp.: Pt. Barrow: Ikakevik Lake.

Tendipes (s. str.), *plumosus* group—2 spp.: Pt. Barrow; Noluk Lake; Ikakevik Lake. Both species were swarming *in copula* 9:00 p.m. at Noluk Lake in company with the *Spaniotoma* above.

Tendipes (s. str.) 2 spp.: Pt. Barrow, one green species with a black striped thorax in the male and a second black species with a banded abdomen were in addition to those above of the *plumosus* group.

Polypedilum sp.: Umiat.

Diamesinae

? *Prodiamesa*: Pt. Barrow.

Culicidae

Aedes (*Ochlerotatus*) *communis* (DeGeer), *hexodontus* Dyar, *nearcticus* Dyar, *nigripes* (Zett.) and *punctor* (Kirby) occur in this region. Females of the last species at Noluk Lake were inserting their probosces into the decaying flesh of a young caribou which had died several days earlier and was also attracting many other flies (*Scopeuma, Protophormia, Calliphora,* etc.).

A. nigripes was identified among the mosquitoes which became a pest for the first time in the 1949 summer on July 5 at Anaktuvuk. On a mountain here, 3910 feet high, it persisted on the windy slopes to the summit, though in reduced numbers and became a marked pest down to temperatures in the 50°s F. At Umiat July 12 a few were taken at 9:00 a.m. after a night of airplane spraying of DDT ending five hours earlier. By July 20 here, however, hordes of mosquitoes including this species were present. At Fish Creek they were held close to the ground by wind and were not a pest July 16. They were extremely pestiferous July 22 at an unnamed lake (68° 24′ N., 150° 31′ W.) in the Brooks Range.

Fungivoridae (Sciophilidae, Mycetophilidae)

Boletina sp. near *borealis* Zett.: Pt. Barrow.

Exechia ? *frigida* Holmgren: Noluk Lake, swarming *in copula* on or over muck at the lake shore at 9:00 p.m., July 6; Umiat.

Lycoriidae (Sciaridae)

Lycoria (= *Sciara*) spp.: Noluk Lake; Anaktuvuk; Umiat; Pt. Barrow.

BRACHYCERA

Rhagionidae

Chrysopilus sp.: Umiat; Fish Creek.

Ptiolina mallochi Hardy and McGuire: Umiat.

Ptiolina majuscula Loew: Anaktuvuk.

Empididae

Charadrodromia (?) sp.: Anaktuvuk.

Clinocera sp.: Anaktuvuk.

Hilara sp.: Umiat; Anaktuvuk; Chandler River (69° 10′ N., 151° 35′ W.) in *Populus balsamifera* grove.

Hormopeza brevicornis Loew. ?: 68° 24′ N., 150° 30′ W.

Rhamphomyia sp.: Noluk Lake, at caribou carcass.

Rhamphomyia conservatica Mall.: Anaktuvuk.

Rhamphomyia diversipennis Becker ?: Anaktuvuk.

Dolichopodidae

Dolichopus sp. probably new: Anaktuvuk; Umiat.

Dolichopus sp. nr. *opportunus* V.D.: Umiat.

Hydrophorus sp.: Anaktuvuk.

CYCLORRHAPHA

Phoridae

Megaselia sp.: Umiat: Anaktuvuk.

Dorilaidae (Pipunculidae)

Dorylomorpha nr. *exilis* (Mall.): Umiat.

Syrphidae

Epistrophe bulbosus Fluke ?: Umiat, common July 3-11; Pt. Barrow, flying to window in cabin of DC-3 airplane July 20 which came from Fairbanks and stopped at Umiat. A female *Aedes* mosquito also came to this window here.

Helophilus groenlandicus O. Fabr.: Umiat. The species was described from Greenland in 1780 and was recorded as *latro* and *bilineatus* from Canada a century ago.

Melanostoma pictipes Bigot ?: Anaktuvuk; Umiat; Fish Creek.

Melanostoma spp.: Anaktuvuk; Umiat, feebly alive on a yellow flower five hours after the area was sprayed during the night with DDT from an airplane. A few mosquitoes (*Aedes nigripes*), two *Bombus*, and a dying *Erebia youngi* were also seen or taken at this time.

Platycheirus apparently *discimanus* Loew.: Noluk Lake. A species found in Great Britain.

Platycheirus probably *scutatus* Meig.: Umiat. A species found in Great Britain.

Syrphus contumax O.S.: Noluk Lake. The specimen was compared with the type of *adolescens* Walker 1849, a synonym of *contumax.*

Volucella bombylans arctica Johnson: Anaktuvuk.

Volucella bombylans var. *plumosa* (de Geer): Umiat.

Piophilidae

Piophila (*Allopiophila*) *arctica* Holmgren (= ? *Allopiophila* sp. in previous publication) (det. Sabrosky): Pt. Barrow, larvae and imagoes from wild duck carcass, tundra, snowy owl feces and lemming remains on mound, and from liver bait. Described from Novaya Zemyla.

Allopiophila borealis Holmg.: Pt. Barrow.

Lasiopiophila pilosa Duda: Anaktuvuk.

Liopiophila varipes Meig. ?: Anaktuvuk.

Piophila affinis Meig.: Noluk Lake.

Heleomyzidae

Neoleria rotundicornis Mall.: Pt. Barrow, in hair of Eskimo dog carcass.

Neoleria tibialis Zett.: Noluk Lake.

Scopeumatidae
(Scatophagidae, Cordyluridae)

Allomyella sp. (nr. *unguiculata* Mall. and *borealis* Curran): Pt. Barrow.

Ernoneura argus Zett.: Umiat: Anaktuvuk; Noluk Lake.

Microprosopa sp.: Anaktuvuk.

Scopeuma lanatum (Lund.): Noluk Lake.

Scopeuma suilla Fabr.: Pt. Barrow.

Scopeuma nr. *futilis* (Coq.): Pt. Barrow.

Muscidae sens. lat. (Anthomyiidae)

Coenosia sp.: Umiat.

Eupogonomyia spp.: Anaktuvuk, at flower heads of *Potentilla;* Oumalik.

Fannia sp.: Anaktuvuk; Oumalik.

Hoplogaster sp.: Anaktuvuk.

Hydrophoria ambigua (Fallen): Ikakevik Lake.

Hydrophoria laticornis Ringd.: Umiat.

Hydrophoria lucidiventris (Zett.): Ikakevik Lake.

Hydrotaea bispinosa (Zett.): Noluk Lake.

Hydrotaea houghi Mall. ?: Anaktuvuk.

Hydrotaea pilitibia Stein.: Umiat.

Lasiops septentrionalis L.: Anaktuvuk.

Limnophora (L.) *discreta* Stein.: Noluk Lake, July 7, on flower of *Ranunculus nivalis* L. (det. Spetzman).

Limosia nigrescens Stein ?: Anaktuvuk.

Macrorchis comita Huck.: Anaktuvuk: Oumalik: Chandler River in *Populus balsamifera* grove.

Macrorchis sp. (?): Pt. Barrow.

Mydaeina obscura Mall.: Anaktuvuk, at yellow flowers of *Potentilla biflora* (det. Spetzman); Pt. Barrow.

Phaonia imitatrix Mall. (?): Anaktuvuk.

Phaonia sp.: Anaktuvuk.

Phyllogaster sp.: Umiat.

Pogonomyia sp.: Anaktuvuk.

Spilogona comata Huck.: Anaktuvuk, on sandbar; Colville R. (68° 52′ N., 157° 20′ W.) on sandbar.

Spilogona contractifrons var. *fumipennis* (Zett.): Umiat. Chandler River in *Populus balsamifera* grove; Anaktuvuk.

Spilogona denudata Holmg.: Anaktuvuk.

Spilogona hyperborea Boh.: Pt. Barrow; Oumalik; Fish Creek.

Spilogona instans Huckett: Noluk Lake, July 7, on flower of *Saxifraga punctata* L. s.sp. *Nelsoniana* (D. Don.) (det. Spetzman).

Spilogona macropyga (Frey): Pt. Barrow.

Spilogona megastoma (Zett.): Pt. Barrow.

Spilogona monacantha Collin: Oumalik.

Spilogona obscuripennis Zett.: Fish Creek.

Spilogona obsoleta (Mall.): Pt. Barrow.

Spilogona reflecta Huck.: Oumalik.

Spilogona sanctipauli (Mall.): Pt. Barrow.

Spilogona nr. *sectata* Huck.: Pt. Barrow.

Spilogona sospita Huck.: Pt. Barrow.

Spilogona unicolor (Ringd.): Pt. Barrow.

Calliphoridae

Calliphora terrae-novae Macq. (= *viridescens* Rob.-Desv.): Noluk Lake, from carcass of young caribou dying several days earlier.

Phaenicia sericata (Meig.): Pt. Barrow, from Eskimo dog carcass (= *Phoenicia* sp. in 1950 report).

Protophormia terrae-novae (R.D.): Noluk Lake, from the carcass of caribou of *Calliphora* above; Pt. Barrow; Umiat; Anaktuvuk, about Eskimo trash (= *Phormia terrae-novae* in 1950 report).

Hypodermatidae

Oedemagena tarandi L.: Umiat, adults July 6; Pt. Barrow, adult July 16 on dead caribou shot a few minutes earlier (J. Thomas *et al.*) and adult July 21 at vehicle; Nigiaktuvuk River (70° 20′ N., 158° W.), March 5, second instar larvae under mid-dorsal skin of three year old male caribou (Arctic Research Laboratory).

BOOK REVIEW

HOW TO KNOW THE SPIDERS, Pictured-Keys for determining the more common spiders, with suggestions for collecting and studying them, by B. J. and Elizabeth Kaston. Spiral or cloth binding, offset, 220 pages, 552 text figs., 1953. A Pictured-Key Nature Series volume published by Wm. C. Brown Co., Dubuque, Iowa. $2.25.

Here is an extremely useful and authoritative guide for those who would like to learn how to distinguish our more common spiders. There is a short introductory section discussing the biology, collection and preservation, and morphology. Following this are keys with interspersed illustrations to 190 genera and 271 species of North American spiders, or approximately two-fifths of the genera and a tenth of the species known to occur in this region. None of the spiders belonging to the large family Micryphantidae are included—because of their tiny size and retiring habits they are rarely noticed, and the taxonomy is based largely on minute genitalic characters of the males. Nine additional, small and obscure families are not treated. The numerous diagnostic and habitus illustrations prepared by Mrs. Kaston add greatly to the ease of identification.—KARL V. KROMBEIN, *Agricultural Research Service.*

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.

OFFICERS FOR THE YEAR 1954

PROCEEDINGS

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ENTOMOLOGICAL SOCIETY OF WASHINGTON
630TH REGULAR MEETING, NOVEMBER 5, 1953

The 630th regular meeting of the Society was held at 8:00 p.m. Thursday, November 5, 1953 in room 43 of the U. S. National Museum, attended by 43 members and 18 visitors. The meeting was called to order by President W. H. Anderson and the minutes of the previous meeting were read and corrected.

New members elected to the Society were:

Lt. Col. Irving H. Marshall, Office of the Surgeon General, Headquarters Second Army, Ft. Meade, Md.

James R. Foster, University of Maryland, College Park.

President Anderson announced that C. F. W. Muesebeck would serve as chairman of the nominating committee, with F. W. Poos and W. B. Wood.

R. I. Sailer exhibited a vial containing empty fly puparia which he collected last summer at the Eskimo village of Teller, Alaska. The sample was taken from among the bones of one of the many victims of the 1918-1919 influenza epidemic. The bodies had been placed in pine board coffins and left on the tundra. It seemed likely that the fly puparia would date from the summers of 1919 and 1920. (Speaker's abstract.)

A. B. Gurney noted a trip to Nevada and nearby states in June and July, in continuation of a study of the bionomics of the grasshopper, *Melanoplus rugglesi* Gurney.

An exhibit of much interest was the book, *Iconographia Insectorum Japonicorum*, given to P. W. Oman by Japanese entomologists who became his friends during his army service in Japan.

The first principal speaker of the evening was T. L. Bissell of the University of Maryland, who told about hay crop insects and spraying in Maryland. In 1953 Maryland produced an estimated 499,000 acres of hay crops including legumes, grasses, and some grains cut for hay. Alfalfa alone was 70,000 acres. The most important insects are the meadow spittlebug (which is injurious to all the legumes) and the potato leafhopper and alfalfa weevil (which are injurious to alfalfa). A program of insect control on hay crops was begun in 1951 with demonstrations on spraying first cutting alfalfa and red clover for the spittlebug. Tenth acre plots were sprayed and yield records made at hay cutting time. In 1953, 15 demonstrations were held, the spraying usually being done by the farmer with tractor mounted sprayers. Records showed increases of 24 percent for red clover and 13 percent for alfalfa. Materials used were benzene hexachloride, methoxychlor, and toxaphene. Spray material costs about $1.00 an acre and a low-gallonage spray machine costs about $200.00. Spraying for the spittlebug has become a profitable practice in Maryland. The potato leafhopper affects the second and later cuttings of alfalfa. Spraying with methoxychlor has shown striking gains in weight and quality of hay. The alfalfa weevil was first discovered in Maryland in 1952; in 1953 it spread over a total of 18 counties and did appreciable damage in 7, from Howard County eastward to Cecil and Caroline Counties. The first cutting on many farms was reduced at least a half and the second cutting was delayed 10 days to two weeks. Spraying for spittlebugs did not control alfalfa weevil this year. Apparently it will be necessary to spray earlier in the season as is done in the West, to kill the adults before eggs are laid. (Speaker's abstract.)

Dr. C. C. Roan, of the section of Insecticide Investigations, spoke on the use of radioisotopes in entomological research. Radioisotopes are used for marking insects in studies of their field behavior, in labeling compounds to facilitate toxicological and physiological investigations, and as sources of ionizing radiations in investigations of the biological effects of such radiations on various life stages of insects. Of the three types of emanations of radioisotopes, alpha, beta, and gamma, the last two probably are the most used. Gamma rays, photonic in nature, are the most penetrating. Beta rays, electronic particles, are next in order of penetration. The two most frequently used radioisotopes in entomological research are carbon and phosphorus, both being beta emitters. Gamma emitters, such as cobalt, iodine, and scandium, are of extreme usefulness in marking insects for field studies. In this talk before the Society, demonstrations of the penetrating power of beta and gamma rays and the rate of uptake of phosphorus^{32} by bean leaves were given. The Geiger-Mueller counting tube, operating a count rate meter, was used. (Speaker's abstract.)

Visitors introduced were O. H. Graham, entomologist with the U. S. Army in the Canal Zone, A. F. Sander, agronomist with the U. S. Air Force in Washington and Dr. W. L. P. Dassanayake of Ceylon; also Lt. Col. Irvine H. Marshall, a new member, and Ernestine B. Thurman, a member who has returned from Thailand.

Meeting adjourned at 10:00 p.m.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
631ST REGULAR MEETING, DECEMBER 3, 1953

The 631st regular meeting of the Entomological Society of Washington, held in room 43 of the U. S. National Museum, Thursday, December 3, 1953, was attended by 37 members and 17 visitors. President W. H. Anderson called the meeting to order at 8:00 p.m. and the minutes of the preceding meeting were read and accepted.

Two new members were elected:

Theodore B. Davich, Virginia Agricultural Experiment Station, Tidewater Field Station, Holland, Va.

J. M. Magner, Entomologist, Development Department, Organic Chemicals Division, Monsanto Chemical Company, St. Louis 4, Mo.

President Anderson summarized officers' reports on the state of the Society. R. H. Nelson's report that he had succeeded in obtaining two full page ads for six issues of the *Proceedings*, for a total of \$200, was received with thanks.

The following officers were elected for 1954:

Honorary President	C. L. MARLATT
President	A. B. GURNEY
First Vice President	T. L. BISSELL
Second Vice President	R. A. ST. GEORGE
Recording Secretary	KELLIE O'NEILL
Corresponding Secretary	LOUISE M. RUSSELL
Treasurer	P. X. PELTIER
Editor	B. D. BURKS
Custodian	H. J. CONKLE
Program Chairman	K. A. HAINES
Representing the Society as Vice President of Washington Academy of Sciences	F. W. POOS

F. W. Campbell made a motion that a committee be appointed to consider the advisability of changing the constitution or bylaws as necessary for the purpose of speeding the annual elections; the motion was carried.

Comments on the Eastern Branch Meeting of the Entomological Society of America were given by C. H. Hoffman and B. A. Porter. President Anderson announced that A. B. Gurney had accepted an appointment as Executive Secretary of the Entomological Society of America.

On the regular program Dr. Howard E. Evans of Cornell University spoke on his studies on the comparative behavior of wasps of the genus *Epibembex*. In the digger wasp genus *Epibembex* (Sphecidae), studies thus far indicate that each species is markedly distinct in the various aspects of its behavior. Differences have been found in the mating flights of males, habits of the female in leveling the mound of earth in front of the burrow, nature and dimensions of the nest, manner of oviposition, manner of closing the nest, and other characteristics. Moving pictures were shown of the habits of four species of *Epibembex* recently studied in Kansas. (Speaker's abstract.)

Visitors introduced were Dr. George H. Plumb, of Charlottesville, Virginia, where he studies forest insects and diseases, John Robinson, entomologist with the U. S. Air Force Headquarters in Europe, at Wiesbaden; Donald R. Johnson, recently returned from an Indonesian assignment with the Public Health Service Division of International Health; and Burton Kiltz, agronomist with the Department of the Army here.

The meeting adjourned at 10:00 p.m.

KELLIE O'NEILL, *Recording Secretary*

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PROCEEDINGS OF THE
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VOL. 56 JUNE 1954 NO. 3

A SYNOPSIS OF ATRACHELUS

(HEMIPTERA, REDUVIIDAE)

BY JOE C. ELKINS, *American Optical Co., Instrument Division, Dallas, Tex.*

Originally begun as a revision, this paper has been reduced to the scope of a synopsis. In spite of having at hand most of the major collections, only 402 specimens of *Atrachelus* were available, and over half of these belonged to one species. Due to this paucity of material, a full revision was not feasible.

Little has been known about the *Atrachelus-Phorobura* group. This is shown by the fact that the fairly well known *Atrachelus cinereus* (Fab.) is the only species that was consistently identified correctly in the collections seen. Also, since Champion (1899) described *Atrachelus tenuispinis*, the only subsequent basic work on the group is Wygodzinsky's (1948) synonymization of *Atrachelus crassicornis* (Burm.) and *Atrachelus curvidens* Sign. under *Atrachelus cinereus* (Fab.).

The type of *Atrachelus tenuispinis* Champ. and the Fabrician specimens of *Reduvius cinereus* were not available, but the types of *Phorobura ignobilis* Stål, *Phorobura rustica* Stål, *Phorobura fusca* Stål, and *Atrachelus curvidens* Sign. were seen.

I am deeply indebted to Dr. Petr Wygodzinsky, Instituto Medicina Regional, Tucumán, Argentina (WYGOD), whose suggestion led me to undertake this study, and without whose aid and advice this work would have been very difficult to finish.

I also wish to thank the following for lending me material either belonging to them or under their care: Dr. René Malaise, Entomologiska Avdelningen, Naturhistoriska Riksmuseum, Stockholm, Sweden (STOCK), for the type of *Phorobura fusca* Stål and other valuable specimens; Dr. S. von Keler, Zoologisches Museum der Universität, Berlin, Germany (ZMU), for the types of *Phorobura ignobilis* Stål and *Phorobura rustica* Stål; Dr. Reece I. Sailer, U. S. National Museum, Washington, D. C. (US); Dr. Max Beier, Naturhistorisches Museum, Vienna, Austria (NM), for the type of *Atrachelus curvidens* Sign. and other valuable specimens; Dr. Herman Lent, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (IOC);

Ing. N. A. Kormilev, Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; Dr. Henry Dietrich, Cornell University, Ithaca, N. Y. (COR); Drs. Edward S. Ross and Robert L. Usinger, California Academy of Sciences, San Francisco, California (CAS); Dr. R. H. Beamer, Snow Entomological Collection, University of Kansas, Lawrence, Kansas (KANS); Dr. Kenneth Hayward, Fundacion Miguel Lillo, Tucumán, Argentina (FML); Prof. C. A. Lizer y Trelles, Vincente Lopez, F. C. N. G. M., Prov. Buenos Aires, Argentina (LyT); Prof. H. J. Reinhard, Dept. of Entomology, Texas A. & M. College, College Station, Texas (A&M); Dr. A. B. Torres, Museo La Plata, La Plata, Argentina (MLP); Dr. Mont A. Cazier, American Museum of Natural History, New York, N. Y. (AMNH); Sr. R. P. G. Williner, Instituto de Historia Natural "Sanchez Labrador," San Miguel, Argentina (SL); Dr. John C. Lutz, Philadelphia, Pa. (LUTZ); Dr. James A. Slater, Dept. of Entomology, Iowa State College, Ames, Iowa (SLA); Mr. Lonnie M. Sibley, Rockefeller Refuge, Grande Chenier, La. (SIB); Dr. Richard Froeschner, Dept. of Entomology, Iowa State College, Ames, Iowa (FR); Prof. Juan Badillo, Texas A. & I. College, Kingsville, Texas; Prof. Frank A. Cowan, Sam Houston State College, Huntsville, Texas; Mr. L. J. Bottimer, U. S. D. A., Bureau of Entomology and Plant Quarantine, Kerrville, Texas.

Insects in my collection, ELK.

In addition, I wish to thank Dr. Lloyd H. Shinners, Director of the Herbarium, Southern Methodist University, Dallas, Texas, for translating Latin descriptions.

Family **REDUVIIDAE**

Subfamily **HARPACTORINAE**

Genus **Atrachelus** Amyot & Serville

Genotype, *Reduvius cinereus* Fabricius.

Atrachelus Amyot & Serville, 1843. Hist. Nat. des Ins. Hemip., Paris, LXXVI:378.

Phorobura Stål, 1859. Oefv. K. Vet.-Ak. Foerh., Stockholm, 16:368. New synonymy.

The original definition of *Atrachelus* does not diagnose the genus as it was monotypically conceived by Amyot and Serville. Some subsequent authors (Fracker, 1913, and Readio, 1927) obviously used the original definition while constructing keys to the harpactorine genera. Since the presence of two postero-dorsal and two humeral spines on the pronotum is not mentioned, these keys will mistakenly run an individual of *Atrachelus* to either *Repipta* Stål or *Rocconota* Stål.

In 1859 Stål defined *Phorobura*, mentioning that the third antennal segments in the males are thickened, and that all abdominal segments, or at least the apical ones are spined or spiney pointed. The study of present material that was not available to Stål shows that the males of three species in this group lack the thickened condition of the third antennal segments, and that in one species none of the apical connexiva is spined or pointed.*

Stål (1859) separated *Atrachelus* from *Phorobura* by stating that the males of *Atrachelus* have strongly thickened third antennal segments, and that in both sexes the postocular part of the head is only slightly longer than the anteocular part. In *Phorobura*, he stated that the third antennal segments of males known to him are only slightly thickened, and that the postocular part of the head is about twice the length of the anteocular part.

The difference in the length of the postocular portion of the head in each group does not seem to merit a separate generic status in this case. The thickened condition of the third antennal segments in the males of one geographic race of *Atrachelus cinereus* (Fab.) is found to vary from lacking to slightly evident.

The general aspect and many salient particulars of the two groups are too similar, and the peculiar absence of gonoforceps and a similarity of aedeagal and basal plate conformity among the males, along with a similarity of the genital tergites among the females, unite them further.

The difference in the length of the postocular portion of the head, coupled with a variance in the shape of the hemelytral membrane cells does seem to justify subgeneric value for each group.

In the following definition of *Atrachelus*, repetitions of subfamily and tribal characters are avoided whenever possible.

Small insects, from 6.5 to 14.8 mm.

General color brownish, blackish, or amber, without distinct color pattern on body or wings; legs sometimes annulated and often with longitudinal markings; connexiva sometimes darkened at posterior margins.

Head, body, legs, and corium of hemelytra pubescent; pubescence usually short and appressed, generally dense; longer hairs never covering very extensive areas.

Head with a spine at posterior base of each antenna; first segments of antennae each considerably longer than head, the third segments in both

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*In general usage the term connexivum refers to the entire lateral area of one side of the abdominal dorsum. As used in this paper each of the individual plates making up this whole dorsolateral area is referred to as a connexivum. (Editor.)

sexes with fine appressed pubescence and finely wrinkled annulations; proportionate measurements of segments usually variable even among individuals of a species, usually the first is the longest, but sometimes subequal to or shorter than the third; second always the shortest, the fourth only slight longer. An interocular sulcus between posterior margins of eyes dorsally. Ocelli large, slightly elevated, located dorsolaterally next to posterior margin of interocular sulcus. Basal rostral segment either reaching posterior margins of eyes or slightly exceeding them; slightly longer than second segment; third segment half or less the length of basal segment.

Prothorax with a blunt projection at each antero-lateral angle; pronotum slightly constricted a little before the middle; anterior lobe of pronotum with a median longitudinal sulcus and a slight gibbosity on either side; the posterior lobe bicarinate, each carina terminating near the base of a prominent spine near the posterior pronotal margin; a prominent spine at each humeral angle. A Y-shaped carina on scutellum that ends at the apical process; apical process less than half the length of scutellum proper. Osteolar peritremes scarcely evident.

Abdominal spiracles located just behind middle of each connexivum, laterally; somewhat projecting on all segments. Locations of spines on postero-dorsal angles of connexiva varying among the species; lacking altogether in some. Wings never extending much beyond abdominal apex, if any; each corium of hemelytra with coarse, appressed pubescence; membrane semi-hyaline.

General color of legs the same as that of body. Prothoracic and metathoracic femora usually subequal in length, one never much longer than the other; mesothoracic femora shorter than preceeding; prothoracic femur and tibia subequal; mesothoracic and metathoracic tibiae longer than corresponding femora.

In females the ventral sternite VIII, fig. 22, extends distally farther over sternite IX than in females of closely allied genera.

Male genital capsule with a median process on superior posterior border; gonoforceps absent; basal plate bridge with two lateral extensions, fig. 21; posterior portion of basal plate with arms fused at contact with aedeagus; aedeagus with two dorso-lateral chitinous arms that articulate with the basal plate and extend longitudinally over the aedeagus; chitinous arms fused dorsally over the aedeagus in some species; ventral and lateral portions of phallosoma thickened and rugulose.

In all species the females are consistently larger than the males.

Closely related to *Repipta* Stål and *Rocconota* Stål, but the males of *Atrachelus* can readily be distinguished due to a lack of gonoforceps. The females of *Atrachelus* can be distinguished by the less widely exposed IXth sterna; also, *Rocconota* has the posterior lobe of the pronotum rugulose and pitted, and in *Repipta* the head is highly polished, covered with sparse, long, erect hairs. These two conditions are lacking in *Atrachelus*.

Following is a key to the subgenera; characters used in the dichotomy constitute adequate definitions:

Postocular portion of head slightly longer than the anteocular portion; proportion of the dorsal thoracic width to entire length of insect varying from 1:3.5 to 1:4.5; basal membrane cell of a somewhat transverse conformation (fig. 1); general body surface rather dull beneath the pubescence; prothoracic femora noticeably incrassate .... s. gen. *Atrachelus* A & S

Postocular portion of head from 1.5 to 2 times longer than anteocular portion; proportion of dorsal thoracic width to entire length of insect varying from 1:5 to 1:7.5; basal hemelytral membrane cell of a longitudinal conformation (fig. 2); general body surface shining beneath the pubescence; prothoracic femora feebly incrassate .. s. gen. *Phorobura* Stål

Subgenus **Atrachelus** Amyot & Serville

Monotypic, *Atrachelus cinereus* (Fabricius).

Atrachelus cinereus (Fabricius)

Reduvius cinereus Fabricius, 1796. Ent. Syst. . . . Suppl., Hafniae, 374. Type locality, "Carolina."

Zelus cinereus (Fab.). Fabricius, 1803. Syst. Rhyng., Brunsvigae, 287.

Zelus crassicornis Burmeister, 1835. Handb. Ent., Berlin, 2(1):225: Type locality, Uruguay.

Atrachelus heterogeneus Amyot & Serville, 1843. Op. cit., 378. Type locality, U. S. A. Stål, 1872. Enum. Hemip. II. K. Vet.-Ak. Handl., Stockholm, 10(4):78. Champion, 1899. Biol. Centr. Am., London, II(16):284. Wygodzinsky, P., 1948. Rev. Br. Biol., 8(2):220. Wygodzinsky, P., 1949. Univ. Nac. Tuc., Monogr. 1, Pub. 473:36.

Phorobura crassicornis (Burm.). Stål, 1859. Op. cit., 368.

Atrachelus curvidens Signoret, 1863. Ann. Soc. Ent. Fr., 4(3):582. Type locality, Chili. Stål, 1872. Op. cit., 78 (nec. syn.). Wygodzinsky, P., 1948. Op. cit., 220. Wygodzinsky, P., 1949. Op. cit., 36.

Atrachelus cinereus (Fab.). Stål, 1872. Op. cit., 78. Champion, 1899. Op. cit., 284. Wygodzinsky, P., 1948. Op. cit., 220. Wygodzinsky, P., 1949. Op. cit., 36.

Atrachelus crassicornis (Burm.). Stål, 1872. Op. cit., 78 (nec. syn.). Wygodzinsky, P., 1948. Op. cit., 220. Wygodzinsky, P., 1949. Op. cit., 36.

This is the best known and most widespread species of the genus, ranging from Argentina to the United States. Its distinguishing characteristics are those of the subgenus *Atrachelus* in the previous key to the subgenera.

The male genitalia of *Atrachelus cinereus*, due to this species being monotypic, characterizes the subgenus *Atrachelus* and are described as follows:

Genital capsule, fig. 3, with a median lip on superior posterior border that fringes outward and also is turned inward into cavity, surmounted by a small median spine. Each anterolateral angle of capsule overlapping into cavity in the form of a sinuous process. Basal plate robust; lateral extensions of bridge mere enlarged knobs; arms of posterior portion thickened over half of anterior length, fig. 21. Chitinous arms of aedeagus extending over most of organ when not extended, each arm terminating in a widely flaring bi-lipped process. Terminal portion of endosoma thickened, very rough due to many small spurs.

Key to the Subspecies

1. Spines on head and thorax rather long; dorsal thoracic spine half or more the length of basal rostral segment 2
   Spines on head and thorax short; dorsal thoracic spine less than half the length of basal rostral segment .... *cinereus wygodzinskyi*, new subspecies
2. Legs usually concolorous, sometimes with indistinct speckled longitudinal markings, or rarely with very faint annuli on femora .... *cinereus cinereus* (Fab.)
   Femora and tibiae with well defined annuli, often with additional longitudinal markings .... *cinereus crassicornis* (Burm.)

Consideration of the Subspecies

While the southwestern United States form, *A. cinereus wygodzinskyi*, is more obviously a distinct geographic race, the elevation of the southeastern United States form, *A. cinereus cinereus*, and the neotropical form, *A. cinereus crassicornis*, to subspecies necessitates statistical consideration. *A. cinereus wygodzinskyi* is also treated statistically in order to stay on the safe side of inference.

At first glance, *A. cinereus wygodzinskyi* seems to be more robust than either of the other two forms. In order to determine if this robustness is apparent or real, statistics of an index nature are utilized; e.g.,

$$\frac{\text{length of insect}}{\text{width of thorax}} \times 100 = \text{index}$$

Parameters, table 3, for 44 male *A. cinereus wygodzinskyi* and 44 male *A. cinereus crassicornis* show a difference between the means of 2.88; probable error of the difference .161; ''t'' score of 17. With a ''t'' score of 17 it is a certainty statistically that the robustness is real.

Again, similar index comparisons, table 3 between 44 male *A. cinereus wygodzinskyi* and *A. cinereus cinereus* show a difference between the means of 2.76; probable error of the difference .135; ''t'' score of 20. The ''t'' score is even higher in this case than in the former.

This robustness found in *A. cinereus wygodzinksyi*, coupled with the less thickened third antennal segments in the males, shorter head spines and thoracic spines, and blunter abdominal spines, indicates that there is a valid subspecific difference between it and the other two forms.

For a comparison between *A. cinereus cinereus* and *A. cinereus crassicornis*, a study of frequencies was made.

Well defined annuli on both femora and tibiae are characteristic of *A. cinereus crassicornis*, while pale concolorus legs seem to characterize *A. cinereus cinereus;* however, *A. cinereus cinereus* infrequently has very faint annuli on the femora. In this study the annulated condition of the femora is considered.

Of *A. cinereus crassicornis*, 135 individuals were examined and all had distinct annuli on the femora. Of the 57 individuals of *A. cinereus cinereus* that were studied, only 4 had annulated femora, and in each case the annuli were so faint that they were scarcely noticeable. Granting that the 57 specimens represent a random sampling, by use of the point binomial theorem, it is found that approximately 2/3 of the time the frequency of annulated femora lies between 3.6% and 9.3%.

The probability of a larger deviation of ''t'' between the samples of the two races being drawn from the same general population is approximately 1:730,000,000. When this probability is considered along with the wide gap between the geographic ranges of the two forms, the indication is to validate subspecific separation.

Ninety-nine percent limits of total length for the subspecies are 6.58 to 9.32 mm for *A. cinereus cinereus*, 7.25 to 9.6 mm for *A. cinereus wygodzinskyi*, and 6.6 to 9.3 mm for *A. cinereus crassicornis.*

A. cinereus wygodzinksyi seems to be associated with an average annual rainfall of less than 35 inches. The most typical form from the southwestern U. S. (Arizona and New Mexico) comes from an area with an average annual precipitation of 15 inches or less.

The few individuals seen from southern California seem typical, and those from Texas are typical with the exception of the third antennal segments in the males. In northwest, central, and south Texas, the males have noticeably thickened third antennal segments, but this condition does not approach that found in the other two races. Males from Brownsville, Santa Maria, Kingsville, Dimmit Co., Boerne, and Waco, exhibit this thickening of the third antennal segments, and the average annual rainfalls for those localities are 28.26 inches, 24.71 inches, 19.81 inches, 34.01 inches, and 32.12 inches, respectively. Two males from Willis, Texas, where the average annual precipitation is 48 inches are the only exceptions found of this subspecies occurring in an area with more than 35 inches of annual rainfall. It might be noted that in Willis the evaporation still exceeds the rainfall in spite of the high precipitation.

Individuals that appear to be clines between *A. cinereus wygodzinskyi* and *A. cinereus cinereus* are from Brazos Co., Texas, and Huntsville, Texas, where the average annual rainfalls are 38.66 inches and 44.09 inches, respectively.

Another male from Cuernavaca, Mexico, seems to be a cline between *A. cinereus wygodzinskyi* and *A. cinereus crassicornis.* The average annual rainfall here is 29 inches. One other male, simply labeled ''Mexico,'' is a typical form of *A. cinereus wygodzinskyi.*

A. cinereus cinereus has a range that includes east Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, and North Carolina. The average annual precipitations in all of these localities are over 40 inches. In most cases, the evaporation does not exceed the rainfall. Champion (1899) lists *Atrachelus cinereus* from Philadelphia, and Readio (1927) records this species as occurring in Pennsylvania, but in the collections studied there are no individuals that come from a locality farther north than Falsam, North Carolina.

A. cinereus crassicornis is a neotropical form whose range extends from Argentina to Southern Mexico. It is difficult to associate this race with rainfall. Individuals seen come from areas with average annual precipitations varying from 100 inches to 7 inches. All specimens seem to be rather constant in general appearance and proportionate measurements.

From the evidence at hand it would seem that the two North American forms are more recent than the neotropical form. This is evidenced by the homogeneity of *A. cinereus crassicornis* and its wide range of distribution; moreover, all the other species of *Atrachelus* are found in the neotropical realm only, indicating that the headquarters of this genus is in the neotropics. From this evidence it would seem that the two North American subspecies constitute allopatric forms that have branched from the neotropical subspecies.

Habitat notes on *Atrachelus cinereus* are limited. Several individuals have labels stating that they came from cotton and cotton blooms. Blatchley (1926) records this species as being taken from the foliage of oak and tall grasses. I have collected three individuals with a sweep net in the grasses and weeds of open fields. It is interesting to note that one male was captured by airplane collecting at 8000 feet, Talullah, La., VI-19-29, P. A. Glick.

In the course of this study, 57 individuals of *A. cinereus cinereus* (44 ♂, 13 ♀) and 135 individuals of *A. cinereus crassicornis* (92 ♂, 43 ♀) were seen.

Atrachelus cinereus wygodzinskyi, new subspecies

Beyond the features already mentioned, the following should be noted: General color varying from stramineous to light brown. Femora and tibiae distinctly annulated. A pale yellow annulus at the base of each third antennal segment in the male. Spines on head and thorax stout, sometimes hardly more than mere tubercles.

Trivial name in honor of Dr. Petr Wygodzinsky, Instituto Medicina Regional, Tucumán, Argentina.

Types.—Holotype, ♂, US, Phoenix, Ariz., V-27-38, C-9266. Paratypes, 49 ♂, 11 ♀ : ARIZONA, Tucson, VIII-12-24, E. P. Van Duzee; Thatcher, IX-5-47, E. J. Taylor; Phoenix, R. Kunze; Patagonia, VI-24-33, P. W. Oman; Yuma, VIII-25-29, E. D. Ball (3); Yuma, VI-17-15, H. Morrison; Phoenix, IX-14-37, L. D. Christenson; Patagonia, V-25-29, E. D. Ball; Yuma, XI-1-31, E. D. Ball; Phoenix, VI-26-34, E. D. Ball; Douglas, Aug.

F. H. Snow (13); Bill Williams Fork, Aug., F. H. Snow (3); Buckeye, VI-21-35, H. G. Johnson; NEW MEXICO, Dona Anna Co., IX-27-50, J. C. Elkins (2); TEXAS, Dimmit Co., II-1-33, S. E. Jones (2); 1576. C. F. Baker; Willis, J. C. Bridwell (2); Boerne, X-7-05, F. C. Pratt; Sta. Maria, V-20-95; Brownsville; VI, Wickham (3); Brownsville, II-7-43, I. Shiller; Brownsville, III-23-03, Jones & Pratt; Brownsville, June (8); Brownsville, IX-20-47, L. J. Bottimer; Kingsville, IV-25-51, J. Badillo; Waco, X-11-49, J. C. Elkins, CALIFORNIA, Coachella, V-21-24, F. C. Van Dyke; Westmoreland, VII-26-16, E. A. McGreagor; Imperial Co., V-21-12, J. C. Bridwell; Los Angeles Co., Coquillot; MEXICO, Bouchard. Paratypes deposited in the following collections: CAS 2, SL 1, COR 1, A&M 2, US KANS 24, ELK 6, STOCK 1.

Subgenus **Phorobura** Stål

Genotype, *Phorobura ignobilis* Stål.

Phorobura Stål, 1859. Op. cit., 368.

KEY TO THE MALES

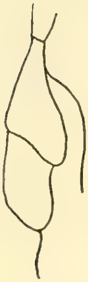
1. Length 10 mm or less. Postocular part of head approximately 1.5 times length of anteocular part 2
   Length 10.5 mm or more. Postocular part of head varying from 1.8 to 2 times length of anteocular part 5
2. Head spine as long as or longer than basal rostral segment 3
   Head spine length less than that of basal rostral segment 4
3. Median process of genital capsule tipped with a small spine, fig. 4 .... *tenuispinis* Champion
   Median process of genital capsule not tipped with a small spine, fig. 5 .... *lenti,* new species
4. Postero-dorsal border of pronotum with a band of dense white pilosity. Spines absent on abdominal segments two through five. Median process of genital capsule tipped with a small horizontal spine, fig. 6 .... *beieri,* new species
   Postero-dorsal border of pronotum lacking a band of dense white pilosity. Spines usually present on abdominal segments two through four, and always present on fifth. Median process of genital capsule merely a projecting portion of superior posterior border which tapers to a blunt point (fig. 7) .... *saileri* new species
5. Genital capsule with median process a wide truncated lip with heavy bristle tufts on each half of dorsal surface, fig. 8 .... *fusca* (Stål)
   Median process otherwise 6
6. Abdomen somewhat flattened dorso-ventrally. Median process of genital capsule Y-shaped, each arm of "Y" tipped with a tuft of hairs, fig. 9 .... *keleri* new species
   Abdomen not flattened. Median process otherwise 7

7. Legs darkly annulated, sometimes with additional longitudinal markings. Median process of genital capsule in the form of a long spine; on each side of spine the superior posterior border is deeply indented, fig. 10 .... *malaisei*, new species
   Legs with faint annuli, concolorous, or with longitudinal markings. Median process otherwise 8
8. Median process of genital capsule a rounded projection of superior posterior border with a median ridge terminating in a very small point; laterally projecting hairs on each side of median ridge, fig. 11 .... *dietrichi*, new species
   Median process of genital capsule a horizontal spine with faint winglike thickenings on either side, fig. 12 .... *ignobilis* (Stål)

Key to the Females

1. Length 10 mm or less. Postocular part of head approximately 1.5 times length of anteocular part 2
   Length 10.5 mm or more. Postocular part of head varying from 1.8 to 2 times length of anteocular part 5
2. Head spine as long as or longer than basal rostral segment 3
   Head spine less than length of basal rostral segment 4
3. A wide dark marking on postero-lateral portion of each connexivum .... *tenuispinis* Champion
   Connexiva without dark markings .... *lenti*, new species
4. Postero-dorsal border of pronotum with a band of dense white pilosity .... *beieri*, new species
   Postero-dorsal border of pronotum lacking a band of dense white pilosity .... *saileri*, new species
5. Abdomen somewhat flattened dorso-ventrally. Sixth connexiva not projecting or angular .... *keleri*, new species
   Abdomen not flattened. Sixth connexiva angularly projecting 6
6. Proportion of 1st antennal segment to total length of insect varying from 1 : 2.9 to 1 : 3.2 .... *dietrichi*, new species
   Proportion of 1st antennal segment to total length of insect varying from 1 : 2.2 to 1 : 2.7 7

Fig. 1, membrane venation of forewing, *Atrachelus cinereus*; fig. 2, membrane venation of forewing, *A. malaisei;* fig. 3, median process of *A. cinereus;* fig. 4, median process of *A. tenuispinis;* fig. 5, median process of *A. lenti*; fig. 6, median process of *A. beieri*; fig. 7, median process of *A. saileri;* fig. 8, ventral, median process of *A. fusca;* fig. 9, median process of *A. keleri*; fig. 10, median process of *A. malaisei*; fig. 11, median process of *A. dietrichi;* fig. 12, median process of *A. ignobilis;* fig. 13, dorsal, basal plate and aedeagus of *A. tenuispinis*; fig. 14, dorsal, basal plate and aedeagus of *A. beieri;* fig. 15A and 15B, dorsal and lateral, basal plate and aedeagus of *A. saileri.*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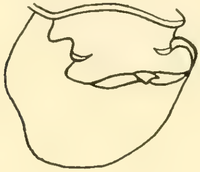
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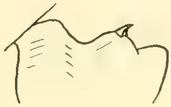
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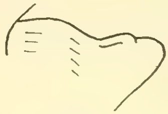
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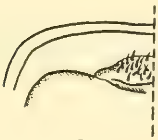
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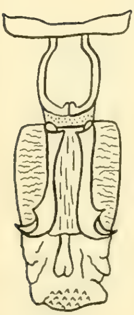
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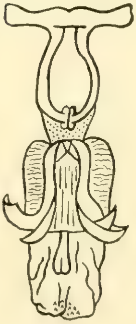
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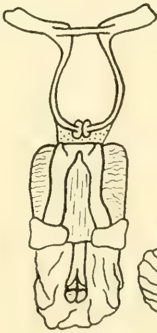
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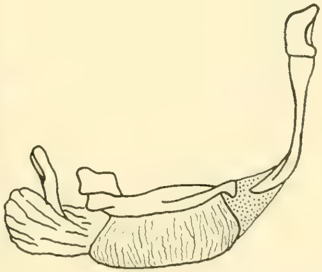

15B

7. Abdominal segments one through four with small knobs or projections; fifth with short blunt spine; sixth connexiva widely flaring and tipped with a blunt spine. Legs with faint annuli, longitudinal markings, or both .... *ignobilis* (Stål)

Distinct spines on all abdominal segments. Legs pronouncedly annulated, sometimes with additional longitudinal dark markings .... *malaisei*, new species

Atrachelus (Phorobura) tenuispinis Champion

Atrachelus tenuispinis Champion, 1899. Op. cit., 284. Type locality, Panamá. Wygodzinsky, P., 1949. Op. cit., 43.

This species belongs to a complex that may be termed the ''tenuispinis group'' (see discussion on relationships), which also includes *Atrachelus beieri*, new species, *Atrachelus saileri*, new species, and *Atrachelus lenti*, new species. Perhaps most closely related to *Atrachelus lenti*, but the males of *Atrachelus tenuispinis* can be easily distinguished by the shape of the median process and the females by the darkened posterior portion of each connexivum.

The geographic range of this species is the most extensive of any species belonging to the subgenus *Phorobura*. Specimens studied represent a range that inceldes Panamá, Columbia, Venezuela, Trinidad, Suriname, Bolivia, and Brazil.

There is also evidence of geographic races, but the material at hand is too scant to draw any conclusions.

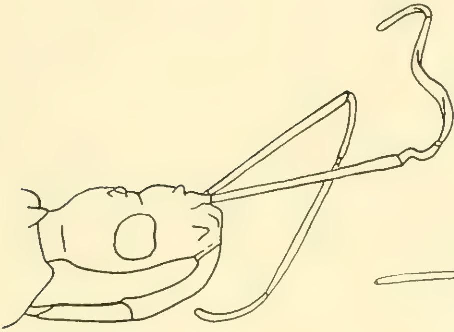
The male genitalia, which have not been described before, are as follows: Median process of genital capsule a short vertical triangular projection of superior posterior border, tipped with a small slightly curved spine. Basal plate rather delicate, fig. 13, lateral extensions of bridge long, not very bulbous; arms of posterior portion bowed outward, a little bulbous at line of posterior fusion. When aedeagus it not extended, the chitinous arms cover approximately two-thirds its length; arms not fused dorsally, each terminating in a short bi-lipped process. Endosoma with a bi-lobed process; a small thickened area distally, covered with many small spurs.

Fifty-three individuals were seen (33 ♂, 20 ♀).

Atrachelus (Phorobura) lenti, new species

Length varying from 7.9 to 9.7 mm. General color variable, amber, dark brown, or blackish.

Fig. 16, dorsal, basal plate and aedeagus of *A. fusca;* fig. 17, dorsal, basal plate and aedeagus of *A. keleri;* fig. 18, dorsal, basal plate and aedeagus of *A. malaisei;* fig. 19, dorsal, basal plate and aedeagus of *A. dietrichi*; fig. 20, dorsal, basal plate and aedeagus of *A. ignobilis*; fig. 21, dorsal, basal plate and aedeagus of *A. cinereus*; fig. 22, ventral, external female genitalia of *A. cinereus;* fig. 23, lateral, head of *A. cincereus;* fig. 24, lateral view of holotype, *A. malaisei.*



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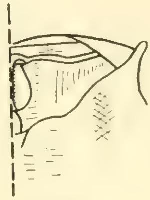

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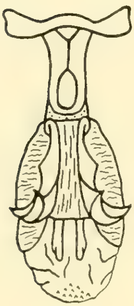

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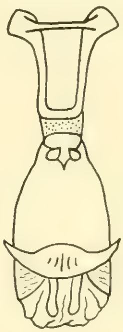

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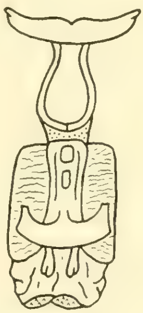

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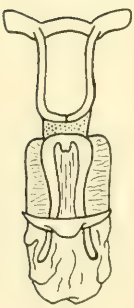

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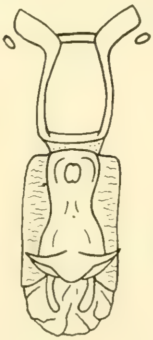

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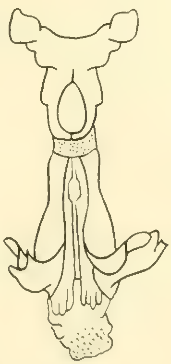

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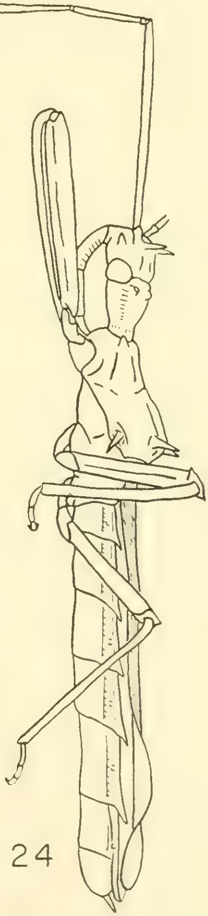

24

Head covered with short dense pubescence, interspaced with a few long hairs dorsally; indistinct dorsal postocular median carina sometimes present; spine as long as or longer than basal rostral segment. Postocular portion of head approximately 1.5 times the length of anteocular portion. Third segments of antennal missing in the only male, which is the holotype.

Thorax amber in some, dark brown in others. Anterior lobe of pronotum a bit darker than posterior lobe; pubescence short and sligthly dense, interspaced with a few long hairs; anterior lobe with a bare spot on each gibbosity; median sulcus the length of posterior half of anterior lobe; dorsal spines each longer than basal rostral segment. In some individuals the anterior area of mesothorax with dense, white, agglutinated, scale-like pubescence.

General abdominal color varying from amber to blackish, covered with sparse, short pubescence. Ventral light area the length of abdomen, covered with white scale-like tomentum in some individuals. All connexiva spined; fifth segment with the longest spine in the male; fifth and sixth with the longest in the female, both of approximately equal length. Connexiva pale and concolorous in both sexes, the fifth and sixth a bit angular in the female.

Legs either concolorous or faintly annulated; the number of annuli variable.

Median process of male genital capsule a short triangular projection of superior posterior border, somewhat blunt at the tip. Capsule not dissected.

Geographic range. Peru.

Trivial name in honor of Dr. Herman Lent, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

Types.—Holotype, ♂, COR, El Campaneniento, Peru, June, 1920, Perene Col., Cornell Univ. Exp., Lot 801, Sub. 166, Det. H. G. Barber as *Phorobura*. Paratypes, 2 ♀: PERU, Tingo Maria, Rio Huallaga, 700m, I-4-40, Weyrauch; Porto Bermudez, Rio Pichio, VII-12-19-1920. Paratypes deposited in the following collections: WYGOD 1, COR 1.

Atrachelus (Phorobura) beieri, new species

Length varying from 7.7 to 9.7 mm. General color varying from amber to blackish.

Head usually amber, covered with sparse, short appressed pubescence; postocular dorsal median carina evident in a few individuals; spines each shorter than basal rostral segment. First antennal segments each usually slightly over twice the length of head; third segments of male not thickened. Postocular portion of head approximately 1.5 times length of anteocular portion.

Thorax usually amber, blackish in a few individuals. Anterior lobe of pronotum somewhat darker than posterior lobe; a band of dense, white pubescence along postero-dorsal border of pronotum, this pubescence sometimes following carinae of posterior lobe cephalad, extending a bit onto each gibbosity of anterior lobe; otherwise, pubescence generally very sparse and short. Anteriorly and antero-laterally, the prothorax with dense, white, agglutinated, scale-like pubescence; similar pubescence laterally on mesthorax and metathorax. Median sulcus of anterior lobe the length of posterior half of lobe. Dorsal spine of pronotum shorter than length of basal rostral segment; lateral spine much shorter than dorsal spine.

Abdominal color usually amber; black laterally in a few females; pubescence very short and sparse laterally, somewhat denser ventrally, interspaced with a few long hairs. A light area ventrally the length of abdomen; in females this area often covered with dense, white, agglutinated, scale-like pubescence. Connexiva pale and concolorous in both sexes; in the female the connexiva underlined laterally with a longitudinal red line. First abdominal connexiva with an inconspicuous spine; other connexiva lacking spines.

Legs faintly annulated, usually with two annuli on femur and three on tibia, but the number of annuli is less than this in a few individuals.

Median process of male genital capsule a backward projection of superior posterior border, tipped with a small horizontal spine. Basal plate with thick extensions of bridge; bridge of same thickness; arms of distal portion rather robust, fig. 14. Chitinous arms of aedeagus with widely flaring bi-lipped processes on terminal portions; not fused dorsally. Endosoma with a small bi-lobbed process; a small thickened area distally covered with many small spurs.

Perhaps most closely related to *Atrachelus saileri,* new species, but can readily be distinguished by the shape of the male median process, lack of spines on abdominal segments two through five in the male, two through six in the female; also, by the dense fringe of hairs along the postero-dorsal border of pronotum in both sexes. Basal plate of male more robust than those of other members of the "tenuispinis group."

Geographic range, Panamá.

Trivial name in honor of Dr. Max Beier, Naturhistorisches Museum, Vienna, Austria.

Types.—Holotype, ♂, US, Trinidad Rio, Panamá, III-17-12. Paratypes, 5 ♂, 6 ♀: PANAMA, Gatun, C. Z., Tres Rios Plantation, III-1930, T. O. Zschokke (3); Porto Bello, 6 mi. E. XX Plantation, II-17-30, T. O. Zschokke; Trinidad Rio, III-18-12, A. Busck, Sabanas, IV-27-23, R. C. Shannon; Alhajuelo, IV-5-11, A. Busck; Alhajuelo, IV-18-11, A. Busck; Barro Colorado C. Z., VII-25-24, N. Banks; Barro Colorado, C. Z., VII-13-24, N. Banks; Barro Colorado, C. Z., VII-15-24, N. Banks. Paratypes deposited in the following collections: CAS 4, US 7.

Atrachelus (Phorobura) saileri, new species

Length 7.5 to 9.7 mm. General color varying from amber to blackish. Head covered with short pubescence, rather dense ventrally. Median carina evident in all individuals on postocular dorsal part of head; spine shorter than basal rostral segment. First antennal segments each usually slightly over twice the length of head; third segments of antennae thickened in the male. Postocular portion of head approximately 1.5 times length of anteocular portion.

General thoracic color varying from amber in some individuals to blackish in others; anterior lobe of pronotum slightly darker than posterior lobe; pronotum covered with short, sparse pubescence, each gibbosity of anterior lobe a bit bare. Mesothorax and metathorax with rather dense pubescense; ventro-laterally and ventrally with dense, white, agglutinated, scale-like pubescence. Dorsal spines of pronotum each usually as long as or longer than basal rostral segment, but slightly shorter than basal rostral segment in a few individuals. Median sulcus of anterior lobe the length of posterior half of lobe.

Abdominal color usually amber laterally and black ventro-laterally; pubescence sparse in some individuals, rather dense in others. A ventral light area the length of abdomen; a few individuals with white, agglutinated, scale-like pubescence covering the area. Connexiva pale and concolorous; one to four with short spines, the fifth with long spines in the male, fifth and sixth with long spines in the female; fifth and sixth connexiva a little angular in the female.

Prothoracic femora and tibiae usually concolorous, very faintly annulated in a few individuals; mesothoracic and metathoracic femora and tibiae with annuli varying from faint to distinct, the number variable, usually two on each femur and three on each tibia.

Median process of male genital capsule a mere backward projection of superior posterior border with a small pointed tip. Basal plate, fig. 15, very delicate, the bridge and lateral extensions extremely narrow; arms of posterior portion bowed outward, rather bulbous at point of distal fusion. Chitinous arms of aedeagus not fused dorsally, each terminating with a flaring uni-lipped process. Endosoma with a bi-lobbed process; a distal thickened area not evident.

Geographic range, Brazil, Suriname, British Guiana, and Bolivia.

Trivial name in honor of Dr. Reece I. Sailer, U. S. National Museum, Washington, D. C.

Types.—Holotype, ♂, COR, Moego Boven, Cottica R., Surinam, Lot 801, Sub. 203, Det. H. G. Barber. Paratypes, 17 ♂, 20 ♀: BRAZIL, Manaos, Amazon, March, Roman (2); Manaos, Amazon, Dec., Roman (9); Manaos, Amazon, July, Roman (4); Manaos, Amazon, Roman (2); Manaos, Amazon, Nov., Roman; Manaos, Amazon, Aug., Roman, Manaos, W. M. Mann (2); Para, P. R. Uhler, Collection (2); BOLIVIA, Chapare, Zischka; SURINAME, Upper Litani River; Moengo Boven, Cottica R., V-17-24 (4); Moengo Boven, V-12-27 (2); Meongo Boven, Cottica R., V-18-27; BRITISH GUIANA, Kartabo Bartica Distr., X-1920; Demerara, IV-8-01, R. J. Crew; Demerara R., VI-23-27; Tumatumari, Potaro R., VI-29-27. Paratypes deposited in the following collections: STOCK 19, ELK 1, WYGOD 2, COR 8, US 6, CAS 1.

Atrachelus (Phorobura) fusca (Stål)

Phorobura fusca Stål, 1872. Op. cit., 78. Type locality, Columbia.
Phorobura fusca Stål. Wygodzinsky, 1949. Op. cit., 43.

Perhaps most closely related to a complex of species that may be termed the ''ignobilis group,'' which is comprised of *Atrachelus ignobilis* (Stål), *Atrachelus malaisei*, new species, *Atrachelus Keleri*, new species, and *Atrachelus dietrichi*, new species.

This relationship of *A. fusca* to the ''*ignobilis* group'' is based upon general external morphology since the basal plate and aedeagus does not fit exactly into any of the species groups. The female is unknown. Males may be distinguished by the peculiar truncated median process that bears two dorso-lateral bristle tufts.

The holotype and two additional males were seen; these three individuals varied in length from 11.1 to 11.5 mm.

Geographic range, Columbia, Venezuela.

The male genitalia, which have not been described before, are as follows: Median process of genital capsule a thick truncated projection of superior posterior border, with heavy bristle tufts on each side of dorsal surface. Basal plate, fig. 16, rather robust; bridge somewhat narrow, lateral extensions thick; posterior portion with arms thick, meeting and fusing a little less than one-half the anterior distance, the fusion line almost reaching the bridge anteriorly. Chitinous arms of the aedeagus not fused dorsally, each terminating in a flaring bi-lipped process. Endosoma with two lobular conformations; a small thickened area distally covered with many small spurs.

Atrachelus (Phorobura) keleri, new species

Length 11.1 to 13.1 mm. General color varying from amber to light brown.

Head usually amber, light brown in a few individuals; covered with sparse, short pubescence, somewhat denser ventrally. Spines each less than half length of basal rostral segment. Postocular dorsal median carina slightly evident; postocular portion of head approximately twice the length of anteocular portion. First antennal segments each usually a little over twice the length of head; third segments of antennae in males thickened.

Thorax amber in some individuals, light brown in others. Anterior lobe in pronotum a little darker than posterior lobe; pubescence short, sparse on anterior lobe, denser on posterior lobe; median sulcus of anterior lobe short, not very deep, approximately one-fourth the length of lobe posteriorly. Dorsal and lateral spines subequal, each less than length of basal rostral segment. Mesothorax and metathorax covered with short pubescence of medium deneness laterally and ventrally.

Abdomen usually light amber, light brown in a few individuals; pubescence generally short, dense and interspaced with a few long hairs; a light area ventrally the length of abdomen; tomentum on light area the same denseness and length as that laterally. Each connexivum with either a spine or a knob, the locations of spines varying among different specimens, ranging from the second through the fifth connexiva. Females without flaring or angular fifth and sixth connexiva. Abdomen somewhat flattened ventro-laterally throughout its length.

Legs concolorous. Usually the prothoracic femora longer than metathoracic femora, of equal length in a few individuals.

Median process of male genital capsule a Y-shaped conformity of the superior posterior border, each arm of ''Y'' tipped with a tuft of hairs. Lateral extensions of basal plate bridge rather short, the bridge long and narrow, fig. 17; arms of posterior portion narrow and connect anteriorly to each lateral extremity of bridge. Chitinous arms of aedeagus fused dorsally, covering aedeagal surface throughout their length, terminating in a widely flaring anchor-like process. Endosoma with two lobular conformations; a distal thickened area not evident.

Belongs to the ''*ignobilis* group,'' which is characterized by the chitinous arms of the aedeagus being fused dorsally and the presence of two lobes in the endosóma. Males of *A. keleri* can be distinguished by the shape of the median process, and the females by a lack of angular fifth and sixth connexiva.

Geographic range, Brazil.

Trivial name in honor of Dr. S. von Keler, Zoologisches Museum der Universität, Berlin, Germany.

Types.—Holotype, ♂, IOC, Esperito Santo, Sta. Teresa, Brasil, IX-43, Travassos. Paratypes, 1 ♂, 3 ♀: BRAZIL, Sao Paulo, Ilha seca, X-26-40; Corcovado Mt., Rio de Janeiro D. F., II-9-45, P. Wygodzinsky; Esperito Santo, Sta. Teresa, IX-43, Travassos; Rio Grande do Sul, VI-20-50. Paratypes deposited in the following collections: IOC 1, WYGOD 3.

Atrachelus (Phorobura) malaisei, new species

Length 11.0 to 13.2 mm. General color varying from amber to dark brown or blackish.

Head usually dark amber, blackish in a few individuals; covered with short, dense pubescence, postocular dorsal median carina covered by apposing hairs on either side of carina which fold over one another. Postocular portion of head approximately 1.8 times the length of anteocular portion. Head spine each half or less the length of basal rostral segment. First antennal segments each over twice the length of head; porportion of first antennal segment to total length of insect varying from 1 :2.2 to 1 : 2.7; third segments of male not thickened.

Color of thorax amber in most individuals, dark brown or blackish in a few. Anterior lobe of pronotum darker than posterior lobe; pubescence sparse on anterior lobe, dense on posterior lobe, the hairs forming a dense line of extension onto each gibbosity of anterior lobe; median sulcus of anterior lobe short, not over one-third the length of lobe posteriorly. Antero-lateral protrusions inconspicuous and rounded. Dorsal and lateral thoracic spines subequal, each usually less than half the length of basal rostral segment. Mesothorax and metathorax laterally and ventrally with dense pilosity longer than that found on pronotum; many longer hairs interspaced among the short ones.

Color of abdomen usually amber, dark brown in a few individuals; pubescence generally dense, especially ventrally along light area, which extends the ventral length of abdomen, and interspaced with many long hairs. Each connexium spined; relatively long spine of fifth connexiva in both sexes; in female, each connexivum with a dark area next to postero-lateral border, the fifth and sixth connexiva angular.

Legs darkly annulated in all individuals but one male from Peru, this individual with distinct, but less darkened annuli; usually three annuli on each femur and three on each tibia.

Median process of male genital capsule in the form of a long spine; superior posterior border of capsule, on either side of spine, deeply indented. Lateral extensions of basal plate bridge robust, fig. 18; arms of posterior portion thin and bowed outward. Chitinous arms of aedeagus fused posteriorly over dorsal aedeagal surface, forming a widely angular anchor-like process. Two long lobular conformities in endosoma; a thickened area distally with many small spurs on the surface.

Males are easily distinguished by the median process. Females might be confused with *Atrachelus ignobilis* Stål, but can be separated because each connexivum is spined.

Geographic range, Bolivia Peru, Brazil, Argentina.

Trivial name in honor of Dr. René Malaise, Entomologiska Avdelningen, Naturhistoriska Riksmuseum, Stockholm, Sweden.

Types.—Holotoype, ♂, LyT, Cuatro Ojos, Bolivia, IX-1917. Paratypes, 4 ♂, 6 ♀: BOLIVIA, Cuatro Ojos, IX-17 (6); PERU, Puerto Bermudez, Rio Pichis, VI-12-19-1920. BRAZIL, Pambu, Bahia, Schubart; ARGENTINA, San Ramon, Dep. Famaille, Tucuman, V-42, B. L. Garcia; Santa Fe, IX-30, J. Bridarollis. Paratypes deposited in the following collections: LyT 6, COR 1, FML 1, ELK 1, SL 1.

Atrachelus (Phorobura) dietrichi, new species

Length 12.5 to 14.6 mm. General color varying from amber to blackish. Head amber in most individuals, blackish in a few; covered with short, dense pubescence; postocular dorsal median carina evident in a few specimens, lacking in most. Postocular portion of head approximately twice the length of anteocular portion. First antennal segments each usually a little over twice the length of head; proportion of first antennal segment to total length of insect varying from 1 : 2.9 to 1 : 3.2; third segments of males missing among individuals studied. Head spine less than length of basal rostral segment.

Thorax amber or blackish. Anterior lobe of pronotum darker than posterior lobe; covered with sparse short pubescence; a bare spot on each gibbosity of anterior lobe. Lengths of dorsal and lateral spines variable. Antero-lateral protuberances scarcely noticeable. Mesothorax and metathorax with sparse short pubescence laterally, interspaced with a few long hairs; ventrally much denser and more thickly interspaced with long hairs.

General color of abdomen amber or blackish; covered with sparse short pubescence laterally, interspaced with a few long hairs; the lighter color ventrally, which extends the length of abdomen, with much denser pubescence, also interspaced with long hairs. All connexiva spined, fifth with the longest spine in the male; fifth and sixth connexiva with the longest spines in the female; fifth and sixth connexiva widely angular in the female and each segment with a darkly colored area at each postero-lateral border; connexivum usually concolorous in the male.

Legs concolorous in some individuals, annulated in others, the number of annuli variable; a few individuals with additional longitudinal markings.

Median capsule of male genital capsule a rounded projection of superior posterior border with a dorsal median ridge that terminates in a small point; laterally projecting hairs on each side of ridge. Lateral extensions of basal plate bridge moderately long, fig. 19; the bridge rather long; posterior portion with arms widely separated, each arm connected at lateral extremity of bridge proper. Chitinous arms of aedeagus fused postero-dorsally, forming a widely angular anchor-like process that has a large median lip. Two lobes in the endosoma; terminal area with a small thickened portion on whose surface are many small spurs.

Typical of the "ignobilis group;" basal plate similar to that found in *Atrachelus keleri*, new species, but chitinous arms of aedeagus similar to that of *Atrachelus ignobilis* (Stål).

Geographic range, Brazil, Peru.

Trivial name in honor of Dr. Henry Dietrich, Cornell University, Ithaca, N. Y.

Types.—Holotype, ♂, STOCK, Rio Japura, Amazona, April, Roman. Paratypes, 1 ♂, 3 ♀; BRAZIL, Manaos, VIII-7-9-1920; Solimoes, Amazon, IV-1933; Manaos, Uypiranga, Amazona, 1942, Parko. PERU, Dos de Mayo, Rio Ucayali, IV-25-20. Deposited in the following collections: COR 2, WYGOD 1, IOC 1.

Atrachelus (Phorobura) ignobilis (Stål)

Phorobura ignobilis Stål, 1859. Op. cit., 368. Type locality, Pernambuco. Stål, 1872. Op. cit., 78 Wygodzinsky, 1949. Op. cit., 43.

Phorobura rustica Stål, 1859. Op. cit., 368. Stål, 1872. Op. cit., 78. Wygodzinsky, 1949. Op. cit., 43. New Synonymy.

Stål, in his original description of *Phorobura rustica*, erroneously listed the type as a female. Since the type of *Phorobura ignobilis* is a female, this is possibly the reason for his separating the two as different species.

The type of *Atrachelus ignobilis* is a somewhat anomalous form because the distal membrane cell of the left hemelytron has an extra vein that closes off an additional cell.

The name *Phorobura ignobilis* is mentioned first in Stål's 1859 work, hence it has priority.

In addition to the characters used in the key, the following features should be mentioned: Length, 11.4 to 13.0 mm. Proportion of first antennal segment to total length of insect varying from 1 : 2.2 to 1 : 2.7; third antennal segments in the male thickened. Head spines seldom more than tubercles, never more than one-fourth length of basal rostral segment. Connexiva one through five spined in the male; fifth and sixth spined and widely flaring in the female, one through four with either knobs or very small points.

Median process of male genital capsule a semi-horizontal spine surmounted on a lip-like process, with faint wing-like thickenings on either side. Basal plate, fig. 20 with lateral extensions of bridge and arms of posterior portion rather stout; the bridge narrow; arms of posterior portion bowed outward distally. Chitinous arms of aedeagus with small accessory arms anteriorly; fused posteriorly over dorsal surface of aedeagus and forming a widely angled anchor-like process. Endosoma with two lobed conformations; no thickened area evident distally.

Geographic range, Brazil, Paraguay, Argentina.

Holotype and 6♂, 4♀ additional individuals examined.

Relationships

From the evidence at hand it seems rather futile to state which species or group of species is the most primitive. When the entire subfamily Harpactorinae has been studied from this viewpoint, such information might be helpful in the study of *Atrachelus.*

Atrachelus is certainly not a climax group, but perhaps a rather decadent one. This is evidenced by the rarity of individuals and a supposed overspecialization such as a lack of gonoforceps in the males.

As it was pointed out in the discussion of the subspecies of *Atrachelus cinereus* (Fab.), this genus obviously had its original focal point in the neotropical area where most of the species are found today.

A few phylogenetic relationships can be derived from a study of the male aedeagi and basal plates. Such a study first divides the genus into two groups corresponding to the subgenera. The subgenus *Atrachelus* A & S is characterized by a very heavy basal plate and an extensive distal area of the endosoma that is very thickened and covered with many small spurs.

The extreme robustness of the basal plate is not found among the species of the subgenus *Phorobura* Stål, nor is the distal thickened area of the endosoma nearly so extensive with the species on which it is found.

One complex of species of the *Phorobura* subgenus may be termed the "*tenuispinis* group." It is comprised of *Atrachelus tenuispinis* Champ., *Atrachelus beieri,* new species, and *Atrachelus saileri,* new species. *Atrachelus lenti,* new species probably belongs to this group, but the genitalia were not dissected since the only male is the holotype.

Among the three species of which males were dissected, the chitinous arms of the aedeagus are not fused dorsally over the phallosoma. This group is also characterized by a small bilobulate process in the endosoma; moreover, *Atrachelus tenuispinis* and *Atrachelus saileri* are further united by very delicate basal plates, and *Atrachelus beieri,* though with a stouter basal plate, still does not approach the subgenus *Atrachelus* in this respect.

Another species complex may be termed the "*ignobilis* group." In this group are found *Atrachelus keleri* n. sp.,

Table 1

Parameters for thoracic width and total length

Sample	Thoracic Width			Total Length		
	1	2	3[1]	1	2	3
N =	44	44	44	44	44	44
Mean (mm)	2.04	1.74	1.67	8.01	7.72	7.48
Pe_m (mm)	.018	.006	.008	.030	.043	.035
S.D. (mm)	.122	.067	.090	.279	.452	.352

Table 2

Indices of the Samples

Sample	N	Mean	pem	S. D.
1	44	25.04	.107	1.049
2	44	22.16	.121	1.285
3	44	22.28	.084	0.833

Table 3

Comparison of the Indices

Series Compared	Difference between the means	p.e.d.	"t" score
1 & 2	2.88	.161	17
1 & 3	2.76	.135	20

[1]1—*Atrachelus cinereus wygodzinskyi*
2—*Atrachelus cinereus crassicornis*
3—*Atrachelus cinereus cinereus*

PERTINENT DIMENSIONS OF HOLOTYPES

ALL MEASUREMENTS IN MILLIMETERS

	A. cinereus wygodzinskyi	*A. lenti*	*A. beleri*	*A. saileri*	*A. fusca*	*A. keleri*	*A. malaisei*	*A. dietrichi*	*A. ignobilis*
Total length	8.0	7.9	7.8	8.1	11.1	11.1	11.0	12.7	13.0
Abdominal length	4.0	4.0	4.4	4.6	6.9	6.8	6.7	7.5	7.5
Head length	1.5	1.4	1.3	1.5	1.8	1.6	1.3	1.9	2.0
Dorsal head width through eyes	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0
Pronotal width	2.1	1.4	1.3	1.5	1.8	2.0	1.8	2.1	1.9
1st rostral seg. length	0.8	0.7	0.7	0.8	1.0	0.8	0.9	1.1	0.9
Head spine length	0.1	0.8	0.2	0.4		0.1	0.4	0.4	0.1
Fore femur length	2.8	2.2	2.9	2.9	4.4	3.7	3.3	3.9	4.0
Hind femur length	2 8	2.9	2.6	2.9	4.4	3.4	3.4	4.0	4.0
1st ant. seg. length	2.2		3.2	3.7	5.0	4.4	3.4	4.9	
2nd ant. seg. length	0.7		0.8	0.9	1.1	1.0	1.1		
3rd ant. seg. length	1.5		4.5	3.9	3.9	5.2	3.8		
4th ant. seg. length	1.2		1.6	1.9		1.4			

Atrachelus ignobilis (Stål), *Atrachelus malaisei* n. sp., and *Atrachelus dietrichi* n. sp. This group is characterized by the chitinous arms of the aedeagus being fused dorsally over the phallosoma. Each species also has two rather large lobes in the endosoma.

The remaining species, *Atrachelus fusca* (Stål), cannot be united with any of the above mentioned groups by genitalic characters. General external morphology places it close to the "*ignobilis* group."

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A SECOND SPECIES OF ORTHEZIOLA SULC

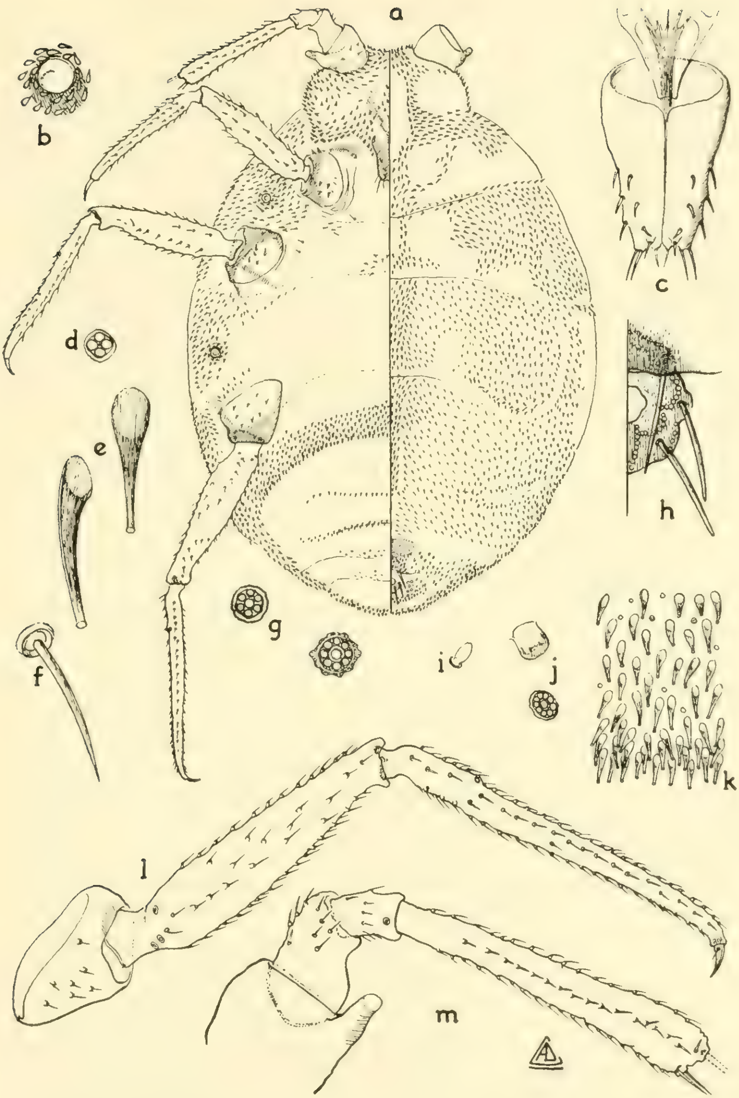
(HEMIPTERA, COCCOIDEA)

BY HAROLD MORRISON, *Entomology Research Branch, U. S. Department of Agriculture, Washington, D. C.*

I am much indebted to Dr. A. Balachowsky of the Pasteur Institute, Paris, for the opportunity to study the specimen here described. The insect is of especial interest both because it adds another species to this genus, hitherto represented only by the genotype, and because of its unusual distribution in relation to the genotype. The drawings accompanying the description have been prepared by Mr. Arthur Cushman.

Ortheziola guineensis, new species

Adult female.—Represented by a single slide mounted specimen with no information available on the appearance and extent of the covering secretion. Body shape, as mounted, elongate ovoid, more pointed anteriorly, length 1.92 mm., greatest width 1.34 mm. Derm membranous, except for a lightly sclerotized, transversely subrectangular plate about 220 μ across by 87 μ on the median line, this located dorsally just anterior to the cluster of spines before the anal plate. Antennae 3-segmented, but each set on a conspicuous, stout, sclerotized cylinder with eyestalk a digitate protuberance from the outer face and outer end invaginated for the reception of the basal antennal segment; dimensions of segments: I, 158 μ long by 99 μ wide, tapering to a constriction before apex, then again expanded; II, 87 μ long by 47 μ wide about middle, gradually enlarged to a flared apical collar about 59 μ in diameter; III, 434 μ long by



Ortheziola guineensis: a, adult female, dorsal and ventral showing approximate condition of spine bands and clusters; *b*, thoracic spiracle with immediately adjacent spines; *c*, beak; *d*, quadrilocular pore; *e*, body spines; *f*, body seta; *g*, multilocular pores of two sizes; *h*, anal ring, right half; *i*, small stout spine from area close to anal ring; *j*, multilocular pore showing additional variation and invaginated position; *k*, ovisac band, anterior median section; *l*, posterior leg; *m*, antenna and basal tubercle supporting it.

71 μ wide near apex, long clavate; antennal setae slender lanceolate each set at apex of a well developed, angularly protruding derm tubercle, average length around 16 μ, those near apex of third segment somewhat longer, probably with an elongate apical seta as in other species, but if so this broken from its socket; with a subapical seta about 44 μ long. Legs slender, dimensions of one hind leg: trochanter-femur 590 μ, tibia-tarsus 670 μ, claw 64 μ: anterior legs somewhat shorter; leg setae slender lanceolate as with antenna, basal tubercles even more prominent; claw digitules short, acute apically, slightly curved, about 11 μ long; no claw denticle; a single sensory pore about one-fourth of the length of the tibio-tarsus from its base and two or three such pores on each face of the fused trochanter. Beak somewhat obscured, apparently 1-segmented, short, about 167 μ long by 118 μ wide at base, apex nearly truncate, with several heavy setae, especially at apex. Thoracic spiracles moderate in size, diameter of atrium around 35 μ, the opening of each surrounded by spines showing a tendency to cluster; abdominal spiracles not located. Multilocular disk pores present, characteristically with eight or more loculi, in small clusters on each side of the anal ring and scattered elsewhere dorsally, and along the inner margin of the posterior portions of the ovisac band and in transverse bands intermingled with setae in front of and behind the vulvar opening, most of these pores appearing as if irregularly margined; small quadrilocular pores scattered through the spine bands. Normal body spines elongate, slender, only slightly curved dorsally, stouter and more strongly curved laterally and ventrally, but characteristically with a distinctly capitate tip, this, however, reduced or wanting in the spines in rows within the ovisac band and in some other ventral spines: these spines well distributed over body in bands and clusters about as shown in figure, the clusters including three narrow wedge-shaped ones on the midline dorsally, these crossing the metathorax and the anterior abdominal segments; spine bands and clusters possibly damaged, as not identical on both sides; in addition to the normal spines, with a few short, stout clavate spines in the spaces on each side of the transverse spine cluster just anterior to the anal ring; two transverse rows of spines across the area enclosed by the ovisac band anterior to the vulva; sample spine lengths, dorsal 20 μ, ventral anterior 15 μ, ovisac band 12 μ, ventral abdominal transverse 9 μ. Anterior median section of ovisac band without associated pore bands along the posterior (inner) margin but with a few small obscure quadriloculars just at the anterior (outer) margin and more of these scattered through the band of spines itself. A few ordinary setae scattered dorsally and ventrally and transverse bands of somewhat stouter setae in front of and behind the vulvar opening. Anal ring small, depressed below the adjoining body surfaces, about 70 μ long by 64 μ wide, the inner row of pores sharply extended towards the center opposite each ring seta, the outer with the pores of the posterior section separated and non-contiguous: anal ring setae moderate, about 58 μ long, approximately equal in length and size.

This species has been described from a single, somewhat imperfect, mounted specimen marked as collected in moss at 500 to 1700 meters in the Nimba Mountains in French Guinea by A. Villiers, Nov. 1946. Through the courtesy of Dr. Balachowsky, this type is deposited in the U. S. National Collection of Coccoidea.

This insect appears to the writer to agree satisfactorily with all the important generic characteristics of *Orthezіola,* such as the 3-segmented antenna seated on a sclerotized cylinder bearing the eyestalk on one side, the presence of a transverse sclerotized plate dorsally just before the anal ring, the 1-segmented beak, the capitate body spines, and, negatively, the apparent absence of abdominal spiracles. The host association (mosses) is also similar. At the same time, it differs strikingly from the genotype *Ortheziola signoreti* (Haller) (= *vejdoskyi* Sulc) in many details of structure, notably the presence of spine bands and clusters over most of the dorsal surface, with special clusters on the midline, in contrast to the completely exposed, bare discal area of *signoreti.* Legs and antennae are more slender, the anal ring is not so fully developed and the two transverse rows of spines across the enclosed area ventrally are not matched in the genotype, which has no spine rows in this area. The type locality of this new species represents a striking jump from the west European home of the genotype and the discovery of this second species hints that others may be found eventually and that the genus may presently show the same sort of discontinuous distribution of species that is evident for such related genera as *Newsteadia* and *Nipponorthezia.*

NEARCTOPSYLLA (HOLLANDIANA) GEORGIANA, NEW SPECIES FROM GEORGIA

(SIPHONAPTERA, DOLICHOPSYLLIDAE)

BY HARRY D. PRATT[1] and J. O. HARRISON[2]

During the fall of 1952, the junior author collected a single male flea belonging to the rare genus *Nearctopsylla* from the short-tailed shrew (*Blarina brevicauda carolinensis* Bachman). The shrew was taken on the top of Brasstown Bald, elevation 4,782 feet, the highest mountain in Georgia. The six previously described species of *Nearctopsylla* have been found only in Canada or in northern or western United States (Holland and Jameson, 1949.) The discovery of this flea on a high mountain

[1]Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Atlanta, Ga.

[2]Department of Entomology University of Georgia, Athens.

in Georgia indicates the probable extension of the genus *Nearctopsylla* down the Appalachian mountain range. This is a phenomenon well known to botanists and zoologists in other species of northern plants and animals, and is of some interest to students of zoogeography. The species name, *georgiana*, is given to this new flea to emphasize its geographical isolation (as known at the present time) from other species in the genus *Nearctopsylla*.

The new species of flea belongs in the genus *Nearctopsylla* Rothschild as defined by Holland (1949) and Holland and Jameson (1949). Within the genus *Nearctopsylla* it falls in the subgenus *Hollandiana* (Hopkins, 1951) on the basis that "there are no pseudochaetae on the underside of the metanotum though the mesonotum has pseudochaetae in this position. The pronotum and mesonotum each bears but one row of bristles and there are only two rows on the metanotum. Of the two rows of bristles on abdominal terga II to VI, the anterior row consists of not more than about three bristles on each side and is often entirely absent on some of the posterior segments."

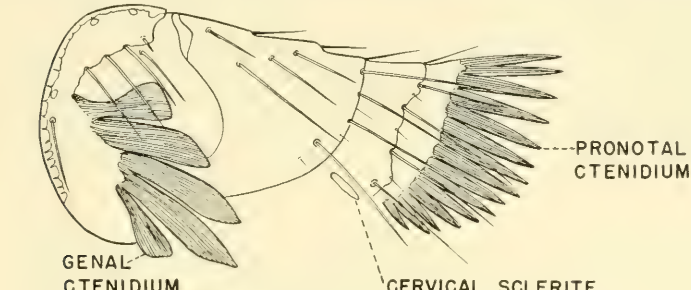
The new species runs to *Nearctopsylla princei* Holland and Jameson in the key of Holland and Jameson (1949), but differs in having the fourth genal spine barely longer than the third, a more slender ninth sternite, in details of the clasper (such as the relatively small size and great width of the movable process), and in the position and length of the acetabular seta on the clasper. The U. S. National Museum collection contains a number of specimens of *Nearctopsylla genalis* (Baker), from *Blarina brevicauda*, the same species of host as the type of *georgiana*, from Iowa, Minnesota, New York, Ontario, and Michigan. These all have the fourth genal spine distinctly longer than the third, the apex of the ventral arm of sternum IX pointed, the movable process of the clasper at least three times as long as wide, and the conspicuous pseudosetae on the clasper lobe.

Nearctopsylla (Hollandiana) georgiana, new species

Male.—Length about 1.8 mm. Chaetotaxy of the head as in fig. 1. If the five spines of the genal ctenidium are numbered one to five, considering the most dorsal spine the first and the most ventral spine the fifth, the fourth genal spine in *georgiana* is barely longer than the third, as in *N. hyrtaci* (Rothschild). In *N. princei* and *genalis* the fourth genal spine is distinctly longer than the third, while in *N. jordani* Hubbard and in *N. hamata* Holland and Jameson the third genal spine is longer than the fourth.

Pronotal ctenidium of 14 to 15 spines per side. Metanotum without pseudosetae under the collar. Hind coxa with a short row of seven spiniform setae. Abdominal terga I, III, and IV each with about five long bristles and two apical spinelets in primary row on either side, tergum II with three spinelets and about five long bristles on either side. Second row of bristles on terga I, II, and III reduced to a single bristle on either side. Single antepygidial bristle slender and moderately long, about 1.3 times as long as pygidium. Anal tergum with three rather slender, only slightly curved setae per side.

Clasper lobe broad, with about four large setae anteriorly just behind anal tergum and a few smaller setae disposed marginally as shown in



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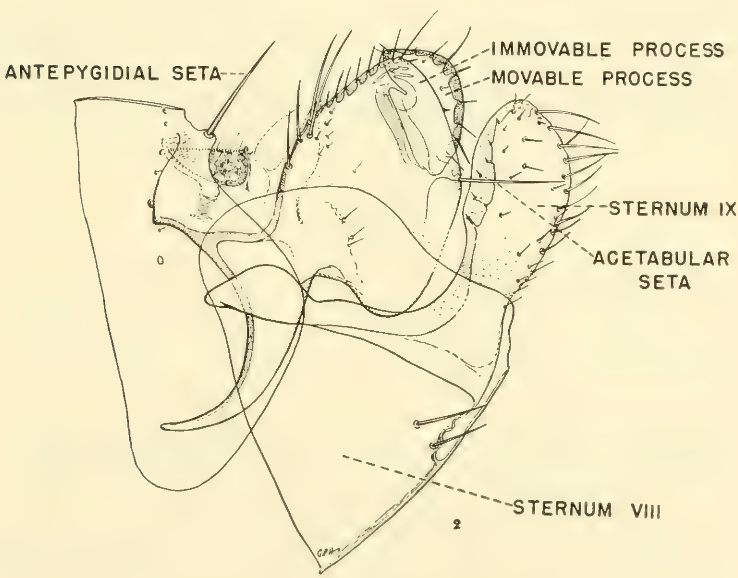

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Nearctopsylla georgiana, new species: fig. 1, lateral aspect of head and pronotum; fig. 2, terminal abdominal structures. Fig. 2 drawn by G. P. Holland.

fig. 2, with only a few short, delicate setae on inner surface, not in patches as in *N. princei, hyrtaci,* or *hamata.* Movable process of clasper very small, smaller than in the other described species, and located at extreme postero-dorsal angle of clasper lobe. Movable process almost twice as long as wide, inserted at about midpoint of posterior margin of clasper lobe, posterior margin of movable process with at least six fine setae. The single acetabular seta inserted near base of immovable process longer than in the other species as figured by Holland (1949) and Holland and Jameson (1949), about as long as movable process of clasper. Manubrium gently and evenly curved, tapering rather gradually from base to tip as in figure 2. Ventral arm of sternum IX shaped very much as in *princei,* but somewhat more slender the apical setae straight as in *princei,* intermediate in length between those in *princei* and *hyrtaci.*

Type locality—Top of Brasstown Bald, 4, 782 feet, Georgia, November 16, 1952, collected by J. O. Harrison.

Type host—Carolina short-tailed shrew, *Blarina brevicauda carolinensis* (Bachman).

Type—U. S. No. 61859.

The writers are indebted to Lt. Col. Robert Traub for examining this flea and expressing his opinion that it represented a new species. The writers are particularly indebted to Dr. G. P. Holland, Science Service, Department of Agriculture, Ottawa, Canada, for many critical comments regarding the position and peculiarities of this new species, and especially for redrawing the terminal abdominal structures, fig. 2 of the present paper. Dr. E. A. Chapin kindly allowed the senior author to study all the material of *Nearctopsylla* in the U. S. National Museum collection.

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THE ANT LARVAE OF THE MYRMICINE TRIBE MYRMECININI

(Hymenoptera)[1]

By George C. Wheeler and Jeanette Wheeler, *University of North Dakota, Grand Forks*

The tribe Myrmecinini comprises about a hundred species

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in sixteen genera. All genera are paleotropical and—with the exception of a few species—exclusively so. The exceptions are in *Pristomyrmex* (one species in the southern Palearctic) and *Myrmecina* (two Palearctic and two Nearctic species). The tribe is little known, even to myrmecologists—apparently not abundant anywhere, of little economic importance, and with no unusually interesting habits or structures.

This is one of the myrmicine tribes which Wheeler[2] characterized as "very unsatisfactorily defined." After a study of the larvae we heartily concur, for they are certainly a heterogeneous lot. In fact, each of the five genera studied might as well be in a different tribe. To be sure, *Myrmecina* and *Pristomyrmex* both have the head extremely elongate—a most unusual and bizarre character, but they have little else in common. We have not been able to find any significant characters common to all the genera; hence we have not even attempted a characterization of the tribe.

Genus **Podomyrma** F. Smith

Prothorax and mesothorax bent ventrally about 90° to form a short, stout neck; rest of body straight and paunchy. Body hairs numerous and uniformly distributed (except sparse at the posterior end); of two types; mostly very short, simple and spike-like; anchor-tipped hairs present. Head small; cranium subrectangular in anterior view, a fourth broader than long. Head hairs numerous, short, simple and spike-like. Posterior surface of labrum densely spinulose. Mandibles narrowly subtriangular, with three stout, blunt teeth. Maxillary palp a skewed peg; galea a tall frustum. Labium with exceedingly minute spinules in short rows; palp an irregular knob.

Podomyrma adelaidae (F. Smith)
Pl. I, figs. 8-13

Prothorax and mesothorax bent ventrally about 90° to form a short, stout neck; rest of body straight and paunchy; posterior end narrowly rounded. Anus ventral. Segmentation distinct on the anterior half; indistinct posteriorly. Integument of ventral surface of thorax with rather numerous, conspicuous rows of spinules, rest of venter and dorsal surface of posterior somites with minute spinules in short rows. Body hairs numerous and uniformly distributed, except sparse at the posterior end. Of two types: (1) long (about 0.36 mm.) anchor-tipped hairs, with tortuous shaft, 4-9 in a row across the dorsum of each abdominal somite I-V; (2) all other hairs very short (0.027-0.036 mm.), simple and spike-like, mostly without alveolus and articular membrane. Head small, cranium subrectangular (but with the corners rounded); breadth about a fourth greater than the length. Antennae each with three sensilla, each of which

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[2]Bull. Amer. Mus. Nat. Hist. 45:659, 1922.

bears a spinule. Head bristling with numerous short (0.027-0.063 mm.), spike-like hairs. Labrum bilobed, narrowed dorsally; anterior surface of each lobe with three hairs, 8-9 sensilla and a few minute spinules in short rows; ventral border of each lobe with two contiguous and 1-2 isolated sensilla and a few short rows of minute spinules; posterior surface of each half with a cluster of three (or two clusters of two) contiguous and 4-5 isolated sensilla; posterior surface with numerous short, arcuate rows of minute spinules. Mandibles heavily sclerotized; narrowly subtriangular in anterior view, with three stout, blunt teeth, one apical (which is curved medially) and two subapical and medial. Maxillae with the apex lobose; palp a tall, skewed peg, with one lateral, two subapical and two apical sensilla; galea a tall frustum with two apical sensilla. Anterior surface of the labium with exceedingly minute spinules in short rows; palp an irregular knob with five sensilla (one of which bears a spinule); an isolated sensillum between each palp and the opening of the sericteries; the latter a transverse slit. (Material studied: a single larva from Victoria (Australia), courtesy of W. L. Brown.)

Genus **Dilobocondyla** Santschi

Prothorax inclined ventrally to about 45°; rest of body straight and elongate-subovoidal. Body hairs numerous and uniformly distributed; mostly very short; of four types, including anchor-tipped hairs. Cranium as long as broad; occipital border broadly rounded; genae bulging below the antennal level. Head hairs numerous; minute to long; of two types; a cluster of four long hairs on each genal bulge. Labrum extremely broad; posterior surface apparently without spinules. Mandibles narrowly subtriangular in anterior view; apical tooth sharp and scarcely curved medially; anterior surface with a medial blade bearing a blunt medial tooth; posterior surface with a narrow, medial blade. Maxillary palp a slight elevation bearing five sensilla; galea minute represented only by the two sensillae. Labial palp small, represented only by a cluster of five sensilla.

Dilobocondyla chapmani Wheeler
Pl. I, figs. 1-7

Prothorax inclined ventrally to about 45°; rest of body straight and elongate-subovoidal; posterior end rounded. Anus ventral. Segmentation indistinct. Leg and wing vestiges present. Mesothoracic spiracle rather large, others decreasing in size posteriorly. Integument apparently without spinules. Body hairs numerous and uniformly distributed. Of four types: (1) on the ventral surface of the thorax, many very short (0.036-0.054 mm.), simple, flexible; grading laterally into (2) stout, short (0.027-0.063 mm.), denticulate hairs, the most abundant type occurring everywhere except on the thoracic venter; (3) a few moderately long (0.09-0.22 mm.), with denticulate tip, on the dorsum of each thoracic somite and abdominal somites VII-VIII and on the lateral surfaces of abdominal somites I-VI; (4) long (about 0.4 mm.), anchor-tipped, with tortuous shaft, 1-5 in a row across the dorsum of each abdominal somite I-V or I-VI. Head moderately large; occipital border broadly rounded; genae bulging below the antennal level; cranium with maximum breadth equal to length. Antennae each with three sensilla, each of which bears a spinule. Head hairs numerous, of two types: (1) minute to short (0.009-0.054 mm.), simple, abundant; (2) long (0.072-0.126 mm.) with denticulate tip, a cluster of four on each genal bulge and three on either side of the clypeus. Labrum large, extremely broad in proportion to the head (breadth 3X length), subtrapezoidal, narrowed dorsally, ventral corners rounded; ventral border feebly concave; anterior surface of each half with 10-13 sensilla and/or minute hairs; posterior surface of each half with a cluster of 2-3 sensilla near the ventral border and 5-6 isolated sensilla dorsally. Mandibles narrowly subtriangular in anterior view; apical tooth sharp and scarcely curved medially; anterior surface with a medial blade bearing a blunt, medial tooth; posterior surface with a narrow, medial blade. Maxillae lobose; palp small, a slight elevation bearing five sensilla; galea minute, represented only by the two sensilla. Labial palp small, represented only by a cluster of five sensilla; an isolated sensillum between each palp and the opening of the sericteries; the latter a transverse slit. (Material studied: several damaged larvae from the Philippine Islands.)

Wheeler, G. C., 1938, Pl. 16, fig. 11: anterior end of a larva in ventral view.

Genus **Atopula** Emery

Atopula hortensis Bernard

Bernard, 1948: ''Quant aux larves elles semblent primitives par leur tête, plus évoluées par le reste du corps. La tête serait assez bien celle d'une larve d'*Aphaenogaster,* avec antennes et mandibules présentes, palpes figurés par de courts mamelons. L'abdomen est incomplètement segmenté (3 sutures visibles au lieu de 6 à 8 chez *Aphaenogaster*) et plutôt obèse. Les larves sont couvertes de longs poils bruns en pinceau mêlés de grands poils fourchus (à double crosse terminale). Ces poils existent souvent chez *Leptothorax* (notamment *L. arenarius,* dont Santschi prétend que les poils en crosse retiennent l'animal au sable et l'empêchent de tomber sur le fond trop humide du terrier). *Aphaenogaster,* et tous les Myrmicinés primitifs, paraissent avoir des larves sans poils crochus ni poils en pinceau. . . Sculpture et poils des adultes et des larves . . . placeraient *Atopula* dans le genre *Leptothorax.* . . Je propose donc de placer ce genre à la base de la tribu des Leptothoracinés, sans l'inclure pour le moment aux genres voisins'' (pp. 179-180). Fig. 10 on p. 178: *a,* head of mature worker larva in anterior view; *b,* larva in profile; also hair tips enlarged.

Genus **Myrmecina** Curtis

Body strongly curved ventrally at both ends so that the anus in ventral and the head is directed posteriorly; dorsal profile long and C-shaped, ventral short and J-shaped; diameter greatest at the fourth abdominal somite, diminishing gradually to the anterior end of the prothorax (which has the same diameter as the head) and rapidly to the posterior end. Body hairs moderately numerous and uniformly distributed; short to moderately long; of only one type—simple and flexible. Head small, thickest at the base of the mouth parts; extremely long and narrow; genae bulging slightly just below the antennal level; occipital border narrowly rounded. Head hairs few, long, simple and flexible. Posterior surface of labrum spinulose. Mandibles narrowly subtriangular in anterior view; apex forming a very long, slender, sharp-pointed tooth, which is curved medially; with two widely separated, medial teeth; anterior and medial surfaces with short, arcuate ridges bearing spinules. Maxillary palp a skewed peg; galea digitiform. Anterior surface of labium densely spinulose; palps lateral, each an irregular knob.

Myrmecina americana Emery
Pl. II, figs. 17-21

Body strongly curved ventrally at both ends so that the anus is ventral and the head is directed posteriorly; dorsal profile long and C-shaped, ventral short and J-shaped; diameter greatest at abdominal somite IV, diminishing gradually to the anterior end of the prothorax (which has the same diameter as the head) and rapidly to the posterior end. Leg and wing vestiges present. Segmentation distinct on the anterior half. Mesothoracic spiracle the largest, the others diminishing gradually and slightly toward the posterior end. Integument of ventral surface of thorax and first abdominal somite with a few short, transverse rows of minute spinules; integumentary structures of unknown nature and function in the intersomitic furrows on the dorsal and ventral surfaces. Body hairs moderately numerous and uniformly distributed; short to moderately long (0.072-0.3 mm.), simple and flexible; alveolus and articular membrane lacking. Head small; thickest at the base of the mouth parts; extremely long and narrow; genae bulging slightly just below the antennal level; occipital border narrowly rounded and slightly impressed at the middle; breadth of cranium about half the length. Antennae each with three sensilla, each of which bears a spinule. Head hairs few, long (0.054-0.09 mm.), simple and flexible. Labrum short and wide (width 2X length); ventral border slightly curved, ventral corners rounded; anterior surface of each half with one sensillum; ventral border of each half with 3-4 sensilla; posterior surface spinulose, the spinules in numerous, transverse, arcuate rows; posterior surface with four isolated sensilla. Mandibles heavily sclerotized; narrowly subtriangular in anterior view; apex forming a very long slender, sharp-pointed tooth, which is curved medially; with two widely separated, medial teeth, the distal being the larger; anterior and medial surfaces with short, arcuate ridges bearing spinules. Maxillae narrowly conoidal; palp a skewed peg with five sensilla—one basal, one lateral and three apical; galea finger-like with two apical sensilla. Labium hemispherical with the anterior surface spinulose, the spinules minute and in numerous, transverse rows; palp concealed behind maxilla, a low irregular knob with four sensilla (three of which bear a spinule each); opening of sericteries a short, transverse slit on the ventral surface. Hypopharynx with numerous, subtransverse ridges. (Material studied: numerous larvae from Connecticut, Massachusetts and Mississippi.)

Myrmecina graminicola (Latreille)

Donisthorpe, 1915: "Mandibles thin and pointed, reddish; head long and narrow, bent over with three thoracic somites, and the first abdominal, posteriorly towards the ventral surface; the mesothoracic somite is prominent, projecting more forward than the other two somites. Abdomen pyriform, the first somite very prominent. The whole body is clothed with long thin curved hairs, mixed with shorter ones; when young the larva is white, and the somites are not well defined posteriorly, but the full grown larva is distinctly yellowish and all the somites are distinct" (p. 77 = 1927, p. 81). Pl. I, photograph of small and full-grown larvae (= 1927, Pl. I). "The ants pass the winter in the larval state and are piled on each other in a heap by the workers. The latter feed the larvae by mouth, but also place cut-up bits of insects and other food on their bodies for them to eat" (p. 80 = 1927, p. 85).

Eidmann, 1943, p. 226: Small larvae were found in the nest in winter.

Genus **Pristomyrmex** Mayr

Body hairs numerous. Head extremely long and narrow. Gula spinulose. Head hairs few; short to moderately long. Posterior surface of labrum spinulose. Mandibles narrowly subtriangular in anterior view. Anterior surface of labium densely spinulose; palps lateral.

Subgenus **Pristomyrmex** Mayr

Stout; prothorax bent ventrally to 90,° its anterior half narrowed abruptly to form a short neck; rest of body elongate-subovoidal; dorsal profile long and C-shaped, ventral short and S-shaped; diameter greatest at abdominal somites IV and V. Body hairs uniformly distributed; of four types, including anchor-tipped. Head widest just below the antennal level. Antennae small. Head hairs simple. Mandibles with the apical tooth long, slender, sharp, slightly curved medially; one small medial tooth; basal half of medial surface conspicuously denticulate. Maxillary palp a skewed peg; galea a tall frustum. Posterior (as well as anterior) surface of labium spinulose; palp represented only by a cluster of five sensillae.

Pristomyrmex pungens Mayr

Pl. I, fig. 21; Pl. II. figs. 1-7

Mature.—Length about 2.5 mm. Stout; prothorax bent ventrally to 90,° its anterior half narrowed abruptly to form a short neck; rest of body elongate-subovoidal; dorsal profile long and C-shaped; ventral profile short and S-shaped; diameter greatest at abdominal somites IV and V. Anus posteroventral. Leg, wing and gonopod vestiges present. Segmentation indistinct. Mesothoracic spiracle rather large, the others decreasing posteriorly. Integument of the ventral surface of abdominal somites I-IV, metathorax, mesothorax and posterior portion of the prothorax spinulose, the spinules scattered and rather coarse. Body hairs numerous, short to moderately long, uniformly distributed. Of four types: (1) short (0.035-0.105 mm.), bifid, with the branches finely denticulate, on all somites, the most abundant type; (2) short to moderately long (0.054-0.18 mm.), simple, few, on neck and ventrolateral surfaces of mesothorax, metathorax and first four abdominal somites; (3) moderately long (0.105-0.23 mm.), with short, bifid tip, a few in a row across the dorsum of mesothorax, metathorax and abdominal somites V-VIII; (4) long (about 0.25 mm.), anchor-tipped, with tortuous shaft, in a row of 6-8 across the dorsal surface of each abdominal somite I-IV. Head moderately large; extremely long and narrow; gula spinulose; cranium elongate-suboval in anterior view, but with a conspicuous genal bulge just below the antennal level; maximum width 2/3 the length. Antennae small, drumlin-shaped, each with three sensilla, each of which bears a spinule. Head hairs few, short to moderately long (0.018-0.063 mm.), simple. Labrum small, short (width 2 2/3X length), ventral and lateral borders feebly convex; anterior surface with two sensilla; ventral border with two cluster of four sensilla each; posterior surface with numerous short, transverse rows of minute spinules and ten scattered sensilla. Mandibles narrowly subtriangular in anterior view; apex forming a long, slender, sharp tooth which is slightly curved medially; with one small medial tooth; basal half of medial surface conspiculously denticulate. Maxillae with apex conoidal; palp a skewed peg with five sensilla (one basal with spinule and four apical); galea a tall frustum with two apical sensilla. Labium with the anterior and posterior surfaces densely spinulose, the spinules minute and in short transverse rows; palp represented by a lateral cluster of five sensilla (three of which bear a spinule each); an isolated sensillum between each palp and the opening of the sericteries; the latter a short transverse slit.

Young.—Length about 1.1 mm. Slender; thorax curved ventrally. Segmentation distinct. Anchor-tipped hairs on the dorsal surface of the mesothorax, metathorax and abdominal somites I-VII, about eight in a row across each somite. Head relatively very large, otherwise similar to the mature larva.

Material studied: two dozen larvae from the Philippine Islands.

Pristomyrmex japonicus Forel

Young.—Length 0.87-1.71 mm. Generally similar to the young of *pungens*. (Material studied: a dozen larvae from Japan.)

Subgenus **Odontomyrmex** Forel

Anterior portion of prothorax forming a small, short neck of about the same diameter as the head; diameter of body increasing rapidly to the middle of the mesothorax, decreasing to abdominal somite I, increasing again to IV, then decreasing rapidly to the posterior end which is round. Body hairs uniformly distributed except on conspicuous, naked, intersomitic zones on the thorax; dorsal surface of neck and mid-ventral surfaces of mesothorax, metathorax and first four abdominal somites practically naked. Body hairs of five or six types, including anchor-tipped. Head thickest at the base of the mouth parts and widest just above the antennal level. Antennae minute. Head hairs simple or with short bifid tip. Mandibles with the apical tooth short, hook-like, curved medially; with a deep notch at the distal third, in which a slender, medial tooth is set; anterior, medial and posterior surfaces with a few coarse denticles. Apex of maxillae spinulose; palp and galea digitform. Labial palp a low knob bearing four sensilla.

Pristomyrmex (Odontomymex) sp.

Pl. I, fig. 22; Pl. II, figs. 8-16

Mature.—Length about 3 mm. Anterior portion of prothorax forming a small, short neck of about the same diameter as the head; diameter of body increasing rapidly to the middle of the mesothorax, decreasing to abdominal somite I, increasing again to IV, then decreasing rapidly to the posterior end, which is round; thorax swollen and curved ventrally; abdomen straight. Anus posteroventral, surrounded by a cluster of hairs (type 5). Leg and wing vestiges present. Segmentation distinct on the anterior half. Mesothoracic spiracle the largest, the others diminishing gradually and slightly toward the posterior end. Integument of ventral surface of metathorax, mesothorax, posterior portion of prothorax and first four abdominal somites with short, scattered, transverse rows of minute spinules; the spinulose areas on the abdominal somites are slightly raised. Body hairs numerous, short to moderately long. Thorax with conspicuously naked, intersomitic zones; dorsal surface of neck practically naked; midventral surface of mesothorax, metathorax and abdominal somites I-IV also practically naked; elsewhere the hairs are rather uniformly distributed. Body hairs of six types: (1) on the ventral surface of the neck, few, simple, short (about 0.036 mm.); (2) on the ventral surface of the posterior portion of the prothorax, of the mesothorax and metathorax and of the first four abdominal somites, few, minute (about 0.009 mm. long), simple; (3) on the dorsal surface of the prothorax and on the ventrolateral surfaces of the mesothorax, metathorax and first four abdominal somites, few, simple, long (0.15-0.23 mm.), occasionally with the tip flattened; (4) across the dorsal surface of each abdominal somite II-IV, a row of four long (about 0.25 mm.), anchor-tipped hairs, with the shaft mostly straight but contorted and kinked near the base; (5) on each somite, few, moderately long (0.108-0.162 mm.), with short bifid tip; (6) on the dorsal surface of the prothorax, on the dorsal and lateral surfaces of mesothorax, metathorax and abdominal somites I-IV and on all surfaces of abdominal somites V-IX, numerous, short (0.054-

0.09 mm.), bifid, the branches roughened with fine denticles; types 5 and 6 lack alveolus and articular membrane. Head moderately large; thickest at the base of the mouth parts; extremely long and narrow; gula spinulose. Cranium subpyriform in anterior view; width about half the length; widest just above antennal level; occipital outline broadly rounded. Antennae minute, each with three sensilla, each of which bears a spinule. Head hairs few, very short to moderately long (0.009-0.045 mm.), simple or with short-bifid tip. Labrum feebly bilobed, narrowed dorsally; anterior surface of each lobe with four sensilla; ventral border of each lobe with a cluster of 3-4 sensillae and a few minute spinules; posterior surface with ten scattered sensilla and with short, transverse, arcuate rows of short spinules. Mandibles heavily sclerotized; narrowly subtriangular in anterior view; apical tooth short, hook-like, curved medially; with a deep notch at the distal third, in which a slender medial tooth is set; anterior, medial and posterior surfaces with a few coarse denticles. Maxillae with the apex conoidal and spinulose (the spinules exceedingly minute); palp digitiform with two apical and three lateral sensilla (four bearing a spinule each); galea digitiform and bearing two apical sensilla. Labium hemispherical with the anterior surface densely spinulose, the spinules exceedingly minute and in short, arcuate, transverse rows; palps lateral, each a low knob with four sensilla (three bearing a spinule each); opening of sericteries a short transverse slit on the apex. Hypopharynx spinulose, the spinules in short, transverse, arcuate rows.

Submature.—Length about 3 mm. Thorax more slender, its somites more distinct. The spinulose areas on the ventral surface of the abdomen form distinct bosses. Otherwise as in the mature larva.

Young.—Length about 0.5 mm. Ventral profile straight; meeting the posterior profile at an angle at the apex of which is the anus. Otherwise as in the mature larva.

Material studied: a dozen larvae from Malanda, N. Queensland, XI-50, collected by W. L. Brown, who considers this to be a new species.

Pristomyrmex (Odontomyrmex) sp.

Mature.—Length about 4.25 mm. Similar to *P.* (*O.*) sp. from Queensland except in the following details: Body hairs of five types: (1) on the ventral surface of the neck, few, simple, short (about 0.036 mm); (2) on the rest of the venter of the thorax and of abdominal somites I-IV, few, simple, minute (0.009-0.018 mm.); (3) on the dorsal surface of the prothorax, and on the ventrolateral surfaces of the mesothorax, metathorax and first four abdominal somites, few, simple, long (0.225-0.45 mm.); (4) across the dorsal surface of each abdominal somite II-IV a row of 5-8 long (about 0.45 mm.), anchor-tipped hairs, with the shaft mostly straight but contorted and kinked near the base; (5) on the dorsal surface of the prothorax, on the dorsal and lateral surfaces of the mesothorax, metathorax and abdominal somites I-IV and on all surfaces of abdominal somites V-IX, numerous, short (0.054-0.108 mm.), bifid, the branches smooth and flexible. Anterior surface of each lobe of the labrum with two sensilla. (Material studied: ten larvae from the Philippine Islands.)

Genus **Dacryon** Forel

Body straight, except for the anterior end (prothorax and mesothorax) which is directed ventrally at a right angle; thorax quite stout, abdomen only a trifle stouter; diameter greatest at abdominal somite IV. Body hairs numerous; uniformly distributed except sparser at the posterior end and denser on the prothorax; minute to moderately long; of four types, including anchor-tipped. Antennae minute. Head hairs few. Mandibles subtriangular in anterior view; apical tooth short and nearly straight; two stout, blunt medial teeth arising from the anterior surface; the medial surface may also bear 1-4 rounded denticles. Maxillary palp an irregular knob; galea a short frustum. Labial palp represented only by a cluster of 4-5 sensilla.

Dacryon rugosum (Clark)

Pl. I, figs. 14-20

Body straight except for the anterior end (prothorax and mesothorax) which is directed ventrally at a right angle; thorax quite stout, abdomen only a trifle stouter; diameter greatest at abdominal somite IV. Anus ventral. Leg and wing vestiges present. Segmentation distinct. Mesothoracic spiracle somewhat larger than the metathoracic and first abdominal (which are equal) and twice as large as the remainder. Integument of the dorsal surface and of the ventral surface of the thorax with a few transverse rows of minute spinules. Body hairs numerous, uniformly distributed, except sparser at the posterior end and denser on the prothorax, minute to moderately long. Of four types: (1) on all somites, except abdominal somites IX-X, few, exceedingly minute (about 0.006 mm.); (2) on each somite, few, moderately long (0.054-0.22 mm.), with denticulate tip; (3) across the dorsal surface of each abdominal somites I-IV, a row of 4-5, long (about 0.31 mm.), anchor-tipped hairs, with tortuous shaft; (4) on all somites, except the ninth and tenth abdominal, short (0.026-0.16 mm.), with the distal third denticulate, without alveolus and articular membrane. Cranium subnonagonal, slightly longer than broad. Antennae minute, each with 3-4 sensilla, each of which bears a spinule. Head hairs few, short (0.027-0.054 mm.), simple or with a few denticles near the tip, asymmetrically arranged. Labrum feebly bilobed, breadth twice the length; anterior surface of each lobe with 6-7 sensilla; ventral border with a few spinules and, on each half, 2-3 isolated and a cluster of 2-3 sensilla; posterior surface of each lobe with four isolated and a cluster of 2-3 sensilla scattered among a few isolated spinules. Mandibles heavily sclerotized and rather stout, subtriangular in anterior view, apical tooth short and nearly straight; two stout, blunt, medial teeth arising from the anterior surface; the medial surface may also bear 1-4 rounded denticles. Maxillae with the apex small and conoidal; palp an irregular knob bearing five sensilla, two encapsulated and three with a spinule each; galea a short frustum bearing two apical sensilla. Labium somewhat narrow; palp represented by a cluster of 4-5 sensilla; an isolated sensillum between each palp and the opening of the sericteries; the latter a short slit. (Material studied: a dozen larvae from Victoria, Australia, courtesy of W. L. Brown.)

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EXPLANATION OF PLATES

Plate I. Larvae of Myrmecinini

Dilobocondyla chapmani Wheeler, figs. 1-7—1, head in anterior view, X53; 2, left mandible in anterior view, shaded to show medial blades, X95; 3-6, four types of body hairs, X185; 7, larva in side view (reconstruction), X11. *Podomyrma adelaidae* (F. Smith), figs. 8-13—8, larva in side view, X12; 9, head in anterior view, X56; 10, left mandible in anterior view, X93; 11-13, three body hairs, X190. *Dacryon rugosum* (Clark), figs. 14-20—14-17, four types of body hairs, X95; 18, head in anterior view, X76; 19, left mandible in anterior view, X118; 20, larva in side view, X20. *Pristomyrmex pungens* Mayr, fig. 21, young larva in side view, X32. *Pristomyrmex* (*Odontomyrmex*) sp. from Queensland, fig. 22, left maxilla in anterior view, X370.

Plate II. Larvae of Myrmecinini

Pristomyrmex pungens Mayr, figs. 1-7—1, head in anterior view, X121; 2-5, four types of body hairs, X190; 6, left mandible in anterior view, X235; 7, larva in side view, X32. *Pristomyrmex* (*Odontomyrmex*) sp. from Queensland, figs. 8-16—8, head in anterior view, X121; 9, left mandible in anterior view, X242; 10, bifid body hair, X185; 10*a*, branch of same enlarged to show denticles, X340; 11 and 12, two simple short body hairs, X185; 13, anchor-tipped body hair, X185; 14, long simple body hair, X185; 14*a*, enlargement of flattened tip which may occur on long simple hair, X340; 15, body hair with short bifid tip, X185; 16, larva in side view, X24. *Myrmecina americana* Emery figs. 17-21—17, head in anterior view, X121; 18, left mandible in anterior view, shaded to show blade, X170; 19 and 20, two body hairs, X93; 21, larva in side view, X20.

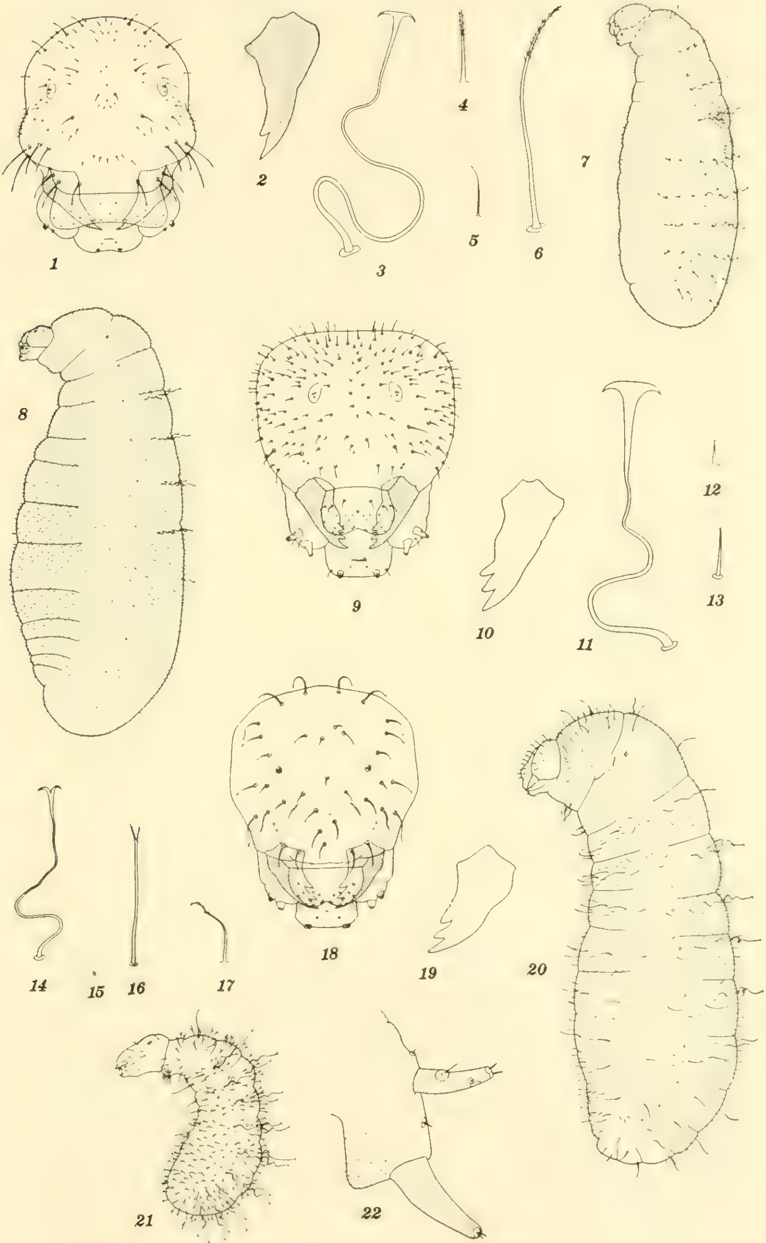

Plate I. Larvae of Myrmecinini

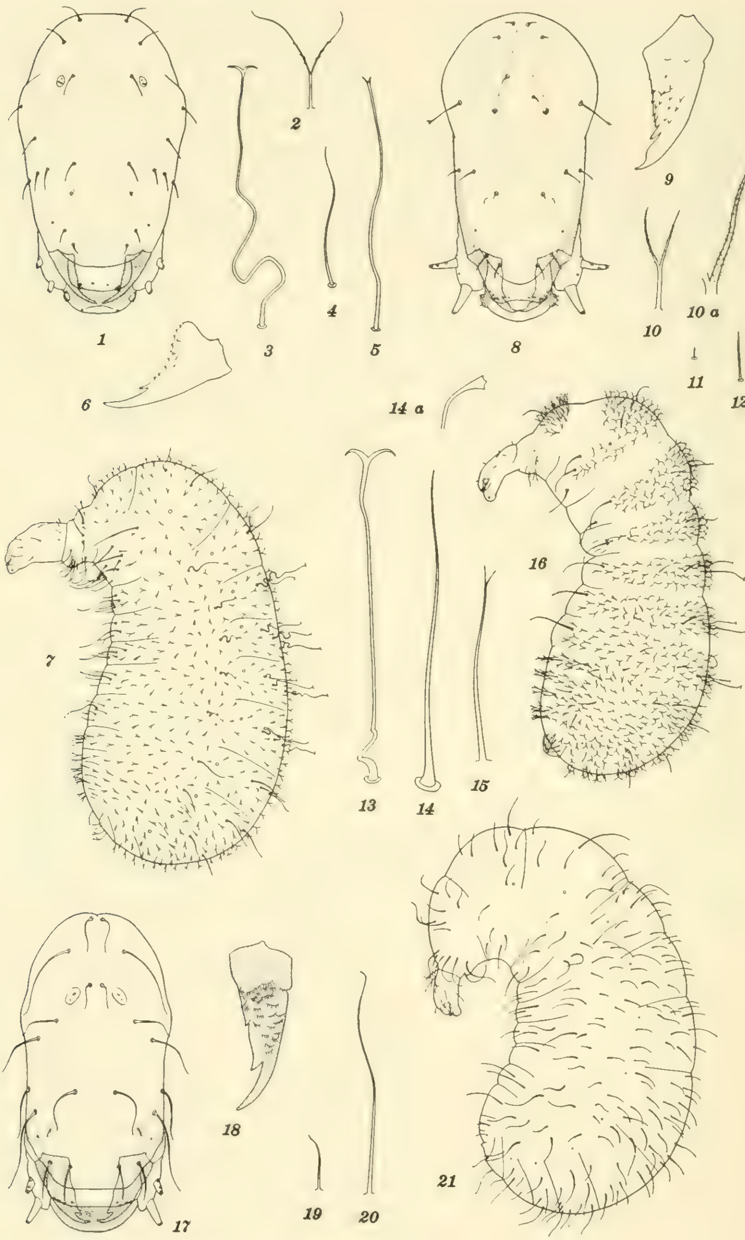

PLATE II. LARVAE OF MYRMECININI

CHRYSOMELID BEETLES OF THE OEDIONYCHUS MINIATUS COMPLEX

(COLEOPTERA)

BY DORIS H. BLAKE, *Washington, D. C.*

In my revision of the beetles of the genus *Oedionychus* north of Mexico, published in 1927[1], I made no dissections and no studies of the aedeagus of any specimens and as a result was at a loss to separate those beetles which are so similar in markings that they have gone under the name *Oedionychus miniatus* (Fabricius) for the most part. I was able to recognize in the material studied only one other species, *O. ulkei* Horn, of which I had seen the type at the Philadelphia Academy of Sciences. Three other species, *O. horni* Harold, *O. jocosus* Harold, and *O. longulus* Harold, were listed as unidentified.

Since 1927, a great many specimens of this group have been accumulating in the U. S. National Museum which after H. S. Barber's death came to light in material that he had set aside for further study. Mr. Barber had made many dissections and had recognized *O. jocosus* Harold and questioned whether another species might not be *O. horni* Harold. On a small box containing a series of beetles from Greeley, Colorado, he had left a note that this might represent a form of an eastern species or possibly that it might be new. This is apparently new and I am dedicating it to him in calling it *Oedionychus barberi.*

The beetles belonging to this group are all similar in color and markings but there are small differences in the shape and width of the elytral vittae, as well as in the punctation and shape of the whole beetle, that are correlated with differences in the aedeagus. It is a pity that no more is known of the food habits of these different species as the food plant may be different in each case.

The first of the group was described by Fabricius in 1801 as *Galleruca miniata* from the Bosc collection, the type locality "Carolina" being probably near Charleston, S.C. Three cotypes of this are still in the old Bosc collection at Paris and these I have examined. They are perhaps the most easily differentiated of any of the group, being as a rule paler, with the elytral dark vittae narrow and the median one not curved about towards the suture at the apex. Harold in describing *O. jocosus* mentions most of the points in which *O. miniatus* differs from the others, and it seems to me that he was describing the same species, although I have not examined the type.

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[1]Blake, Proc. U. S. Nat. Museum, vol. 70, art. 23, 1927, pp. 1-44.

Harold described two other species with similar markings, *O. longulus* from California, which I am unable to recognize, never having seen any such beetle from the Pacific coast, and the other *O. horni* from Texas, which is a densely and strongly punctate beetle. Specimens matching his description of this are in the U. S. National Museum.

One other species of this group, *O. fallax*, was described by Melsheimer in 1844 from Pennsylvania. His description might fit two species that occur in Pennsylvania. In the LeConte collection at the Museum of Comparative Zoology in which Melsheimer's specimens may be, although not labelled as such, are five specimens, all probably the same species, two of which have pink discs, indicating the locality as the Middle States (the other three have orange red discs, indicating the Southern States). I may be wrong in assuming that these two specimens are Melsheimer's. There is also in the Melsheimer collection one female of the same species under that name but not an authentic type. I am following these specimens in interpreting Melsheimer's *Oedionychis fallax*.

Besides these already described are four others not described, (1) from Greeley, Colorado, (2) a large, smooth, nearly impunctate species from Florida, (3) one collected by D. M. Weisman in the sandhill region about Wilmington, N. C., and (4) one with narrow elytral vittae which ranges from Massachusetts to Florida and which has always been labelled as *O. miniatus*. Brief descriptions of the eight species recognized in the *O. miniatus* complex, with citations of localities and remarks on the distinctive characters and a key are given here, together with figures of the beetles and their aedeagi.

Key to the Species

1. Elytral dark vittae narrow, usually reddish brown, median one often interrupted and at apex not curving about and approaching sutural vitta. North Carolina to Florida, west to Mississippi .... *miniatus* Fabricius

   Elytral vittae wider, median one usually curving towards and sometimes joining sutural vitta at apex 2

2. Large (6.5 to 8 mm.), elytra smooth and shining, very faintly and sparsely punctate. Florida .... *floridanus*, new species

   Smaller, elytra more or less densely and coarsely punctate 3

3. Shining, coarsely and densely punctate, elytral vittae usually wide and deep piceous, body beneath and legs tending to be piceous. Maryland to Texas .... *horni* Harold

   Not so coarsely punctate, usually alutaceous to some extent, usually the body beneath and legs deep brown, not piceous 4

4. Aedeagus having on the lower surface a small hollowed-out depression or dent near the tip 5

   Aedeagus without a hollowed-out depression or dent near the tip 7

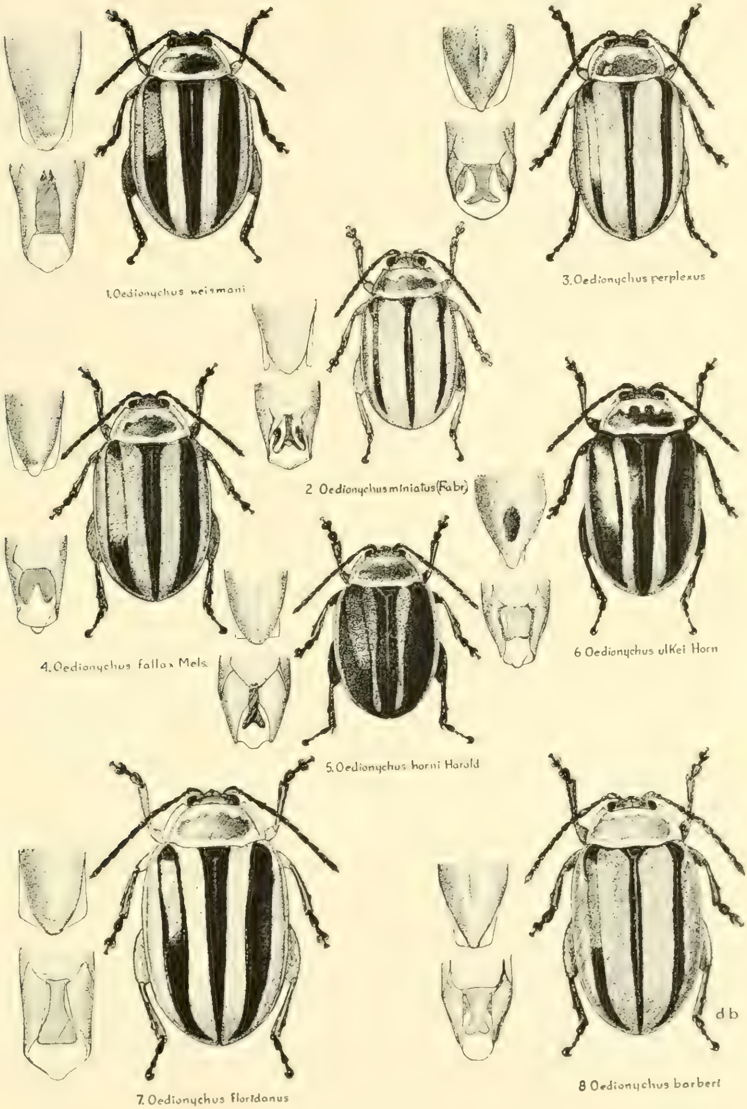

Plate I. Beetles of Genus Oedionychus

5. Elytral dark vittae wide, sometimes uniting at apex, surface finely but densely punctate, 3rd and 4th antennal joints often subequal. Aedeagus with a deep hollow on lower surface near the tip. North Carolina to Florida and Alabama .... *ulkei* Horn
   Elytral dark vittae not so wide, elytral punctation coarser, 4th antennal joint noticeably longer than 3rd. Aedeagus with a slight dent on ventral surface near tip 6
6. Aedeagus with a broad rounded tip above. Massachusetts to Florida. .... *perplexus*, new species
   Aedeagus not so wide at tip. Wisconsin, Missouri, Kansas, Nebraska, Colorado .... *barberi*, new species
7. Aedeagus acutely rounded at tip, elytra coarsely and densely punctate. New York to Texas .... *fallax* Melsheimer
   Aedeagus broadly rounded at tip, elytra rather finely and not so densely punctate. North Carolina to Florida .... *weismani*, new species

Oedionychus miniatus (Fabricius)

Fig. 2

Galleruca miniata Fabricius, 1801, Syst. Eleut., vol. 1, p. 495.
Altica miniata Olivier, 1808, Ent. vol. 6, p. 685.
Oedionychis miniata Melsheimer, 1847, Proc. Acad. Phila., vol. 3, p. 162.
Oedionychis jocosa Harold, 1876, Col. Heft., vol. 15, p. 124.

From 5 to 6.5 mm. in length, oblong oval, not very convex, moderately shiny, the prothorax distinctly alutaceous and rather densely and strongly but not coarsely punctate, pale yellow or yellowish brown with a reddish brown fascia across pronotum, elytra rather densely and somewhat coarsely punctate, with a narrow and usually reddish brown sutural and median vitta, the median vitta not curving towards suture at the apex, sometimes represented only in part, occasionally both vittae absent. Body beneath and legs reddish brown. Antennae with the 3rd joint shorter than 4th.

Three cotypes in Bosc collection, Museum of Natural History, Paris, from Carolina, probably near Charleston, S. C.

Other localities.—Florida (Orange Co., Hubbard and Schwarz; Tampa, Hubbard and Schwarz). Georgia (Brunswick). South Carolina (Myrtle Beach, J. G. Watts). North Carolina (Southern Pines, A. H. Manee). Alabama (Mobile, H. P. Loding, on *Hypericum setosum*). Mississippi (Pascagoula, H. L. Dozier).

Remarks.—This is distinguished mainly by the median elytral vitta which is straight, narrow and not curved at the apex towards the suture as it is in others of the group. Usually the markings are paler also, being reddish brown, and the beetle is smaller and not very convex.

Oedionychus ulkei Horn

Fig. 6

Oedionychis ulkei Horn, 1889, Trans. Am. Ent. Soc., vol. 16, p. 188.

From 4.5 to 6 mm. in length, oblong oval, convex, shining, the prothorax sometimes feebly alutaceous, shallowly and finely and moderately densely punctate, the elytral dark vitta wider than the pale, sometimes uniting with the sutural at the apex, the intervening pale vitta rather obscure (in dried specimens). Body beneath and legs deep reddish brown to piceous. Antennae with the third and fourth joints subequal. Aedeagus with the ventral surface flattish and with a deep hollow in the middle.

Type in Horn Collection, Philadelphia Academy of Sciences, from Florida.

Distribution.—Florida (Kissimmee, Sumter Co., Hubbard and Schwarz; Haulover, Hubbard and Schwarz; Jacksonville, Ashmead; Estero, Van Duzee; Crescent City, Schwarz) South Carolina (Conway, J. G. Watts; Myrtle Beach, J. G. Watts). North Carolina (Southern Pines, A. H. Manee). Alabama (Mobile, on *Hypericum setosum*, H. P. Loding).

Remarks.—The oval convex shape, fine punctation, wide dark elytral vittae, and the subequal 3rd and 4th antennal joints distinguish this species. It seems to be confined to the southeastern states.

Oedionychus horni Harold

Fig. 5

Oedionychis horni Harold, 1881, Berliner Ent. Zeit., vol. 25, p. 142.

Between 4.8 and 6.5 mm. in length, broadly oval not very convex, shiny, not at all alutaceous, coarsely, densely and deeply punctate, the head, antennae, legs and undersurface deep reddish brown almost piceous, prothorax pale with a reddish brown fascia, not at all alutaceous; elytra with wide dark sutural and median vittae, the median vitta approaching the margin sometimes and in some specimens uniting at the apex with the sutural vitta; explanate margin wide. Body beneath and legs usually deeper than in other species in coloring, almost piceous. Aedeagus ventrally with a broad rounded apex.

Type locality.—Texas; whereabouts of type unknown.

Other localities.—Alabama (Mobile, on *Dasystoma bignoniiflora* Small; Tumblin Gap, Saraland, Orchard, all collected by H. P. Loding; Langdale, Chambers Co., H. H. Smith; Chickasaw). Georgia (Atlanta, P. W. Fattig). South Carolina (Clemson College, W. H. Clarke; Antreville). Virginia (Glen Carlyn, Great Falls, Alexandria, E. Shoemaker, Fredericksburg, W. D. Richardson). District of Columbia. Maryland (Bladensburg, Hubbard and Schwarz).

Remarks.—The coarse, dense punctation and broad dark elytral vittae as well as the flatness of the beetle differentiate this species from the others. In addition, the surface is shiny and not at all alutaceous.

Oedionychus fallax Melsheimer

Fig. 4

Oedionychus fallax Melsheimer, 1847, Proc. Acad. Phil., vol. 3, p. 162.

From 5.5 to 7 mm. in length, oblong oval, moderately convex, prothorax alutaceous, elytra shining, densely and coarsely punctate, the elytral dark vittae as wide or wider than pale, and in the pale vitta a narrow orange red stripe apparent in life but fading to dark brown or even entirely in dried specimens. Median dark vitta approaching the sutural at apex. Third antennal joint distinctly shorter than fourth. Body beneath and legs deep reddish brown, tibiae and tarsi darker. Aedeagus beneath convex with a short narrowed tip, no depression on lower surface.

Type (?) in LeConte collection, Museum of Comparative Zoology, (2 specimens with pink disc representing the Middle States); described from Pennsylvania.

Distribution.—New York (Rock Beach, L. I., E. Shoemaker and Chas. Schaeffer). Illinois (Soltau collection). New Jersey (Iona, G. M. Greene; Anglesea, Chas. Schaeffer). Maryland (Bladensburg, Hubbard and Schwarz; Glen Echo, J. C. Bridwell). Virginia (Norfolk, G. E. Gould; Richmond, S. W. Cook; Ft. Monroe, Hubbard and Schwarz; Fairfax Co., E .Shoemaker; Holland, Nansemond, G. M. Bousch). North Carolina (Raleigh, D. M. Weisman). South Carolina (Myrtle Beach, E. R. Kalmback). Georgia (Tifton, on cotton, Glick; State College, Scott and Fiske). Florida (Gainesville, H. F. Howden). Alabama (Daphne, Mobile, H. P. Loding). Mississippi (Montgomery, J. A. Wilcox). Texas (Dallas, C. R. Jones; Houston, J. L. Ward, on *Trifolium* sp.; Victoria, J. D. Mitchell; Greenville, C. R. Jones).

Remarks.—There are 5 specimens in the LeConte collection, the first labelled "*Oe. miniata* (Fabr.) *fallax*! Mels.", three of these have an orange red disc, indicating the Southern States, and two have a pink disc, indicating the Middle States, and these two might possibly be Melsheimer's specimens. There is in the Melsheimer collection one female of the same sort but this too cannot be regarded as an authentic type. All have rather convex elytra and remnants of the orange red stripe in the pale vitta. In all, the median dark vitta is as wide if not wider than the pale one, and the elytral punctation is coarse and dense.

Oedionychus perplexus, new species

Fig. 3

From 5 to 6.5 mm. in length, oblong oval, shining, the thorax alutaceous, densely and strongly punctate, the dark elytral vittae not so wide as the pale usually, body beneath and legs reddish brown, tibiae and tarsi deeper brown.

Head with coarse dense punctures on either side of front and less dense over occiput, sometimes front smoother. Antennae with third joint distinctly shorter than fourth. Prothorax alutaceous and strongly and moderately densely punctate, without definite callosities or depressions. Elytra not very convex, shining, densely and strongly punctate, intrahumeral sulcus broad and shallow; dark median vitta usually not as wide as pale, a trace of an orange-red stripe in the pale median vitta in some specimens. Body beneath and legs reddish brown, with the tibiae and tarsi deeper in coloring.

Type.—U.S.N.M. no. 61981, collected on corn leaf July 20, 1944, Johns Island, South Carolina.

Distribution.—Massachusetts (Mt. Holyoke, F. Knab). New York (West Point, W. Robinson). New Jersey. Maryland (Beltsville, L. J. Bottom). Virginia (Lynnhaven, Woodford Station, J. C. Bridwell, on alder). North Carolina (New River, G. E. Bohart; Wilmington; Hertford, W. R. Walton). South Carolina (Johns Island, Isle of Palms, Geo. M. Greene; Charleston, J. G. Watts; Dents, J. G. Watts). Florida (Jacksonville).

Remarks.—This species has never been recognized as distinct from *miniatus*. It differs from *miniatus* in that the narrow median elytral vitta curves towards the suture at the apex and the aedeagus has a little hollowed out spot on the ventral side and is acutely tipped below. Apparently it ranges farther north than the others, being found in Massachusetts, but also as far south as Florida.

Oedionychus barberi, new species

Fig. 8

From 5.5 to 7 mm. in length, oblong oval, convex, shining, the prothorax alutaceous, whole upper surface densely and strongly punctate, the dark elytral vittae not as wide as the pale; body beneath reddish brown with the breast tending to be deeper in color, tibiae and tarsi dark and sometimes a dark streak on upper side of femora.

Head more or less densely punctate over upper part, deep reddish brown. Antennae with 3rd joint distinctly shorter than 4th. Prothorax without depressions, alutaceous, thickly and moderately coarsely punctate, a broad reddish brown transverse fascia. Elytra more densely and coarsely punctate than prothorax, the dark median vitta not so wide as the pale, and a trace of a faded out pale (? orange colored) vitta in the pale vitta in some specimens. Body beneath with the breast tending to be deeper in color, the femora sometimes with a darker streak above, tibiae and tarsi dark.

Types.—Type Male and 1 ♂, 2 ♀ paratypes, U.S.N.M. no. 61982, from Greeley, Colorado, July 26, 1940, on snapdragons, J. L. Hoerner.

Other localities.—Kansas (Riley C., Popenoe; also a specimen without locality except Kansas in Chas. Schaeffer collection). Missouri (St. Louis, M. Schuster). Nebraska (Holt Co.). Colorado (Colorado Springs, 6-7000 ft., July 15-30, H. F. Wickham). Wisconsin.

Remarks.—This resembles the eastern species, *Oe. fallax,* in its convexity, but is even more densely punctate. The principal difference is in the shape of the aedeagus. It is one of the largest of the group.

Oedionychus floridanus, new species

Fig. 7

From 6.5 to 8 mm. in length, oblong oval, moderately convex, shining, finely and shallowly but not densely punctate, median dark elytral vitta not any wider than pale, sutural vitta narrow, body beneath and legs reddish brown, the tibiae with a darker streak.

Head reddish brown over occiput and front, lower front paler, a circle of punctures near eye, the occiput usually smooth. Antennae with 3rd joint considerably shorter than 4th. Prothorax faintly alutaceous with reddish brown fascia, finely and shallowly punctate. Elytra without very distinct intrahumeral sulcus, shining, finely punctate, the median dark vitta not any wider than the pale. Body beneath and legs reddish brown.

Type.—Male, U.S.N.M. no 61983, from Lakeland, Florida, collected on collards, Jan. 18, 1944, collector unknown.

Other localities.—Florida (Terra Ceia, May 25, 1944, on lima bean; Hilliard, Oct. 5, 1935, P. Oman; Baldwin, Oct. 6, Hubbard and Schwarz; Tampa, F. Knab; Royal Palm Park, Chas. Schaeffer; Dade Co., J. A. Wilcox; Ft. Myers, J. N. Knull; Interlachen, H. F. Howden, B. Dozier).

Remarks.—This is the largest of the group, and also the smoothest, with fine, not dense, elytral punctation. It is so far known only from Florida.

Oedionychus weismani, new species

Fig. 1

From 5.5 to 5.7 mm. in length, ovate, shining, elytra not coarsely or densely punctate, the black median vitta usually a little wider than pale, head dark on occiput, paler in lower front, breast tending to be dark, tibiae and tarsi deeper in coloring.

Head with a circle of punctures near eye, only a few elsewhere over occiput, upper half of head deep red brown to piceous, lower front paler. Antennae with 4th joint distinctly longer than 3rd, entirely dark. Prothorax shining, very lightly punctate, a slight but distinct callosity on each side. Elytra rather finely and not at all densely punctate, a distinct intrahumeral sulcus and wide explanate margin, dark median vitta tending to be wider than pale. Body beneath with breast usually darker than rest of undersurface, tibiae and tarsi dark.

Type.—Male and one ♂ paratype, U.S.N.M. no. 61984, collected by D. M. Weisman at Orton, North Carolina, March 23, 1952.

Other localities.—North Carolina (Lake Waccamaw, March 23, 1952, Holly Shelter, March 22, 1952, collected by D. M. Weisman in sweeping). Florida (Indian River, F. Knab, one female).

Remarks.—This species is most closely allied to *O. floridanus* but differs from it by being more distinctly punctate and smaller. The aedeagus, although quite distinct, likewise resembles that of *O. floridanus.*

THE PROBABLE TYPES OF SPHEX LANIERII GUÉR. AND SPHEX PAULINIERII GUÉR.

(HYMENOPTERA, SPHECIDAE)

In the well-known monograph of the genus *Sphex* by F. F. Kohl (Ann. naturh. Hofmus. Wien V, 1890), *Sphex lanierii* Guér., described from Cuba in 1845, is placed in the synonymy of the widespread *Sphex ichneumoneus* L. Fernald (Proc. U. S. Nat. Mus. XXXI, 1906) considered it more probable that *S. lanierii* would be identical with the species described by Kohl as *Sphex clavipes* (renamed *cubensis* by Fernald because Kohl's name was preoccupied). He wrote, ''The identity of Guérin's *Sphex lanierii* does not seem to have been settled with certainty, and I can not learn the whereabouts of the type.'' He pointed to the fact that Guérin himself had warned that this species should not be confused with *Chlorion ichneumoneum* Fabr., and stated that specimens of *Chlorion cubensis* in the collection of the American Entomological Society were labelled *lanierii* in Cresson's handwriting.

When recently I looked through some notes made long ago, in 1926, during a study of the *Sphex* collection in the Leiden Museum, I found that I had then written as follows: ''Fernald correctly supposed that *S. lanierii* Guér. was misidentified by Kohl. The type, a male from Cuba (ex collection F. Monchicourt) is in the Leiden Museum; it is undoubtedly identical with *Sphex cubensis* Fern. (*Sphex clavipes* Kohl, 1890). Guérin's name must be used for this species.''

How the Leiden Museum obtained this insect is unknown to me, but it is of interest in this connection to record that it also possesses a wasp which is perhaps the type of the African *Sphex paulinierii* Guér., described in 1843. This specimen is a female, labelled ''Senegal, F. Monchicourt'' in the same handwriting as the label of *S. lanierii*. *Sphex paulinierii* was unknown to Kohl, who placed it as a doubtful species in the subgenus *Chlorion*. In 1918 this error was corrected by R. E. Turner (An.. Mag. Nat. Hist. (9) 3:397), and the species was subsequently described in detail and figured by G. Arnold (Ann. Transvaal Mus. XII, 1928:369, pl. IX, fig. 3).

The name *Sphex* is used here in accordance with Opinion 180 (Intern. Comn. Zool. Nomencl. 1946).—J. VAN DER VECHT, *Bogor, Indonesia.*

THE MALE OF HAEMAGOGUS ALBOMACULATUS THEOBALD

(DIPTERA, CULICIDAE)

BY WILLIAM H. W. KOMP, *National Institutes of Health, Laboratory of Tropical Diseases, Bethesda, Md.*

Haemagogus albomaculatus was described in 1903 by F. V. Theobald (1)[1] from a single female collected in British Guiana. Parts of the original description follow: "Abdomen covered with rich metallic violet scales, the penultimate and the antepenultimate segments with a silvery-white median basal patch, laterally the segments have basal white elongated triangular spots, forming almost a distinct lateral line; . . . the fourth segment with two large posterior border-bristles, the fifth with one very long black bristle, arising from the middle of the segment and passing over the sixth and with two border-bristles; . . . legs unbanded, bronzy brown and metallic blue and violet . . . ungues [claws] equal and simple. Wings with . . . the first submarginal cell very slightly longer, but narrower than the second posterior cell, its base nearer the apex of the wing than that of the second posterior cell, which is broad, nearly as long as the cell . . ."

Habitat.—Cara Cara, Demerara River, and Pomeroon River, British Guiana (Dr. Low). Observations.—Described from a single ♀ taken by Dr. Low."

It will be noted that Theobald describes the female claws as "equal and simple." Howard, Dyar and Knab (2) repeat this error, stating: "Claw formula, 0.0-0.0-0.0" which means that the claws of the female are without teeth.

The late F. W. Edwards of the British Museum kindly informed the writer in 1936 that Theobald's description is erroneous, as the type female in the British Museum has the claws of the front and middle legs with a single tooth.

The peculiar chaetotaxic character of the fifth abdominal segment of the female abdomen, mentioned in the original description and figured by Theobald (1) on page 309, Fig. 171, was shown to be an adventitious character, as Howard, Dyar and Knab (2) state on pages 870 and 871: "*Haemagogus albomaculatus* was founded upon the presence of a large seta on the fourth [Theobald says fifth] abdominal segment; we had seen no specimen showing such a characteristic and suspected an error. Mr. [August] Busck has examined the type of *albomaculatus* in the British Museum at our request, and reports: 'Three specimens from British Guiana from Dr. Low, one of them labeled type; on the type specimen there is a small, probably extraneous, hair on the fourth abdominal

[1]Numbers in parentheses refer to the numbered citations in the bibliography below.

segment, which I can not perceive in the other two specimens which appear quite smooth.' It therefore appears from Mr. Busck's examination that this seta is extraneous, and upon its elimination from the description, we are able to recognize the species. It is evidently the one described by Dyar and Knab (3) as *Haemagogus regalis.*"

Howard, Dyar and Knab were misled in believing *regalis* to be the same species as *albomaculatus,* as they did not know that the type female of *albomaculatus* had toothed claws. The female of *H. regalis* has claws without teeth.

The writer collected larvae from a tree hole near the Penal Colony at Mazaruni, near Bartica, on the Mazaruni River, in British Guiana in 1936. He obtained a single male and several females from these larvae. Unfortunately, the preserved larval skins and the dissected male terminalia were destroyed when his laboratory was moved from the Panama Canal Zone to Washington, D. C. No notes were made on the larval characters, but drawings of the dissected parts of the terminalia were made. In 1944, Dr. Hervé Floch, Director of the Pasteur Institute in Cayenne, French Guiana, sent the writer a single male from Haute-Mana in French Guiana, which proved to be the same as the male from British Guiana. This specimen has likewise been destroyed. The drawing of the male terminalia from Mazaruni has been compared with the terminalia of the single male from British Guiana in the U. S. National Museum, and the two terminalia were found to agree. Dyar (4) states: "The present male from the same general region [of British Guiana] has been arbitrarily assigned to *albomaculatus.*" Dyar's description of the male terminalia and his figure 104 (4) are erroneous. The slide from which the figure was drawn is over-pressed, and details are difficult to make out. He states: "Claspette stout and even, narrowest centrally, the tip triangularly widened and truncate; filament small, inserted on the whole tip, but projecting from the outer angle as a short, stout spine . . . Mesosome an elliptical plate."

Levi-Castillo (5) purports to describe the male terminalia of *albomaculatus,* but he merely translates into Spanish Dyar's (4) description of the claspette, and his figures of claspette and mesosome (2b and 2c) are erroneous. His illustrations may be "garantizadas 100% como originales; cualquier parecido con las de otros trabajos es sólo una coincidencia, todo basado sobre ejemplares representativos de las faunas regionales de América del Sur." Translated, this reads: "guaranteed 100 per cent original; any resemblance to those of other works is just a coincidence, as all are based on representative specimens from the regional fauna of South America." In a letter dated February 19, 1953, Levi-Castillo repeats these statements.

saying: "... I must make clear that the pictures were made from actual specimens that were sent to me by the following persons ... Dr. Hervé Floch (*H. albomaculatus* pictured in my work [5] was reproduced with camera lucida from an (sic) specimen, actually photographed and kept in our files for observations like yours [Komp], from French Guiana)" and Levi-Castillo also sent photomicrographs of parts of the male terminalia which show very well the cleft apex of the mesosome; the photograph of the claspette shows that the large leaf at its apex was folded over, the edge thus making a straight line, as shown in his figure 2b. But one wonders how Levi-Castillo's artist got the concept of the mesosome shown in his figure 2c, which shows an apical point[2]—instead of the cleft apex so well shown in Levi-Castillo's photomicrographs. It is an author's responsibility to see that his artist makes correct drawings.

Description of male terminalia of Haemagogus albomaculatus Theobald

The following description, photomicrographs and drawings are taken from slide No. 1465 in U. S. National Museum collection, which is mounted with 8th sternite nearest the glass slide, i.e., wrong side up. The locality is Plantation Porars Major, Georgetown, British Guiana, collector H. W. B. Moore, but no date is given. Clasper (dististyle) (Fig. 1, upper arrow) moderate, about half the length of the sidepiece, curved inward, with a rather long, cylindrical terminal spine, slightly curved near apex (Fig. 1, upper arrow). Sidepiece (basistyle) somewhat conical, without an apical lobe; basal lobe small, with many long flattened setae (Fig. 2, upper black arrow). Ventral distal margin clothed with long striate lanceolate scales. Tenth sternites with rounded cap-like chitinized tips, with a few fine hairs below them. Lobes of ninth tergite poorly developed, bearing two long setae on each lobe. (The tubercles from which these arise are seen to the left of the lower black arrow in Fig. 2.) Mesosome (Figs. 3 and 5) with apex cleft, forming a deep sulcus, with two terminal projections. At the base of the sulcus is a triangular beak-like chitinized

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[2]The figures drawn by Levi-Castillo's artist are remarkably like many figures from the works of others to whom no credit is given. Fig. 1b of the claspette of *H. splendens* appears to be redrawn from Plate IV, Fig. 5, of Kumm et al. (6). Evidently Fig. 6b is from Kumm's Plate IV, Fig. 6, of the claspette of *H. lucifer*. Figs. 7b and 9b are from Kumm's Plate IV, Figs. 8 and 7 of *H. anastasionis* and *H. chalcospilans*, respectively. Fig. 10a is redrawn from Fig. 17 on page 171 of Osorno-Mesa's paper (7), and Fig. 10b is from Osorno's Fig. 23, page 172 (7). Fig. 11b is from the same article, Fig. 11, page 168, and Fig. 11a is Osorno's Fig. 6, page 167. Fig. 12b is from Cerqueira and Antunes (8), Plate 3, Fig. 14a. Fig. 14b is from Plate 3, Fig. 14, of the same article (8) except for a few extra meaningless additional frills.

point. Body somewhat widened laterally, at about two-thirds the distance from base to apex. Spines absent on dorsal surface below the apex. (The mesosome of *albomaculatus* is unique in form among all other known species of *Haemagogus*. In this genus the apex of the mesosome is produced into a median point, sometimes short, sometimes very long and beak-like, as in *H. spegazzinii falco* Kumm et al. In *albomaculatus* the apex is cleft, as noted above.) Claspette (Figs. 4 and 6) with a very long stem, sharply curved laterally towards apex at middle, minutely pilose on basal half with a single short seta arising near base; triangularly expanded at apex, and bearing a very large flattened filament, almost semicircular in

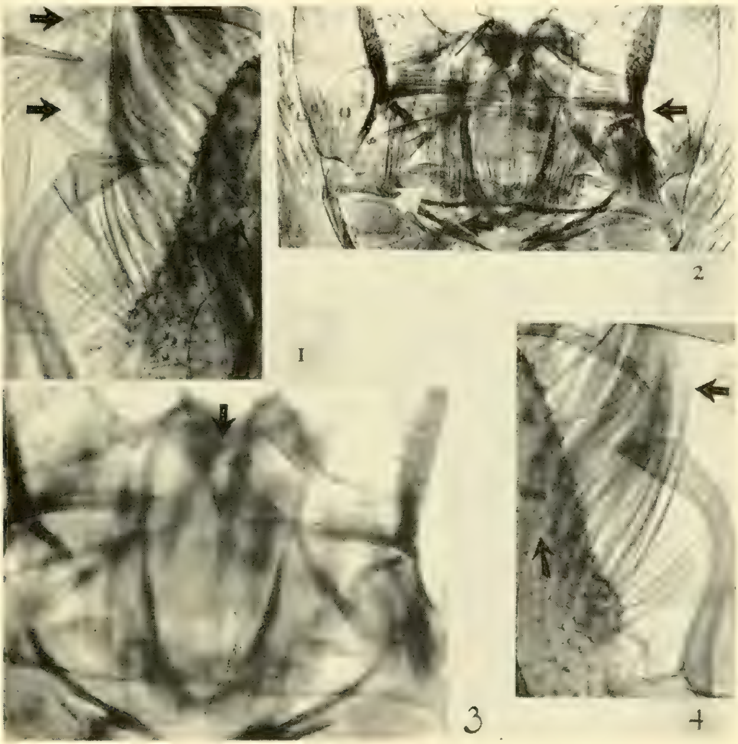

Fig. 1, clasper and terminal spine (upper arrow), filament of right claspette (middle arrow); tip of claspette filament (lower arrow); fig. 2, basal lobe of sidepiece, showing flattened setae (upper black arrow); eighth tergite, showing lanceolate scales mesially, and stout setae laterally (white arrow, at left); two tubercles of ninth tergite, bearing curved setae (lower middle black arrow); fig. 3, mesosome; the arrow points to the apical sulcus, below which is a triangular chitinized point; fig. 4, filament of left claspette (upper arrow); behind filament is the terminal spine of left clasper; tip of claspette filament (lower arrow).

outline, the tip narrowed to a point which projects well beyond the end of the claspette. Eighth tergite (Fig. 2, lower white arrow) with many long lanceolate striate scales mesially, with a few long, stout setae laterally.[3]

H. albomaculatus seems to be generally distributed in the Guianas, as the writer collected larvae at Mazaruni, British Guiana, and Dr. Hervé Floch obtained adults, including males, at Haute-Mana, French Guiana; the writer confirmed Dr. Floch's identification of the latter. It seems to be the commonest species found in this region, although *H. spegazzinii* has been found in French Guiana by Floch (9). During six weeks of intensive collecting at Mazaruni, the writer obtained *albomaculatus* only. It probably is an efficient vector of jungle yellow fever as Sneath (10, 11) examined many persons, including Amerindians from the interior of British Guiana, and found that 43.5 per cent showed yellow fever immune bodies in their blood; Schüffner et al. (12, 13) reported similar findings among the natives in Dutch Guiana.

H. albomaculatus could probably be reared in an insectary, as it belongs to a group of *Haemagogus* species in which the males have densely plumose antennae, and of which the females have toothed claws and no setae on the postnotum. Several species of this group have been successfully colonized, and have been shown to be efficient vectors of yellow fever in the laboratory (14).

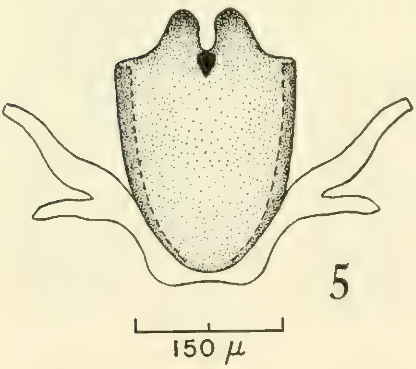

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Fig. 5, mesosome, showing apical sulcus, beak-like point, and lateral arms; fig. 6, left claspette, showing large apical filament.

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[3]Acknowledgement is made of the skillful assistance of Mr. Vernon Taylor of the National Institutes of Health, in photographing the terminalia, and of Mrs. Frances Rose of the same organization, for the line drawings in Figs. 5 and 6.

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ENTOMOLOGICAL SOCIETY OF WASHINGTON
632ND REGULAR MEETING, JANUARY 7, 1954

The 632nd meeting of the Society was called to order at 8:00 P.M., by President Gurney, in room 43 of the U. S. National Museum. Fifty-five members and 34 visitors squeezed in. The minutes of the preceding meeting were read and accepted.

The following were elected to membership in the Society:

Albert F. Sander, Buildings and Grounds Branch, Directorate of Installations, Headquarters, U.S. Air Force, Washington 25, D.C.

Donald R. Johnson, Division of International Health, U.S. Public Health Service, Washington 25, D.C.

Clyde F. Rainwater, Entomology Research Branch, Plant Industry Station, Beltsville, Maryland

President Gurney announced that an honorary doctorate had been conferred on R. E. Snodgrass by the University of Tübingen.

New committees named by President Gurney are as follows: Membership, J. H. Fales, chairman, E. R. McGovran, Helen Louise Trembley, D. A. Young, and C. H. Hoffmann: Program, F. F. Smith, chairman, H. S. Fuller, P. A. Woke, O. L. Cartwright, and R. H. Arnett; Notes and Exhibition of Specimens, F. L. Campbell, chairman, G. L. Hutton, J. F. G. Clarke, G. W. Wharton, and R. H. Nelson; Memoirs, R. H. Foote, chairman, W. E. Bickley, and K. V. Krombein; Reserve Stock, Helen Sollers and R. I. Sailer; Advertising, R. H. Nelson; Auditing, Howard Baker and W. B. Wood.

One of the problems most actively discussed at the Rome meeting of the Food and Agriculture Organization of the United Nations in November, 1953, was the control of the desert locust in the Middle East, S. B. Fracker told the meeting.

George L. Hutton exhibited specimens of termite damage to polyvinyl chloride coverings used experimentally by the Navy for communication lines.

M. D. Leonard called the attention of the Society to ''The Comstocks of Cornell,'' completed by G. W. Herrick from the biography on which Mrs. Comstock was working at the time of her death.

On the regular program, reports on the Los Angeles meetings of the Entomological Society of America were given by E. F. Knipling, P. W. Oman, R. W. Sherman, and T. R. Gardner.

George B. Vogt's talk on ''Observations of an Entomologist in Burma'' was richly illustrated with color slides. The malaria control program in the Shan States was concerned principally with *Anopheles minimus* Theob., a proved vector. In places such as on Inle Lake, where *A. minimus* is absent, malaria incidence is very low. At Akyab on the Arakan Coast, *A. sundaicus* Rod. was a problem in silted channels cut off from tidal action and about paddy fields reclaimed from mangrove swamp by means of dikes. In the Arakan, heavy incidence of malaria in areas remote from *A. sundaicus* breeding places indicated other possible vectors. On the basis of human biting records, *A. aconitus* Don. was the principal suspect but no gland or gut infections were found in the course of dissections of this mosquito.

Kodachrome slides were shown of various Burmese insects, including hispine and buprestid beetles and their habitats, both as larvae and adults. By far most of the 160 spp. of Buprestidae collected by the speaker while in Burma develop in living plant tissues, not dead wood. The same is true of the Cerambycidae. Hispine beetles occurred principally on monocotyledonous plants. *Dendrocalamus strictus,* one of the most widespread bamboos of Burma, supports the greatest diversity of hispines with no less than 23 species being associated with it, some boring the culm, others mining, skeltonizing or rolling the leaf blades, some working in the uncurling terminal blades and still others being invariably associated with lepidopterous blade tiers. Palm hispines to a great extent were found to depend upon, for their habitat, twining vines mostly convolvulaceous, to bind the unfolding new fronds. (Speaker's abstract.)

The meeting concluded with the introduction of A. L. Moffat, former chief of STEM, to which Mr. Vogt was assigned, Mr. L. F. Curl, Regional Director of the Plant Pest Control Branch in San Antonio; Dr. Henry S. Fuller, and Robert D. Murrill, from the C. D. C., headquarters in Atlanta.

The meeting adjourned at 10:20 P.M.

KELLIE O'NEILL, *Recording Secretary*

ENTOMOLOGICAL SOCIETY OF WASHINGTON 633RD REGULAR MEETING, FEBRUARY 4, 1954

The 633rd meeting was held in room 43 of the U. S. National Museum Thursday, February 4, attended by 61 members and 33 visitors. President Gurney called the meeting to order at 8:00 P.M., and the minutes of the previous meeting were read and approved.

The report of the Treasurer for 1953 was given by E. P. Reagan; of the Custodian, by H. J. Conkle; of the Corresponding Secretary, by A. M. Vance; and of the Editor, by B. D. Burks. President Gurney commented on the success of R. H. Nelson's work on advertising and the benefit of advertising as a source of revenue to the Society. Howard Baker gave the report of the auditing committee on the books of the Treasurer and the Custodian.

Three new members were elected to the Society:

Bernard Krafchick, Insect Control and Research, Inc., Johnnycake Rd., Baltimore 7, Md.

Richard B. Selander, University of Illinois, Urbana, Ill.

Horace V. Wester, National Capital Parks, Department of Interior, Washington 25, D. C.

E. N. Cory has invited the Society to hold the June picnic meeting at the University of Maryland, President Gurney announced, and the Executive Committee accepted Dr. Cory's invitation in behalf of the Society.

R. A. St. George told of the publicity obtained to commemorate 100 years of professional entomology, through the use of stamp cancellations, by the Washington, D. C. Pest Control Association. ''Fight Your Insect Enemies,'' will appear on three-fourths of the 750,000 to 850,000 pieces of mail cancelled in Washington every 24 hours.

E. N. Cory exhibited the recently-published book, ''An Entomologist's Quest,'' the story by the Dr. C. L. Marlatt of his world-wide search for the native home and natural enemies of the San Jose scale.

The address of the retiring President, Dr. W. H. Anderson, was on ''Systematic Entomology—Then and Now.'' [Abstract]

A century ago, systematic entomologists had, as available ''tools,'' literature, physical equipment, collections, and an understanding of the basic principles of zoological nomenclature, much as we do today. The principle differences between conclusions drawn earlier and those at present are found in the approach to the problems of relationships and differences between species. It is being realized with increasing frequency that solutions of such problems can no longer be solved on observed structural characters alone. Differences in ecological relationships, physiology, genetics, and geographical distribution, must be considered, together with anatomical characters. It must be realized that the progress already made is insignificant when compared with that which will be made in the future, but to make significant inroads on the problem there will be required many more research workers than are available at present. (Speaker's abstract.)

The remarkable film, ''Scrub Typhus Disease in Japan,'' prepared by the Laboratory of the Institute for Infectious Diseases, University of Tokyo, was shown.

This moving picture, showed in perfect focus, the extremely minute forms in the life cycle of the tsutsugamushi chigger.

Visitors introduced were Dr. Hugo Jamnback of the New York State Museum at Albany, and Mrs. Jamnback; Major Arthur S. Kidwell and Captain Thomas T. Harriss, from the Second Army Headquarters at Fort Meade; Miss Grazia Principi, Florence of Italy, here on a Fulbright scholarship to observe methods of teaching entomology and related subjects in secondary schools; and Mr. D. M. Anderson, Cornell University student. Society members were also pleased to see Dr. A. G. Böving and Mrs. Böving.

The meeting adjourned at 9:35 P.M.

KELLIE O'NEILL, *Recording Secretary*

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1953

TREASURER

General Fund		
Cash on hand, January 1, 1953	569.27	
Receipts from all sources during 1953	2728.63	
Total		$3297.90
Cash and securities on hand, January 1, 1953	-8.32	
Expenditures during 1953	3306.22	
Total		$3297.90
Memoir Publication Fund		
Cash on securities on hand, January 1, 1953	5318.42	
Receipts and earnings during 1953	1880.83	
Total		$7199.25
Cash and securities on hand December 31, 1953	4525.45	
Expenditures during 1953	2673.80	
Total		$7199.25

Respectfully submitted,

E. P. REAGAN, *Treasurer*

Corresponding Secretary

Membership, January 1, 1953		500
Reductions:		
Resigned	17	
Deceased	3	20
Total		480
Elected to membership during 1953		24
Total membership, December 31, 1953		504
Net gain in membership 1953		4
Classes of Membership		
Active, dues paying		482
Retired		15
Honorary		2
Life		5
Total		504

The membership is distributed among 42 States, the District of Columbia, 6 territories, and 21 foreign countries.

Distribution of *Proceedings*:	
To members	489
To subscribers	207
Total	696

The Proceedings goes to members and subscribers in 47 States, the District of Columbia, 6 territories, and 41 foreign countries.

Respectfully submitted,
ARLO M. VANCE, *Corresponding Secretary*

Custodian

Items sold:	
Miscellaneous papers and reprints	$ 36.53
Miscellaneous volumes and copies of the Proceedings, including two compete sets	529.15
Memoirs	1352.40
Total	$1918.08

Memoirs:

	Distributed 1953	On hand Dec. 31
Memoir No. 1	3	123
Memoir No. 2	3	63
Memoir No. 3	20	291
Memoir No. 4	233	1096

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

Copies of the complete reports are on file with the Corresponding Secretary.

Actual publication date, Vol. 56, No. 2, May 13, 1954.

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.

OFFICERS FOR THE YEAR 1954

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.

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 56 AUGUST 1954 NO. 4

TWO NEW FLEAS OF THE GENUS ARAEOPSYLLA JORDAN AND ROTHSCHILD, 1921

(SIPHONAPTERA)

By ROBERT TRAUB, *Lt. Col., MSC, Department of Entomology, Army Medical Service Graduate School, Washington, D. C.*

During public health research activities in Egypt and Thailand, the U. S. Naval Medical Research Unit No. 3 and the Special Technical and Economic Mission of the Public Health Service, respectively, collected ectoparasites of unusual interest. Among the Siphonaptera sent to the Army Medical Service Graduate School for study were two new species of the genus *Areaopsylla* Jordan and Rothschild, 1921, which are described below.

The genus *Araeopsylla* includes three previously described species of fleas parasitizing bats in widely separated regions of the world. The genotype, *A. scitulus* (Rothschild, 1909), is known only from South Africa. *A. martialis* (Rothschild, 1903) has been reported only from the Island of Réunion, in the Malagasy subregion. *A. gestroi* (Rothschild, 1906) was originally described from Italy, but females from Ceylon have been identified as this species (1).[1]

Included in the present paper are illustrations of pertinent features of *A. gestroi*, made from the male holotype, in the British Museum (Tring) collection, by F. G. A. M. Smit.

Araeopsylla wassifi, new species

Diagnosis.—Near *A. gestroi* (Rothschild, 1906) but separable as follows: Apex of crochet conspicuously beak-shaped, fig. 20, *CR.*,[2] not subtruncate, fig. 3. Apex of manubrium, fig. 15, *MB.*, quite narrow, about seven times as long as broad at midpoint and somewhat inclined ventrad, instead of being broad (about one-third as broad at midpoint as long) and somewhat upturned, fig. 5. Ninth sternum of male with distal arm, fig. 11, apically narrowed and produced into a short snout instead of being broad and subrounded, fig. 6.

Description.—*Head*, fig. 7, *Male.* Frontoclypeal margin evenly curved. The curved row of preantennal bristles below the submarginal anterior

[1]Figures in parentheses refer to entries in the bibliography below.
[2]For explanation of abbreviations, *see* Proc. Ent. Soc. Wash. 54:2, 1952.

and dorsal clear area consisting of about 16 or 17 short bristles, of which the dorsalmost are the longest, especially that bristle bordering antennal groove. Other preantennal bristles as follows: two submedian bristles at level of apex of second antennal segment (when *in situ*); a third bristle in a horizontal line with these two, but alongside antennal groove; with a similar bristle immediately above this, also near groove; ocular bristle, *O.B.*, very long, bordering antennal fossa and inserted above base of genal process. Anterior spine of genal ctenidium apically subtruncate, slightly broader and shorter than second, which is apically more ovate. Maxillary lobe with dorsal margin distinctly concave so that lobe is subapically expanded; distal margin truncate, not extending to apex of third segment of maxillary palpus, *M.P.*, or apex of first segment of labial palpus, *L.P.* First segment of maxillary palpus the longest; nearly twice as long as second segment. Labial palpus four-segmented, not reaching much beyond proximal third of forecoxa. Second antennal segment with a lightly sclerotized flange which is as long as segment proper and which covers proximal four or five segments of club; the bristles of the segment moved distad to apex of flange and with conspicuous pore channels. Postantennal region with four irregular rows of bristles, arranged 3-4-5-6; in addition, with a few irregular, fairly long bristles which, with ventralmost of above rows, form an oblique row bordering antennal fossa, and a group of four subspiniform bristles at ventrocaudal angle; the uppermost of the spiniforms the longest. Dorsal margin of postantennal region heavily sclerotized, the incrassations delimited by bases of dorsal bristles. First vinculum, *VC.-1*, dilated at each end; this link plate received in a very distinct sinus in prosternosome. The tentorial bridge, *T.BR.*, arising midway between first vinculum and uppermost of spiniform bristles at ventrocaudal angle of head.

Thorax.—Pronotum with two rows of bristles and dorsal incrassations similar to those of postantennal region of head. Second vinculum, *VC.-2*, with spiracle inserted at level of base of lowermost spine of pronotal ctenidium. Pronotum with a comb of about 10 spines per side. Mesonotum incrassate in manner suggesting pronotum and other terga; mesonotum with a clump of bristles near anterodorsal angle; with a vestige of three rows represented by but two bristles each, the bristles subdorsal; at times with an additional, submedian bristle, between and ventral to last two rows. Mesonotal flange with three pseudosetae, two of which are subdorsal, the third ventral. Mesopleura pitched or inclined forward in manner characteristic of many bat fleas. Mesepisternum, fig. 13, *MPS.*, with a clump of about 10 or 12 bristles in anterodorsal region; with two submedian bristles immediately below this clump; with the episternal rod, *EP.R.*, of Johnson (*in litt.*) well developed. Mesepimere, *MPM.*, with a dorsal bristle and one submedian bristle; in addition with a ventral row of three or four bristles, that above spiracle long. Metanotum, *MTN.*, with three rows of bristles, the first row consisting of a dorsomarginal bristle and a longer submedian one, the second of three subdorsal or dorsal bristles and the third of three or four longer ones—this last row displaced somewhat caudad onto heavily sclerotized flange; in addition with one or two dorsomarginal small bristles. Metanotal flange with one or two apical teeth per side. Lateral metanotal area, *L.M.*, well demarcated; long and narrow, about three times as long as broad; with two well-developed submedian bristles, the dorsalmost twice as long as the ventral one. Metepisternum, *MTS.*, with a long bristle in posterodorsal region; squamulum, *SQ.*, small but distinct. Pleural arch completely lacking. Metepimere, *MTM.*, with about seven to nine medium-sized bristles in four rows, two of these caudomarginal and quite stout in relation to length. Spiracle of metepimere broadly ovate.

Legs.—Procoxa with many lateral bristles scattered over length of segment. Mesocoxa and metacoxa with very few lateral bristles, and these marginal or submarginal. Femora with a dorsomarginal row of short stiff bristles. Profemur lacking submedian bristles; with one ventromarginal bristle at base and one such subapical. Mesofemur with two or three submedian bristles; ventral margin with a basal bristle, two or three subbasal thin ones, and two subapical bristles; with one or two subapical lateral bristles. Metafemur essentially similar to mesofemur. Tibiae with some dorsomarginal bristles single, forming a false comb; the comb relatively inconspicuous because these bristles are lightly sclerotized. Paired dorsolateral tibial bristles arising from distinct notches, usually one bristle very long and thin. Pro- and mesotibiae with five such pairs; metatibia with but four. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted):

Leg	Tibia	Tarsal Segments				
		I	II	III	IV	V
Pro-	180	61	82	75	56	122
Meso-	258	182	164	108	66	129
Meta-	339	248	182	122	78	136

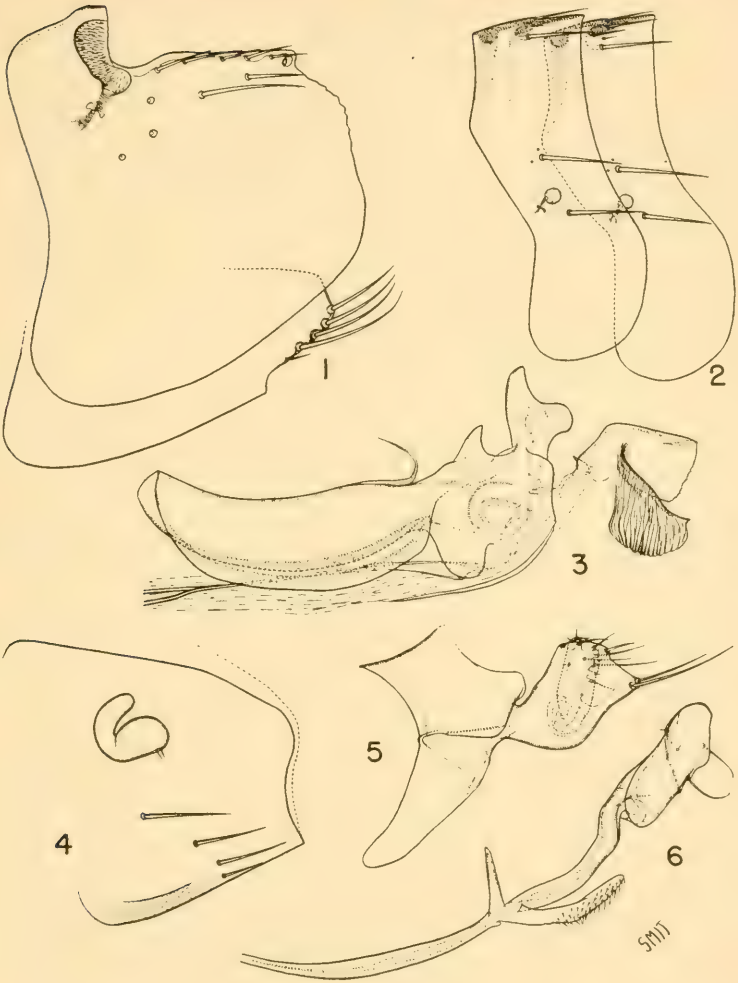
None of tarsal bristles reaching beyond apex of following segment. Tarsal segments with an ovate mesal sclerotization near apex of segment, this structure usually displaced towards the outer part of the leg. Fifth tarsal segment with four pairs of lateral plantar bristles plus a basal pair displaced mesad.

Abdomen.—First tergum with three rows of bristles, the first two reduced to but two or three bristles per side; dorsal incrassation extending ventrad as far as do bristles; flange with one or two apical teeth on each side. Basal sternum with one ventromarginal bristle per side. Dorsal margins of terga two to six deeply incrassate, the heavily sclerotized portion extending ventrad slightly more than halfway to subrounded spiracle. Terga two to six with one row of bristles developed and this reduced, interrupted, the dorsal portion of row consisting of one or two long bristles, the ventral remnant consisting of one long bristle above and another below spiracle; with a small bristle and two lucodiscs dorsad to upper spiracular bristle, the length of the gap between the two groups of bristles equal to about one and one-half times the length of the spiracular bristle; with a second, anterior, row represented by but one subdorsal bristle. First and second terga in both sexes with one apical spinelet per side. Basal sternum with one marginal bristle per side. Typical sterna in both sexes with two or three marginal or submarginal bristles. With one well-developed antesensilial bristle, figs. 15, 16, *A.B.*, in each sex.

Modified Abdominal Segments, Male, fig. 15.—Eighth tergum enclosing much of genitalia, extending ventrad to level of penis rods and caudad to near apex of aedeagal endchamber; dorsocaudal angle somewhat produced; with five to seven dorsomarginal or subdorsal bristles, and one to three submedian bristles. Eighth spiracle, *8SPC.*, very large, about two and one-half times as long as broad. Eighth sternum, *8S.*, very large, extending dorsad to ventral portion of aedeagus; somewhat narrowed apically and bearing four submarginal bristles. Immovable process of clasper, *P.* and fig. 22, with expanded portion about as long as broad, dorsally convex, evenly rounded except for somewhat flattened or concave portion near dorsocaudal angle; caudal margin fairly straight, ventral margin convex except for proximal portion. Process *P.* with two stout, conspicuous bristles at dorsocaudal angle; with two or three dorsomarginal bristles. Digitoid or movable finger, *F.* and fig. 22, almost three times as long as broad at maxima; anterior and posterior margins fairly straight and parallel except where caudal margin curves to meet subtruncate apical margin; dorsal margin with two small bristles, caudal margin with five or six marginal or submarginal bristles, four or five of which are almost as long as those on *P.* Manubrium, *MB.*, long and narrow, about seven times as long as broad at midpoint; directed ventrad but slightly curved caudad. Apodeme of ninth tergum, *T.AP.9*, extending cephalad as a thumb-like process.

Ninth sternum with proximal arm, *P.A.9*, weakly sclerotized, especially apically. Distal arm of ninth sternum, *D.A.9* and fig. 11, well developed, long and narrow but with apical two-thirds inclined dorsad, almost at right angles to basal third; this apical region sinuate and expanded distally, forming a cleaver-shaped lobe, *L.9*, whose ventral margin is subtruncate and apex produced into a slight snout. Distal arm with *L.9*, bearing three caudomarginal bristles as follows: one subapical, and one each at extremities of truncate portion; also with approximately three very small median subapical bristles. *D.A.9* with a conspicuous, elongate, tufted, semimembranous process, *9PR.*, arising near base of distal arm and extending as far apicad as base of crochet.

Aedeagal apodeme very broad, the region cephalad of apodemal strut about three times as long as broad; lateral plate, *L.PT.* and fig. 20, very prominently directed ventrad at base of pouch wall so that endchamber is extremely broad. Median dorsal lobe, *M.D.L.*, distally produced, forming a fairly narrow projection. Crochet, *CR.*, enormous, as in most bat fleas, and with a well-developed peg, *PG.*; its base massive and subquadrate; apical portion produced to form a long, conspicuous talon



Araeopsylla gestroi (Rothschild, 1906), fig. 1, male eighth tergum and eighth sternum; fig. 2, unmodified abdominal terga; fig. 3, aedeagus; fig. 4, seventh sternum and spermatheca; fig. 5, manubrium and processes of clasper; fig. 6, ninth sternum, male.

but with apex somewhat rounded. Ventral (apparently caudal) margin of crochet at times sinuate at midpoint. Sclerotized inner tube, *S.I.T.*, short, squat, subvertical. Armature of inner tube, *A.I.T.*, represented as a dorsal (apparently anterior) apical spur. Lateral sclerotization of inner tube, *L.S.I.*, an acuminate ventral projection. Apodemal strut with its lobes very stout, its dorsal lobe, *D.S.*, convex, its mesal lobe, *M.S.*, proximally broad, apically acuminate. Accessory lateral lobe of aedeagus, *A.L.L.*, broad but acuminate and extending to well-developed crescent sclerite, *C.S.* With a lateral narrow sclerite, *S.P.*, overlying *D.S.* and dorsal margin of *S.I.T.*, suggesting sidepiece of *Polygenis*, 2., and primary and secondary lateral sclerites of *Sternopsylla*, 3. Penis rods, *P.R.*, uncoiled. Ventral intramural rod, *V.I.R.*, well-developed and arising from the inconspicuous vesicle, *V.* Sensilium, *SN.*, very flat. Dorsal lobe of proctiger, *D.A.L.*, somewhat longer than broad, with two groups of bristles arranged 3-2, the apical one slightly longer. Ventral lobe of proctiger conical, with an apical tuft of bristles.

Modified Abdominal Segments, Female, fig. 16. Seventh sternum, *7S.*, with caudal margin slightly concave, with one row of about four or five bristles. Eighth tergum, *8T.*, with a very large spiracle, *8SPC.*; with two long bristles below sensilium and a longer, more median one below these; with about four caudomarginal bristles, two or three submedian bristles merging with a group of three subventral ones; with three short, stout, mesal, submarginal bristles at level of ventral anal lobe. Eighth sternum, *8S.*, quite well developed, more than half as broad as long; without bristles. Anal stylet, *A.S.* and fig. 18, about three times as long as broad, with a very long apical bristle and two rudimentary subapicals. Ventral anal lobe, *V.A.L.* and fig. 19, short; caudal margin concave, and with five marginal bristles, three of which are at ventrocaudal angle; with one submedian bristle. Spermatheca, fig. 17, with tail one and one-half times as long as head and two-thirds as broad; apex of tail slightly concave. Apex of head almost subtruncate. Bursa copulatrix, *B.C.*, very broad, its duct broad and short.

Types.—Holotype male and allotype female *ex Tadarida aegyptiaca*; Egypt: Giza Province, Abu Rawash; coll. H. Hoogstraal, 3 October 1952, for the United States Naval Medical Research Unit No. 3. Paratypes as follows: five males, six females with same data; four females *ibid.*, but *ex Tadarida teniotis*, 18 September 1952; one female *ibid.*, but *ex T. teniotis*, 22 September; one female *ex Taphozous perforatus*; Cairo, 3 October 1952, coll. H. Hoogstraal; one male and two females with same data as holotype, but coll. Kamal Wassif, 20 October 1951. Holotype and allotype in U. S. National Museum. Paratypes in collections of the Chicago Natural History Museum, the British Museum and that of the author.

Comment.—The species is named for one of the collectors, Dr. Kamal Wassif, an Egyptian scientist who has been of great assistance to the Naval Medical Research Unit No. 3 at Cairo.

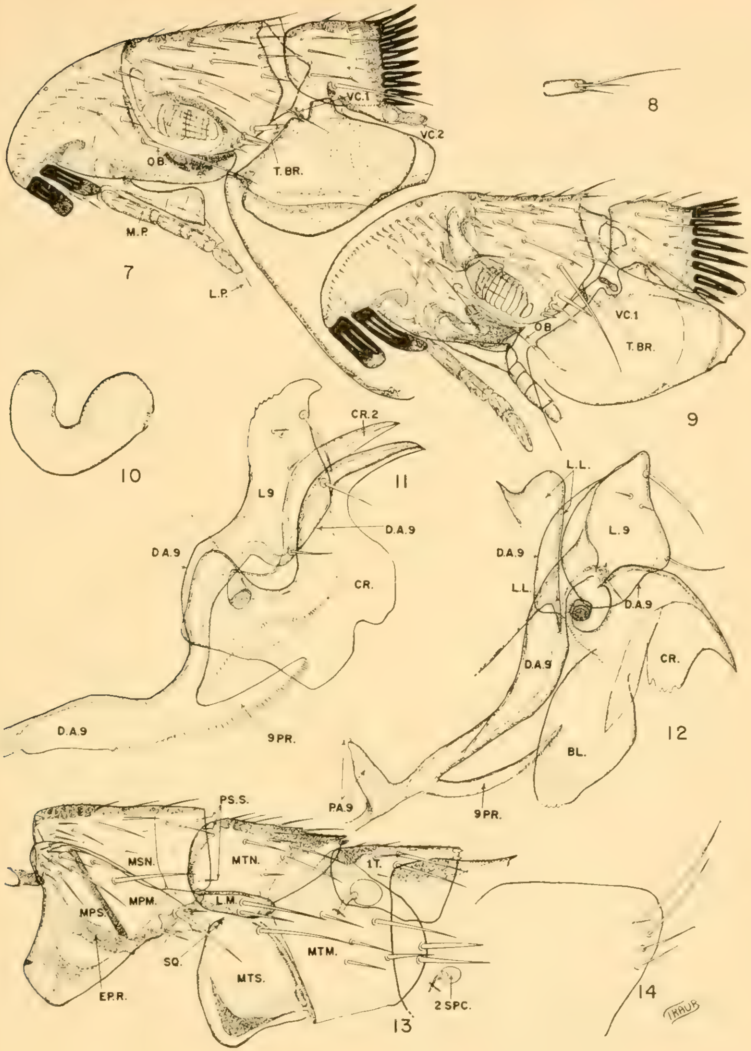


Fig. 7, *Areaopsylla wassifi*, new species, head and prothorax, male; fig. 8, *Araeopsylla elbeli*, new species, anal stylet, female; fig. 9, *ibid.*, head and prothorax, male; fig. 10, *ibid.*, spermatheca; fig. 11, *Arasopsylla wassifi*, distal arm of male ninth sternum and erochet; fig. 12, *Araeopsylla elbeli*, distal arm of male ninth sternum and erochet; fig. 13, *Araeopsylla wassifi*, meso- and metathorax; fig. 14, *Araeopsylla elbeli*, apex, male eighth sternum.

Araeopsylla elbeli, new species

Diagnosis.—Near *A. wassifi*, but immediately separable as follows: Aedeagal crochet, fig. 21, *CR.*, with a huge ventral bladder-like projection, *BL.*, which is absent in *A. wassifi*, fig. 20, *CR.* Distal arm of male ninth sternum, fig. 12, *D.A.9*, apically much broader, i.e., *L.9* is about as broad as long instead of narrowing somewhat to form a snout (*cf.* fig. 11). Process *P.* of clasper, fig. 23, *P.*, caudally produced into a thumb-like projection which is absent in *A. wassifi*, fig. 22, *P.* Female eighth tergum with spiracle relatively much broader, more than half as broad as long instead of merely one-third as broad as long.

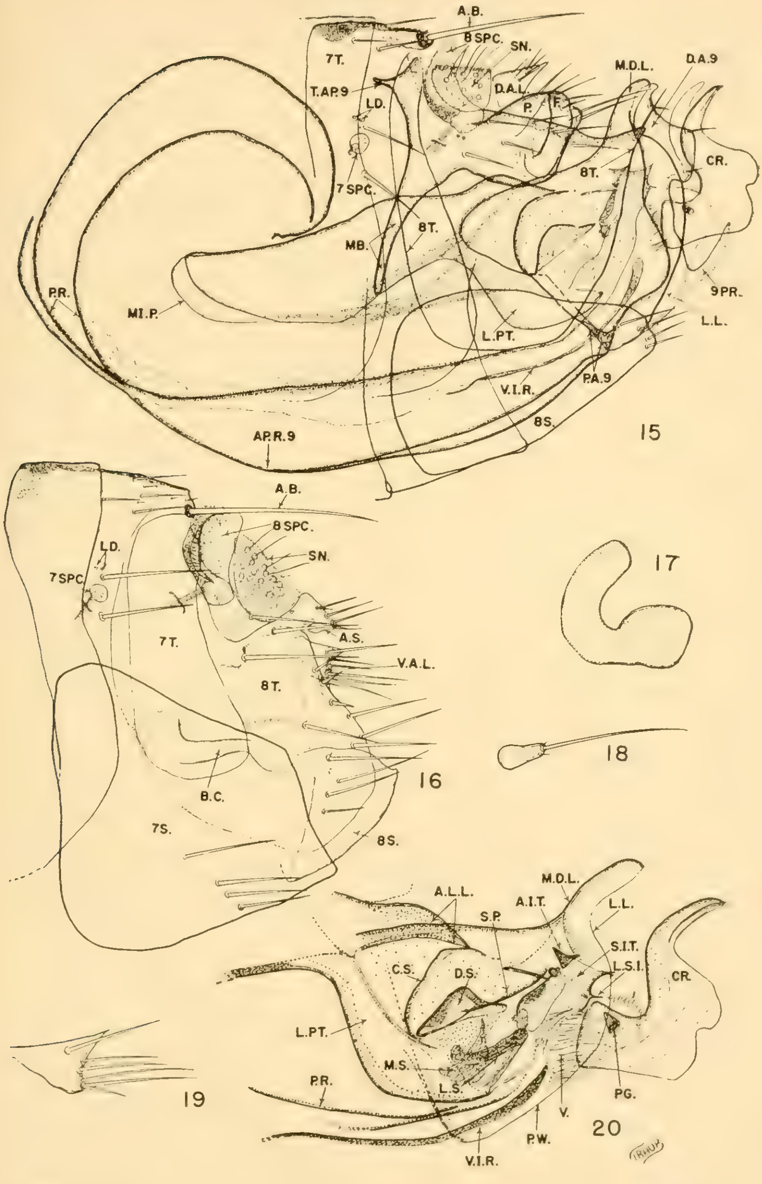
Separable from *A. gestroi* (Rothschild, 1906) as follows: Crochet fig. 21, *CR.*, apically acuminate, not subtruncate, fig. 3; the bladder-like process, *BL.*, apically subovate, not broadly rounded. Male eighth sternum caudally evenly rounded, fig. 14, not excised at insertion of marginal bristles, fig. 1. Manubrium distally downward-directed, not somewhat upturned, fig. 5. Gap between lowest subdorsal bristle of unmodified abdominal terga and that bristle above spiracle definitely smaller, i.e., shorter than length of bristle directly above or below spiracle, whereas in *A. gestroi* the gap is greater than the length of the bristles by spiracle, fig. 2.

Description.—The following description stresses differences from *A. wassifi.*

Head, fig. 9.—with a group of about 15 subdorsal bristles in area between antennal groove and row bordering clear area. Most of these short and stout, but two submedian ones long, nearly as long as the ocular bristle, *O.B.* Maxillary lobe with dorsal margin only slightly concave; apical margin somewhat concave. Maxillary palpus with second segment more than two-thirds length of first. Labial palpus short, not extending beyond apex of maxillary palpus. Antennal flange ensheathing proximal two or three segments of club. Postantennal region with five somewhat irregular rows of bristles, arranged 5-4-4-5-6, the ventralmost of first two rows forming a confused group of four to six short bristles; with a ventral bristle between last two rows; with a group of about four or five subspiniform bristles at apex of antennal groove, the uppermost by far the longest and stoutest.

Thorax and Legs.—Metepimere with four or five bristles arranged 2(3)-2. Metatibia with five pairs of dorsomarginal bristles arising from distinct notches. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted):

Leg	Tibia	Tarsal Segments				
		I	II	III	IV	V
Pro-	212	82	101	80	52	113
Meso-	306	212	174	111	71	118
Meta-	418	311	205	124	78	125



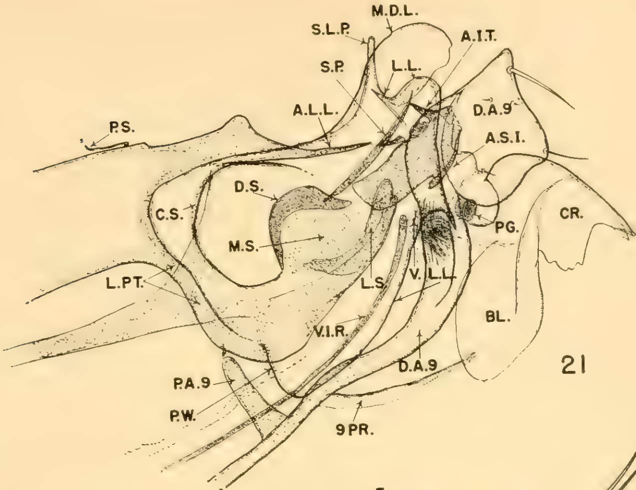
Araeopsylla wassifi: Fig. 15, modified abdominal segments, male; fig. 16, female; fig. 17, spermatheca; fig. 18, anal stylet; fig. 19, ventral anal lobe, female; fig. 20, endchamber of aedeagus.

Abdomen.—Unmodified terga with gap between lowest subdorsal bristle and the bristle above spiracle somewhat shorter than length of bristle below spiracle; with a single lucodisc above upper spiracular bristle, the second lucodisc distinctly ventrad to this bristle. Typical sterna in male with one or two ventromarginal or submarginal bristles, three in female.

Modified Abdominal Segments, Male.—Eighth tergum, fig. 25, *8T.*, with seven dorsomarginal or subdorsal bristles; in addition, with a row of three submedian bristles below first dorsomarginal and a horizontal row of four evenly spaced subdorsal bristles, the last near dorsocaudal angle. Eighth sternum, fig. 14, *8S.*, broad; somewhat ovate apically, bearing a submarginal row of four long bristles, and at times with an adjacent small subapical one. Immovable process of clasper, fig. 23, *P.*, dorsally convex, caudally produced into a conspicuous median snout, bearing two long stout bristles; with three or four fairly thin dorsomarginal bristles. Digitoid, *F.*, inserted only slightly below midpoint of process *P.*, about two and one-half times as long as broad at maxima; sides subparallel to apex; distal margin fairly straight; with two fairly stout median bristles and about six caudomarginal bristles. Manubrium about four times as long as broad at midpoint, directed ventrad. Ninth sternum with proximal arm, fig. 21, *P.A.9*, very weakly sclerotized, except for subtriangular basal portion. Distal arm of ninth sternum, fig. 12, *D.A.9*, long and narrow, but apical third expanded to form a subquadrate lobe, *L.9*, about twice as broad as remainder of arm; this lobe apically subtruncate, almost angled; with a subapical, caudomarginal bristle; ventral margin of lobe sinuate, with a fairly long bristle at ventrocaudal angle; with about two subapical or submedian short bristles.

Aedeagus, fig. 21, with crochet, *CR.*, almost twice as long as broad; dorsal margin fairly straight but apically acuminate; ventral margin usually proximally serrate; apex falcate. Crochet with a very conspicuous but lightly sclerotized bladder-like portion, *BL.*, which is as long as remainder of crochet. Lateral lobes, *L.L.*, dorsoapically produced to form a long narrow beak, *cf.* fig. 12. Lateral plate of aedeagus dorsoapically modified to form a well-developed, long dorsoapical spur, *S.L.P.*, and an acuminate accessory lateral lobe, *A.L.L.* Median dorsal lobe, *M.D.L.* paired distally broad.

Modified Abdominal Segments, Female.—Seventh sternum, fig. 24, *7S.*, with caudal margin dorsally rounded, remaining portion concave; with a row of four or five fairly long bristles; if but four, the fifth median and represented by a smaller bristle, as in figure. Anal stylet, fig. 8, about four times as long as broad, its sides mainly parallel; with a long apical bristle and two short subapical ones. Spermatheca, fig. 10, with tail longer than head and almost as broad; upcurved so that it is essentially at right angles to head; dorsal margin somewhat concave; ventral margin fairly straight. Bursa copulatrix, B.C. fig. 24, apically dilated, its duct one-half to two-thirds the diameter of the apex.



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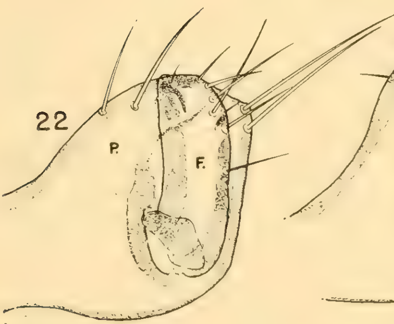

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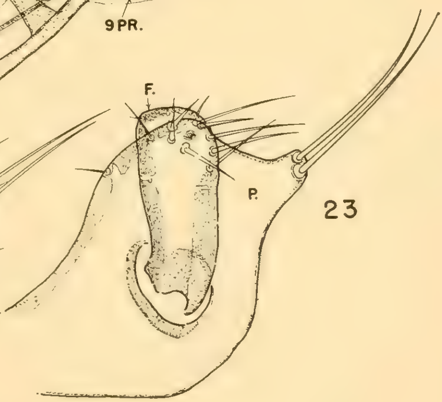

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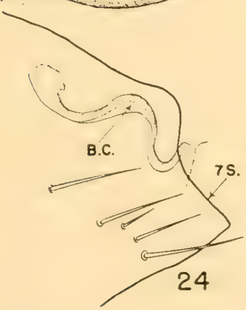

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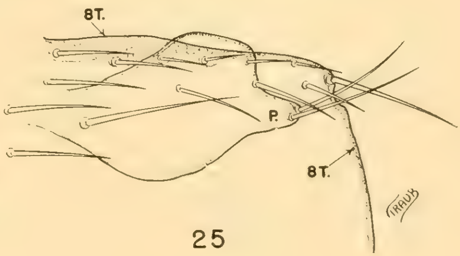

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Fig. 21, *Araeopsylla elbeli*, endchamber of aedeagus; fig. 22, *Araeopsylla wassifi*, immovable process and digitoid of clasper; fig. 23, *Araeopsylla elbeli*, immovable process and digitoid of clasper; fig. 24, *Ibid.*, seventh sternum and bursa copulatrix, female; fig. 25, *Ibid.*, eighth tergum, male.

Types.—Holotype male and allotype female *ex Taphozous melanopogon fretensis* Thomas; Thailand: Kanchanaburi, Tamoung Bantum; coll. R. E. Elbel, 5 April 1952. Two partaype males with same data. Holotype deposited in the U. S. National Museum; paratypes in the author's collection.

Comment.—The species is named for the collector, Robert E. Elbel, who, while contributing much towards the improvement of the health of the Thai people, managed to collect quantities of indigenous mites, fleas and chiggers, thus adding greatly to our knowledge of Indo-Malayan ectoparasites.

Acknowledgments

Thanks are due Mr. Harry Hoogstraal, of the Naval Medical Research Unit No. 3, and to Mr. Robert E. Elbel, of the Special Technical and Economic Mission to Thailand, for having collected and made available for study these fine species of fleas. I am indebted to F. G. A. M. Smit for having made comparisons with *Aracopsylla gestroi*, which is known only from one male and 5 females deposited in the British Museum at Tring, and for having prepared drawings of its critical characters. Miss Phyllis Johnson of the Department of Entomology, Army Medical Service Graduate School, kindly reviewed the manuscript.

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3. Traub, R. 1950. Siphonaptera from Central America and Mexico—A Morphological Study of the Aedeagus, with Descriptions of New Genera and Species, Zool. Mem. Chicago Nat. Hist., Mus. 1 (1): 1-127; pls. 1-54.

A CONSPECTUS OF THE NORTHEASTERN NORTH AMERICAN SPECIES OF GEOPHILUS

(Chilopoda, Geophilomorpha, Geophilidae)

By R. E. Crabill, Jr., *St. Louis University, St. Louis, Mo.*

The genus *Geophilus* is one of the hallmarks of the Holarctic Chilopoda for in the North Temperate Zones its members are encountered in nearly every environmental situation inhabitable by geophilomorph centipedes. Considered to be nearly exclusively Holarctic, it includes not less than eighty species, some of which are reputed to be polytypic. The majority of the known forms are Palearctic, and it is this fauna that has been subjected to the most searching analysis in the past, chiefly owing to the efforts of Meinert, Latzel, Verhoeff, and Attems. The best known North American congeners occur east of the Rocky Mountains, but west of the one hundredth meridian, in Utah, Montana, and California, only a few poorly known species have been recorded. The present revision recognizes six northeastern North American forms.

Genus **Geophilus** Leach

Scolopendra Linné [in part], Syst. Nat., ed. X, p. 637 (1758).

Geophilus Leach, Edinb. Encycl., VII, p. 409 (1814).

Arthronomalus Newport, Trans. Linn. Soc. Lond., XIX, p. 276 (1844).

Scnipaeus Bergsöe and Meinert, Naturh. Tidsskr., (3) IV, p. 95 (1866).

Orinomus Attems, Sitzenber. Akad. Wien, CIV, p. 166 (1895).

Orinophilus Cook, Proc. U. S. Nat. Mus., XVIII, p. 72 (1895).

Bothrogeophilus Verhoeff, Bronn Kl. u. Ordn., V, p. 581 (1925).

Type: *Scolopendra electrica* Linné, 1758 [= *Geophilus electricus* (Linné)]. (Monobasic).

The genus is one of the two score or so that comprise the large subfamily Geophilinae, which, together with Pachymeriinae, Chilenophilinae, and Aphilodontinae constitute the cosmopolitan family Geophilidae. Dignathodontidae, i.e. Linotaeniidae, *sensu* Chamberlin, and Scolioplanidae, *sensu* Verhoeff, is considered a family here, although Attems has accorded the group only subfamilial rank.

According to the present interpretation, six genera are represented in North America east of the Rocky Mountains: they may be distinguished by means of the following key.

1. Ultimate pretarsus tuberculate 2
   Ultimate pretarsus unguiform 3
2. Prosternal chitin lines complete. Cephalic plate subquadrate .... *Nannocrix* Chamberlin
   Prosternal chitin lines incomplete anteriorly. Cephalic plate at least 1.3 times longer than wide .... *Arenophilus* Chamberlin
3. Ventral pore *fields* absent 4
   Ventral pore *fields* present 5
4. Second maxillary syncoxite suturate medially .... *Dysmesus* Chamberlin
   Second maxillary syncoxite not suturate medially .... *Brachygeophilus* Brolemann
5. Coxopleural sutures reaching the anterior prosternal margin, or if not, then terminating very close to it .... *Geophilus* Leach
   Coxopleural sutures terminating far short of the anterior margin of the prosternum .... *Necrophlocophagus* Newport

It may be seen, then, that *Geophilus*, as it is represented in North America, is distinguished from allied genera by its possession of: an unguiform ultimate pretarsus; ventral pore fields; complete or very nearly complete prosternal coxopleural sutures (which are not to be confused with prosternal chitin lines). The following generic diagnosis applies chiefly to the northeastern North American members of *Geophilus*.

Generic Diagnosis. Antenna: less than four times longer than the cephalic plate. Cephalic plate: at most 1.3 times longer than wide, usually much less; transverse suture generally distinct. Clypeus: with or without consolidated areas (i.e. smooth, non-reticulate regions of the clypeus; when present, one lies in front of each labral side-piece); usually lacking a clypeal area but when present it merges with the coarse reticulation of the clypeus. Labrum: midpiece completely exposed, not overlapped by the side-pieces, bearing a number of strong, pigmented teeth; side-pieces with a number of fragile fimbriae. First maxillae: with long syncoxital and telopodital lappets. Second maxillae: coxites fused medially; apical claw short and robust varying to long and thin. Prehensorial segment: prosternum with distinct but incomplete chitin lines; coxopleural sutures running forward obliquely relative to the prosternal outer margins and attaining the anterior outer margin of the prosternum. Sternites: ventral pore fields present as transverse bands on the more anterior sternites, on the more posterior sternites dividing medially into two paramedian fields which are usually indistinct and which persist through the penultimate pedal sternite; in addition to the band-like pore field of each of the more anterior sternites are two small circular bilateral fields on the anterior portion of each sternite, these usually are very vague particularly upon the more posterior sternites; medial longitudinal fossulae shallow, if present; carpophagus-structures present or absent, paxilli and sacculi present or absent, consolidated or not.[1] Ultimate pedal segment: sternite subquadrate, usually slightly longer than wide, trapesoidal or nearly rectangular; pores of each coxopleuron opening into two pits bordering the sternite, or opening freely along the sternite ventrally and the tergite dorsally and absent laterally, or else opening freely upon the dorsal, ventral, and lateral surfaces uniformly; pretarsus unguiform.

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[1]The so-called carpophagus-structure, which derives its name from *Geophilus carpophagus* in which it was first noted, is characteristic of the more anterior sternites of many species. Associated with the pro- and metasternital regions of the sternite, it is a composite mechanism. It consists of a peg-like protuberance, the paxillus (new term), which projects posteriorly from the metasternite and fits into a groove, the sacculus (new term), upon the succeeding prosternite. If the paxillus or sacculus is strongly sclerotized and smooth or non-reticulate, either is said to be consolidated (new character). If, on the other hand, either is reticulate, it is said to be non-consolidated. This distinction, heretofore overlooked, is very important. Either or both structures may be present, and if present either or both or neither may be consolidated. Progressing posteriorly the carpophagus-apparatus gradually vanishes. It is invariably absent upon the more posterior sternites.

Systematic Notes.—In 1925 Verhoeff[2] presented a key to the subgenera of *Geophilus*. Three years later he published a similar though expanded arrangement.[3] Both of his subgeneric interpretations were based upon Palearctic species. In these papers Verhoeff proposed several new subgenera and accorded subgeneric rank to some groups viewed by others, Attems and Brolemann for example, as good genera, viz. *Clinopodes*, *Galliophilus*, *Brachygeophilus*, *Eurygeophilus*.

In the *Nachtrag* of his celebrated 1929 monograph on the Geophilomorpha Attems suggested that Verhoeff's subgeneric categories are, for the most part, based upon arbitrary criteria. One such genus is *Bothrogeophilus* which Attems included in the synonymy of the nominate group. In this particular instance, Attems pointed out, uniting a group of species on the basis of their possession of a large sternital carpophagus-structure [= sacculus] suggests a relationship not corroborated by other equivalent characteristics. Although one of the principal dichotomies in Attems' key to the species of *Geophilus* involves the presence of a sacculus, he makes no formal attempt at subgeneric revision.

Being well acquainted with relatively few Holarctic *Geophilus* forms, I have chosen in this paper to follow Attems' example in ignoring the Verhoeff subgeneric arrangement. This decision has also been influenced by the fact that I am unable to reconcile the New World species treated here with the systems proposed by Verhoeff in 1925 and 1928. For example, using the 1928 key one cannot be certain whether Verhoeff would have referred *G. vittatus* (Raf.) to *Nesogeophilus* or to *Onychopodogaster* if, indeed, to either. I feel sure, however, that he would have allocated the true *G. mordax* Meinert unhesitatingly to *Bothrogeophilus*. But even though such action might be justified morphologically, it cannot be nomenclatorially, as we shall see.

Verhoeff proposed the subgenus *Bothrogeophilus* in 1925 for the reception of *electricus* (Linne) and *carpophagus* Leach without stating the name of the genotype. But the type of *Geophilus* is clearly *electricus* by monotypy, so that a subgeneric revision must involve the nominate subgenus and its type, *electricus*. If we accept Verhoeff's arrangement, then *electricus* and *carpophagus*, by virtue of their possession of large sternital sacculi, are consubgeneric. Consequently no matter which of the two originally included species (of *Bothrogeophilus*) is selected as type, *Bothrogeophilus* is a synonym of the typical subgenus either subjectively (by

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[2]Bronns Klassen und Ordnungen, V, p. 581 (1925).
[3]Mitt. Zool. Mus. Berlin, XIV, p. 266 (1928).

designating *carpophagus* as type or isogenotypically through synonymy (by designating *electricus* as type). To obviate future difficulties *Geophilus electricus* is selected here as the genotype of *Bothrogeophilus* Verhoeff. Finally it should be noted that when a satisfactory subgeneric system is worked out, if *vittatus* (Rafinesque) is still included within *Geophilus*, one subgenus must be *Nemopleura* Rafinesque, 1820, whose genotype is *Mycotheres* (*Nemopleura*) *vittata* Rafinesque [= *Geophilus* (*Nemopleura*) *vittatus*], by subgeneric monotypy. This species is the senior synonym (by one year!) of the much more famous Say name, *Geophilus rubens*, 1821.

The Genotype of Geophilus.—Chamberlin, Attems, Verhoeff, Latzel, Brolemann, and others have repeatedly erred in the citation of the original publication of the generic name *Geophilus*. It first appeared in Brewster's Edinburgh Encyclopaedia in 1814, a year before it was published in the Transactions of the Linnaean Society of London, the journal to which most authors have ascribed its initial appearance. Originally the genus included only one species, *electricus* (Linne), which is its genotype by monotypy. The species usuall understood to be the type, *carpophagus* Leach, was not not described until 1815.

Key to the Species

1. Each coxopleuron with pores either opening into two pits often partially covered by the sternite, or opening freely along and partially under the sternite and tergite margins; no lateral pores 2
   Each coxopleuron with freely opening pores that pierce its dorsal, ventral, and lateral surfaces; pores neither opening into pits nor opening freely only along the sternite and tergite 4
2. Coxopleural pores opening into two ventral pits on each coxopleuron. Consolidated sacculi lacking. Dorsum with a distinctive series of diamond-shaped markings .... *vittatus* (Rafinesque)
   Coxopleural pores opening freely along and partially under the sternite and tergite margins. Consolidated sacculi present or absent 3
3. Consolidated sacculi absent. Prelabral consolidated areas present. 67-77 pairs of legs .... *oweni* Bollman
   Consolidated sacculi present. Prelabral consolidated areas absent. 49-57 pairs of legs .... *mordax* Meinert
4. Prebasal plate concealed. 57-67 pairs of legs 5
   Prebasal plate exposed. 45-55 pairs of legs 6
5. Prelabral consolidated areas present. Consolidated paxilli and sacculi absent. Ultimate legs very long (fig. 6) .... *varians* McNeill

Prelabral consolidated areas absent. Consolidated paxilli present; sacculi tiny, but consolidated. Ultimate legs short (fig. 8) .... *cayugae* Chamberlin

6. Large consolidated sacculi present .... *mordax* Meinert
Consolidated sacculi absent .... *ampyx*, new species

Geophilus vittatus (Rafinesque)

Mycotheres (Nemopleura) vittata Rafinesque, Annals of Nature, I, p. 8 (1820) ["highlands of New York"].

Geophilus rubens Say, Journ. Acad. Nat. Sci. Phila., II, p. 113 (1821). [Probably Philadelphia, Pennsylvania]. *New synonymy.*

Geophilus cephalicus Wood, Journ. Acad. Nat. Sci. Phila., (2)V, p. 44 (1862) [Philadelphia, Pennsylvania].

Geophilus laevis Wood, Journ. Acad. Nat. Sci. Phila., (2)V, p. 44 (1862) [Georgia].

Strigamia rubens (Say),—Wood, Journ. Acad. Nat. Sci. Phila., (2)V, p. 46 (1862).

Geophilus deducens Chamberlin, Ann. Ent. Soc. Amer., II, p. 180 (1909) [Sea Cliff, Long Island, New York]. *New synonymy.*

? *Mecistocephalus melanonotus* Wood,—Crabill, Canad. Ent., LXXXII, p. 253 (1950) [Georgia].

The lack of consolidated carpophagus-structures together with the presence of a linear series of dorsal diamond-shaped markings will readily identify *vittatus*.

Specific Diagnosis. Length: to 52 mm., averaging 25-40 mm. Color: sordid brownish-yellow to orange-yellow; always with a distinctive linear series of dorsal diamond-shaped markings (superficially appearing as a continuous black band). Cephalic plate: typically slightly longer than wide (1.15-1.2 X). Clypeus: without prelabral consolidated areas. Labrum: with 4-7 teeth on midpiece. Second maxillae: apical claw short and robust (fig. 4), not long and thin as in *varians*, *cayugae*, and *oweni*. Prebasal plate: exposed. Carpophagus-structures: paxilli and sacculi reticulate, not consolidated, very weakly developed. Ventral pore fields: transverse on sternite one through about twenty-three, thereafter extending through penultimate pedal sternite as two medially separated and almost circular fields. Pedal segments: ♂ 49-51, ♀ 49-53; anterior legs sparsely clothed with short setae. Ultimate pedal segment: legs short; coxopleural pores opening into two pits on each coxopleuron, these pits concealed in varying degrees by the lateral edges of the sternite.

Ethology. Next to *Strigamia bothriopa* Wood, this is by far the most common Geophilomorph in the Ithaca area where it may be collected in considerable numbers throughout the spring, summer, and fall. I have come upon it in a variety of habitats, under rocks and any debris that litters the ground but most frequently beneath the loose bark of fallen trees. Damp paper and rags upon the moist floor of the woods constitute favorite resting places.

During the first two weeks of July I have rarely failed to find females brooding eggs and young. Their habitations are invariably beneath the loose bark of dead though still damp trees. The female arranges her body in coils upon which the young, or eggs, rest. When disturbed she does not attempt to flee but instead searches ferociously with ready fangs for the intruder.

At Ithaca both males and females may be found very frequently among the loosely embedded rocks about the bases of large trees in early spring and late autumn. Presumably they hibernate in such sites.

Distribution. The most commonly encountered *Geophilus* in the northeast, *vittatus* ranges from Massachusetts west to Nebraska and eastern Texas and south to the Gulf coast: in the far west it is known from Utah, Arizona, and California. MASSACHUSETTS: Longwood; Braintree; Chester. CONNECTICUT: Woodbridge. NEW YORK: Ithaca; Varna; Slaterville; Robert Treman Park, Tompkins county; Etna, Tompkins county; Taughonnock Falls State Park, Tompkins county; Ringwood Wild Flower Preserve, Tompkins county; Caroline; Elmira; Lloyd-Cornell Reserve, Tompkins county; Cayuta; Lisle; Syracuse; Forbes Manor; Essex county; Albany; Gloversville; Normal; Altamont; Bay Shore; Sea Cliff; Rensselaer; Bronx Park; New York City; Wilmont; Fishkill; Kenwood. PENNSYLVANIA: Philadelphia. MARYLAND: Cumberland; Frederick county; Charles county. VIRGINIA: Charlottesville; Sugar Hollow; Clifton Forge; Fairfax county; Wythe county; "near Washington, D. C." OHIO: (no locality given). KENTUCKY: Louisville. INDIANA: Dune Acres; Tremont; Bloomington; Upland; Brookville. ILLINOIS: Aurora; Glenview; Cook county; Plano; Mahomet; Champaign; Nor-

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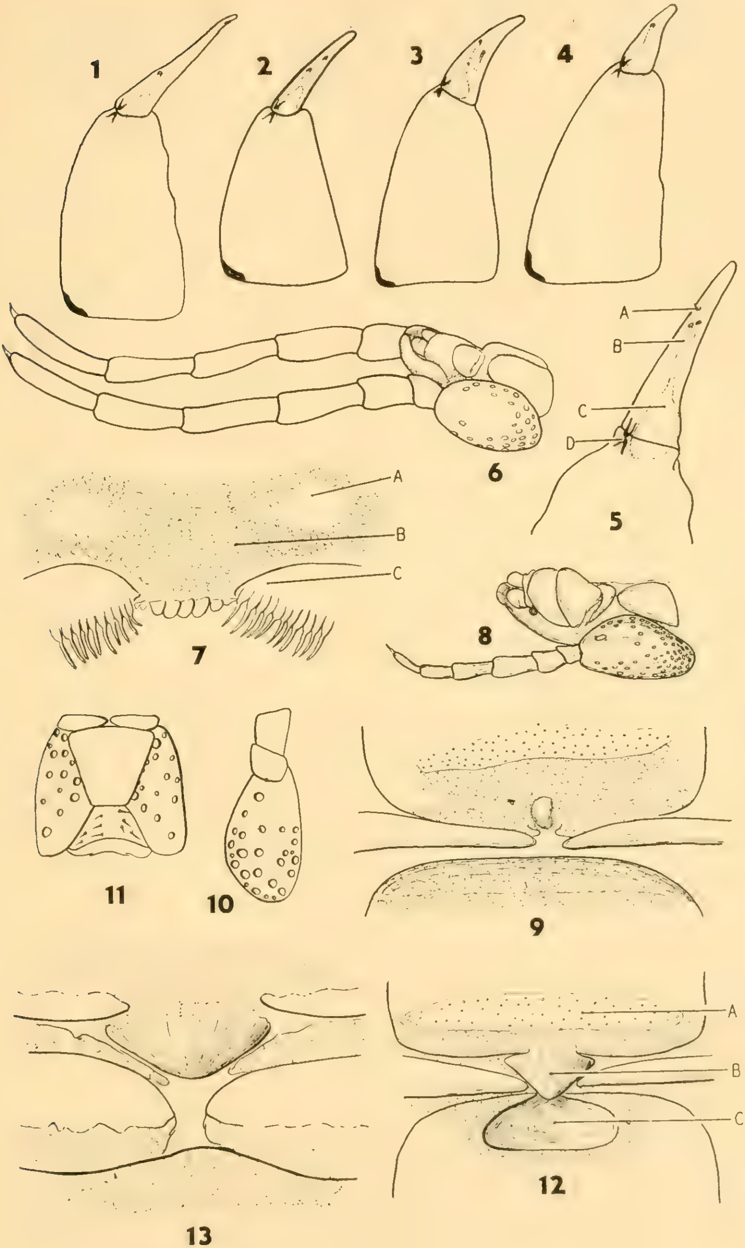
Figures 1-5 illustrate the second maxillary, right telopodital ultimate article, and apical claw. Fig. 1, *Geophilus oweni* Bollman; fig. 2, *G. cayugae* Chamberlin; fig. 3, *G. mordax* Meinert; fig. 4, *G. vittatus* (Rafinesque); fig. 5, *G. varians* McNeill, A, pore, B, canal, C, reservoir (?), D, condyle; fig. 6, *G. varians* McNeill, ultimate pedal and postpedal segments, left ventro-lateral aspect (due to perspective, pores apparently absent laterally); fig. 7, *G. oweni* Bollman, part of mandible and clypeus, A, prelabral consolidated area, B, clypeus, C, mandibular side-piece; fig. 8, *G. cayugae* Chamberlin, ultimate pedal and postpedal segments, left ventro-lateral aspect; fig. 9, *G. ampyx*, new species, eighth metasternite and ninth prosternite; fig. 10, *G. ampyx*, new species, right coxopleuron, lateral aspect; fig. 11, *G. ampyx*, new species, ultimate pedal segment, ventral aspect; fig. 12, *G. mordax* Meinert, ninth metasternite and tenth prosternite, A, pore field, B, paxillus of segment IX, C, sacculus of segment X; fig. 13, *G. cayugae* Chamberlin, fifth metasternite and sixth prosternite, showing consolidated paxillus, tiny consolidated sacculus of segment VI concealed.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mal; Chicago; Galesburg; Urbana; Franklin Grove. WISCONSIN: Delavan; Antigo. MICHIGAN: Ann Arbor; Douglas Lake; Saugatuck; Saunders; Plymouth; Willow Run. ONTARIO: Ottawa; Toronto; Amprior.

Geophilus oweni Bollman

Geophilus oweni Bollman, Proc. U. S. Nat. Mus., X, p. 623 (1887) [New Harmony, Indiana].

Geophilus missouriensis Chamberlin, Ent. News, XXXIX, p. 152 (1928) [St. Charles, Missouri]. *New Synonymy.*

The lack of consolidated sacculi, the numerous pedal segments, the prelabral consolidated areas, and the remarkably long, thin second maxillary apical claws will readily identify *oweni*.

Specific Diagnosis. Length: to 40 mm. Color: bright yellow to dilute yellow; without special dorsal markings. Cephalic plate: slightly longer than wide (1.15-1.18 X). Clypeus: with distinct prelabral consolidated areas (fig. 7). Labrum: midpiece with some five teeth. Second maxillae: apical claw extremely long and thin to a degree not paralleled in any of the other species (fig. 1). Prebasal plate: exposed. Carpophagus-structures: consolidated paxilli on sternites four through fourteen; consolidated sacculi lacking. Ventral pore fields: transverse, single on sternites one through twenty-two or so, thereafter breaking medially into two weakly defined fields which are represented by only a few scattered pores upon the penultimate sternite. Pedal segments: ♂ 67-73, ♀ 71-77; anterior legs clothed with numerous long setae. Ultimate pedal segment: legs short; each coxopleuron with a few large pores opening along the sternite and tergite margins, lateral pores absent.

Distribution.—Except for Jefferson City, and St. Charles, Missouri, the species is known only from New Harmony, Indiana and from Ohio.

Geophilus varians McNeill

Geophilus varians McNeill, Proc. U. S. Nat. Mus., X, p. 332 (1887) [Bloomington, Indiana].

Geophilus lanius Brolemann, Ann. Soc. Ent. France, LXV, p. 51 (1896) [North Carolina].

Geophilus legiferens Chamberlin, Ann. Ent. Soc. Amer., II, p. 182 (1909) [Washington, D. C.]. *New synonymy.*

Pleurogeophilus lanius (Brolemann), Attems, Tierreich, LII, p. 199 (1929).

The complete lack of consolidated paxilli and sacculi together with the concealed prebasal plate and the remarkably long ultimate legs will distinguish this handsome species.

Specific Diagnosis. Length: to 40 mm., averaging 30-35 mm. Color: light sordid yellow to whitish-yellow; without special dorsal markings. Clypeus: with a pair of distinct prelabral consolidated areas. Cephalic plate: much longer than wide (ca. 1.3 X). Labrum: midpiece with some 8-11 robust teeth. Second maxillae: apical claw long and thin, fig. 5. Prebasal plate: concealed. Carpophagus-structures: absent. Ventral pore fields: fields on sternites one through about twenty are transverse, thereafter breaking medially into two poorly defined and nearly circular groups, these detected on the penultimate pedal sternite with great difficulty. Pedal segments: ♂ 53-59, ♀ 55-61; anterior legs clothed with numerous long setae. Ultimate pedal segment: legs very long, much longer than their homologues in the other species; coxopleural pores opening freely, uniformly distributed dorsally, ventrally and laterally, fig. 6.

Distribution. From South Carolina north to Indiana, Ohio, and Pennsylvania.

PENNSYLVANIA: Morgan Creek, Berks county. DISTRICT OF COLUMBIA: Washington. VIRGINA: "near Washington, D. C."; Charlottesville; Lowmoor; Hot Springs Valley; Clifton Forge; Vesta; Blacksburg. KENTUCKY: Louisville. OHIO: Good Hope Township, Hocking county; Cleveland. INDIANA: Bloomington; Salem; New Providence.

Geophilus cayugae Chamberlin

Geophilus cayugae Chamberlin, Proc. Acad. Nat. Sci. Phil., LVI, p. 655 (1904) [Ithaca, New York].

The presence of well-developed paxilli, of weakly consolidated sacculi, and of a concealed prebasal plate together with the lack of prelabral consolidated areas will identify *cayugae*.

Specific Diagnosis. Length: to 68 mm., averaging 25-40 mm. Color: bright whitish-yellow; without special dorsal markings. Cephalic plate: longer than wide (ca. 1.2 X). Clypeus: prelabral consolidated areas absent. Labrum: midpiece with some 6-9 teeth. Second maxillae: apical claw long and thin (fig. 2). Prebasal plate: concealed. Carpophagus-structures: paxilli consolidated, large, on sternites three through about sixteen; sacculi each consisting of a small almost circular consolidated area on sternites seven through twelve (fig. 13). Ventral pore fields: fields transverse and single on sternites one through twenty-three or so, thereafter dividing medialy into two fields which persist through the penultimate pedal sternite. Pedal segments: ♂ 57-65, ♀ 63-67; anterior legs sparsely clothed with setae. Ultimate pedal segment: legs much shorter than those of *varians;* coxopleural pores opening freely dorsally, ventrally, and laterally (fig. 8).

Ethology. I have found the members of this species to be considerably less numerous at Ithaca than those of *vittatus*. Although I have taken several dozen specimens during the past six years, I have never discovered a female with her brood. Unlike *vittatus*, *cayugae* has never been found beneath tree bark; it apparently prefers the cover afforded by rocks and debris upon the ground exclusively.

Distribution. Outside of the type locality, Ithaca, New York, the species is unknown at present except in Virginia and Mt. Mitchell, Yance county, North Carolina.

NEW YORK: Ithaca. VIRGINIA: Mountain Lake, Giles county.

Geophilus mordax Meinert

Geophilus mordax Meinert, Proc. Amer. Phil. Soc., XXIII, p. 217 (1886) [type locality unknown].

Geophilus salemensis Bollman, Ent. Amer., III, p. 82 (1887) [Salem, Indiana].

Geophilus virginiensis Bollman, Proc. U. S. Nat. Mus., XI, p. 346 (1889) [Natural Bridge, Virginia].

Geophilus louisianae Brolemann, Ann. Soc. Ent. France, LXV, p. 55 1896) [Louisiana].

Geophilus atopleurus Chambrelin, Ann. Ent. Soc. Amer., II, p. 181 (1909) [Raleigh, North Carolina].

Geophilus mordax Meinert [in part], Chamberlin, Bull. Mus. Comp. Zool. Harv., LIV, p. 412 (1912).

The bright red color in life and the enormous and consolidated sacculi will readily identify *mordax.*

Specific Diagnosis. Length: to 50 mm., averaging 25-40 mm. Color: sordid yellow to yellow orange after long immersion in alcohol, bright red in life and for a variable time after immersion in alcohol. Cephalic plate: slightly longer than wide (ca. 1.08-1.15). Clypeus: without preclypeal consolidated areas. Labrum: with 3-5 teeth. Second maxillae: apical claw short and robust (fig. 3). Prebasal plate: exposed. Carpophagus-structures: paxilli large, consolidated on sternites three through fifteen or so; sacculi very large, consolidated, heavily sclerotized on sternites three through about fifteen (fig. 12). Ventral pore fields: single, transverse on sternites one through twenty-one or twenty-three, thereafter dividing into two paramedian fields which persist through the penultimate pedal sternite. Pedal segments: ♂ 49-53, ♀ 49-57; anterior legs sparsely clothed with short setae. Ultimate pedal segment: legs short; (*virginiensis* form) each coxopleuron with pores opening freely dorsally, ventrally, and laterally; (*louisianae* form) each coxopleuron with freely-opening pores bordering the sternite ventrally and the tergite dorsally, pores absent lateraly, the ventro-posterior-most pore typically closed and represented by a tiny sclerotized thickening.

Distribution. The question of the distribution of the true *mordax* is complicated by its having been confused with a second, distinct, though similar species, *ampyx*, which is described here as new. The following records are the only ones for which I can vouch.

(Louisianae form) INDIANA: Salem; Wyandotte. ARKANSAS: Little Rock.

In addition I have examined specimens from Louisiana, North and South Carolina, Kansas, and Florida. (*virginien-*

sis form) This form, evidently long confused with *ampyx*, sp.n., is definitely known only from the following Virginia localities: Natural Bridge; Cape Henry, Princess Anne county; and Stony Point, Albemarle county. It is possible that, if *virginiensis* Bollman and *louisianae* Brolemann are subspecifically distinct, *virginiensis*, rather than *louisianae*, is the junior synonym of the nominate subspecies. This cannot be validated at the present time, however, because I have been unable to find the type of *mordax* at Harvard's Museum of Comparative Zoology. For further particulars, see the discussion under *Geophilus ampyx*.

Geophilus ampyx, new species

Geophilus mordax [in part], Chamberlin, Bull. Mus. Comp. Zool. Harv., LIV, p. 412 (1912).

The bright red color in life and in newly killed specimens, the small, weakly consolidated paxilli, and the absence of sacculi will distinguish this interesting new centipede.

Type. Female, Clemson, Oconee county, South Carolina, March 28, 1950 (E. C. Turner, Jr. and W. R. Mason). In author's collection; C-1590.

Length: 52 mm. Color: in life bright crimson, this color persisting in alcohol for six months to a year, thereafter fading to sordid red or orange-brown; without special dorsal markings. Antenna: 5.1 mm. long, 3.4 times longer than cephalic plate; first four or five articles subdensely, remaining articles densely setose. Cephalic plate: 1.5 mm. long, 1.18 times longer than wide; transverse suture distinct; postero-paramedian sutures slightly divergent anteriorly, 0.52 mm. long. Prebasal plate: almost completely exposed, only the lateral limits partially concealed by the cephalic plate. Clypeus: without consoidated prelabral areas; setae disposed in four rows, viz. 1+1, 1+1, 5+5, 10+7. Labrum: midpiece fully exposed but small (1/7 as long as either side-piece), with five strongly sclerotized and deeply pigmented teeth; each side-piece fringed with long, numerous, hyaline, fimbriae. First maxillae: with two pairs of long, hyaline lappets. Second maxillae: right apical claw with four, left apical claw with five apparent pores and associated ducts, all ducts appear to empty into receptacle at claw base; bridge-piece narrow, coarsely areolate, essentially like *mordax*. Prehensors: bright crimson in life; tarsungular denticle black, small; coxopleural sutures almost attaining anterior prosternal margin; chitin lines distinct, black, extending 0.8 of distance to the anterior prosternal margin. Carpophagus-structures: sacculi entirely absent; paxilli not peg-like but appearing as flat, tiny, consolidated plates on metasternites four through sixteen, fig. 9. Ventral pore fields: anterior fields paired and circular as usual; transverse fields single on sternites one through twenty, thereafter dividing into two, roughly oval fields and persisting through the penultimate pedal sternite, very difficult to detect on the more posterior sternites. Pedal segments: 53 pairs of legs, legs clothed with sparse, short and occasionally very long setae. Ultimate pedal segment: right coxopleuron with twenty-seven, the left with thirty-two pores located ventrally, laterally, and dorsally, peripheral pores much smaller than the rest, without a ventro-posterior sclerotized thickening (vestigial pore); legs slightly longer than those immediately preceding, sparsely clothed with long and short setae; apical claw unguiform, robust and deeply pigmented, figs. 10 and 11. Anal pores: large but concealed.

Allotype. Male, Clemson, Oconee county, South Carolina, March 25, 1952 (E. C. Turner, Jr.). In author's collection; C-1591.

The male allotype agrees with the female type except in the following particulars. Length: 34 mm. Color: in alcohol shading to bright orange. Antenna: 3.7 mm. long, 3.5 times longer than cephalic plate. Cephalic plate: 1.05 mm. long, 1.17 times longer than wide. Prebassal plate: completely exposed. Labrum: with six strongly sclerotized teeth. Carpophagus-structures: flat weakly consolidated plates in paxillar position on metasternites six through fifteen; sacculi absent. Ventral pore fields: transverse fields on sternites one through eighteen, thereafter dividing in two and persisting through penultimate sternite. Pedal segments: 51 pairs of legs. Ultimate pedal segment: right coxopleuron with seventeen, left with eighteen pores.

Paratype Series.—The remaining paratypes were collected at the following localities on the dates and by the persons specified. GEB = G. E. Ball, JCM = J. C. Martin, WRM = W. R. Mason, ECT = E. C. Turner, BDV = B. D. Valentine. SOUTH CAROLINA: Oconee county, Clemson, III-27-50, ECT & WRM (1 ♂, 2 ♀♀), III-(24-27)-51, GEB, JCM & WRM (6 ♀♀, 4 ♂♂), III-25-52, ECT, (3 ♀♀, 2 ♂♂), III-28-50, ECT & WRM (1♀); Issaquena Lake, III-26-50, ECT & WRM (4 ♀♀). Sumter county, Sumter, III-27-51, WRM (1 ♀). ALABAMA: Tuscaloosa county, Tuscaloosa, III-29-48, WRM (1 ♀), III-29-48, WRM (1♀), Hurricane Creek, II-20-50, GEB, (1 ♀, 5 ♂♂); Lawrence county, Lawrence, IV-29-50, GEB (1♀, 5 ♂♂); Madison county, Monte Sand State Park, X-30-49, BDV (1♀); Fayette county, 5 miles north of Fayette, IV-8-49, BDV (1♀, 2 ♂♂).

The paratypes agree with the type and allotype except, of course, in those predictable discrepancies that depend upon age and the usual slight individual variational tendency. The number of pedal segments varies as follows: ♂ 49-53, ♀ 51-55; the length variation is 18-52 mm., the majority of specimens ranging between 30 and 40 mm.

Systematic Notes. One of the most useful and trustworthy characters for distinguishing a species or a group of species in *Geophilus* is now believed to be the carpophagus-structure (see footnote 1). It attracted little attention, however, until Attems and Verhoeff stressed it in their *Geophilus* studies.

Verhoeff relied heavily upon it as a subgeneric criterion, a point of view that was not sanctioned by Attems and is not followed here. One of the objects of the present study is to refine our interpretation of this structure, chiefly through the recognition of and emphasis upon its component parts, the sacculus and paxillus, whose form, extent, and sculpturing are variable and diagnostically significant.

At the time that Chamberlin wrote on the Geophiloidea of the southeast[4] the carpophagus-apparatus evidently had not yet been generally recognized as the valuable criterion that we consider it today. In 1912 Chamberlin carefully discussed what he considered to be a protean and ubiquitous species, *G. mordax* Meinert. Referring to that important paper the reader will note that its author viewed the Meinert centipede as being highly variable in certain respects. Consequently he united it with Bollman's *salemensis* and *virginiensis*, Brolemann's *louisianae*, and his own *atopleurus* and at the same time pointed out that he considered the variability of the "sternal pits" [sacculi] and the disposition of coxopleural pores of the specimens that he had studied to be of an intraspecific order. Also, he did not, according to his paper, consider *mordax* polytypic.

But Chamberlin believed that these prosternital pits, or sacculi, although always present, were often concealed by the contiguous margins of two successive sternites. He wrote: "Mr. Bollman established *G. virginiensis* chiefly on the presence of these sternal pits in his type; but he must not have had specimens which he recognized as *G. mordax*, for the type of this species [i.e. of *mordax*], which I have recently examined, together with all the other specimens studied, have these pits plainly showing, though in some few they are less conspicuous and may be overlooked when the sterna are closely articulated." Chiefly on the basis of this evidence he united four names, two, or possibly even three, of which are applicable to distinct natural entities. It is important to note that Chamberlin, who examined the holotype of *mordax*, which I have been unable to find at Harvard, declared that it possessed *conspicuous prosternital pits*, that is sacculi.

We know that *virginiensis* was similarly endowed, for Bollman described its sacculi very clearly, and Brolemann compared the "apophyse au bord postérieur, correspondant à une facette déprimée au bord antérieur de l'écusson suivant" of *louisianae* with the homologues of *Geophilus carpophagus* itself. Chamberlin unambiguously described the carpophagus-apparatus of his new *atopleurus* in 1909. Finally in his 1912

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[4]Bull. Mus. Comp. Zool. Harv., LIV (1912).

article Chamberlin pointed out that: "A cotype of *G. salemensis* [Bollman] which I have examined is also a large specimen of *mordax* in which the sternal pits [sacculi] are conspicuously developed though they appear to have been overlooked by Mr. Bollman." Therefore, through one or another source of information it is apparent that the typical specimens of each of these species, *salesmensis, virginiensis, louisianae, mordax,* and *atopleurus* possessed conspicuous sacculi.

I have found, however, that many of those specimens whose sacculi are "less conspicuous and may be overlooked when the sterna are closely articulated" really possess no sacculi at all. In these specimens the prosternite is simply folded against the preceding metasternite, but when they are pried apart, it may be seen that the paxillus is represented only by an almost flat, sclerotized mound, and that there is no prosternital pit at all as the accompanying illustration shows, fig. 9. Consequently all of those specimens to which Chamberlin applied *mordax* evidently were not referable to the Meinert name. At least some were applicable to another species which I have named *ampyx.*

It is possible that this name is actually the junior synonym of an older name, perhaps of one of the following: *brunneus* McNeill, *indianae* McNeill, *brevicornis* Wood, or *smithii* Bollman. But at present this suspicion cannot be validated inasmuch as their original descriptions are both inadequate and ambiguous; also, at last report the typical series of none could be located.

I should like to stress the fact that *mordax*, as it is interpreted in this paper, includes at least two kinds of specimens, those whose coxopleura possess lateral pores (*mordax* Meinert [?], *virginiensis* Bollman), and those whose coxopleura possess no lateral pores, the pores being aggregated along the margins of the ultimate pedal sternite and tergite (*louisianae* Brolemann, *atopleurus* Chamberlin). The latter forms frequently, though not invariably, also exhibit on the posteroventral surface of each coxopleuron, as Chamberlin described it, "a chitinous thickening," which seems to represent a vestigial pore. Chamberlin believed that as individuals age, the lateral pores vanish or migrate in the course of successive instars to the edges of the sternite and tergite. I have, however, several specimens which lack lateral pores, which possess ventro-posterior vestigial pores, but which are also evidently young individuals. Two such centipedes were taken at Manhattan, Kansas recently.

I am not convinced that these two *mordax* variants, i.e. *virginiensis* and *louisianae,* are one and the same. The future may show us that they are closely related though distinct species, or more likely, geographical races. However, in lieu of sufficient specimens and adequate distributional data it is impossible to arrive at more definite conclusions at this time. We cannot be sure, for example, which of these two *mordax* variants Meinert had before him when he described his new species.

Species Inquirendae

The affinity and identity of each of the following species is uncertain due to the inadequate original description and the unavailability of the type. Most were originally referred to *Geophilus*, where many probably belong, but some certainly do not belong to this genus.

Geophilus attenuatus Say, Journ. Acad. Nat. Sci. Phila., II, p. 113 (1821) [Probably Philadelphia, Pennsylvania].

Geophilus brevicornis Wood, Journ. Acad. Nat. Sci. Phila., (n.s.) V, p. 45 (1862) [Illinois and Texas].

Geophilus brunneus McNeill, Proc. U. S. Nat. Mus., X, p. 331 (1887) [Bloomington, Indiana].

Geophilus indianae McNeill, Proc. U. S. Nat. Mus., X, p. 331 (1887) [LaFayette, Indiana].

Geophilus smithii Bollman, Proc. U. S. Nat. Mus., XI, p. 347 (1889) [Washington, D. C.].

Geophilus setiger Bollman, Ent. Amer., III, p. 82 (1887) [Salem, Indiana].

This form may be referable to *Brachygeophilus* or to *Geophilus*. Its author declares: ''ventral plate with three longitudinal depressions . . . coxopleural pores few (5-6) [per coxopleuron] . . .'' In addition, the male possesses 43, the female 45 pairs of legs. The trisulcate sternites, to which Bollman refers, seem quite distinctive, so that my guess is that the Bollman species is referable to *B. rupestris* Crabill, 1949, to *B. truncorum* (Bergsoe and Meinert), 1866, or to one of the small European *Geophilus* forms (some of which have striking trisulcate sternites) that may have been introduced, viz. *pauropus* Attems, 1927, *proximus* C. L. Koch, 1847. The question can never be settled solely on the basis of the original description, and the holotype cannot be found.

Mecistocephalus strigosus McNeill, Proc. U. S. Nat. Mus., X, p. 332 (1887) [Bloomington, Indiana].

McNeill undoubtedly placed *strigosus* in *Mecistocephalus*, being ignorant of the mandibular criterion involved, because of the magnitude of the cephalic plate's length-to-width ratio, 1.64 in *strigosus*. In 1888 he stated:[5] ''There are almost no easily discernible, constant characters to distinguish this [*Mecistocephalus*] from the following genus [*Geophilus*]. Wood gives the 'cephalic segment twice as long as broad; antenna approximate;' but I know of no *Mecistocephalus* that has the

[5]Bull. Brookville Soc. Nat. Hist., no. 3 (1888).

cephalic segment more than once and a half as long as broad. The whole head is certainly longer and narrower than [that of] *Geophilus*.'' Two aspects of *strigosus* suggest another austral McNeill species, *varians*: (1) the very long ultimate legs (in *strigosus* 1.63 times longer than the penultimates); and (2) its 55 pairs of legs (*varians* has 53-61 pairs of legs). Although it is true that the cephalic ratio of *strigosus* (1.64) is greater than that of *varians* (1.3), it is equally true that McNeill may very well have based *strigosus* upon an immature specimen, as is suggested by its length, only 23.5 mm., which is rather short for an adult form with 55 pairs of legs. But this evidence is admittedly inadequate, and I would not now feel justified in uniting the two names on the basis of it.

THREE NEW HELIOTHRIPINE THYSANOPTERA FROM FORMOSA

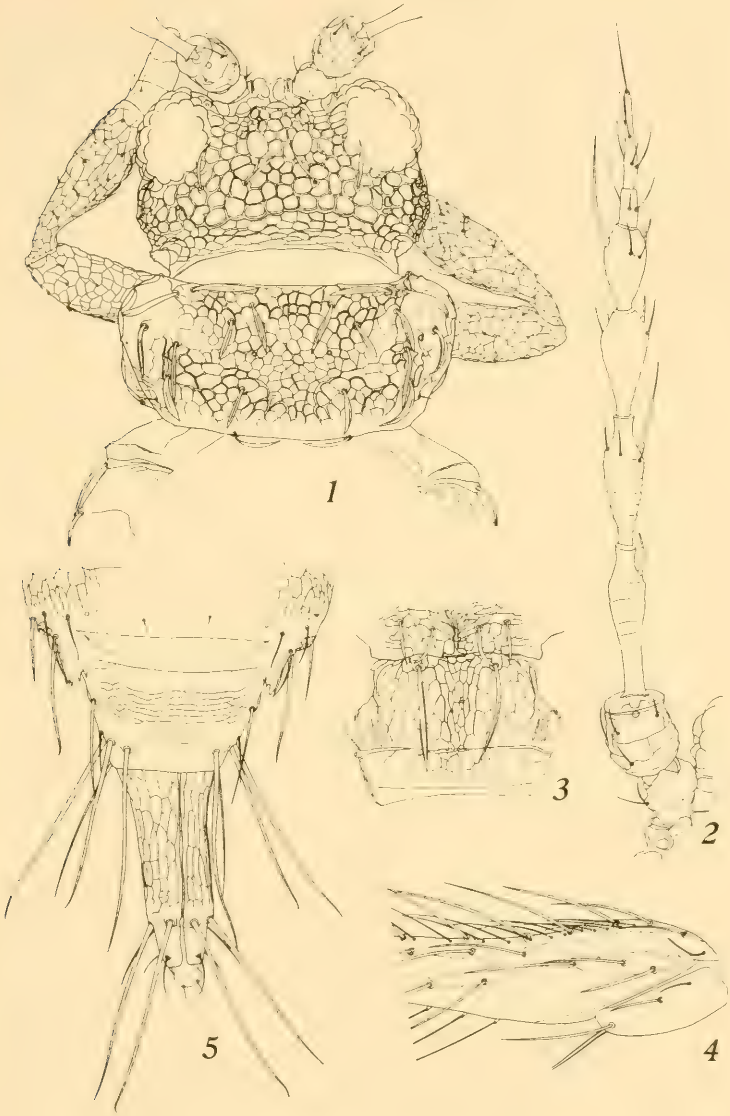
By J. DOUGLAS HOOD, *Biological Laboratories, Cornell University, Ithaca, N. Y.*

The thrips described below were all collected more than twenty years ago by Mr. R. Takahashi. Now, despairing of further material, I am describing the first because the generic name is needed for use in another connection, and the other two because each has been confused in the literature with a closely allied species.

Copidothrips, new genus
(*Kopis*, scimitar; *thrips*)

Like *Panchaetothrips*, *Dinurothrips*, and *Chaeturothrips* in having the last abdominal segment elongate and tube-like, and the last two or three segments armed with very long, heavy setae; but with the major cephalic and thoracic setae dagger-shaped.

Head, prothorax, and sides of abdomen polygonally reticulate; head broad, with occipital groove at sides only; vertex elevated, prominent, overhanging anteriorly and to some degree laterally, the median ocellus directed forward; frontal costa with a median and two small lateral emarginations; cheeks swollen; occipital and postocular setae large, broadened at middle; eyes strongly protruding, separated from vertex by a groove; mouth-cone conical, attaining posterior margin of prosternum, maxillary palpi 2-segmented; antennae 8-segmented, normal, segments III and IV strongly narrowed apically and thus vasiform, sense-cones simple, VIII long and slender. Prothorax short and broad; pronotum with somewhat shelf-like anterior angles; upper surface with 8 or 9 pairs of large dagger-shaped setae (broadened at middle and pointed) and another pair at about lateral thirds of posterior margin, these last arising beneath the margin itself. Pterothorax ovoid, narrowed pos-



COPIDOTHRIPS FORMOSUS

Fig. 1, head and prothorax, x 145. Fig. 2, right antenna, x 232. Fig. 3, median area of pterothorax, x 145. Fig. 4, base of left forewing, x 116. Fig. 5, tip of abdomen, x 145.

teriorly. Legs slender. Forewings ensiform, without non-pilose subbasal area, with two longitudinal veins closely paralleling margins, each vein set with evenly-spaced long setae (11-12 on each vein in type species), costal margin with numerous long setae which are longer and stouter than the fringing hairs, 6 or 7 of the latter closely spaced at base of wing ventrally. Abdomen with terminal segment elongated and tube-like, about twice as long as preceding segment, both with their setae very long and heavy; anterior margins of sterna only slightly arched; tergum II with a large patch of seta-like microtrichia on either side extending nearly the length of the sclerite; antecostal lines heavy, not crenate posteriorly, the segments thickened in front of them.

Type species: *Copidothrips formosus*, new species.

Copidothrips formosus[1], new species

Female (macropterous). Length about 1.32 mm. COLOR largely yellow and brownish yellow; head bright yellow in front and between eyes (except for the red ocellar pigmentation), as well as in a narrow streak paralleling cheeks, the latter and most of occiput shaded lightly with gray; thorax brownish yellow, darker along sides, and with very faint gray clouds; abdominal terga III-VII each with a brown band across base extending to the darker antecostal line, I-V each with a very indistinct media gray cloud, sides of IX and X darkened with yellowish brown, VII and VIII more nearly clear yellow; legs yellow, somewhat more deeply so in femora; forewings light yellowish (especially in basal ninth), shaded with gray just anterior to anal area and with two gray cross-bands, the first one-sixth the length of wing and ending at middle of wing, the other narrower and ending at apical sixth; antennae very pale yellow in segments I and III-VI, this last lightly shaded with gray across tip, II much darker and yellowish brown, VII and VIII largely pale gray. HEAD (Fig. 1) 113μ long, width across eyes 183, just behind eyes 168, across cheeks 190, across subbasal carina 168, at base 148, of frontal costa 27, its dorsal surface deeply polygonally reticulate, many of the lines in darkened, median, postocellar area with dot-like thickenings, the posterior margins of the rearmost row of large reticles more heavily thickened, extreme posterior margin of head with a cross-stria; postocellar and postocular setae dilated at middle, about 27μ long, and lying on same transverse line; cheeks with two pairs of forwardly-directed smaller setae; eyes 63μ long dorsally, 47 wide, 90 apart; mouth-cone extending 109μ beyond posterior dorsal margin of head; antennae (Fig. 2) with segment I 20(28), II 40(33), III 73(16-17), IV 56(18), V 48 (21), VI 37(19), VII 17(8-9), VIII 44(6-7). PROTHORAX (Fig. 1) short and broad, the pronotum 100μ long and 220 wide, with sides

[1]The specific name is the Latin word meaning beautiful, not a word based upon the name of the island from which the species came (which would require a different ending), but it is hoped that both ideas will come to mind.

shelf-like and with a shallow groove in front of middle, this groove curving forward to anterior angles; setae and sculpture shown in figure. MESO- AND METANOTA with sculpture and chaetotaxy as shown in Fig. 3, the former 239μ across anterior angles and 287 in width posteriorly. FOREWINGS (Fig. 4) 868μ long, with 18-19 long, curved setae on costal margin (in addition to the fringing hairs), those at middle of wing about 182μ, the anterior and posterior veins each with 11-12 long setae, those at middle of wing about 90μ, stem vein with 4, including one at fork. ABDOMEN narrowed at base, 329μ wide at segment III, tergum I with strong antecostal line and a pair of minute submedian setae at middle, where it is delicately cross-striate, II nearly smooth except for a sublateral brush-like patch of heavy microtrichia, laterad to which are three long pale setae, III-VIII polygonally reticulate in about lateral fourths, their median halves with widely-spaced pale cross-striae basally, IX similarly cross-striate across middle and 66μ long, X 133μ long, 64 across base, 43 across at bases of seta II, its surface reticulo-striate, the polygons longitudinal; major setae on IX and X (Fig. 5) long and heavy, IX with seta I 129μ, II 113, III 130, IV 105, X with seta I 127, II 118, large ventro-lateral one on VIII 74.

FORMOSA: Rarasan, July 31, 1933, R. Takahashi, 1 ♀ (holotype).

Helionothrips cephalicus, new species

From the other species of the genus that have the forewings dark, with a subbasal pale area, but no pale subapical band, this species is readily known by the long head (its width only 1.2 times its length, as against about 1.7 times) and the long ninth abdominal segment.

Female (macropterous). Length about 1.38 mm. COLOR dark blackish brown, only slightly paler in about last three abdominal segments, front of head not paler; fore legs yellow, with femora nearly black along upper surface except at tip, their tibiae shaded with gray-brown except at either end; middle and hind femora and tibiae largely blackish brown, with bases of femora yellow and their tips pale, their tibiae yellow in the narrow basal portion and paling to yellow in about apical third; forewings dark blackish brown in basal sixth (including all of anal area) and in apical 0.7, the narrow intervening (complete) subbasal band white; antennae blackish brown in segments I and II, pale yellow in III-V and base of VI, remainder gray-brown, tip of V lightly shaded. HEAD 140μ long dorsally (about 160 long if measured from base of cheeks), across eyes 168, least width just behind eyes 150, greatest width across cheeks 164, width of frontal costa 27; surface in front of occipital line polygonally reticulate with dark lines, most of the reticles in and immediately behind ocellar area very minutely wrinkled; occipital area (behind the sharp carina which parallels posterior margin) reticulate also, the posterior reticles with numerous minute black granules; cheeks rounded to eyes, subparallel but slightly concave behind them, with two pairs of forwardly-directed, slender, pale setae; one pair of curved setae about 37μ long between ocellar area and eyes and three shorter pairs just in front of occipital carina; eyes 87μ long dorsally, 47 wide, 74 apart; mouth-cone about attaining base of prosternum, its tip 105μ beyond dorsal margin of head; antennae normal, segments III and IV narrowed apically and vasiform, V stouter than usual, oval, with short distinct pedicel, I 23(26), II about 41(31), III 49(24), IV 41(24), V 34(24), VI 30(20), VII 10(11), VIII 32(5), sense-cones on III and IV forked, outer arm of that on IV nearly reachinging tip of V. PROTHORAX longer and narrower than usual, pronotum 146μ long, 210 wide, its surface polygonally reticulate and with small pale setae. MESO- AND METATHORAX normal, the former with greatest width 284μ, the anterior sclerite of notum of latter with the usual elevated triangular area, the posterior sclerite 44 x 114μ and with about eight transverse rows of reticles. FOREWINGS 924μ long. ABDOMEN 302μ wide at segment IV, sculpture normal to genus, but almost completely lacking from a narrow area on each side of the strongly reticulate row of median ellipses; tergum IX 125μ long, twice the length of X (61μ); seta I on IX 83μ, II 93, III 63, X with seta I 72, II 75.

FORMOSA: Shinten, April 2, 1933, R. Takahashi, 1 ♀ (holotype), from grass.

Helionothrips compressus, new species

Allied to *brunneipennis* and *errans*, but with second antennal segment yellow, head not paler anteriorly, and pronotum compressed between posterior pair of foveae and thus subcarinate for a short distance medially just in front of posterior margin.

Female (macropterous). Length about 1.5 mm. COLOR very dark blackish brown (almost black) in all of head, thorax, and abdomen; femora blackish brown, mid and hind pairs darker, the fore pair yellowish apically, the others with bases and trochanters yellow; tibiae yellow at either end, the fore pair more extensively so and only lightly shaded between; all tarsi golden yellow; forewings dark blackish brown in basal eighth, nearly colorless in second eighth, light brown in third and fourth eighths, and brownish yellow in remainder except for the darkened veins; antennae golden yellow in segments I-V, gray-brown in VI and VII, the base of VI and all of VIII paler. HEAD about 130μ long dorsally, across eyes 193, least width just behind eyes 190, greatest width across cheeks 196, width just in front of basal collar 190, across collar 209, at base 147, across frontal costa 35; surface in front of occipital line polygonally reticulate with dark lines, the reticles smooth; occipital area (behind the sharp carina which parallels posterior margin) reticulate also, the stronger (median, posterior) reticles with numerous minute black granules; cheeks rounded to eyes, nearly straight to basal collar, margined with a narrow frill, with two pairs of forwardly-directed, slender, pale setae; one pair of curved setae between ocellar area and eyes and three pairs just in front of occipital carina; eyes 83μ long dorsally, 48 wide, 97 apart; mouth-cone short, its tip about 100μ beyond dorsal margin of head; antennae normal, segments III and IV narrowed apically and vasiform, I 25(26), II 49(31), III 76(26-27), IV 58(28), V 44(25), VI 31(23), VII 9(9-10), VIII 30(5-6), sense-cones on III and IV forked, outer arm of that on IV surpassing tip of V. PROTHORAX elliptical, nearly 1.5 times as wide as long, polygonally reticulate throughout, with pale setae, with complete lateral shelf which is broader anteriorly, and with a longitudinal median subcarina in front of posterior margin between the posterior pair of foveae. PTEROTHORAX much narrowed posteriorly, the width across base of segment II of abdomen (196μ) only 0.6 the greatest width of mesothorax (318μ); meso- and metanota normal, their reticles smooth, anterior sclerite of latter with the usual elevated triangular area, the posterior sclerite 45 x 137μ and reticulate. FOREWINGS 1110μ long. ABDOMEN 333μ wide at segment IV, sculpture normal to genus, the median, elliptical, reticulated areas on terga II-VII with their lateral margins well differentiated by black lines which extend posteriorly beyond middle of terga; segment IX only slightly longer than X; seta I on IX 86μ, II 97, III 72, X with seta I 75, II 64.

FORMOSA: Yusho, near Piyanan, August 13, 1934, R. Takahashi, 4 ♀♀ (including holotype), from leaves of *Prunus* sp.

HAEMAGOGUS LUCIFER H., D. & K., 1912, A SYNONYM OF HAEMAGOGUS REGALIS D. & K., 1906

(DIPTERA, CULICIDAE)

By W. H. W. KOMP, *Laboratory of Tropical Diseases, National Institutes of Health, Bethesda, Maryland*

Haemagogus regalis Dyar and Knab, 1906 was described from specimens reared from larvae taken at Sonsonate, Salvador, by Frederick Knab. The original description follows: (1) "Proboscis long, black; head and thorax brilliant metallic blue and green; pleurae silvery; abdomen dark blue with silvery bands on all the segments above, broader below. Legs blue-black, the mid and hind femora white below towards base. Base of the first submarginal cell slightly nearer the base of wing than base of the second posterior cell. . . . Type. —Cat. No. 10,024, U. S. Nat. Mus." Later Dyar (2) stated that Sonsonate, Salvador should be considered the type locality.

Haemagogus lucifer Howard, Dyar and Knab 1912 was treated as *H. splendens* Will. in the four-volume monograph (3), but Dyar (2) states that the name "depends upon the published figure" of the male terminalia given on Plate II, Fig. 23, p. 164 (1912) of Vol. II of Howard, Dyar and Knab (3). Dyar states that this figure "was made from a specimen from Tabernilla, Canal Zone, Panama (A. H. Jennings, breeding number 399), and this locality becomes the type locality [for *lucifer*]."

The writer has examined the male terminalia of *H. lucifer* on Slide No. 1461 in the U. S. National Museum collection, which was made from a male of the type series (Jennings No. 392, Tabernilla, Canal Zone, July 24, 1908), and finds that the terminalia of this specimen correspond in all particulars with the male terminalia on three slides (No. 1463, Knab 330 zc; Knab 330 zh (no slide number); and Knab 330 zc (no slide number), which are from the type series of *H. regalis* from Sonsonate, Salvador (Knab's breeding number 330). The terminalia of the type slide of *regalis* (No. 10,024, U.S.N.M.), which is numbered "330 v, Knab's notes," are in poor condition, and were mounted in balsam in 1936, but what can be seen agrees with the terminalia on the three slides of the type series noted above.

The writer has many specimens of "*H. lucifer*" from Panama, of which he has dissected and mounted the male terminalia. These agree with those of the three slides of the type series of *H. regalis*, noted above.

Through the kindness of Dr. Alan Stone, of the Division of Insects of the U. S. National Museum, the writer was permitted to make photomicrographs of the terminalia of *H. lucifer*, from slide 1461, male from Tabernilla, Canal Zone, July 24, 1908 (Jennings 342), from the type series of *lucifer*; and of the terminalia of *H. regalis* from slide 1463, male from Sonsonate, Salvador [no date] (Knab 330 zc), from the type series of *regalis*.[2]

Examination of the photomicrographs will show that the parts numbered in the legends for Figure 1 (*lucifer*) agree in all particulars with those shown in Figure 2 (*regalis*); the parts of the terminalia of *lucifer* (Figure 3) correspond with those of *regalis*, shown in Figure 4. The shape of the claspette filament is well shown in Figure 4 of *regalis*.

Literature Cited

1. Dyar, H. G., and Knab, F., 1906. Notes on some American mosquitoes with descriptions of new species. Proc. Biol. Soc. Wash., v. 19, p. 167.

[2]The writer acknowledges with thanks the skillful assistance of Mr. Vernon Taylor of the Photographic Section of the National Institutes of Health, who made the four photomicrographs reproduced here, and the gracious aid of Mrs. Frances Rose of the Medical Arts Section in numbering the parts of the terminalia in these photographs.

2. Dyar, H. G., 1921. The genus *Haemagogus* Williston. Ins. Ins. Mens., v. 9, p. 101.

3. Howard, L. O., Dyar, H. G., and Knab, F., 1917. The mosquitoes of North and Central America and the West Indies. Carnegie Institution of Washington, Publ., 159, p. 865.

Fig. 1, *Haemagogus lucifer.* 1. Terminal spine of clasper; 2. Apical lobe of side piece; 3. Filament of claspette; 4. Median patch of scales on side piece; 5. Mesosome; 6. Basal lobe of side piece. Fig. 2, *Haemagogus regalis.* 1. Terminal spine of clasper; 2. Apical lobe of side piece; 3. Filament of claspette; 4. Median patch of scales on side piece; 5. Mesosome; 6. Basal lobe of side piece. Fig. 3, *Haemagogus lucifer.* 1. Mesosome; 2. Strong, short setae on 8th tergite. Fig. 4, *Haemagogus regalis.* 1. Filament of claspette; 2. Mesosome; 3. Strong short setae on 8th tergite.

SOME NEW OR LITTLE-KNOWN MIRIDAE FROM THE NORTHEASTERN UNITED STATES

(HEMIPTERA)

BY ROLAND F. HUSSEY, *University of Florida, Gainesville*

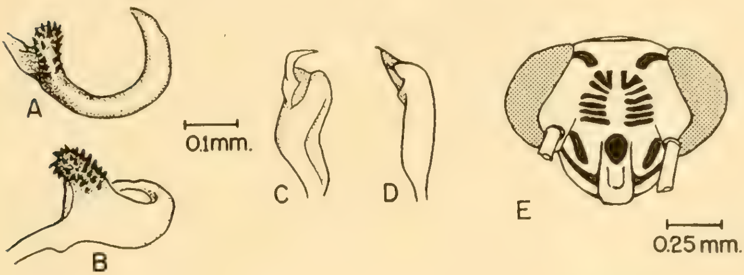
This paper includes the description of two new species and notes on two previously described forms.

Lygus epelys, new species
Figs. A-E

Male.—Length 4.2 mm., humeral width 1.70 mm. Head, width 1.01 mm., vertex .45 mm.; yellowish; vertex with an oblique curved brown mark each side, attaining inner margin of eyes; front with six or seven minutely rugulose dark brown or black striae each side of middle line, fig. E; tylus with a dark brown spot on base and several vague brown markings on apical half; jugae with a small brown streak extending upward to level of antenniferous tubercle; upper and lower margins of genae brownish-fuscous. Antennae yellow-testaceous, fourth segment and apical half (or more) of third segment infuscated; first segment embrowned at extreme tip, and with an elongated brown spot at middle on inner side; second segment slightly, gradually thickened from base to apex, where it is very slightly thicker than first segment, extreme base ringed with brown, apical fifth somewhat darkened; lengths of segments I-IV (in hundredths of a millimeter), 35: 106: 65: 66. Basal carina of vertex thin and sharp at the middle, disappearing at either side. Rostrum, length 1.58 mm., surpassing hind coxae and attaining third ventral segment.

Pronotum, length 1.00, width at base 1.70 mm.; shining, coarsely punctate and with prostrate golden pubescence; yellow-testaceous, marked with brownish-fuscous as follows: a somewhat triangular spot behind each callus, widened outwardly and invading the callus, continued forward on outer side to reach pronotal collar, a small spot at middle of lateral pronotal margin, a rounded spot within each humeral angle, and a short transverse intra-marginal line before the scutellum, interrupted at middle. Propleura brownish-piceous on the middle, with a low, horizontal, subcallous, ivory-white ridge originating at coxal cleft. Mesosternum black, opaque, with a yellow spot before coxal cleft, the cleft margined with yellow. Mesopleura black above ostiolar peritreme, which is yellowish, becoming fuscous anteriorly. Mesoscutum yellowish, with sericeous golden pubescence. Scutellum moderately convex, transversely rugulose, sparsely punctate; blackish-brown, middle line (slightly widened at tip), base at each side, and lateral margins toward base, yellowish; base and lateral margins with sericeous golden pubescence, disk with longer and finer prostrate hairs concolorous with their respective areas.

Hemelytra variegated with blackish-brown and yellow-testaceous, and irrorate with tufts of golden sericeous pubescence which sometimes partially conceal the underlying color pattern. Clavus lightly embrowned toward base, the part lying behind scutellum yellow, a short black streak at middle just inside claval vein, and a wider streak at same level adjacent to claval suture. Corium largely yellowish, marked with blackish-brown as follows: extreme outer edge of embolium, a large area on basal half of corium, joined by two vague but rather broad vittae (one each side



Lygus epelys: A, left clasper, dorsal aspect; B, left clasper, lateral aspect; C, right clasper, median aspect; D, right clasper, ventral aspect; E, front view of head.

of cubital vein) with a second blackish area extending across embolium and corium to include paracuneus and basal half of cuneus; extreme apex of embolium pale; tip of cuneus with a black spot; testaceous areas of corium and cuneus more or less translucent. Membrane fuscous; basal part of cells, also a marginal spot behind middle, pale; veins pale, the brachium largely black next to larger cell. Hemelytra with fine prostrate pubescence in addition to the tufts of golden sericeous hairs.

Venter brownish piceous, shining, with short, sparse, pale pubescence; each spiracle surrounded by a yellow spot, also a row of larger pale spots about midway between lateral margin and midventral line. Genital claspers, figs. A-D, distinctive, most nearly like those of *L. ultranubilus* Knight, the left clasper (seen from above) less strongly incurved at tip, claw of right clasper differently shaped.

Front and middle femora brownish-piceous on basal half, yellow on apical half, with two brown bands (interrupted above) before apex; hind femora with a broad brown band just beyond middle and with two narrower pre-apical bands, the basal half spotted with paler brown above. Front and middle tibiae yellowish, with two dark spots near base on outer (dorsal) side; hind tibiae infuscated below except at tip, outer side pale, spines dark.

Female.—Length 4.6 mm., humeral width 1.98 mm. Head, width 1.10 mm., vertex .50 mm. Lengths of antennal segments I-IV (in hundredths of a millimeter), 43: 118: 75: 70; first segment with a narrow black line below, curving to inner side near base. Vertex and front marked as in male; tylus brownish-black along median line. Pronotum, length 1.13 mm., colored as in male. Hemelytral coloration generally like that of male; black area of clavus longer, extending to middle of commissure; dark areas of corium not joined by longitudinal vittae; cuneus pale, translucent, black at tip and with an oblique black band from outer basal angle to base of smaller cell of membrane; median pale spot of membrane extended as a pale stripe roughly paralleling inner vein, but separated from it by a narrow fuscous stripe. Median dark band of hind femora narrower than in male. Second ventral segment narrowly margined with white on inner and posterior edges; ventral spots on segments 3-8 almost coalescent to form an irregular pale band. Rostrum distinctly surpassing hind coxae.

Types.—Holotype ♂, 2 miles east of Lakeville, Town of Salisbury, Litchfield County, Connecticut, Oct. 9, 1933 (R. F. Hussey), in my collection; Allotype ♀: Midland County, Michigan, July 10, 1952 (R. R. Dreisbach), in Dreisbach collection.

This species is most nearly allied to *L. ultranubilus* Knight, 1917; slightly larger than that species, the frons with blackish striae, the male genital claspers different as noted above. The holotype stood alone in my collection for twenty years; no additional specimens were taken in my subsequent collecting at Lakeville in 1934 and 1935. I had seen no other specimen until the allotype was received from Mr. Dreisbach. A second female was taken by Mr. Dreisbach in Osceola Co., Mich., May 23, 1953.

The occurrence of this species in the northeastern states is of particular interest since its closest relatives range from the Rocky Mountains west to the Pacific coast; and none of them has been reported, so far as I am aware, farther east than northwestern Nebraska.

Lygus superiorensis Knight, 1917

This species has been known heretofore only from the male holotype collected at Sault Ste. Marie, Michigan. It is to be presumed that the antennae of this specimen were lost, as no mention of them appeared in the original description or in Blatchley's (1926) abstract therefrom, though Blatchley placed the species in his key partly on antennal characters.

A female in the University of Michigan Museum of Zoology undoubtedly belongs here. It was collected on Isle Royale, Lake Superior, July 11, 1905, was identified as "*Lygus pratensis* L., var." by Herbert Osborn, and was reported under that name by Adams (1909, p. 261). However, it is clearly distinct from *Lygus lineolaris* P.B. (then considered a synonym of *pratensis*) by its larger size, its shining, nearly glabrous aspect, its longer rostrum, its coloration, and its distinctly longer antennae whose second joint is much less thickened toward the tip. It is very similar in appearance to *L. rubroclarus* Knight, but is smaller and has the membrane (except the veins) entirely colorless and transparent.

This specimen agrees well with the male in the critical measurements of head and thorax, but its coloration appears to be somewhat lighter—as is not uncommonly the case in this group of *Lygus* species. A description of this female follows.

Length 6.0 mm., width across hemelytra 2.83 mm. Head: length .50 mm., height .64 mm., width 1.11 mm., vertex .49 mm.; yellow, shining; front with indistinct oblique striations, and with two parallel longitudinal reddish lines which widen anteriorly to meet bases of antennae; tylus red at tip, clouded with pale reddish-brown each side, and with a faint brown median line extending a short distance onto front; jugae yellow; lorae reddish; gula and bucculae yellow. Antennae: segment I, length .58 mm., reddish; II, 1.75 mm., uniformly slender (.05 mm.) on basal half, thence very gradually thickened to a maximum of .08 mm., at apex, red, infuscate on apical fourth but without trace of dark ring at base; III, 1.00 mm., blackish; IV, 1.04 mm., blackish. Rostrum red, basal joint yellow at apex, fourth joint blackish on apical fourth; length 2.28 mm., attaining apex of third abdominal segment.

Pronotum, length 1.25 mm., width at humeral angles 2.25, at anterior angles .88 mm., glabrous, strongly shining, punctuation about as in *L. lineolaris*; yellowish, with a transverse piceous band across posterior fourth, extreme hind margin narrowly pale; disk with two reddish rays behind each callus (the outer one becoming piceous behind the middle), and with a narrower reddish submarginal ray, abbreviated anteriorly; calli reddish on outer half, reddish color outwardly extending forward to sulcus behind collar and there becoming piceous. Scutellum partly destroyed in pinning, yellow, with faint traces of an oblique, red, submarginal vitta on each side; disk with about a dozen, more or less interrupted, fine transverse sulci, most numerous on basal third.

Hemelytra shining, shallowly punctate, each puncture with a minute, prostrate, pale hair; reddish-brown, becoming piceous on clavus; corium more or less translucent, with two divergent piceous streaks on basal half, one next the costal vein, the other inside the radial vein; apical half with a similar piceous streak outside the radial vein, curving to join a piceous spot in outer apical angle of corium; embolium reddish, fading to testaceous at base, more or less piceous at apex; cuneus translucent, brownish, all three margins bordered with red. Membrane transparent, nearly colorless, most faintly clouded with brownish in apical part of smaller cell and adjacent part of larger cell; veins red.

Beneath reddish; front acetabula, prosternum, narrow hind margin of mesepisternum, lower part and posterodorsal edge of epimeron, ostiolar peritreme, and a spot around each ventral spiracle, yellow; sides of venter with a nearly obsolete yellow band; mesosternum blackish. Legs red; tips of coxae and edges of trochanters yellow; femora with two or three faint yellow annuli near tips; tibiae yellowish on basal half, the extreme base, a sub-basal spot, and apical half, red; spines very dark brown; tips of tarsi blackish.

Alepidia bellula, new species

Male.—Length to tip of abdomen 2.9 mm., to apex of membrane 3.6 mm.; maximum width 1.2 mm.

Head, length .48 mm., width .93 mm., vertex .48 mm., height as seen from side .63 mm.; black, weakly shining; glabrous above, genae and tylus with sparse, minute hairs, lower cheeks and gula with setulae less conspicuous than in *A. gracilis* (Uhler); vertex minutely wrinkled, faintly impressed each side before the sharp basal carina; front with a few indistinct transverse ridges each side of median line, sides not at all or scarcely flattened next to the eyes. Antennae pale yellowish, third and fourth joints fuscous, first segment with a narrow pale brown ring near base, second segment sometimes lightly infuscated at extreme tip; first segment with a few erect setae, other segments with fine semi-prostrate pilosity; lengths of segments I-IV (in hundredths of a millimeter), 24: 96: 50: 45. Rostrum yellow, piceous at tip; length 1.20 mm., not reaching tips of middle coxae.

Pronotum, length .63 mm., width at humeri 1.02 mm.; black, feebly shining, glabrous, faintly alutaceous; sides strongly oblique on posterior third, subparallel or lightly converging in front on the anterior two-thirds; basal margin broadly and shallowly sinuate; anterior angles rounded, humeral angles subacute, projecting beyond bases of hemelytra. Propleura more shining and more distinctly wrinkled than the pronotum; mesosternum shining, black, mesepimeron with an oblique band of silvery pile; ostiolar peritreme thickly and finely grayish-granulose. Scutellum black, its disk shining, with a tuft of silvery hairs in basal angles and a band of similar hairs across the depressed apical portion.

Hemelytra pale brownish or pale reddish-brown, embolium and extreme base of corium yellowish, tip of embolium sometimes piceous, sometimes suffused with red, basal area of clavus infuscated, apex of clavus smooth, black; inner edge of corium commonly dark brown or fuscous next to claval suture at about its mid-length, the corium often suffused with reddish adjacent to this spot; cuneus strongly shining, brownish-piceous; apical half of exocorium, between embolium and radial vein, dark brown, a little paler and less strongly shining than the cuneus, the shining area narrowed anteriorly, extending forward slightly beyond the posterior silvery line. Membrane fumate, with a large, oval, velvety black, discal spot whose proximal end invades apical portion of larger cell. Hemelytra with sparse, prostrate hairs, and with deciduous, silvery, scale-like hairs occurring (in unrubbed specimens) as follows: a tuft on inner basal angle of cuneus; a tuft on clavus before its tip, sometimes extending slightly across claval suture onto corium; a transverse band across corium opposite tip of scutellum, dislocated and sometimes rather widely interrupted at radial vein; a transverse band on inner half of mesocorium opposite middle of claval commissure, this band often connected by a slender line of silvery hairs with the pre-apical tuft on clavus; a slightly oblique band on exocorium approximately opposite pre-apical tuft on clavus; and a sparse sprinkling of silvery hairs on the apical fourth of mesocorium, not forming a definite pattern.

Venter shining black, with sparse, minute, prostrate, black hairs; segments 3 and 4 with a tuft of silvery hairs on each side. Legs pale yellow; coxae sometimes pellucid whitish; hind femora clouded with reddish or reddish-piceous on apical third, the extreme tip pale; tibial spines and last tarsal segment fuscous.

Female.—Length 3.5 mm., width 1.13 mm. Very similar to the male in size, form, and coloration.

Types.—Holotype ♂, 5 miles southeast of Newaygo village, Newaygo County, Michigan, T. 12 N., R. 12 W., Sec. 26/27, July 12, 1953 (R. F. Hussey), in University of Michigan Museum of Zoology; Allotype, ♀: same data as holotype; Paratypes: 7 males, 9 females, taken with the types on young *Pinus banksiana* beside Highway M-46 where it skirts the "High Rollaway" on the south bank of the Muskegon River.

This species is readily separable from *Alepidia gracilis* (Uhler) by the basic light brown color of the hemelytra and the yellowish embolium, also by the distinctly oblique head which (in side view) is thicker at the tip than in Uhler's species. Other characters which distinguish this species from *gracilis* are the shallower impressions on the vertex, the front not flattened next the eyes, the second antennal segment less than twice as long as the third, and the rostrum not reaching the tips of the middle coxae. In actual length the rostrum of *gracilis* is shorter than that of *bellula,* but in *gracilis* the vertical position of the head (with the tylus not anterior to the front margin of the eyes) causes the tip of the rostrum to surpass the middle coxae and sometimes even to reach the apex of the hind ones. The comparison material of *Alepidia gracilis* (Uhler, 1895) used here is of the variety *squamosa* Knight, 1926, and was collected by me at Ann Arbor, Michigan, July 28, 1950.

The deciduous scale-like hairs are very easily lost, and few specimens retain enough of them to show their distributional pattern in its entirety. Furthermore, eggs in the bodies of the females decompose after death and release oily substances which penetrate the cuticle and form a film over these hairs, rendering them almost invisible. In some of the paratypes this took place within four weeks from the time of capture; and while the individual hairs can still be seen under proper illumination, they no longer have the silvery aspect characteristic of fresh material.

The name *Alepidia* is a most inappropriate one for this genus, as Reuter based it on the absence of deciduous scale-like hairs (perhaps rubbed away) on the specimens examined by him and by Uhler. As pointed out many times by others, however, inappropriateness of a name does not invalidate it, and this one will have to be retained.

Deraeocoris albigulus Knight, 1921

When describing this mirid, Knight remarked that he had found it only on the introduced species *Pinus sylvestris*, and surmised that the original host plant might be the native *Pinus resinosa*. In central Michigan *D. albigulus* is the species of *Deraeocoris* commonly found on jack pine, *Pinus banksiana*. I have taken it on this tree in Huron and Newaygo Counties, and the University of Michigan Museum has specimens from Roscommon County collected on jack pine by Professor S. A. Graham. These last specimens are labelled "predator on spruce bud worm."

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BOOK NOTICE

PLANT DISEASES IN ORCHARD, NURSERY AND GARDEN CROPS, by Ernst Gram and Anna Weber (translated from the Danish by Evelyn Ramsden), edited and adapted by R. W. G. Denis. Cloth, quarto, 618 pages, 349 text figures, 10 colored plates, bibliography, and index. Philosophical Library, New York, 1953. Price $18.50.

THREE NEW AFRICAN SPECIES OF CLAYIA

(MALLOPHAGA, MENOPONIDAE)

By K. C. EMERSON, *Stillwater, Okla.*

The genus *Clayia* Hopkins 1941, as now defined, contains three species of Menoponidae found on African hosts of the Avian order Galliformes. Three new species are described in this paper from material present in the British Museum (Natural History) and the American Museum of Natural History. The author is greatly indebted to Miss Theresa Clay, British Museum (Natural History) and to Mr. G. H. E. Hopkins, Zoological Museum, Tring, for their assistance and suggestions.

Genus **Clayia** Hopkins

Clayia Hopkins, 1941. J. Ent. Soc. S. Africa, 4: p. 46.—Clay, 1947. Proc. Zool. Soc. London, 117 (II and III): p. 457 (genus redefined).
Type: *Colpocephalum mjöbergi* Cummings, by original designation.

Medium-sized Menoponidae. Laterodorsal margins of head with broad preocular slit or shallow notch, temples moderately expanded. Terminal segment of antenna elongate and cylindrical, without signs of division. Prosternum with four or more median setae; otherwise, thorax as in *Colpocephalum s. str.* Venter of third femur with a distinct patch of setae. Abdominal sternites IV-VI with distinct patches of setae in each posterior lateral angle. Male genitalia with long, moderately broad basal plate; and parameres and endomeres which are free distally, rod-like and similar.

Clayia mjöbergi (Cummings)

Colpocephalum mjöbergi Cummings, 1914. Bull. Ent. Res., 5 (II): p. 163, figs. 4-6.
Clayia diasi Kéler, 1952. Moçambique, 72: p. 26, figs. 10-11.

Material examined: Four male and one female paratypes collected from *Guttera edouardi sethsmithi* Neumann, Budongo Forest, Bunyoro, Uganda; eight females collected from *Guttera edouardi pucherani* (Hartlaub), Kenya; and one male collected from *Guttera edouardi pucherani* (Hartlaub), Italian Somaliland.

On the basis of the description and illustrations given by Kéler, *Clayia diasi* described from two females obtained from *Guttera lividicollis* [= *Guttera edouardi edouardi* (Hartlaub)] appears to be identical with *Clayia mjöbergi*.

Complete illustrations of this species have been given by Cummings. The male genitalia have been illustrated in figure 1.

Clayia theresae Hopkins

Clayia theresae Hopkins, 1941. J. Ent. Soc. S. Africa, 4: p. 46.

Material examined: Holotype male and allotype female collected from *Numida meleagris major* Hartlaub, Buruli, Buganda Province, Uganda, and three males and four females from the same host collected at Soroti, Teso, Uganda.

Complete illustrations of this species have been given by Kéler. The male genitalia have been illustrated in figure 3.

Clayia spinosa (Piaget)

Colpocephalum spinosum Piaget, 1880. Les Pédiculines, p. 537, pl. 44, fig. 9.

Material examined: Lectotype male and paratype female collected from *Francolinus capensis* (Gmelin), presumably S. Africa.

When examining the types of this species, I neglected to make a drawing of the male genitalia. Miss Clay has kindly furnished me with an illustration of the male genitalia of the lectotype, which is shown as figure 2.

Clayia subtheresae, new species

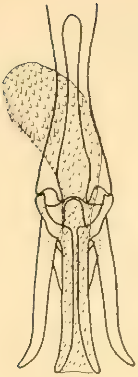
Material examined: Three males and fifteen females collected from *Acryllium vulturinum* (Hardwicke), Kenya.

Male. As illustrated in figure 4. Genitalia as illustrated in figure 5.

Female. Except for terminal abdominal segments, similar to the male. Tergite VIII bare except for lateral setae; five short setae on each lateral margin, and one long and four short setae in each posterior lateral angle. Tergite IX bare except for marginal setae; three short setae on each lateral margin, two long setae in the posterior lateral angles, and twelve short stout setae on the posterior margin. Genital plate oblong, posterior margin broadly rounded; bare except for eighteen long slender setae on the posterior margin. Fourteen long slender setae in the anal fringe.

Measurements:	Male	Female
Length of head	0.37 mm.	0.40 mm
Width of head	0.55	0.58
Width of prothorax	0.46	0.48
Width of metathorax	0.58	0.67
Width of abdomen	0.72	0.85
Total length	1.90	1.98

Figs. 1-3, 5, 7 and 9, male genitalia of *Clayia* spp.: fig. 1, *C. mjöbergi* (Cummings); fig. 2, *C. spinosa* (Piaget); fig. 3, *C. theresae* Hopkins; fig. 5, *C. subtheresae*, n. sp.; fig. 7, *C. chapini*, n. sp.; fig. 9, *C. distincta*, n. sp. Fig. 4, *C. subtheresae*, male, dorsoventral view. Fig. 6, *C. chapini*, male, dorsoventral view. Fig. 8, *C. distincta*, male, dorsoventral view.



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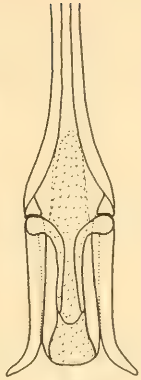

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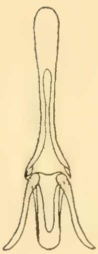

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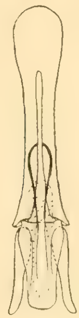

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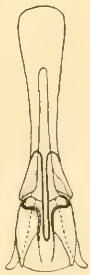

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Holotype male and allotype female in the British Museum (Natural History), type slide number 610.

Clayia chapini, new species

Material examined: Two males and one female collected from *Afropavo congensis* Chapin, East Congo Forest.

Male. As illustrated in figure 6. Genitalia as illustrated in figure 7.

Female. Except for terminal abdominal segments, similar to the male. Tergite VIII bare except for lateral setae; four short setae on each lateral margin, and one long and two medium-length setae in each posterior lateral angle. Tergite IX bare except for marginal setae; four short setae on each lateral margin, two long setae in the posterior lateral angles, and twelve short setae on the posterior margin. Genital plate oblong, posterior margin broadly rounded; bare except for twenty long slender setae on the posterior margin. A patch of fourteen long slender setae on each side of the genital plate. Twelve long slender setae in the anal fringe.

Measurements:	Male	Female
Length of head	0.33 mm.	0.33 mm.
Width of head	0.47	0.47
Width of prothorax	0.42	0.42
Width of metathorax	0.53	0.57
Width of abdomen	0.70	0.74
Total length	1.68	1.70

Holotype male and allotype female in the American Museum of Natural History, type slide number 611. Paratype male in the British Museum (Natural History).

Clayia distincta, new species

Material examined: Four males collected from *Francolinus levaillanti kikuyuensis* Ogilvie-Grant, Uganda.

Male. As illustrated in figure 8. Genitalia as illustrated in figure 9. This species differs from other species in the genus in the atypically small head and long slender abdomen. The endomeres are not free distally, and they are not similar to the parameres; yet all other characters leave little doubt that the form belongs in this genus.

Measurements of the male: Length of head, 0.36 mm.; width of head, 0.48 mm.; width of prothorax, 0.44 mm.; width of metathorax, 0.64 mm.; width of abdomen, 0.73 mm.; and total length, 2.13 mm.

Holotype male in the British Museum (Natural History), type slide number 612.

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THE BIOLOGY OF AEDES NIPHADOPSIS DYAR AND KNAB

(Diptera, Culicidae)

By Don M. Rees and Glen C. Collett, *University of Utah, Salt Lake City*

This is a report of an investigation of the distribution, life history and habits of *Aedes niphadopsis* Dyar and Knab, conducted by the authors over a period of several years. It contains available information from the literature pertaining to this species and unpublished results contained in a master's thesis prepared by the junior author. *Aedes niphadopsis* was selected for investigation because of its restricted distribution and its importance as a vernal pest in certain parts of its range.

Review of Literature

The literature contains few references to *Aedes niphadopsis*. The species was described by Dyar and Knab (1918) from specimens collected in Salt Lake County, Utah, April 1914, by Professor C. T. Vorhies. Dyar (1922) briefly referred to this species, stating that the larvae resemble those of *Aedes impiger* Walker. Matheson (1929) maintained that *Aedes niphadopsis* was probably a variety of *Aedes impiger*, but in his revised edition of the Mosquitoes of North America (1944) he gave it the status of a distinct species. Rees (1943) recognized *Aedes niphadopsis* as a valid species, cited the known distribution, and included remarks relative to its life history and importance.

Distinguishing Characters

Female. A medium sized dark gray mosquito. The mesonotum is densely covered with coarse brown and white scales. The mesonotal pattern consists of a median stripe of brown scales of variable width extending to the antescutellar space; the side and antescutellar space covered with white scales. A white line extends forward on each side of the antescutellar space and encloses a brown spot of variable size. The abdomen is black scaled with very broad basal bands of white scales on each segment and an irregular median line of white scales reducing the black scales to small quadrate spots. Wing scales are heavy and coarse with black and white scales intermixed. Costa, black scales predominate, except basal portion which is white scaled; subcosta nearly completely white scaled; black and white scales evenly intermixed on first, second, and fourth veins; black scales predominate on third, fifth, and sixth veins. Legs black and white scaled, tarsi not banded.

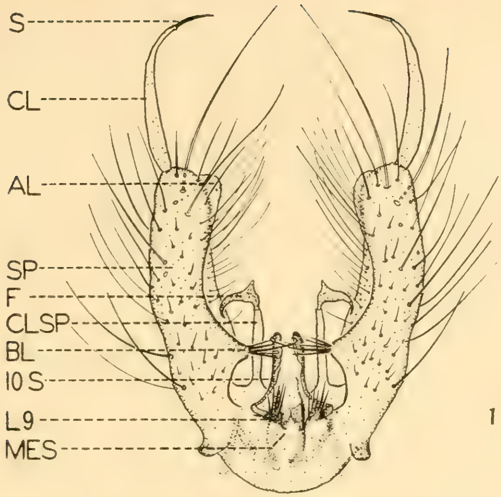
Male. Coloration and vestiture similar to female. Genitalia (Fig. 1). Side-piece nearly three times as long as wide. Apical lobe small, conical, almost bare or with a few outwardly directed small setae; basal lobe small, conical, with a single marginal long spine surrounded by one to three stout setae. Clasper expanded on basal two thirds, terminated by long spine. Claspette stem moderately stout, filament longer than stem, expanded near the middle. Mesosome cylindrical, rounded at apex. Lobes of ninth tergite distinct, each with eight to twelve stout, short spines. Tenth sternite prominent, each half with an apical hook.

Larva. (Figs. 2 and 3). Head rounded, wider than long; antennae stout, spinose, a small tuft present at the middle; upper and lower head hairs single or occasionally double; lateral abdominal hairs double on the first six segments, absent on seventh. Comb an irregular double row of eight to twelve scales; single scale with a long apical spine and several shorter lateral spines; anal segment longer than wide; anal plate extends half-way down the sides; anal gills bud-like; dorsal brush of two long hairs and two multiple hair tufts; ventral brush long and well developed; air tube nearly four times as long as wide; pecten of six to eight teeth on basal third of tube, the last one or two more widely spaced; each tooth with two or three denticles; multiple hair tuft just beyond pecten.

Distribution and Importance

To date this species has been collected only in the vicinity of suitable habitats in the Great Basin of Utah, southern and central Idaho, eastern Nevada and southern Oregon. It is frequently abundant in the spring of the year and extremely annoying to domestic livestock, other animals and man.

Fig. 1, male genitalia: AL, apical lobe; BL, basal lobe; CL, clasper, CLSP, claspette; F, filament of claspette; L9, lobe of ninth tergite; 10S, tenth sternite; Mes, mesosome; S, spine of clasper; SP, side piece. Fig. 2, head of larva: A, antenna; AT, antennal tuft; AAT, anteantennal tuft; LH, lower head hairs; UH, upper head hairs. Fig. 3, apical abdominal segments of larva: AG, anal gills; AS, anal segment; C, comb of 8th segment; DB, dorsal brush; DP, dorsal plate; P, pecten; S, siphon or air tube; SHT, siphon hair tuft; VB, ventral brush.



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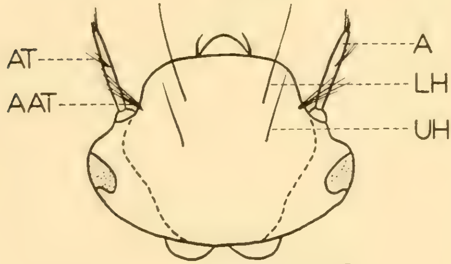

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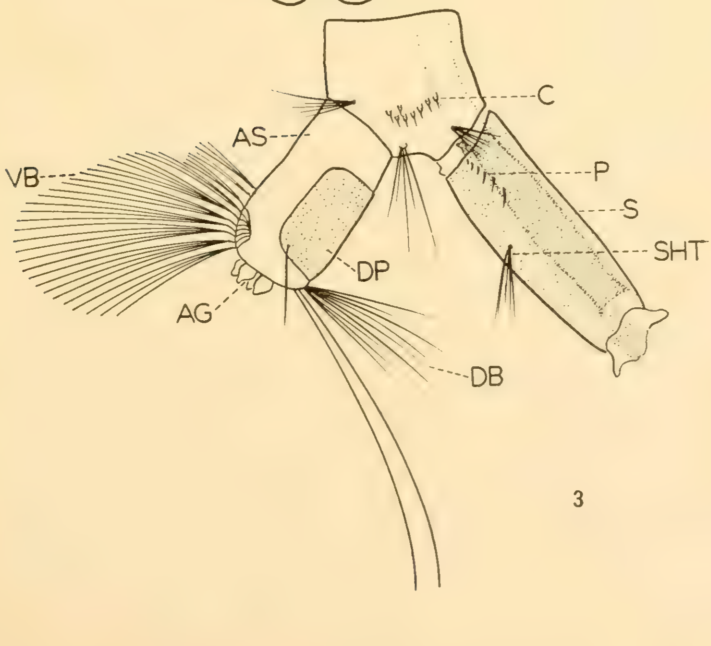

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Habitat

Aedes niphadopsis is primarily a prairie mosquito. The larvae develop in temporary, small, shallow, grassy pools exposed to sunlight. They are found at times with larvae of *Aedes campestris* Dyar and Knab and *Aedes dorsalis* (Meigen). The principal sources of water for these pools are melting snow, vernal precipitation and water from springs. The water is always alkaline, the pH varying from 7.1 to 8.2 with an average of about 7.6. The larvae also have been collected in saline water around the shores of the Great Salt Lake with a salt concentration as high as ten per cent by weight. However, salt (sodium chloride) in measurable amounts in the water does not appear to be a necessary requisite for a suitable larval habitat of this species.

The vegetation in and around the shallow pools in which the larvae develop is principally salt grass, *Distichlis stricta* (Torr.) Rydb. The adults disperse from the larval habitats into adjacent brushland of *Sarcobatus*, *Atriplex* and *Artemisia* and into the Pinyon-Juniper region of the foothills, but they have never been observed in shady, heavily timbered areas.

Life History and Habits

Aedes niphadopsis passes the summer, fall and winter in the egg stage and there is one annual brood. The eggs are deposited late in the spring singly on moist soil where they remain in suspended development until the depressions are filled with water early the following spring. Apparently the eggs must be subjected to winter climatic conditions before hatching occurs.

In the laboratory females were induced to lay eggs on cellucotton, moistened with water obtained from known larval habitats. The ovipositing females were observed making probing, exploratory movements with the tip of the abdomen in the folds and creases of the cellucotton. The eggs were deposited with the tip of the abdomen in close contact with the surface of the cellucotton, where it was slowly drawn forward leaving the egg adhering to the cellucotton. A small group of eggs was laid before another location was selected and the process repeated. In these observations the number of eggs produced by each female varied from 54 to 118. The eggs when laid are pearly white in color but turn black within 60 to 90 minutes. The females die soon after egg laying.

The larvae of *Aedes niphadopsis* are the first of the mosquito larvae to appear in the spring of the year, frequently being present in early February while the snow is on the ground. First instar larvae often were found after breaking the thin ice along the margins of pools.

Under optimum laboratory conditions, with a mean temperature of 72 to 75 degrees Fahrenheit, the length of time required to complete the life cycle from first instar larva to adult was 23 days. The length of time spent in each of the first three larval stages was similar, extending slightly over 72 hours for each instar, while the fourth stage larvae lasted approximately 10 days. The pupal stage required approximately 72 hours. The length of time required for complete larval development seems to depend primarily upon the temperature. This was established by comparing temperature to the rate of development in the field and in the laboratory. The time required for complete larval development in the field was approximately sixty days. Under these field conditions the maximum water temperature was 68 degrees Fahrenheit and the average temperature was much lower. This differs from *Aedes campestris* and *Aedes dorsalis* found in the same area whose larvae generally appear later in the spring and develop more rapidly.

The larvae of *niphadopsis* generally feed on the bottom of the shallow pools but will also remove material from the surface of grass submerged in the water and from the surface of the water if food is available there. Examination of the stomach content of fourth instar larvae revealed that they had fed chiefly on micro-organisms, such as algae and bacteria and upon available decaying organic materials including their own molted skins.

Emergence of the majority of the brood begins about the middle of April and is completed about the last of May, a period of approximately six weeks. When a brood of adults begins to emerge, the males appear first in a ratio of three males to one female. This ratio continues for the first 24 to 48 hours then the ratio is gradually reversed until the last emerging adults are all females.

Copulation is always associated with swarming of the males. The mating habits of *Aedes niphadopsis* are distinct from those of other associated species of *Aedes* in that *niphadopsis* apparently does not swarm near the place of adult emergence. Mating swarms of *Aedes niphadopsis* have been located only in foothill areas adjacent to higher mountain ranges. The swarms observed were at least one and one-half miles removed from the nearest known place of larval development and not infrequently swarming has been observed five to six miles from the nearest known place of adult emergence. Several swarms have been observed at the mouth of Sardine Canyon near Brigham City, Box Elder County, which is at least five miles from the nearest known area of larval development. The males swarm at dusk six to nine feet above the ground over some object such as a sagebrush. The number of individuals in the swarm have been observed to be less than one hundred. The females are found near the swarming males. Copulation takes place when the females enter the swarm.

After copulation, the female seeks a blood meal which is apparently necessary for the production of viable eggs. After the blood meal has been obtained, the female rests upon vegetation until the food is absorbed, which takes approximately 48 hours. Females are able to lay viable eggs in the laboratory in 60 to 72 hours after a feeding, and die soon after egg laying. In the field adult females are present until approximately the middle of June.

Flight Habits

The flight movements of this species from the area of emergence is an interesting phenomenon and seems to be closely correlated with their mating habits. From observations made on *Aedes dorsalis, Aedes vexans,* and *Aedes campestris,* Rees (1943) reported that the movements of these species are of two types: (1) a general dispersal, and (2) a direct migration. Also, in these species as in most other *Aedes*, the swarming of the males and insemination of the females takes place at the reproductive area soon after emergence, and is followed by a general dispersal or migration from these centers of population.

It seems that the first flight movements of *Aedes niphadopsis* constitute a migration into the foothill regions for mating purposes, following which there is a general dispersal of the females in search of suitable hosts for blood feedings. Those females that obtain a blood feeding of necessity must return to suitable lowland aquatic areas to deposit their eggs. Other factors influencing flight are temperature, relative atmospheric humidity and wind.

Environmental Influences

The larvae of *Aedes niphadopsis*, as previously stated, may survive freezing water temperatures, but their development at low temperatures is retarded and at temperatures not exceeding 50° F. may require 60 days. Such a prolonged larval stage extends the period over which the larvae are exposed to natural enemies. The natural enemies which have been observed feeding on the larvae of this species are: larval beetles of the families Dytiscidae and Hydrophilidae; adult Hemiptera of the family Notonectidae. Trichoptera larvae of the genus *Brachycentrus* have been observed to be voracious predators and undoubtedly other insects, amphibians, birds and other natural enemies destroy the larvae and pupae. However, after extensive observation, it is doubtful whether natural enemies can be considered significant in reducing the larval population in the kind of water in which this species of mosquito is produced. The temporary nature of most of the pools prevent certain species of natural enemies from becoming established in sufficient numbers to be obviously effective in control. The most destructive factor responsible for the highest mortality among larvae and pupae of this species is the loss of the water by evaporation and percolation into the soil, before immature stages are completed. As a result of such water loss the water areas are diminished in size and the larvae are frequently concentrated in small, isolated pockets of water or moist depressions where they die in great numbers. The species seems to have made some adaptation to these adverse conditions as many survive under such conditions. In the laboratory, using moist filter paper to simulate moist soil conditions, it was found that the survival rate of fourth instar larvae was less than one per cent, while the survival rate of pupae was 90 to 95 per cent. In the field the survival rate of the fourth instar larvae may be higher due to more favorable conditions than was provided in the laboratory.

The adults are influenced by temperature, being most active at temperatures between 60° and 70° F. At temperatures above 80° and below 50° F. activity noticeably decreases. Extended activity of adults is also closely correlated with precipitation, relative atmospheric humidity and wind velocity. Their response to these factors are similar to other prairie species of *Aedes* reported by Rees & Nielsen (1947).

Importance and Feeding Habits

The female of *Aedes niphadopsis* is a vicious biter and will persistently attack man and other animals. In the spring of the year among the foothills and along the piedmont slopes of the mountains, *Aedes niphadopsis* is frequently present in sufficient numbers to constitute a serious annoyance to domestic livestock, larger game animals and man.

Soon after emergence, both males and females were observed feeding on plant juices in the vicinity of the water from which they emerged. The females were not observed taking a blood meal until after the mating flight into the foothills and probably not until copulation had taken place.

On alighting upon the host the female usually does considerable probing with her proboscis before actual feeding takes place. Until the proboscis is inserted and feeding begins, the female is wary, but after feeding starts she is not easily disturbed. The time required to complete a blood meal is variable, requiring one and one half to three minutes. In the laboratory females could be induced to take only one complete blood meal.

Control

Aedes niphadopsis can readily be controlled by the insecticides used on other species of *Aedes*. Since this species appears as a single brood in the spring of the year, a single chemical treatment of the water in which the larvae develop, if applied at the proper time, is sufficient control for a season.

No extended abatement program has been directed specifically towards the control of this species as it is a prairie species appearing in areas generally remote from larger centers of human habitation.

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BOOK NOTICE

INSECTS: THEIR SECRET WORLD, by Evelyn Cheesman. Cloth, octavo, 246 pages, 17 full page line drawings, index. Published by William Sloane Associates, New York, 1953. Price $3.50. We had the pleasure of meeting Miss Cheesman in London a short time ago and she proved to be as energetic and entertaining as is this book of insect stories. The volume has proven in actual test to be attractive to the general reader.

ON THREE POORLY-KNOWN NEOTROPICAL MILLIPED GENERA

(POLYDESMIDA, EURYDESMIDAE)

BY RICHARD L. HOFFMAN, *Clifton Forge, Virginia*

The fundamental importance of male genitalia in the classification of diplopods has long been recognized. Inasmuch as differences reflected in these appendages are entirely qualitative, it is necessary to use illustrations to convey an idea of their appearance. Considering the remarkable degree of specific constancy in the gonopods of most forms, and the consequential ease of study, it would seem to follow that every measure should be taken to assure adequate illustration of such significant features. Unfortunately, this has not always been done.

In many instances, species have been described very briefly, and without any attempt to figure the gonopods. Generally their authors planned to follow these diagnoses with illustrations and detailed descriptions, and the intention was never executed. In some cases drawings have been published, but they are inaccurate, lack detail, or are otherwise unsatisfactory. Drawings of parts of an animal should be made with some deference to the principle of uniformity if the illustrations are to be useful to other workers. For a long time, European students of the Diplopoda have been using more or less standardized aspects of the gonopods in preparing drawings, with the result that comparisons of specimens with species depicted in the literature are readily possible. American workers have not adopted this simple and logical procedure, and their papers show the gonopods drawn from a great diversity of positions. Moreover, they have made no attempt to distinguish the various parts of the gonopods, or to indicate homologies with related species.

The present paper is concerned with the status of three South American genera, the systematic positions of which cannot be determined from the original descriptions of the genera or their included species. Two of these genera were proposed by R. V. Chamberlin in 1941; the type specimens of the species originally included (in the collection of the American Museum of Natural History) were recently studied through the kindness of Dr. Willis J. Gertsch. The other, named in 1902 by Sig. Filippo Silvestri, was based upon a poorly described species and has remained a *genus inquirenda* ever since. The discovery of a paratype of this genotype species in the collection of the U. S. National Museum makes possible a revelation of the characters of the genus and consideration of its position. All three of these genera belong to the large and doubtless heterogeneous family Eurydesmidae (= Chelodesmidae Cook, Leptodesmidae Attems).

Genus **Inconus** Chamberlin

Inconus Chamberlin, 1941, Bull. Amer. Mus. Nat. Hist., 78: 488 (generotype, *I. fronterus Chamberlin*).

The original description contrasted *Inconus* with *Chondrodesmus* Silvestri and *Zigwadesmus* Chamberlin as regards size of the keels, and stated that the gonopods are distinctive. From the illustrations one gets the impression that these appendages are biramous, one of the branches being simple and laminate, the other divided into two slender divaricate prongs. It is impossible to ascertain from the drawings which of these divisions is the solenomerite, and which is the prefemoral process.

My examination of the gonopods of the type of *Inconus fronterus* leads me to believe that the original drawings are inaccurate. The accompanying illustration, Fig. 1, of the left gonopod in mesial aspect scarcely resembles those in Chamberlin's paper (due partly to a difference in aspect). It can be seen that the coxal joint bears a conspicuous tooth on its upper mesial side, a trait shared with many other eurydesmoid genera. The prefemoral portion is of normal size and shape, bearing a moderate sized laminate prefemoral process which is remarkable chiefly in that one distal corner is drawn out into a small, slender, distally uncate process. The tibiotarsal division is separated into two branches, one of which is simply cuneate in shape with a small terminal crook—it serves as the solenomerite. The other branch (tibiotarsus proper) is slightly longer and laminate; it is somewhat rolled to form a trough-like arrangement.

As described, *Inconus* included three species, only one of which, the generotype, was known from the male sex. The other two, *brunnior* and *lissus*, were based upon female specimens provisionally referred to the genus because of similarity of body form with *fronterus*. *I. lissus* was described from the same locality as *fronterus*, and is possibly the same species. My examination of the type specimens of these three species failed to show significant differences between *brunnior* and *lissus* and only the usual sexual ones between them and *fronterus*. According to Chamberlin's drawings of the collum of *lissus* and *fronterus*, *lissus* has a much shorter collum. I think, however, this is due to the fact that the head of the specimen was depressed when the drawing was made, thus

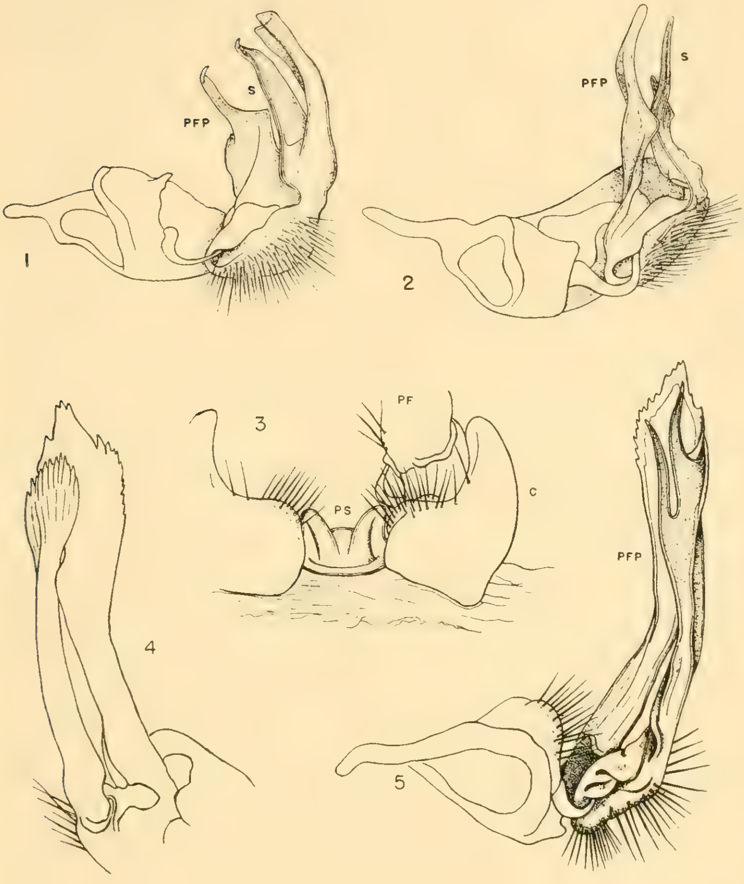

Fig. 1, *Inconus fronterus* Chamberlin, left gonopod of holotype, mesial aspect. Fig. 2, *Iphyria claralata* Chamberlin, left gonopod of holotype, mesial aspect. Fog. 3, *Euthydesmus acicarina* Silvestri, coxae of gonopods of paratype, connected by a pseudosternite. Fig. 4, the same, lateral aspect of telopodite of left gonopod. Fig. 5, the same, mesial aspect of gonopod. Abbreviations: *c*, coxa; *pf*, prefemur; *pfp*, prefemoral process; *s*, *solenomerite*. All drawings approximately same scale.

causing a foreshortening effect. The color differences mentioned seem to be due to the effects of preservation.

Two other, long-known species are clearly congeneric with *Inconus fronterus*. One is *Leptodesmus angustus* Carl, described in 1914 (Mem. Soc. neuchat. Sci. nat., 5: 884) from La Camelia, Colombia. Comparison of Carl's figure 111 (reproduced in Das Tierreich 69, 1938, as fig. 40) with that of *fronterus* given herein will show a very close relationship in every respect and one which may be demonstrated to be only subspecific. In other characters as well, such as reduction of the keels, *angustus* agrees with the *Inconus* species from Peru. The second of these species was described in 1931 (Zoologica, v. 30 (Heft 79) : 22) by Attems as *Leptodesmus levis*, from specimens collected in the Loja Valley, Ecuador. This milliped, which has little more than family relationship to the type of *Leptodesmus*, is quite similar in genital structure to both *fronterus* and *angustus* and must be included in any group embracing either of them. From the present ensemble of species, there emerges a small genus of closely related species restricted to the Andes in Colombia, Peru, and Ecuador. Numerous additional forms are to be anticipated.

A recent paper by Otto Schubart (1946, An. Acad. Brasileira Cienc., 13(3) : 165-202) has endeavored to provide a natural grouping of the numerous species heretofore referred to *Leptodesmus*. Of one of these groups, that including the forms *didymus*, *pugiunculus*, and *parallelus*, Schubart writes "Veja o genero Inconus Chamberlin 1941 de Peru." None of these three is at all similar to any of the species of *Inconus*, although it is easy to understand how Schubart could have been misled by the original description of that genus.

Actually the nearest relatives of *Inconus* are to be found in another small genus from eastern Brasil—*Cornalatus* Attems (1931, Zoologica, 30 (79) : 40). The male gonopods of the type species, *C. permutatus* Attems, are built on the same plan as those of *Inconus* except that the prefemoral process is slender and acicular instead of broadly laminate. The keels are also well developed in *Cornalatus* instead of being much reduced, although this character has less value as a generic distinction. *Cornalatus* has heretofore been monotypic. I take this opportunity to increase it with the addition of a long-misplaced species first described by Attems (1901, Mitt. Mus. Hamburg, 18: 91) as *Leptodesmus virgulatus*. *Cornalatus virgulatus* (new combination) is almost identical with the generotype in gonopod structure, differing chiefly in the shape of the keels.

Genus **Iphyria** Chamberlin

Iphyria Chamberlin, 1941, Bull. Amer. Mus. Nat. Hist., 78: 500 (Generotype, *I. claralata* Chamberlin).

Iphyria was originally described as a member of the family Xystodesmidae, owing to the presence of sharp, ventrodistal spines on the prefemora of the legs. It has recently been found, however, that this character, hitherto regarded as of considerable diagnostic value, is somewhat variable. Until the entire group has been studied, and a better distinction discovered, Dr. Chamberlin and I are in agreement that the family Xystodesmidae can not be maintained as separate from the Eurydesmidae.

From the illustration of the gonopod of *I. claralata* little can be made out. The appendage is described, in part, as follows: ". . . femoral division large, in line with terminal division; the latter presenting a broad lamina from the base of which rises a slender stylus and a shorter hook as shown in Fig. 224." The figure referred to represents the gonopod drawn *in situ*, and is obviously made at very low magnification, with much detail omitted. Reference to the illustration reproduced herein as Fig. 2 will show that Chamberlin's "terminal division" is actually the prefemoral process. The "slender stylus" and "shorter hook" are in no way connected to it, the latter actually being a small projection from about the mid-length of the former, which is the somewhat reduced tibiotarsus.

All things considered, it is clear that the closest generic relative of *Iphyria* is the large and prosperous Neotropical genus *Chondrodesmus*. This relationship is particularly evident from the striking similarities of the gonopods. *Iphyria* differs primarily in only two respects: its coxal joint is much enlarged and projects entirely behind the telopodite, and the tibiotarsus-solenomerite branch bears a small accessory projection at about its midlength. The large size of the coxa nearly approximates that attained in the Brazilian genus *Macrocoxodesmus* Schubart.

Genus **Euthydesmus** Silvestri

Euthydesmus Silvestri, 1902, Boll. Mus. Torino, 17 (432): 6 (generotype, *E. acicarina Silvestri*).

Silvestri's diagnosis of this genus is very short and does not mention much of taxonomic value aside from a peculiarity of the 2nd segment in the type species. The gonopods were not illustrated. Attems lists *Euthydesmus* in the "Unsichere gattungen" of the Leptodesmidae in his 1938 summary of the group. A male paratype of *E. acicarina* was obtained from

Silvestri by O. F. Cook, and later deposited in the U. S. National Museum. I have studied this specimen; on the basis of the gonopod structure the genus may be considered valid and distinct from all other related genera. At present it seems to be monotypic, although several species now placed in *Leptodesmus* may be allocated to *Euthydesmus* when they have been more thoroughly studied.

The following descriptive notes have been made to supplement the illustrations, figs. 3-5, of the gonopods:

Paratype.—U. S. N. M. no. 2049; adult male, 41.5 mm long and 8.0 mm wide, greatest width occurs at 7th and 8th segments. Shape of body rather compact, dorsum moderately arched, keels wide, mostly contiguous, their anterior corners rounded, posterior corners caudal to 4th segment becoming increasingly produced; keels of 19th segment very small but still discrete pointed lobes large enough to carry the pore. Upper surface of keels strongly convex. Keels margined laterally, peritreme elongate oval, pore opening dorsolaterad.

Sides of metazonites and entire prozonites smooth. Dorsum appearing smooth and shining but finely coriaceous under magnification.

Legs long, most of femur visible from above; ventral sides of legs with numerous coarse bristles; legs attached to a slightly raised metasternal platform, with a low knob at base of each leg. No arthrodial tarsal pads or other such modifications. Prefemora of pregenital legs somewhat enlarged. Sternum between 3rd pair of legs produced into a conspicuous, laminate, distally notched process, its length about equal to height of adjacent coxae.

Head smooth, of normal appearance, without peculiarities. Antennae reaching back to the middle of 4th segment, slender, articles 2-6 subequal in length and width, moderately setiferous, with four terminal sensory cones.

Gonopod socket very large, subtrapezoid in shape, wider than distance between bases of femora of 8th leg pair, with a prominent raised marginal flange. Gonopods *in situ* extend cephalad almost to base of 3rd legs, subparallel to each other and to longitudinal median axis of body. Coxae small to moderate in size, subglobose, distally with a conspicuous field of setae; tracheal rod short, stout, slightly sinuate. Coxae attached rigidly by a large prominent sclerotized median piece, probably analogous to a true sternite. Prefemur short, basally with a small rounded lobe bearing dense fine setae, and a more proximal area with much longer and larger setae. Distal end of solenite inserted beneath an overhanging lappet, from which originates the course of the seminal channel. Prefemoral process distinctly jointed at base, with the shape of a straight, very thin, lamina, distally expanded with serrate edges, exceeding the telopodite proper in length and partly embraced by an arm of the tibiotarsus. Femur and tibiotarsus of gonopod set off from prefemur by a sinuate ridge and constriction but not differentiated between themselves. Distally three tibiotarsal processes, two of which are simple and elongate; the third enlarged and curved partly around the apical third of the prefemoral process, this division, membranous and fimbriated in appearance, receives the distal end of the seminal channel. There is no distinct solenomeriate.

Specimen almost completely bleached, but giving the impression that color in life may have been uniformly reddish as in many related forms.

Type locality.—Carandasinho (Corumba), State of Matto Grosso, Brazil. The type specimens were collected by Sig. A. Borelli in 1899.

BOOK REVIEW

THE SOCIAL INSECTS, by Dr. O. W. Richards. Cloth, octavo, 219 pages, 12 text figures, 51 halftones. Published by the Philosophical Library, New York, 1953. Price $4.75.

This extremely interesting and well written book covers the subject of social life among the insects. Dr. Richards is a well known student of this field and speaks with first hand knowledge. Following a generalized introduction, the book covers the biology and habits of the solitary and social wasps and bees, the ants, termites, social parasites, and insect societies. Dr. Richards traces the steps in the evolution of insect social life from the progressive provisioning of the nest by the mother to the full development of colonies. In discussing ants, he states that not only are all ants social, but they are also more highly adaptable in their nesting habits than most bees and wasps -a very decided advantage!

The author points out the difference between gregariousness and true social life. In his words, the explanation for social life is that, ''all the advanced insect societies appear to have arisen from a progressive development of maternal care, the social unit being the mother and her offspring rather than a collection of brothers and sisters.'' He further states, ''the first essential step is that the female should continue to have contact with her eggs after she has laid them, and usually after they have hatched.''

Sex determination in the social insects is briefly but adequately covered, and an unusually interesting chapter is that devoted to the origin of social parasitism, its hazards, and how some of the hazards are met. In discussing insect societies, he states that the principal difficulties which insects have to meet in maintaining social life are, ''first, how to control reproduction; second, how to obtain enough food from a limited territory; third, how to substitute cooperative and docile for solitary, aggressive behaviour; and fourth, how to adjust behaviour to the varying needs of the community.''—MARION R. SMITH, *Agricultural Research Service.*

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

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PROCEEDINGS

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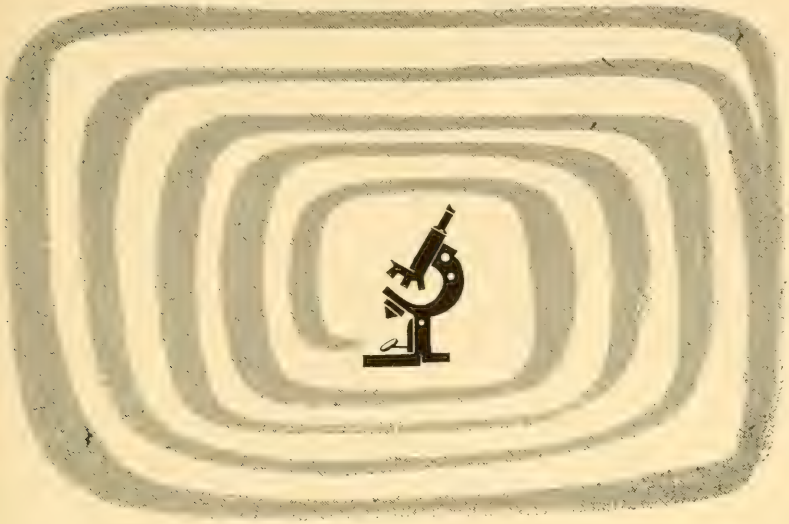

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VOL. 56 OCTOBER 1954 NO. 5

A LIST OF WASPS COLLECTED IN FLORIDA, MARCH 29 TO APRIL 5, 1953, WITH BIOLOGICAL ANNOTATIONS

(HYMENOPTERA, ACULEATA)

BY KARL V. KROMBEIN[1] and HOWARD E. EVANS[2, 3]

From March 29 to April 5, 1953, a party of hymenopterists made a brief collecting trip in southern and central Florida. Our party consisted of W. R. M. Mason, of the Division of Entomology, Canadian Department of Agriculture; C. M. Yoshimoto and C. S. Lin, graduate students in entomology at Cornell University; and the authors. We made the trip in the middle of the dry season, and had warm, sunny weather for collecting on all but one morning. Much of the vegetation, especially in Everglades National Park, was rather desiccated, and this condition is reflected in the small number of species obtained which are characteristic of moist habitat with lush vegetation. The ground-nesting species of wasps, which are perhaps more tolerant of dry conditions than those nesting in twigs, wood, or clay cells above ground, were present in surprisingly large numbers.

We collected such an impressive number of species, 166 in all, that we considered it desirable to work up an annotated list for publication. Unfortunately we can furnish only a rough estimate of the percentage of the Floridian wasps that we collected. There is no State list of insects of Florida, and the synoptic catalog of North American Hymenoptera (U. S. Dept. Agr., Monogr. 2, 1951) gives for some species only vague generalizations such as "general over most of U. S." or "eastern states." Florida may or may not be included in such statements. At any rate using the catalog as a basis, and

[1]Entomology Research Branch, U.S. Department of Agriculture, Washington, D. C.

[2]Department of Entomology, Cornell University, Ithaca, N. Y.

[3]The authors are indebted to W. R. M. Mason, C. M. Yoshimoto, and C. S. Lin for making their specimens available for inclusion in this report. We are grateful to the following specialists for identification of the prey or inquilines of wasps: A. B. Gurney (Orthoptera), C. W. Sabrosky (Diptera), and H. K. Wallace (Araneae).

making allowances here and there for species known to occur in Florida but not definitely indicated in the catalog as including Florida within the range, the senior author has estimated a total of 357 species of wasps for the State.

In this list we have indicated for each species the localities in which it was taken, the number of specimens taken at each locality, the preferred habitat where any was apparent, and biological notes for some of the species. Except for the mutillid, *Photomorphus paula* (Brad.), all species are diurnal. We have included also one sight record, the sphecid, *Podium carolina* Roh. Also included are records for a few wasps taken at Oneco in Manatee County, Waccasassa River in Levy County, and Myakka River State Park in Sarasota County by J. G. Franclemont and G. E. Ball, members of another party of entomologists, who collected in those areas from March 29 to April 4, 1953.

The itinerary of our party was as follows:

Miami, Dade County—March 29-30; collections by the senior author only on a flat sandy area with sparse vegetation opposite the Naval Air Station at Opa Locka, a Miami suburb; 38 species collected.

Florida City, Dade County—March 30; collections made in a pine-palmetto area; 6 species.

Paradise Key, Everglades National Park, Dade County—March 30; in and on the edge of a dense hammock forest; 23 species.

Cape Sable, Everglades National Park, Monroe County—March 31; on salt flats with sparse to moderately dense vegetation five miles west of Flamingo; 12 species.

Everglades, Collier County—April 1; on and adjacent to airfield; most specimens obtained on sand flats with moderate vegetation, others on vegetation at edge of mangrove association at margin of field; 34 species.

Collier-Seminole State Park, Collier County (formerly Royal Palm Hammock, but now thoroughly ''domesticated'')—April 1; most specimens on sand flats with moderate vegetation; 4 species.

Marco, Collier County—April 1; on loose white beach sand with sparse vegetation; 21 species.

Punta Gorda, Charlotte County—April 2; in ditch along roadside; 3 species.

Arcadia, De Soto County—April 2-3; a short time in open deciduous woods along Joshua Creek, several miles southwest of Arcadia, but most of the time on sandy flats adjacent to and lying above the Peace River west of town; these flats had sparse to moderately dense, mostly decumbent vegetation and were adjacent to open woods principally of live oak; 82 species, our richest collecting both in number of species and population density.

Lake Placid, Highlands County—April 4; in open deciduous woods; 12 species.

Avon Park, Highlands County—April 4; along roadside; 1 species.

Orlando, Orange County—March 29 by entire party except senior author, April 4 by entire party; sandy flats with sparse to moderately dense, mostly decumbent vegetation, and on thistles covered with honeydew; 34 species.

Juniper Springs, Marion County—April 5; open, deciduous woods and on sand flats along road; 16 species.

Silver Springs, Marion County—April 5; open, deciduous woods along road, and visiting honeydew on thistles; 9 species.

Lochloosa, Alachua County—April 5; in and on edge of open woods; 12 species.

Identifications of the wasps were made as follows; Chrysididae Tiphiidae, Mutillidae, Scoliidae, Vespidae, and Sphecidae, except *Cerceris* by the senior author, Pompilidae by the junior author, and *Cerceris* by H. A. Scullen.

Family CHRYSIDIDAE

Chrysis (*Chrysis*) *coerulans* F. Silver Springs (1♀); visiting honeydew on thistles.

Chrysis (*C.*) *conica* Br. Silver Springs (1♀); visiting honeydew on thistles.

Chrysis (*C.*) *montana* Aar. (?) Miami (1♀), Arcadia (1♀, 1♂); on sand flats.

Family TIPHIIDAE

Tiphia floridana Robt. Orlando (10♂♂), Juniper Springs (1♀); males visiting honeydew on thistles.

Tiphia intermedia Mall. Oneco (1♂), Silver Springs (1♂).

Tiphia sp. Arcadia (1♂).

Myzinum maculatum (F.). Miami (2♂♂).

Methocha (*Methocha*) *formosa* Krom. Arcadia (7♀♀); on sand flats

Methocha (*M.*) *stygia* (Say). Arcadia (3♀♀); on sand flats.

Family MUTILLIDAE

Photomorphus alogus Vier. Arcadia (1♀, 1♂); on sand flats.

Photomorphus paula (Brad.). Arcadia (4♀♀, 6♂♂); females and two males crawling on sand flats, and four males attracted to gasoline lanterns on sand flats from 7 to 8:30 p.m. One of us (KVK, No. 4523 C) caught a pair on the surface of the sand sparsely covered with prostrate vegetation, the male crawling excitedly in circles about the female half an inch from her.

Sphaeropthalma p. pennsylvanica (Lep.). Lochloosa (1♂).

Pseudomethoca frigida torrida Krom. Miami (2♀♀), Everglades (1♀), Arcadia (28♀♀, 1♂); on sand flats. One of us (KVK, No. 4353 A) caught a pair on the surface of the sand sparsely covered with prostrate vegetation, the male crawling and flying excitedly in circles about the female half an inch from her.

Pseudomethoca sanbornii aeetis (Fox). Cape Sable (1♀), Marco (1♀), Arcadia (14♀♀), Orlando (2♀♀); on salt flats, sand flats and beach sand.

Pseudomethoca simillima (Sm.). Arcadia (3♀♀), Orlando (1♀), Juniper Springs (1♀); on sand flats.

Dasymutilla asopus cassandra Mick. Paradise Key (1♀), Lake Placid (1♂), Orlando (3♀♀), Lochloosa (1♀); mostly on sand flats.

Dasymutilla castor (Bl.). Juniper Springs (1♀).

Dasymutilla chattahoochei Brad. Miami (6♀♀), Marco (4♀♀, 1♂), Arcadia (27♀♀, 3♂♂), Orlando (8♀♀, 2♂♂); mostly on sand flats.

Dasymutilla cypris (Bl.). Orlando (1♀); visiting honeydew on thistle.

Dasymutilla lepeletierii (Fox). Marco (1♀), Arcadia (1♀); on sand flats and beach sand.

Dasymutilla mutata (Bl.). Arcadia (3♀♀, 1♂); on sand flats.

Dasymutilla nigripes (F.). Miami (4♀♀, 3♂♂), Marco (1♂), Arcadia (4♀♀), Orlando (7♀♀); on sand flats and beach sand.

Dasymutilla o. occidentalis (L.). Everglades (4♂♂).

Dasymutilla pyrrhus (Fox). Marco (1♂); on beach sand.

Dasymutilla vesta sappho (Fox). Miami (3♀♀, 1♂), Cape Sable (37♀♀, 22♂♂), Everglades (2♀♀), Marco (3♀♀, 3♂♂), Arcadia (11♀♀, 31♂♂), Oneco (1♀), Lake Placid (2♀♀, 1♂), Orlando (3♀♀), Juniper Springs (1♀); on sand flats, salt flats, beach sand, and in wooded areas. One of us (KVK, No. 33153 A) observed a female *sappho* entering an empty burrow of *Epibembex cinerea* (Handl.) on the salt flats at Cape Sable on March 31. These two species were the most abundant wasps on the salt flats, and it is almost certain that the bembecid is the host of the mutillid in this area.

Timulla (Timulla) d. dubitata (Sm.). Miami (1♀), Arcadia (5♀♀), Orlando (4♀♀); on sand flats.

Timulla (T.) ferrugata (F.). Arcadia (12♀♀), Orlando (5♀♀); on sand flats.

Timulla (T.) floridensis (Bl.). Miami (1♀), Arcadia (2♀♀), Juniper Springs (1♂); females on sand flats.

Timulla (T.) ornatipennis (Brad.). Orlando (3♀♀), Silver Springs (1♀); on sand flats and visiting honeydew on thistles.

Timulla (T.) vagans rufinota Mick. Miami (1♀), Everglades (1♀); on sand flats.

Ephuta sabaliana sabaliana Schust. Cape Sable (1♀); on salt flats.

Ephuta slossonae slossonae (Fox). Miami (1♀), Arcadia (5♀♀); on sand flats.

Ephuta stenognatha stenognatha Schust. Orlando (10♂♂); visiting honeydew on thistles.

Family **SCOLIIDAE**

Campsomeris (Campsomeris) plumipes fossulana (F.). Orlando (1♀).

Campsomeris (C.) quadrinotata (F.). Arcadia (1♀).

Campsoscolia (Campsoscolia) octomaculata hermione (Bks.). Miami (1♂).

Family VESPIDAE

Vespula (*Dolichovespula*) *maculata* (L.). Arcadia (1♀).

Polistes annularis (L.). Paradise Key (1♀), Arcadia (3♀♀), Oneco (1♀); in or around wooded areas.

Polistes bellicosus Cr. Arcadia (1♀), Oneco (2♀♀); in or around wooded areas.

Polistes e. exclamans Vier. Miami (1♀), Paradise Key (7♀♀). One of us (WRMM) found a typical long, narrow nest of this species in palmetto fronds at Paradise Key, attached by a pedicel at one end, and hanging downward with the comb vertical and the long axis of the individual cells horizontal.

Polistes h. hunteri Beq. Miami (3♀♀, 3♂♂), Everglades (4♀♀, 4♂♂), Marco (2♀♀), Arcadia (3♂♂), Juniper Springs (2♀♀), Lochloosa (1♀); mostly on edge of wooded areas.

Polistes metricus Say. Cape Sable (3♀♀), Everglades (1♀), Marco (1♀), Collier-Seminole State Park (3♀♀), Arcadia (1♀), Oneco (4♀♀), Lochloosa (4♀♀); in or around wooded areas.

Polistes rubiginosus Lep. Paradise Key (1♀), Lake Placid (1♀), Lochloosa (1♀); in or around wooded areas.

Mischocyttarus (*Kappa*) *c. cubensis* (Sauss.). Miami (11♀♀, 8♂♂), Paradise Key (5♀♀), Everglades (1♀), Juniper Springs (1♀). One of us (KVK) collected a small nest behind a window shutter in Miami on March 30. The nest measured 1¼ by 2 inches, and there were eight females and eight males on the surface of the comb when it was collected.

Zethus (*Zethusculus*) *spinipes variegatus* Sauss. Arcadia (2♀♀, 1♂), Myakka River State Park (1♂), Oneco (1♂); in or around wooded areas.

Eumenes fraternus Say. Paradise Key (1♀), Lochloosa (1♀); in or around wooded areas.

Pseudodynerus quadrisectus (Say). Paradise Key (1♀, 1♂); in woods.

Monobia quadridens (L.). Paradise Key (2♀♀, 1♂); in woods.

Rygchium annulatum arvense (Sauss.). Arcadia (1♀).

Rygchium megaera (Lep.). Paradise Key (1♂); Oneco (1♂), Lochloosa (1♀); in or around wooded areas.

Rygchium molestum (Sauss.). Lochloosa (1♀).

Rygchium turpe (Sauss.). Lake Placid (1♀); in open woods; probably subspecifically distinct from typical *turpe*.

Pachodynerus erynnis (Lep.). Miami (1♂), Florida City (2♀♀), Everglades (1♀, 4♂♂); mostly at edge of wooded areas.

Symmorphus walshianus (Sauss.). Paradise Key (1♀).

Leptochilus t. tylocephalus (Boh.). Florida City (1♀, 1♂), Cape Sable (1♀), Arcadia (1♀), Silver Springs (1♀), Lochlossa (1♀); mostly in or around wooded areas.

Stenodynerus (*Stenodynerus*) *a. ammonia* (Sauss.). Miami (2♀♀, 3♂♂), Florida City (1♂), Everglades (1♂), Marco (1♂), Lochloosa (1♀); both in open and wooded areas.

Stenodynerus (*S.*) *australis* (Robt.). Silver Springs (1♀).

Stenodynerus (*S.*) *f. fundatiformis* (Robt.). Miami (1♂), Florida City (1♀), Everglades (2♀♀); in both open and wooded areas.

Stenodynerus (*Parancistrocerus*) *fulvipes rufovestis* (Boh.). Florida City (1♀, 1♂), Paradise Key (1♂), Cape Sable (1♂), Everglades (6♂♂), Marco (1♀), Collier-Seminole State Park (2♂♂); mostly in or at edge of woods.

Stenodynerus (*P.*) *pedestris bifurcus* (Robt.). Paradise Key (1♂); at edge of woods. [Det. R. M. Bohart.]

Stenodynerus (*P.*) *perennis anacardivora* (Roh.). Paradise Key (1♀), Marco (1♀).

Stenodynerus (*P.*) *saecularis rufulus* Boh. Florida City (1♀).

Family POMPILIDAE

Priocnemioides fulvicornis (Cr.). Cape Sable (3♂♂), Everglades (2♀♀, 6♂♂); flying around vegetation.

Cryptocheilus i. idoneum Bks. Arcadia (2♂♂); on grassy area along roadside.

Priocnemis (*Myrmecosalius*) *cornica* (Say). Arcadia (5♀♀); on sand.

Ageniella (*Ageniella*) *o. obscura* Bks. Orlando (1♂).

Minagenia julia (Brim.). Lake Placid (1♂), Orlando (2♀♀), Juniper Springs (1♂); first three visiting honeydew on thistles in open country; last male visiting honeydew on ground in a wooded area.

Psorthaspis legata (Cr.). Silver Springs (3♂♂); visiting honeydew on thistles.

Evagetes mohave (Bks.). Arcadia (4♀♀); on sand.

Evagetes padrinus minusculus (Bks). Arcadia (1♀); on sand.

Evagetes n. sp. (Dreisbach MS). Miami (2♀♀), Arcadia (6♀♀), Juniper Springs (1♀); mostly on sand flats.

Sericopompilus apicalis (Say). Arcadia (3♀♀), Lake Placid (1♀); on sand.

Episyron posterus (Fox). Miami (3♀♀, 1♂); on sand.

Tachypompilus f. ferrugineus (Say). Oneco (1♀).

Anoplius (*Lophopompilus*) *bengtssoni* (Regan). Arcadia (3♂♂); flying over sand flats.

Anoplius (*Notiochares*) *a. amethystinus* (F). Everglades (7♂♂), Marco (1♂); no evidence of intergradation with the following subspecies.

Anoplius (*N.*) *amethystinus atramentarius* (Dahlb.). Everglades (4♂♂).

Anoplius (*Anopliodes*) *parsonsi* (Bks.). Paradise Key (1♂), Oneco (1♂); on vegetation.

Anoplius (*Arachnophroctonus*) *americanus trifasciatus* (Beauv.). Arcadia (2♀♀); on sand.

Anoplius (*A.*) *apiculatus pretiosus* (Bks.). Everglades (1♀, 1♂), Marco (6♀♀), Arcadia (33♀♀, 5♂♂); on sand. One specimen at Arcadia (HEE No. 304) was seen stinging a spider, *Lycosa helluo* (Walck.) (immature male).

Anoplius (*A.*) *marginalis* (Bks.). Marco (2♀♀), Arcadia (5♀♀, 7♂♂); on sand.

Anoplius (*A.*) *relativus* (Fox). Miami (1♀), Cape Sable (1♂).

Anoplius (*A.*) *semirufus* (Cr.). Arcadia (6♂♂), Myakka River (1♀), Waccasassa River (1♀).

Anoplius (*Pompilinus*) *cylindricus* (Cr.). Miami (2♀♀, 1♂), Marco (2♀♀), Orlando (6♂♂); on sand and visiting honeydew on thistles.

Anoplius (*P.*) *fraternus* (Bks.). Cape Sable (9♀♀, 2♂♂), Everglades (3♂♂), Punta Gorda (21♂♂). This species was common on the salt flats at Cape Sable, where four specimens were found with their lycosid prey—*Lycosa watsoni* Gertsch (HEE 301 and 302 A), both immature; *Lycosa carrana* (Bryant) (HEE 302 B), male; and *Sosippus floridanus* Simon (HEE 400), immature. The spider was dragged backward over the ground, grasped in the wasp's mandibles by the base of the hind legs, the anterior end of the spider up. Two of the specimens (Nos. 301 and 400) were seen entering various ready-made holes in the ground for possible nesting sites, including natural cracks in the ground, crabholes, and the burrows of *Epibembex cinerea* (Handl.). Both of these individuals eventually used abandoned crabholes for nesting, preparing a cell 3 to 4 inches down off the side of the crab's burrow. The eggs were laid vertically midway on the side of the abdomen of the spider; the egg of No. 400 hatched in 2 days in a tin carried in the car, and the larva fed for 5 days, when it was preserved in an apparently full-grown condition.

Anoplius (*P.*) *insolens* (Bks.). Orlando (4♂♂); visiting honeydew on thistles.

Anoplius (*P.*) *krombeini* Evans. Arcadia (1♀); Orlando (6♀♀, 5♂♂); on sand and visiting honeydew on thistles.

Anoplius (*P.*) *splendens* (Dreis.). Arcadia (2♀♀), Orlando (2♀♀, 10♂♂); on sand and visiting honeydew on thistles. All the males are entirely black; the females have the first abdominal tergite black, the second with a reddish-brown band; the outer flagellar segments of the female are nearly four times as long as their greatest thickness.

Anoplius (*P.*) *s. stenotus* (Bks.). Arcadia (7♀♀, 5♂♂), Orlando (1♂), Silver Springs (3♀♀); on sand and visiting honeydew on thistles. Females tentatively assigned here closely resemble *splendens*, but have the outer flagellar segments only about three times as long as their greatest thickness.

Anoplius (*P.*) *s. bequaerti* (Dreis.). Miami (1♀, 1♂); on sand. The female assigned here tentatively is not separable from the preceding subspecies.

Anoplius (*Anoplius*) *fulgidus* (Cr.). Everglades (1♂).

Pompilus (*Anoplochares*) *apicatus* Prov. Juniper Springs (1♀); on ground in wooded area.

Pompilus (*A.*) *similaris* (Bks.). Paradise Key (1♀), Myakka River (2♀♀); in wooded areas. This and the preceding species are the first Florida records for the genus *Pompilus*.

Aporinellus apicatus (Bks.). Miami (1♀); on sand.

Aporinellus fasciatus (Sm.). Miami (1♀), Everglades (1♀), Arcadia (1♀), Orlando (9♀♀, 2♂♂); on sand and visiting honeydew on thistles.

Aporinellus t. taeniatus (Kohl.). Miami (3♀♀, 3♂♂), Lake Placid (1♀), Orlando (7♀♀, 3♂♂); on sand and visiting honeydew on thistles.

Paracyphononyx funereus (Lep.). Oneco (1♀), Silver Springs (1♂).

Family SPHECIDAE

Solierella inermis (Cr.). Arcadia (3♀♀, 3♂♂); on sand flats.

Solierella peckhami (Ashm.). Arcadia (1♀).

Miscophus americanus Fox. Miami (1♀), Everglades (1♀); on sand flats.

Nitelopterus slossonae barberi Krom. Orlando (5♀♀); on sand flats.

Nitelopterus s. slossonae Ashm. Miami (1♀, 2♂♂), Marco (2♀♀), Arcadia (19♀♀, 18♂♂), Juniper Springs (1♀); on sand flats. One of us (KVK, No. 4253 A) captured a female with her prey, a paralyzed spider, on the sand flats covered with sparse vegetation at Arcadia at 2 p.m. on April 2. The spider, an immature jumping spider (Salticidae), *Metaphidippus galathea* (Walck.), was held beneath the wasp, venter to venter, the wasp clutching its fore legs near the apices between her mandibles. Kaston states (Conn. State Geol. Nat. Hist. Survey Bull. 70:475, 1948) that *protervus* (Walck.), which is found in the same habitats as *galathea*, is ''abundant in grassy fields and on trees and bushes.'' The spider was as long as the wasp, and somewhat bulkier, and the latter transported her prey awkwardly and slowly by short leaps forward. The spider's third and fourth legs on the left side and second and fourth legs on the right side were missing beyond the coxae. Presumably the legs had been amputated by the wasp, possibly to make transport easier.

Nitela virginiensis Roh. Cape Sable (1♀); on salt flat, swept from semiprostrate vegetation.

Tachytes (Tachytes) rufofasciatus Cr. Everglades (1♂), Arcadia (3♂♂); on sand flats.

Tachytes (Tachynana) obductus Fox. Arcadia (1♀, 2♂♂); on sand flats.

Tachytes (T.) parvus Fox. Arcadia (4♂♂); on sand flats.

Tachytes (T.) pattoni Bks. Arcadia (2 ♀♀); on sand flats.

Tachytes (Tachyoides) mergus Fox. Everglades (1♀), Arcadia (4♀♀, 1♂); on sand flats.

Tachysphex apicalis Fox. Miami (1♀, 2♂♂); on sand flats.

Tachysphex minimus (Fox). Arcadia (3♂♂); on sand flats.

Tachysphex punctifrons (Fox). Arcadia (22♀♀, 9♂♂); on sand flats.

Tachysphex similis Roh. Miami (6♀♀, 1♂), Everglades (1♂), Collier-Seminole State Park (7♂♂), Arcadia (2♀♀), Lake Placid (1♀), Orlando (1♀); on sand flats.

Tachysphex sp. No. 1. Paradise Key (1♀); probably new.

Tachysphex sp. No. 2. Arcadia (4♀♀); on sand flats; apparently undescribed.

Tachysphex sp. No. 3. Arcadia (1♀), Orlando (1♀); on sand flats; apparently undescribed.

Motes argentata (Beauv.). Miami (1♂), Everglades (2♀♀, 8♂♂), Arcadia (5♀♀, 1♂), Orlando (1♀, 1♂); on sand flats. One of us (KVK, No. 4353 B) took a female at Arcadia at 3 p.m. dragging over the sand a paralyzed immature female gryllid, *Acheta assimilis* F. (sens. lat.).

Motes muesebecki Krom. Miami (2♀♀, 1♂), Arcadia (3♀♀, 2♂♂), Orlando (2♀♀, 1♂), Juniper Springs (4♀♀); mostly on sand flats.

Motes vinulenta muspa Pate. Arcadia (1♀).

Trypoxylon (*Trypoxylon*) *adelphiae* Sandh. Paradise Key (1♂).

Trypoxylon (*T.*) *pennsylvanicum* Sauss. Arcadia (1♂).

Trypoxylon (*Trypargilum*) *collinum* Sm. Paradise Key (1♀), Arcadia (1♀).

Trypoxylon (*T.*) *johannis* Rich. Miami (1♂), Paradise Key (1♀).

Trypoxylon (*T.*) *striatum* Prov. Arcadia (1♀); in open woods. One of us (KVK, No. 4253 B) captured this female at 11 a.m. along Joshua Creek on April 2, while she was stinging a small, immature epeirid spider, *Neoscona minima* Camb., on some vegetation.

Pluto arenivagus Krom. Arcadia (1♀).

Pluto littoralis (Mall.). Punta Gorda (3♂♂); flying over low vegetation in roadside ditch.

Chlorion (*Ammobia*) *ichneumoneum fulviventre* (Guér.). Paradise Key (5 ♀♀, 10♂♂), Everglades (13♂♂). Two colonies were observed at Paradise Key, and one at Everglades. Each consisted of 20 to 40 individuals, mostly males, flying swiftly and low over the ground in circles or figure-8 patterns.

Chlorion (*Ammobia*) *singulare* (Sm.). Cape Sable (1♀). One of us (HEE, No. 300) observed this female on the salt flats at Cape Sable closing her nest at 1:30 p.m. She was pounding the surface of the soil vigorously with her head while buzzing rather loudly. The burrow was found to be almost vertical, and at a depth of 3 inches was found a cell containing a single female long-horned grasshopper, *Conocephalus fasciatus* (DeGeer). The egg of the wasp was placed on the mesosternum of the grasshopper, one end glued firmly to the anterior margin near the mid-line, the remainder extending free at an angle from the surface. The grasshopper was fully paralyzed, but remained alive for 12 days, when it died and began to deteriorate. The egg failed to hatch in the rearing tin.

Further digging in this nest revealed two additional cells at a depth of about 6 inches, about 3 inches apart. One contained a full-grown larva spinning its cocoon, the other a completed cocoon. Each cell contained the remains of three grasshoppers, apparently of the same species as that in the upper cell. Why there was only one in the upper cell as compared to three each in the two lower cells is not known; the wasp appeared to be making the final closure of the nest and had presumably finished provisioning. It is not possible to be certain that all three cells belonged to a single nest, since the connecting burrows could not be traced. However, considering their close proximity it seems likely that they did.

A female *Chlorion singulare* emerged on October 20 from one of these cocoons after remaining at room temperature all summer. Probably the species undergoes a prolonged diapause during the hot months in southern Florida. This individual lived for 12 days on sugar-water.

Chlorion (*Isodontia*) *aztecum* (Sauss.). Paradise Key (1♀), Oneco (1♀).

Chlorion (*I.*) *harrisi* Fern. Marco (1♀).

Chlorion (*Priononyx*) *pubidorsum* (Costa). Miami (1♀), Everglades (1♀, 1♂), Arcadia (4♀♀, 1♂), Oneco (1♂), Orlando (2♂♂), Juniper Springs (1♂); mostly on sand flats. One of us (KVK, No. 32953 A) captured the Miami female as she began to excavate a burrow in a sandy area with sparse vegetation at noon on March 29.

Sphex aureonotatus (Cam.). Paradise Key (1♂), Orlando (1♀).

Sphex placidus (Sm.). Everglades (1♂), Arcadia (3♀♀); on sand flats.

Sphex procerus (Dahlb.) Arcadia (6♀♀); on sand flats.

Sphex urnarius floridensis Fern. Paradise Key (4♀♀, 3♂♂), Everglades (2♀♀), Arcadia (1♀), Juniper Springs (1♂); mostly in vegetation at edge of woods.

Sphex u. urnarius (Dahlb.). Lochloosa (1♂); in open woods.

Sceliphron caementarium (Dru.). End o'Glades (16 mi. W. of Paradise Key) (2♀♀), Everglades (2♀♀, 2♂♂), Arcadia (2♂♂).

Chalybion californicum (Sauss.). Arcadia (5♀♀), Oneco (1♀), Lochloosa (1♀).

Podium carolina Roh. Juniper Springs (1♀); in open woods; a sight record.

Alysson melleus Say. Everglades (1♂), Collier-Seminole State Park (1♂), Arcadia (6♀♀, 2♂♂); on sand flats.

Didineis texana (Cr.). Arcadia (2♂♂); on sand flats.

Nysson (*Epinysson*) *hoplisivora* Roh. Arcadia (1♀), Juniper Springs (1♂).

Dienoplus citipes Krom. Arcadia (2♀♀), Orlando (2♀♀, 4♂♂); on sand flats.

Psammaecius denticulatus (Pack.). Miami (1♂), Everglades (5♂♂), Arcadia (8♀♀, 18♂♂); on sand flats.

Psammaecius sp. Orlando (1♂); apparently undescribed.

Gorytes (*Gorytes*) *dorothyae russeolus* Krom. Lake Placid (1♀, 1♂), Juniper Springs (1♂); in open woods.

Gorytes (*Pseudoplisus*) *phaleratus* Say. Paradise Key (1♀).

Bicyrtes quadrifasciata (Say). Everglades (1♂), Arcadia (1♂), Lake Placid (1♂); in open woods and on sand flats.

Epibembex cinerea (Handl.). Cape Sable (15♀♀, 6♂♂), Everglades (1♀, 1♂), Punta Gorda (1♀); on salt flats at Cape Sable. Almost every bare spot for at least 1 mile along a dirt road at Cape Sable contained large numbers of these wasps flying over the ground about 1 foot above the surface. Males were abundant in the morning but declined in numbers after noon. Females were observed digging nests in the hard-packed dark soil, but none of the few nests that were dug out had been completed. Apparently the active period for this species had only just begun, since no females were observed carrying prey.

Epibembex sayi (Cr.). Lake Placid (1♂).

Epibembex similans (Fox). Arcadia (2♀♀); on sand flats.

Epibembex spinolae (Lep.). Marco (3♂♂); on beach sand.

Philanthus ventilabris F. (Miami (1♂).

Cerceris b. bicornuta Guér. Everglades (5♂♂), Arcadia (1♀).

Cerceris blakei Cr. Miami (1♂), Marco (1♀), Arcadia (1♂); on sand flats.

Cerceris sp. Marco (1♀), Arcadia (1♀), Avon Park (1♀). ''Close to *C. robertsonii* Fox.'' [H. A. Scullen, personal communication].

Cerceris sp. Miami (1♀). ''Also close to *robertsonii* but not the same as the preceding. Either of these could be the female of *C. austrina* Fox or *C. floridensis* Banks. Both of these are described from Florida and further study may show them to be synonyms. I have a good series on hand, but have not had time to study them carefully.'' [H. A. Scullen, personal communication].

Cerceris sp. Orlando (1♀); on sand flats. ''Very close to *C. clypeata* Dahlb. except for coloration. It possibly should be considered a subspecies of *clypeata*.'' [H. A. Scullen, personal communication.]

Entomognathus (*Toncahua*) n. sp. Arcadia (1♀).

Crabro (*Paranothyreus*) *rufibasis* (Bks.). Oneco (1♀).

Crabo (*Norumbega*) *argus* (Pack). Arcadia (2♀♀); on sand flats. One of us (HEE) observed a female flying in and out of a burrow in a sloping sand bank along the Peace River. The burrow was dug out, but no cell was found.

Ectemnius (*Hypocrabro*) *e. excavatus* (Fox). Paradise Key (2♀♀, 7♂♂); in dense woods.

Ectemnius (*H.*) *scaber rufescens* Krom. Everglades (1♂), Marco (1♂).

Oxybelus emarginatus Say. Miami (1♂), Everglades (1♀, 1♂), Arcadia (2♂♂); on sand flats.

Oxybelus exclamans Vier. Arcadia (1♂); on sand flats.

Oxybelus fulvipes Robt. Orlando (1♂); on sand flats.

Oxybelus sericeus Robt. Everglades (1♀).

Appendix

A List of the Miltogrammini (Diptera, Sarcophagidae)

Since many of the miltogrammine inquilines associated with solitary ground-nesting wasps may be collected by the same techniques useful in obtaining the wasps, one of us (KVK) attempted to make a comprehensive collection of these flies during the trip. All specimens were taken on sand flats.

Metopia lateropili Allen (?). Everglades (1♀).

Metopia leucocephala (Rossi). Everglades (4 ♀♀, 3 ♂♂).

Phrosinella fulvicornis (Coq.). Arcadia (1♀).

Gymnoprosopa polita Tns. Miami (3♀♀).

Senotainia litoralis Allen. Marco (1♀), Arcadia (1♂).

Senotainia rubriventris Macq. Collier-Seminole State Park (1♀), Arcadia (8♀♀, 18♂♂).

Senotainia trilineata Wulp. Miami (3♂♂).

AN OUTLINE OF A RECLASSIFICATION OF THE EPHEMEROPTERA[1]

By George F. Edmunds, Jr.[2] and Jay R. Traver[3]

At the present time the writers have in preparation a more extended paper on the suprageneric classification of the Ephemeroptera. It will be some time before this manuscript will be completed, and in the meantime we have some papers in press in which the new classification will be used. Also some of our colleagues have urged us to make the classification available. Although hesitant to publish our new arrangement without explaining the reasons for our decisions, we find it desirable to do so under the present circumstances.

Until such time as a discussion of the origin and authorship of the family names can be given, and until some of the protested decisions of the Copenhagen Meetings of the International Commission of Zoological Nomenclature concerning family and superfamily names are clarified, we reluctantly omit the authors of family and superfamily names. We are, in accordance with the new rules, restoring the well-known family names Polymitarcidae (in place of Ephoridae or Ephoronidae) and Prosopistomatidae (for Binoculidae), the family names being based upon available subjective synonyms of the type genera. We are tentatively including as valid genera a few generic names of doubtful validity. The names *Procloeon* and *Pseudocloeon* of S. Matsumura (1931) are impossible to apply in the present state of our knowledge. Both names are homonyms of valid genera of Baetidae; they are referred to the family Ephemerellidae in Zoological Record.

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[2]University of Utah, Salt Lake City.

[3]University of Massachusetts, Amherst.

Superfamily **HEPTAGENIOIDEA** (= Siphlonuroidea, Baetoidea)

Family **Siphlonuridae**

Subfamily SIPHLONURINAE.—The following genera are included: *Ameletoides* Tillyard, *Ameletopsis* Phillips, *Ameletus* Eaton (= *Paleoameletus* Lestage, **new synonymy**), *Andromina* Navas, *Chiloporter* Lestage, *Chimura* Navas, *Dipteromimus* McLachlan (= *Dipteromimodes* Matsumura), *Edmundsius* Day, *Metamonius* Eaton, *Metreletus* Demoulin, *Metreturus* Burks, *Nesameletus* Tillyard, *Parameletus* Bengtsson (= *Potameis* Bengtsson, *Sparrea* Esben-Peterson, *Palmenia* (Aro, MS) Lestage, *Siphlonuroides* McDunnough), *Siphlonisca* Needham, *Siphlonurus* Eaton (= *Siphlurus* Eaton, *Siphlurella* Bengtsson), *Siphluriscus* Ulmer.

Subfamily ONISCIGASTRINAE, **new rank**.—The following genera are included: *Oniscigaster* McLachlan, *Siphlonella* Needham and Murphy, *Tasmanophlebia* Tillyard, *Tasmanophlebioides* Lestage.

Family **Isonychiidae, new rank**

Subfamily ISONYCHIINAE.—The following genera are included: *Coloburiscoides* Lestage, *Coloburiscus* Eaton (= *Coloburus* Eaton *nec* Dumeril), *Murphyella* Lestage (= *Dictyosiphlon* Lestage), *Isonychia* Eaton (= *Chirotonetes* Eaton, *Jolia* Eaton), *Mirawara* Harker.

Family **Oligoneuriidae**

Subfamily PSEUDOLIGONEURIINAE (= Chromarcyinae).—The following two genera are included: *Pseudoligoneuria* Ulmer, *Chromarcys* Navas.

Subfamily OLIGONEURIINAE.—The following genera are included: *Elassoneuria* Eaton, *Homoeoneuria* Eaton, *Lachlania* Hagen (= *Neophlebia* Navas *nec* Selys, *Noya* Navas, *Noyopsis* Navas, *Alloydia* Needham), *Oligoneuria* Pictet, *Oligoneuriella* Ulmer, *Oligoneuriopsis* Crass, *Oligoneurisca* Lestage, *Spaniophlebia* Eaton.

Family **Heptageniidae** (= Ecdyonuridae, Ecdyuridae, Arthropleidae)

Subfamily HEPTAGENIINAE.—The following genera are included: *Afronurus* Lestage, *Anepeorus* McDunnough, *Arthroplea* Bengtsson (= *Haplogenia* Blair, *Remipalpus* Bengtsson), *Atopopus* Eaton, *Bleptus* Eaton, *Cinygma* Eaton, *Cinygmina* Kimmins, *Cinygmula* McDunnough, *Compsoneuria* Eaton, *Compsoneuriella* Ulmer, *Ecdyonurus* Eaton (= *Ecdyurus* Eaton, *Cinygmoides* Matsumura), *Epeorella* Ulmer, *Epeorus* Eaton [with subgenera *Epeorus* Eaton, *Iron* Eaton, *Ironodes* Traver, *Ironopsis* Traver], *Heptagenia* Walsh (= *Kageronia* Matsumura), *Notonurus* Crass, *Ororotsia* Traver, *Paegniodes* Eaton, *Rhithrogena* Eaton, *Rhithrogeniella* Ulmer, *Stenonema* Traver, *Thalerosphyrus* Eaton.

Subfamily PSEUDIRONINAE, **new subfamily**.—Only a single genus is included: *Pseudiron* McDunnough.

Family **Ametropodidae** (= Siphloplectonidae)

Subfamily AMETROPODINAE.—A single genus is included: *Ametropus* Albarda.

Subfamily METRETOPODINAE.—The two following genera are included: *Metretopus* Eaton, *Siphloplecton* Clemens.

Family **Baetidae**

Subfamily BAETINAE.—The following genera are included: *Baetiella* Ueno, *Baetis* Leach (= *Heterocloeon* McDunnough, **new synonymy**; *Acentrella* Bengtsson, *Brachyphlebia* Westwood), *Baetodes* Needham and Murphy, *Callibaetis* Eaton, *Centroptiloides* Lestage (= *Haplobaetis* Navas), *Centroptilum* Eaton, *Cloeodes* Traver, *Cloeon* Leach (= *Cloe* Burmeister, *Cloeopsis* Eaton, *Austrocloeon* Barnard), *Neobaetis* Navas, *Neocloeon* Traver, *Procloeon* Bengtsson (= *Pseudocloeon* Bengtsson *nec* Klapalek), *Pseudocloeon* Klapalek, *Pseudocentroptilum* Bogesco.

Superfamily **LEPTOPHLEBIOIDEA, new superfamily**

Family **Leptophlebiidae**

Subfamily LEPTOPHLEBIINAE.—The following genera are included: *Adenophlebia* Eaton (= *Esbenophlebia* Lestage), *Adenophlebiodes* Ulmer (= *Euphlebia* Crass), *Aprionyx* Barnard, *Atalonella* Needham and Murphy, *Atalomicria* Harker, *Atalophlebia* Eaton, *Atalophlebioides* Phillips, *Borinquena* Traver, *Calliarcys* Eaton, *Castanophlebia* Barnard, *Choroterpes* Eaton, *Choroterpides* Ulmer, *Cryptopenella* Gillies, *Deleatidium* Eaton, *Dipterophlebiodes* Demoulin, *Euthraulus* Barnard, *Fulleta* Navas, *Habroleptoides* Schoenemund, *Habrophlebia* Eaton, *Habrophlebiodes* Ulmer, *Hagenulodes* Ulmer, *Hagenulopsis* Ulmer, *Hagenulus* Eaton, *Hermanella* Needham and Murphy, *Isca* Gillies, *Jappa* Harker, *Kirrara* Harker, *Leptophlebia* Westwood [with subgenera *Leptophlebia* Westwood (= *Euphyurus* Bengtsson), *Blasturus* Eaton], *Massartella* Lestage, *Neohagenulus* Traver, *Nousia* Navas, *Paraleptophlebia* Lestage, *Simothraulus* Ulmer, *Thraulodes* Ulmer, *Thraululus* Ulmer, *Thraulus* Eaton, *Traverella* Edmunds.

Family **Ephemerellidae**

Subfamily EPHEMERELLINAE.—The following genera are included: *Ephemerella* Walsh [with subgenera *Eurylophella* Tiensuu (? = *Melanameletus* Tiensuu), *Chitonophora* Bengtsson, *Drunella* Needham (= *Eatonella* Needham), *Ephemerella* Walsh, *Timpanoga* Needham, *Torleya* Lestage], *Ephemerellina* Lestage, *Lithogloea* Barnard, *Melanemerella* Ulmer, *Teloganella* Ulmer, *Teloganodes* Eaton, *Teloganopsis* Ulmer.

Family **Tricorythidae**

Subfamily TRICORYTHINAE.—The following two genera are included here: *Tricorythus* Eaton (= *Tricorythurus* Lestage), *Neurocaenis* Navas.

Subfamily LEPTOHYPHINAE, **new subfamily**.—The following genera are included: *Bruchella* Navas, *Leptohyphes* Eaton, *Leptohyphodes* Ulmer, *Tricorythafer* Lestage (= *Caenopsis* Needham *nec* Bach, *Needhamocoenis* Lestage), *Tricorythodes* Ulmer.

Subfamily DICERCOMYZINAE, **new subfamily**.—A single genus is included: *Dicercomyzon* Demoulin.

Superfamily **CAENOIDEA**

Family **Caenidae**

Subfamily CAENINAE.—The following genera are included: *Austrocaenis* Barnard, *Brachycercus* Curtis (= *Oxycypha* Burmeister, *Eurycaenis* Bengtsson), *Caenis* Stephens (= *Ordella* Campion), *Caenodes* Ulmer, *Tasmanocoenis* Lestage.

Family **Neoephemeridae**

Subfamily NEOEPHEMERINAE.—The following two genera are included: *Neoephemera* McDunnough (= *Oreianthus* Traver), *Neoephemeropsis* Ulmer.

Superfamily **EPHEMEROIDEA**

Family **Behningiidae**

Subfamily BEHNINGIINAE.—A single genus is included: *Behningia* Lestage.

Family **Potamanthidae**

Subfamily POTAMANTHINAE.—The following genera are included: *Leucorhoenanthus* Lestage, *Neopotamanthodes* Hsu, *Potamanthellus* Lestage (= *Rhoenanthodes* Lestage), *Potamanthindus* Lestage, *Potamanthodes* Ulmer, *Potamanthus* Pictet, *Rhoenanthopsis* Ulmer, *Rhoenanthus* Eaton.

Family **Euthyplociidae, new rank**

Subfamily EUTHYPLOCIINAE.—The following genera are included: *Afroplocia* Lestage, *Campylocia* Needham and Murphy (= *Longinella* Gros and Lestage), *Euthyplocia* Eaton, *Exeuthyplocia* Lestage, *Mesoplocia* Demoulin, *Polyplocia* Lestage.

Family **Ephemeridae**

Subfamily EPHEMERINAE.—The following genera are included: *Eatonica* Navas, *Eatonigenia* Ulmer, *Ephemera* Linnaeus (= *Nirvius* Navas), *Hexagenia* Walsh [with subgenera *Hexagenia* Walsh, *Pseudeatonica* Spieth], *Ichthybotus* Eaton, *Pentagenia* Walsh.

Family **Polymitarcidae** (= Ephoridae, Ephoronidae)

Subfamily POLYMITARCINAE.—A single genus is included: *Ephoron* Williamson (= Eopolymitarcys Tshernova, **new synonymy**; *Polymitarcys* Eaton).

Subfamily CAMPSURINAE.—The following two genera are included: *Campsurus* Eaton, *Tortopus* Needham and Murphy.

Subfamily ASTHENOPODINAE, **new subfamily** (type, *Asthenopus*).—The following genera are included: *Asthenopodes* Ulmer, *Asthenopus* Eaton, *Povilla* Navas.

Family **Palingeniidae**

Subfamily PALINGENIINAE.—The following genera are included: *Ana-*

genesia Eaton, *Chankagensia* Buldovskii (= *Chankgenesia* Buldovskii), *Cheirogenesia* Demoulin, *Mortogenesia* Lestage, *Palingenia* Burmeister, *Plethogenesia* Ulmer (= *Tritogenesia* Lestage).

Superfamily **PROSOPISTOMATOIDEA**, new rank (= Baetiscoidea)

Family **Baetiscidae**

Subfamily BAETISCINAE.—A single genus is included here: *Baetisca* Walsh.

Family **Prosopistomatidae** (= Binoculidae)

Subfamily PROSOPISTOMATINAE.—A single genus is included here: *Binoculus* Geoffroy (= *Prosopistoma* Latreille, *Chelysentomon* Joly and Joly).

TWO NEW CHIGGERS FROM THE CENTRAL STATES

(ACARINA, TROMBICULIDAE)[1, 2]

BY D. A. CROSSLEY, JR. and LOUIS J. LIPOVSKY, *University of Kansas, Lawrence*

Investigations at the University of Kansas have disclosed two new species of chiggers belonging to the genus *Euschöngastia*. Both were taken from mammals inhabiting the short-grass prairies and canyons of the high plains region in the central states. These are summer chiggers and are known only from limited localities, as listed. Both species have been reared by one of us (Lipovsky) to the nymphal stage; descriptions of the nymphs will be published elsewhere.

In the following descriptions the terminology used is that of Wharton *et al.*, 1951. All measurements are in microns. Descriptions are based on the holotypes, with variations in the paratypes noted.

Euschöngastia cynomyicola, new species

(Figs. 1-5)

Diagnosis.—A *Euschöngastia* characterized as a larva by a trifurcate palpal claw, galeal seta with four or five branches, sensillae obovoid, two genualae I, subterminala and parasubterminala I present, tibiala III present, ventral setal formula beginning 2-6.

Body.—Shape almost spherical when engorged. Color in life, white. Length and width of body of holotype 369 by 341 (engorged). Eyes, two on each side; posterior eye smaller and situated on a plate apparently independently of anterior eye; distance across both eyes of one side 18, in holotype.

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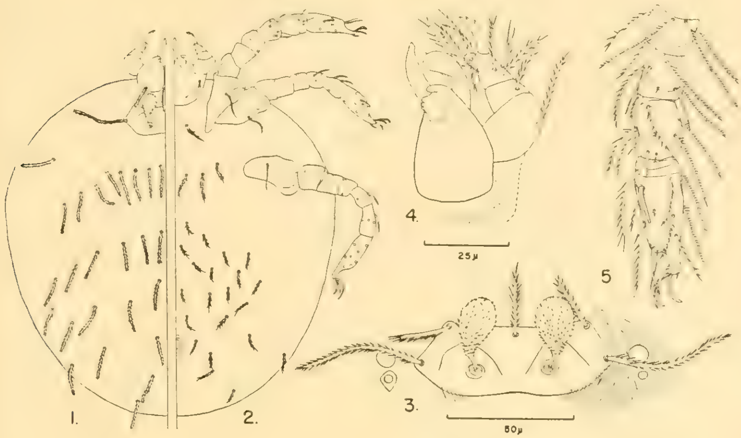
[1]The studies upon which this paper is based were conducted under a contract, N6 ori 220 Task Order II, between the University of Kansas and the Office of Naval Research.

[2]Contribution No. 865 of the Department of Entomology, University of Kansas.

Dorsal setal formula approximately 2-16-12-10-6-2-2, total 50; humeral seta measures 41, anterior dorsal seta 32, posterior dorsal seta 30. Ventral setal formula 2-6-plus 42, total 50; anterior sternal seta measures 32, anterior ventral seta 18, posterior ventral seta 23. Total body setae approximately 100.



Euschöngastia cynomyicola, new species. Fig. 1, dorsal aspect of larva; fig. 2, ventral aspect of larva; fig. 3, scutum; fig. 4, dorsal aspect of gnathosoma; fig. 5, terminal segments of leg I.

Gnathosoma.—Cheliceral blade long, slender, slightly curved, and bearing a tricuspid cap; basal segment approximately two-thirds as wide as long, punctate basally. Galeal seta with four to five branches. Capitular sternum with one pair of branched setae. Palpal femoral seta with approximately eight branches; dorsal tibial seta with approximately eight branches, lateral tibial seta nude or with one or two branches, ventral tibial seta with approximately twelve branches; tarsus with six (possibly seven) branched setae and a basal spur (7μ). Palpal claw with three prongs, the accessory prongs external or dorsal and in tandem.

Scutum.—Shape roughly rectangular, more than twice as wide as long, and pointed at the posterolateral corners; posterior margin slightly sinuous as illustrated, two ridges present, one anterior to each sensillary base; no punctae. Sensillae obovoid and with fine barbs. Scutal measurements of holotype: AW—57, PW—79, SB—33, ASB—20, PSB—14, AP—16, AM—28, AL—32, PL—57, S—32. Average and extremes of ten specimens (paratypes): AW—62 (56-69), PW—81 (76-89), SB—33 (30-35), ASB—22 (19-25), PSB—14 (13-15), AP—19 (18-21), AM—31 (29-32), AL—29 (26-32), PL—60 (55-67), S—33 (28-35).

Legs.—Branched leg setae of two types: Flexible setae with coarse setules, and stiff, rod-like setae with fine setules. Lex I coxa, trochanter, and basifemur each with one branched seta; telofemur with five branched setae, three with fine setules; genu with two genualae, one microgenuala, and four branched setae, two with fine setules; tibia with two tibialae, one microtibiala, and five branched setae, two with fine setules; tarsus with spur (15μ), microspur, subterminala, parasubterminala, pretarsala, and approximately eighteen branched setae, four with fine setules. Leg II coxa and trochanter each with one branched seta; basifemur with two branched setae, one with fine setules; telofemur with four branched setae, one with fine setules; genu with one genuala and three branched setae, one with fine setules; tibia with two tibiala and six branched setae, two with fine setules; tarsus with spur (14μ), microspur, pretarsala, and approximately fourteen branched setae, three with fine setules. Leg III coxa, trochanter, and basifemur each with one branched seta; telofemur with four branched setae, one with fine setules; genu with one genuala and three branched setae, one with fine setules; tibia with one tibiala and six branched setae, three with fine setules; tarsus with approximately sixteen branched setae, three with fine setules.

Type material.—Holotype, slide no. 7101, and 6 paratypes, nos. 7102-07, from 4 miles east of Stratton, Hitchcock County, Nebraska, found on 8 prairie dogs, *Cynomys ludovicianus* (Ord), field nos. RL490808-11 and RL490810-7, collected by Richard B. Loomis and Robert E. Elbel, August 8, 1949; and 5 paratypes, nos. 7108-12, from 13 miles south, 6 miles east of McDonald, Rawlins County, Kansas, found on 3 *Cynomys ludovicianus*, field no. RL490808-6, collected by Richard B. Loomis and Robert E. Elbel, August 8, 1949. The holotype and paratypes are deposited in the Snow Entomological Museum, University of Kansas. One paratype each will be sent to the United States National Museum, the Rocky Mountain Laboratory, the British Museum (Natural History), collection of Dr. G. W. Wharton, the South Australian Museum, Adelaide, and the Muséum National d'Histoire Naturelle, Paris, France.

Additional material examined.—The following larvae in the Snow Entomological Museum are referred to this species. KANSAS (Rawlins County): 13 mi. N. McDonald, *Perognathus hispidus,* July 28, 1948, KU slide no. 7113; 13 mi. N, 6 mi. E. McDonald, *Citellus tridecemlineatus*, August 7-8, 1949, KU 7114, and *Cynomys ludovicianus*, August 7-8, 1949, KU 7115-7116; 11 mi. S., 1 mi. E. McDonald, *Cynomys ludovicianus,* July 27, 1948, KU 7117.

Remarks.—The combination of a trifurcate palpal claw, sensillae obovoid, tibiala III present, and six setae in the second row of sternal setae will distinguish *Euschöngastia cynomyicola* from the other known species of the genus. The affinities of this species are not clear; it appears closely related to *Euschöngastia samboni* (Radford, 1942) in the shape of the scutum and sensillae. Other species possibly related to *Euschöngastia cynomyicola* are *E. criceticola* Brennan, 1948, *E. cordiremus* Brennan, 1948, and *E. guntheri* (Radford, 1942).

Euschöngastia loomisi, new species[3]

(Figs. 6-11)

Diagnosis.—A *Euschöngastia* characterized as a larva by a trifurcate palpal claw, galeal seta nude, sensillae sub-capitate, four humeral setae, three genualae I, subterminala and parasubterminala I present, and tibiala III present.

Body.—Length and width of body of holotype 397 by 326 (engorged). Color in life, white to pale orange. Eyes, two on each side, posterior eye smaller; ocular plate apparently subdermal; distance across both eyes of one side 20 in holotype.

Dorsal setal formula approximately 4-12-4-8-6-8-8-4-2-2, total 58; humeral seta measures 30, anterior dorsal seta 25, posterior dorsal seta 25. Ventral setal formula approximately 2-2-12-12-8-8-4-2-2, total 52; anterior sternal seta measures 26, anterior ventral seta 17, posterior ventral seta 21. Total body setae approximately 110.

Gnathosoma.—Cheliceral blade slender, curved, bearing a tricuspid cap and an elongate, curved subapical ventral tooth as illustrated; basal segment stout, about two-thirds as wide as long, punctate basally. Galeal seta nude. Capitular sternum with one pair of branched setae. Palpal femoral seta with approximately six branches; genual seta with approximately four branches; dorsal tibial seta with approximately four branches, lateral tibial seta nude, ventral tibial seta with approximately four branches; tarsus with four branched setae and a basal spur (5μ). Palpal claw with three prongs, the paired accessory prongs external or dorsal to the axial prong.

Scutum.—Shape roughly rectangular, less than twice as wide as long; posterior margin sinuous as illustrated; two ridges present, one anterior to each sensillary base; no punctae. Sensillae sub-capitate and with fine barbs. Scutal measurements of holotype: AW—45, PW—64, SB—11, ASB—21, PSB—11, AP—19, AM—26, AL—25, PL—32, S—22. Average and extremes of ten specimens (paratypes): AW—44 (42-26), PW—63 (59-65), SB—13 (11-15), ASB—22 (20-25), PSB—11 (9-13), AP—19 (16-20), AM—27 (25-32), AL—27 (25-32), PL—35 (28-39), S—24 (21-26).

Legs.—Leg I coxa, trochanter, and basifemur each with one branched seta; telofemur with five branched setae; genu with three genualae, one

[3]We take pleasure in naming this species in honor of Mr. Richard B. Loomis, our co-worker on the University of Kansas Chigger Project.

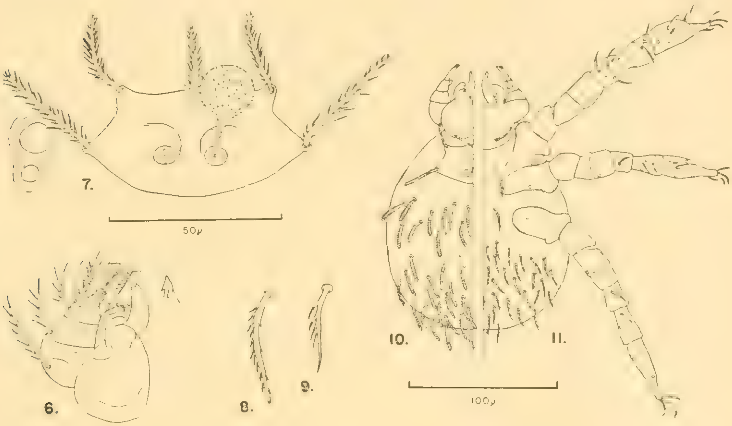
microgenuala, and five branched setae; tibia with two tibialae, one microtibiala, and eight branched setae; tarsus with a spur (11μ), microspur, subterminala, parasubterminala, pretarsala, and approximately nineteen branched setae. Leg II coxa and trochanter each with one branched seta; basifemur with two branched setae; telofemur with four branched setae; genu with one genuala and three branched setae; tibia with two tibialae and six branched setae; tarsus with a spur (13μ), microspur, pretarsala, and approximately sixteen branched setae. Leg III coxa and trochanter each with one branched seta; basifemur with two branched setae; telofemur with three branched setae; genu with one genuala and three branched setae; tibia with one tibiala and six branched setae; tarsus with approximately fourteen branched setae.

Type material.—Holotype, slide no. 7024, and twelve paratypes, nos. 7025-36, from ten and one-half miles west of Hardtner, Barber County, Kansas, found on an eastern cottontail, *Sylvilagus floridanus* (Allen), field no. RL520726-7, collected by Richard B. Loomis and D. A. Crossley, Jr., July 26, 1952; five paratypes, nos. 7037-41, from four miles south of Aetna, Barber County, Kansas, found on a silky pocket mouse, *Perognathus flavus* Baird, field no. RL520726-3, collected by Richard B. Loomis and D. A. Crossley, Jr., July 26, 1952; and ten paratypes, nos. 7042-51, from five miles south, four miles east of Aetna, Barber County, Kansas, found on two ord kangaroo rats, *Dipodomys ordi* Woodhouse, field no. RL490822-6, collected by Richard B. Loomis and Robert E. Elbel, August 22, 1949. The holotype and paratypes are deposited in the Snow Entomological Museum, University of Kansas. Two paratypes each will be sent to the United States National Museum, the Rocky Mountain Laboratory, the British Museum (Natural History), collection of Dr. G. W. Wharton, the South Australian Museum, Adelaide, the Muséum National d'Histoire Naturelle, Paris, France, collection of Dr. Charles D. Radford, the Army Medical Service Graduate School, Washington, D. C. and Dr. J. R. Audy, Institute for Medical Research, Kuala Lumpur, Malaya.

Additional material examined.—The following larvae in the Snow Entomological Museum are referred to this species: KANSAS (Barber County): 4 mi. S. Aetna, *Neotoma micropus*, August 22, 1949, KU slide nos. 7052-55, *Peromyscus leucopus*, July 25-26, 1952, KU 7056-59 and 7071-76, and August 23, 1949, KU 7060-64, *Peromyscus maniculatus*, October 7, 1951, KU 7065-70, *Perognathus flavus*, July 26, 1952, KU 7077 (4 specimens); 3 mi. S. Aetna, *Neotoma micropus*, July 25, 1952, KU 7078; 5 mi. S., 3 mi. E. Aetna, *Neotoma micropus*, July 25, 1952, KU 7086 (5 specimens); 5 mi. S. Sun City, *Sylvilagus floridanus*, September 12, 1948, KU 7089-93. OK-

LAHOMA (Woods County): 7½ mi. S., 5 mi. E. Aetna, Kansas, *Perognathus hispidus*, July 26, 1952, KU 7094-95. TEXAS (Zavala County): *Neotoma micropus,* August 20, 1952, KU 7096-7100.

Remarks.—Euschöngastia loomisi may be distinguished from all other known species of the genus by the combination of a trifurcate palpal claw, three genualae I, tibiala III present,



Euschöngastia loomisi, new species. Fig. 6, dorsal aspect of gnathosoma; fig. 7, scutum; fig. 8, anterior dorsal seta; fig. 9, anterior ventral seta; fig. 10, dorsal aspect of larva; fig. 11, ventral aspect of larva.

four humeral setae, and sensillae sub-capitate. The shape of the scutum, with the two scutal ridges and the sub-capitate sensillae, appears to be unique. The relationship of this species to other members of the genus *Euschöngastia* is obscure, due to the unique features of *E. loomisi* and to inadequate descriptions of some poorly known species; however, several characters of *E. loomisi* indicate similarity with *Pseudoschöngastia hungerfordi* Lipovsky, 1951. The ventral tooth of the chelicera, the shape of the sensillae, the shape of the anterior portion of the scutum, and the number and arrangement of the nude setae of leg I, possibly indicate a relationship between the two species. These similarities are worthy of note since the two species belong to different subfamilies, *Euschöngastia loomisi* (Subfamily Trombiculinae) having the femur of legs II and III divided into basifemur and telofemur, and *Pseudoschöngastia hungerfordi* (Subfamily Walchiinae) having the femoral segments of these legs undivided. Lipovsky, 1951, noted that some specimens of *Pseudoschöngastia* appear to have a vestige of this division, and Brennan, 1952 confirmed this observation but pointed out that "in no case are femur II and III segmentally divided in any species of *Pseudoschöngastia.*" In *Euschöngastia loomisi* femur II and III are divided; however, this division is not pronounced, since at their unions the basifemur and telofemur are the same size and seem closely articulated. Careful observation is necessary to distinguish the external division. Brennan, 1952 further states, "It would appear that *Pseudoschöngastia* is a genus of considerable taxonomic interest and phylogenetic importance since obviously it represents a transitional group between the Trombiculinae and the Walchiinae." This statement is augmented by observations on *Euschöngastia loomisi.*

Acknowledgments

The writers gratefully acknowledge the assistance of the many persons who have contributed to this study. Mr. Richard B. Loomis and Dr. Charles D. Michener, University of Kansas, made many helpful suggestions and critically read the manuscript. Specimens of both species were examined by Dr. James M. Brennan, Rocky Mountain Laboratory. Specimens of *Euschöngastia loomisi* from Texas were sent to us by Dr. Richard B. Eads, Texas State Department of Health Laboratories.

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A NOTE ON THE GENUS IDIOTETTIX OSBORN

(HOMOPTERA, CICADELLIDAE)

BY JENARO MALDONADO CAPRILES, *College of Agriculture and Mechanic Arts, Mayaguez, Puerto Rico*

In this paper a new species of *Idiotettix* is described, and *Idiocerus magnus* Osborn is redescribed and assigned to this genus. The author is greatly indebted to Dr. D. A. Young Jr., of the U. S. Department of Agriculture, for reviewing the manuscript and making several suggestions; to Dr. George Wallace, of the Carnegie Museum, Pittsburgh, Pennsylvania, for lending the type of *Idiocerus magnus,* and to Dr. J. N. Knull, Ohio State University, for allowing the examination of the type species of *Idiotettix* deposited in the collection of the university.

Idiotettix magnus (Osborn), new combination

Idiocerus magnus Osborn, 1923. Ann. Carnegie Mus. 15 (1): 13.

Male.—Crown relatively short, slightly shorter at middle than near eyes; face longer than wide; upper extremities of clypeus clearly defined, lateral edges gently curved to clypellus; clypellus slightly wider at tip than at base, twice as long as basal width; lora arcuate, reaching above middle of lateral edges of clypeus. Pronotum four times as long as the crown, less than twice as long as wide, hind margin shallowly concave; scutellum broad at base, slightly longer than pronotum.

Dull gray; head and pronotum tinged with rufous or brown; dark spot on crown near eyes; numerous irregular arcs and dots or dashes on front; clypellus with a large spot at base, its apex black; facial sutures black; pronotum with irregular blackish irrorations; scutellum black on disk, with dark triangular spots on basal angles; forewing translucent, veins blackish brown, clavus with fuscous spots at middle and apex; two transverse fuscous or blackish bars across apical cell. Thorax yellowish with some sutures blackish; hind coxae blackish at apex, legs with femora fuscous, tibiae at apex and tarsi blackish brown. Abdominal sterna blackish brown, with narrow yellowish apical margin. Pygofer yellowish, inner margin from base to apex brownish, spines brown.

Male genitalia.—Style with posterior end very long and slender, upcurved near apex; connective twice as long as wide, with posterior end produced much more than in any of the genitalia previously described, shallowly bilobed and expanded at tip; pygofer with two well developed lobes, the upper one ending in a sharp upcurved spine, lower lobe blunt at tip; aedeagus C-shaped, pointing cephalad, with basal half flattened, with two small slender, backward pointed spines near tip, caudad to these spines with a small dorsal membranous area, figs. 1-5. Length, 10.0 mm.

The description of color is slightly modified from Osborn's original description. The greater size of the posterior end of the connective and the two small spines at the tip of the aedeagus make the genitalia of this species very distinctive and different from all of Nast's species. Like *Idiotettix lautus* Nast, *I. fasciatus* Osborn, and *I. brunneus* this species has arcs on the face; it can be separated from *lautus* Nast by the shape of the genitalia and the absence of stripes on the pronotum, from *fasciatus* Osborn by the absence of the four longitudinal stripes on the pronotum and from *brunneus* Osborn by the numerous spots on the forewing.

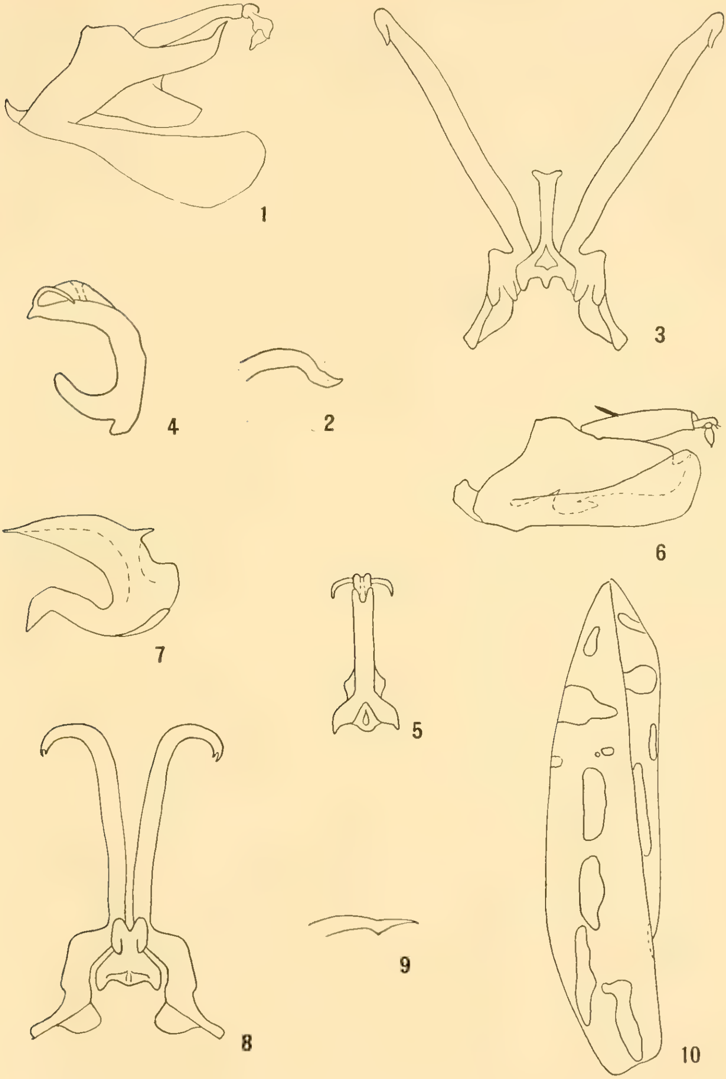
Type.—Holotype ♂, collected sweeping on an island in Río Guaporé, San Antonio de Guaporé, Brazil, July 26, 1909. Haseman collector. Carnegie Museum Acc. No. 4043.

Idiotettix festivus, new species

Male.—Crown relatively short, slightly longer at middle than next to eye; face longer than wide; upper extremities of clypeus clearly defined, lateral edges gently curved to clypellus, with slight pilosity; clypellus slightly wider at base than at apex, nearly twice as long as basal width; lora arcuate, reaching above middle of lateral edges of clypeus; genae with scarce pilosity. Pronotum four times as long as crown, less than twice as long as wide, hind margin shallowly concave; scutellum broad at base, equal in length to pronotum.

Head from base of antennae to crown reddish, with a bluish vitreous area on disc of crown, with three transverse pale orange bands, one between antennal bases, one slightly below, and one slightly above ocelli; remaining parts of face stramineous; eyes blackish brown. Pronotum wine red, hind margin with a dark olive green transverse band; scutellum wine red, disc with a lighter small area; clavus wine red, with four olive green elongate spots, the first anterior two transverse, the posterior two longitudinal; costal area wine red, remaining portions of wing almost black, with six large elongate and two small ovoid olive green spots, the last four large spots caudad after the two small spots, fig. 10. Thorax stramineous, with several irregular blackish areas; femora stramineous; first and second tibiae darker, hind tibiae brownish; abdominal sterna yellow, with semicircular blackish-brown spots on first three, corresponding spots broader and less curved on last two sterna. Valve yellowish, plate blackish brown at apex and fading to yellowish at base.

Male genitalia.—Styles with apical portion very long and slender, upcurved near apex; connective with posterior end short, bilobed; pygofer with lower lobe poorly developed, pointed, upper lobe with a notch near apex, pointed; aedeagus C-shaped, short, pointed cephalad, sharply pointed at apex, without accessory spines, apical half very thin as seen from behind, with a small process pointed caudad, basal half flattened, attached to the connective where basal half begins to flatten, figs. 6-9. Length 10.0 mm.



Idiotettix magnus (Osborn): Fig. 1, lateral view of genital capsule; fig. 2, tip of style; fig. 3, dorsal view of connective and styles; fig. 4, lateral view of aedeagus; fig. 5, posterior view of aedeagus. *Idiotettix festivus,* new species: Fig. 6, lateral view of genital capsule; fig. 7, lateral view of aedeagus; fig. 8, dorsal view of connective and styles; fig. 9, tip of style; fig. 10, pattern of spots of forewing.

The general shape of the genitalia of this species is very close to that of *stigmatus* Nast, but the aedeagus is very different in lacking accessory spines. The absence of markings on the face below the antenna and the different coloration of the wings will also separate these two species. Like *Idiotettix magnificus* (Osborn), *I. boliviana* Osb., *I. stigmatus* Nast, *I. columbianus* Nast, and *I. invitus* Nast this species lacks blackish arcs on the face. It can be separated from *magnificus* by having only one transverse band on the pronotum and this on the hind margin; from *boliviana* by the absence of any dark markings on the face below the antennae and having only one transverse band on the pronotum; and from the last three species by the genitalia.

Type.—Holotype ♂, upper Cunucunuma River, Territorio Amazonas, Venezuela, S. A. April 28, 1950. Collector J. Maldonado Capriles. U. S. N. M. no. 62273.

With the two species here discussed the genus *Idiotettix* now includes 10 species, namely: *boliviana* Osborn (1929: 466), *brunneus* Osb. (1929:467), *columbianus* Nast (1952:2), *fasciatus* Osb. (1929:466), *festivus* n. sp., *invitus* Nast (1952: 3), *lautus* Nast (1952:3), *magnificus* (Osb.) (1924:424), *magnus* (Osb.) (1923:13) and *stigmatus* Nast (1952:2).

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BOOK NOTICE

THE BEETLES OF THE PACIFIC NORTHWEST, Part I, Introduction and Adephaga, by Melville H. Hatch. vii + 340 pp., 37 plates; bibliography, index. University of Washington, Publications in Biology, vol. 16. Seattle, 1953. $5.00.

In the treatise of which this volume is part I, the author proposes to provide a descriptive analysis for the separation and naming of the species and varieties of Coleoptera found in British Columbia, Washington, Idaho, and Oregon.

FIVE NEW SPECIES OF TRIPLAX FROM WESTERN NORTH AMERICA

(COLEOPTERA, EROTYLIDAE)

By W. WAYNE BOYLE, *University of Hawaii, Honolulu.*

During the course of a revisionary study of the Erotylidae north of Mexico ten new forms have been found. Five of these are species of *Triplax*, descriptions of which follow. The number of known species of the genus in the United States and Canada now stands at sixteen, exclusive of synonyms. The revision itself will contain illustrations and the results of genitalic studies not presented here.

It appears desirable to define a few morphological terms employed in this paper for the first time in connection with North American erotylids. *Postmandibular lobes* are laterally produced flanges of the head capsule below, lying between the ventral edges of the eyes and the oral cavity. Their lateral edges form continuations posteriorly of the arcuate outline of the mandibles in ventral view, and the strongly transverse terminal segments of the maxillary palpi rest upon them in repose. These lobes are present in *Triplax* spp. and absent in *Tritoma* spp. (an exception being *Tritoma pulchra* Say, the most aberrant member of that genus in our fauna);* thus their presence or absence constitutes one of several major differences between these two largest and most closely related of North American erotylid genera. Moreover, the size and shape of the postmandibular lobes are of extreme diagnostic value and constancy at the species level within *Triplax*. Their length I define as that dimension parallel to the longitudinal body axis.

Prosternal lines are anterior continuations on the prosternum beyond the coxae of the ridges which laterally delimit the prosternal process. These are absent in *Triplax* but are present in all our species of *Tritoma* in which they bend sharply mesad and end before the prosternal apex (a difference is again evident in *Tritoma pulchra* where the prosternal lines converge to the apex and delimit a flat, raised, triangular prosternum).

Pronotal angle pores are circular or oval punctures often surrounded by one or two concentric-circular ridges (hence umbilicate in form) and are located one at each pronotal angle. They are present in all North American Erotylidae but are simple (not umbilicate) and small in all forms except *Triplax* spp. Relatively large and umbilicate in all our species of *Triplax*, their size, shape, and orientation are of considerable diagnostic value. In *T. californica* Lec. and *T. antica* Lec., for example, they are extremely large and distinguish these species at once from all others. These structures are termed "foviferous thickenings" by Casey (Mem. Coleop. 7:164-166. 1916), but I prefer the more descriptive name applied by Arrow (Fauna British India: Coleop.; Erotylidae, etc., p. 125, fig. 7. 1925.). (Arrow synonymizes *Triplax* with *Tritoma* on page 119 of that work, but such action is contraindicated by the North American forms; see discussion under *Triplax cuneata,* new species.)

Triplax cuneata, new species

This distinctive species is the most likely of any in our fauna to be mistaken for a *Tritoma.* It resembles forms of the latter genus in its elongate-oval shape, with the body distinctly more pointed behind, and in its compact antennal club, which is no more than twice as long as wide. The following characteristics, however, unquestionably place it in *Triplax*: The third antennal segment is shorter than the fourth and fifth together; the pronotum is margined basally and immarginate apically (not vice versa as in *Tritoma*) and is transversely subrectangular, with the sides weakly convergent apically (not transversely arcuate like a truncated cone laid flat, with the sides strongly convergent apically and the basal lobe strong); the stridulatory files of the occiput are absent; the angle pores of the pronotum are well developed and umbilicate; the terminal segment of the maxillary palpus bears a brush along the truncate apex; the coxae are relatively close together, separated by no more than the maximum width of the femora; postmandibular lobes are present; and the prosternal lines are absent.

In discussing the genera *Triplax* and *Tritoma,* Arrow (Fauna British India: Coleop.; Erotylidae, etc., p. 121. 1925.) states: "The two types [*Triplax russica* (L.) and *Tritoma bipustulata* Fab.] are obviously widely separated and inevitably received different generic names, but the study of their allies in all parts of the world reveals that they are connected by a long series of intermediates, so that the dividing line becomes completely obliterated." Nevertheless, no North American forms are known which are truly intermediate and not readily referable to one or the other of these genera. Several species have been described, however, or placed in the wrong genus, e.g. *Tritoma sanguinipennis* (Say), *Tritoma biguttata* (Say), and *Triplax dissimulator* (Crotch)—the latter described as *Mycotretus dissimulator* Crotch and erroneously listed under *Tritoma* in the Leng Catalogue.

Diagnosis.—Most closely related to *antica* Lec., it is distinguishable from this and all other species by the elytral color pattern which consists of three black vittae on a yellowish red background—a wide, common, wedge-shaped vitta medially including the scutellum and widest basally, and a much narrower vitta on each elytron laterally, not quite attaining the elytral apices or edges. It has neither the exceedingly large angle pores of *antica* nor the unicolorous black elytra of most other species. The trivial name is suggested by the large, median, wedge-shaped elytral vitta.

Description of type.—Color, yellowish-red, the vertex behind middle of eyes, seven irregular pronotal spots (due to muscle attachments), and tarsi except claw joints fusco-testaceous, the following piceous: a common, wedge-shaped elytral vitta and two narrower lateral ones, the entire pterothorax, middle and hind coxae, and abdomen (lighter apically); the body strongly nitidous, glabrous except on abdomen.

Shape.—Elongate-oval, weakly depressed, length 1.95 times width, dorsal profile in lateral view almost evenly arcuate; widest one-fourth elytral length behind base, the sides equally convergent anteriorly and posteriorly from this point; body suddenly obtusely rounded in anterior tenth, parabolically rounded in posterior two-fifths.

Head.—Ocular striae interrupted by punctures before reaching antennal insertions; vertex with sparse, small but unequal punctures unevenly spaced medially, these a bit stronger laterally, much stronger basally; front weakly depressed on each side between midline and antennal insertion and bearing a group of eight to ten larger punctures in each depression; epistoma short, finely, more densely punctate, the sides indistinctly, narrowly margined, apex weakly notched on median third and widely, indistinctly margined; antennae as long as width of pronotum at apical angles, the club three-segmented, moderately silvery-pubescent, compact, only twice as long as wide; segment ten shortest and widest, eleven circular, its width about seven-tenths length of eye; stem sparsely pubescent, with segments four to eight of equal length but increasing faintly in apical width; terminal segment of maxillary palpus 2.75 times as wide as long, its apical brush distinct; mentum pentagonal, the five sides about equal, its width equal to length of terminal segment of maxillary palpus; postmandibular lobes wide, with anterior edges transverse and lateral edges straight, moderately diverging posteriorly from midline of body, not quite attaining inner edges of eyes in ventral view.

Pronotum.—Transversely subrectangular, widest basally, basal width 1.56 times median length; sides feebly arcuate, moderately convergent anteriorly, more strongly so in apical third; apical angles weakly produced, slightly obtuse, approximately equalled by middle of convex, submembranous apex when the four pronotal angles are in equal focus; base finely margined, with basal lobe moderate and faintly darker in color; basal impressions weak, the basal margin in these areas scarcely interrupted by punctures no larger than those immediately anterior; discal punctures deep and sharply incised, very sparse and obsolescent on basal lobe, moderate on middle of disc, denser and stronger laterally, especially near the middle of each lateral third; angle pores average, about twice the diameter of larger discal punctures, posterior pores transversely oval.

Scutellum.—Subcordate, nitidous, sides finely margined near base.

Elytra.—With three piceous vittae, a common median one extending between fifth intervals and including scutellum basally, narrowing somewhat abruptly at widest point of elytra to area between third striae, terminating one-fifth from apex; a narrower one on each side laterad of seventh stria extending from base to near apex and narrowly separated from lateral margin, attaining same for a short distance at widest point of elytra; elytral length 1.35 times common width; bases immarginate; sides converging behind widest point to parabolically rounded apex in final third; each elytron with eight scarcely impressed striae plus a partial ninth and an indistinct scutellar stria of eight small punctures subequal in size to adjacent interval punctules; strial punctures weaker than those of pronotum, especially near the suture, separated by little more than their diameters, those on red part of disc surrounded by individual semi-translucent spots; intervals moderately punctulate.

Thorax below.— Anterior halves of pronotal epipleura strongly, sparsely punctate, the prosternum more densely so but very sparsely punctate on the process; prosternal apex strongly compressed medially but not produced in a pitcher-like lip, the apical margin transverse; prosternal process concave basally, limited laterally by posteriorly divergent ridges; mesosternum with median disc one-third wider than long, strongly convex anteriorly, more weakly so posteriorly, bearing twelve to fifteen moderate punctures; mesopleural sclerites minutely alutaceous, with a few obsolescent punctures; metathorax strongly punctate laterally, much more densely but less strongly so antero-medially, punctuation obsolescent posteriorly, the setae distinct laterally; metasternal coxal lines extremely short, raised.

Abdomen.—Punctuation and pubescence of normal density, becoming denser, the setae longer, apically; abdominal coxal lines present, extending two-thirds across basal sternite.

Measurements of type (mm).—Length 4.20; width 2.15; width of pronotal base 1.84; median pronotal length 1.18; width at extremities of pronotal apical angles 1.20; width of head at eyes 1.06; interocular width of vertex 0.81; length of eye 0.25; width of terminal segment of maxillary palpus 0.32.

Type.—Male, Midday Valley, Merritt, British Columbia, Wm. Mathers, June 21, 1926, R. Hopping Collection, California Academy of Sciences.

Paratypes.—Midday Valley, Merritt, B. C., Wm. Mathers (*Pinus ponderosa*) July 14, 1925, 1 ♀, Calif. Acad. Sci.; London Hill Mine, Bear Lake, B. C., R. P. Currie (7000 ft., collected on snow) July 21, 1 ♀, U. S. National Museum.

Variation.—The paratypes agree well with the type in size, the first-mentioned being 4.00 mm. long by 1.98 wide, the second 4.14 by 2.19 mm., respectively. Differences in color pattern are as follows: The first paratype does not exhibit the faint flush of piceous on basal lobe of pronotum; neither has the tarsi and middle coxae much darker than legs; in both paratypes the piceous color of metathorax and lateral elytral vittae becomes confluent across the bases of elytral epipleura, and the base of the prosternum is darker, thus intergrading in color between prothorax and pterothorax. In neither is the pubescence of metathoracic sides quite so visible as in the type. No secondary sexual dimorphism is apparent.

Triplax lacensis, new species

Diagnosis.—Agrees more closely with *cuneata,* new species than with any other but is distinguished therefrom by its completely black elytra and uncolorous ferruginous head. It is easily separated from *californica* and *antica,* its only certain sympatric relatives, by its much smaller angle pores, which are no more than twice the diameter of pronotal discal punctures. Separable from other species approaching it in color pattern by its complete lack of a margin on elytral bases.

Description of type.—Color, ferruginous, the scutellum piceous, the following black: elytra, pterothorax (except mesepisterna), hind coxae, and abdomen; the body strongly nitidous, essentially glabrous except on abdomen.

Shape.—Oblong-elliptical, twice as wide as long; body widest one-fourth the elytral length behind base, the sides a little more strongly convergent anteriorly than posteriorly from this point; anterior end slightly more pointed than the parabolically rounded posterior.

Head.—Ocular striae interrupted by small punctures in front of eyes; vertex with strong, moderately dense punctures, these small across arc of frontal area and above eyes, extremely coarse and scarcely separated basally near eyes; fronto-epistomal area weakly depressed on each side mesad of antennal bases, with relatively large punctures in these depressions; epistoma immarginate, its apex feebly but distinctly concave on median third, discal punctures strong latero-basally but becoming rapidly smaller and denser apically; antennae approximately as long as width of pronotum at apical angles, the club three-segmented, twice as long as wide, nitidous, moderately yellow-pubescent, with segment eleven feebly transversely elliptical, its width nine-tenths the length of eye; stem with very short, sparse setae, these slightly increasing in length and number on each segment distally, segments four to eight subequal in size and shape; terminal segment of maxillary palpus two and one-third times as wide as long; mentum pentagonal, one-fourth wider than long, the median length equal to that of terminal segment of maxillary palpus, the sides feebly convergent posteriorly; gulogenal region coarsely, densely punctate like vertex latero-basally; postmandibular lobes slightly shorter than eyes, the anterior edges transverse, lateral edges straight, diverging feebly from midline of body posteriorly, not attaining edges of eyes in ventral view, the anterolateral angles sharp.

Pronotum.—Transversely subtrapezoidal, widest basally, the basal width 1.55 times median length; sides weakly, evenly arcuate, moderately convergent to the scarcely produced apical angles which are approximately right-angular and almost equalled by the convex, feebly bilobed, submembranous apex when the four pronotal angles are in equal focus; base with a moderate lobe considerably more produced than apex; basal impressions absent, the margin here interrupted by large punctures equal in size to those adjacent on disc; discal punctures strong, sharply incised, and deep, smallest medially and sparsest on basal lobe, separated by about their diameters on middle of disc but becoming progressively larger and slightly denser laterally until those close to sides are separated by a fraction of their diameter which is subequal to basal width of third antennal segment; angle pores moderate, the anterior ones simple and equal in size to larger discal punctures, the posterior ones distinctly umbilicate, transversely oval, twice as large.

Scutellum.—Subcordate, one-half wider than long, the apex sharp but obtusely angled.

Elytra.—One-half longer than wide, immarginate basally, widest one-fourth from base; sides equally convergent to base and posteriorly for one-third their length from widest point, the apex parabolically rounded in remaining five-twelfths; each elytron with nine unimpressed striae plus a scutellar stria of six or seven punctures, the ninth striae entire but of widely spaced punctures half as numerous as those of other striae; strial punctures smaller than those of pronotum, less sharply incised, mostly separated by more than their diameters; intervals punctulate.

Thorax below.—Prosternum and apical three-fourths of epipleura coarsely, densely punctate like pronotal disc laterally, the punctures much smaller on prosternal process; prosternum compressed medioapically, without a produced median lip, the apex transverse; prosternal process weakly longitudinally rugose behind coxae, delimited laterally by posteriorly divergent ridges, the base arcuately concave; mesosternum transversely subquadrate, anteriorly convex, posteriorly truncate, the disc bearing twelve to fifteen moderate punctures mostly disposed in two transverse rows in front of the middle, the lateral wings each with six or seven scarcely separated larger punctures; mesepisterna ferruginous, impunctate; mesepimera black, with a few irregular punctures; metathoracic punctures laterad of middle coxae as coarse as those of pronotum, becoming weaker and scarcely denser antero-medially, obsolescent posteriorly, confluent on outer sides of metepisterna.

Legs.—With the dense tibial pubescence shorter than usual.

Abdomen.—Punctuation normally dense, becoming somewhat denser apically; setae much shorter and less distinct than normal, a few longer ones medially on the three apical sternites; abdominal coxal lines well developed, strongly divergent posteriorly, extending three-fourths across basal sternite.

Measurements of type (*mm*).—Length 4.21; width 2.13; width of pronotal base 1.86; median pronotal length 1.20; width at extremities of pronotal apical angles 1.24; width of head at eyes 1.13; interocular width of vertex 0.85; length of eye 0.25; width of terminal segment of maxillary palpus 0.32.

Type.—Male, Lake Tahoe, California, Hubbard and Schwarz, July 14, U. S. N. M. no. 61979.

Paratypes.—Same data as type, 1 ♂, 2 ♀, U. S. National Museum; Round Meadow, Giant Forest, Tulare County, Calif., Ralph Hopping, July 1908, 1 ♀, R. Hopping Collection, Calif. Acad. Sci.

Variation.—The wide intraspecific range in size often seen in species of *Triplax* and *Tritoma* is well shown by the five specimens before me. The male and one of the females taken with the type are much smaller than the other three specimens. The length and widths, respectively, of the four paratypes are (in mm.): 3.52 by 1.79; 3.45 by 1.73; 4.55 by 2.39; and 4.55 by 2.37. The color of the mesopleural sclerites is variable; sometimes both are piceous or black, and sometimes the mesepisternum is ferruginous and the mesepimeron black as in the type. Moreover, the entire mesosternum may be piceous and intermediate in color between the prothorax and metathorax. The anterior pronotal angle pores may be either simple and half the size of the posterior ones as in the type, or they may be umbilicate and equal in size to the posterior ones. The few longer setae of the abdomen may not be confined to the middle of the last three sternites, or may be entirely absent. The abdominal pubescence, however, appears always to be much shorter than usual over the greater portion of the abdomen. No secondary sexual characters can be found.

Triplax marcescens, new species

Diagnosis.—Closely related to *T. frontalis* Horn which has the head above black except the vertex behind the eyes, the entire undersurface yellow, and the elytra nitidous, with moderate punctures. This new form has the head entirely yellow, the metathorax and abdomen piceous, and the elytra made dull by a strong reticulate microsculpture and bearing excessively large punctures—those of the sixth and seventh striae behind the humeral callus subequal in diameter to the width of interval between. The dull and strongly punctate elytra distinguish this from all other New World forms. The trivial name alludes to the characteristics which give the elytra a somewhat shrivelled or desiccated appearance.

Description of type.—Color, reddish yellow, the scutellum and elytra black, the following piceous: antennae, mesopleural sclerites, metathorax, middle and hind coxae and trochanters, and abdomen.

Shape.—Oblong-elliptical, length 2.3 times width, sides subparallel and moderately indented at pronotal-elytral base, the body widest two-fifths the elytral length behind base and about equally, slightly parabolically rounded at both ends.

Head.—Ocular striae strong, extending over antennal insertions; vertex coarsely, densely punctate, the punctures deep, separated by from one-half to once their diameter which is equal to about half the basal width of third antennal segment, those above eyes somewhat larger and denser; sides of head strongly arcuately concave immediately in front of eyes, thus making sides of fronto-epistomal region almost parallel and only faintly convergent anteriorly; epistoma with sides straight and narrowly, indistinctly margined, apical angles sharply rounded, apex faintly angularly concave, the punctures denser and a bit smaller, the setae more visible laterally, than those of vertex; antennae one-third longer than pronotal width at apical angles, the club three-segmented and narrow, its length 2.5 times width, the three segments increasing slightly in width distally, segments nine and ten truncate apically, eleven circular and four-fifths as wide as length of eye, its apical half densely gray-pubescent; stem clothed with whorls of sparse, coarse, piceous setae; terminal segment of maxillary palpus strongly asymmetrical, i.e. the basal attachment lying nearly two-thirds of width from remote side, its width three times median length and twice the length of eye; mentum minute, campanulate, as long as wide; postmandibular lobes large, as long as eyes, with lateral edges arcuately convex and overlapping edges of eyes in ventral view.

Pronotum.—Transversely subrectangular, widest one-fourth before base, its basal width 1.4 times median length, sides evenly arcuate, and base appearing but little wider than apex (actually 0.32 wider); apical angles obtuse and extremely weakly produced, exactly equalled by the faintly convex and bilobed apex when the four pronotal angles are in equal focus; basal lobe weak, scarcely more convex than apex; basal impressions absent but short basal rows of larger punctures present on each side of lobe; punctuation less dense but stronger than that of vertex except on basal lobe, especially coarse laterally on middle of each half of disc; the setae, as on head and entire prothorax, scarcely exceeding punctures but unusually stout and distinct; angle pores circular, about equal in diameter to largest of punctures along basal margin.

Scutellum.—Two-thirds wider than long, with sides subparallel, apex short and faintly acuminate, the disc punctulate-pubescent like intervals behind.

Elytra.—Length 1.56 times width, the bases strongly margined, with submarginal striole interrupted by closely and irregularly spaced, coarse punctures; sides arcuately convergent anteriorly in basal fifth, straight and faintly convergent posteriorly in second and third fifths, slightly parabolically rounded in apical two fifths, the profile of dorsum in lateral view similar to that of each side in dorsal view; each elytron with eight strong, moderately impressed striae plus a weaker ninth, the first and second striae diverging strongly from suture near base but scutellar striae absent; strial punctures exceedingly large and deep, much coarser than pronotal punctures, those of sixth and seventh striae near humeral callus but little smaller in diameter than width of interval between; intervals setigerous-punctulate, strongly and minutely reticulate, consequently dull, contrasting with nitidous pronotum; many strial punctures, especially along the suture, separated by short, transverse, undulate rugae, the apical two-thirds of epipleura likewise rugulose.

Thorax below.—Apical halves of pronotal epipleura and prosternum punctate like pronotum medially; prosternum evenly convex, apically transverse, its process relatively narrow between coxae (equal in width to fore-tibial apex), limited laterally by weak ridges, its base declivent and slightly concave medially; mesosternum quadrate, each lateral wing with four or five extremely coarse punctures; mesopleural sclerites minutely reticulate, with obsolescent punctuation; metathoracic punctuation strong laterally, weaker medially and posteriorly, the setae a bit longer and more visible than on rest of thoracic venter; metasternal coxal lines virtually obsolete.

Abdomen.—Moderately densely punctulate-pubescent, the density increasing apically, the setae similar to those of metasternal sides; abdominal coxal lines completely absent.

Measurements of type (mm).—Length 5.18; width 2.25; width of pronotal base 1.89; median pronotal length 1.34; width at extremities of pronotal apical angles 1.43; width of head at eyes 1.24; interocular width of vertex 0.94; length of eye 0.31; width of terminal segment of maxillary palpus 0.62.

Type.—Female, Santa Rita Mountains, Pima and Santa Cruz Counties, Arizona, Hubbard and Schwarz, June 14, U. S. N. M. no. 62003.

Paratypes.—Same data as type, 1 ♀, U. S. National Museum; Huachuca Mts., Cochise and Santa Cruz Counties, Ariz., D. J. and J. N. Knull, Aug. 12, 1950, 1 ♀, Ohio State University.

Variation.—The three specimens show only a moderate range in size, the length and width of the first-mentioned paratype being 5.80 and 2.69 mm., of the second 5.45 and 2.30 mm. The paratype taken with the type has the metasternum lighter in color than the other two specimens, but it is probably somewhat teneral, as all of the dark parts are lighter in color. Judging by the affinities of this species with *frontalis* and *macra*, in both of which the males have the front tibiae more strongly dilated than the females, it appears likely that the same sexual dimorphism will be found to obtain in *marcescens* when males are collected.

Triplax wehrlei, new species

Diagnosis.—A close relative of *T. flavicollis* Lacordaire from which it differs by having the scutellum, pterothorax below (except metepisterna), and abdomen reddish yellow, not black, and in having the terminal segment of the maxillary palpus wider, its width 55 percent of the interocular width of vertex as contrasted to from 45 to 48 percent in *flavicollis.* From *flavicollis* and all other American species it is separable by its gradually emergent, five-segmented antennal club, segment seven being triangular and considerably wider than six, thus belonging to the club. The antennal club of *flavicollis* is four-segmented, with segment seven neither triangular nor wider than six, hence clearly belonging to the stem.

This species is dedicated to the memory of the late Dr. L. P. Wehrle of the University of Arizona, under whose kind direction I first became interested in entomology.

Description of type.—Color, reddish yellow, elytra above and antennal clubs black, elytral epipleura reddish yellow, metepisterna piceous; the body nitidous.

Shape.—Oblong-elliptical, twice as wide as long, widest one-fourth to one-third the elytral length behind base; sides gently, evenly arcuate, weakly indented at pronotal-elytral base; ends of body about equally, slightly parabolically rounded in anterior and posterior fourths.

Head.—Ocular striae extending over antennal insertions; vertex densely, deeply punctate, the punctures not sharply incised, mostly separated by less than their diameters which are from one-third to one-half as great as basal width of third antennal segment, becoming stronger basally and confluent latero-basally where they efface the ocular striae immediately behind eyes; setae clearly visible, exceeding the punctures considerably to give this form the most distinctly pubescent head of any North American species; sides of fronto-epistomal area forming feebly convex edges of head apically; epistoma with apical angles rounded, the apex broadly, 145-degree-angularly concave, discal punctuation uniformly dense, weaker than that of front and vertex; labrum apically concave, longer than usual; antennae about one-eighth longer than pronotal width at apical angles, the club five-segmented and lax, its length 2.7 times width, segment eleven transversely elliptical and 0.84 as wide as length of eye; stem reddish yellow, slender, with normal sparse, coarse yellow setae, segments three to six gradually decreasing in length, subequal in width, segment six intermediate in color between stem and club; terminal segment of maxillary palpus strongly transverse, its width 3.67 times length and 0.55 times interocular width of vertex; mentum pentagonal, its width one-fifth greater than median length and equal to length of terminal segment of maxillary palpus, its apical angle weakly obtuse, sides moderately convergent posteriorly; gulo-genal region densely, coarsely punctate, with setae a bit stronger than on vertex; postmandibular lobes small but strongly produced laterally, three-fifths as long as eye, anterior and lateral edges rounded and not attaining inner edges of eyes, lateral edges parallel to longitudinal body axis.

Pronotum.—Transversely subtrapezoidal, widest one-tenth before base, basal width 1.56 times median length; sides evenly arcuate, moderately convergent to the obtuse, scarcely produced apical angles which are not quite equalled by the faintly convex, submembranous apex when the four pronotal angles are in equal focus; basal lobe much more strongly produced than apex; basal impressions absent, the margin here touched by five to eight large punctures with diameters two to three times those of adjacent discal punctures; the latter small, a little sparser than those of vertex and of approximately uniform density, mostly separated by a bit more than their diameters, slightly stronger and more sharply incised laterally near middle of each half of disc; setae very fine but exceeding punctures by at least their depth; angle pores moderately small, the posterior ones larger and appearing half cut off by pronotal base.

Scutellum.—Reddish yellow, the postero-lateral edges appearing black because of dark elytra beneath; one-half wider than long, base slightly concave and sharply deflexed under basal lobe of pronotum, apex sharp, obtuse-angular.

Elytra.—Piceous-black, the epipleura reddish yellow edged with black; four-tenths longer than wide, the bases narrowly margined, with submarginal striole interrupted by numerous punctures somewhat smaller than those of striae; sides weakly, evenly convex, the common apex parabolically rounded in terminal third; each elytron bearing eight unimpressed striae plus an indistinct ninth of much smaller punctures; punctures bluntly incised, larger than pronotal discal punctures and separated by about their diameters on basal halves of fourth and fifth striae, smaller laterad and mesad and more closely spaced on first three striae some distance behind base; intervals coarsely, moderately densely punctulate and bearing a coarse reticulum of fine cracks, each interstice of which includes one strial puncture or one to three interval punctules (this characteristic also more or less discernible in a few other species); the setae minute; epipleura sparsely setigerous-punctulate.

Thorax below.—Pronotal epipleura on anterior halves with numerous large, shallowly indented setigerous punctures; prosternal-episternal area densely, coarsely punctate, with punctures sharply incised and larger than those of vertex, the setae less distinct than those of epipleura; prosternum evenly convex, apically transverse, the process sparsely punctulate-pubescent, relatively narrow, limited laterally by subparallel ridges, the base unusually deeply emarginate in a shallow V; mesosternum subpentagonal, obtuse-angular anteriorly, truncate posteriorly, bearing a few setigerous punctules medially and several large punctures on sides and lateral wings; mesopleural sclerites scarcely punctate; metasternum on lateral sixths coarsely punctate like sides of prosternum, minutely, not more densely punctulate on median half, all metasternal punctures bearing rather long setae; metasternal coxal lines absent; metepisternal punctures a bit denser than on metasternal sides.

Legs.—Front and hind coxae narrowly separated, maximum width of hind femora about one-seventh greater than width of prosternal and abdominal processes.

Abdomen.—Uniformly densely punctulate-pubescent, the setae moderately long; abdominal coxal lines fine, weakly divergent posteriorly, extending two-thirds across basal sternite.

Measurements of type (mm).—Length 4.55; width 2.30; width of pronotal base 2.07; median pronotal length 1.33; width at extremeties of pronotal apical angles 1.38; width of head at eyes 1.24; interocular width of vertex 0.92; length of eye 0.29; width of terminal segment of maxillary palpus 0.51.

Type.—Male, Patagonia, Santa Cruz County, Arizona, J. O. Martin, July 9, 1930, California Academy of Sciences.

Paratypes.—Santa Rita Mts., Pima and Santa Cruz Counties, Ariz., Hubbard and Schwarz, June 15, 1 ♀, U. S. National Museum. (Besides the paratype, there is a single specimen in the Fall Collection, Museum of Comparative Zoology, Harvard Univ., from the Pinal Mts., Gila County, Ariz.)

Variation.—The paratype differs from type in the following respects: It is somewhat smaller in size, its length and width being respectively 4.14 and 2.12 mm.; a teneral specimen, it has the dark parts of body lighter than those of type, and the metepisterna are yellow like the metasternum; the epistomo-frontal sides are straight, not weakly convex; the apical angles of epistoma are more sharply rounded; the apex less deeply concave than in the type. The disc of vertex bears a shallow impression on each side, but these are probably of accidental origin. No certain secondary sexual characters are discernible.

Triplax microgaster, new species

Diagnosis.—Agrees more closely with *T. thoracica* Say than with any other, but is almost equally close to *T. puncticeps* Casey. It is distinguishable at once from these and all other species by its almost uniform brownish yellow color and by its relatively short abdomen, which occupies scarcely more than the apical half of elytral cavity below.

Description of type.—Color, brownish yellow, with elytra faintly darker, eyse alone black; the body moderately nitidous, essentially glabrous.

Shape.—Elongate-oval, length 2.16 times width, body widest one-fourth the elytral length behind base, obtusely rounded in front, parabolically rounded in apical five-twelfths of elytra, elytral sides straight and moderately convergent for one-third their length behind point of greatest width.

Head.—Ocular striae fine but distinct posteriorly, extremely close to eyes directly above, obliterated anteriorly by large discal punctures; vertex with dense, coarse, deep punctures separated by from one-fourth to once their diameter and with scattered, minute punctules between; setae scarcely visible on entire dorsum of body; fronto-epistomal region weakly impressed on each side between midline and antennal insertions; epistoma trapezoidal, its sides straight, immarginate, rather strongly convergent to the gently rounded apical angles, apex scarcely, shallowly notched medially, punctures much smaller than on vertex; antennae as long as pronotal width at apical angles, the club three-segmented, its length two and one-third times width, segment ten widest, eleven circular, densely gray-pubescent on apical third, its width three-fourths length of eye; stem scarcely short-pubescent, with segments four to eight almost as wide as long and faintly increasing in width, one and two globular, three only one-half longer than wide; terminal segment of maxillary palpus 2.5 times as wide as long; mentum pentagonal, the five sides and angles roughly equal, its length and width equal to length of terminal segment of maxillary palpus; postmandibular lobes with antero-lateral angles rather sharply right-angular, lateral edges straight, equal in length to mentum, diverging very weakly posteriorly from midline of body, not quite attaining inner edges of eyes in ventral view.

Pronotum.—Transversely subrectangular, widest at base, basal width 1.6 times median length; sides weakly convergent, more strongly apically; apical angles inordinately short, almost equalled by the faintly bilobed and convex apex when the four pronotal angles are in equal focus; basal lobe short and broad; basal impressions absent, but the short, uneven row of larger punctures present basally on each side of lobe; discal punctures sparsest on basal lobe, otherwise of uniform density, as strong as those of vertex but sparser, their diameters equal to from one-half to three-fourths basal width of third antennal segment; angle pores with diameters two to three times those of discal punctures, the posterior ones transversely oval.

Scutellum.—Subcordate, basally truncate, one-half wider than long, the apex sharp, slightly obtuse-angular.

Elytra.—Length 1.6 times width, bases immarginate but inner half of each with a narrow piceous border; each elytron bearing eight unimpressed striae plus a scutellar stria of four to six punctures; strial punctures equal in size to those of pronotum, separated by from one-half to twice their diameters, obsolescent apically as usual; intervals with strong, sparse, setigerous punctules.

Thorax below.—Setae a little more visible than on dorsum; each pronotal epipleural area bearing some fifteen large, shallow punctures on apical half; prosternum punctate like pronotum, its apex feebly compressed, transverse, the process broad, strongly bilobed behind coxae, basally concave; mesosternum one-half wider than long, coarsely, densely punctate anteriorly, sparsely so posteriorly; mesopleural sclerites smooth; metathorax strongly punctate antero-laterally, the punctures weaker postero-medially; metasternal coxal lines short, thick, raised.

Abdomen.—Unusually short, the hind coxae approximating elytra laterally at a point 46 percent of elytral length from base, the punctules moderately dense and setae relatively long as usual.

Measurements of type (mm).—Length 3.52; width 1.63; width of pronotal base 1.56; median pronotal length 0.97; width at extremeties of pronotal apical angles 1.01; width of head at eyes 0.94; interocular width of vertex 0.69; length of eye 0.21; width of terminal segment of maxillary palpus 0.28.

Type.—Male "Nev[ada]", Holland Collection, Carnegie Museum Type No. 187.

HAEMAGOGUS, A STRICTLY NEOTROPICAL GENUS (DIPTERA, CULICIDAE)

BY W. H. W. KOMP, *National Institutes of Health, Laboratory of Tropical Diseases, Bethesda, Md.*

Culicidologists in general have accepted the idea that the mosquito genus *Haemagogus* is strictly neotropical. Vargas (1) has, however, advanced the suggestion that species of this genus are found also in British India. Edwards (2) stated previously that three Indian species, *H. achaetae* Leic. 1908, *H. discrepans* Edw. 1922, and *H. tripuncatus* Theobald 1908, might belong to *Haemagogus*, but that the affinities of these species were not clear, as no males were known. Edwards placed them provisionally in the genus *Heizmannia* Ludlow, 1905. Vargas further states "Barraud (3) aduce estos mismos argumentos y se olvida enteramente de la existencia de *Haemagogus*, aunque presenta dibujos de genitalias masculinas de especies orientales, que indudablemente corresponden a *Haemagogus*. . . . Esto nos obliga a declarar que *Haemagogus* está bien representado en la región oriental por *dissimilis* (Leicester, 1908), *pulchriventer* (Giles, 1901), *sintoni* Barraud, 1924 y *subsimilis* Barraud, 1927." This being translated reads: "Barraud adduces the same arguments, and forgot completely the existence of *Haemagogus*, yet he gives figures of the male genitalia of Oriental species, which undoubtedly correspond with those of *Haemagogus*. . . . This causes us to assert that *Haemagogus* is well represented in the Oriental region by. . . ." etc. Barraud's figures, not specifically mentioned by Vargas, are those of the male terminalia of *A.* (*F.*) *pulchriventer*.

The writer has been studying the genus *Haemagogus* for some time, and has had the opportunity to collect most of the species of this genus found in Central and South America, the neotropical region. He has compared the figures given by Barraud, mentioned above by Vargas, of the male terminalia of *A.* (*F.*) *pulchriventer* Giles (3), fig. 43, a, with those of several species of *Haemagogus,* and finds that the figure of the side piece is much like that of a *Haemagogus,* but the other parts figured, with the exception of the claspette, but including the lobes of the 9th tergite, are unlike those of any species of this genus. Several pinned male specimens of *A. pulchriventer* in the U.S.N.M. collection were examined; it was possible to see the scales on the ventral distal margin of the side piece. The color of the body vestiture, however, is quite different, and the specimens lack the large collar-like prothoracic lobes characteristic of *Haemagogus.* To show the difference in coloration, a part of Barraud's (3) description of the female, given on page 199, is quoted: "Adult. Recognizable by dark tarsi and conspicuous *orange* patches on abdominal sternites. ♀.—Head: dorsal surface covered with narrow golden scales and numerous dark upright scales. . . . Thorax: mesonotum covered with *golden and brownish-black* scales, former arranged chiefly in a wide median area from front, narrowing posteriorly and dividing either side of antescutellar space, and in a curved line each side over wing-roots. . . . Abdomen: dorsum black, with narrow basal silvery bands on II-VII, some orange scales on lateral margins of tergites; sternites with narrow white basal bands, narrow black medial bands; remainder covered with *orange scales.*" (Italics ours.) [All neotropical *Haemagogus* have brilliant metallic blue, purple, or green scales on thorax and abdomen.] "♂.—Palpi about ¾ length of proboscis, last two segments with small hair-tufts. Ornamentation as in ♀. Hypopygium (Fig. 43, a): Form of 9 t [tergite], coxite, and harpago characteristic." Fig. 43, a, gives figures of the 10th sternite, claspette, 9th tergite lobes, and side piece and clasper. The side piece resembles that of *Haemagogus* very closely, in having lanceolate scales on the ventral distal margin of the side piece, and long flattened setae from an inconspicuous basal lobe. The clasper (dististyle) is cylindrical and tapering, with a short cylindrical terminal spine. The claspette resembles that of some species of *Haemagogus,* but the lobes of the 9th tergite are entirely different in form from those of any known species of this genus. Without figures or descriptions of the mesosome and 8th sternite, *pulchriventer* cannot be assigned definitely to *Haemagogus,* as other *Finlaya* species, e.g. *kochi* (Dönitz) have scales on the ventral distal margin of the side piece. But *kochi* is unlike any *Haemagogus,* as it has black-and-white-spotted wings.

The figure of the larval head of *pulchriventer* given by Barraud (3), fig. 42, c, shows an arrangement of the dorsal hairs different from that found in *Haemagogus;* the fringed scales on the 8th abdominal segment are also unlike those of any known *Haemagogus* species.

F. W. Edwards (2) page 179, tentatively assigned three Oriental *Finlaya* species to his "Group C (Oriental species, perhaps belonging to *Heizmannia*)" [Ludlow, 1905]. These are *Haemagogus* (?) *achaetae* Leic. 1908; *H.* (?) *discrepans* Edwards, 1922; and *H.* (?) *tripunctatus* Theobald, 1908. This was in 1932, before males of *Heizmannia* were known. Barraud (3) page 299, gives a figure of the male terminalia of *Heizmannia covelli,* which shows that this genus has affinities with the Sabethini, and not, so far as the writer knows, with *Aedes* or *Haemagogus.* As the males of *achaetae, discrepans,* and *tripunctatus* are still unknown, the most reasonable course is to refer them tentatively to *Heizmannia,* as Edwards did.

It is therefore concluded, contrary to the contention of Vargas (1), that *pulchriventer* and its allies, which are included in the Oriental species of *Finlaya* by Knight and Marks (4), should not be placed in *Haemagogus,* which is a strictly neotropical genus.

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THE CORRECT NAME FOR A PEST OF CACAO

(Lepidoptera, Stenomidae)

Zetesima baliandra (Meyrick), new combination

Stenoma baliandra Meyrick, Exotic Microlepidoptera, 1:442, 1915; (British Guiana).

Zetesima theobromae Busck, Ins. Ins. Mens., 8:88, 1920; (Dutch Guiana). (New Synonymy.)

A study of Meyrick's type of *baliandra* in the British Museum (Natural History), and of Busck's type of *theobromae* in the U. S. National Museum, revealed that the two names apply to a single species. Since this insect has been reported as a serious pest of Cacao in Dutch Guiana and Peru it is desirable to provide the correct name.

As pointed out by Busck, the venation of this species is typical of *Zetesima* but the genitalia are atypical. Both male and female show an affinity to *Cerconota* and eventually a new genus may be required for *baliandra*.

Distribution.—Brazil, British Guiana, French Guiana, Dutch Guiana, Peru.—J. F. GATES CLARKE, *U. S. National Museum, Washington, D. C.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
634TH REGULAR MEETING, MARCH 4, 1954

The Entomological Society of Washington held its 634th regular meeting on Thursday, March 4, 1954 in room 43 of the U. S. National Museum, attended by 40 members and 26 visitors. President A. B. Gurney called the meeting to order at 8:00 P.M., and the minutes of the previous meeting were read and approved.

The Society elected the following persons to membership:

Charles R. Rosenberger, Jr., Section on Medical Entomology, National Institutes of Health, Bethesda, Md.

Charles D. Hyslop, Agricultural Research Service, Plant Quarantine Branch, 1254th A. T. Group, M.A.T.S., Washington 25, D. C.

John G. Barker, 104 6th Ave., Radford, Va.

Professor Herbert Osborn, honorary member of the Society, is to celebrate his 98th birthday on March 19, announced President Gurney. A letter of congratulations will be sent to Professor Osborn by the Society.

President Gurney told the Society of the death of Dr. C. L. Marlatt, honorary president of the Society, at his Washington home on March 2. An obituary will be published in a later issue of the Proceedings.

A note on the ''electrochemical production of insects'' was given by Dr. Campbell. This is an account published in 1837 in the *Annals of Electricity*, vol. 1, p. 242; it sounds ridiculous today.

On the regular program Ernestine B. Thurman, Division of International Health, Department of Health, Education, and Welfare, told of ''Establishing of a Training Center for Malaria Control Technical Assistance in Thailand.'' Before 1950 more than 40,000 persons died annually from malaria in Thailand, malaria being the leading cause of death in the nation of over 18,000,000 population. Upon a request from Thailand, American cooperation was begun in 1951 for the extension of the Thai malaria and filariasis control program with the services of advisers and the provision of equipment, insecticides, and anti-malaria drugs. Cooperation was begun under the Special Technical and Economic Mission of the Mutual Security Agency. Hyperendemic areas were rendered virtually free of malaria after three years of control by DDT residual house-spraying and distribution of anti-malaria drugs. Concurrently with the control program a training center was established for Thai technical assistants. By the end of 1953, 54 students had completed training in technique of field and laboratory investigation, evaluation, and control of malaria and other vector-borne diseases. (Speaker's abstract.)

Lucile W. Yates of the Entomology Research Branch, Department of Agriculture, then spoke on "Cataloguing Entomological Literature—Why and How." The Section of Insect Identification maintains a catalogue of literature indexed and abstracted from scientific journals in many languages, from all parts of the world, on systematic and biological entomology, for all Orders of insects. This catalogue for all Orders was established in the early 1930's, but card catalogues for Lepidoptera, Hymenoptera, and Coccidae had been maintained since the early years of this century. These catalogs bring together all available information, and show the taxonomists what literature is available, what genera and species have been described, as well as distribution, habits, biology, ecology, and any revisions of families, genera, or species; hosts, plant or animal, are indexed. The catalogue for each Order is divided into two parts; one part is referred to as the author card file, the other part is the systematic file. Since World War II the volume of entomological literature has increased to overwhelming proportions. The catalogue is an important working tool for our taxonomists, and is designed to save hours of searching through unclassified literature, thus giving more time for research. (Speaker's abstract.)

C. R. Parencia, a visitor from Waco, Texas, from the field laboratory of the Section of Insects Affecting Cotton and Other Fiber Plants, was introduced, as well as Herbert L. Dozier, a member who has recently returned from a tour of duty in Europe with the Army Corps of Engineers, and is now working at the University of Maryland.

The meeting adjourned at 10:00 P.M.—Kellie O'Neill, *Recording Secretary.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON
635TH REGULAR MEETING, APRIL 1, 1954

The 635th regular meeting of the Society was held in room 43 of the U. S. National Museum, Thursday, April 1, 1954, attended by 38 members and 29 visitors. President Gurney opened the meeting at 8:07 P.M. and the minutes of the previous meeting were read and approved.

The Society voted the following to membership:

Herbert Matsumori, Entomology Research Branch, Insecticide Investigations, Bldg. A., Beltsville, Md.

Donald M. Anderson, Dept. of Entomology, Cornell University, Ithaca, New York.

Lt. T. J. Curtin, 562nd Medical Detachment, Fort Meade, Md.

Dr. G. Congdon Wood, Chemical-Biological Coordination Center, National Research Council, Washington 25, D. C.

President Gurney appointed a committee to prepare an obituary for Dr. C. L. Marlatt, consisting of E. R. Sasscer, chairman, E. N. Cory, and W. D. Reed. The Marlatt family, Mrs. Edward W. Russell, Mrs. Alice G. Korff, and Mr. Serge A. Korff, have each made donations to the Society in memory of Dr. Marlatt, and these donations will be placed in the publication fund, announced President Gurney.

Dr. R. E. Snodgrass was elected Honorary President, to succeed Dr. Marlatt, upon recommendation of the Executive Committee.

Changes in the By-laws of the Society designed to clarify the provisions for Honorary Members, to speed the annual elections, and to provide for the reading of papers at the Annual Meeting, which have been approved by the Executive Committee, were read by President Gurney.

Miss Flora Gorirossi, of the University of Maryland, exhibited a slide showing the mouth parts of mites and explained the structure and function of the various parts, a subject to which little attention has been given previously. The first paper of the regular program was given by Col. Traub, who presented some ''Entomological Observations on Hemorrhagic Fever in Korea.'' The absence of a laboratory host susceptible to hemorrhagic fever makes it impossible to determine the vectors and reservoirs of this disease. Epidemiological and entomological observations indicate that trombiculid mites, laelaptid mites, fleas, and ticks should all be considered as potential vectors, but, of these, only chiggers can be correlated with the epidemiology of the disease. Chiggers are active throughout the year, and exhibit striking peaks of abundance during the spring and fall seasons, while they are at a minimum during the summer. The incidence of hemorrhagic fever exhibits a similar seasonal pattern. Potential reservoirs are more likely to be found among field rodents such as *Apodemus*, *Microtus*, *Clethrionomys* and *Cricetulus*, rather than among domestic rats and mice. (Speaker's abstract.)

Dr. G. Congdon Wood of the National Research Council then told about ''The Chemical-Biological Coordination Center and Entomological Research.'' The CBCC assembles and organizes information describing the effects of chemicals on biological systems, metabolism of test chemicals within biological systems, and the mechanism of drug action; it also sponsors preliminary screening of chemicals on a variety of organisms. Data are obtained from systematic searching of pertinent literature, and from all possible unpublished sources. All information is available to accredited scientists. A detailed biology code and techniques for punched card filing are used. (Speaker's abstract.)

Visitors introduced were Robert W. Zwick, U. S. Navy, stationed in Puerto Rico, and Dr. David Johnson, of the Smithsonian Institution.

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

Actual publication date, vol. 56, no. 4, Aug. 23, 1954.

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.

OFFICERS FOR THE YEAR 1954

PROCEEDINGS

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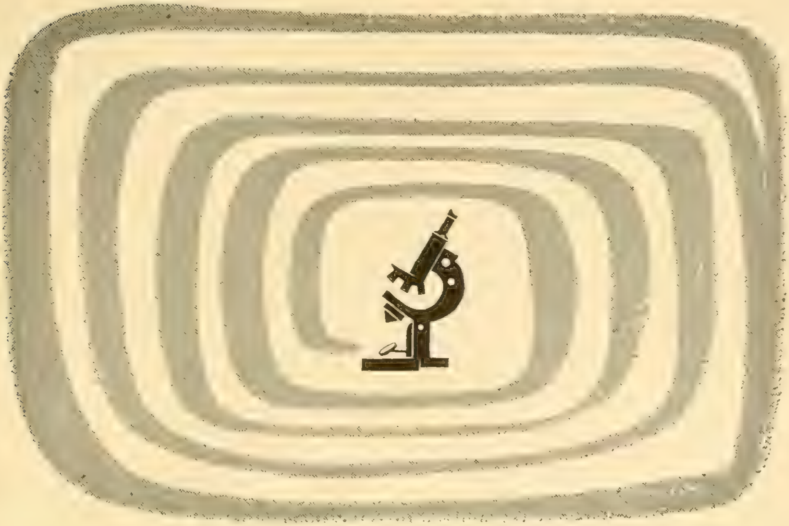

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VOL. 56 DECEMBER 1954 No. 6

NOTEWORTHY AFRICAN TICK RECORDS IN THE BRITISH MUSEUM (NATURAL HISTORY) COLLECTIONS

(IXODOIDEA)[1]

BY H. HOOGSTRAAL, *U. S. Naval Medical Research Unit #3, Cairo, Egypt*[2]

The following unpublished records of African ticks in collections of British Museum (Natural History) are noteworthy for providing new data on distribution and hosts of African species. The information has been obtained from studying collections in the Museum and from large numbers of unidentified specimens sent me for identification. Some additional information has been obtained from Nuttall's tick logbook, now in the Museum file.

I am indebted to the Director, to Mr. E. Browning, and to Dr. G. Owen Evans for the privilege of seeing this material and making this report as well as for many kindnesses during my visits there.

ARGASIDAE

Argas transgariepinus White, 1846

Usually considered as an African tick, this species has been known only from three type specimens from Basutoland (White, 1846), one male (as *A. kochi*) from the same area (Neumann, 1901), numerous specimens from Egypt (Hoogstraal, 1952) and two from Italy (Berlese, 1913).

Additional data for the extra-Africa range of this tick were encountered while examining Nuttall's logbook. Entry for lot number 3135 indicates that a female was received on Feb. 15, 1915, from Valdealgorfa, Teruel, Spain, and mounted on a slide. Although the specimen cannot be located now, Nuttall had the types for comparison and there can be little doubt as to the accuracy of identification of this highly distinctive species.

In Egypt this tick is so secretive that I believe the rarity of records from elsewhere is due chiefly to the difficulty of finding it. Eventually it will probably be found in intervening localities.

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[1]Research Report no. NM 005 050.29.19.

[2]The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

Ornithodoros moubata (Murray, 1877)

2 ♀ ♀, 1 nymph, Daru, Sierra Leone, June 1911, Dr. J. C. Murphy. 1 nymph, Ashanti, Obuasi (Gold Coast), May 21, 1906, W. M. Graham. These collecting localities are quite far west of the presently known range of *O. moubata* (Leeson, 1952) and lie within areas frequently reported as free of this species, the well-known vector of African relapsing fever. It is difficult to determine whether these specimens represent isolated populations introduced by human travelers from the east, whether they indicate that this tick is actually more widely spread in West Africa than previously suspected, or whether they are from relict populations from pre-human-habitation days when *O. moubata* was probably entirely an inhabitant of large animal burrows. A renewed search for this important vector of African tick-borne relapsing fever is indicated in these areas.

Specimens from Gros Namaland, South-west Africa, Trommsdorff (Nuttall lot 2831). Although *O. moubata* has been recorded from South-west Africa in early literature, confirmatory data for material examined by Nuttall from this remote area are of importance.

1 nymph from warthog, near Mwengwa, Northern Rhodesia, Aug. 9, 1913 (Nuttall lot 2389). 4 nymphs from a collection of 64 nymphs from a warthog burrow, Monkey Bay, Nyasaland, Aug. 27, 1915 (Nuttall lot 3216). These records add to the rapidly increasing body of knowledge that *O. moubata* frequently inhabits large burrows of wild animals, especially warthogs, and that such situations are probably this tick's original habitat.

Ornithodoros capensis Neumann, 1901

1 ♀, from leg of soldier, Benfi Island, Amera Bay, Lake Nyasa. This is the only record of this tick from inland Africa. It is a parasite of nesting sea birds and penguins on islands and seacoasts in the southern hemisphere, and is a notorious biter of man when he ventures into these places. The Lake Nyasa specimen may have dropped from a wandering bird. It would be of interest to know whether *O. capensis* has established itself in Nyasaland.

IXODIDAE

Amblyomma cohaerens Dönitz, 1909

4 ♂ ♂, 1 ♀ from black rhinoceros, *Diceros bicornis bicornis* (Linnaeus), Fateo, Victoria Nile, Uganda, C. R. S. Pitman. This is the only record of the buffalo tick attacking a rhinoceros.

10 ♂ ♂, 4 ♀ ♀ from buffalo, *Syncerus caffer* subsp., Kibango, Northern Tanganyika, C. Christy. No other locality record in Tanganyika itself is available for this species, and this is the most southern record for this East and Central African buffalo parasite, except possibly for the type locality of *A. anceps* Dönitz, 1909, a synonym of *A. cohaerens*, from "Lake Tanganyika."

Amblyomma cuneatum Neumann, 1899

Records of this unusual tick are rare and usually with less detailed data than the following, all collected by I. T. Sanderson in Cameroons from 1932 to 1934:

6 ♂♂, 3 ♀♀ from long-tailed pangolin, *Uromanis longicaudata* (Brisson), beneath scales of back and tail, one on skin below neck; secondary forest, 450 feet alt., Mamfe, Nov. 10. 11 ♂♂, same host species, under scales of back; farmed forest land, 550 feet alt., Bachor-N'Taylor, Dec. 2. 10 nymphs, 3 ♂♂, arboreal pangolin, *Phataginus* (= *Manis*) *tricuspis* (Rafinesque), under scales all over body; secondary forest, 450 feet alt., Mamfe, Nov. 7. 2 nymphs, 8 ♂♂, same host species as preceding, beneath scales; secondary forest, 700 feet alt., Bashaui, Mar. 23. 1 nymph, same host, locality, and date as preceding; under scale on back. 3 ♂♂, from same host species as preceding; from skin on underside; secondary jungle, 700 feet alt., Mokonyong, Mar. 23.

Amblyomma marmoreum group

1 ♀ from African puff adder in London Zoological Gardens, Sept. 13, 1904. An interesting record.

7 nymphs from a bird, the African hoopoe, *Upupa africana,* mouth of Lurio River, Mozambique, June 28, 1932, J. Vincent. This is the only record of nymphs from a wild bird, although domestic fowl have been reported as hosts of this stage.

1 ♀ from ''tortoise from bush,'' Ninkintumania, Sierra Leone, June 28, 1913 (Nuttall lot 2326). There is no other indication of *A. marmoreum* from Sierra Leone except for an entomological note in the 1914 Medical Report of this territory, published in 1916.

Amblyomma pomposum Dönitz, 1909

4 nymphs, 3 ♂♂ from Ankole topi, *Damaliscus korrigum ugandae,* Lugaga, Ankole, Uganda, C. R. S. Pitman. This is the only record of this tick from Uganda and from this host.

Amblyomma rhinocerotis de Geer, 1778 (= *A. petersi* Karsch, 1878)

1 ♂, 1 ♀, from grass, Kajo Kaji, Equatoria Province, Anglo-Egyptian Sudan, Captain C. M. Stigand. Previously only known from Torit and Bor in the Anglo-Egyptian Sudan (King, 1926), this is the only record of the rhinoceros tick from west of the Nile in this territory. It is probably associated with the ''white'' or ''square-lipped'' rhinoceros.

Amblyomma tholloni Neumann, 1899

1 ♂ from buffalo, Kibango, Northern Tanganyika, C. Christy. This elephant parasite has not previously been reported from the buffalo, *Syncerus caffer.*

Amblyomma variegatum Koch, 1844

1 nymph from a raven, Harar, Abyssinia, Feb. 27, 1912. 2 nymphs from a harnessed bushbuck, *Tragelaphus scriptus,* dry season, Bulukatoni, West Nile, Uganda, Mar. 21, 1923, C. R. S. Pitman. 25 nymphs,

1 ♂, 2 ♀ ♀ from an oribi, *Ourebia montana*, Nadda, Djimma, Abyssinia, May 11, 1927, F. W. J. Cox. All nymphal *A. variegatum* were either identified by Dr. G. Theiler, or my determinations of these specimens were confirmed by her. The above records give valuable data for the little-known host preferences of the immature stage of this ubiquitous African tick.

1 ♂ from an Arabian wolf, *Canis lupus arabs*, Ain, Southern Arabia, B. S. Thomas. An unusual host and locality record. My own collecting records (unpublished) contain much data for *A. variegatum* in the mountains of Yemen. Carnivores are rarely attacked by adult ticks of this species; this exception possibly reflects the marginal conditions in which *A. variegatum* persists in certain poorly populated areas of Southern Arabia where its usual domestic animal hosts are scarce.

Aponomma exornatum (Koch, 1844)

3 ♂ ♂ from fruit bats, Il. Sao Thome, Angola, J. A. Barnes. This is an unusual host record for this parasite of *Vananus* lizards.

12 ♂ ♂ from a warrener lizard, *Varanus* sp., Yegi, Valta, Gold Coast. There are no other records of the lizard tick from the Gold Coast.

Aponomma latum (Koch, 1844) (= *A. laeve capensis* Neumann, 1901, of authors)

1 ♀ from python's head, Ibadan, Nigeria, F. D. Golding. The first record of the snake tick from Nigeria, this represents a considerable extension of known range.

1 ♀ from coastal warrener lizard, *Varanus albigularis*, near Mida, Sokoke Forest, Malindi, Kenya (with four ♀ ♀ *A. exornatum*), E. A. Lewis. I know of no previous reliable records of this tick from hosts other than snakes.

1 ♀ from a porcupine, *Hystrix* sp., Mduna River, Acabisa, Zululand. Another unusual host record for the snake tick.

1 ♂ from a tree snake, *Chloropis emini*, Lake Victoria, Uganda. The first record from this host.

Boophilus annulatus (? *congolensis* Minning, 1934)

8 ♀ ♀ from Hausa cattle, east of Obubra, Nigeria, Aug. 8, 1913. Dr. J. R. Allen. 1 ♂, 4 ♀ ♀ from cattle, Kamagota, Sierra Leone, Nov. 1, 1913, Dr. J. J. Wood (Nuttall lot 2670). These are the only records of this tick from Nigeria and Sierra Leone. The specimens cannot be differentiated from American specimens of *B. annulatus*. Note that the latter lot listed above also includes *B. decoloratus* (listed below). In the anglo-Egyptian Sudan we find these two species on the same host animals, and, as here, our Sudan collections usually contain many more specimens of *B. decoloratus* than they do of *B. annulatus*.

Boophilus decoloratus Koch, 1844

1 ♂, numerous ♀ ♀ from cattle, Kamagota, Sierra Leone, Nov. 1, 1913, Dr. J. J. Wood (Nuttall lot 2670). The blue tick has not previously been recorded from Sierra Leone.

Dermacentor rhinocerinus Denny, 1813 (= *D. rhinocerotis* of authors)

1♂, from rhinoceros, *Diceros b. bicornis,* Northern Rhodesia (without further locality), July 6, 1932, H. S. Purchase (Nuttall lot 3856). This specimen, which had been determined as ''variety *permaculatus* Nm.'', appears to be the only record of this tick from Northern Rhodesia.

Haemaphysalis hoodi hoodi Warburton and Nuttall, 1909

4♂♂ from shrike, ''*Telephonus,*'' Gazi, Kenya (= B.E.A.), Aug. (? Apr.) 23, 1910, Robin Kemp. 1♂, 1♀ from spurfowl (*Francolinus* sp. or *Pernistes* sp.), Isiolo, Kenya, E. A. Lewis. Kenya has not heretofore been reported as within the host range of this avian parasite although its presence there was to be expected.

4♂♂, 2♀♀ from tchagra shrike, *Tchagra* sp., mouth of River Lurio, Mozambique, J. Vincent. Few hosts of *H. hoodi hoodi* have been listed, and this is the first definite record for the tchagra shrike. The Mozambique data and other records in my collection from elsewhere in Africa indicate that this bird is probably a frequent host.

Haemaphysalis parmata Neumann, 1905

1♂, 1♀ from forest duiker, *Cephalophus* sp., and 2 nymphs from a genet, *Genetta* sp., all from Ngong, Kenya, L. J. Boreham. These specimens had been labelled and reported by E. A. Lewis (1934) as *H. bispinosa.* I have been unable to find any evidence that, possibly beyond arriving at the Mombasa port on Asiatic cattle, *H. bispinosa* is established in Africa. Adults and immature stages of *H. parmata* usually feed on hoofed animals, and rarely on domestic dogs, but this is the first record of nymphs from a wild carnivore. My collection, however, contains additional nymphs from mongoose in French Equatorial Africa.

1♀ from domestic goat, Fairfield, Nakuaso, Kenya, E. A. Lewis. This specimen had been identified as *H. calcarata* by the collector, and was evidently the basis of his published report of *H. calcarata* from sheep (Lewis, 1931). *H. calcarata* actually is one of the most host-specific of African haemaphysalid ticks and its occurrence on any animal other than ground squirrels would have to be considered as most exceptional.

2♀♀ from bushbuck, *Tragelaphus scriptus* subsp., Afran Plains, Ashanti, Gold Coast, Nov. 4, 1937, G. S. Cansdale. 6♀♀ from bushbuck, Kakatia Forest, Kenya, E. A. Lewis. 2♀♀ from impalla, *Aepyceros melampus* subsp., Naivasha, Kenya. 1♀, 2 nymphs from Harvey's duiker, *Cephalophus natalensis harveyi,* Taveta, Kenya, E. A. Lewis. 1♀ from bay duiker, *Cephalophus dorsails* subsp., old secondary forest, Mamfe, Eschobi, Cameroons, Oct. 25, 1932, I. T. Sanderson. 2♀♀ from cattle, Loitokitok, Kenya, E. A. Lewis. Published host data for this tick are so scarce that the above records are noteworthy.

Hyalomma truncatum Koch, 1844 (= *H. transiens,* variously attributed to Schulze, 1919 and to Delpy, 1949; See Feldman-Muhsam, 1954)

Some of the most important papers on this genus in tropical Africa have been the biological and disease relation studies of E. A. Lewis. The species were identified at a time when the taxonomic status of these ticks was chaotic, and Lewis used a variety of species and subspecies names to refer to his materials. These names have subsequently been differently interpreted by various authors without reference to Lewis' specimens. British Museum (Natural History) collections contain a number of *H. truncatum* specimens collected by Lewis in Kenya which are listed below with his determinations in parenthesis. The records in themselves are of considerable interest and the discrepancies in determinations will indicate the errors in previously published assumptions of what species Lewis was using for his experiments.

12♂♂, 6♀♀, cattle, Soysambu, Mar. 3, 1931 (*H. impressum*). 3♂♂, 3♀♀, sick calf, Malewa, Naivasha, Feb. 18, 1931 (*H. impressum*). 1♂, Masai calf, Ngong-Kajiado, July 13 (*H. dromedarii*). 2♂♂, cattle, Ngoliba, Thika, July 20, 1932 (*H. dromedarii*). 3♂♂, 1♀, native sheep, Harries farm, Njoro, June 17 (*H. dromedarii*). 2♂♂, cattle, Taaneata, Naivasha, Feb. 8, 1931 (*H. impressum*). 6♂♂, Masai cattle, Kedong dam, July 5, 1932 (*H. dromedarii*). 1♂, man, Kajaido, May 25, 1931 (*H. dromedarii*). 10♂♂, Masai cattle, Kajiado, July 19, 1932 (*H. dromedarii*). 7♂♂, sheep, Essaigeri, July 7, 1932 (*H. dromedarii*).

Rhipicephalus compositus Neumann, 1897 (= *R. ayeri* Lewis, 1933)

1♂ from leg of man, Elizabethville, Belgian Congo, Dec. 20, 1927, M. Burr. *R. compositus* has not been recorded from man and not from the Belgian Congo except for remarks (as *R. ayeri*) by Theiler presented by Santos Dias (1949).

Rhipicephalus complanatus Neumann, 1911

1♀ from short-haired rat, *Praemomys tullbergi* subsp., Mamfe, Eschobi Mamfe, Cameroons, May 12, 1933, I. T. Sanderson. Man and wild pigs only have previously been recorded as hosts of this tick.

Rhipicephalus muhlensi Zumpt, 1943

2♂♂ from roan antelope, *Hippotragus equinus* subsp., Tanganyika, 1912, Dr. Schellhase (Nuttall lot 3006). Little data on this tick has been published and this lot is of particular interest in that Nuttall had considered (and labelled) it as the apparently excessively rare *R. longicoxatus* Neumann, 1905.

Rhipicephalus pravus Dönitz, 1910

Numerous nymphs from ''elephant shrew'' (Insectivora: Macroscelididae), Morogora, Tanganyika, November, Mr. Dodd. 1♀ from a shrike, ''*Telephonus*'' Gazi, Kenya, Aug. 23, 1910, and numerous nymphs from a rodent, Voi, Kenya, both by Robin Kemp. These records indicate the predilection of nymphal stages for small insectivores and rodents and the occasional feeding of adults on birds.

Rhipicephalus simus senegalensis Koch, 1844

Numerous ♂♂ and ♀♀ from cattle, Mgunda, Kilosa, Tanganyika, Jan. 11, 1927, N. C. E. Miller. *R. simus senegalensis* is a West and Central African tick. This is the first record from Tanganyika. Additional specimens in my collection comprising new distribution records come from Equatoria Province, Anglo-Egyptian Sudan, and Uganda, between Lake Victoria and the Sudan.

Rhipicephalus supertritus Neumann, 1907

Several adults of both sexes from warthog, *Phacochoerus aethiopicus* subsp., Marimba, Nyasaland, July 1913 (Nuttall lot 2394). Although not unexpected, this is the only record of this seldom collected tick from a warthog. Larger animals, especially antelopes, are the usual host.

Rhipicephalus ziemanni Zumpt, 1943

1♀ from leopard, *Felis pardus* subsp., primary forest, 500 feet elevation, Maimya bridge, Mamfe, Cameroons, May 12, 1933, I. T. Sanderson. 1♂, 1♀ from behind ears of hyrax, Tinta-Atolo, Mamfe, Cameroons, Apr. 12, 1933, I. T. Sanderson. Domestic cattle and a few large wild animals have been listed as hosts for this rare tick. These are the first records from a carnivore or a hyrax.

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BIOLOGY OF EUMENINE WASPS, IV. A TRIGONALID WASP PARASITIC ON RYGCHIUM RUGOSUM (SAUSSURE)

(HYMENOPTERA, TRIGONALIDAE)[1]

BY KENNETH W. COOPER, *Biology Department, University of Rochester, Rochester, N. Y.*

Until recently, the very rare and little known trigonalid wasps were believed to be hyperparasites that normally have an ichneumon fly as the primary host. The primary host is reached by a remarkable chain of incidents, as Clausen (1929, 1931) showed. The microtype eggs of the trigonalid wasp are laid along margins of leaves. If eaten by a caterpillar, the trigonalid egg hatches and develops to the third instar larva in the body cavity of the caterpillar. Unless the infested caterpillar itself also serves as the host of an ichneumon fly, or perhaps some other parasite, development of the trigonalid larva is at an end, and it perishes. If the third instar trigonalid larva is able to enter an ichneumon larva, however, it remains within, ultimately devouring its new host, and pupating within the cocoon of the ichneumon fly. Since trigonalid wasps are of good size, both the secondary and primary hosts in this sequence must be of considerable size also.

A number of trigonalid wasps, however, are known to have come from the nests of social wasps. Their occurrence in vespine, polistine, and polybiine nests has been considered by some to be more or less accidental, indicating only that worker wasps chanced upon parasitized caterpillars when collecting food, thereby infecting their own larvae. It is now clear, however, that the trigonalid wasps normally include among their primary hosts not only ichneumon flies, but social wasps, sawflies, and even a tachinid fly (Clausen, 1940). In all of these cases, except perhaps that of the social wasps, a large fleshy larva (lepidopterous or symphytid) seems invariably to serve as an indirect host or, rarely, as in the sawfly *Perga,* as a direct host.

It will now be shown, however, that a small lepidopterous larva may also serve as a secondary host for a trigonalid wasp, and that a solitary wasp can be the primary host. The case to be reported was discovered in routine rearings of *Rygchium rugosum* (Sauss.). This is especially interesting, for the trigonalid which was reared from the *Rygchium* was *Lycogaster pullata* Shuckard, which is already known to be a secondary parasite of the moth *Telea* and a primary parasite of an ichneumon fly *Enicospilus.*

[1]The field studies reported herein were carried out under the auspices of the E. N. Huyck Preserve, Rensselaerville, N. Y.

The Nests of Rygchium rugosum

During July and August of 1952, series of trap nests (Cooper, 1953) were placed in stone walls along the margins of woods and thickets at Rensselaerville, Albany Co., N. Y. These nests were simple borings, 6 or 7 mm. in diameter and from 95-130 mm. long, in 6 inch lengths of 1 x 1 inch straight-grained, seasoned white pine. Such borings are accepted as nesting sites by a variety of eumenines and other wasps, and serve admirably for the large scale collection of natural history data about burrow-dwelling wasps and their parasites. Such information is obtainable in no other simple way for, as is well known, the natural nests of these wasps are generally extremely difficult to find, and are rarely if ever obtainable in numbers.

The table on p. 282 gives data for six nests of *Rygchium rugosum*. These nests were all of the second generation for that year, and their occupants had spent the winter in diapause as cocooned prepupae. The trap nests were kept through the winter in an open shed, and first brought indoors in mid-April, at which time they were split open and their contents recorded. Eclosion dates are those for the shedding of the pupal integument. Maturation was judged complete when the wasp was no longer teneral or callow, and left its prematurely opened cocoon and cell of its own accord. Despite the fact that some inhabitants of inner cells matured before those of outer cells, in all nests but no. 2, it is likely that emergence from the nests would have been in the reverse order of cell closure had the nests not been split open. All wasps eclosed and matured in each nest within a span of 6 days. Ordinarily mature wasps in inner cells will remain within their cocoons for a week or so until the cells closer to the entrance have been vacated. When a wasp from an inner cell prematurely cuts its way through unopened outer cells, as sometimes happens, the inhabitants of the outer cells commonly perish.

The six nests studied contained 27 stocked cells. Although the sex ratio within a nest may be extreme, the primary sex ratio does not significantly differ from equality of the sexes. The over-all mortality in these overwintering nests has been determined to be 18.5%; from 7 to 13% of the females died, and from 31 to 25% of the males. Two deaths, both in nest 5, were apparently due to endogenous causes and not to parasitic insects. In neither cell 3 nor 5 was the majority of the caterpillar prey eaten. In nest 1 both deaths were brought about by single, thread-like bombylid larvae, enclosed within the cocoons, which first attacked the developing wasps just before the onset of pupal coloration. The bombylid fly, *Anthrax irrorata* Say, was reared from these two cells; it is also a common parasite in the nests of *Ancistrocerus antilope* (Panzer). The prepupal larva of cell 3, nest 6, however, died from a wholly unexpected cause: it was killed by the trigonalid wasp *Lycogaster pullata* Shuckard—the first case known in which a trigonalid has had a solitary wasp as its primary host.

TABLE, CONTENTS OF SIX NESTS OF RYGCHIUM RUGOSUM

The sex of the occupant of each inhabited cell is indicated; bracketed individuals did not survive. Cell-1 is the first sealed by the mother, and is innermost; cell-2 is next, and so on. The order of attainment of complete maturity for each occupant of a nest is indicated in the last column by the cell numbers; thus 3<2 means that the occupant of cell-3 matured before that of cell-2, etc.

No.	Nest Placed In Field	Nest Sealed By	Sex of Occupant of Cell No.: 1	2	3	4	5	6	Earliest And Latest Dates Of Eclosion	Order Of Maturation
1	Jl 5	Aug 9	♀	[♀][1]	♀	[♂][1]	♂	----	Ap 4-9	5<1<3
2	Jl 5	Aug 14	♀	♀	♀	♂	♂	----	Ap 29-May 4	5<4<3<2<1
3	Jl 5	Aug 23	♀	♀	♀	----	----	----	May 4	Not Noted
4	Aug 1	Aug 7	♀	♀	♀	----	----	----	Ap 30-May 3	2<1<3
5	Aug 1	Aug 9	♂	♂	[?][2]	♂	[♂][3]	----	Ap 28-May 3	5<2<4<1
6	Aug 19	Sep 8	♂	♀	[♂][4]	♀	♂	♂	Ap 28-May 3	6<1<4+2

[1]Pupa destroyed by the bombylid fly *Anthrax irrorata* Say (determination by W. W. Wirth, Entomology Research Branch).
[2]Mummified larva; a genetic death?
[3]Dwarf male, died unable to free self from pupal envelopes.
[4]Destroyed by *Lycogaster pullata* Shuckard; see text.

THE DEVELOPMENT OF LYCOGASTER PULLATA

Cell-3 immediately attracted attention when nest 6 was opened at 12 N. on April 22. It contained a prepupal larva, whereas all other cells of the nests of *Rychium* possessed coloring pupae. Furthermore, a pair of slender, sickle-shaped, chestnut-brown mandibles that flicked open and swept shut every 6-10 seconds or so, could be seen (when examined at a magnification of 30x) within the prothorax of the left side. These were below the violet crescent of the posterior margin of the compound eye of the enclosed pupa. At 9 P.M., that same night, no noticeable change had occurred, and the mandibles were still to be seen opening and closing within the prothorax of the prepupa. As later became evident, the mandibles were those of a fourth instar trigonalid larva, *Lycogaster pullata.*

By the next morning (10 A.M., Apr. 23), the trigonalid larva had cut through the pleuron of the left prothorax of the prepupal *Rygchium.* All but the tip of the abdomen of the 4th instar, parasitic, honey-colored larva had emerged through the oozing wound in the side of the host. Although the segmentation of its thoracic region was pronounced, there was but the faintest suggestion of abdominal segmentation. At this stage the larva was approximately 5 mm. long x 1 mm. in greatest girth. Lying curved about the thorax of the *Rygchium,* with the tip of the abdomen still within the exit wound, the larval *Lycogaster* chewed the oozing intertergital membrane between the thorax and head of its host.

On April 24, although it had not changed its position, the larval trigonalid had advanced to the fifth and final instar by 10 A.M. Nearly double its earlier volume, with the moulted skin crumpled and slid caudally, *Lycogaster* still had the tip of its abdomen stuck in the host's side. The abdomen of the prepupal *Rygchium* showed only a slight deflation at this point, although the thorax was now crumpled and collapsed. The major part of the feeding task still lay ahead of the parasitic larva. By noon the parasite's abdomen had been withdrawn from the host's thorax; the collapsed 4th instar *Lycogaster* exuvium remained in the pasty, pulpy mass. Feeding went on at a greatly accelerated pace, and by 4:30 P.M. the host was no more than a collapsed, rumpled sac, lying encircled by the relatively enormous larval *Lycogaster.* Only the head capsule of *Rygchium* prevented the tips of the two ends of the parasite from touching. The trigonalid larva, now at the close of its feeding, was approximately 17 mm. long and 6 mm. wide. It crushed, chewed and plied the soft pulpy tissues of the host, still working a considerable ooze from them. At the completion of its feeding, it was a warm golden color and swollen almost to the bursting point, showing little trace of segmentation.

At 10 A.M., Apr. 26, the remains of *Rygchium* lay at the end of its cocoon, and the turgid, larval *Lycogaster*—now creamy white in color—was sluggishly moving in the cell. By 10 A.M., Apr. 27, the trigonalid larva had become quiescent, and lay straight along the length of the cocoon. It remained quiet thereafter, and by 1 P.M., Apr. 28, the posterior, pale but tinged margins of the compound eyes of an enclosed pupa had become visible. *Lycogaster pullata,* then, spins no cocoon of its own.

By 9 P.M., Apr. 29, the *Lycogaster* had passed a transparent, liquid-filled, voluminous sac, fully 3 mm. in greatest diameter, containing the insoluble, greyish-brown, meconial precipitate. The meconial sac pressed against the apex of the abdomen of the prepupal *Lycogaster*, and was connected to the abdominal tip by an integumentary strand. The coloring eye and very convex head of the enclosed pupa were now clearly visible through the larval integument. The tan-eyed, ivory-white pupa eclosed from the larval integument 24 hours later. It was unmistakably like the adult trigonalid in appearance.

Coloration of the pupal body was complete on the morning of May 8, and the characteristic loosening and wrinkling of the pupal envelope forewarned the coming of eclosion. By 9 A.M., May 9, the pupa had become unresponsive to handling, and the pupal integument over the imago was glistening, appearing moist within. That evening, at 10:30 P.M., the trigonalid wasp, its wings expanded but still waxy, was tugging its hind legs free from its pupal cast. The next day all traces of callow appearance had passed, and the wasp was preserved.

In resumé: Passage of the 4th instar of *Lycogaster pullata* required at least 46 hours at approximately 25°C. Exit from the host took place approximately a day before the close of the 4th instar. The 5th instar was completed within 3 days, and the pupa required 12 days for completion of its development. Following the onset of the pupal period (*i.e.*, attainment of the prepupal state), the meconium was passed at 2.5 days, the larval integument was cast at 3.5 days, and the body coloration was complete after 8 days.

A Comparison of Lycogaster with Poecilogonalos and Taeniogonalos

Digestion of the crumpled remains of the host in KOH disclosed the head capsules of the 3rd and 4th instar larva of *Lycogaster*, and freed the enclosed pupal integument of *Rygchium*.[5] The 5th instar cast of *Lycogaster* partially enveloped the legs and abdomen of the trigonalid pupa.

The mandibles of larval *Lycogaster pullata*, figs. 1b-3, are notably like those of corresponding stages of *Poecilogonalos thwaitesii* Westwood (Clausen, 1929, 1931, 1940) and *Taeniogonalos maculatus* (Smith) (= *Trigonalys maculatus* Smith) (Raff, 1934), the only other species for

[5]Development of the pupal *Rygchium* had advanced to the point that it could be identified as a male from the envelope of the genital capsule.

which there is such information. The sclerotized, tan head capsule of the 3rd instar larva of *Lycogaster*, fig. 1a, however, differs notably from that figured by Clausen (*op. cit.*). It is more or less truncate before and behind, and not biemarginate anteriorly and constricted posteriorly as in *Poecilogonalos*. The larva of *Lycogaster* only moderately tapers to each end, and is more nearly of the same diameter over most of its length.

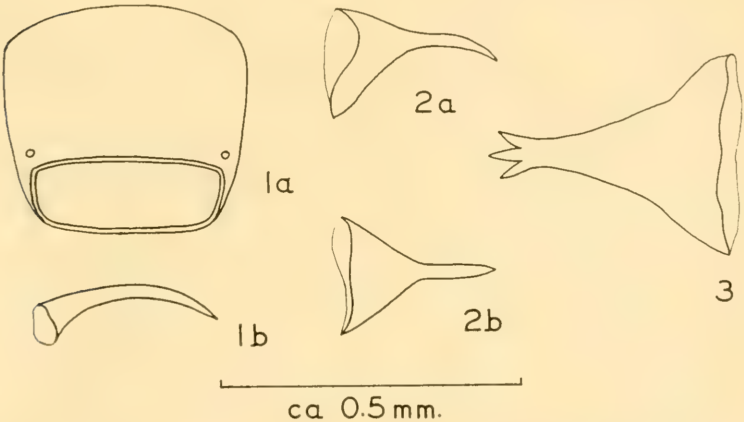

Fig. 1a, head capsule of 3rd instar larva of *Lycogaster pullata*; fig. 1b, mandible of 3rd instar larva; fig. 2, mandible of 4th instar larva from dorsal aspect (2a) and external aspect (2b); fig. 3, external face of mandible of 5th instar larva.

As with *Poecilogonalos thwaitesii*, the larva of *Lycogaster pullata* cuts its way out of the host during the 4th instar. It emerges, however, not through the eye as *P. thwaitesii* is said invariably to do, nor immediately after the onset of the 4th instar, but through the pleuron of the prothorax and toward mid-passage through this instar. Nor does *Lycogaster's* host putrefy following emergence of the parasite, and the 5th instar trigonalid still has most of its feeding to be completed. *P. thwaitesii* is not an active feeder in the 5th instar, and Clausen says that its tridentate mandibles are of little use. The very similar mandibles of *Lycogaster*, however, prove themselves most serviceable instruments in dispatching the mighty repast that is the final task of its larval life.

Cocooning occurs in *Poecilogonalos*, and to a limited degree in *Nippogonalos jezoënsis* Uchida (Van der Vecht, 1933, cited in Clausen, 1940) where only a cross partition of silk is formed across the pupal cell of the vespine host. In both of these cases the cocoon appears to function primarily as a means for separating the host's remains from the trigonalid pupa. However, as Bischoff (1909) has already shown, *Lycogaster pullata* pupates without any vestige of a cocoon, and this is also the case for *Taeniogonalos maculatus* (Raff, 1934). Whereas *Poecilogonalos* passes a viscid, black meconial mass after the onset of the pupal period, both *Taeniogonalos maculatus* and *Lycogaster pullata* pass a liquid meconium enclosed within a special, water-tight membrane. In *Lycogaster* the meconial sac is swollen by a clear, supernatant fluid that lies over the fine-textured, greyish-brown, solid matter of the meconium.

So far as I can discover, this is a relatively rare and little-known method of isolating the meconium in the Hymenoptera. Flanders (1942) mentions the enclosure of the meconium of the proctotrupoid *Helorus paradoxus* (Prov.) within the peritrophic membrane at the time of its passage. In *Taeniogonalos* and *Lycogaster*, however, it is very likely that the membrane is formed from the impervious lining of the larval hind gut, and is not a peritrophic membrane. As a general rule peritrophic membranes are freely permeable to fluids, and characteristic of insects that have a coarse diet.

The meconium passed by *Lycogaster* contained very few sclerotized or chitinous fragments, some 14-20 small concretions, and a large bulk of fine precipitate. When placed in a dilute solution of KOH, the concretions and precipitate quickly dissolved. Among the few insoluble remainders there were no 3rd instar head capsules, as Raff (1934) found in the meconium of *Taeniogonalos*, that would testify to a multiple infestation of the primary host.

The Hosts of Lycogaster

Bischoff (1909, 1927, 1936) first proved *Lycogaster pullata* to be a secondary parasite of *Telea polyphemus* (Cram.), and a primary parasite of *Enicospilus americanus* (Christ) [= *Ophion macrurus*]. *Lycogaster nevadensis* (Cresson) very likely has a similar history, for Townes (1951) records it from *Hyphantria cunea* (Drury), which in turn is known to be parasitized by species of *Enicospilus* and *Charops* (host catalog in Townes, 1944) that may serve as primary hosts for the trigonalid wasp.

In contrast to these records, the female *Lycogaster pullata* reared from the prepupa of *Rygchium rugosum* must have passed its earliest instars in a small pyralid or gelechioid caterpillar (Cooper, 1953). In such a case, simple hyperparasitism could not allow completion of Lycogaster's development, for the caterpillar is of a size that could not serve as an adequate food mass (host) for a large ichneumon fly. Indeed the average stock of a single provisioned cell of *Rygchium rugosum* is from 8-14 of these small caterpillars. The largest of these caterpillars are assuredly in their final instar. When unconsumed, they occasionally pupate within the nest of *Rygchium*.

This record, then, offers an interesting new light on the primary and secondary host ranges of trigonalids. It is clear that the microtype egg need not be consumed by a caterpillar of sufficiently large ultimate bulk to nourish the necessarily large primary host. Caterpillars of small moths may serve as secondary hosts, provided only that they are of a species normally collected as the prey of medium or large solitary wasps. Potential primary and secondary host ranges of some trigonalids are very likely immeasurably wider than has hitherto been imagined. The fact that solitary wasps are not at present known to be hosts of trigonalids is perhaps no more than a reflection of how scant is our knowledge about the life histories of even our commonest wasps. Quite possibly too, small caterpillars that are secondary hosts serve as a source of trigonalid infestation of the nests of some social wasps.

The Origin of Hyperparasitism in the Trigonalidae

The trigonalids have long been considered an archaic group, close to the evolutionary point of separation of the terebrant and aculeate stems. In view of the supposedly primitive status of the trigonalid wasps, their complex, hyperparasitic mode of life has seemed an extreme specialization the origin of which is difficult to picture. Admittedly our knowledge of trigonalid host relations is still too slender to permit the drawing of sweeping conclusions of any finality. Nevertheless there are some facts that point clearly to the possibility that trigonalids were initially parasites of sawflies. For one thing, the only conclusively demonstrated non-hyperparasitic life history is that of *Taeniogonalos maculatus* (Smith) whose single hosts are sawflies of the genus *Perga* (Raff, 1934). For another, primary hosts in known hyperparasitic cycles include ichneumon flies (*Enicospilus*, *Charops*) and a tachinid fly (*Zenillia*) of genera having species parasitic on larvae of sawflies and moths.

It is a plausible notion that the hyperparasitic habit of trigonalids is the outgrowth of simple parasitism of sawfly larvae. With deposition of microtype eggs that must be eaten by a phytophagous sawfly larva, and with adaptation of the trigonalid larva to other hymenopterous and tachinid hosts acquired through an inevitable association with these competing parasites of sawflies, it is not difficult to understand how successful hyperparasitic cycles may have developed that now include caterpillars of moths having parasites related to those of sawflies. Adapted from the start to development in hymenopterous hosts, no special modification of the life cycle is necessary to account for trigonalid primary parasitism of social and solitary wasps that prey upon the larvae of sawflies and Lepidoptera. Nor is it difficult to account for a derived cycle that involves larvae of butterflies as secondary hosts, as seems to be the case for *Pseudogonalos hahni* (Spin.), if Reichert's claim is correct that *Trogus* is among its primary hymenopterous hosts (Bischoff, 1927).

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THE NORTH AMERICAN SPECIES OF DISSOMPHALUS

(Hymenoptera, Bethylidae)

By Howard E. Evans, *Cornell University, Ithaca, N. Y.*[1]

The genus *Dissomphalus* was erected by Ashmead in 1893 (U. S. Natl. Mus. Bull. 45, p. 41) for certain species of Bethylidae possessing "two minute wart-like, pubescent tubercles"

[1]The Grace H. Griswold Fund, Entomology Department, Cornell University, is acknowledged for assuming the expense of two plates.

on the second abdominal tergite in the male sex. Two species of males, *xanthopus* Ashmead and *californicus* Ashmead, were recognized, with the former as type-species. A third species, *carolinensis* Ashmead, was recognized from the female only, but this species, and Ashmead's supposed female of *xanthopus*, have proved to belong to *Scleroderma*. The next and only other consideration of the genus was that of Kieffer in 1914 (Das Tierreich, 41: 495-503). Kieffer recognized twenty species from all zoogeographic regions except the Palaearctic and Australian. Although he listed four species in the female sex (three of them Ashmead's), it is clear that he had no real knowledge of the females of *Dissomphalus;* in fact, he failed to include this sex in his key to bethylid genera. Kieffer's keys to the males of *Dissomphalus* are completely unworkable, and his descriptions are very brief and often ignore the more important characters. Hence this genus has remained in a hopeless state taxonomically (though not any worse than that of most other genera of Bethylidae).

My attention was first drawn to this genus in 1950, when Roland L. Fischer, now of Michigan State College, collected a series of *Dissomphalus* on the windows of his garage at Manhattan, Kansas. In the three following summers, Karl V. Krombein collected a series of this same form on the windows of his garage at Arlington, Va. Attempts to identify this species led me to examine the *Dissomphalus* in the U. S. National Museum and several other institutions. It is now apparent that the genus is a fairly large one, having at least nine species in North America, and probably well over 50 throughout the warmer regions of the globe, with an especially large number of species from the Neotropical region. It was my original intention to work out all the species, but since nearly every specimen before me from Central and South America represents a different species, it seems unwise to attempt a wide-scale revision at this time. Indeed, since the nine North American species are known to me from only 80 specimens, the present revision can be considered of only a preliminary nature. It is hoped that it will at least serve to draw attention to this interesting and easily recognized genus of bethylid wasps.

This study is based largely on material in the U. S. National Museum (abbreviated USNM in the text). A few specimens from each of the following institutions have also been employed: Cornell University (CU), Museum of Comparative Zoology at Harvard (MCZ), Kansas University (KU), and Kansas State College (KSC). Several specimens from the personal collections of Karl V. Krombein (KVK), Roland L. Fischer (RLF), and the author (HEE) have also been employed.

The female sex.—The problem of what constitutes the female sex of *Dissomphalus* has been a serious one, and one which I believe can now be considered solved. There is good reason to regard *Ecitopria* Wasmann as a synonym of *Dissomphalus*, representing the female sex, and it also seems certain that the species placed in *Psilobethylus* Kieffer by Brown and Cheng (1952, Psyche, 58: 141-148) represent females of *Dissomphalus*. Three lines of reasoning have led me to these conclusions. (1) The male *Dissomphalus* belongs in the Pristocerini, apparently close to *Pseudisobrachium*. *Ecitopria*, and *Psilobethylus* in the sense of Brown and Cheng, are known from females only, and these females are very close to *Pseudisobrachium*. The sexes of all other genera of Pristocerini and most other Bethylidae occurring in North America have been properly associated. (2) Both *Dissomphalus* and *Ecitopria* occur throughout the warmer parts of the globe, and both show a predominance of Neotropical species; the type of *Ecitopria*, *crassicornis* Wasmann, is from Brazil. (3) There is good reason to consider *Psilobethylus lucidus* Brown and Cheng, which I would place in *Ecitopria*, to be the female of *Dissomphalus xanthopus* Ashmead (see discussion under that species on a later page).

As discussed by Brown and Cheng, the chief character separating *Psilobethylus* and *Ecitopria* appears to be whether the mesonotum and scutellum are "deutlich" or one or the other is "fehlend." In the specimens assigned by Brown and Cheng to *Psilobethylus*, the suture separating the mesonotum and scutellum is at most very faintly suggested. In some specimens of *foveolatus* it is more evident than in others, and in the other species it is scarcely visible at all. Although I have seen no specimens definitely assignable to *Psilobethylus* (based on two European species), it seems evident from Kieffer's description that the scutellum is distinctly separate from the mesonotum ("Mesonotum vorn bogig, kürzer als das helbkreisförmige Scutellum"). Other than this there seem to be no tangible characters separating these genera. It is possible that they are synonyms, but for the present I shall consider *Ecitopria* Wasmann and *Psilobethylus* Brown and Cheng (?*nec* Kieffer) as synonyms of *Dissomphalus* Ashmead.

Ethology.—There are a number of notes attached to various specimens of *Dissomphalus*, but when put together they do not present a consistent picture of the ethology of these wasps. The only host record is a male *D. apertus* from Salisbury, N. C., "reared from *B. brachialis;* cage no. 8253; J. S. Pinckney coll." This is, I suppose, *Bruchus brachialis,* the vetch bruchid; it goes without saying, however, that one must treat such host records with caution. A male *D. xanthopus* from Ohio is pinned with a small bagworm case. The female allotype of *D. barberi* n. sp. is labeled "*ex* log infested with cecidomyids and micromalthids." A male *D. apertus* was taken at quarantine along the Mexican border on zinnias, a female *D. clypeatus* n. sp. on roots of a cactaceous plant, and an unidentified female on *Lilium longiflorum.* The types of *foveolatus* were taken "in *Andropogon.*" Most of the other records indicate an association with the soil: a female *xanthopus* from two inches deep in sand on oak, another female in an ant nest, three females and one male from the soil of a peach orchard, and a female taken in a Berlese funnel with ants and collembolans. Dr. Kurt Bohnsack of Swarthmore College recently took a female *xanthopus* at the E. S. George Reserve in Michigan; the specimen was taken in the upper three inches of soil, after removing the litter, in an oak-hickory woods; several ants were present in this same sample. The type of *Ecitopria crassicornis* was taken in the nest of an *Eciton* in Brazil. Males of *xanthopus* and *apertus* have been taken at light, and Glick collected males of three species at various altitudes in airplanes over Tallulah, La. As mentioned earlier, two series of *apertus* males have been collected at garage windows.

From these data it is not possible to draw any very complete picture of the ethology of these insects. The females seem to be structurally adapted for living beneath the soil or in other concealed places, and there are enough records to substantiate this. The males apparently fly about rather freely; it is possible that the two series taken in garages emerged from timber in the walls which was infested with their hosts. Two records suggest that Coleoptera may be the usual hosts, though the one specimen pinned with a bagworm is puzzling. Whether those specimens taken with ants indicate some genuine relationship or merely an accidental association, I do not know. All in all, we can only hope that more exact information on the habits and host relationships of these insects may some day become available.

Structural characters.—As indicated by Ashmead in his original description of the genus, *Dissomphalus* is readily separated from all other bethylid genera by the peculiar modifications of the second abdominal tergite of the male, in the form of paired, more or less circular pits from which issue numerous minute setae. The form and position of these pits differ remarkably in the different species and provide excellent specific characters (see figs. 1-8). In three of the North American species there are also additional paired, hyaline spots anterior to these.

The male genitalia are of the usual bethylid type, but exhibit an exceedingly complex aedoeagus; the genitalia also provide excellent specific characters (see figs. 9-14). In the terminology of the genitalia, I have in general followed Snodgrass (1941, Smithson. Misc. Coll., v. 99, no. 14). The prominent parameres arise from large parameral plates. The volsellar structures consist of a rather simple digitus and a more complex cuspis, the latter terminating in an apparently hinged process which is acute at its apex and ridged or knobbed above, overlapping the tip of the digitus. The most ventral structures in the aedoeagus, which I term simply the *ventral rami*, arise at the extreme base and extend for most of the length of the aedoeagus, being either simple or variously knobbed or serrated apically. The main part or *dorsal body* of the aedoeagus is more directly connected with the basal aedoeagal apodemes; its apex bears thin lobes which are often strangely modified, and on its dorsal side are various small sclerites which differ in shape in the various species. It must be borne in mind that the genitalia of these insects are extremely minute, and must be examined with the high power of a compound microscope; even at this magnification it is difficult to resolve all of the intricacies of the very complex aedoeagus, and the drawings and descriptions of these structures must be regarded as only rough approximations of the truth. The drawings show both ventral and dorsal aspects (on the left and right sides, respectively). In comparing genitalia with the figures, it should be remembered that slight differences in the angle of mounting may present great differences in outlines of various parts.

In other body structures, the males of *Dissomphalus* resemble *Pseudisobrachium* rather closely. The mandibles bear from one to four teeth; the clypeus is somewhat produced apically, generally tridentate, and is strongly carinate medially. The 13-segmented antennae arise from rather deep basins at the base of the clypeus. The eyes are oval, slightly hairy in all the species known to me. The relative length and breadth of the head is expressed, following Brown and Cheng, as the *cephalic index*, which may be defined as the maximum head width expressed as a percentage of the head length (to the apical margin of the clypeus).

The pronotum of the male is short and may or may not have a transverse carina margining the slope. The mesonotum possesses well-developed notauli in all the North American species; the parapsidal furrows are less strong and do not attain the anterior margin of the mesonotum. The scutellum has a deep basal transverse groove which is slightly expanded on each side. The propodeum is shorter than in *Pseudisobrachium* and possesses a distinct transverse carina on the upper margin of the posterior declivity as well as strong carinae on the sides of the dorsum and a more or less well developed median carina. The fore wing resembles that of *Pseudisobrachium* except that the transverse median vein is erect; the media is either obsolescent or extended rather slightly beyond the transverse median vein.

The females are wingless, somewhat depressed, pale in color, with minute eyes possessing from 4 to about 15 facets. The antennae are 13-segmented, the scape very large, increasing in size distad, the flagellum compact and also more or less incrassate. The mandibles have four apical teeth; the clypeus possesses a strong median carina. The pronotum is moderately long, the mesonotum very short; the scutellum is not in evidence unless a very faint transverse impression on the mesonotum represents the suture. The propodeum is elongate, its anterior margin arcuately embracing the mesonotum. The mesopleura are barely visible from above, by no means as prominently swollen as in *Pseudisobrachium*. The legs are without spines, having only soft hairs; the middle and hind femora are not strongly swollen. The abdomen is rather short and stout, the first segment with a distinct short petiole. For a more complete description of this sex, with figures, see Brown and Cheng, 1952, Psyche, 58:141-148.

Briefly, the females may be separated from *Pseudisobrachium* and *Pristocera* by the much less prominent mesopleura and the lack of spines on the legs, and from *Scleroderma* by the minute eyes and the petiolate abdomen.

Key to Species

Males

1. Second abdominal tergite with a single pair of pits or small tubercles, located dorso-laterally and flanked by several erect hairs, figs. 1-5; genitalia with the ventral rami of the aedoeagus elongate and conspicuous, the inner margin of the dorsal body without a serrated portion, figs. 9-12 (*xanthopus*-group) 2

   Second abdominal tergite with a pair of anterior, pale spots in addition to a pair of more median pits behind these, the tergite without hairs on the sides, figs. 6-8; aedoeagus with the ventral rami relatively short and blunt, not conspicuous, the inner margin of dorsal body with a strongly serrated portion, figs. 13, 14, and 21 (*apertus*-group) 6

2. Clypeus strongly expanded apically, only the median tooth distinct, fig. 18; first abdominal tergite without a median basal groove;

second tergite with small pits located in elongate depressions, fig. 5; parameres of genitalia broad and strongly emarginate apically, fig. 12 .... *clypeatus*, new species

Clypeus not strongly expanded apically, more or less distinctly tridentate, figs. 15-17; first abdominal tergite with a median basal groove; pits of second tergite not in elongate depressions; parameres not as above 3

3. Median carina of propodeum complete, reaching the transverse carina bordering the declivity; pits on the second tergite small but distinct, figs. 2 and 3 4

Median carina of propodeum not reaching the transverse carina; pits on second tergite either large, fig. 1, or merely represented by minute tubercles, fig. 4 5

4. Median groove of first tergite extending well over half the length of the tergite; notauli completely, evenly impressed; pits of second tergite located in very shallow depressions, fig. 2 .... *californicus* Ashmead

Median groove of first tergite extending about half the length of the tergite; notauli subfoveolate, narrowed in front and barely reaching the anterior margin of the mesonotum; pits of second tergite in distinct depressions, fig. 3 .... *barberi*, new species

5. Second abdominal tergite with large pits, fig. 1; median carina of clypeus somewhat flat-topped or round-topped, fig. 15; digitus and cuspis of genitalia not located at the end of an elongation of the parameral plates, fig. 9 .... *xanthopus* Ashmead

Second tergite with minute tubercles rather than distinct pits, fig. 4; clypeus with a high, sharp, angulate carina; digitus and cuspis of the genitalia located at the ends of prolongation of the parameral plates, fig. 11 .... *kansanus*, new species

6. Second abdominal tergite with a transverse band of erect hairs surrounding the pits, fig. 6; mandibles with a strong apical tooth and above this sharp-edged or with one or two weakly defined teeth; clypeus with a strong, projecting median keel .... *apertus* Kieffer

Second tergite without erect hairs other than the small ones arising from the pits, which are located on the sides of a bowl-shaped depression, fig. 7 and 8; mandibles distinctly tridentate; clypeus with the median carina low and even, not projecting 7

7. Propodeum with a transverse smooth area on the posterior part of the dorsum; legs and antennae straw-yellow; parameres more narrow and acute apically; dorsal body of aedoeagus with a more finely serrated margin, fig. 21 .... *altivolans*, new species

Propodeum heavily sculptured throughout, without a smooth area behind; legs and antennae strongly suffused with brownish; parameres somewhat broader and more truncate apically; serrations of aedoeagus much more pronounced, fig. 14 .... *nigrescens*, new species

Females

1. Eyes with from 10 to 15 facets, of moderate size; setigerous punctures of front and sides of head more or less contiguous, except medially, the head and thorax hardly at all shining .... *foveolatus* (Brown and Cheng)

Eyes very small, with from 4 to 8 facets; setigerous punctures of front and sides of head not contiguous, the head at least somewhat shining medially 2

2. Propodeal spiracles unusually large, directed dorsad, each with a narrowly elevated border; front with relatively strong microscopic reticulate sculpturing, therefore somewhat dull, more shining medially .... *clypeatus*, new species

Propodeal spiracles small, directed latero-dorsad; front strongly shining, the sculpturing weak or absent 3

3. Head, in anterior view, with the posterior margin distinctly concave, the sides somewhat converging in front (fig. 19); front very strongly shining, without any evidence of sculpturing .... *barberi*, new species

Head, in anterior view, with the posterior margin nearly straight, the sides not markedly converging in front; front with microscopic reticulate sculpturing evident under high power .... *xanthopus* Ashmead

Dissomphalus xanthopus Ashmead

Figs. 1, 9, 15

Dissomphalus xanthopus Ashmead, 1893, Bull. U. S. Natl. Mus., 45:42. [Type: ♂, Cedar Point, Md., USNM no. 14050.]—Kieffer, 1914, Das Tierreich, 41:498.—Muesebeck and Walkley, 1951, U.S.D.A. Monogr. 2, p. 732.

Psilobethylus lucidus Brown and Cheng, 1952, Psyche, 58:146. [Type: ♀, El Paso Co., Texas, 2 Nov. 1936, from soil of a peach orchard, USNM no. 62271.] New synonymy.

This is the type species of the genus and one of its less infrequently encountered members. The above synonymy has been made on the basis of the following information: (1) a male and female mounted on the same card point, taken at light in Washington, D. C., July 31, 1924, by J. R. Malloch [USNM]; (2) a male in the USNM bearing locality and ecological data identical to that of the female holotype of *lucidus*, though dated 23 July, 1937; (3) the fact that the ranges of *xanthopus* and *lucidus* appear co-extensive and that size and structure render this sex association entirely logical. The females are variable in certain characters and, as suggested by Brown and Cheng, may actually represent more than one species, though there is good reason to associate the holotype of *lucidus* with *xanthopus*.

Male.—Length 1.7 to 3.3 mm. Color varying from castaneous to deep brownish-fuscous, the head and sometimes the thorax often approaching black, the abdomen usually slightly paler than the head and thorax; legs, including the coxae, entirely pale yellowish-brown; antennae yellowish-brown basally, becoming brownish apically; mouthparts mostly yellowish; wings hyaline, the veins and stigma pale yellowish-brown. Body clothed with short, pale yellowish hairs.

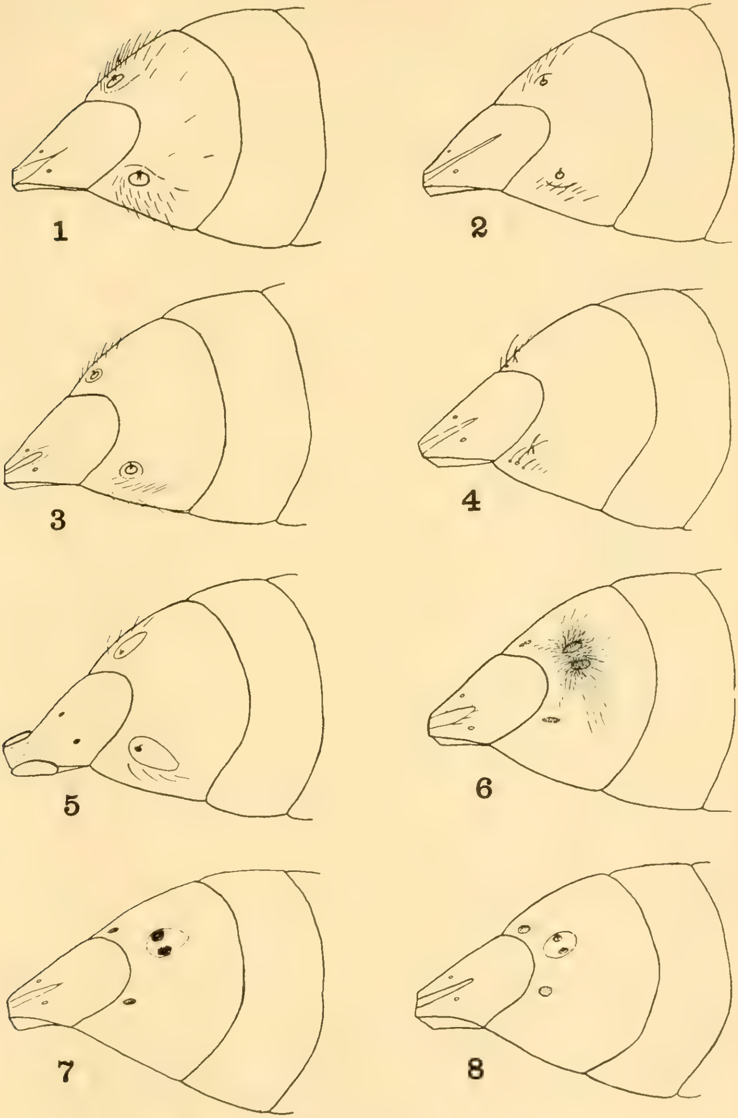
Anterior aspect of head shown in figure 15. Mandibles with four well-defined teeth. Clypeus tridentate apically, with a strong, rather flat-topped or round-topped median elevation which slopes off just before the apical margin. Antennae rather short; flagellar segments 6-9 each about 1.3 times as long as thick. Punctures of front rather widely separated, the integument between them finely reticulate. Cephalic index varying from 100 to 107.

Pronotum elongate, smooth, sloping evenly. Mesonotum with the notauli evenly developed from front to rear. Propodeum with a median carina for the anterior 0.7 to 0.9 of the dorsum and with several shorter carinae laterad of it; dorsum of propodeum with reticulate ridges anteriorly and laterally, posteriorly and postero-laterally smooth and polished. Fore wing with the media developed beyond the basal vein a short distance if at all.

Median basal groove of first abdominal tergite extending back about half the median length of the first tergite. Second tergite, fig. 1, with the pits located latero-dorsally in broad, shallow, depressions; the pits themselves vary slightly in size and shape, but are quite large, subcircular, with a tuft of very small setae in the center of each. Laterad of each pit is a small group of conspicuous setae. Genitalia, fig. 9, rather slender, due largely to the rather narrow parameral plates. Aedoeagus with the ventral rami elongate, somewhat club-shaped apically, with the extreme apex attenuate; extending from these about half-way out are two small rod-like structures, not present in any other North American species. Dorsal body of the aedoeagus very broad, the apex narrowed and provided with a pair of more or less pointed lobes.

Female.—Length 1.2 to 2.0 mm. Color medium to pale yellowish-brown; body sparsely clothed with pale yellowish hairs. Mandibles with four teeth. Clypeus with a high median ridge. Eyes small, dark, with four to eight facets in each. Cephalic index varying from 66 to 75. Front strongly shining, with very fine reticulate sculpturing visible under high magnification; punctures widely separated. Sides of head subparallel, straight or slightly convex; posterior margin of head, in frontal aspect, nearly straight, sometimes very slightly concave. Dorsum of thorax and propodeum somewhat shining, but with slightly stronger reticulate sculpturing. Propodeal spiracles small, directed laterad; carinae along sides of dorsum of propodeum fairly well developed.

Brown and Cheng have recently described the female in more detail (as *lucidus*) and it seems unnecessary to repeat their description. I have examined their entire type series



Figs. 1-8, basal abdominal segments of male *Dissomphalus* in dorso-lateral aspect. Fig. 1, *D. xanthopus* Ashmead; fig. 2, *D. californicus* Ashmead; fig. 3, *D. barberi*, n. sp.; fig. 4, *D. kansanus*, n. sp.; fig. 5, *D. clypeatus*, n. sp.; fig. 6, *D. apertus* Kieffer; fig. 7, *D. altivolans* n. sp.; fig. 8, *D. nigrescens*, n. sp.

and three additional females. There is considerable variation in head shape in this series, and it is possible that females of other species are contained in it.

Distribution.—This species appears to be widely distributed throughout the upper and lower austral zones east of the Rockies. Records are as follows: MARYLAND: 1 ♂, Cedar Point [type, USNM]; 1 ♂, Tacoma Park, 5 July 1942 (G. F. Townes) [HEE]; DISTRICT OF COLUMBIA: 1 ♀, 1 ♂ at light, on same card point, 31 July 1924 (J. R. Malloch) [USNM]; 1 ♂, Washington, 13 Aug. 1952 (R. Boettcher) [USNM]; VIRGINIA: 1 ♂, Arlington, at light, 12 Sept. 1953 (K. V. Krombein) [KVK]; 1 ♂, Warrenton, 1914 (H. Fox) [USNM]; NORTH CAROLINA: 1 ♀, Duke Forest, Durham, 2 June 1945, oak on sand, 2 in. deep (A. S. Pearse) [USNM]; GEORGIA: 1 ♀, Savannah, in ant nest, 19 Mch. 1949 (H. T. Vanderford) [USNM]; ALABAMA: 1 ♂, Flatwood, Wilcox Co., 10 June 1917 (J. C. Bradley) [CU]; TENNESSEE: 1 ♂, Hamilton Co., 20 Sept. 1939 (Turner) [USNM]; 2 ♂ ♂, "Tenn." [USNM]; OHIO: 1 ♂, "Ohio," pinned with small bag-worm case [USNM]; MICHIGAN: 1 ♀, E. S. George Res., Livingston Co., 24 June 1949 (K. Bohnsack) [USNM]; ILLINOIS: 3 ♀ ♀, Urbana, 18 Feb. 1945 (J. L. C. Rapp) [USNM]; KANSAS: 1 ♂, Manhattan, 29 Aug. 1933 (D. A. Wilbur) [KSC]; LOUISIANA: 2 ♂ ♂, Tallulah, taken in airplane (P. A. Glick) [USNM]; TEXAS: 1 ♂, Brownsville, 13 May 1904 (H. S. Barber) [USNM]; 3 ♀ ♀, 1 ♂, El Paso Co., from soil of peach orchard, 2 Nov. 1936 and 23 July 1937 (Turner and Anderson) [USNM]; MEXICO: VERA CRUZ: 1 ♂, Motzorongo, 11 Feb. 1892 (H. Osborn) [USNM]; TABASCO: 1 ♀, Santa Rosa, 16 Aug. 1945, in Berlese funnel soil sample with ants and collembolans (F. Bonet) [USNM].

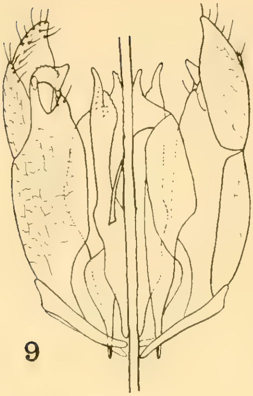
Dissomphalus barberi, new species

Figs. 3, 10, 16, 19

Holotype: ♂, Plummer's Island, Maryland, 12 Sept. 1909 (H. S. Barber) [USNM no. 62274]. *Allotype:* ♀, Plummer's Isl., Md., 10 Aug. 1913, *ex* log from Jackson's I. infested with cecidomyids and micromalthids (H. S. Barber) [USNM].

This species is closely allied to *xanthopus*, but the male differs in characters of the clypeus, propodeum, second tergite,

Figs. 9-14, male genitalia of *Dissomphalus;* ventral aspect shown on left side, dorsal on right. Fig. 9, *D. xanthopus* Ashmead; fig. 10, *D. barberi,* n. sp.; fig. 11, *D. kansanus,* n. sp.; fig. 12, *D. clypeatus,* n. sp.; fig. 13, *D. apertus* Kieffer; fig. 14, *D. nigrescens,* n. sp.



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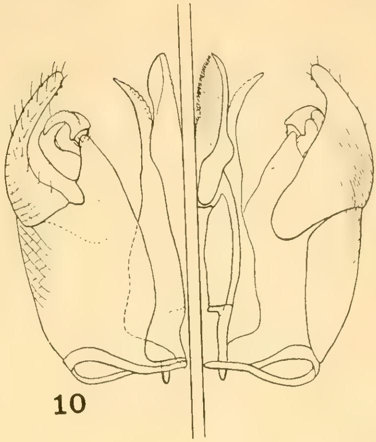

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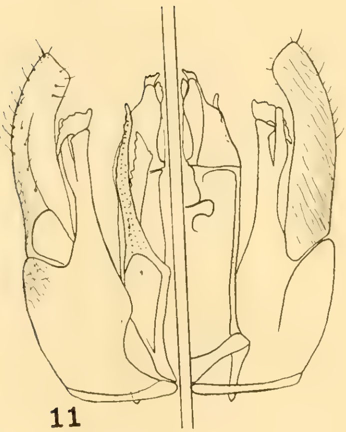

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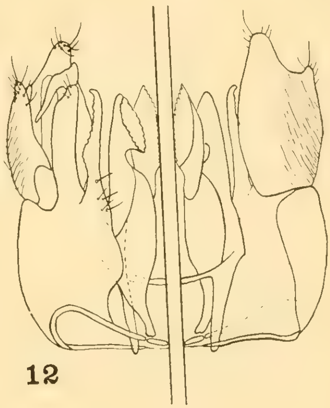

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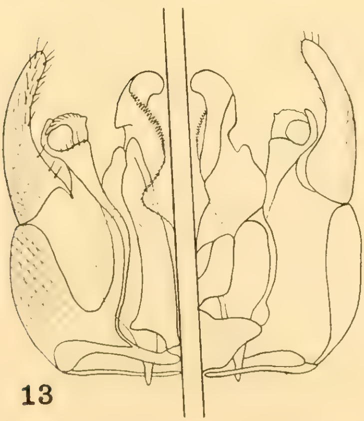

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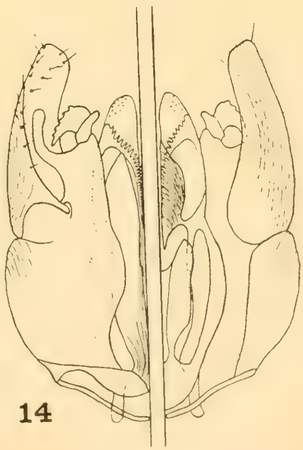

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and genitalia. The female is also very similar to that of *xanthopus,* differing only in head shape and complete lack of sculpturing on the front. This association of sexes may possibly prove incorrect when the genus is better known, though for the present it seems a likely one.

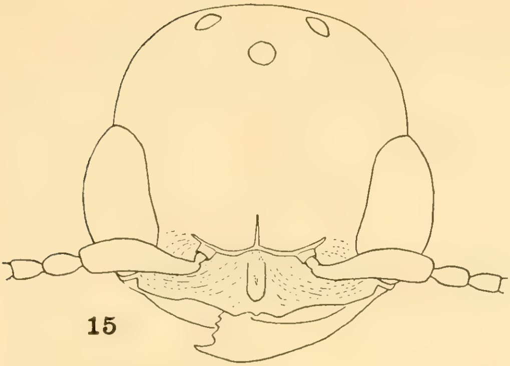
Male.—Length about 3.2 mm. Body color rich fusco-ferruginous, the base of the abdomen tinged with yellowish; legs, including coxae, entirely pale yellowish-brown; scape yellowish-brown, the first two flagellar segments somewhat so, the greater part of the flagellum brownish-ferruginous; tegulae and wing veins yellowish-brown; wings hyaline. Head and thorax clothed rather evenly with short golden-brown setae.

Mandibles with four small though well-defined teeth, fig. 16. Clypeus with three distinct apical teeth, the middle one obtusely angulate, the lateral ones rounded; disc with a narrow, low median carina. Antennae moderately elongate, flagellar segments 6-9 each about 1.7 times as long as thick. Setigerous punctures of front rather widely separated, the sculpturing between them finely reticulate. Cephalic index 100.

Pronotum sloping evenly in front, rather smooth. Mesonotum with the notauli rather broad, subfoveolate, suddenly narrowed in front and barely reaching the anterior margin. Propodeum with a median carina for its entire length; surface of the propodeum reticulately rugose except for small bare areas on each side of the posterior part of the dorsal surface. Fore wing with the basal and transverse median veins interstitial, the media extended beyond the transverse median vein for a short distance, then fading out.

Median basal groove of first abdominal tergite extending about half the length of the tergite. Second tergite, fig. 3, with the pits similar to and in much the same position as in *xanthopus;* however, they are smaller and located in somewhat smaller and deeper depressions; laterad of each is a small group of setae. Genitalia, fig. 10, very unlike those of *xanthopus;* the entire genital structures are much broader, due to the much broader parameral plates. Aedoeagus with the ventral rami long and attenuate, apically flaring outward toward the sides; the rod-like structures toward the base, present in *xanthopus,* are lacking; apex of dorsal body broadly bilobed, the inner margins of the lobes striated.

Female.—Length about 1.2 mm. Color entirely pale brownish-yellow; body sparsely clothed with pale, inconspicuous setae. Mandibles with four teeth. Clypeus with a low median carina. Eyes with apparently four facets. Cephalic index 74. Head, in anterior view, fig. 19, with the sides distinctly convergent in front, the posterior margin emarginate, the head as a whole thus somewhat heart-shaped. Front very highly polished, with no evidence whatever of sculpturing under high magnification. Thorax and abdomen also highly polished; propodeal spiracle very small.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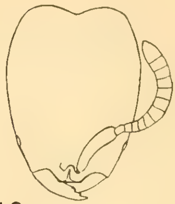
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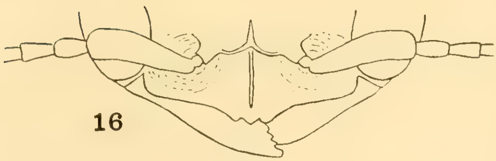
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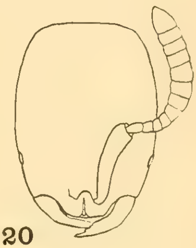
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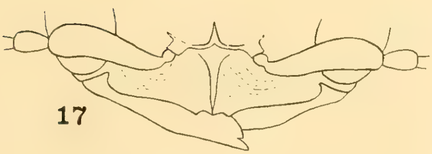
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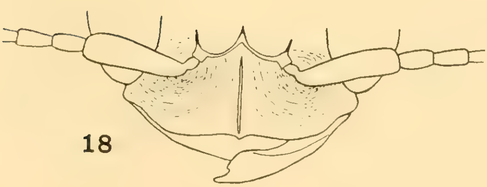
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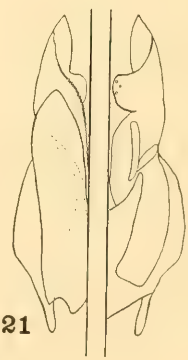
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Fig. 15, anterior view of head of male *Dissomphalus xanthopus* Ashmead; fig. 16, anterior view of lower part of head of male *D. barberi*, n. sp.; fig. 17, same of *D. kansanus*, n. sp.; fig. 18, same of *D. clypeatus*, n. sp.; fig. 19, anterior view of head of female *D. barberi*, n. sp.; fig. 20, same of *D. clypeatus*, n. sp.; fig. 21, aedoeagus of male *D. altivolans*, n. sp., ventral aspect shown on left side, dorsal on right.

Dissomphalus californicus Ashmead

Fig. 2

Dissomphalus californicus Ashmead, 1893, Bull. U. S. Natl. Mus., 45:42. [Type: ♂, California, said to be in coll. Amer. Ent. Soc. (see below)].—Kieffer, 1914, Das Tierreich 41:499.—Muesebeck and Walkley, 1951, U.S.D.A. Monogr. 2, p. 732.

Ashmead described this species from a single specimen, said to be in the collection of the American Entomological Society. However, the type is apparently not in the Academy of Natural Sciences of Philadelphia. In the National Museum there is a single specimen from Poway, Calif., with a label in Ashmead's hand indicating that it is the type of this species. This is the only specimen assignable to this species which I have seen, and unfortunately it is without a head or prothorax. The characters of the propodeum and second tergite will, however, readily separate it from its closest relatives, *xanthopus* and *barberi*.

Male.—Length (according to Ashmead) 3 mm. Color dark brown, the legs, including the coxae, yellowish; wings hyaline, the veins and stigma pale yellowish-brown. The following head characters are given by Ashmead: "head but feebly punctate, with a frontal depression before the front ocellus; . . . mandibles rufous; palpi whitish; . . . antennae 13-jointed, fuscous, the scape and pedicel yellow; the first flagellar joint very small, only half the length of the pedicel; the three or four following scarcely longer than thick; those beyond longer, all densely covered with a short pubescence."

Mesonotum with the notauli complete, evenly impressed. Propodeum with the median carina complete; dorsum of propodeum reticulately rugose except for smooth areas on either side of the median line posteriorly. Wing venation not differing from that of *xanthopus*. Median groove of first tergite rather long, extending over half the length of the tergite. Second tergite, fig. 2, with the pits well-defined though rather small, located in very shallow depressions; laterad of each pit is a small group of setae. The pits are somewhat closer to the median line than in *xanthopus* or *barberi*. I have not examined the genitalia of the single known specimen.

Female.—Unknown.

Dissomphalus kansanus, new species

Figs. 4, 11, 17

Holotype: ♂, Lawrence, Kansas, August 20, 1896 (Hugo Kahl) [USNM no. 62275].

This minute species seems not unrelated to *xanthopus*, but the second abdominal tergite bears no distinct pits, but only a pair of minute elevations, fig. 4. The genitalia are quite unlike those of any other species. It is known from a single specimen, which may be teneral.

Male.—Length about 2 mm. Body color pale ferrugino-castaneous, the upper half of the head somewhat infuscated; legs pale yellowish-brown; scape and basal flagellar segments pale yellowish-brown, the remainder of the antenna slightly darker; wings hyaline, the veins pale amber. Body with short golden-brown erect hairs.

Mandibles with a strong apical tooth and a weaker subapical tooth; above this the mandible is sharp-edged but there appear to be no other well-defined teeth, fig. 17. Clypeus with a very pronounced high median carina, cut off virtually at a right angle at the apex; apical margin with the median tooth not well defined, the lateral teeth present but small. Antennae slender, flagellar segments 6-9 each nearly twice as long as thick. Front somewhat shining, with microscopic reticulations, the punctures rather widely separated. Cephalic index 103.

Pronotum with an arching carina margining the dorsum anteriorly. Notauli narrow, complete. Propodeum with a basal reticulum of ridges, which tend to form three short longitudinal carinae; the median of these is the longest, but it does not nearly reach the posterior slope, which is also reticulately ridged; the posterior part of the dorsum is smooth, shining. Fore wing with the media distinct beyond the basal vein for a distance about equal in length to the basal vein.

Median basal groove of first abdominal tergite extending about half the length of the segment. Second tergite, fig. 4, without distinct pits, but with a pair of small prominences in the usual position of the pits; laterad of these is a small group of setae. Genitalia, fig. 11, very unlike those of any other species; the parameres are elongate and truncate apically; the digiti and cuspides are located at the ends of prolongations of the parameral plates; the aedoeagus is very complex; the ventral rami are nearly straight, slender, the outer margins serrate; directly beneath these are additional serrated, blade-like structures; the apex of the dorsal body of the aedoeagus is provided with two sets of peculiar, digit-like structures suggesting the tips of the chelicerae of a tick.

Female.—Unknown.

Dissomphalus clypeatus, new species

Figs. 5, 12, 18, 20

Holotype: ♂, Cordoba, Mexico, May 20, 1908. (A. Fenyes) [USNM no. 62276]. *Allotype:* ♀, ''Mexico,'' Dec. 28, 1936, ''Lot no. 37-118'' (found in an express shipment from an unspecified locality in Mexico at San Francisco, Calif., in the decayed part of a root of a cactaceous plant) (R. H. Buffham coll.) [USNM].

This form possesses an abundance of specific characters in the mandibles, clypeus, propodeum, and abdomen of the male. This association of the sexes is a tentative one, but the presence of unusually large, circular propodeal spiracles in both sexes makes the association a likely one.

Male.—Length about 3.3 mm. Body deep fusco-ferruginous, the head almost black, the abdomen somewhat paler; first two antennal segments yellowish-brown, the remainder of the antenna brownish-ferruginous; legs bright amber-yellow, the hind femora somewhat infuscated, all the coxae suffused with dark ferruginous; wings hyaline, the veins and setulae on the membrane brownish. Head and thorax with abundant short, golden-brown setulae.

Mandibles rather strongly arched, the apical tooth strong, but without other well-defined teeth, fig. 18. Clypeus broadly expanded, the apical margin with only the median tooth defined; disc with a low, even median carina; base of the clypeus strongly hollowed out beneath the antennal sockets. Antennae long and slender, flagellar segments 6-9 each about twice as long as thick. Cephalic index 90 (the head thus distinct longer than broad). Ocelli large, separated by less than their diameters. Punctures of the front rather large, for the most part separated by less than their own diameters.

Pronotum with the anterior slope low and even, without a carina. Notauli complete and evenly impressed. Propodeum with a reticulum of fine carinae antero-dorsally and on the posterior slope; postero-dorsal surface smooth and shining; spiracle large, oval, directed dorso-laterally; median carina not reaching the transverse carina bordering the declivity. Fore wing with the media extended beyond the basal vein a distance slightly greater than the length of the basal vein; transverse median vein meeting the media slightly beyond the basal.

First abdominal tergite without a median basal groove. Second tergite, fig. 5, with lateral pits which are not well defined but which are located near the anterior end of elongate, shallow depressions; there are a few suberect setae laterad of each depression. Genitalia, fig. 12, unusual in that the aedoeagus is of relatively simple structure; the parameres are broadly emarginate apically; the inner margins of the parameral plates bear slender processes that resemble the ventral aedoeagal rami of other species, but which are certainly not homologous with them; ventral rami cusp-like apically, the apices of the dorsal body acute.

Female.—Length about 2.6 mm. Body color pale ferrugino-castane ous, the thorax and propodeum slightly darker than the head or the abdomen; antennae and legs pale yellow-brown; body clothed with fairly numerous short, pale setae. Mandibles rather strongly arched, with four distinct teeth. Clypeus somewhat projecting, with a high median carina which angles downward just before the apex. Eyes black, with about 8 facets. Cephalic index 73; in anterior view, the posterior margin of the head is nearly straight, the sides of the head gently convex, fig. 20. Front with rather strong microscopic reticulate sculpturing, therefore somewhat dull, though more shining medially; punctures rather close together, especially on the sides, though rather small and not contiguous. Thorax and propodeum with the sculpturing rather pronounced, the surface thus somewhat dull; propodeum with fairly prominent ridges along the sides of the dorsum. Propodeal spiracles unusually large, directed dorsally, each with a narrowly elevated border. Abdomen smooth, strongly shining.

Dissomphalus apertus Kieffer

Figs. 6, 13

Dissomphalus apertus Kieffer, 1914, Bull. Soc. Ent. France, p. 60. [Type: ♂, Fayetteville, Ark. (Hayhurst) (see note below)]—Kieffer, 1914, Das Tierreich, 41: 499.—Muesebeck and Walkley, 1951, U.S.D.A. Monogr. 2, p. 732.

Kieffer gave the type locality of this species as "Lafayette," then in his revision in Das Tierreich changed it to "Fayetteville." Since the specimen was sent to him by Hayhurst, who was at one time on the staff of the University of Arkansas, it seems probable that Fayetteville, Ark., is the correct type locality. The type cannot now be located at the University of Arkansas, nor is it in the Museum d'Histoire Naturelle at Paris. The species here considered under the name *apertus* appears to fit Kieffer's brief description better than any other North American species, and is also probably the commonest *Dissomphalus* in the type locality.

Male.—Length 1.5 to 3.5 mm. Color deep brownish-fuscous, the head and thorax usually nearly or quite black; mouthparts and genitalia varying from straw-yellow to amber; antennae pale yellowish-brown, somewhat infuscated apically; legs entirely bright straw-yellow; wings hyaline, the veins brown. Body clothed with short golden-brown setae.

Mandibles with apical tooth well-defined and a subapical tooth somewhat indicated, above this sharp-edged and occasionally with one or two other teeth poorly defined. Clypeus with a very strong median keel, in lateral view forming a right angle or even an acute angle just before the apical margin; apical margin with the median tooth strong, the lateral teeth moderately developed. (In anterior view, the mandibles and clypeus do not differ notably from *kansanus*, shown in figure 17.) Antennae shorter than in the preceding two species, flagellar segments 6-9 each about 1.5 times as long as thick. Front with microscopic sculpturing and with rather abundant shallow, circular setigerous punctures. Cephalic index varying from 100 to 108. Ocelli separated by more than their own diameters.

Pronotum with a strong, arching carina bordering the anterior slope. Notauli evenly impressed for the full length of the mesonotum. Propodeum with a well-defined median carina which usually does not quite reach the transverse carina bordering the declivity, and with two or more shorter, more irregular carinae laterad of it; surface of propodeum reticulately ridged except for a transverse smooth area on the posterior part of the dorsum (sometimes small or actually absent). Propodeal spiracle small, directed more laterad than dorsad. Fore wing with the media not extended to any appreciable extent beyond the transverse median vein.

First abdominal tergite with a strong median basal groove on its basal half. Second tergite, fig. 6, with a pair of oval, pale spots dorsolaterally, just behind the anterior margin. Posterior to these is a pair of larger, circular pits, one just each side of the median line; the pits themselves are densely hairy, and there is a transverse band of erect hairs on this tergite surrounding the pits, the hairs more or less directed toward the pits. Genitalia, fig. 13, rather large and broad; parameres prominent, in lateral view somewhat triangular and pointed, the inner margins setose; apex of cuspis with radiating ridges; aedoeagus with the ventral processes rather short and blunt; inner margins of the dorsal body with a sinuate, prominently serrate edge. In lateral view the aedoeagus is seen to be strongly produced dorsally and angulate near the middle.

Female.—Unknown; may possibly be the following species.

Distribution.—This species ranges from Mexico north to Kansas, Ohio, and New Jersey. Records are as follows: NEW JERSEY: 1 ♂, Princeton, 2 Aug. 1948 (K. W. Cooper) [USNM]; DELAWARE; 1 ♂, Wilmington, 14 Aug. 1951 (J. Touhey) [USNM]; DISTRICT OF COLUMBIA: 3 ♂♂, Washington [USNM]; VIRGINIA: 5 ♂♂, Arlington, July 3-Sept. 13, on window in barn and at light (K. V. Krombein [KVK]; 1 ♂, Vienna, Aug. 1932 (J. C. Bridwell) [USNM]; NORTH CAROLINA: 1 ♂, Salisbury, reared from *B. brachialis* (J. S. Pinckney) [USNM]; 1 ♂, Smoky Mts., Bryson City, 2000 feet, 25 Aug. 1930 (F. M. Carpenter) [MCZ]; SOUTH CAROLINA: 1 ♂, Greenville, 22 June 1933 (H. Townes) [HEE]; FLORIDA: 1 ♂, Flagler Co., 21 Dec. 1929, fruit fly survey (D. B. Webb) [USNM]; LOUISIANA: 1 ♂, Tallulah, taken in airplane trap (P. A. Glick) [USNM]; OHIO: 1 ♂, Lucas Co., in corn field, 24 July 1935 (R. T. Everly) [USNM]; KANSAS: 10 ♂♂, Manhattan, 15 July-25 Sept., several taken on garage windows by R. L. Fischer [KSC, RLF, HEE]; MEXICO; 1 ♂, taken at quarantine on zinnias, 2 Nov. 1939 [USNM].

Dissomphalus foveolatus (Brown and Cheng), new combination

Psilobethylus foveolatus Brown and Cheng, 1952, Psyche, 58:143.[Type: ♀, Mt. Vernon, Va., 16 Dec. 1944, in *Andropogon* (J. C. Crawford); USNM No. 62270].

This species was described from two specimens from Virginia; I have seen seven additional specimens from localities in Maryland, Mississippi, and Arizona. Thus the range is not very different from *apertus*, and I would expect this to be the female of that species. However, there are no records of the two having been taken in close association, and hence I hesitate to make this synonymy at this time. Furthermore, it is possible that I have included females of more than one species under this name.

Female.—Length 1.9-2.6 mm. Color varying from yellowish-brown to brownish-ferruginous, the abdomen often slightly darker than the head and thorax; legs and antennae yellowish. Body clothed with short, pale erect hairs. Mandibles with four distinct teeth. Clypeus with a high median ridge which is angulately declivous apically. Eyes oval, black, with from 10 to 15 facets. Cephalic index 75 to 79; in anterior view, the sides of the head slightly convex, the posterior margin nearly straight. Front and sides of the head with densely arranged, broad and shallow setigerous punctures, mostly absent from the median line, where the reticulate sculpturing is most in evidence. Thorax rather dull, with fine reticulate sculpturing and rather sparse setigerous punctures. Propodeal spiracles small, circular, directed laterad; sides of the propodeal dorsum subcarinate. Abdomen smooth and shining. For a more detailed description and figures, see Brown and Cheng, 1952.

Distribution.—Apparently widely distributed in the warmer parts of the United States. Records are as follows: MARYLAND: 1 ♀, Plummer's Island, 22 Oct. 1905 (E. A. Schwarz) [USNM]; VIRGINIA: 2 ♀♀, Mt. Vernon, 16 Dec. 1944, in *Andropogon* (J. C. Crawford) [USNM]; MISSISSIPPI: 1 ♀, Lincoln Co., 10 March 1938 (Turner) [USNM]; ARIZONA: 2 ♀♀, Ft. Yuma [USNM]; 3 ♀♀, Yuma, shore of Colorado River, 23 Jan. 1897 [USNM].

Dissomphalus altivolans, new species

Figs. 7, 21

Holotype: ♂, Tallulah, La., "Airpl. 794" (taken in airplane trap at between 20 and 500 feet altitude, P. A. Glick) [USNM no. 62277]. *Paratypes:* 4 ♂♂, same data as type but bearing numbers 1162, 1188, and 1252 [USNM].

This is the form referred to by Glick (1939, U.S.D.A. Tech. Bull. 673, p. 50) as *Dissomphalus* sp. in his account of the insects taken at various altitudes over Tallulah, La. In most characters it approaches *apertus* closely, although the pits on the second tergite differ considerably; the genitalia are very similar to those of *apertus* except for several differences in the aedoeagus.

Male.—Length about 2.6 mm. Body deep brownish-fuscous, the pronotum and base of the abdomen slightly paler brown; mouthparts, antennae, tegulae, and legs in their entirety, straw-yellow; wings hyaline, the veins and stigma straw-colored. Body with abundant short, pale setae.

Mandibles with three distinct teeth. Clypeus with the apical margin strongly tridentate, the median carina well defined but low and even, not projecting as in *apertus*. Antennae slender, flagellar segments 6-9 each about 1.5 times as long as thick. Front with microscopic sculpturing and with numerous shallow, setigerous punctures which are mostly separated by more than their own diameters. Cephalic index 95. Ocelli larger and head somewhat more rounded behind than in *apertus*.

Pronotum with a carina bordering the anterior slope. Notauli distinctly impressed for the entire length of the mesonotum. Propodeum with the median carina weakened behind and narrowly interrupted a short distance in front of the transverse carina bordering the declivity; dorsum of propodeum with two shorter lateral carinae, the surface reticulately rugose in front, smooth behind. Fore wing with the median vein not at all developed beyond the transverse median.

First abdominal tergite with a short median basal groove. Second tergite, fig. 7, with the anterior, lateral spots situated about as in *apertus*, though somewhat more slender; median pits subcircular, densely short-haired, situated on the sides of a prominent bowl-shaped depression; there are no setae on the second tergite except for those arising from the pits. Genitalia very similar to those of *apertus* so far as the lateral elements are concerned; aedoeagus, fig. 21, of the same general plan as *apertus*, but the ventral rami are broader and blunter and the dorsal body differently shaped apically; the serrations on the inner margins of the aedoeagus are finer than in either *apertus* or *nigrescens*.

The four paratypes closely resemble the type in most respects; the cephalic index varies from 95 to 102. Two of the specimens lack abdomens. In all of the paratypes the propodeal carina is more widely interrupted behind than in the type. The genitalia were described and figured from a paratype, those of the type not having been dissected.

Dissomphalus nigrescens, new species

Figs. 8, 14

Holotype: ♂, Denison, Texas, 15 June 1938, peach orchard (Christenson) [USNM no. 62278]. *Paratypes:* 1 ♂, Loui[siana] 2392 (C. F. Baker collection) [Opelousas, 15 June 1897 (G. R. Pilate)] [USNM]; 1 ♂, Garden City, Alabama, 7 July 1939 (D. E. Hardy) [KU].

This species is very closely allied to the preceding, from which it differs in the much more heavily sculptured propodeum, darker appendages, and in the genitalia. The second abdominal tergite differs only very slightly from that of the preceding species.

Male.—Length about 2.8 mm. Color deep brownish-fuscous, the head and thorax nearly black, the abdomen, especially at the base, a little lighter; mouthparts yellowish; antennae yellowish-brown, rather heavily infuscated beyond the fourth segment; legs light brown, the coxae, femora, and tibiae somewhat darker; wings hyaline, the veins and stigma pale yellowish-brown. Body with rather abundant short, golden-brown setae.

Mandibles with three distinct teeth. Clypeus with the apical margin with three distinct teeth, the median carina strong, rather even from front to rear. Antennae of moderate length, flagellar segments 6-9 each about 1.3 times as long as thick. Front with rather evenly spaced shallow punctures, for the most part separated by slightly more than their own diameters. Cephalic index 98. Ocelli smaller and the head more broadly rounded behind than in *altivolans*, about as in *apertus*.

Pronotum with a transverse carina margining the anterior slope; this carina is unusually strong, nearly straight, and does not extend back on the sides to the posterior lobes. Notauli complete, deeply impressed. Propodeum heavily sculptured throughout, without a transverse smooth area behind; median carina extending back to the transverse carina, though weakened behind; there are two additional carinae laterad of this which posteriorly curve mesad and disappear; the sides of the dorsum are strongly foveolate. Fore wing with media not developed as a distinct vein beyond the basal vein; transverse median and basal veins interstitial.

First abdominal tergite with a strong median basal groove. Second tergite (fig. 8) with the anterior, lateral spots subcircular in shape, located about as in the preceding two species. Median pits small, located on the sides of a bowl-shaped depression, not so conspicuously setose as in the preceding two species. Genitalia (fig. 14) with the parameres broader and more truncate apically than in the preceding two species; aedoeagus with the ventral rami rather short, subacute apically; dorsal body rounded and somewhat knobbed apically, the serrated flange very prominent.

The two paratypes both measure about 3 mm.; the cephalic index varies from 94 to 98. The specimen from Louisiana has the mandibles, antennae, and legs deep brownish-ferruginous; the description and figures of the genitalia were drawn from this specimen.

THE CORRECT NAME FOR A PEST OF LEGUMES

(Lepidoptera, Olethreutidae)

Epinotia aporema (Walsingham), new combination

Eucosma aporema Walsingham, 1914, Biologia Centrali-Americana, Heterocera: 4:235, pl. 7, fig. 22; (Costa Rica).

Epinotia opposita Henrich, 1931, Proc. U. S. Nat. Mus., 79:7, pl. 6, fig. 21, pl. 7, fig. 26; (Peru). (New synonymy.)

Since its description, *Epinotia opposita* has become well known as a pest of alfalfa, green beans, and cowpeas. It was only recently that the above synonymy was suspected. Specimens and genitalic preparations of *opposita* were submitted to Mr. John D. Bradley, British Museum (Natural History), who compared them with Walsingham's type of *Eucosma aporema* in that institution and confirmed the suspicion that a single species was involved. Hence, the pest of alfalfa, green beans, and cowpeas, formerly known as *Epinotia opposita* Heinrich, must be called *Epinotia aporema* (Wlsm.).

Distribution.—Argentina, Costa Rica, Guatemala, Mexico, Peru, Uruguay, Texas.—J. F. GATES CLARKE, *U. S. National Museum, Washington, D. C.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON

636TH REGULAR MEETING, MAY 6, 1954

The 636th regular meeting of the Society was held in room 43 of the U. S. National Museum, Thursday, May 6, 1954. President A. B. Gurney called the meeting to order at 8:05 p.m. Forty-three members and 21 visitors were present. The minutes of the previous meeting were read and approved.

President Gurney presented the new Honorary President, Dr. R. E. Snodgrass, who had been elected at the April meeting. Dr. Snodgrass expressed his pleasure upon being notified of his election.

The following five new members were elected:

Floyd P. Harrison, Dept. of Entomology, University of Maryland, College Park, Md.

Dr. Robert S. Simmons, 1305 Light Street, Baltimore 30, Md.

Dr. Raymond E. Ryckman, Dept. of Entomology, School of Tropical and Preventive Medicine, Loma Linda, Calif.

Maj. Arthur S. Kidwell, Long Point on the Severn, Crownsville, Md.

K. P. Ewing, Section of Cotton Insect Investigations, Entomology Research Branch, Plant Industry Station, Beltsville, Md.

Carroll N. Smith, Section of Insects Affecting Man and Animals, Entomology Research Branch, Plant Industry Station, Beltsville, Maryland.

The Society voted to change the constitution so that Article I of the By-Laws now reads: "At or before the regular October meeting the President shall appoint a nominating Committee which shall submit at the meeting prior to the annual meeting a list of names comprising one or more nominees for each office, including membership in the Executive Committee, each selection to represent the Committee's best judgment in the interests of the Society. Other nominations for any office may be made from the floor at the annual meeting. Elections shall be held separately for each office for which there are two or more candidates. When only one candidate for an office is before the Society election shall be viva voce on motion and second from the floor, and in that case two or more offices may be treated in one motion. When two or more candidates are presented for an office, vote shall be by written ballots distributed, collected and counted by tellers appointed by the President.''

Article V of the By-Laws was voted to be amended to include a new item 7, ''Reading of papers,'' the former item 7 and following items to be renumbered in order.

Article VIII of the By-Laws was voted to read as follows: ''The Society may elect honorary members in recognition of long and meritorious effort directed toward the advance of entomological science. Individuals so recognized shall be approved unanimously by the Executive Committee and by two-thirds vote of members present at any regular meeting. Honorary members shall be elected for life, shall pay no dues, and shall be accorded all privileges of members. The number of honorary members carried concurrently on the membership roll shall not exceed three, except when an honorary member is chosen Honorary President, in which case there may be four.''

The election of Dr. A. G. Böving as Honorary Member had been approved by the Executive Committee, President Gurney announced. Upon motion by F. L. Campbell and second by J. S. Wade, Dr. Böving was unanimously voted an Honorary Member by the Society.

''Some Insects Used for Food in Northern Thailand and Vietnam,'' was the subject of a note by Ernestine Thurman. A great many insects are used as food in this area.

A. R. Palmer told of an excellently preserved fauna consisting mostly of fossil aquatic arthropods discovered in lacustrine deposits of Middle Miocene or older age in the Calico Mountains, Mojave Desert, California. Seven orders of insects are represented.

The principal paper of the evening was given by J. F. Gates Clarke, on ''Insect Collecting on the Island of Kusaie.'' Dr. Clarke conducted a five months' survey of terrestrial arthropods on Kusaie in 1953, under the auspices of the Office of Naval Research, the National Academy of Sciences, and other cooperating agencies. On Kusaie alone over 700 species of the arthropods collected were recognized as distinct, and many more from Berlese collecting will be added to the total later. He estimates that between 1,000 and 1,500 species will eventually be found on Kusaie. He showed maps and color slides which illustrated the collecting sites, methods of collecting, and habitats of the insects. (Secretary's abstract.)

Dr. Harold Coolidge, Director, and Mrs. Lenore Smith, Secretary, of the Pacific Science Board, and Herbert Matsumori, new member, were introduced. Other visitors were Dr. Claude Wakeland, with Grasshopper Control in the Plant Pest Control Branch at Denver, Merton C. Lane, in charge of the Truck Crops Laboratory at Walla Walla, Wash., and Mrs. Lane.

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

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.

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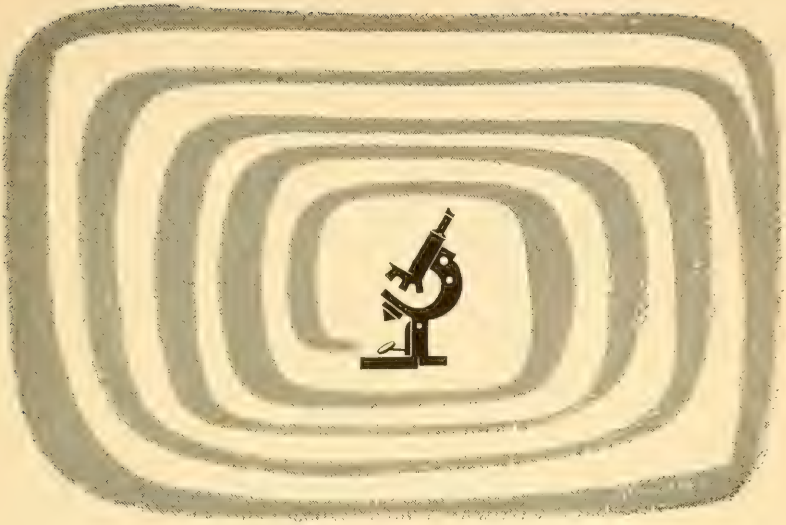

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